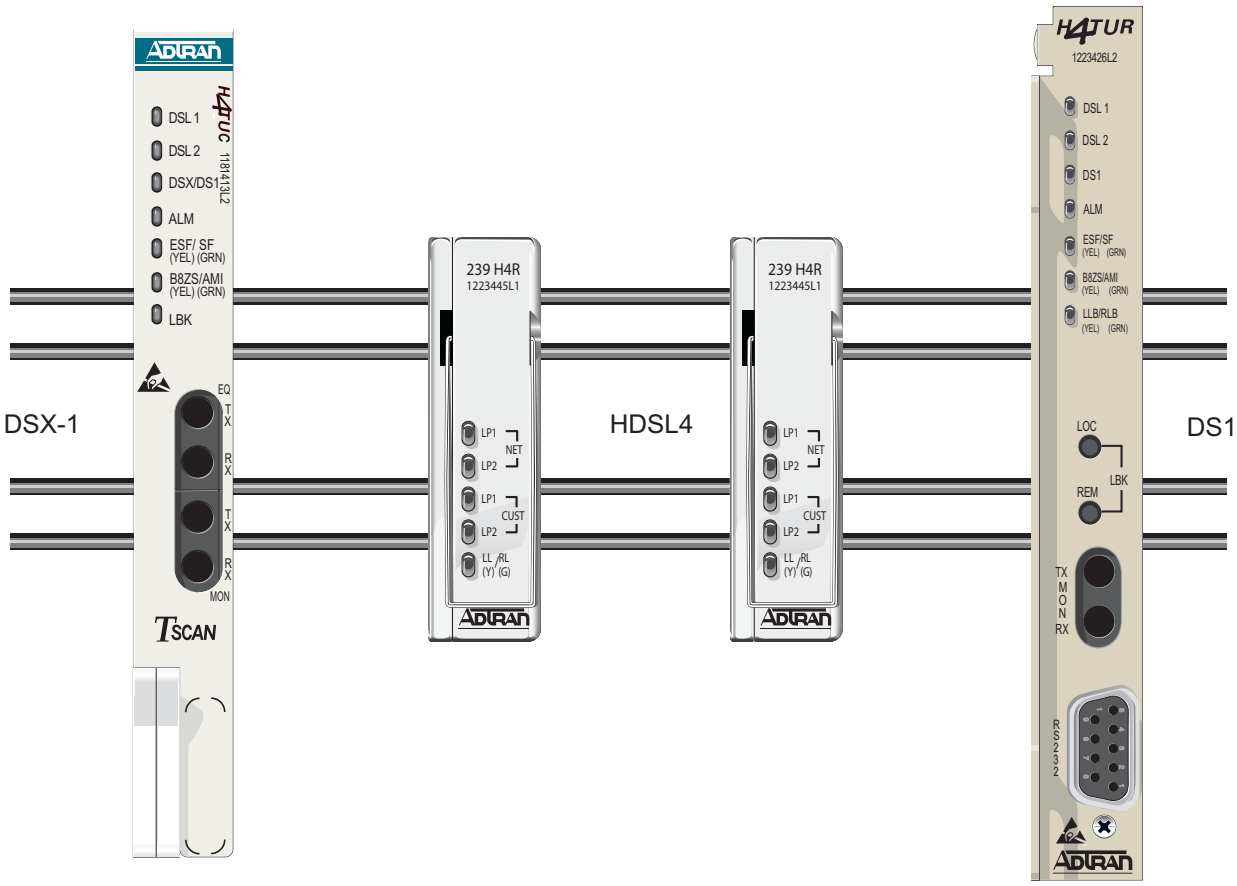

HDSL4 for General Distribution Installation and Maintenance Practice

Document Number: 61223HDSL4L2-5C
August 2005

Total Access 3000 H4TU-C	1181413L2	SIC4W3XD_ _
220 H4TU-C	1223401L2	T1L8PNMC_ _
DDM+ H4TU-C	1223403L2	T1L8VOSC_ _
3192 H4TU-C	1223404L2	T1L8YHWC_ _
3192M H4TU-C	1223404L12	T1L9EFGA_ _
T200 H4TU-C	1223406L2	T1T2JE0B_ _
T200 H4TU-R, Local Powered	1223424L2	T1L497PC_ _
T200 H4TU-R, Span Powered	1223426L2	T1L85M7C_ _

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Revision History

Revision	Date	Description of Changes
A	November 2004	Initial release
B	June 2005	Add new products: 3192M H2TU-C and T200 H2TU-C; Add TScan to front panel illustrations; Add clarifying notes in Powering and Craft Access sections; update screen prints for Bad Splice Detection and Flash Upgrade
C	August 2005	Add three-repeater support information.

Conventions

The following typographical conventions are used in this document:

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

This font indicates screen menus, fields, and parameters.

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

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

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

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

This font indicates silkscreen labels or other system label items.

This font is used for strong emphasis.

NOTE

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

CAUTION

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

WARNING

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

Training

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

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HDSL4 for General Distribution

PRODUCT DESCRIPTION

The HDSL4 modules referenced in this document are used to deploy a T1 circuit using 4-wire metallic facilities. HDSL4 provides extended range to DS1/T1 transport while providing spectral compatibility with ADSL and other transport technologies. The ADTRAN HDSL4 Transceiver Unit for Central Office (H4TU-C) works in conjunction with the ADTRAN HDSL4 Remote Transceiver Unit (H4TU-R) to provide extended-range DS1 service on the local loop.

The H4TU-C receives DSX-1 signals, converts them, and provides HDSL4 signals to the local loop. The H4TU-R receives the HDSL4 signals from the H4TU-C and provides DS1 signals to the customer. Up to three H4R repeaters may be utilized to extend the service range. See "HDSL4 Deployment Guidelines" on page 55 for details.

New features available with this product release are described in detail in "Appendix B, HDSL4 Features".

Table 1 lists the ADTRAN HDSL4 Central Office modules approved for general distribution.

Table 1. HDSL4 Central Office Modules

HDSL4 Module	Part Number	CLEI Code
Total Access 3000 H4TU-C	1181413L2	SIC4W3XD_ _
220 H4TU-C	1223401L2	T1L8PNMC_ _
DDM+ H4TU-C	1223403L2	T1L8VOSC_ _
3192 H4TU-C	1223404L2	T1L8YHWC_ _
3192M H4TU-C	1223404L12	T1L9EFGA_ _
T200 H4TU-C	1223406L2	T1T2JE0B_ _

Table 2 lists the ADTRAN HDSL4 remote modules provided for general distribution.

Table 2. HDSL4 Remote Modules

HDSL4 Module	Part Number	CLEI Code
T200 H4TU-R, Local Powered	1223424L2	T1L497PC_ _
T200 H4TU-R, Span Powered	1223426L2	T1L85M7C_ _

Illustrations

Figure 1 illustrates the front panels of the ADTRAN H4TU-C modules approved for general distribution.

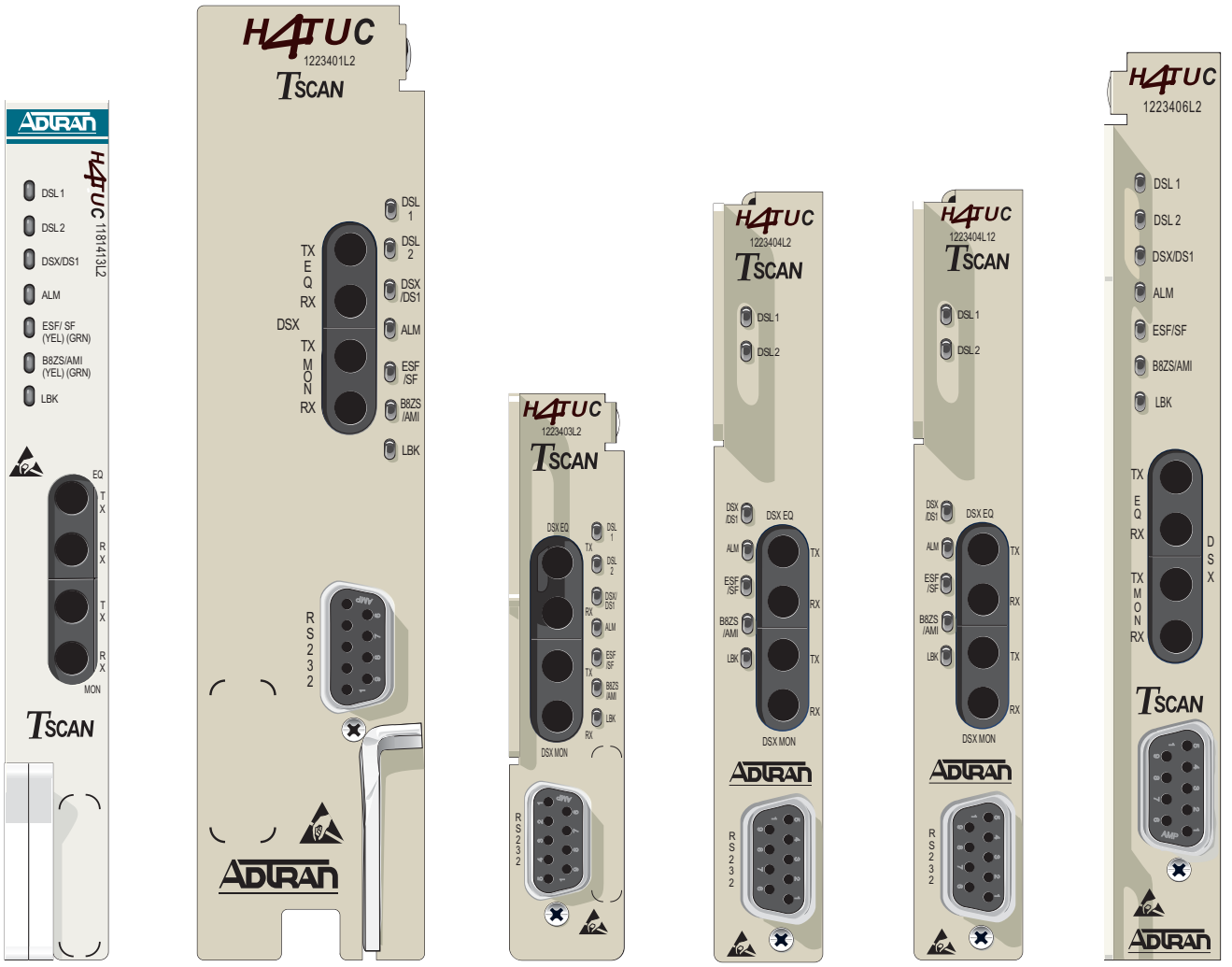
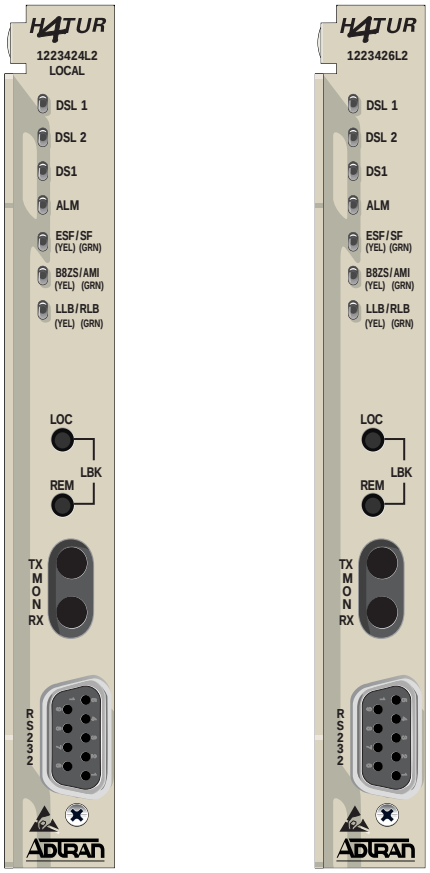


Figure 1. ADTRAN HDSL4 Central Office Units for General Distribution

Figure 2 illustrates the front panels of the ADTRAN H4TU-R modules approved for general distribution.



T200 H4TU-R, LOCAL POWERED P/N 1223424L2

T200 H4TU-R, SPAN POWERED P/N 1223426L2

Figure 2. ADTRAN HDSL4 Remote Units for General Distribution

Table 3. H4TU-R Enclosure Compatibility

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

1. In all applications the H4TU-C must be installed in NEBS compliant and UL listed enclosures to insure full compliance with this unit.
2. The ADTRAN T200 Dual-Mount housing (P/N 1245034L1) is required when using the T200 H2TU-C for HDSL Loop Support System (HLSS™) protection circuits.

Compliance

ADTRAN HDSL4 modules are NRTL listed to the applicable UL standards. The HDSL4 modules are to be installed in a restricted access location and in a type “B” or “E” enclosure only.

These devices comply with Part 15 of the FCC rules. Operation is subject to the following two conditions:

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

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

H4TU-C Compliance

Table 4 shows the compliance codes for the H4TU-C modules.

Table 4. Compliance Codes, H4TU-C

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

The H4TU-C modules provide span powering voltage (negative only with respect to ground, –190 VDC nominal, GFI protection <5 mA) and meets requirements of Bellcore GR-1089-CORE (Class A2) and ANSI T1.418-2002.

H4TU-R Compliance

Table 5 shows the compliance codes for the H4TU-R modules.

Table 5. Compliance Codes, H4TU-R

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

The H4TU-R modules must only be installed in shelves or mountings that utilize pin 27 of the edge connector as a frame ground.

INSTALLATION GUIDELINES

After unpacking an HDSL4 module, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. For more information, refer to "Appendix D, Warranty". If possible, keep the original shipping container for returning the module 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.

ADTRAN HDSL4 modules plug directly into the enclosure. Installation wiring is not required.

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

These products are intended for installation in **restricted access locations** only.

Powering Options

H4TU-C

The H4TU-C is default enabled for span powering mode. The H4TU-C has the ability to power one, two, or three elements and can be set to have span power disabled when the H4TU-R is locally powered and no H4Rs are on the circuit.

CAUTION

Disabling the span power removes all voltage from the HDSL4 loop. This results in an absence of sealing current which could have an adverse effect on circuit continuity over an extended period of time.

The H4TU-C uses a DC-to-DC converter to derive its internal logic and span powering voltages from the –48 VDC office supply. The H4TU-C can span power three modules (an H4TU-R and up to two H4Rs as listed above) by applying –190 VDC power to the local loop. The span powering voltage is less than –200 volts with GFI protection to less than 5 mA. The span powering supply is current limited to approximately 150 mA.

Refer to **Figure 3**. The differential span power output voltage is measured between Loop 1 and Loop 2 (reference to Loop 1) and is typically –185 VDC. Loop 1 shows a typical voltage of –6 VDC with respect to ground potential, while the Loop 2 potential is typically –191 VDC with respect to ground potential.

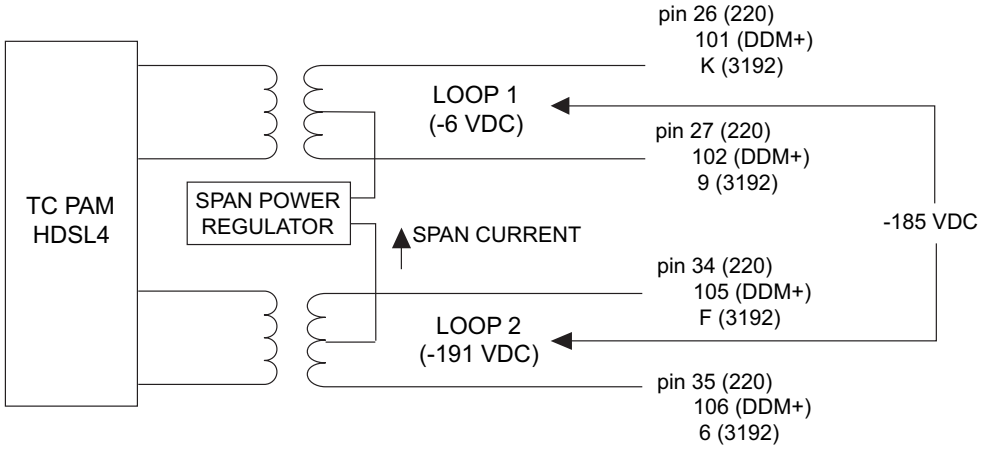


Figure 3. H4TU-C Span Powering Diagram

H4TU-R Span Power

The H4TU-R P/N 1223426L2 receives span power from the H4TU-C.

H4TU-R Local Power

In some circumstances a locally powered remote unit is required. The H4TU-R P/N 1223424L2 can meet those needs.

Module Installation

Follow the step-by-step procedures below to put the HDSL4 modules in service.

Total Access 3000 and 220/E220 H4TU-C Installation

To install the Total Access 3000 H4TU-C (P/N 1181413L2) or 220 H4TU-C module (P/N 1223401L2), perform the following steps:

1. Pull the ejector latch (located on the bottom of the module front panel) out from its closed position.
2. Hold the unit by the front panel while supporting the bottom edge of the module with the ejector latch opened to engage the enclosure edge.
3. Align the unit edges to fit in the lower and upper guide grooves for the module slot.
4. Slide the unit into the module slot. Simultaneous thumb pressure at the top and bottom of the unit ensures that the module is firmly seated against the backplane of the chassis.
5. Secure the module in place by pushing in on the ejector latch.

All Other Modules

To install any of the HDSL4 modules, with the exception of those explained above, perform the following steps:

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

Initialization

When a module is installed, it runs a series of self-tests. Once the self-tests are complete, the status LEDs reflect the true state of the hardware. Refer to “Front Panel LED Indicators” on page 17 for LED indications.

CONNECTIONS

An H4TU-C module occupies one card slot in the respective Office Repeater Bay for which it is named. Power and alarm signals are provided to the module through the backplane of the shelf. DSX-1 and HDSL4 loop signals are connected to the wire-wrap pins or mass termination (amphenol) shelf connectors corresponding to the slot the module occupies.

Edge Connector Wiring

Figure 4, **Figure 5**, and **Figure 6** specify edge connection wiring required for proper operation.

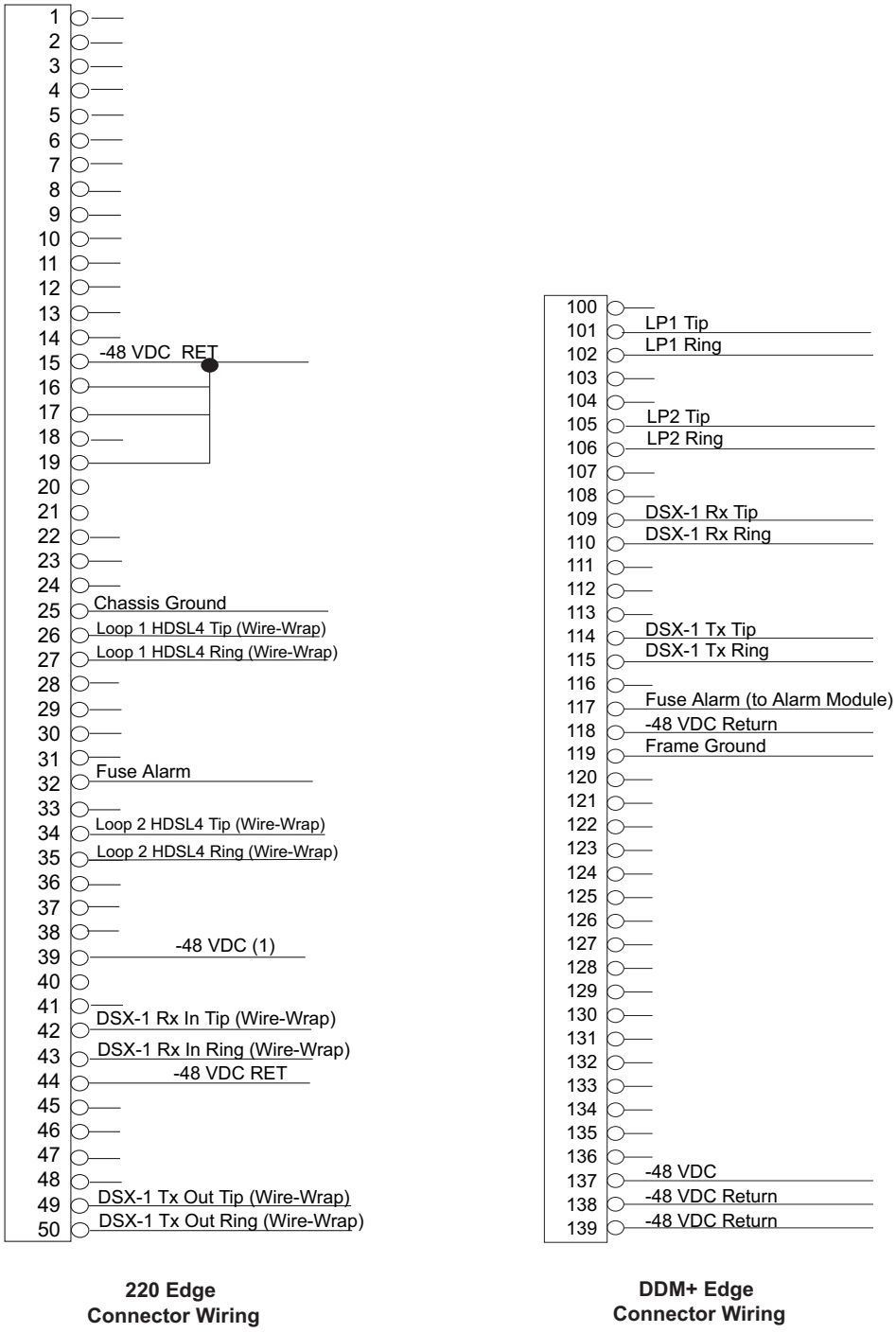


Figure 4. 220 and DDM+ H4TU-C Edge Connector Wiring

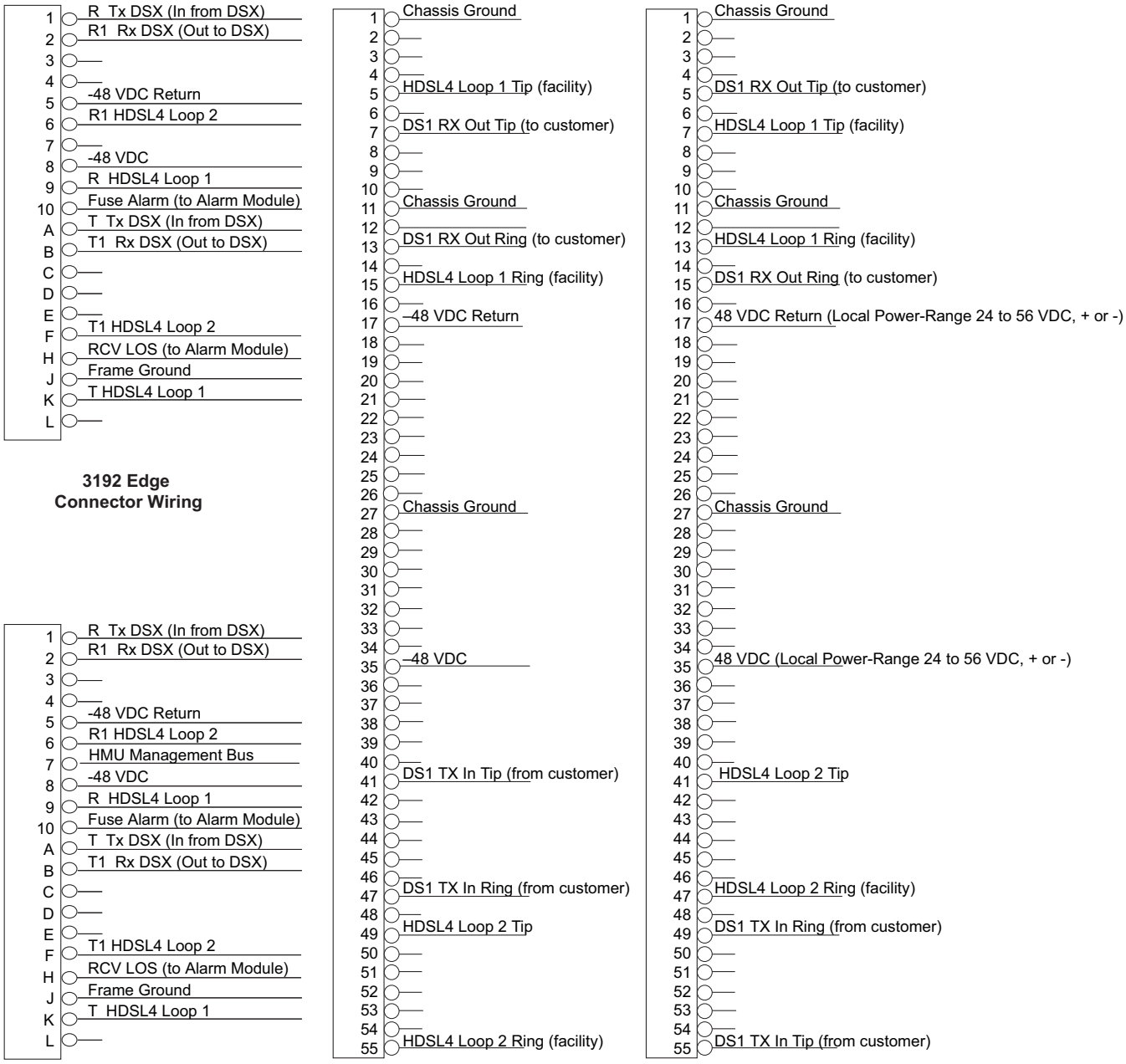


Figure 5. 3192M, 3192, T200 H4TU-C and T200 H4TU-R Edge Connector Wiring

Total Access 3000 H4TU-C Edge Connector

Figure 6 illustrates the edge connector wiring for the Total Access 3000 H4TU-C module.

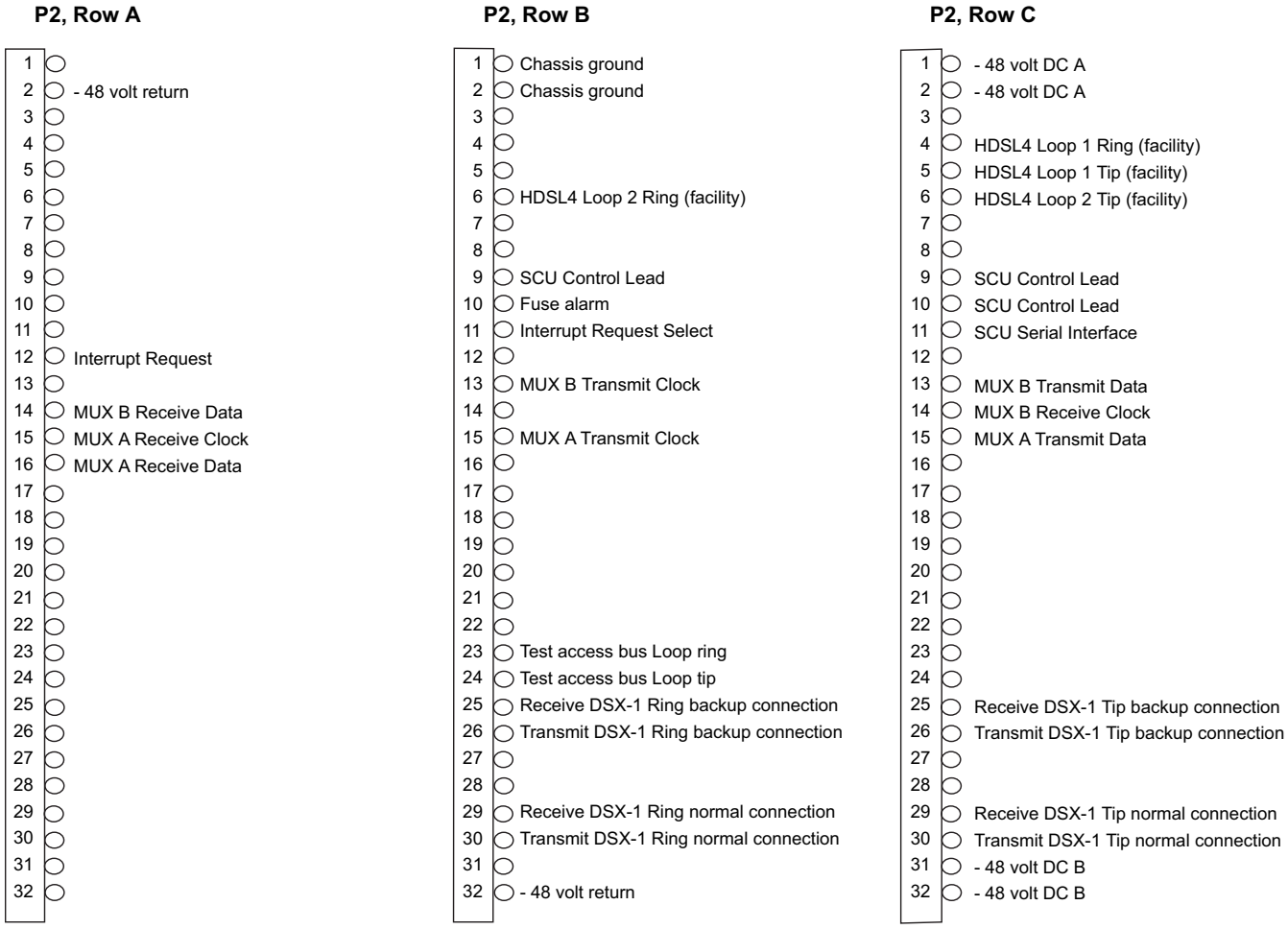


Figure 6. Total Access 3000 H4TU-C Edge Connector Wiring

Total Access 3000 Chassis Amphenol Connectors

The Total Access 3000 shelf delivers DSX-1 from the network to the H4TU-C via connectors on the backplane labeled “Pair 7” and “Pair 8”. The HDSL4 signal is provided toward the customer via the backplane connectors labeled “Pair 1” and “Pair 2”. Pins 1 and 33 of the connectors Pair 7 and Pair 8 are the DSX connections for the H4TU-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.

PROVISIONING

HDSL4 Configuration is performed via software control. For more information, refer to the "Control Port Operation" section of this practice.

Provisioning Options

The provisioning settings can be viewed and manipulated through access to the firmware via the front panel RS-232 port. **Table 6** lists the available provisioning options and their factory default settings.

Table 6. Provisioning Options

Provisioning Option	Option Settings	Default Settings
1. DSX-1 Line Build Out	External [1], 0-133 feet, 133-266 feet, 266-399 feet, 399-533 feet, 533-655 feet	0-133 feet
2. DSX-1/DS1 Line Code	B8ZS, AMI	B8ZS
3. DSX-1/DS1 Framing	SF, ESF, Unframed, Auto	ESF
4. Force Frame Conversion [2]	Disabled, Enabled	Disabled
5. Smartjack Loopback	Disabled, Enabled	Enabled
6. Loopback Time Out	None, 120 Minutes	120 Minutes
7. Latching Loopback Mode [3]	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 [4]	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	34 dB
13.SNR Margin Alarm Threshold	0 (Disabled), 1-15 dB	04 dB

Table 6. Provisioning Options (Continued)

Provisioning Option	Option Settings	Default Settings
14.Remote Provisioning	Disabled, Enabled	Enabled
15.Shelf Alarm [5]	Disabled, Enabled	Enabled

1. External is used only for Kentrox shelves. Unit transmits 12-volt p-p to DSX panel. If using a shelf other than Kentrox, use the 0-133 feet setting.
2. The forced frame format conversion (FFFC) mode sets the H4TU-C to ESF and the H4TU-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.
3. Latching Loopback Mode
   - T1 - When optioned for T1 mode, the unit does not respond to DDS Latching Loopback codes.
   - FT1 - DDS Latching Loopback operation is supported. The H4TU-C and any H4R 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 sends 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.
4. 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).
5. The Shelf Alarm option is available on the DDM+ H4TU-C (P/N 1223403L2), 3192M H4TU-C (P/N 1223404L12) and 3192 H4TU-C (P/N 1223404L2) only.

NOTE

The Span Power option is available on H4TU-C units only.

NOTE

The Shelf Alarm option is available on DDM+, 3192M, and 3192 H4TU-C units only.

Provisioning Options, Total Access 3000 H4TU-C

The Total Access 3000 H4TU-C is provisioned through the SCU on the Total Access 3000 chassis. In addition to the options shown in Table 6 on page 11, the options shown in **Table 7** apply.

Table 7. Total Access 3000 Additional Provisioning Options

Provisioning Option	Option Settings	Default Settings
Service State [1]	In Service, Out-of-Service Unassigned, Out-of-Service Maintenance	Out-of-Service Maintenance
Network Source [2]	DSX, MUX A, MUX B, Auto MUX	DSX
External Alarms	Enabled, Disabled	Disabled
Auto In Service	Disabled, Enabled	Enabled
Auto IS Startup Period	1 hour, 4 hours, 8 hours, 24 hours	4 hours
Auto IS Off Period	1 hour, 4 hours, 8 hours, 24 hours	8 hours

1. The Service State defaults to Out-of- Service Maintenance, which allows active connections to the DSX or MUX interface; however, no alarms are generated. The In Service setting allows full functioning connections to DSX or MUX interfaces. The Auto In Service option must be changed per Local Work Instruction to put the unit in service. Out-of-Service Maintenance allows the loops to train up but does not pass data to the DSX or MUX interface.
2. For Network Source settings, the following options apply:
   - DSX-1: The module utilizes the DSX-1 interface. The Muxes are not used, even if present.
   - Mux A: The module uses Mux A as its data source. The module does not switch to Mux B in the case of a Mux A failure. The EQ jacks can be used as a temporary test point in conjunction with the EQ jack setting on the loopback/test screen.
   - Mux B: The module uses Mux B as its data source. The module does not switch to Mux A in the case of a Mux B failure. The EQ jacks can be used as a temporary test point in conjunction with the EQ jack setting on the loopback/test screen.
   - Auto Mux: The module defaults to Mux A as its data source. In the event of a Mux A failure, the module performs a protection switch to Mux B if it is present and in service. The EQ jacks can be used as a temporary test point in conjunction with the EQ jack setting on the loopback/test screen.

HDSL4 SYSTEM TESTING

The ADTRAN HDSL4 system provides the ability to monitor the status and performance of the DSX-1 signals, DS1 signals, and HDSL4 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 HDSL4 system. Additional testing features are described below.

H4TU-C Bantam Jacks

The front panel of an H4TU-C module contains both metallic splitting (**EQ**) and monitoring (**MON**) bantam jacks.

The **EQ** jacks provide an *intrusive* access point, interrupting signal access to the local loop. This provides a port for the test set to transmit a test signal toward an H4TU-R module and to receive a test signal from an H4TU-R module.

The **MON** jacks, when connected to a bit-error rate test set that is configured for monitoring mode, provide a *non-intrusive* test access point for observing the transmit or receive signal. In this configuration, synchronization, test patterns, and other functions can be observed.

Alternatively, the **MON** jacks can also be used for intrusive testing toward the network. To utilize this configuration, perform the following steps:

1. Disconnect the H4TU-C DSX-1 interface by opening both the metallic splitting **TX** and **RX EQ** jacks with either a bantam open plug or a bantam test cord that is not terminated.
2. Configure a test set for Terminate mode.
3. Connect the test set to the **MON** jacks. (Test access toward the network equipment is achieved.)
4. Connect the output (TRANS) of the test set to the **MON RX** jack, and the input (REC) of the test set to the **MON TX** jack.

A detailed description of testing via the Total Access 3000 H4TU-C Bantam Jack arrangement is provided in “Appendix C, Front Panel DSX and MUX Mode Test Access”.

H4TU-R Bantam Jacks

The DS1 bantam jacks provide access for DS1 signal monitoring.

The jacks labeled **MON** provide a test access point for monitoring the transmit and receive signals at the DS1 interface point. The monitoring jacks can be used in two different ways:

1. The monitoring jack of an H4TU-R module provides a *nonintrusive* tap onto a signal line and permits the connection of test equipment to monitor the characteristics of the signal with the DS1 test set optioned for Monitor mode.
2. If the DS1 test set is optioned for Terminate mode and the customer DS1 is disconnected, then the monitor jack of an H4TU-R module provides an *intrusive* tap and could be used to transmit and receive signals between an H4TU-R module and the network.

Figure 7 illustrates the complete bantam jack arrangement and details for specific jacks.

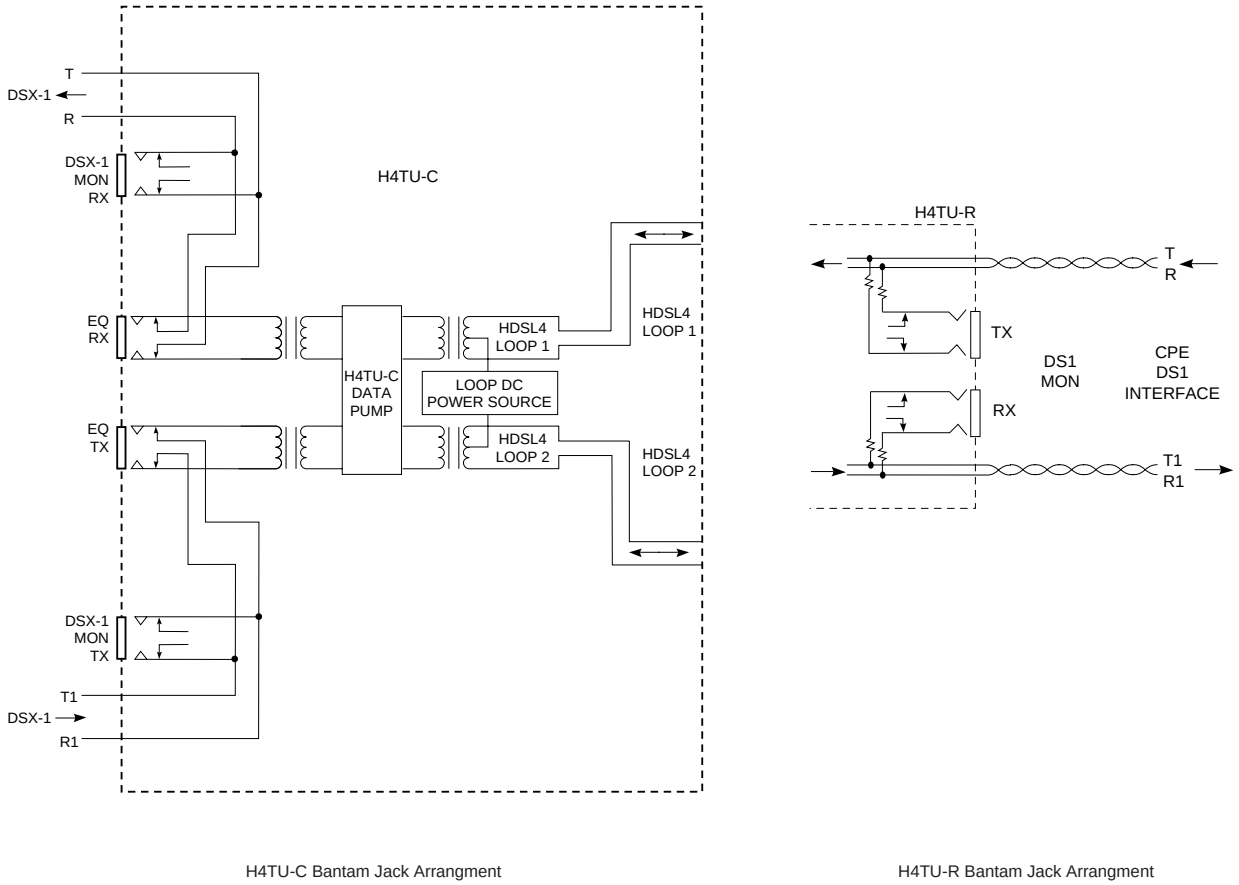


Figure 7. Bantam Jack Arrangements

Loopbacks

The ADTRAN HDSL4 modules respond to three different loopback activation processes. These processes may be utilized to provide a loopback that affects either an H4TU-C or an H4TU-R module (locally or remotely).

1. Loopbacks may be activated using the craft interface. The Loopback Options screen that provides for the H4TU-C and H4TU-R loopbacks is described in "Control Port Operation" on page 19.
2. The modules respond to the industry standard for HDSL loopbacks. A detailed description of these loopback sequences is given in "Appendix A, Loopback, Control Codes, and Commands".
3. H4TU-R modules respond to loopbacks initiated using front panel pushbuttons.

ADTRAN HDSL4 modules contain smartloop technology. By constantly monitoring the DSX-1 for a framing pattern, ADTRAN HDSL4 modules initiate the proper loopback regardless of how the loopback control sequence is sent (framed or unframed).

The loopback condition imposed in both cases is a logic level loopback at the point within an H4TU-C module where the DSX-1 signal passes into the HDSL4 modulators. **Figure 8** depicts all of the loopback locations possible with ADTRAN HDSL4 equipment.

In addition to network-side loopbacks, an H4TU-C module provides customer-side loopbacks initiated by using either the terminal control port or in-band loop codes. For more information, refer to "Appendix A, Loopback, Control Codes, and Commands". In this mode, an AIS (all ones) signal is supplied to the network.

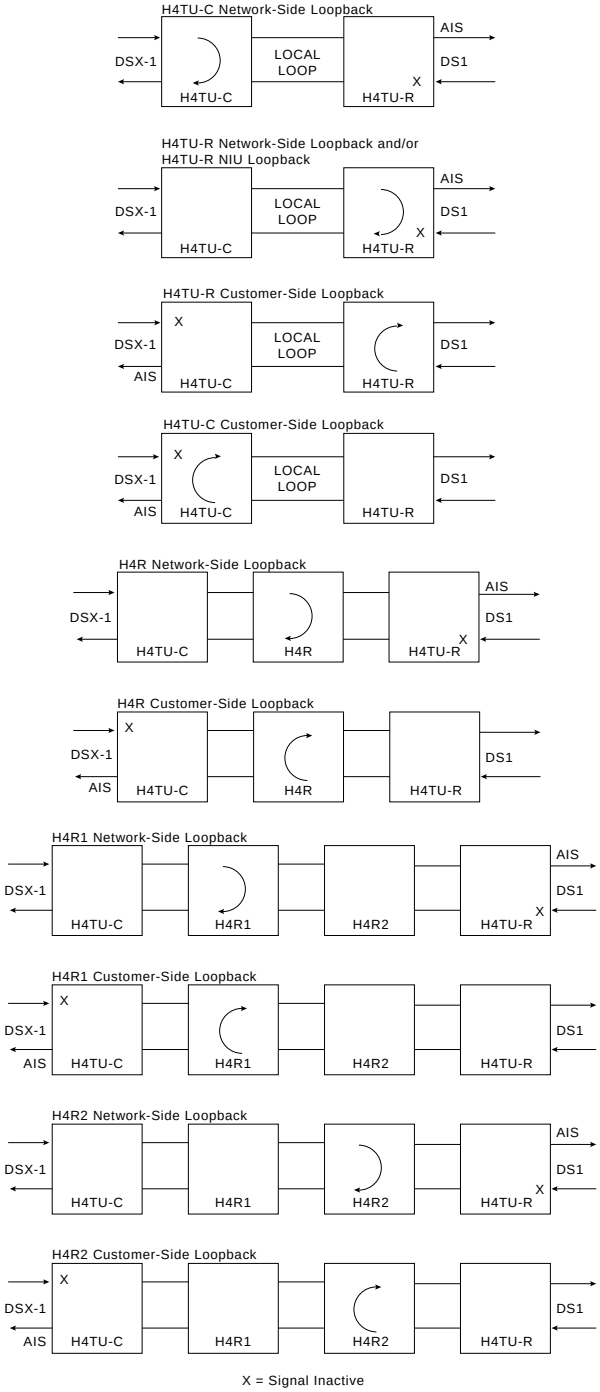


Figure 8. HDSL4 Loopbacks

H4TU-R Front Panel Pushbuttons

Two front-panel pushbuttons, labeled **LOC** and **REM**, provide hardware control of the loopbacks.

Pressing the **LOC** pushbutton causes a bidirectional loopback (toward the customer and the H4TU-C) to occur at the H4TU-R. If a bidirectional loopback is active, pressing the pushbutton a second time disables the loopback.

Pressing the **REM** pushbutton activates a bidirectional loopback at the H4TU-C (toward the H4TU-R and network). If the loopback is active, pressing the pushbutton a second time disables the loopback.

Front Panel LED Indicators

LED indicators mounted on the front panel of the unit provide status of the HDSL4 circuit. Each indicator is described in **Table 8** for the H4TU-C and **Table 9** for the H4TU-R.

Table 8. H4TU-C Front Panel LED Indicators

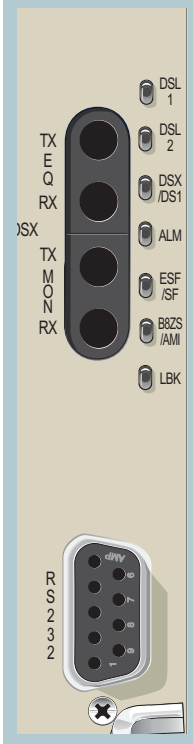
Module	Label	Condition	Description
	**DSL 1** **DSL 2**	● Green ● Red	DSL Loop 1 and Loop 2 sync, no errors currently detected, signal margin ≥3 dB No DSL Loop 1/ Loop 2 sync, errors being detected, or signal margin < 3 dB
	DSX/DS1	● Green ● Red	DSX-1 signal is present, and no errors currently being detected In framed mode, denotes loss of framing or loss of sync at the DSX/DS1 input; in unframed mode, denotes loss of signal at DSX/DS1 input
	ALM	○ Off ● Red ● Yellow	No active alarm present Loss of DSX-1 signal to the unit Loss of DS1 signal to the remote
	ESF/SF	○ Off ● Yellow ● Green	Unit is provisioned for unframed data Unit is provisioned for ESF data Unit is provisioned for SF data
	B8ZS/AMI	● Yellow ● Green	Unit is provisioned for B8ZS line code Unit is provisioned for AMI line code
	LBK	○ Off ● Yellow	Unit is *not* in loopback Unit is in loopback (network and/or customer)

Table 9. H4TU-R Front Panel LED Indicators

Module	Label	Condition	Description
	**DSL 1**	● Green	DSL Loop 1 sync, no errors currently detected, and signal margin ≥ 3dB
		● Red	No DSL Loop 1 sync, errors being detected, or signal margin < 3dB
	DSL 2	● Green	DSL Loop 2 sync, no errors currently detected, and signal margin ≥ 3dB
		● Red	No DSL Loop 2 sync, errors being detected, or signal margin < 3dB
	DS1	● Green	DSX-1 signal is present and no errors currently being 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 provisioned for Unframed data
		● Yellow	Unit is provisioned for ESF data
		● Green	Unit is provisioned for SF data
	B8ZS/AMI	● Yellow	Unit is provisioned for B8ZS line code data
		● Green	Unit is provisioned for AMI line code data
	LLB/RLB	○ Off	Unit is *not* in loopback
		● Yellow	Unit is in loopback (network and/or customer)
		● Green	H4TU-C is in loopback toward the HDSL4 for Verizon

CONTROL PORT OPERATION

The H4TU-C module, with exception of the Total Access 3000 module, 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 9**.

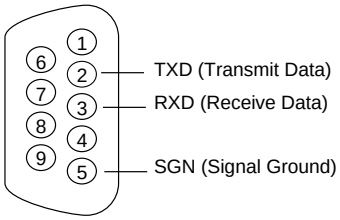


Figure 9. RS-232 (DB-9) Pin Assignments

NOTE

The Total Access 3000 H4TU-C Control Port access is provided via the DB-9 connector on the Total Access System Controller Unit (SCU), P/N 1181018Lx. This section provides Total Access 3000 H4TU-C screens separately where they differ from other HDSL4 screens.

NOTE

When the ADC HiGain® Management Unit (HMU) is installed, the 3192M DB-9 is disabled. Terminal screens must be accessed from any one of these HMUs:

HMU-319-L7A
HMU-319-L7AV307
HMU-319-L7A32

The terminal interface operates at data rates from 1.2 kbps to 19.2 kbps.

The Total Access 3000 SCU default rate is 9.6 kbps, and can operate to data rates as high as 115.2 kbps.

The asynchronous data format is fixed at the following parameters:

- 8 data bits; no parity; 1 stop bit
- Disable the line wrap feature of emulation programs

An H4TU-C module supports two types of terminal emulation modes:

- Manual Update Mode - This mode is a dumb terminal mode, enabling 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 three times to update the screen).

- Real Time Update Mode (default) - This 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.

NOTE

The Manual Update Mode is not a function of the Total Access 3000 H4TU-C.

NOTE

If using a personal computer (PC) with terminal emulation capability, disable any power saving programs. Otherwise, communication between the PC and the HDSL4 unit may be disrupted, resulting in misplaced characters or screen time outs.

Menu Structure

The menu structure for the HDSL4 products is a layered menu. Each menu level consists of submenus and/or menu items.

- Submenus are elements that move the display down to the next menu level.
- Menu items are elements that facilitate changes to the current SCU settings.

The HDSL4 supports two different types of menu items: read-only and read-write.

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

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

NOTE

The screens illustrated in Figure 10 through Figure 51 are for an HDSL4 circuit deployed with the ADTRAN HDSL4 technology. The circuit includes an H4TU-C module, two H4R repeaters, and an H4TU-R module.

Accessing the HDSL4 Main Menu

A terminal session is initiated by entering multiple spacebar characters, which are used by an H4TU-C module to determine the speed of the terminal. Once the speed has been determined, the ADTRAN HDSL4 Main Menu is displayed from which the various Operation, Administrative, Maintenance, and Provisioning (OAM&P) screens may be accessed (**Figure 10**).

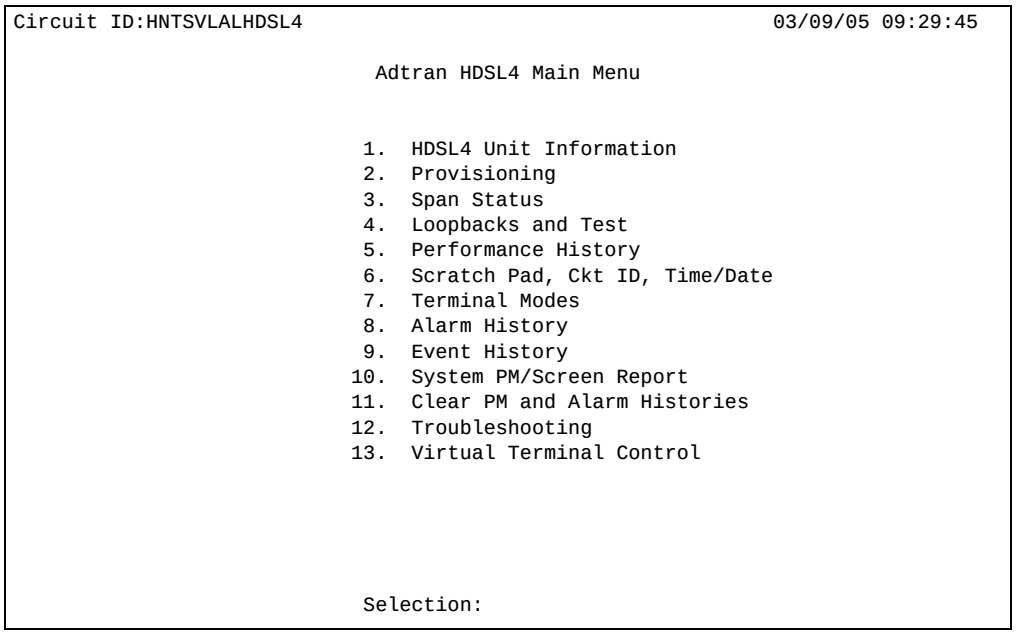


Figure 10. ADTRAN HDSL4 Main Menu

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

The menu options are as follows:

- "HDSL4 Unit Information" on page 24
- "Provisioning" on page 25
- "Span Status" on page 27
- "Loopbacks and Test" on page 31
- "Performance History" on page 36
- "Scratch Pad, Circuit ID and Date/Time Screen" on page 38
- "Terminal Modes" on page 39
- "Alarm History" on page 40
- "Event History" on page 43
- "The System PM/Screen Report" on page 44
- "Clear PM and Alarm Histories" on page 44
- "Troubleshooting" on page 45
- "Virtual Terminal Control" on page 54

Accessing the HDSL4 Main Menu (Total Access 3000 H4TU-C)

Accessing the HDSL4 circuit information via the Total Access 3000 System Controller Unit (SCU) control port requires a successful logon with a recognized account name and password. See **Figure 11**. The default account name is **ADMIN**. The default password is **PASSWORD**.

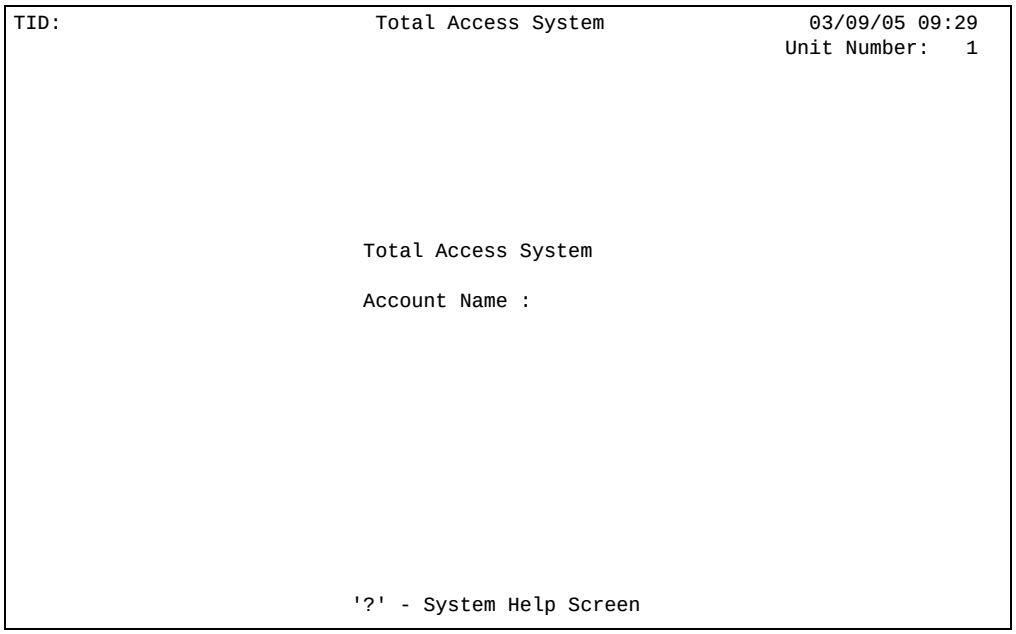


Figure 11. Logon Screen

Total Access 3000 Main Menu

After successful logon, the Total Access 3000 Main Menu (**Figure 12**) displays. Select the Access Modules option from this menu.

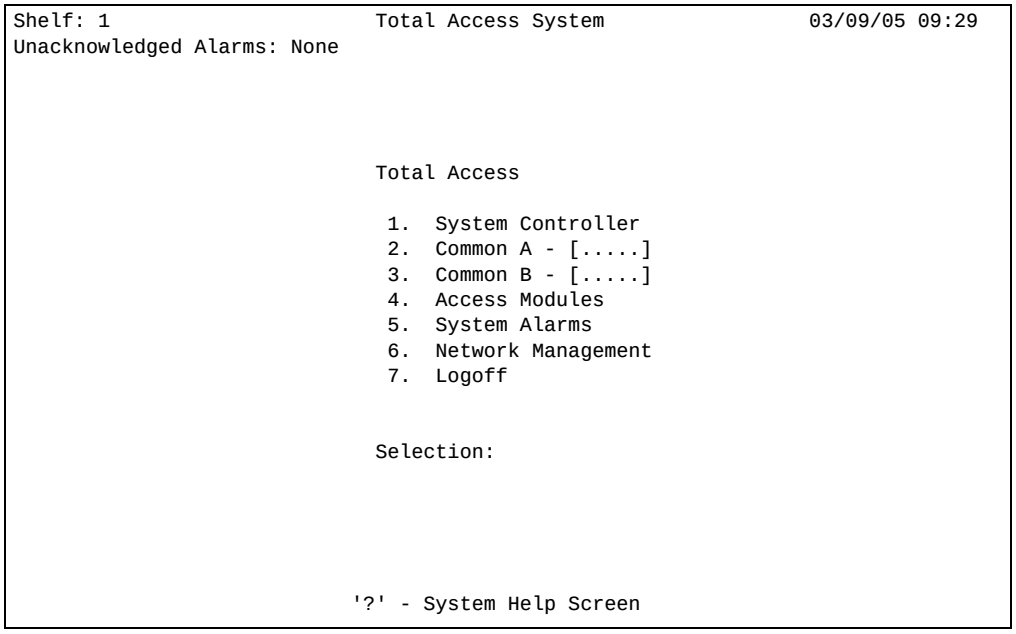


Figure 12. Total Access Main Menu

Access Module Menus

The Access Module Menus screen (**Figure 13**) displays the access modules occupying the Total Access 3000 shelf. Select the corresponding channel slot number for the desired H4TU-C. To the right of each access module listed, the current alarm state is indicated.

```
Shelf: 1                      Total Access System                 03/09/05 09:29
Unacknowledged Alarms: None

                              Access Module Menus

            1 - H4TU-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 :

                    Inverse = Busy Modules
```

Figure 13. Access Module Menus Screen

HDSL4 Main Menu (Total Access 3000 H4TU-C)

The HDSL4 Main Menu provides access to detailed performance and configuration information. The Operation, Administration, Maintenance, and Provisioning (OAM&P) screens are available as listed on **Figure 14**.

```
Shelf:  1  Slot:  15          Total Access System                 03/09/05 10:59
Unacknowledged Alarms: CRITICAL MAJOR             INFO
                     Circuit ID:

                               HDSL4 Main Menu

                              1.  HDSL4 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 14. Total Access 3000 H4TU-C Main Menu Screen

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

The menu options are as follows:

HDSL4 Unit Information

The Unit Information screen (**Figure 15**) provides detailed product information on each component in the HDSL4 circuit. ADTRAN Technical Support contact numbers are also available from the Unit Information screen.

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                      Press ESC to return to previous menu

                                ADTRAN
                           901 Explorer Boulevard
                         Huntsville, Alabama 35806-2807
--------------------- For Information or Technical Support ---------------------
      Support Hours ( Normal 7am - 7pm CST, Emergency 7 days x 24 hours )
Phone: 800.726.8663 / 888.873.HDSL  Fax: 256.963.6217  Internet: www.adtran.com
--------------------------------------------------------------------------------

              ADTN H4TU-C                       ADTN H4TU-R
              P/N: 1223401L2                    P/N: 1223426L2
              S/N: FD14E3648                    S/N: 123456789
             CLEI: T1L8PNMCAA                  CLEI: T1L85M7CAA
             Manf: 08/08/2004                  Manf: 08/01/2004
              Ver: A07                          Ver: A09

              ADTN H4R1                         ADTN H4R2
              P/N: 1223445L1                    P/N: 1223445L1
              S/N: FD14E3648                    S/N: 123456789
             CLEI: T1R6U87DAA                  CLEI: T1R6U87DAA
             Manf: 08/01/2004                  Manf: 08/01/2004
              Ver: A07                          Ver: A09
```

Figure 15. ADTRAN Information Screen

Provisioning

The Provisioning menu displays current settings.

Depending on the selected product, one of two Provisioning menus displays:

- “Provisioning Menu” on page 25
- “Provisioning Menu (Total Access 3000 H4TU-C)” on page 26

Provisioning Menu

The Provisioning menu is displayed in **Figure 16**.

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                      Press ESC to return to previous menu


                                Provisioning

                       1.  DSX-1 Line Buildout     =  0-133 ft
                       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  =  34dB
                      13.  SNR Margin Alarm Thres  =  04dB
                      14.  Remote Provisioning     =  Enabled
                      15.  Shelf Alarm             =  Enabled
                       D.  Restore Factory Defaults

                             Selection:
```

Figure 16. Provisioning Menu

To re-deploy this unit, press D which restores the factory default settings to those shown in Table 6 on page 11.

Provisioning Menu (Total Access 3000 H4TU-C)

The Provisioning menu for the Total Access 3000 H4TU-C occupies two screens, which are shown in **Figure 17** and **Figure 18**.

- To view screen 2, press N, and press ENTER.
- To return to screen 1, press P, and press ENTER.

```
Shelf:  1  Slot:  14          Total Access System                 03/09/05 10:59
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 = 34dB
                      13. SNR Margin Alarm Thres = 04dB
                      14. Remote Provisioning = Enabled
                      15. Service State = OOS Maintenance
                      16. Network Source = DSX
                       N. Next Page
                            Selection:
```

Figure 17. Total Access 3000 H4TU-C Provisioning Screen 1

```
Shelf:  1  Slot:  14          Total Access System                 03/09/05 10:59
Unacknowledged Alarms:                              INFO
                     Circuit ID:

                                 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 18. Total Access 3000 H4TU-C Provisioning Screen 2

To re-deploy this unit, press D. This restores the factory default settings to those shown in Table 6 and Table 7.

Span Status

The Span Status Screen provides quick access to status information for each HDSL4 receiver in the circuit.

Depending on the selected product, one of two Span Status Screens displays:

- "Span Status Screen" on page 27
- "Span Status Screen (Total Access 3000 H4TU-C)" on page 28

Span Status Screen

The Span Status Screen is displayed in **Figure 19**.

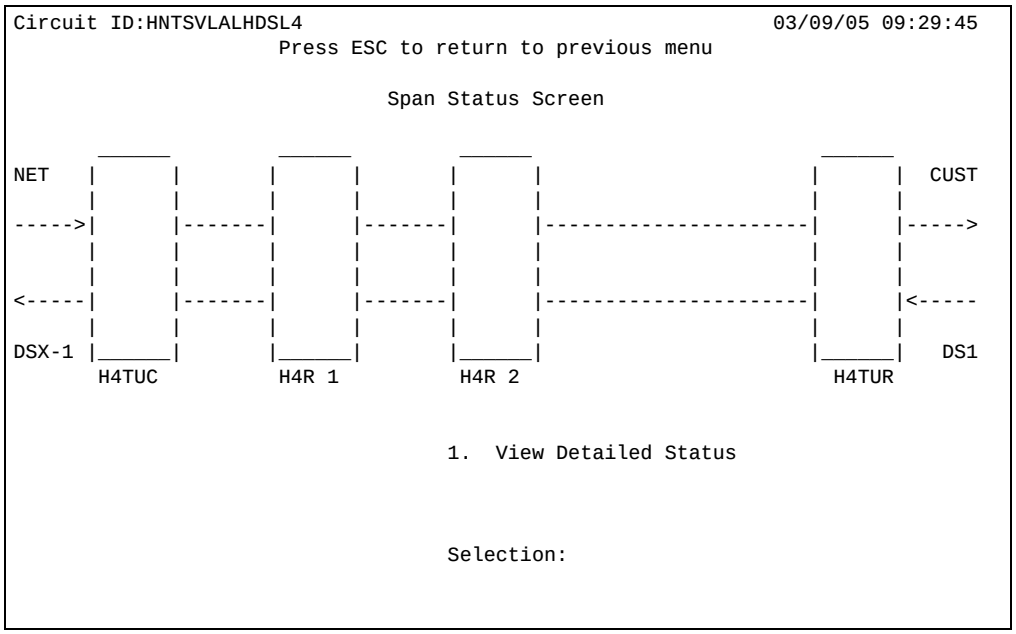


Figure 19. Span Status Screen

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

The only menu option is as follows:

- "View Detailed Status" on page 29

Span Status Screen (Total Access 3000 H4TU-C)

The Span Status Screen for the Total Access 3000 H4TU-C is displayed in **Figure 20**. This screen includes an option to access the Auto In Service feature of Total Access 3000.

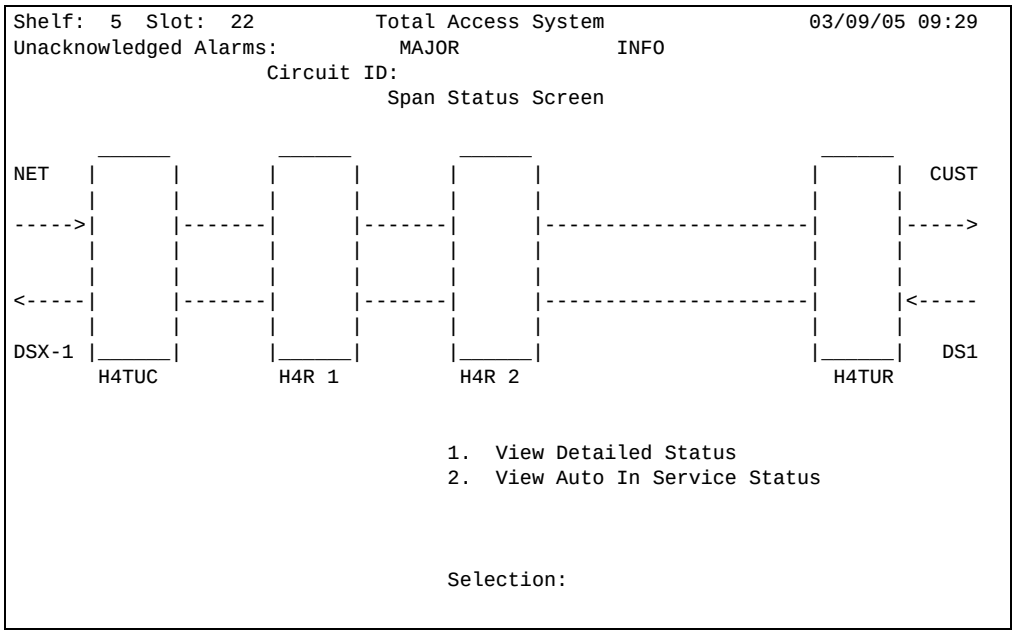


Figure 20. Total Access 3000 H4TU-C Span Status Screen

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

The menu options are as follows:

- "View Detailed Status" on page 29
- "View Auto In Service Status" on page 29

View Detailed Status

The View Detailed Status selection from the Span Status Screen menu (**Figure 21**) displays the HDSL4 status for each receiver point.

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                     Press ESC to return to previous menu

                              Detailed Status Screen

                    LOOP 1                          LOOP 2
                MARGIN       ATTEN              MARGIN       ATTEN
Interface   (CUR/MIN/MAX) (CUR/MAX)         (CUR/MIN/MAX) (CUR/MAX)
---------   ------------- ---------         ------------- ---------
H4TUC         17/00/17      00/00             17/00/17      00/00
H4R1 NETW     17/00/17      00/00             17/13/17      00/00
H4R1 CUST     17/17/17      00/00             17/00/17      00/00
H4R2 NETW     17/00/17      00/00             17/13/17      00/00
H4R2 CUST     17/17/17      00/00             17/00/17      00/00
H4TUR         17/00/17      00/00             17/00/17      00/00




                                    1. Reset Min/Max
                                    2. View Performance History
                                    Selection:
```

Figure 21. Detailed Status Screen

View Auto In Service Status

The Auto In Service Status Screen (**Figure 22**) provides the status of the Auto In Service feature. This option is only available the Total Access 3000 H4TU-C.

```
Shelf:  1  Slot:  15          Total Access System                03/09/05 10:59
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 22. Auto In Service Screen

NOTE

The T1 alarm indications displays if the External Alarms option is set to “Enabled” on the Provisioning menu (Figure 17).

The Auto In Service Status 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 only goes 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 menu.

A link is provided to view the Alarm History Screen. The Alarm History Screen screen is also available by selecting the HDSL4 Main Menu option.

System responses displayed in the status fields on the Alarm History Screen are shown in **Table 10**.

Table 10. 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 22) T1 Alarm Status = Alarm or OK

Loopbacks and Test

The Loopback and Test Commands menu is used to evoke or terminate all available HDSL4 loopbacks. Each HDSL4 circuit component can be looped toward the network or customer from this screen. Unit self tests can also be initiated from this screen. When any loopback is active, a “Loop Down ALL Units” command is available in lieu of the “Run Self Tests” option.

Depending on the selected product, one of two Loopbacks and Test Commands Menus displays:

- “Loopbacks and Test Commands Menu” on page 31
- “Loopback and Test Commands Menu (Total Access 3000 H4TU-C)” on page 32

Loopbacks and Test Commands Menu

The Loopbacks and Test Commands menu is displayed in **Figure 23.**

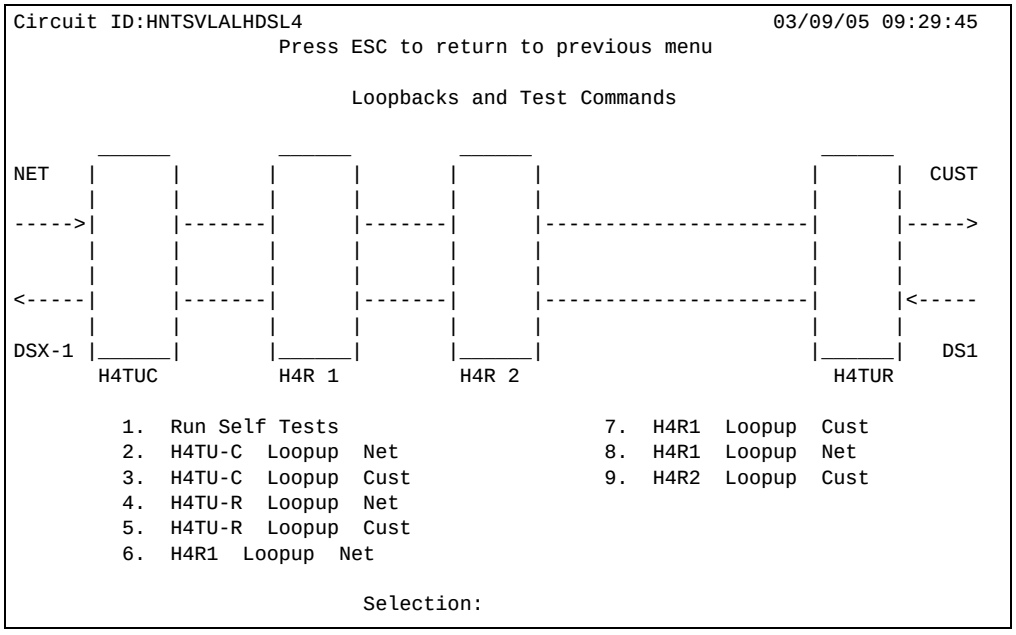


Figure 23. Loopback and Test Commands Menu

Loopback and Test Commands Menu (Total Access 3000 H4TU-C)

The Loopback and Test Commands menu for the Total Access 3000 H4TU-C is displayed in **Figure 24**.

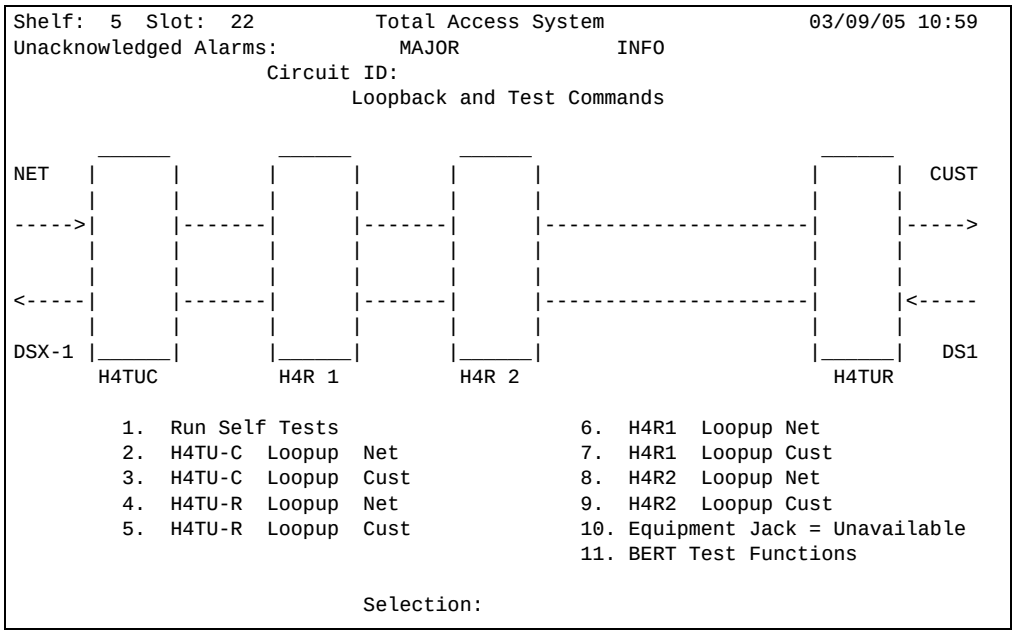


Figure 24. Total Access 3000 H4TU-C Loopback and Test Commands Screen

The Loopback and Test Commands Menu for the Total Access 3000 H4TU-C has the following additional features:

- Equipment Jack selection - Select Network or Customer for testing purposes. Refer to "Appendix C, Front Panel DSX and MUX Mode Test Access" for details.
- Bit Error Rate Testing (BERT).

BERT Test Functions

When selecting the BERT Test Functions option from the Loopbacks and Test Commands menu, the BERT Test Screen displays (**Figure 25**).

```
Shelf:  1  Slot:  18          Total Access System                03/09/05 10:59
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 25. BERT Test Screen

The following options are available from the BERT Test Screen:

- “(Re)start Pattern” on page 33
- “Stop Test” on page 33
- “Select Data Pattern” on page 34
- “Enter Test Timeout” on page 34
- “Toggle Test Direction” on page 35
- “Inject Bit Errors” on page 35

NOTE

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

(Re)start Pattern

The (Re)start Pattern option is used to start (or restart) a test.

Stop Test

The Stop Test option is used to manually stop the test.

Select Data Pattern

The Select Data Pattern option from the BERT Test Screen allows the appropriate data test pattern for the desired results to be selected. **Figure 26** illustrates this screen with the menu of test patterns.

```
Shelf:  1  Slot:  18          Total Access System                03/09/05 10:59
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 26. Select Data Pattern

Enter Test Timeout

The Enter Test Timeout option displays the Timeout Screen (**Figure 27**). The timeout 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.

```
Shelf:  1  Slot:  18          Total Access System                03/09/05 10:59
Unacknowledged Alarms:          MAJOR             INFO
                     Circuit ID:
                           CUSTOMER Timeout Screen

                          Test Timeout(Hr:Min) = 02:00
                          ---------------------------
                          1. Change Timeout

                          *NOTE: When timeout is set to 00:00, the
                                 test will run indefinitely.









                          Selection:
```

Figure 27. BERT Test Functions - Selection 4, Enter Test Time Out

Toggle Test Direction

With no test running, the Toggle Test Direction option on the BERT Test Screen allows changing (toggling) the test signal in the opposite direction (from customer to network and vice versa).

Inject Bit Errors

When the "(Re)start Pattern" option is selected to start the test, the "Enter Test Timeout" option changes to Inject Bit Errors. This option is used to display the screen shown in **Figure 28**. This option generates the selected number of errors from this test origination point to validate the test results.

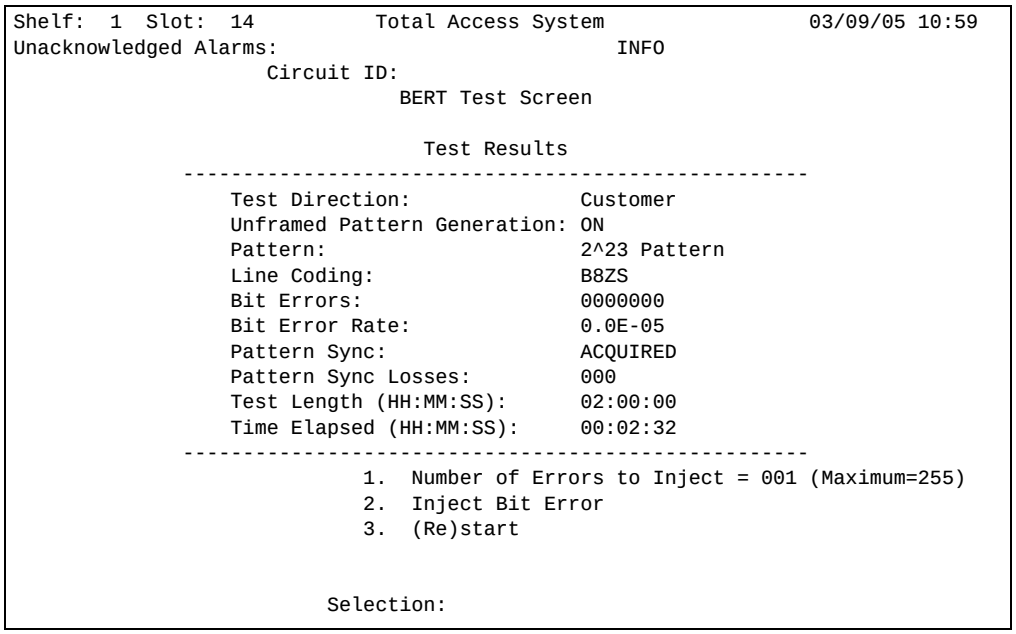


Figure 28. BERT Inject Errors Screen

Performance History

The Performance History menu (**Figure 29**) displays the historical HDSL4 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.

Select a module and interface to view the corresponding performance data. Line (L) and Path (P) can be viewed.

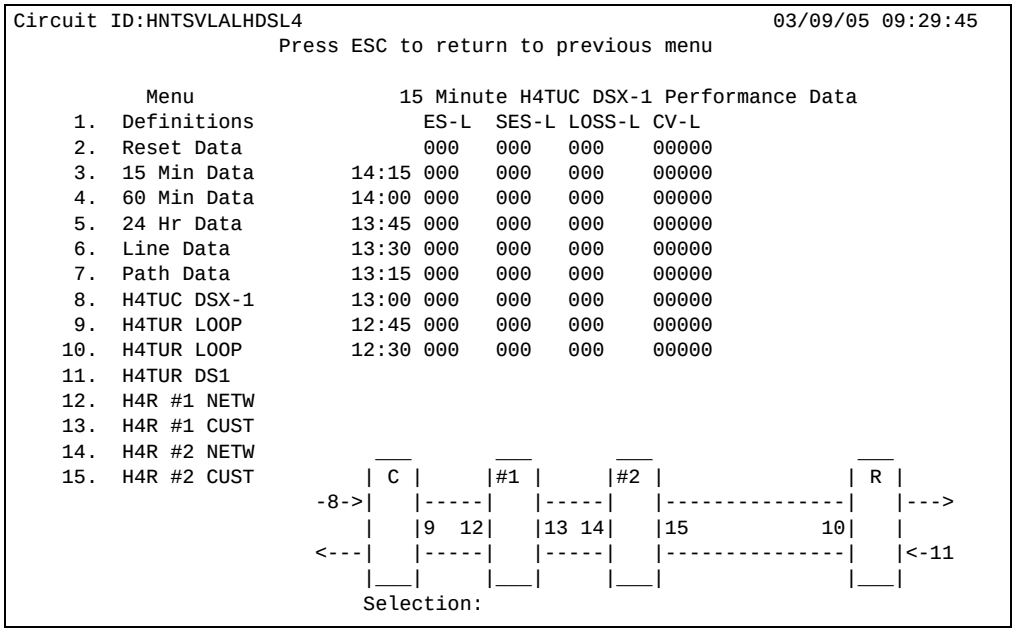


Figure 29. Performance History, 15-Minute Line Data

Definitions

Abbreviations used in the Performance Monitoring screens are defined in the Data Definitions screens (**Figure 30** and **Figure 31**).

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                     Press ESC to return to previous menu

                          Performance Data Definitions

H4TUC, H4TUR, and H4R LOOP Related:     HDSL4 Framing
  ES-L    Errored Seconds                 CRC>=1 or LOSW>=1
  SES-L   Severely Errored Seconds        CRC>=50 or LOSW>=1
  UAS-L   Unavailable Seconds             >10 cont. SES-Ls

DS1 and DSX-1 Line Related:             Superframe and Extended Superframe
  ES-L    Errored Seconds                 (BPV+EXZ)>=1 or LOS>= 1
  SES-L   Severely Errored Seconds        (BPV+EXZ)>=1544 or LOS>=1
  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 30. Performance Data Definitions, Loop

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                     Press ESC to return to previous menu

                          Performance Data Definitions

DS1 and DSX-1 Path Related:           Superframe           Extended Superframe
  ES-P    Errored Seconds               FE>=1 or             CRC>=1 or
                                         SEF>=1 or AIS>=1     SEF>=1 or AIS>=1
  SES-P   Severely Errored Seconds      FE>=8 or             CRC>=320 or
                                         SEF>=1 or AIS>=1     SEF>=1 or AIS>=1
  UAS-P   Unavailable Seconds           >10 cont. SES-Ps     >10 cont. SES-Ps
  SAS-P   SEF/AIS Seconds               SEF>=1 or AIS>=1     SEF>=1 or AIS>=1
  ES-PFE  Far End Errored Seconds       n/a                  PRM bits G1-G6,SE,
                                                              or SL=1, or RAI
  CV-P    Code Violation Count          FE count             CRC error count

NOTE: Under a UAS-P condition, ES-P and SES-P counts are inhibited.
      Under a SES-L or SES-P condition, the respective CV-L or CV-P count is
      inhibited.




    P.  Previous            Selection:
```

Figure 31. Performance Data Definitions, Path

Scratch Pad, Circuit ID and Date/Time Screen

The Scratch Pad, Circuit ID and Date/Time screen (**Figure 32**) provides a logging medium for circuit information. The format for the items on this screen are as follows:

- The scratch pad is for circuit-specific notes. Up to 50 alphanumeric characters, in any combination, can be typed in this field.
- The circuit ID can be any alphanumeric string up to 25 characters in length.
- The time should be entered using military time format (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”).

NOTE

Date/time settings for the Total Access 3000 H4TU-C are set from the SCU.

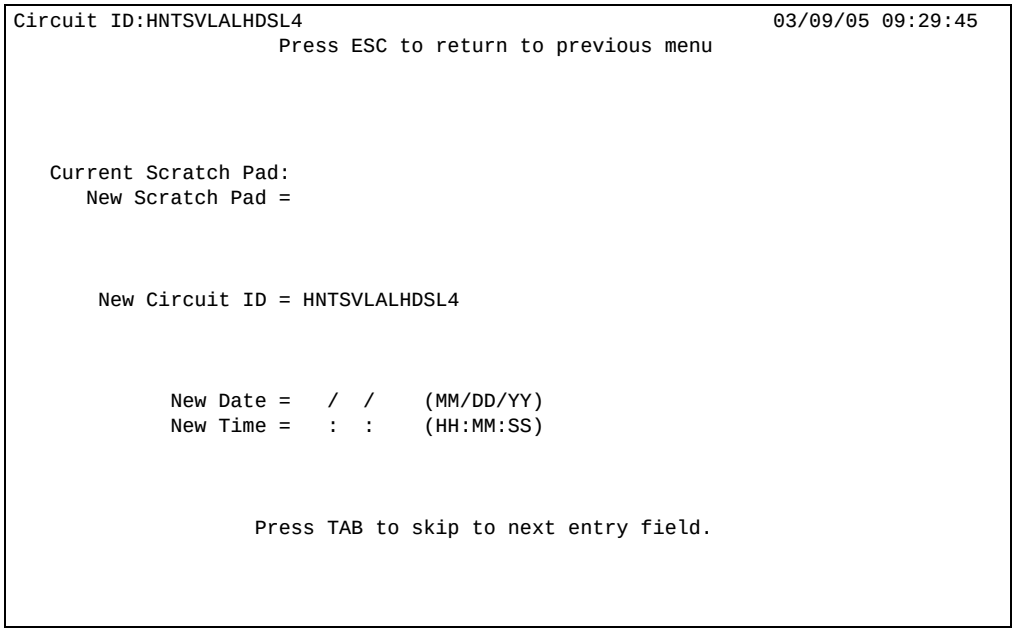


Figure 32. Scratch Pad, Circuit ID, and Date/Time Screen

Terminal Modes

The desired terminal mode can be selected from the Terminal Modes Menu, illustrated in **Figure 33**. Additionally, pressing CTRL+T while on any screen can toggle the two terminal modes.

NOTE

The manual update mode is not a function of the Total Access 3000 H4TU-C.

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                      Press ESC to return to previous menu
                            TERMINAL MODES MENU

   MANUAL UPDATE MODE:

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

   REAL-TIME UPDATE MODE:

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


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

Figure 33. Terminal Mode Menu

The module used in this example includes the following terminal emulation modes:

- Manual Update Mode - This mode is used 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. The message “3 SPACES TO UPDATE” appears at the top of each screen. By pressing the spacebar three times, the screen refreshes and reflects the most current circuit conditions and provisioning options.
- Real-Time Update Mode (VT100) - This mode provides real-time updating of HDSL4 circuit conditions and provisioning options as changes occur. The default mode is Real-Time Update.

Alarm History

The Alarm History screens are divided into three separate screens:

- “T1 Alarm History” on page 40
- “HDSL4 Span History” on page 42
- “HDSL4 Facility Alarm History” on page 41

T1 Alarm History

The T1 Alarm History screen (**Figure 34**) displays the following information:

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

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                     Press ESC to return to previous menu

                              T1 Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
H4TU-C     RED(LOS/LOF) 01/01/00  00:00:04   01/01/00  00:00:04   Alarm      001
 (DSX-1)   YELLOW(RAI)                                           OK         000
           BLUE(AIS)                                             OK         000

H4TU-R     RED(LOS/LOF)                                          OK         000
 (DS1)     YELLOW(RAI)                                           OK         000
           BLUE(AIS)                                             OK         000









-------------------------------------------------------------------------------
    1.  T1 Alarm            4.  Span H4R1 to H4TUR
    2.  Facility Alarm      C.  Clear T1 Alarms
    3.  Span H4TUC to H4R1
                             Selection:
```

Figure 34. T1 Alarm History Screen

HDSL4 Facility Alarm History

The HDSL4 Facility Alarm History screen (**Figure 35**) displays the following information:

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

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                     Press ESC to return to previous menu

                              Facility Alarm History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
FACILITY DC OPEN       01/01/00  00:01:40   01/01/00  00:01:40   OK          001
FACILITY SHORT                                                   OK          000
FACILITY GROUND FAULT                                            OK          000

H4TU-C   POWER CYCLE   01/01/00  00:00:02   01/01/00  00:00:02   OK          001
H4TU-R   POWER CYCLE   01/01/00  00:00:59   01/01/00  21:57:35   OK          006









-------------------------------------------------------------------------------
    1.  T1 Alarm            4.  Span H4R1 to H4TUR
    2.  Facility Alarm      C.  Clear Facility Alarms
    3.  Span H4TUC to H4R1
                             Selection:
```

Figure 35. HDSL4 Facility Alarm History Screen

HDSL4 Span History

The HDSL4 Span History screen (**Figure 36**) displays the following information:

- Loss of Sync for each HDSL4 receiver
- Margin Threshold Alarm for each HDSL4 receiver
- Attenuation Threshold Alarm for each HDSL4 receiver

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                    Press ESC to return to previous menu

                              HDSL4 Span History
LOCATION   ALARM       FIRST                LAST                 CURRENT   COUNT
-------------------------------------------------------------------------------
SPAN C-H1  L1  LOS     01/01/00  00:01:40   01/01/00  00:01:40   OK         001
           L2  LOS     01/01/00  00:01:40   01/01/00  00:01:40   OK         001

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

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

-------------------------------------------------------------------------------
    1.  T1 Alarm            4.  Span H4R1 to H4TUR
    2.  Facility Alarm      C.  Clear Span Alarms
    3.  Span H4TUC to H4R1
                            Selection:
```

Figure 36. HDSL4 Span History Screen

Event History

The Event History screen (**Figure 37**) provides a log history of HDSL4 circuit events.

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                    Press ESC to return to previous menu

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

   1.  H4TU-C Powered Up                           01/01/00 00:00:01  H4TU-C
   2.  H4TU-R Powered Up                           01/01/00 00:03:08  H4TU-R
   3.  H4TU-C Powered Up                           01/01/00 00:00:01  H4TU-C
   4.  H4TU-R Powered Up                           01/01/00 00:14:03  H4TU-R
   5.  Default Options Restored                    01/01/00 00:16:23  H4TU-C
   6.  Date changed to                             06/09/04 02:18:07  H4TU-C
   7.  Time changed to                             06/09/04 11:28:00  H4TU-C
   8.  T1 PM Registers Reset                       06/09/04 11:54:37  H4TU-C
   9.  T1 PM Registers Reset                       06/09/04 11:57:09  H4TU-C



       Page Number:   1/  1   Number of Events:   9
 ------------------------------------------------------------------------
     'P' - Previous Page  'H' - Home      'R' - Reset Events
     'N' - Next Page      'E' - End

                            Selection:
```

Figure 37. Event History Screen

The following is a list (but not all-inclusive) of possible events:

- Circuit ID Change
- DS1 Transmit Level Option Change
- DSX/DS1 Alarm Type Active/Inactive
- DSX-1 Line Build Out Option Change
- Element Network/Customer Loop up/ Loop down
- Event Log Reset
- External Alarm Blocking Change
- Framing Option Change
- H4TU-C/H4TU-R Powered Up
- HDSL/T1 PM Registers Reset
- Line Code Option Change
- Loopback Time Out Option Change
- Network Source Setting Change
- NIU Loopback Option Change
- Span Power Option Change
- Time/Date Changed From/To
- Splice Detector Reset
- Bad Splice Detected

The System PM/Screen Report

The System PM/Screen Report option (**Figure 38**) offers four types of reports on performance monitoring. Selecting a report type displays all the reports for that category on the screen at once, which can be more efficient than accessing each menu individually.

```
                              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 38. System PM/Screen Report Option

Clear PM and Alarm Histories

The Clear PM and Alarm Histories option from the HDSL4 Main Menu initializes data from performance monitoring and alarm histories. Selecting this option from the Main Menu displays the prompt shown in **Figure 39**.

```
Circuit ID:HNTSVLALHDSL4                                  03/09/05 09:29:45

                              Adtran HDSL4 Main Menu


                              1.  HDSL4 Unit Information
                              2.  Provisioning
                              3.  Span Status
                              4.  Loopbacks and Test
                              5.  Performance History
                              6.  Scratch Pad, Ckt ID, Time/Date
                              7.  Terminal Modes
                              8.  Alarm History
                              9.  Event History
                             10.  System PM/Screen Report
                             11.  Clear PM and Alarm Histories
                             12.  Troubleshooting
                             13.  Virtual Terminal Control

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

                              Selection: 11
```

Figure 39. Clear PM and Alarm Histories

Troubleshooting

The Troubleshooting screens include the new feature “Splice Detection.” This and other new features are described in more detail in “Appendix B, HDSL4 Features”.

The HDSL4 Main Menu displays the Troubleshooting option (**Figure 40**). Three menu items plus helpful ADTRAN contact information appear on this screen.

```
Circuit ID:                                                  03/09/05 09:29:45
                      Press ESC to return to previous menu
                                Troubleshooting

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









Hours: Normal 7am - 7pm CST                    1. Troubleshooting Guidance
       Emergency 7 days x 24 hours             2. General Information
Phone: 800.726.8663 / 888.873.HDSL             3. Chronic Circuit Problems
  Fax: 256.963.6217

                                          Selection:
```

Figure 40. Troubleshooting Screen

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

- “Troubleshooting Guidance” on page 45
- “General Information” on page 46
- “Chronic Circuit Guidance” on page 47

Troubleshooting Guidance

Selecting the Troubleshooting Guidance option causes the H4TU-C to read the operational status of the unit and return Troubleshooting guidance, or hints, as to the probable cause of the trouble, as shown in **Figure 41**.

```
Circuit ID:                                                    03/09/05 09:29:45
                      Press ESC to return to previous menu
                        DSX-1 Loss of Signal (Red Alarm)

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

- If signal to H4TUC is missing, insert test set at DSX panel IN Jack connecting
toward H4TUC (to verify wiring between DSX and H4TUC shelf). Check H4TUC to
verify DSX-1 LOS alarm is cleared. This verifies TX(out) and RX(in) pairs are
not swapped.

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

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

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

Figure 41. Troubleshooting Guidance

General Information

Selecting the General Information option from the Troubleshooting screen accesses the General Information Screen (**Figure 42**) that summarizes the deployment guidelines necessary to provision this HDSL4 circuit.

```
Circuit ID:                                                    03/09/05 09:29:45
                      Press ESC to return to previous menu


HDSL4 Loop Guidelines for optimum operation
-------------------------------------------
   Non-loaded cable pair
   Single bridge tap < 2Kft
   Total bridge taps < 2.5Kft
   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 <= 1000 ohms 1st segment
   Loop Resistance <= 920 ohms 2nd segment

The following guidelines are provided as a recommendation and may be superseded
by internal deployment guidelines
   Margin >= 6 dB
   Attenuation (1st Segment) H4TUC <= 31 dB, H4TUR/H4R <= 33 dB
   Attenuation (2nd or 3rd Segment) H4TUR/H4R <= 30 dB
```

Figure 42. General Information Screen

Chronic Circuit Guidance

Selecting the Chronic Circuit Guidance option displays the Chronic Circuit Problems screen (**Figure 43**). This screen provides general information about circuits with bad splice connections as well as a menu to the Bad Splice Detection feature.

Splices that are varying in impedance cause the HDSL transceiver to see a reduced and/or fluctuating signal quality (margin). The HDSL transceiver attempts to track these changes, but when the changes become too severe, errors or loss of synchronization result. This is reflected by the symptoms described on this screen.

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

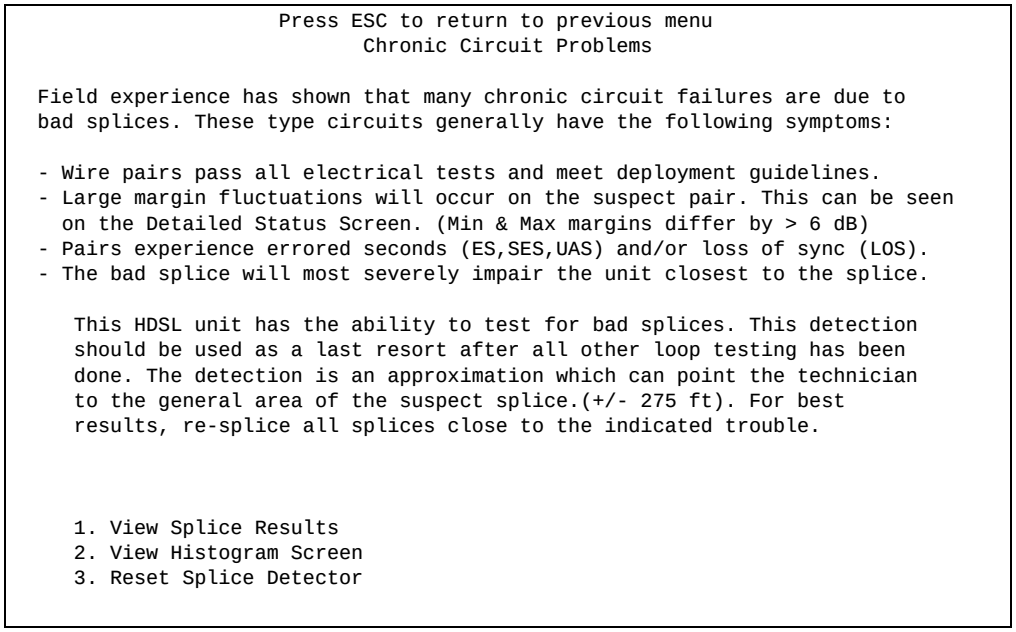


Figure 43. Chronic Circuit Problems Screen

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

- "View Splice Results" on page 48
- "View Histogram Screen" on page 49
- "Reset Splice Detector" on page 49

View Splice Results

Select the View Splice Results screen (**Figure 44**) to display test results for each transceiver. The results, in the Splice Detection Results column, are as follows:

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

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

The (B) Back command access to the previous 14 days Splice Detection Results.

```
Circuit ID:HTSVALHDSL4                                        03/09/05 07:32:04
                      Press ESC to return to previous menu

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

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

 Reference    Splice Detection Results        Version          Result Shown
   Point        Loop 1        Loop 2          Number             for date
 ---------    ----------    ----------        -------            MM/DD/YY
   H4TUC          NTF           650              01              --------
   H4TUR          NTF           NTF              01              03/09/05
   H4RU1 NET      NTF           NTF              01
   H4RU1 CST      NTF           NTF              01            (B)Back
```

Figure 44. View Splice Results Screen

View Histogram Screen

The Splice Histogram Screen (**Figure 45**) displays the counters that the splice detector uses to make its result decision.

```
Circuit ID:HNTSVLALHDSL4                                    03/09/05 09:29:45
                        Press ESC to return to previous menu
HTUC L2   <- Press C to Change Distance Ref        Splice Histogram Screen
Splice |  H4TUC    H4TUR    HR1 N    HR1 C    HR2 N    HR2 C    HR3 N    HR3 C
(feet) |  L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2
------ |  -- --    -- --    -- --    -- --    -- --    -- --    -- --    -- --
 0100  |  00 00    00 00    00 00    00 00
 0650  |  00 09    00 00    00 00    00 00
 1200  |  00 00    00 00    00 00    00 00
 1750  |  00 00    00 00    00 00    00 00
 2300  |  00 00    00 00    00 00    00 00
 2850  |  00 00    00 00    00 00    00 00
 3400  |  00 00    00 00    00 00    00 00
 3950  |  00 00    00 00    00 00    00 00
 4500  |  00 00    00 00    00 00    00 00
 5055  |  00 00    00 00    00 00    00 00
 5610  |  00 00    00 00    00 00    00 00
 6165  |  00 00    00 00    00 00    00 00
 6720  |  00 00    00 00    00 00    00 00
 7275  |  00 00    00 00    00 00    00 00
 7830  |  00 00    00 00    00 00    00 00
 8385  |  00 00    00 00    00 00    00 00
 8940  |  00 00    00 00    00 00    00 00
 9495  |  00 00    00 00    00 00    00 00
```

Figure 45. Splice Histogram Screen

The definitions of abbreviations shown on this screen are as follows:

- Column1, labeled Splice (feet), represents the distance from the H4TU-C that the anomaly detector is evaluating.
- Column 2 indicates the respective transceiver that has reported the anomaly. The L1 and L2 columns represent Loop 1 and Loop 2 of the HDSL4 circuit.
- Column 3 displays the count registered by the H4TU-R, also with Loop 1 and Loop 2 counts.

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

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

Reset Splice Detector

Choose Reset Splice Detector, from the Chronic Circuit Problems screen, to clear all stored Splice Detection results. A prompt displays to make sure a reset is desired. If Y (yes) is chosen the splice detector re-initializes and starts running again.

Flash Upgrade

Ability to download new firmware for the unit is available via the Total Access H4TU-C Flash Image screen (**Figure 46**). This feature allows the download and installation of a firmware upgrade. Any existing provisioning setting is retained, while new provisioning items assume the factory default settings. Prior to installing, the H4TU-C confirms that the firmware is correct. When initiated, setup instructions are displayed on the craft access terminal.

NOTE

This Flash Upgrade option is only available for the Total Access 3000 H4TU-C.

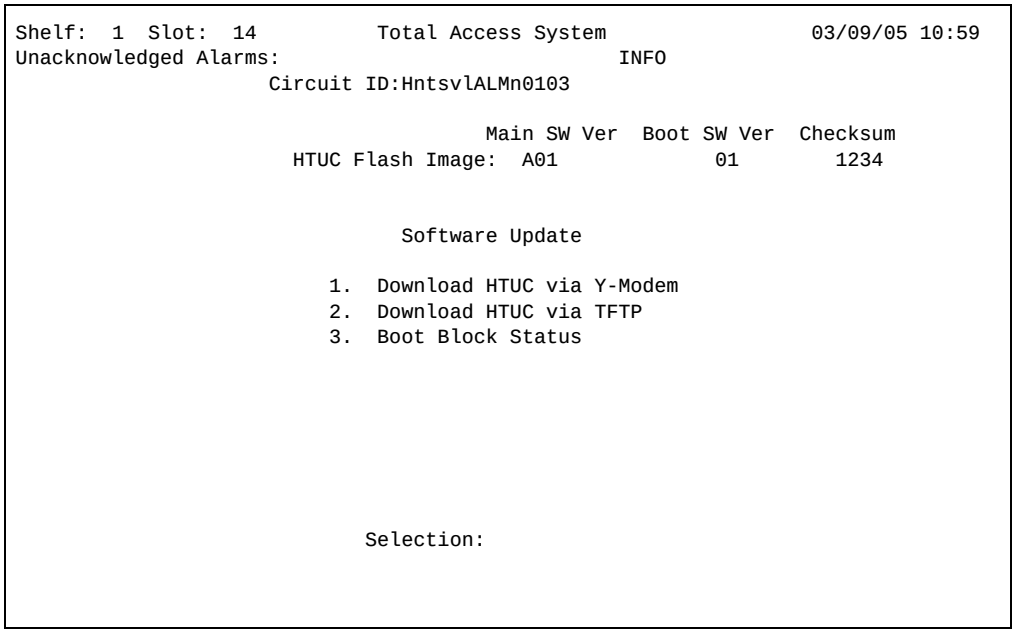


Figure 46. Total Access 3000 H4TU-C Flash Image Screen

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

- "Download HTUC via Y-Modem" on page 51
- "Download HTUC via TFTP" on page 52
- "Boot Block Status" on page 53

Download HTUC via Y-Modem

The Download H4TU-C via Y-Modem screen (**Figure 47**) is used to initiate a Y-Modem file transfer from the computer connected to the SCU craft access port to the H4TU-C. This file is transferred to the SCU and downloaded to the H4TU-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 H4TU-C takes less than 3 minutes. The file downloaded to the H4TU-C via the SCU should be of the ".bin" file type only and is provided for feature enhancements and additions. **Figure 48** illustrates a Flash upgrade session in progress.

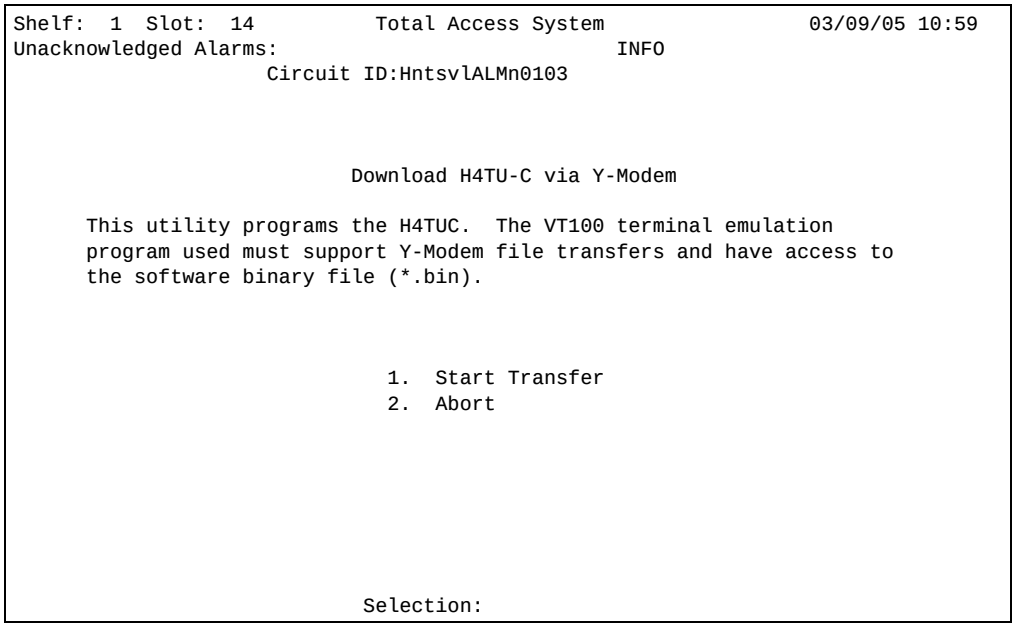


Figure 47. Download H4TU-C via Y-Modem

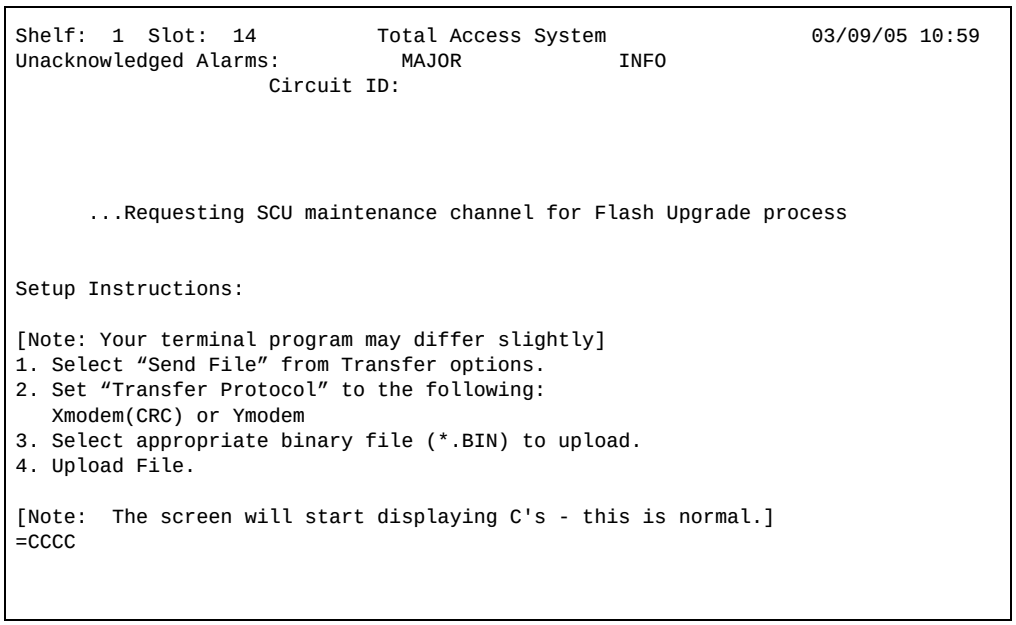


Figure 48. Download via Y-Modem, in Progress

Download HTUC via TFTP

The Download H4TUC via TFTP screen (**Figure 49**) is utilized to perform a TFTP file transfer from a remotely located computer/server to the H4TU-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 H4TU-C unit. Before initiating a TFTP transfer from the menu screen, first enter the TFTP remote filename that is listed on H4TU-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.

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. If settings are improperly entered, neither Telnet sessions nor remote TFTP file transfers will be available.

Refer to the appropriate SCU Installation and Maintenance Practice for details on Ethernet settings.

Once the H4TU-C and SCU have been provisioned properly for the TFTP file transfer, select option 2 from the H4TU-C TFTP file transfer menu screen to initiate the TFTP file transfer from the remotely located computer to the H4TU-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 H4TU-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 H4TU-C.

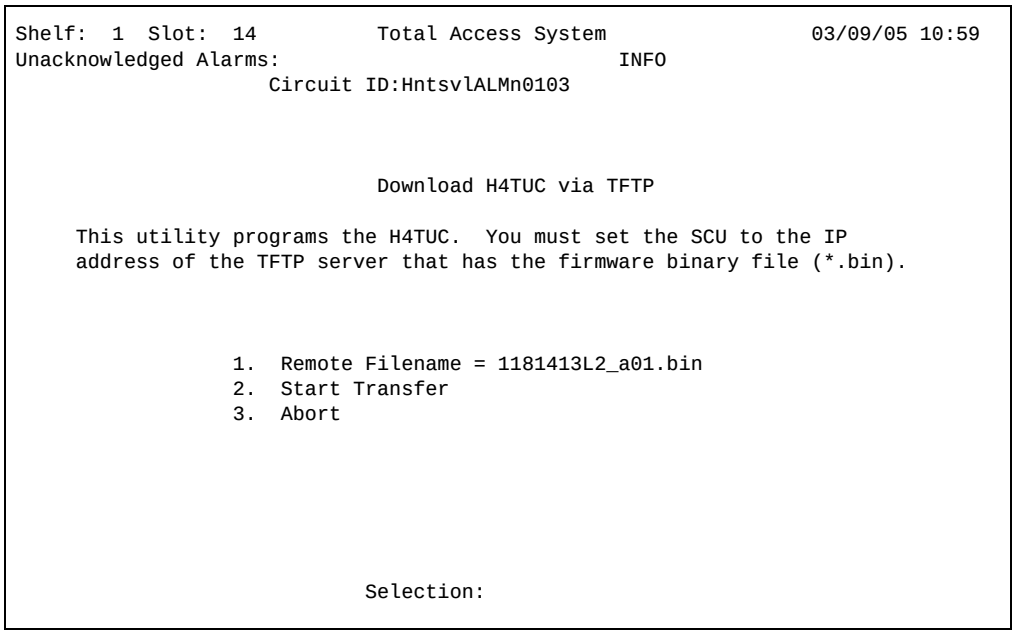


Figure 49. Download H4TU-C via TFTP

Boot Block Status

The Boot Block Status screen (**Figure 50**) provides the status of the Boot Block sector, which in rare cases can become locked. If locked, the bootcode cannot be upgraded by future firmware upgrades. The bootcode is seldom changed with new download code.

The bootcode is the small piece of code that allows firmware upgrades on the H4TU-C unit. If the bootcode becomes corrupted, the H4TU-C will require factory service to restore it to a functional state.

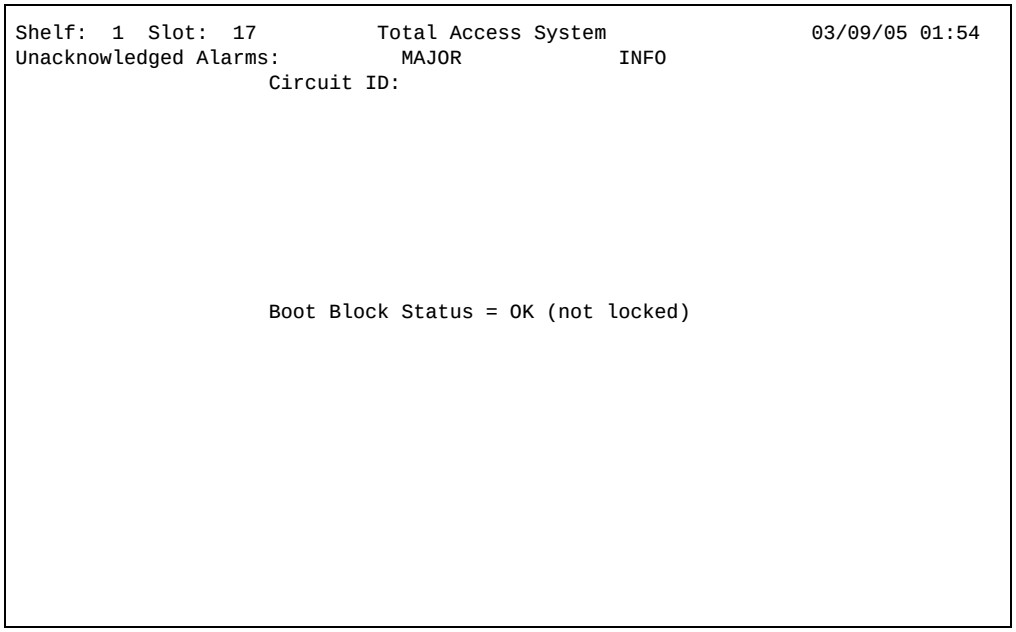


Figure 50. Boot Block Status Screen

Virtual Terminal Control

The Virtual Terminal Control screen (**Figure 51**) allows control of remote unit provisioning from the HDSL4 receiver. Select the Log into H4TU-x option from this screen, and press ENTER to access the management interface of the remote unit. Terminal control of the H4TU-C is retained until 5 minutes of idle time passes, or it may be released immediately; press CTRL+X to terminate the session.

NOTE

This option is not a function of the Total Access 3000 H4TU-C.

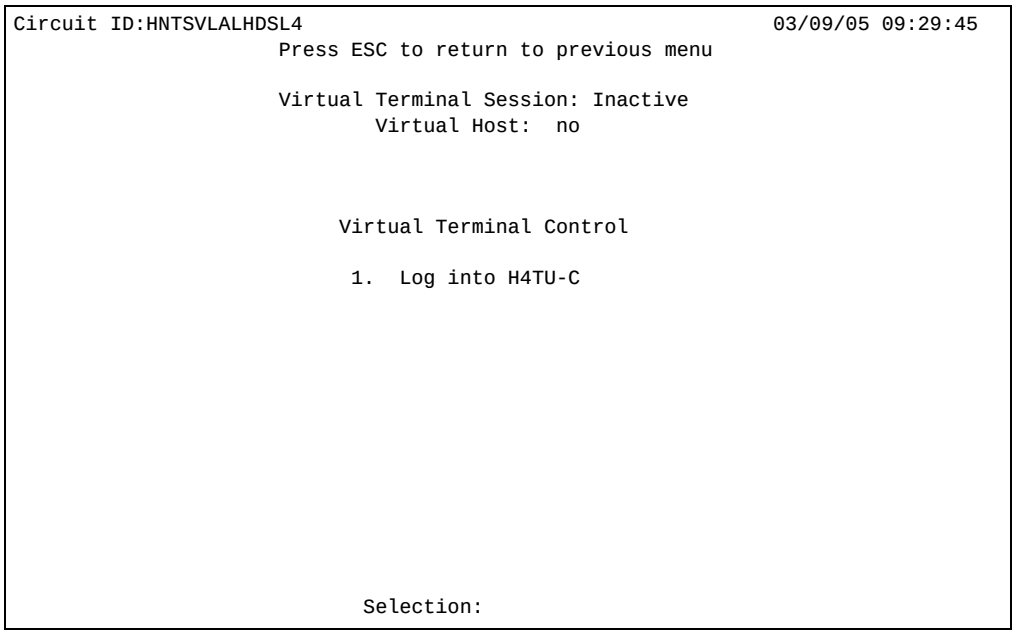


Figure 51. Virtual Terminal Control Screen

HDSL4 DEPLOYMENT GUIDELINES

The different segments of an HDSL4 circuit are defined in **Figure 52**.

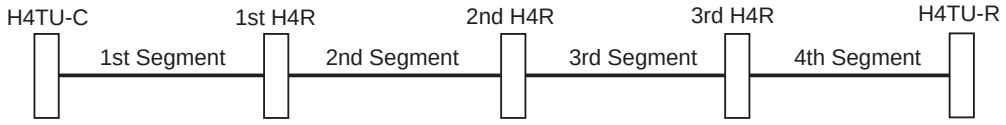


Figure 52. HDSL4 Circuit Segments

NOTE

Four-segment, three-repeater support is a special case and will be described separately

The ADTRAN HDSL4 system provides DS1-based services over loops designed to comply with the guidelines given below. These guidelines apply to a single segment circuit (an HDSL4 circuit with no H4Rs), to a circuit having two segments (with one H4R), or to a circuit having 3 or 4 segments (with two or three H4Rs).

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

Cable Characteristics for HDSL4

The loop (cable/wiring) deployment guidelines are as follows:

1. All loops are nonloaded only
2. Any single bridged tap is limited to 2 kft.
3. Total bridged tap length is limited to 2.5 kft.
4. Loop Attenuation Limits. See **Table 11**.

Table 11. Attenuation limits

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

Range Limits

Table 12 and **Table 13** provide the maximum ranges for HDSL4 segments per wire gauge.

- Recommended Design Limits indicates the recommended range limitation
- Recommended Turn-up Limits indicates the absolute maximum range

NOTE

In three segment circuits (two H4Rs), individual segment resistance values must be verified. For more information, refer to "Resistance Values" on page 57.

Table 12. Range Limits: 26 Gauge / 70°F / PIC

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

Table 13. Range Limits: 24 Gauge / 70°F / PIC

24 Gauge	Recommended Maximum
1st segment	14,770 feet
2nd and 3rd segment	14,050 feet (see note above)

Resistance Values

Span Powering Two Repeaters with Span Powered Remote

Each of the three segments associated with span powering two H4Rs and a H4TU-R must satisfy the DC resistance budgets in addition to the recommended loop attenuation requirements. In general, 22 and 19 AWG segments are restricted by their loop attenuation while the DC resistance restricts the segment reach for 26 and 24 AWG. When designing a dual H4R loop, the first segment should have lower DC resistance than the second segment.
See **Table 14**.

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

NOTE

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

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

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

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

Table 14. Single Pair DC Resistance Value

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

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

Once the resistance of each segment is confirmed, refer to **Figure 53** to decide if the H4TU-C is capable of span powering two H4Rs and one H4TU-R. Alternatively, the DSL Assistant program will automatically calculate this and report any violations.

Follow these steps to utilize the graph shown in Figure 53:

1. Find the line on the graph that represents the known third segment resistance. These are the lines running diagonally across the graph labeled 300 - 1100 ohms. This line represents the upper limit for 2 H4Rs plus H4TU-R span powering.
2. Find the first segment resistance on the vertical axis.
3. Find the second segment resistance on the horizontal axis.
4. Find the instance where the two points from step 2 and step 3 meet on the graph.

   The point found in step 4 must be below the upper limit line defined by the third segment measurement (step 1). If the instance where these two points is above this line, the H4TU-C *cannot* span power two H4Rs and the H4TU-R.

NOTE

These measurements represent only *one* of the two HDSL4 pairs.

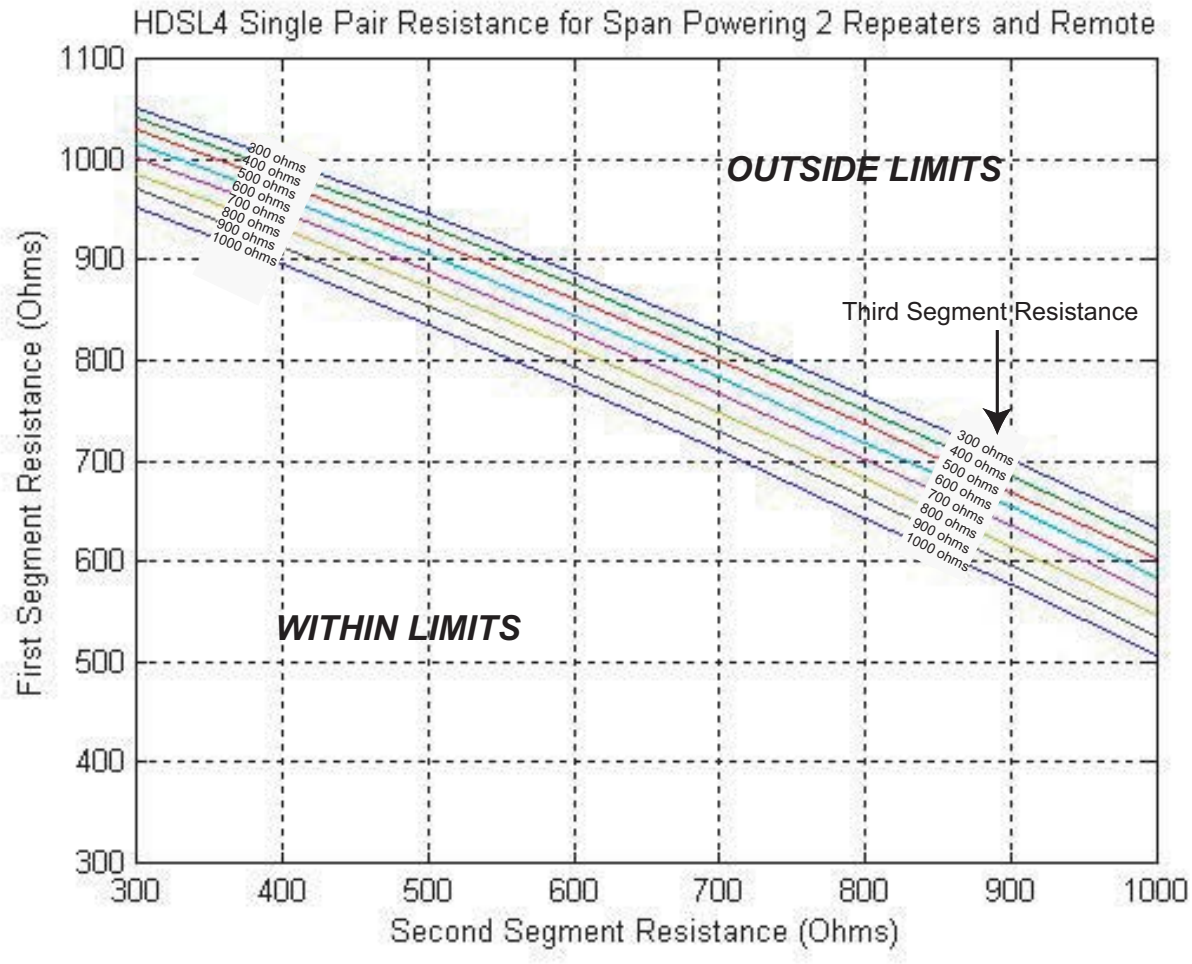


Figure 53. Resistance Budget, Span Powering Two Repeaters

An example problem is illustrated in **Figure 54**. For this example, begin with three known measurements:

- 600 ohm first segment resistance
- 700 ohm second segment resistance
- 900 ohm third segment resistance

Refer to the graph, follow these steps to solve the example problem:

1. Find the 900 ohm third segment resistance line on the graph. This line is depicted in bold in Figure 54. This line is the upper span power limit.
2. Find the 600 ohm first segment resistance point on the vertical axis.
3. Find the 700 ohm second segment resistance point on the horizontal axis.
4. Find the instance on the graph where the points from step 2 and step 3 meet.

   If this point is below the bold line defined in the step 1, then a circuit with these parameters *is* capable of span powering two H4Rs and one H4TU-R.

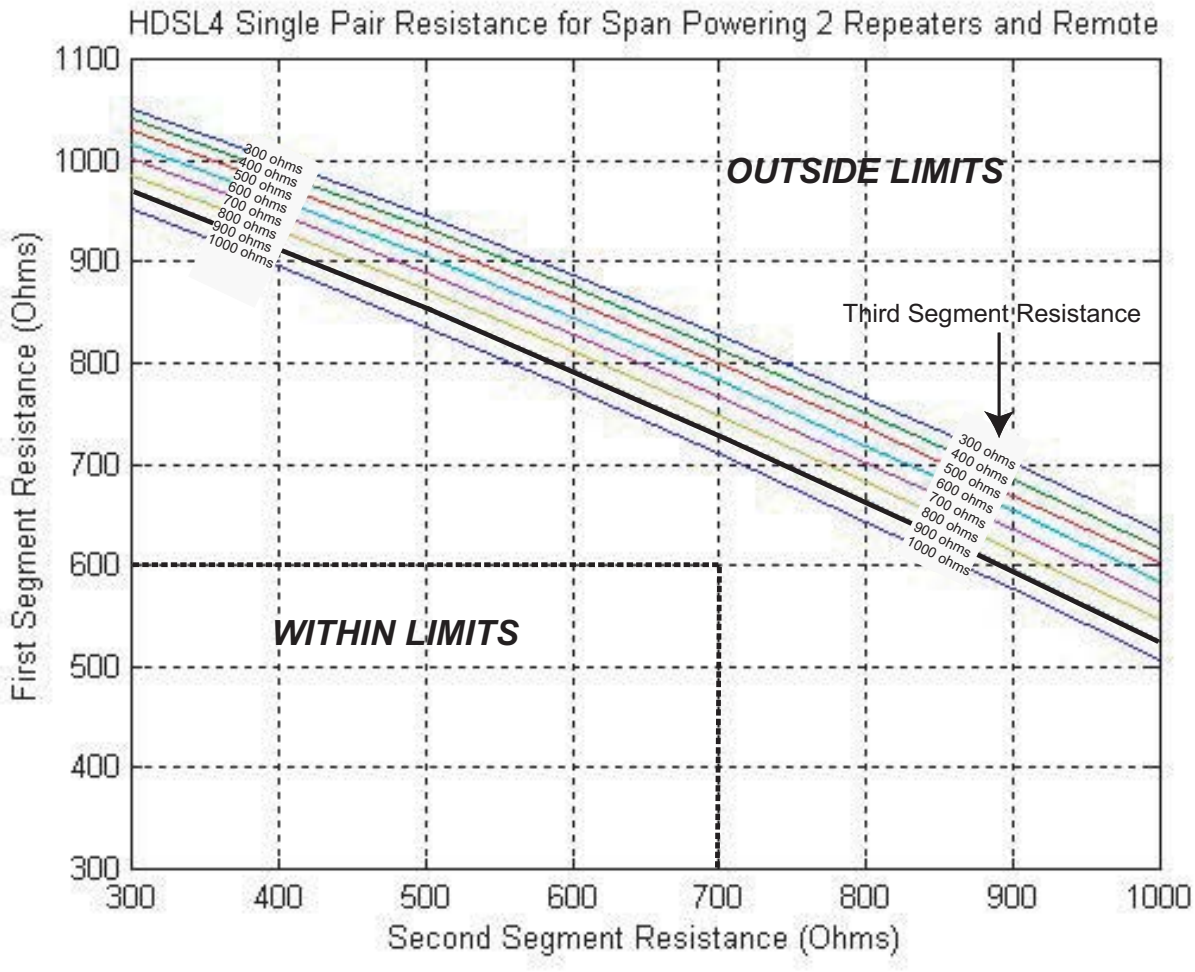


Figure 54. Resistance Budget, Span Powering Two Repeaters (Example)

Span Powering Three Repeaters

NOTE

An ADTRAN HDSL4 circuit can power three elements *only*. If three repeaters are utilized in the circuit, the locally powered H4TU-R (P/N 1223424L2, CLEI T1L83Z3C_ _ or later) must be utilized.

NOTE

HDSL4 circuits utilizing three repeaters have different resistance budget requirements. These requirements are provided separate from the two-repeater support calculations. (DSL Assistant, versions 3.4 and prior, have no provision for three-repeater circuits.)

Under unusual circumstances, there may be extremely long loops for which three repeaters will be required. The standards-based –190 VDC power supply can not span power all three repeaters plus a span-powered remote. In this long-reach application, the DC resistances of the individual segments between the Central Office and the third repeater must be within limits similar to those described on the previous page.

The DC resistance graph for the three-repeater circuit (with locally powered remote) is shown in **Figure 55**.

The procedure for utilizing this graph is identical to that described for “Resistance Budget, Span Powering Two Repeaters” on page 58.

The greatest overall reach can be achieved by shortening the first segment, which reduces first segment resistance, thus allowing the subsequent segments to span further.

The loop attenuation requirements for all of the segments beyond the first repeater are identical since the modulation on those loops is identical.

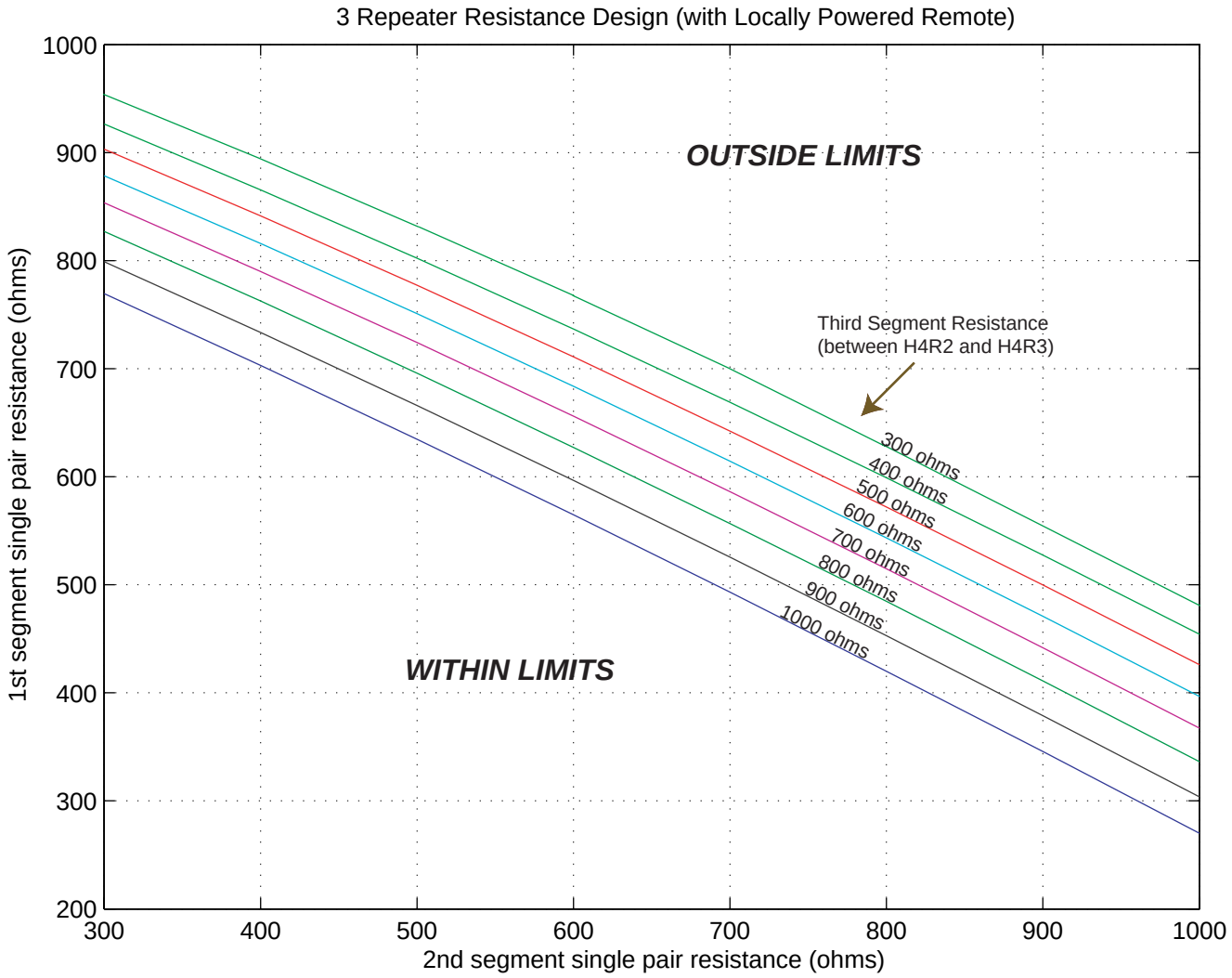


Figure 55. Resistance Budget, Span Powering Three Repeaters

MAINTENANCE

The HDSL4 products detailed in this document do not require 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. For more information, refer to "Appendix D, Warranty".

TROUBLESHOOTING

Table 15 and **Table 16** provide a troubleshooting guide to assist in problem resolution.

H4TU-C Troubleshooting

Table 15. H4TU-C Troubleshooting Guidelines

Condition	Solution
All front panel indicators are *off*.	1. Verify that –48 VDC power is properly connected to the shelf. 2. Inspect the fuse and verify that it is not blown. 3. Insert the H4TU-C into a slot known to be in good working condition, and check the LED indicators. 4. If steps 1 and 2 pass, but step 3 fails, replace the unit.
DSL LED is solid Red.	The HDSL4 Loop has poor signal quality or loss of sync on the loop indicated by the LED. Basic troubleshooting procedures should identify a problem with the cable pair.
ALM LED is solid Red.	Loss of Signal on the DSX-1.
ALM LED is solid Yellow	Loss of Signal on the DS1 on the remote.

H4TU-R Troubleshooting

Table 16. H4TU-R Troubleshooting Guidelines

Condition	Solution
All front panel indicators are *off*.	1. Make sure the H4TU-R is properly seated in the housing. 2. Check powering voltage: • For Span Powered unit (1223426L2) verify that the H4TU-C is delivering sufficient simplex voltage to the loop. • For Local Powered unit (1223424L2) verify that –48 VDC is properly connected. 3. If steps 1 and 2 pass, replace the H4TU-R.
Power is present and adequate, but loop sync is not available (**DSL** LED is *off*).	1. Verify that the loop conforms with CSA guidelines (not too long, etc.). For more information, refer to "HDSL4 Deployment Guidelines" on page 55. 2. Verify that loop loss at 196 kHz is not greater than 35 dB. 3. Verify that noise on the HDSL4 loop is within acceptable limits. 4. If steps 1 through 3 pass and loop sync is still not available, replace unit.

SPECIFICATIONS

Table 17 lists the product specifications for each H4TU-C included in this practice.

Table 17. H4TU-C Product Specifications

Specification	Description
Loop Interface	
Modulation Type:	16-TC PAM
Mode:	Full Duplex Partially Overlapped Echo Canceling
Number of Pairs:	2
Bit Rate:	1.552 Mbps
Baud Rate:	261.333 kbaud
Service Range:	Refer to the “HDSL4 Deployment Guidelines” on page 55.
Loop Loss:	Refer to the “HDSL4 Deployment Guidelines” on page 55.
Bridged Taps:	Single Taps < 2 kft., Total Taps < 2.5 kft.
Performance:	Compliant with T1.418-2000 (HDSL4 Standard)
H4TU-C Tx Pwr (Data) Level:	14.1 ± 0.5 dBm (0 to 400 kHz)
H4TU-C Tx Pwr (Activation) Level:	14.1 ± 0.5 dBm (0 to 307 kHz)
Input Impedance:	135 ohms
Maximum Loop Resistance:	Refer to the “HDSL4 Deployment Guidelines” on page 55.
Return Loss:	12 dB (50 kHz to 200 kHz)
Network Interface	
DSX-1 Line Build Out:	0-133 feet (default) 133-266 feet 266-399 feet 399-533 feet 533-655 feet External (default if using a Kentrox shelf)
DS1 Line Coding:	AMI, B8ZS (default)
DS1 Framing Format:	ESF (default), SF
Power Tested with the ADTRAN H4TU-R (1223426L2)	
Total Power:	–48 VDC @ 200 mA with an H4TU-R –48 VDC @ 330 mA with H4TU-R and one H4R –48 VDC @ 560 mA with H4TU-R and two H4Rs
H4TU-C Power Dissipation:	5.1 watts with H4TU-R 5.7 watts with H4TU-R and one H4R 7.1 watts with H4TU-R and two H4Rs
Span Power:	–190 VDC (Internally Generated); Class A2 compliant; current limited at 150 mA
Fusing:	1.00 amp (on-board; not field-replaceable)

Table 17. H4TU-C Product Specifications (Continued)

Specification	Description
Clock	
Clock Sources:	DSX-1 Derived (with HDSL4 frame bit stuffing)
Internal Clock Accuracy:	± 25 ppm (exceeds Stratum 4); meets T1.101 timing requirements
Tests	
Diagnostics:	Self-test Local Loopback (H4TU-C) Remote Loopback (H4TU-R)
Physical	
Dimensions:	
Total Access 3000 H4TU-C:	5.35 in. high × 0.69 in. wide × 10.2 in. deep
220 H4TU-C:	6.00 in. high × 1.40 in. wide × 10.00 in. deep
DDM+ H4TU-C:	4.00 in. high × 0.69 in. wide × 10.13 in. deep
3192 H4TU-C:	4.75 in. high × 0.69 in. wide × 10.13 in. deep
3192M H4TU-C:	4.75 in. high × 0.69 in. wide × 10.13 in. deep
T200 H4TU-C:	5.50 in. high × 0.69 in. wide × 6.00 in. deep
Weight:	Less than 1 pound
Environment	
Temperature, Operating:	–40°C to +70°C;
Temperature, Storage:	–40°C to +85°C
Relative Humidity:	Up to 95% noncondensing
Compliance	
NRTL Listed to the applicable UL standards Bellcore NEBS Level 3 (SR-3580) FCC 47CFR Part 15, Class A	
Part Number	
Total Access 3000 H4TU-C:	1181413L2
220 H4TU-C:	1223401L2
DDM+ H4TU-C:	1223403L2
3192 H4TU-C:	1223404L2
3192M H4TU-C:	1223404L12
T200 H4TU-C:	1223406L2

Table 18 lists the product specifications for each H4TU-R included in this practice.

Table 18. H4TU-R Product Specifications

Specification	Description
Loop Interface	
Modulation Type:	16-TC PAM
Mode:	Full Duplex Partially Overlapped Echo Canceling
Number of Pairs:	2
Bit Rate:	1.552 Mbps
Baud Rate:	261.333 k baud
Service Range:	Refer to the "HDSL4 Deployment Guidelines" on page 55
Loop Loss:	Refer to the "HDSL4 Deployment Guidelines" on page 55
Bridged Taps:	Single Taps < 2 kft., Total Taps < 2.5 kft.
Performance:	Compliant with T1.418-2002 (HDSL4 Standard)
H4TU-C Tx Pwr (Data) Level:	14.1 ± 0.5 dBm (0 to 400 kHz)
H4TU-C Tx Pwr (Activation) Level:	14.1 ± 0.5 dBm (0 to 307 kHz)
Input Impedance:	135 ohms
Maximum Loop Resistance:	Refer to the "HDSL4 Deployment Guidelines" on page 55
Return Loss:	12 dB (50 kHz to 200 kHz)
Network Interface	
DS1 Output Level:	0 dB, –7.5 dB, –15 dB
DS1 Signal Input Level:	0 to –22.5 dB
DS1 Line Coding:	AMI, B8ZS (default)
DS1 Framing Format:	Auto
Power Tested with the ADTRAN H4TU-C (1223401L2)	
1223424L2	–24 to –48 VDC
1223426L2 Span Powered:	Powered by an H4TU-C module at –190 VDC; Class A2 compliant; current limited at 150 mA
H4TU-R Maximum Heat Dissipation:	4.1 watts
Fusing:	1.00 amp (on-board; not field-replaceable)
Clock	
Clock Sources:	HDSL4 loop derived
Internal Clock Accuracy:	± 25 ppm (exceeds Stratum 4); meets T1.101 timing requirements

Table 18. H4TU-R Product Specifications (Continued)

Specification	Description
Tests	
Diagnostics:	Self Test Loopback (H4TU-R) initiated with T1 NIU in-band codes Loopback (H4TU-R) initiated with H4TU-C command Loopback (H4TU-R) initiated manually Loopback (H4TU-R) initiated from H4TU-R control port
Physical	
Dimensions: T200 H4TU-R:	Height: 5.50 inches Width: 0.69 inch Depth: 6.00 inches
Weight:	Less than 1 pound
Environment	
Temperature, Operating:	–40°C to +70°C
Temperature, Storage:	–40°C to +85°C
Relative Humidity:	Up to 95% noncondensing
Compliance	
NRTL Listed to the applicable UL standards Bellcore NEBS Level 3 (SR-3580) FCC 47CFR Part 15, Class A	
Part Number	
T200 H4TU-R, Local Powered:	1223424L2
T200 H4TU-R, Span Powered:	1223426L2

Appendix A
Loopback, Control Codes, and Commands

HDSL4 MAINTENANCE MODES

This appendix describes operation of the HDSL4 system with regard to detection of inband and ESF facility data link loopback codes.

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

Loopback Process Description

In general, the loopback process for the HDSL4 system elements is modeled on the corresponding DS1 system process. Specifically, the H4TU-C loopback is similar to an Intelligent Office Repeater loopback, and the H4TU-R loopbacks are similar to an in-line T1 Repeater loopback.

In-band control code sequences are transmitted over the DS1 link by either the insert or overwrite method. The HDSL4 elements respond to either method. The insert method produces periodic control sequences that are not overwritten by the DS1 framing bits.

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

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

Loopback Control Codes

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

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

Table A-1. HDSL4 Loopback Control Codes

Type	Source[1]	Code[2,3]	Name
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
	(N)	2in6 (110000)	Loopback data from network toward network in first HRE
	(N)	3in6 (111000)	Loopback data from network toward network in second HRE
	(C)	6in7 (1111110)	Loopback data from customer toward customer in HTU-C
	(C)	5in7 (1111100)	Loopback data from customer toward customer in HTU-R
	(C)	4in6 (111100)	Loopback data from customer toward customer in H4R1
	(C)	5in6 (111110)	Loopback data from customer toward customer in H4R2
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)	FF04 (1111 1111 0000 0100)	Loopback data from network toward network at H4R1
	(N)	FF06 (1111 1111 0000 0110)	Loopback data from network toward network at H4R2
	(N)	FF08 (1111 1111 0000 1000)	Loopback data from network toward network at H4R3
	(C)	3F04 (0011 1111 0000 0100)	Loopback data from customer toward customer at H4R1
	(C)	3F06 (0011 1111 0000 0110)	Loopback data from customer toward customer at H4R2
	(C)	3F08 (0011 1111 0000 1000)	Loopback data from customer toward customer at H4R3
	(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

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

Table A-2. Loopback Control Codes

Function	Code (Hex / Binary)	Response
ARM (in-band) - also known as 2-in-5 pattern	11000 (binary)	If the pattern is sent from the network, the units arm, and the H4TU-R loops up if Smartjack Loopback is enabled.
ARM (ESF Data Link)	FF48 or 1111 1111 0100 1000 sent in the Facility Data Link	If the pattern is sent from the network, the units arm, and the H4TU-R loops up if Smartjack Loopback is enabled. When sent from the customer, the units arm.
Disarm (in-band) - also known as 3-in-5 pattern	11100 (binary)	When sent from the network or customer, all units are removed from the armed state, and loopbacks are released.
Disarm (ESF Data Link)	FF24 or 1111 1111 0010 0100 sent in the Facility Data Link	When sent from the network or customer, all units are removed from the armed state, and loopbacks are released.
H4TU-C Loopback [1,2]	D3D3 or 1101 0011 1101 0011	If armed, the H4TU-C will loop up, 2 seconds of AIS (all ones) are transmitted, the looped data is sent for 5 seconds, and then a burst of 231 logic errors is injected. The burst of 231 logic errors continues every 20 seconds as long as the D3D3 pattern is detected. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 231 logic errors continues every 20 seconds.
Loop Down without Disarm	9393 or 1001 0011 1001 0011	When sent from the network, all units currently in loopback loop down. Armed units do not disarm. To function like a smartjack, the H4TU-R does not loop down from a network loopback in response to the 9393 pattern if Smartjack Loopback is enabled.
Loopback Query [1]	D5D5 or 1101 0101 1101 0101)	When the pattern is sent from the network, logic errors are injected toward the network to indicate a loopback is present toward the network. The number of errors injected is determined by the nearest unit that is in loopback. As long as the pattern continues to be sent, errors are injected again every 20 seconds. The number of errors per transceiver is as follows: H4TU-C 231 errors H4R1 10 errors H4R2 200 errors H4R3 30 errors H4TU-R 20 errors

Table A-2. Loopback Control Codes (Continued)

Function	Code (Hex / Binary)	Response
Loopback Time Out Override[1]	D5D6 or 1101 0101 1101 0110	If the units are armed or a unit is currently in loopback when this pattern is sent from the network, the loopback time out is disabled. As long as the units remain armed, the time out remains disabled. When the units are disarmed, the loopback time out reverts to the previous loopback time out setting. If any element is in network loopback a bit error confirmation will be sent. H4TU-C 231 errors H4R1 10 errors H4R2 200 errors H4R3 30 errors H4TU-R 20 errors
Span Power Disable[1]	6767 or 0110 0111 0110 0111	If the units are armed and 6767 is sent from the network, the H4TU-C disables span power. If the pattern is sent from the network, the span power is disabled as long as 6767 pattern is detected. Once the pattern is no longer received, the H4TU-C reactivates span power. All units then retrain and return to the disarmed and unlooped state.
First H4R Loopback [1,2]	C741 1100 0111 0100 0001	If one or more H4Rs are present, the H4R closest to the H4TU-C loops up toward the network, 2 seconds of AIS (all ones) are transmitted, the looped data is sent for 5 seconds, and then a burst of 10 logic errors is injected. The burst of 10 logic errors continues every 20 seconds as long as the C741 pattern is detected. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 10 logic errors continues every 20 seconds.
Second H4R Loopback [1,2]	C754 1100 0111 0101 0100	If two H4Rs are present, the second H4R from the H4TU-C loops up toward the network, 2 seconds of AIS (all ones) are transmitted, the looped data is sent for 5 seconds, and then a burst of 200 logic errors is injected. The burst of 200 logic errors continues every 20 seconds as long as the C754 pattern is detected. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 200 logic errors continues every 20 seconds.

Table A-2. Loopback Control Codes (Continued)

Function	Code (Hex / Binary)	Response
Third H4R Loopback [1,2]	C743 1100 0111 0100 0011	If three H4Rs are present, the third H4R from the H4TU-C loops up toward the network, 2 seconds of AIS (all ones) are transmitted, the looped data is sent for 5 seconds, and then a burst of 30 logic errors is injected. The burst of 30 logic errors continues every 20 seconds as long as the C743 pattern is detected. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 30 logic errors continues every 20 seconds.
H4TU-R Address 20 for Extended Demarc [1,2]	C742 1100 0111 0100 0010	If armed, the H4TU-R loops up toward the network, 2 seconds of AIS (all ones) is transmitted, the looped data is sent for 5 seconds, and then a burst of 20 logic errors is injected. The burst of 20 logic errors continues every 10 seconds as long as the C742 pattern is detected. When the pattern is removed, the unit remains in loopback. If the pattern is reinstated, the injection of 20 logic errors continues every 10 seconds.

1. All codes listed above must be sent for a minimum of 5 seconds to be detected and acted upon.
2. Units must be armed with 11000b or FF48h before this code will work.
3. Loopback and error injection will only occur if the in-band code is received by the unit that is to go into loopback. In other words, if another loopback blocks the in-band code from being transmitted to the unit that is to go into loopback, loopback and error injection will not occur.

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Appendix B
HDSL4 Features

HDSL NEW ENHANCED FEATURE OVERVIEW

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

Total Access 3000 H4TU-C FEATURES

Auto In Service

The Total Access 3000 Unit 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.

Auto In Service settings are shown and described in more detail in "View Auto In Service Status" on page 29.

Bit Error Rate Testing (BERT)

The Total Access 3000 Unit 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.

BERT screens and descriptions are provided in "Loopbacks and Test" on page 31.

TScan

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

TScan is a patent-pending single-ended diagnostic routine residing on a host server at the central test facility that issues commands and retrieves data via FDL from the H4TU-C.

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

- Detection and location of an open on one or both conductors
- Detection and location of a short between Tip and Ring
- Detection and location of a ground fault from either or both conductors
- Detection of foreign voltage
- H4TU-C Self Diagnostics
- Remote detection of the presence or absence of a ground connection in the remote mount.

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

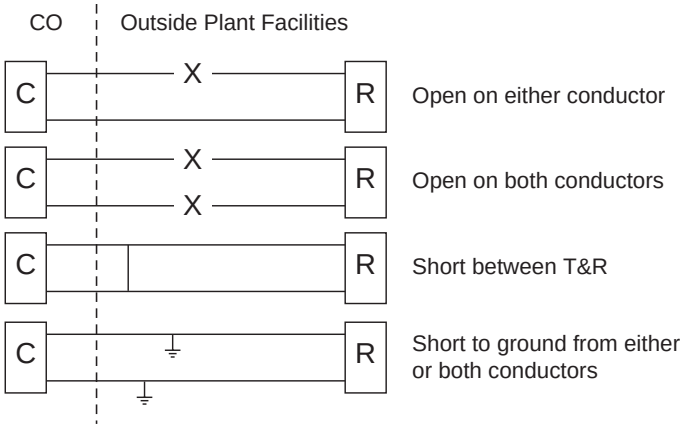


Figure B-1. TScan Diagnostic Capabilities

NOTE

For implementation of TScan please contact an ADTRAN sales representative.

Bad Splice Detection

Runtime TScan 2.0™ splice detection feature is an ADTRAN proprietary non-intrusive algorithm for detection of anomalies (bad splices) in the copper pair.

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

NOTE

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

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

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

These support mechanisms are described in the following subsections.

Splice Detection Algorithm

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

Screen Support

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

This menu provides three choices:

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

EOC Support

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

FDL Support

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

EEPROM Support

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

Event Support

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

Splice Detection Screens

Chronic Circuit Problems

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

```
                    Press ESC to return to previous menu
                           Chronic Circuit Problems

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

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

   This HDSL unit has the ability to test for bad splices. This detection
   should be used as a last resort after all other loop testing has been
   done. The detection is an approximation which can point the technician
   to the general area of the suspect splice.(+/- 275 ft). For best
   results, re-splice all splices close to the indicated trouble.



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

Figure B-2. Chronic Circuit Screen

NOTE

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

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

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

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

View Splice Results Screen

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

- NTF - Reported if the unit is active and no problems have been detected or the number of anomalies detected have not yet reached the detection count threshold, which facilitates the reporting of the result to this screen. (Eight is the present threshold.)
- LOS - Reported if the remote unit has not been detected.
- Number - Reported if an anomaly has been detected a number of times that exceeds the detection count threshold of eight. The number shown in this column represents the number of feet from the transceiver (Reference Point) to that anomaly. This number will also reflect the highest anomaly count seen, as it is possible to have more than one bad splice per circuit. This screen will report the worst (most frequently detected) anomaly.

In this example, a detection has occurred approximately 650 feet from an H4TU-C module. The (B) Back command will allow the technician to scroll back through the last 14 days Splice Detection Results.

```
Circuit ID:HTSVALHDSL4                                    06/17/04 07:32:04
                     Press ESC to return to previous menu

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

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

 Reference    Splice Detection Results        Version          Result Shown
   Point        Loop 1        Loop 2          Number             for date
 ---------    ----------    ----------        -------            MM/DD/YY
   H4TUC          NTF           650              01              --------
   H4TUR          NTF           NTF              01              06/17/04
   H4RU1 NET      NTF           NTF              01
   H4RU1 CST      NTF           NTF              01            (B)Back
```

Figure B-3. Splice Results Screen

Reset Splice Detector

The Splice Detector can be reset by one of three methods:

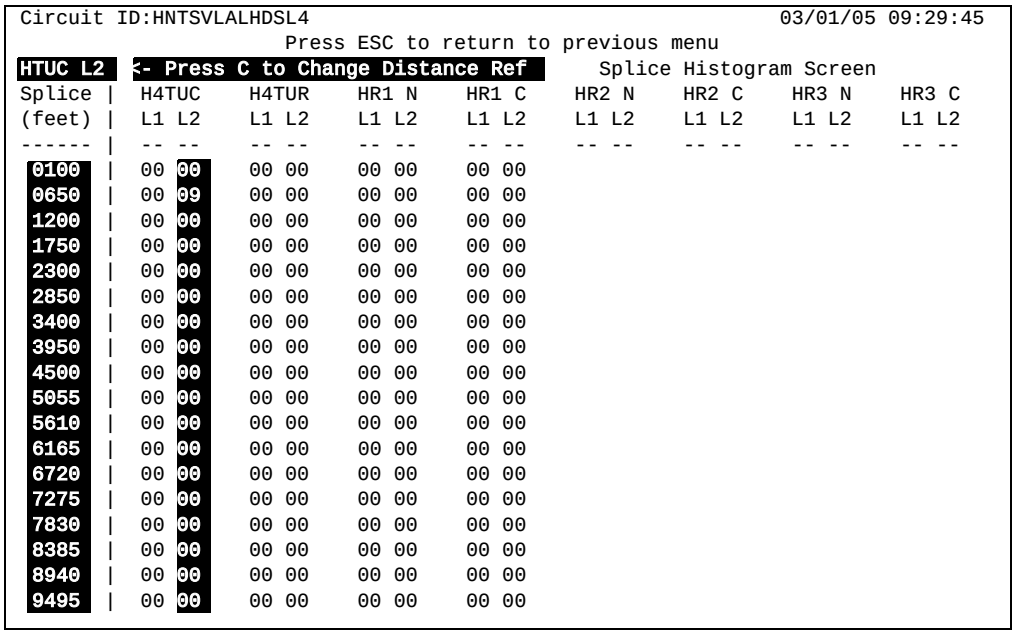
- Power up - The splice detector automatically clears all histogram counters and initializes all distance buffers upon power up. To prevent loss of splice results due to inadvertent power loss, the splice result for the previous 14 days (stored off daily) is available on the Results Screen.
- Manually - The splice detector can be reset via the Troubleshooting Chronic Circuit Guidance Screen. This is recommended when troubleshooting a chronic circuit to clear any old counts out of the detector. This reset will trigger an event log entry.

Choosing Reset Splice Detector option from the Chronic Circuit Problems screen displays a prompt to ensure a reset is desired. If Y (yes) is chosen the splice detector re-initializes and starts running again.

- Automatic Reset - The splice detector resets every 14 days to prevent old data from corrupting the detector. Any problem splice listed will therefore have occurred in the last 14 days and is not leftover data. This reset will trigger an event log entry.

View Splice Histogram

The Splice Histogram Screen (**Figure B-4**) displays the counters that the splice detector uses to make its result decision.



```
Circuit ID:HNTSVLALHDSL4                                  03/01/05 09:29:45
                        Press ESC to return to previous menu
HTUC L2  <- Press C to Change Distance Ref     Splice Histogram Screen
Splice |  H4TUC    H4TUR    HR1 N    HR1 C    HR2 N    HR2 C    HR3 N    HR3 C
(feet) |  L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2    L1 L2
------ |  -- --    -- --    -- --    -- --    -- --    -- --    -- --    -- --
 0100  |  00 00    00 00    00 00    00 00
 0650  |  00 09    00 00    00 00    00 00
 1200  |  00 00    00 00    00 00    00 00
 1750  |  00 00    00 00    00 00    00 00
 2300  |  00 00    00 00    00 00    00 00
 2850  |  00 00    00 00    00 00    00 00
 3400  |  00 00    00 00    00 00    00 00
 3950  |  00 00    00 00    00 00    00 00
 4500  |  00 00    00 00    00 00    00 00
 5055  |  00 00    00 00    00 00    00 00
 5610  |  00 00    00 00    00 00    00 00
 6165  |  00 00    00 00    00 00    00 00
 6720  |  00 00    00 00    00 00    00 00
 7275  |  00 00    00 00    00 00    00 00
 7830  |  00 00    00 00    00 00    00 00
 8385  |  00 00    00 00    00 00    00 00
 8940  |  00 00    00 00    00 00    00 00
 9495  |  00 00    00 00    00 00    00 00
```

Figure B-4. Splice Histogram Screen

The definitions of abbreviations shown on this screen are as follows:

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

In this example, the distances shown are corresponding to an H4TU-C module since that is the transceiver that has detected the anomaly. The count of 09 in the 650 feet row under the H4TU-C, Loop 2, column indicates that an anomaly has been seen 9 times at this distance from an H4TU-C module. Since 9 is larger than the count detection threshold of 8, this result

is reported to the Splice Results Screen. Since all other columns show 00 for all counts, there is no reason to Change (C) the view of the distance column to show the distances an H4TU-R module is evaluating.

Event History Screen

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

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

 Num   Description of Event                        Date     Time      Source
-------------------------------------------------------------------------------
   1.  H4TU-C Event Log Reset                      04/14/04 03:34:36  H4TU-C
   2.  H4TU-C Powered Up                           04/14/04 03:30:01  H4TU-C
   3.  H4TU-R Powered Up                           04/14/04 03:30:15  NO ID
   4.  Splice Detector Reset                       04/14/04 03:30:29  H4TU-R
   5.  Bad Splice Detected                         04/14/04 07:30:33  NO ID









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

                           Selection:
```

Figure B-5. Event History Screen

Compatibility

The H4TU-C and H4TU-R both run local detectors; therefore, a splice-detection capable H4TU-C will be able to detect bad splices up to slightly more than half the circuit length. Likewise, a splice detection capable H4TU-R will be able to detect bad splices up to slightly more than half the circuit from the remote end. With older (non-splice detection units) the splice-detection capable units will not receive Embedded Operations Channel (EOC) messages from the older units so visibility from the other end is lost. Splice detection support is not available for two-wire repeaters.

Using the Bad Splice Detector

A brief synopsis of steps that might be utilized on a trouble analysis are as follows:

1. Check the HDSL units for margin fluctuation by checking the Min & Max margins on the Detailed Span Status screen (differ by > 6 dB) corresponding to the time of the trouble.
2. Check for recorded errors (ES, SES, UAS) and/or loss of sync (LOS) in Performance History data that also correspond to the time of the reported trouble.
3. Check that the copper pairs pass specifications using appropriate test equipment.

   If copper pairs pass all tests, re-install the HDSL units. After they achieve synchronization, clear the PM and Alarm histories from the main menu.
4. Go to the Chronic Circuit menu and reset the splice detector. (It is recommended that the splice detector be reset after a circuit is installed to avoid inaccurate results due to old splice-detect data left in the non-volatile memory).
5. Leave the circuit operating for a few hours or days (depending on severity of problem) and then re-check.
6. Go to Splice Detector Results Screen and see if any indicated trouble is reported.
7. If a problem splice has been detected, re-splicing the closest splices to the indicated trouble (±275 feet for HDSL-2 and ±550 feet for HDSL-4) is recommended.

NOTE

In general, the shorter the distance, the more accurate the measurement.

8. If no trouble is reported on the Splice Detection Results Screen, go to the Histogram screen and check for anomalies that have been detected. The anomaly can exist but may not have reached the threshold level to report it to the Splice Detection Results Screen. Any non-zero counter numbers on this screen may correspond to a deteriorating splice point that should be investigated.

NOTE

If a cable pair acceptance test verified the cable pairs at turn up, and the Splice Detector was reset at that time, then the trouble-shooting procedure would include step 1 and step 2, then proceed immediately with step 7 on the first trouble call.

Fault (GFI, Short) Bridging

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

Fault bridging addresses two general types of problems:

- brief power fault incidents (lightning)
- brief signal distortions.

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

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

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

NOTE

The Fault Bridging feature is not available with this release of the 1223424L1 Remote unit.

NOTE

The Fault Bridging feature is not available in the H4R Repeaters.

Fast Retrain Feature

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

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

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

NOTE

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

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Appendix C
Front Panel DSX and MUX Mode Test Access

GENERAL

Figure C-1 through Figure C-3 are DSX-1 fed modes of operation, and Figure C-4 through Figure C-7 are MUX fed modes of operation. From the Provisioning menu (Figure 16 on page 25), Network Source is used to choose either 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. The Equipment Jack option on the loopback and Test Commands screen (Figure 23 on page 31) is used to configure this jack for the network or customer. Every time the HTU-C 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 C-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 H4TU-C must be provisioned for the Out-of-Service Maintenance service state when intrusive bantam jack testing is being performed.

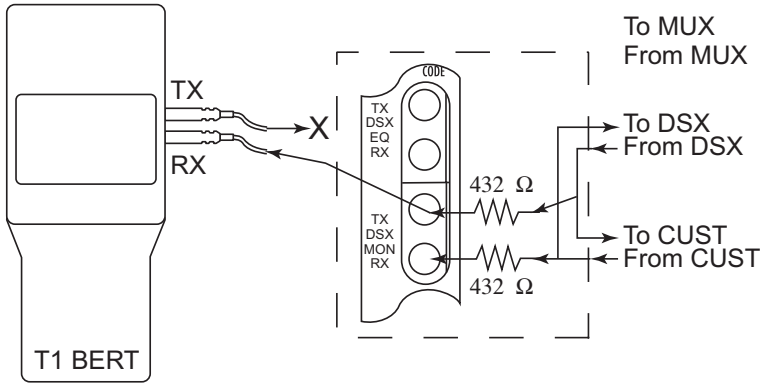

Figure C-1. DSX MON, Tx to Customer

DSX MON, Rx from Customer

The Rx of the BERT receives data from the **RX MON** jack (**Figure C-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**.

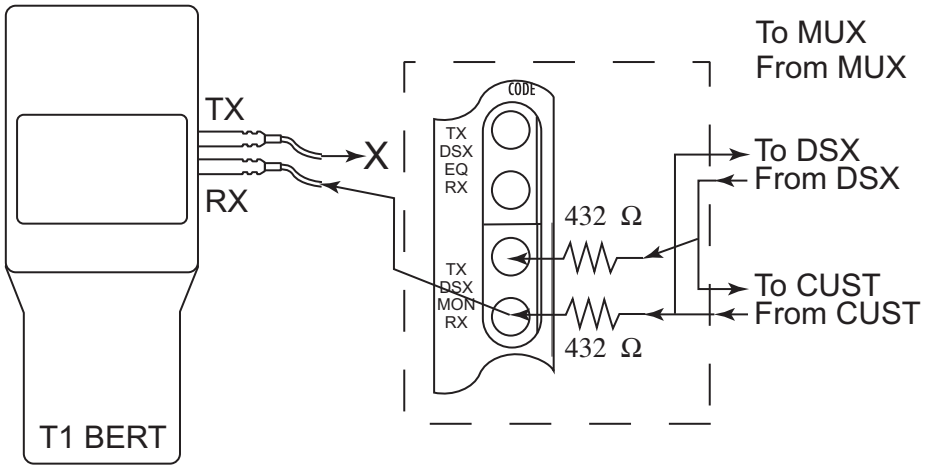

Figure C-2. DSX MON, Rx from Customer

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 C-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.

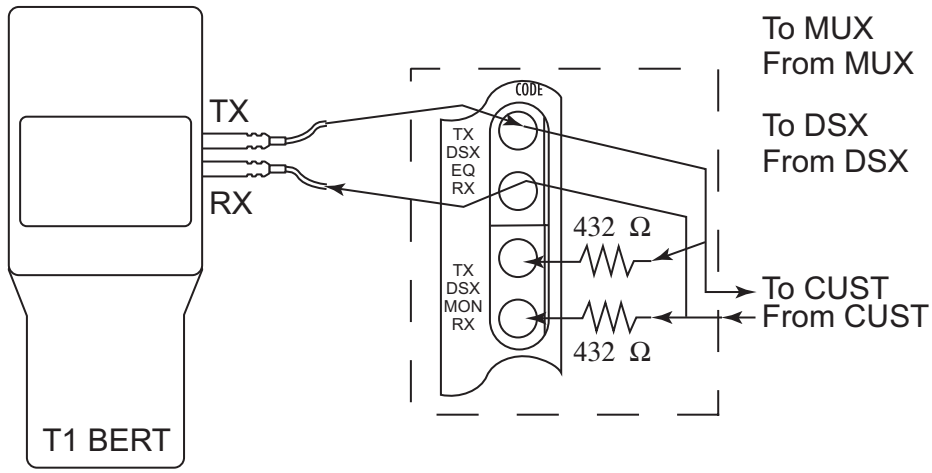

Figure C-3. DSX EQ, Tx to Customer, Rx from Customer

MUX MODE TEST ACCESS

MUX MON, Tx to Customer

The Rx of the BERT receives data from the **TX MON EQ** jack (**Figure C-4**). This data is a copy of the data that the H4TU-C will transmit to the customer. The Tx of the BERT is not used. **This test is non-intrusive.**

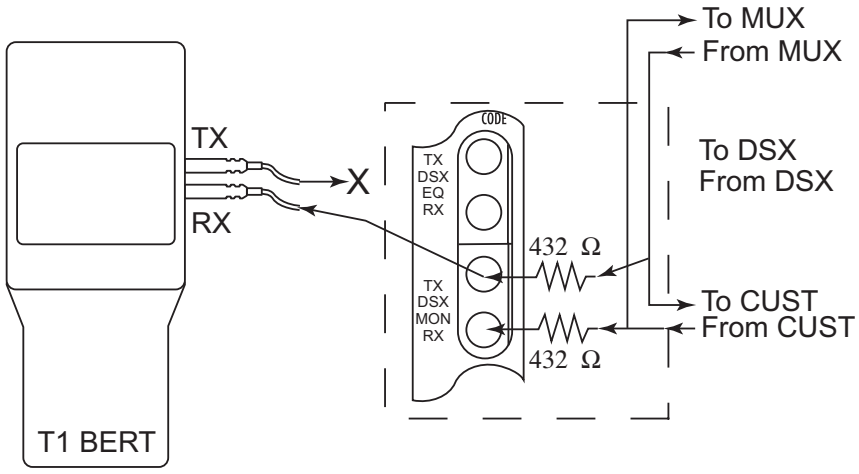

Figure C-4. MUX MON, Tx to Customer

MUX MON, Rx from Customer

The Rx of the BERT receives data from the **RX MON** jack (**Figure C-5**). This data is 432 ohm copy of the data that the H4TU-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**.

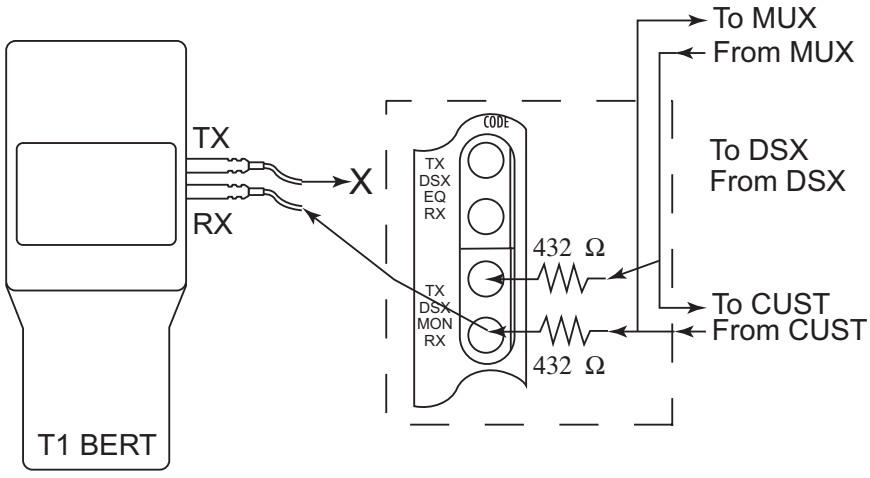

Figure C-5. MUX MON, Rx from Customer

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 C-6**). The Tx of the BERT is then substituted for the data that the H4TU-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**. Via the Test screen, ensure that the equipment jack is in the To Network mode. In the To Network mode, AIS (unframed all 1's) is sent in the customer direction.

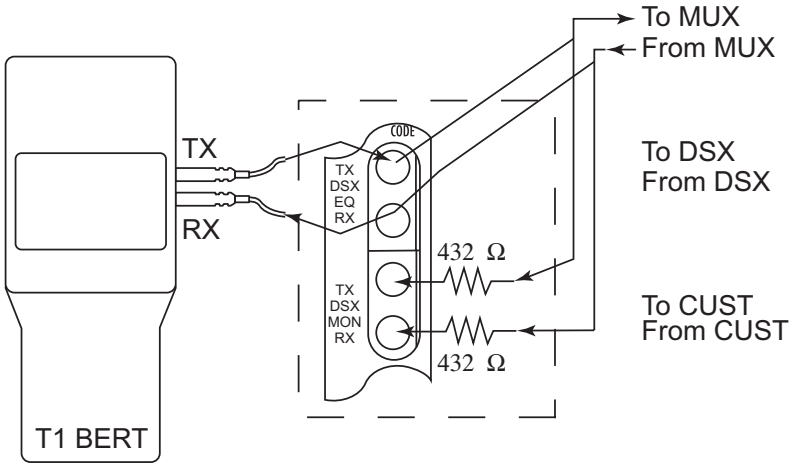

Figure C-6. MUX EQ, Tx to Network, Rx from Network

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 C-7**). The Tx of the BERT is then substituted for the data that the H4TU-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**. Via the Test screen, ensure that the equipment jack is in the To Customer mode. In the To Customer mode, AIS (unframed all 1's) is sent in the network direction.

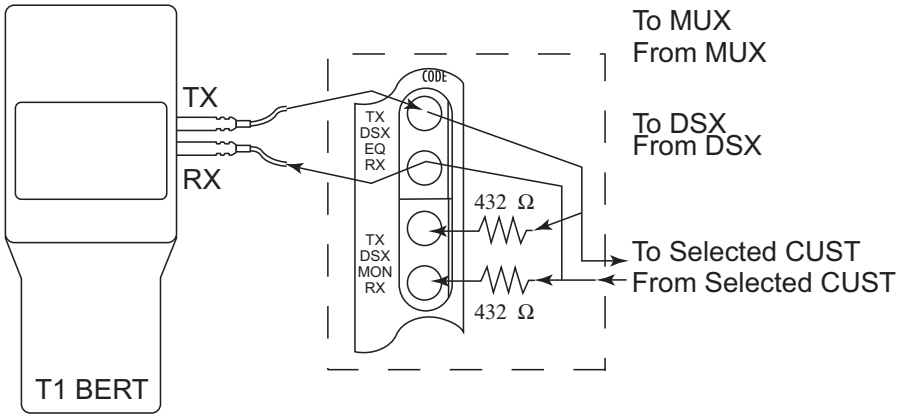

Figure C-7. MUX EQ, Tx to Customer, Rx from Customer

Appendix D
Warranty

WARRANTY AND CUSTOMER SERVICE

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

Refer to the following subsections for sales, support, Customer and Product Service (CAPS) requests, or further information.

ADTRAN Sales

Pricing/Availability:

800-827-0807

ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:

800-726-8663

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

ADTRAN Repair/CAPS

Return for Repair/Upgrade:

(256) 963-8722

Repair and Return Address

Contact CAPS prior to returning equipment to ADTRAN.

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

Carrier Networks Division
901 Explorer Blvd.
Huntsville, AL 35806