HDSL DDM+
Transceiver Unit for Central Office
Installation and Maintenance Practice

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April 2008

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Revision History

Revision	Date	Description
A	April 2008	Initial release

Conventions

The following typographical conventions are used in this document:

This font indicates a cross-reference link.

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 silk-screen 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

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HDSL DDM+ Transceiver Unit for Central Office

INTRODUCTION

This practice is an installation and maintenance guide for the ADTRAN® HDSL DDM+ Transceiver Unit for Central Office (DDM+ HTU-C). The DDM+ HTU-C (P/N 1247003L6) front panel is illustrated in Figure 1.

Figure 1. DDM+ HTU-C Front Panel

DESCRIPTION

DSX-1 signals are provided to and from the network while 2B1Q HDSL signals are provided to the local loop. The DDM+ HTU-C works in conjunction with the ADTRAN HDSL Transceiver Unit for the Remote end (HTU-R) and HDSL Range Extender (HRE) to provide a DS1 service up to 36,000 feet on the local loop.

The DDM+ HTU-C works with multiple list versions of the HTU-R and HRE as listed below in Table 1.

Table 1. HDSL Compatibility

Part Numbers	Description
1245024L1	T400 HTU-R with Local Power Option
1246026Lx	6th Gen HTU-R
1247024L1	7th Gen HTU-R, Local Power
1247026Lx	7th Gen HTU-R, Span Power
1246041L1	6th Gen T200 HRE
1246045L1	6th Gen 239 HRE
1247041L1	7th Gen T200 HRE
1247045L1	7th Gen 239 HRE

x = any number

The DDM+ HTU-C can be deployed in circuits consisting of one HTU-C and one HTU-R. When deployment requires the HRE, the DDM+ HTU-C can be deployed with one or two HREs and one HTU-R.

The HDSL local loop operates as two independent subsystems each operating over a single twisted pair. The DDM+ HTU-C communicates over these two twisted pairs to the HTU-R. Each subsystem carries half of the total bandwidth along with a small amount of overhead used for maintenance and performance monitoring related functions.

System power and alarm bus connections are made through the backplane of the DDM+ shelf. DSX-1 and HDSL signals are connected through the wire-wrap pins related to each individual slot located on the rear of the shelf.

The DDM+ HTU-C uses a DC-to-DC converter to derive its internal logic and span powering voltages from the –48 VDC office supply.

The DDM+ HTU-C can span power HREs and HTU-Rs as listed above. When used with HREs and HTU-Rs, the DDM+ HTU-C can be configured to span power the HTU-R and HRE at –190 VDC (for applications requiring two HREs and an HTU-R). Span powering voltages meet all requirements for Class A2 voltages of by Bellcore GR-1089-CORE.

The DDM+ HTU-C contains an onboard fuse. If a fuse opens, it supplies a –48 VDC voltage to the fuse alarm bus and turns all front panel indicators *off*. These fuses are not designed to be field replaceable.

Compliance

The DDM+ HTU-C is NRTL Listed to the applicable UL standards for continuous use in –40°C to +50°C environmental conditions. Care should be exercised when handling equipment when temperatures at these extremes exist, as surfaces could be very cold or hot.

The DDM+ HTU-C meets or exceeds all the applicable requirements of NEBS, Telcordia GR-63-CORE and GR-1089-CORE and is evaluated to ensure proper operational performance is maintained if environmental conditions ranging from –40°C to +71°C are encountered.

The DDM+ HTU-C is intended for deployment in Central Office type facilities, EEEs, EECs, and locations where the NEC applies (for example, customer premises). Install the DDM+ HTU-C in the appropriate chassis, which is intended to be installed only in Restricted Access Locations by qualified personnel.

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

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

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

Table 2 shows the compliance codes for the DDM+ HTU-C.

Table 2. Compliance Codes

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

WARNING

Voltages up to –200 VDC with respect to ground may be present on the HDSL telecommunications conductors. Voltages up to 200 VDC may be present between individual HDSL telecommunications conductors.

CAUTION

Per GR-1089-CORE the HDSL System is designed and intended for installation as part of a Common Bonding Network (CBN). The HDSL System is not designed nor intended for installation as part of an Isolated Bonding Network (IBN).

CAUTION

Per GR-1089-CORE Section 9, the DDM+ HTU-C does not have an internal DC connection between battery return and frame ground. As such, it may be installed in a DC-I (isolated) or DC-C (common) installation. For installations where other cards or the host system have internal connections between battery return and frame ground, the system would be intended for deployment only in a DC-C installation.

NOTE

The HDSL port is classified as Type 1, 3, and 5, as defined in Appendix B of GR-1089-CORE Issue 4, and meets the lightning and power fault criteria with any primary protector that meets any of the voltage limits of GR-974-CORE or GR-1361-CORE (i.e., carbon blocks, gas tubes, solid states, etc.).

NOTE

The DSX-1 port is classified as Type 2 or 4 as defined in Appendix B of GR-1089-CORE Issue 4, and is suitable for connection to intra-building or unexposed wiring or cabling only. Do not metallically connect this port to interfaces which connect to the Outside Plant (OSP) or to the OSP wiring. The DSX-1 port is designed for use as an intra-building interface only (Type 2 or Type 4 ports as described in GR-1089-CORE Issue 4) and requires isolation from exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect this interface metallically to OSP wiring.

NOTE

Current limiting protectors are not required.

NOTE

The DDM+ HTU-C is designed to operate with a nominal operating voltage of –48 VDC and a minimum operating voltage of –40 VDC. The DDM+ HTU-C will not be damaged by any steady state voltage below –56.7 VDC.

HDSL DEPLOYMENT GUIDELINES

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

- All loops are non-loaded only.
- For loops with 26-AWG cable, the maximum loop length including bridged tap lengths is 9 kft.
- For loops with 24-AWG cable, the maximum loop length including bridged tap lengths is 12 kft.
- Any single bridged tap is limited to 2 kft.
- Total bridged tap length is limited to 2.5 kft.
- The total length of multi-gauge cable containing 26-AWG cable must not exceed the following:
  - $12 - \{(3*L_{26})/(9 - L_{BTAP})\}$ (in kft)
  - L_{26}= Total length of 26-AWG cable excluding bridged taps (in kft)
  - L_{BTAP}= Total length of all bridged taps (in kft)

This deployment criteria is summarized in the chart shown in Figure 2.

Loop loss per kft for other wire is summarized in Table 3.

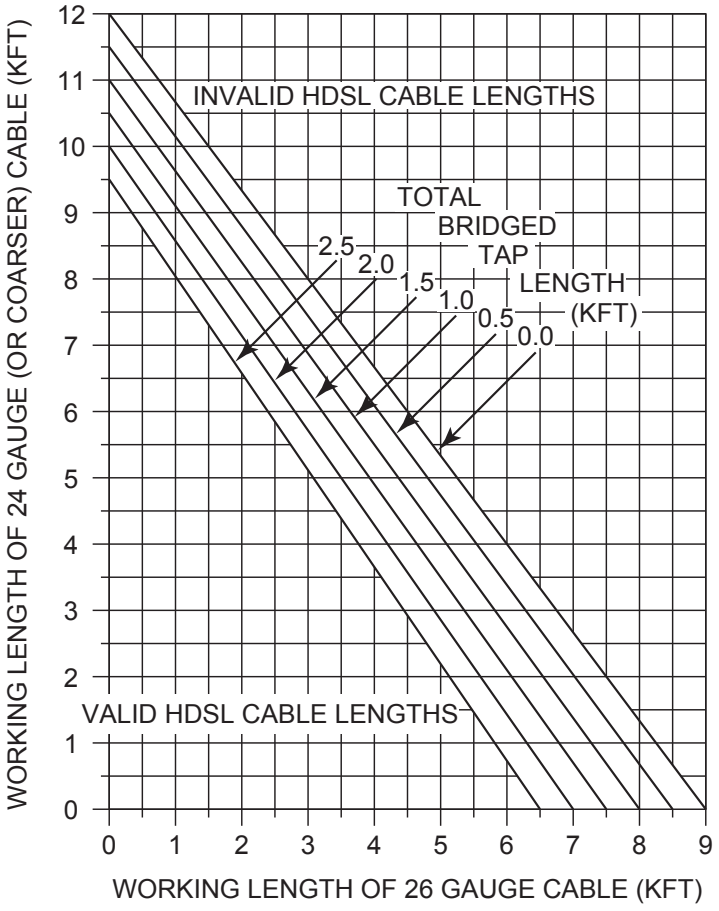


Figure 2. HDSL Deployment Guidelines

Table 3. HDSL Loss Values

(200 kHz cable loss in dB/kft at 135 Ω)

Cable Gauge	Cable Type	Temperature		
		68°	90°	120°
26	PIC	3.902	4.051	4.253
26	Pulp	4.030	4.179	4.381
24	PIC	2.863	2.957	3.083
24	Pulp	3.159	3.257	3.391
22	PIC	2.198	2.255	2.333
22	Pulp	2.483	2.45	2.629
19	PIC	1.551	1.587	1.634
19	Pulp	1.817	1.856	1.909

Recommended maximum local loop loss information for PIC cable at 70°F, 135 Ω resistive termination is provided in Table 4**.**

Table 4. Loop Insertion Loss Data

Frequency (Hz)	Maximum Loss (dB)
3000	12.00
10000	15.00
50000	25.50
100000	30.00
150000	32.75
196000	35.00
200000	32.25
250000	37.50
325000	42.00

An approximation for the maximum amount of wideband noise on an HDSL local loop as measured by a 50 kb filter is ≤ 31 dBrn.

An approximation for the maximum level of impulse noise as measured using a 50 kb filter on an HDSL loop is ≤ 50 dBrn.

NOTE

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

INSTALLATION

CAUTION

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

After unpacking the DDM+ HTU-C, inspect it for damage. If damage has occurred, file a claim with the carrier then contact ADTRAN Customer Service. Refer to "Appendix C, Warranty" for further information. If possible, keep the original shipping container for returning the DDM+ HTU-C for repair or for verification of shipping damage.

Shipping Contents

The contents include the following items:

- HDSL DDM+ Transceiver Unit for Central Office
- *HDSL DDM+ Transceiver Unit for Central Office Job Aid* (P/N 61247003L6-22)
- *HDSL DDM+ Transceiver Unit for Central Office Compliance Notice* (P/N 61247003L6-17)

Shelf Population (Based on Power Requirements)

Typically the DDM+ shelf is fused at 10 amps per side (one half of the shelf).

Several DDM+ HTU-Cs can be mixed with other DDM+ standard plug-ins, providing that the total current draw per shelf side is ≤ 5 amps. Refer to the original equipment manufacturer's specifications for more detail on specific power requirements of these units.

Instructions for Installing the DDM+ HTU-C

To install the DDM+ HTU-C, perform the following steps:

1. Hold the DDM+ HTU-C by the front panel while supporting its bottom edge to engage the chassis edge.
2. Align the DDM+ HTU-C edges to fit in the lower and upper guide grooves for the module slot.
3. Slide the DDM+ HTU-C into the module slot. Simultaneous thumb pressure at the top (above the **STATUS** LED) and at the bottom (below the electrostatic caution symbol) of the DDM+ HTU-C will ensure that it is firmly positioned against the backplane of the chassis.

When the DDM+ HTU-C first powers up it runs the power up self-tests. Once the power up self-tests are complete, the status LEDs reflect the true state of the hardware.

Front Panel Indicator

The DDM+ HTU-C has one front panel LED which indicates operational status. Table 5 describes this LED.

Table 5. Front Panel LED

Label	Status		Description
STATUS	●	Green	Normal operation
	✷	Green Flashing	ES, SES, or BPV detected
	●	Yellow	Loopbacks active
	✷	Yellow Flashing	In-band loopbacks armed
	●	Red	Alarm on any HTU-C loops, HRE loops, DSX or DS1 interface
	✷	Red Flashing	Signal margin of 0 or No Sync on the HDSL loops

Provisioning

The provisioning settings can be viewed through the view mode of the front panel Four Character Display (FCD). For more information on the FCD refer to "Front Panel Operation" on page 12.

The provisioning option settings can be viewed and manipulated through the management access via the front panel RS-232 port. For more information on access through the RS-232 port, refer to "Control Port Operation" on page 16.

Table 6 lists the available provisioning options, option settings, and default settings.

Table 6. Provisioning Options

Provisioning Option	Option Settings	Default Setting
DSX 1 LBO	0-133 feet; 133-266 feet; 266-399 feet; 399-533 feet; 533-655 feet;	0-133 feet
Line Code	B8ZS; AMI	B8ZS
DSX-1 Framing	Auto; UNF	UNF
NIU Loopback	Enabled; Disabled	Enabled
LBTO	None; 1 hr; 2 hr; 8 hr; 24 hr	1 hr
CLOS	AIS; LBK	AIS
DS1 TX LVL	0 dB; –15 dB	0 dB
PRM	None; NPRM; SPRM; Auto	Auto
HTU-C Shelf Alarm	Enabled; Disabled	Enabled
Span Power	Enabled; Disabled	Enabled

CONNECTIONS

The DDM+ HTU-C occupies one card slot in a DDM+ shelf. Power and alarm signals are provided to the card through the backplane of the shelf. DSX-1 and HDSL loop signals are connected to the shelf connector and transmitted to the corresponding slot the unit occupies. Refer to Figure 3 for DDM+ HTU-C edge connection wiring.

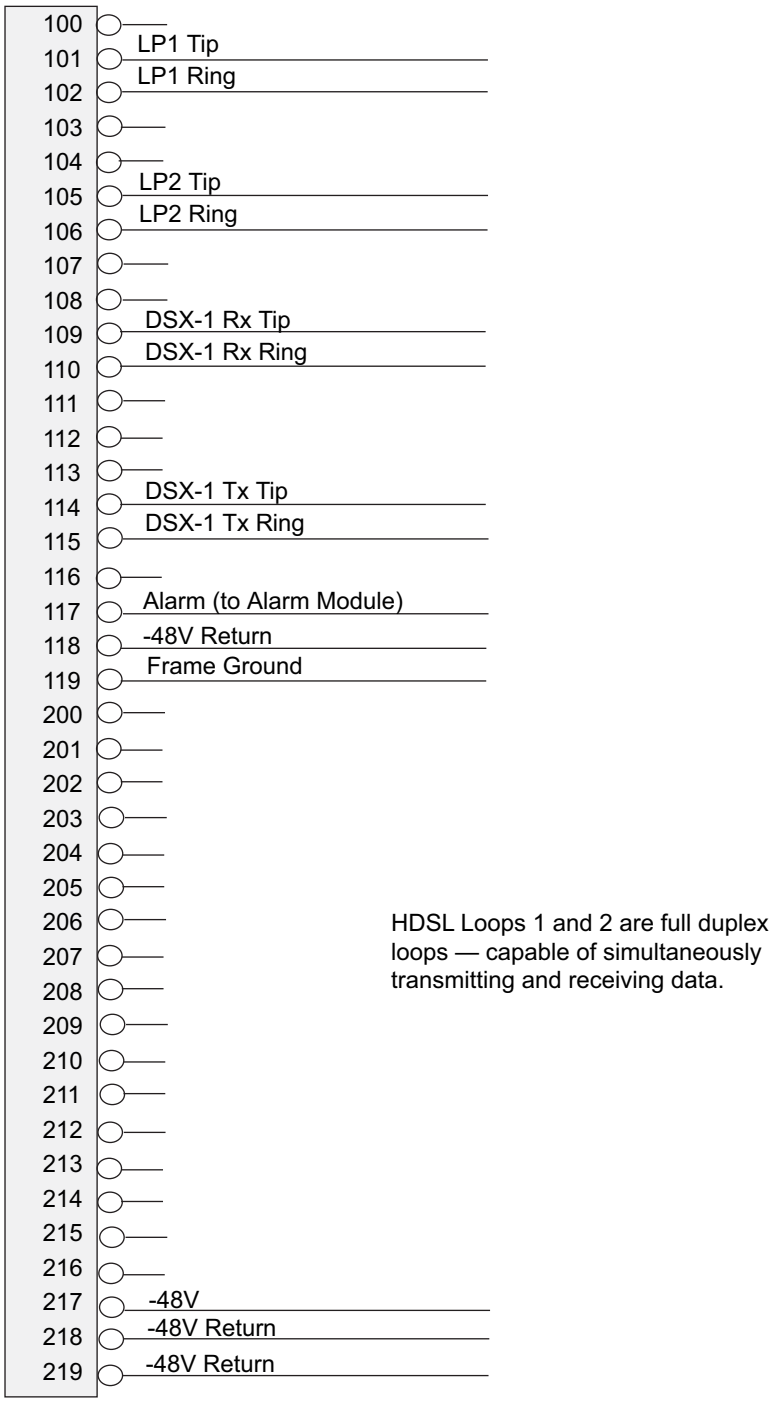


Figure 3. DDM+ HTU-C Edge Connector Wiring

The DDM+ HTU-C is capable of span powering the HTU-R by applying simplex current to the local loop. From 30 mA to 155 mA of current is coupled onto the HDSL span to power the HTU-R and HRE when deployed. The span powering voltage can be configured to be –190 volts with Loop 1 providing the negative voltage and Loop 2 the return (Figure 4).

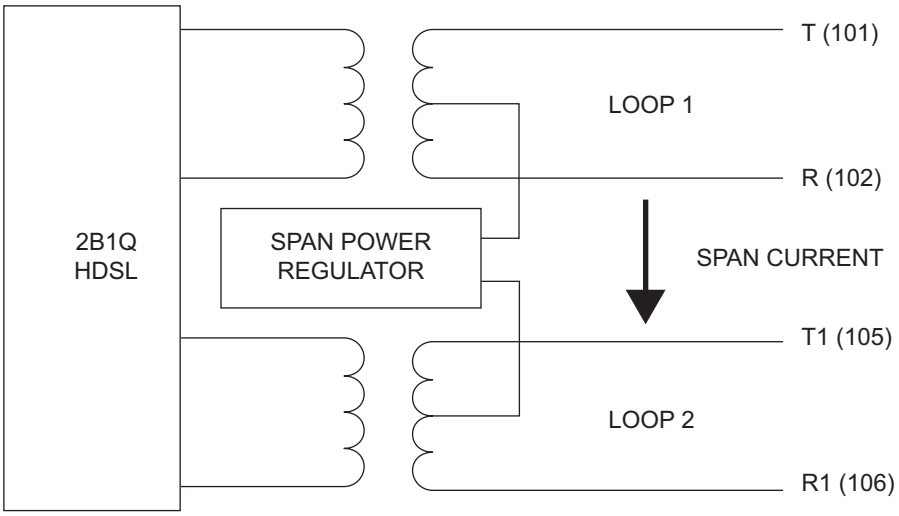


Figure 4. DDM+ HTU-C Span Powering Diagram

Alarm Connections

The following alarm signal is connected to the DDM+ Alarm Module:

- Pin 117
- Label LOS and Fuse Alarm
- Function Loss of signal and fuse alarm of –48 V supply

Alarm processing is actually performed by the DDM+ Alarm Module. Refer to the DDM+ Alarm module documentation for further information.

Alarm conditions are not reported at the DDM+ HTU-C until the HDSL circuit is terminated by connecting an HTU-R. This allows circuit pack pre-provisioning. Once the DDM+ HTU-C is terminated with an HTU-R, the unit will go into an in-service state.

FRONT PANEL OPERATION

The front panel interface consists of an alphanumeric LED Four Character Display (FCD) and two pushbuttons, **MODE** and **SELECT,** that control the FCD. Pressing the **MODE** pushbutton cycles through the FCD modes listed in Table 7. The FCD is used to report the loop margins (dB), and other operational conditions. In addition, the FCD is used to reset unit configuration defaults and control loopbacks. The FCD and front panel pushbuttons are illustrated in Figure 5.

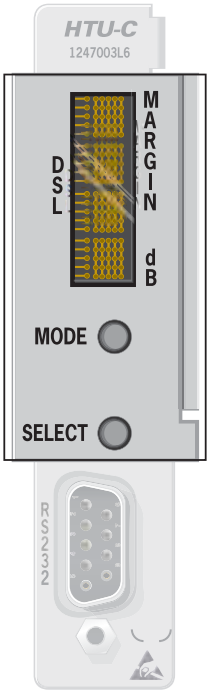


Figure 5. Front Panel Four Character Display and Pushbuttons

Table 7. Four Character Display Modes

Mode	Display	Function
Status	STAT	This mode displays HDSL loop margins, for detailed information, refer to the "Status/Alarm Mode" section of this practice on page 13.
Display Off	Blank	This mode results after five minutes of no activity, for detailed information, refer to the "Display Off Mode" section of this practice on page 13.
View	VIEW	This mode displays current option settings without the ability to change them, for detailed information, refer to the "View Mode" section of this practice on page 14.
Default	DFLT	This mode resets all factory defaults, for detailed information, refer to the "Default Mode" section of this practice on page 15.
Loopback	LPBK	This mode selects and executes HDSL circuit loopbacks, for detailed information, refer to the "Loopback Mode" section of this practice on page 15.

Status/Alarm Mode

The FCD enters Status/Alarm mode after power up or a reset. It displays ADTRAN for 5 seconds and then alternately displays loop margin for each HDSL loop, any active alarm condition, and general status conditions.

The HDSL loop margin is displayed for each loop that is active with the messages 1=xx and 2=xx where xx is the HDSL loop margin for that loop. The loop margin is held on the display for 2 seconds. The loop margin will not be displayed if that loop is in start-up or LOSx condition.

The Status/Alarm mode also displays alarms. If any of the conditions listed in Table 8 are present, the messages for those conditions will be displayed for 2 seconds each after the loop margins.

Table 8. Status/Alarm Display (STAT)

Message	Condition
HER1	CRC error detected on HDSL Loop 1
HER2	CRC error detected on HDSL Loop 2
LERR	Frame bit error (SF Mode), or CRC error (ESF Mode) detected locally at DSX-1 of the HTU-C
RERR	Frame bit error (SF Mode), or CRC error (ESF Mode) detected remotely at DS-1 of the HTU-R
LBPV	Bipolar Violation (BPV) detected locally at DSX-1 of the HTU-C
RBPV	BPV detected remotely at DS-1 of the HTU-R
LOS1/LOS2	No synchronization of HTU-C and HTU-R on Loop 1/Loop 2
LLOS	DSX signal is absent from the network interface or is of a format which does not match the provisioning of the HDSL circuit
RLOS	DS1 signal is absent from the network interface or is of a format which does not match the provisioning of the HDSL circuit
ARM	The loopback arming sequence has been detected

Display Off Mode

The FCD enters Display Off Mode from Status Mode after 5 minutes with no activity on the front panel pushbuttons. While in this mode, the FCD is completely off.

The FCD will return to Status Mode under the following conditions:

- When either **MODE** or **SELECT** is pressed. FCD starts again when the pushbutton is released.
- When a message other than loop margin is to be displayed.

View, Default, and Loopback Mode

The view, default, or loopback mode is entered from the Status Mode by pressing the **MODE** pushbutton. As soon as the **MODE** pushbutton is pressed, the FCD message will cycle through to STAT, VIEW, DFLT, and LPBK. Pressing the **SELECT** pushbutton will cause one of these modes to be entered.

NOTE

At any point in the menu tree, press and hold the **MODE** pushbutton for 3 seconds to move back one menu level.

View Mode

Select the VIEW mode to scroll through each option setting without changing any of the parameters. (This information can be useful in verifying the current settings of the HDSL circuit.) Circuit parameters are described in Table 9. Each option followed by the current setting will flash. No pushbutton presses are necessary and the FCD will return to VIEW after scrolling through each of the options. If the user wishes to exit the VIEW mode the **MODE** pushbutton may be depressed for 3 seconds.

Table 9. Option Settings Display (VIEW)

Message	Description	Settings	Default
LBO	DSX Line Build Out	0, 133, 266, 399, 533	0
CODE	Line Code	AMI, B8ZS	B8ZS
FRMG	DSX Framing	AUTO, UNF	UNF
NLBK	NIU Loopback	EN, DIS	EN
LBTO	Loopback Timeout	0, 1HR, 2HR, 8HR, 24HR	1HR
CLOS	Customer Loss Response	AIS, LPBK	AIS
PRM	Performance Reporting Messages	NPRM, SPRM, NONE, AUTO	AUTO
TXLV	DS1 Transmit Level	0 dB, -15 dB	0 dB
SHLM	HTU-C Shelf Alarm	EN, DIS	EN
SPWR	Span Power	EN, DIS	EN

Note: The DDM+ HTU-C can only be provisioned via the RS-232 port or remotely via inband codes. The front panel can not be used to provision the DDM+ HTU-C.

Default Mode

The DFLT mode can be used to enable all of the factory default HDSL circuit configuration parameters. Once in this mode, the user is prompted to select the factory defaults or not by entering YES or NO respectively. The **MODE** pushbutton is used to toggle between YES and NO. If the **SELECT** pushbutton is pressed while the FCD reads YES, then the unit will enable the factory defaults and display a DONE message. If the **SELECT** pushbutton is pressed while the FCD reads NO, then the unit will retain the current settings.

Loopback Mode

In the Loopback mode the user can select and execute one of the HDSL circuit loopbacks. Only one loopback may be active at a time. From the top level of the FCD use **MODE** to scroll to LPBK. Pressing **SELECT** will force the FCD into the loopback branch. The **MODE** pushbutton can then be used to scroll through the different HDSL system units on the circuit which may include HTUC, HRE1, HRE2 and HTUR. HRE1 is the HDSL Range Extender closest to the DDM+ HTU-C. The FCD will toggle between the unit name and the current loopback state of that unit. The choices are NONE, NET (loopback towards the network), and CST (loopback towards the customer).

To change the loopback state of a particular unit, first press **SELECT** when the appropriate HDSL system unit is being displayed. The unit's current loopback state will be displayed. The **MODE** pushbutton can then be used to scroll through the available choices. Once the desired choice is on the FCD the **SELECT** pushbutton is pressed to activate the choice. The **MODE** pushbutton can now be held down for three seconds to return to the top level of the FCD. Available loopbacks are summarized in Table 10.

Table 10. Loopback Options Display (LPBK)

Mode	Select	Loopback State	Loopback Description
LPBK	HTUC	NET CST NONE	Network loopback at HTU-C Customer loopback at HTU-C No active loopback
	HTUR	BLB NET CST NONE	Bidirectional loopback at HTU-R Network loopback at HTU-R Customer loopback at HTU-R No active loopback
	HRE#1	NET CST NONE	Network loopback at HRE#1 Customer loopback at HRE#1 No active loopback
	HRE#2	NET CST NONE	Network loopback at HRE#2 Customer loopback at HRE#2 No active loopback

CONTROL PORT OPERATION

The DDM+ HTU-C provides a front panel-mounted DB9 connector that supplies an RS-232 interface for connection to a controlling terminal. The pinout of the DB9 is illustrated in Figure 6.

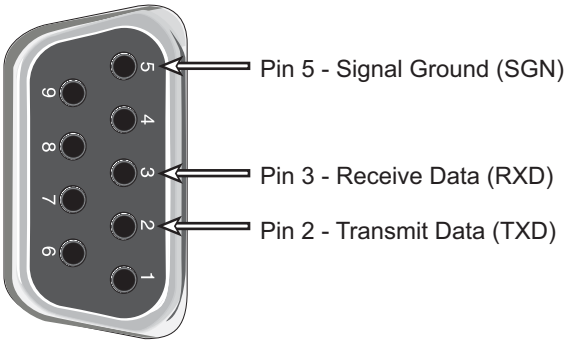


Figure 6. RS-232 (DB9) Pin Assignments

The terminal interface operates at data rates from 1.2 kbps to 19.2 kbps. The asynchronous data format is fixed at 8 data bits, no parity, and 1 stop bit. The supported terminal type is VT100 or compatible.

NOTE

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

USER INTERFACE

This section provides detailed information on the following:

Menu Structure

The DDM+ HTU-C uses a layered menu tree. Each layer of the menu tree is displayed as a menu or a screen.

Menu

A menu is a display that provides numbered selections that are used to navigate to related menus, modify provisioning information, or display information screens. A menu can contain the following objects:

- Menu Option: A menu option is indicated by a number, which when selected navigates the display to another menu layer or is used to change the option setting.
- Read-only Field: A read-only field displays information that cannot be changed. The information displayed in a read-only field can be static or can be automatically updated by the DDM+ HTU-C.
- Read-write Field: A read-write field displays information that when selected can be modified.
- Hot Key: A hot key is a key or combination of keys that are assigned to a function. Hot keys are indicated by the required key(s) and a brief description (i.e., D - Restore factory Defaults).

Screen

A screen is a display that usually indicates the end of a menu tree path. A screen can contain the following objects:

- Read-only Field: A read-only field displays information that cannot be changed. The information displayed in a read-only field can be static or can be automatically updated by the DDM+ HTU-C.
- Read-write Field: A read-write field displays information that when selected can be modified.
- Hot Key: A hot key is a key or combination of keys that are assigned to a function. Hot keys are indicated by the required key(s) and a brief description (i.e., D - Restore factory Defaults).

Menu Navigation

Basic menu navigation is accomplished by selecting the desired option number and then pressing ENTER. To return to the previous menu, press the escape (ESC) key. To access the System Help screen, press the question mark (?) key.

Screen Abbreviations

Table 11 lists the abbreviations used in the screen examples shown in Figures 7 through 23.

Table 11. Screen Abbreviations

Abbreviation	Definition
ES	Errored Seconds • DSX/DS1 – SF: Second in which a BPV or frame bit error occurs – ESF: Second in which a BPV or CRC error occurs • HDSL – Second in which a CRC error occurs
SES	Severely Errored Seconds. • DSX/DS1 – SF: Second in which 1544 BPVs or 8 frame bit errors occurs – ESF: Second in which 1544 BPVs or 320 CRC errors occur • HDSL – Second in which 165 CRC errors occurs
UAS	Unavailable Seconds • DSX/DS1 – Second in which there is a loss of signal or sync • HDSL – Second in which there is a loss of signal or sync
SF	Superframe Format
ESF	Extended Superframe Format
B8ZS	Binary 8 Zero Substitution
AMI	Alternate Mark Inversion
LBO	Line Build Out
BPV	Bipolar Violation • DSX/DS1 – Second in which a bipolar violation occurs
NIU	T1 Network Interface Unit
S/N	Serial number
15M	Fifteen-Minute Period
24H	Twenty-Four-Hour Period

MENU DESCRIPTIONS

The following subsections describe the DDM+ HTU-C menu screens. A terminal session is initiated by entering multiple space bar characters, which will determine the speed of the terminal. Once the speed has been determined, an Introductory menu will appear. The Introductory menu is illustrated in Figure 7.

NOTE

The screens illustrated in Figures 7 through 22 apply to an HDSL circuit deployed with ADTRAN's Low Voltage HDSL technology, using a DDM+ HTU-C, a HTU-R, and two HREs. This sample configuration was chosen in order to illustrate as much functionality as possible; however, other configurations are possible and their displays will vary slightly from those shown in this section.

```
Circuit ID:HNTSVLALHDSL                                    MM/DD/YY hh:mm:ss
                                   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
 ------------------------------------------------------------------------------
  HTU-C INFORMATION                       HTU-R INFORMATION
  -----------------                       -----------------
  S/N : 12345678901234                    S/N : 123456789
  CLEI: T1I3AANAAA                        CLEI: T1I3AAUAAA
  MANF: 10/07                             MANF: 10/07

  HRE #1 INFORMATION                      HRE #2 INFORMATION
  ------------------                      ------------------
  S/N : B916B7813                         S/N : B916B7813
  CLEI: T1RPAABBAA                        CLEI: T1RPAABBAA
  MANF: 02/08                             MANF: 02/08


                          Press "M" to view Main Menu.
```

Figure 7. Introductory Menu Screen

HDSL Main Menu

The ADTRAN HDSL Main Menu, illustrated in Figure 8, is selected from the Introductory menu by pressing “M”. Various Operation, Administrative, Maintenance, and Provisioning (OAM&P) screens may be accessed from the Main Menu.

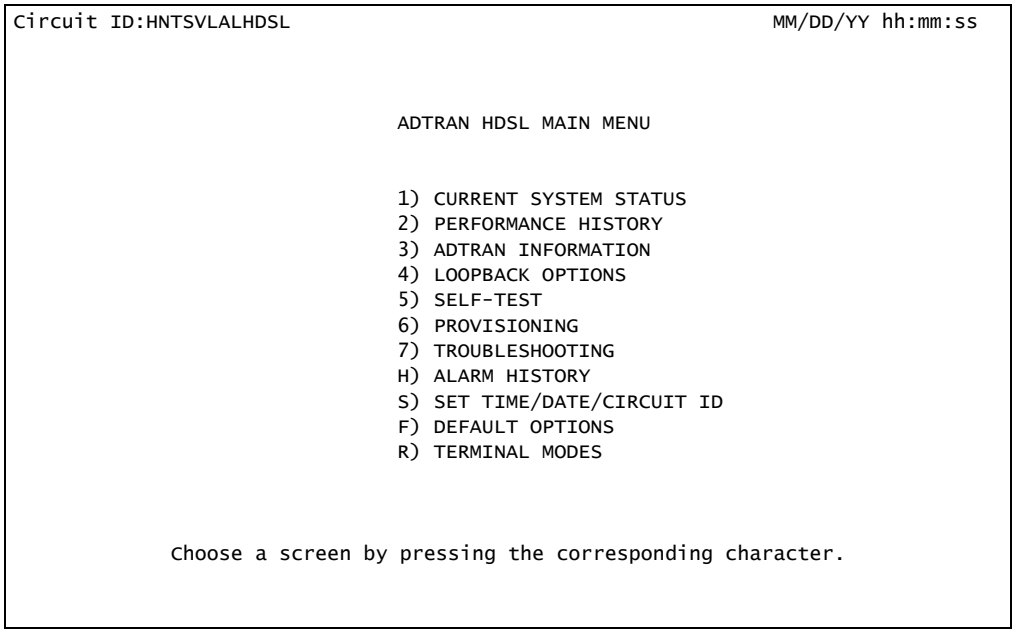


Figure 8. HDSL Main Menu

A list of options for the HDSL Main Menu and their descriptions are found in Table 12.

Table 12. HDSL Main Menu Options

Option	Description	Function
1	Current System Status	This option displays the “Current System Status Screen” on page 22.
2	Performance History	This option displays the “Performance History Screen” on page 25.
3	ADTRAN Information	This option displays the “Introductory Menu Screen” on page 19.
4	Loopback Options	This option displays the “Loopbacks Options Menu” on page 27.
5	Self-Test	This option displays the “Self-Test Screen” on page 27.
6	Provisioning	This option displays the “Provisioning Screen” on page 28.
7	Troubleshooting	This option displays the “Troubleshooting Display Screen” on page 29.
H	Alarm History	This option displays the “Alarm History Screen” on page 30.

Table 12. HDSL Main Menu Options (Continued)

Option	Description	Function
S	Set Time/Date/Circuit ID	This option displays the "Set Time/Date/Circuit ID Menu" on page 31.
F	Default Options	This option displays the "Default Options Screen" on page 34.
R	Terminal Modes	This option displays the "Terminal Modes Screen" on page 35.

Current System Status Screen

The Current System Status screen, illustrated in Figure 9, provides quick access to status information for both the DDM+ HTU-C and the HTU-R.

```
Circuit ID:HNTSVLALHDSL                                          MM/DD/YY hh:mm:ss
LOOP #1 <NETWORK> LOOP #2   CURRENT SYSTEM STATUS     LOOP #1 <CUSTOMER> LOOP #2
----------HTU-C----------                             ----------HTU-R----------
29(29) dB      29(29) dB    <-  LOSS (CUR MAX)  ->    29(29) dB        30(30) dB
YES            YES          <-  SYNC            ->       YES              YES
000/00000      000/00000    <-  ES    15M/24H   ->    000/00000        000/00000
000/00000      000/00000    <-  SES   15M/24H   ->    000/00000        000/00000
000/00000      000/00000    <-  UAS   15M/24H   ->    000/00000        000/00000
   LOOPBACKS INACTIVE                                    LOOPBACKS INACTIVE
                          DSX-1                   DS1
     HTU-C Margin (dB)    --------------------------     HTU-R Margin (dB)
           CUR/MIN/MAX    ESF   <-  FRAME  ->     ESF          CUR/MIN/MAX
                          B8ZS  <-  CODE   ->    B8ZS
     LP1    20/20/20      0-133 <-  LBO    ->    0 dB     LP1    20/20/20
     LP2    20/20/20      N/A   <-  NIU    ->     YES     LP2    20/20/20
                          00000 <-  BPV    ->   00000
                          00000 <-  ES     ->   00000
                          00000 <-  SES    ->   00000
                          00000 <-  UAS    ->   00000
                          NONE  <- ALARMS  ->   NONE

     Press "Z" to zero registers, "X" to restart MIN/MAX, "M" for Main Menu,
                   "H" for HDSL Range Extender #1 (HRE) View.
```

Figure 9. Current System Status Screen

Type the letter "Z" at the Current System Status screen or the Performance History screen in order to reset the current performance registers to zero on both the Current System Status and Performance History screens. A prompt requires user confirmation to execute the zero registers function.

Figures 9 and 10 consolidate current information for the HDSL, DSX-1, and DS1 interfaces. A key to the information provided is found in the center of the screen and defined in Table 13 below. Arrows indicate the key applies to both the DDM+ HTU-C and HTU-R.

Table 13. HDSL, DS1, and DSX-1 Key Definitions

Indicator	Definition
LOSS	Pulse attenuation measurement (1)
SYNC	HDSL loop 1 and loop 2 sync status
ES 15M/24H	Errored seconds (2)
SES 15M/24H	Severely errored seconds (2)
UAS 15M/24H	Unavailable seconds (2)

1. LOSS is typically several dB less than the insertion loss measured at 200 kHz. The LOSS measurement is a better indication of the loop's attenuation of the 2B1Q signal than the insertion loss measured at a single frequency. ADTRAN HDSL can operate on cables with an excess of 30 dB LOSS.
2. The first number is for the current 15-minute period and the second is the current 24-hour period (Loop 1 and Loop 2 numbers are displayed).

An indication of Pair Reversal (if present) appears at the bottom of the first key column. Definitions for this key are provided in Table 14. Status and configuration information for the DS1 and DSX-1 signals is located in the center of the screen near the bottom.

Table 14. Pair Reversal Key Definitions

Indicator	Definition
FRAME	T1 framing format selected
CODE	T1 line coded selected
LBO	Line build-out selected (for DSX-1), Customer signal of 0 or –15 dB (for DS1)
NIU	Network interface unit enabled
BPV	Bipolar violations detected (DSX-1 and DS1)
ES	Errored seconds (DSX-1 and DS1)
SES	Severely errored seconds (DSX-1 and DS1)
UAS	Unavailable seconds (DSX-1 and DS1)
Alarms	Lists current alarm condition status

A measure of signal quality for each HDSL loop appears on the bottom right and left of the screen. Guidelines for interpreting the measure indicators are given in Table 15.

Table 15. HDSL Loop Signal Quality

Measure	Signal Quality	Noise Margin
0	Poor	≤ 0 dB (≈10^{-7} BER)
1-3	Marginal	above 10^{-7} BER in dB
4	Excellent	≥ 4 dB above 10^{-7} BER

Performance predictions are based on signal quality variances with each loop. Generally, a noise margin of 0 or higher will support a bit error rate of better the 10^{-7}. ADTRAN has defined the following guidelines (Table 16) that correspond to the Loop 1 and Loop 2 signal quality (margin) messages 1=XX and 2=XX on the FCD of the DDM+ HTU-C.

Table 16. ADTRAN Noise Margin Guidelines

Margin	LP1/LP2 LED	Loop Quality
Margin = 0	Red	Poor Loop Quality
0 ≤ Margin ≤ 3	Yellow	Marginal Loop Quality
4 ≤ Margin ≤ 20	Green	Good Loop Quality

Current System Status - HRE Screen

The Current System Status - HRE Screen, illustrated in Figure 10, is selected by typing “H” from the Current System Status screen. Type “H” once to view the Current System Status screen for HRE#1. Type “H” a second time to view the Current System Status screen for HRE#2.

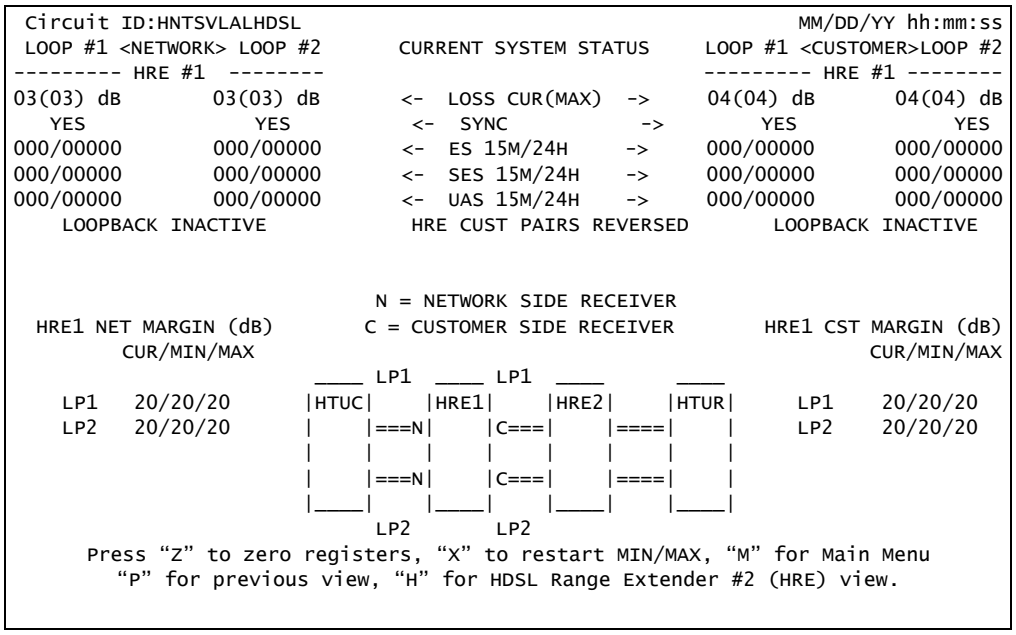


Figure 10. Current System Status - HRE Screen

Performance History Screen

The Performance History screen, illustrated in Figure 11, displays the historical HDSL 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. The DDM+ HTU-C stores performance data in 15-minute increments for the last 24-hour period. At each 24-hour interval, the performance data is transferred into the 24-hour performance data register also accessed from the Performance History screen.

```
Circuit ID:HNTSVLALHDSL                                        MM/DD/YY hh:mm:ss
      24 HOUR REGISTERS       PERFORMANCE HISTORY    15 MINUTE REGISTERS
     ---ES---SES---UAS---                        ---ES--SES-UAS-------ES--SES-UAS-
      00000 00000 00000     <---CURRENT--->         000 000 000
12/31 ----- ----- -----     <-- HISTORY -->  14:30 --- --- --- 10:30 --- --- ---
12/30 ----- ----- -----       |         |    14:15 --- --- --- 10:15 --- --- ---
12/29 ----- ----- -----       |  PAGE#  |    14:00 --- --- --- 10:00 --- --- ---
12/28 ----- ----- -----       |      [1]|    13:45 --- --- --- 9:45  --- --- ---
12/27 ----- ----- -----       |         |    13:30 --- --- --- 9:30  --- --- ---
12/26 ----- ----- -----       |         |    13:15 --- --- --- 9:15  --- --- ---
12/25 ----- ----- -----     <--         |    13:00 --- --- --- 9:00  --- --- ---
                                        |    12:45 --- --- --- 8:45  --- --- ---
VIEW 1 : HTU-C DSX-1                    |    12:30 --- --- --- 8:30  --- --- ---
                                        |    12:15 --- --- --- 8:15  --- --- ---
1->|H|-3---|H|-----|H|---4-|H|-->       |    12:00 --- --- --- 8:00  --- --- ---
   |T|     |R|     |R|     |T|          |    11:45 --- --- --- 7:45  --- --- ---
   |U|     |E|     |E|     |U|          |    11:30 --- --- --- 7:30  --- --- ---
<--|C|-5---|1|-----|2|---6-|R|<-2       |    11:15 --- --- --- 7:15  --- --- ---
                                        |    11:00 --- --- --- 7:00  --- --- ---
Press view number to select view        -->  10:45 --- --- --- 6:45  --- --- ---
Press "H" to view HRE #1 history
                                    PAGE COMMANDS | "B" - Page Back
                                                  | "F" - Page Forward
                      Press "M" to return to the Main Menu
```

Figure 11. Performance History Screen

Performance History - HRE Screen

The Performance History - HRE Screen, illustrated in Figure 12, is selected by typing “H” from the Performance History screen. Type “H” once to view the Performance History screen for HRE#1. Type “H” a second time to view the Performance History screen for HRE#2.

```
Circuit ID:HNTSVLALHDSL                                        MM/DD/YY hh:mm:ss
       24 HOUR REGISTERS       PERFORMANCE HISTORY    15 MINUTE REGISTERS
      --ES----SES---UAS-                          --ES--SES--UAS------ES--SES-UAS-
       00000 00000 00000    <--- CURRENT--->       000 000 000
01/01  ----- ----- -----    <--           --> 22:00 --- --- --- 18:00 --- --- ---
12/31  ----- ----- -----       |          |   21:45 --- --- --- 17:45 --- --- ---
12/30  ----- ----- -----       |  PAGE#   |   21:30 --- --- --- 17:30 --- --- ---
12/29  ----- ----- -----       |     [1]  |   21:15 --- --- --- 17:15 --- --- ---
12/28  ----- ----- -----       |          |   21:00 --- --- --- 17:00 --- --- ---
12/27  ----- ----- -----       |          |   20:45 --- --- --- 16:45 --- --- ---
12/26  ----- ----- -----    <--           |   20:30 --- --- --- 16:30 --- --- ---
                                          |   20:15 --- --- --- 16:15 --- --- ---
VIEW 1 : HRE #1 NETWORK LP1               |   20:00 --- --- --- 16:00 --- --- ---
                                          |   19:45 --- --- --- 15:45 --- --- ---
-->|H|--1--|H|--2--|H|-----|H|-->         |   19:30 --- --- --- 15:30 --- --- ---
   |T|     |R|     |R|     |T|            |   19:15 --- --- --- 15:15 --- --- ---
   |U|     |E|     |E|     |U|            |   19:00 --- --- --- 15:00 --- --- ---
<--|C|--3--|1|--4--|2|-----|R|<--         |   18:45 --- --- --- 14:45 --- --- ---
                                          |   18:30 --- --- --- 14:30 --- --- ---
Press view number to select view          --> 18:15 --- --- --- 14:15 --- --- ---
Press “H” to view HRE #2 history
Press “P” for previous view               PAGE COMMANDS | “B” - Page Back
                                                        | “F” - Page Forward
                      Press “M” to return to the Main Menu
```

Figure 12. Performance History - HRE Screen

Loopbacks Options Menu

The Loopback Options menu, illustrated in Figure 13, displays and allows the changing of loopback settings throughout the HDSL circuit.

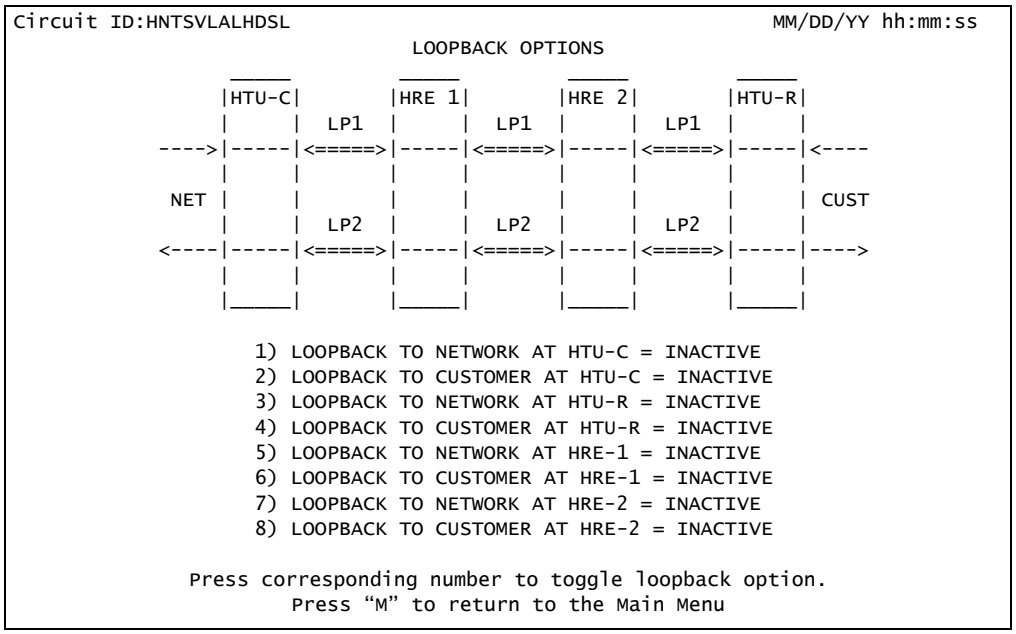


Figure 13. Loopback Options Menu

Self-Test Screen

The Self Test screens, illustrated in Figure 14, allows the initiation of self tests of the DDM+ HTU-C and HTU-R by typing "S."

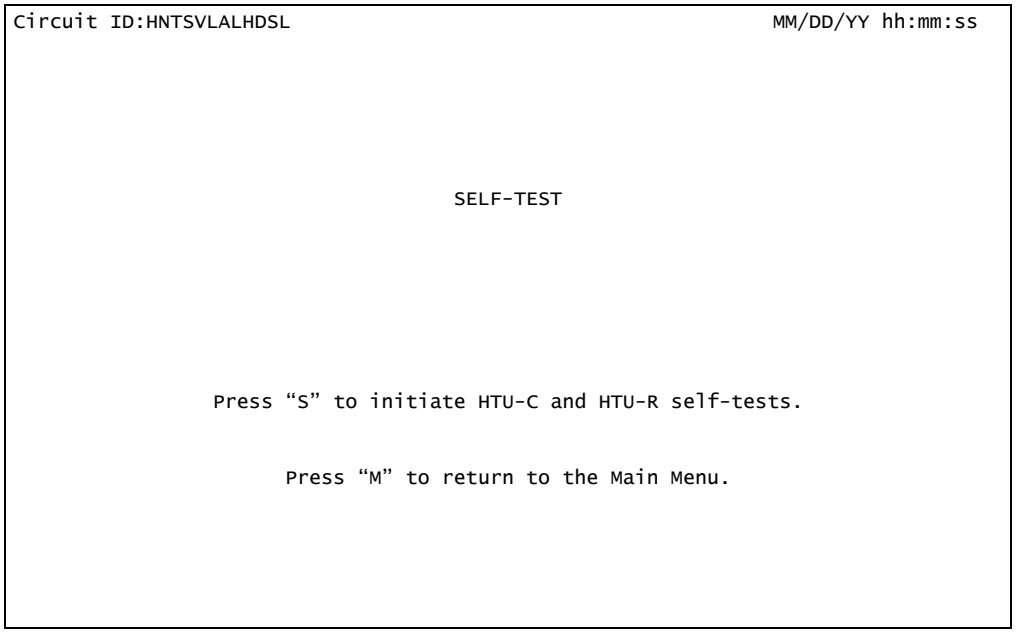


Figure 14. Self-Test Screen

Provisioning Screen

The Provisioning screen, illustrated in Figure 15, provides the option to change the DDM+ HTU-C provisioning settings. A full list of provisioning options can be found in Table 6 on page 9.

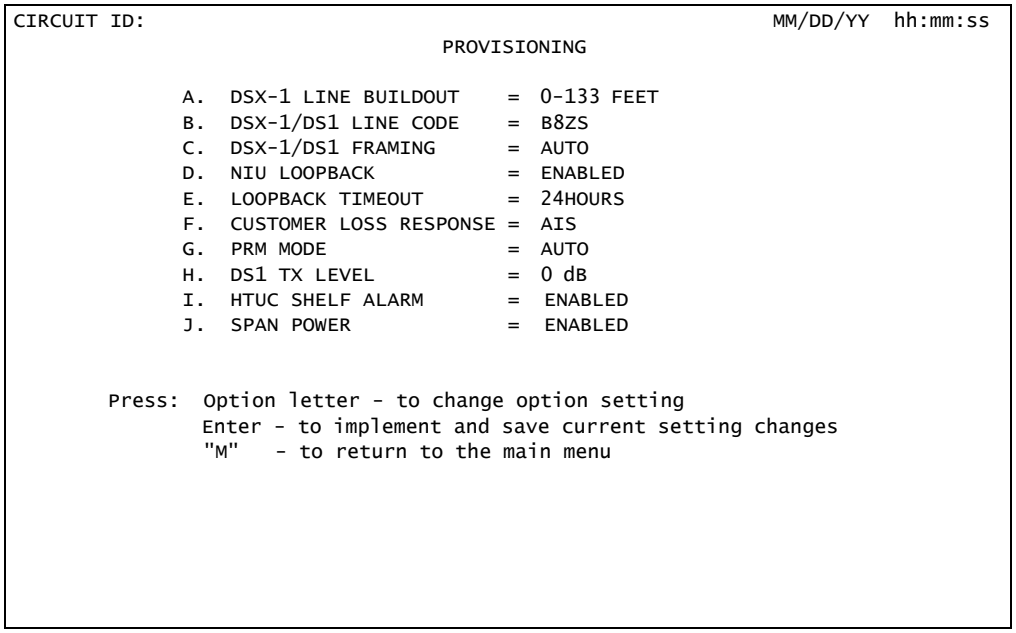


Figure 15. Provisioning Screen

Troubleshooting Display Screen

The Troubleshooting Display screen, illustrated in Figure 16, graphically depicts an HDSL circuit. The DDM+ HTU-C reviews red, yellow, and blue alarm conditions in the circuit to automatically predict where a fault is located. Once a fault location is suspected, the corresponding portion of the circuit on the screen will be highlighted and a message describing the failure will appear.

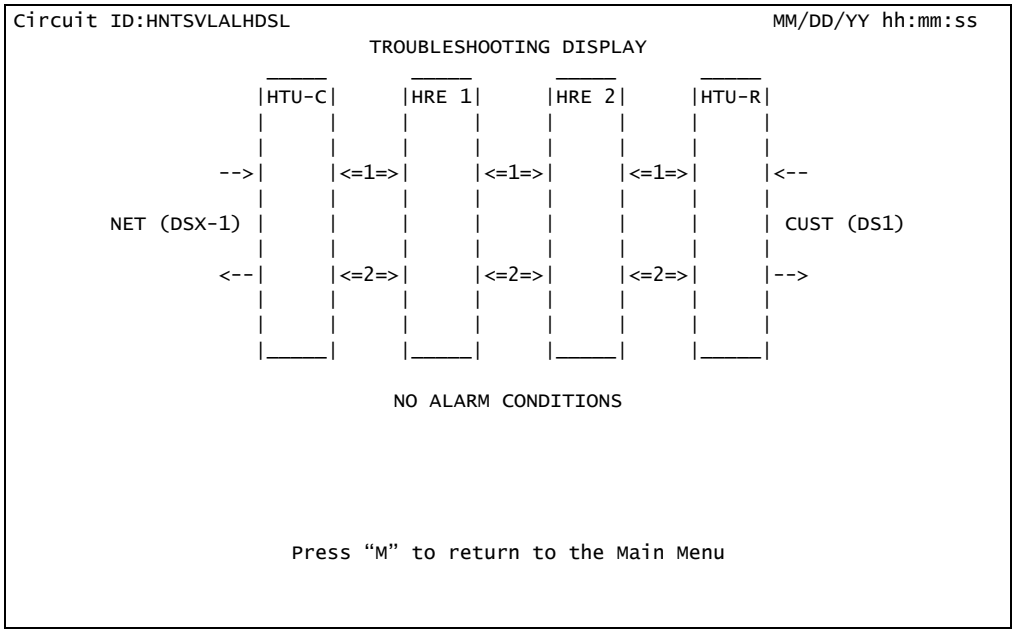


Figure 16. Troubleshooting Display Screen

Alarm History Screen

The Alarm History screen, illustrated in Figure 17, provides detailed information on the alarm history of the HDSL and T1 spans. Information provided includes alarm location, type, first and last time/date, current status, and count.

```
Circuit ID:HNTSVLALHDSL                                    MM/DD/YY hh:mm:ss
                                T1 Alarm History
 LOCATION      ALARM        FIRST              LAST              CURRENT   COUNT
 ------------------------------------------------------------------------------
 HTU-C         RED(LOS)                                          OK         000
  (DSX-1)      YELLOW                                            OK         000
               BLUE(AIS)                                         OK         000

 HTU-R         RED(LOS)                                          OK         000
 (DS1)         YELLOW                                            OK         000
               BLUE(AIS)                                         OK         000
                               HDSL Span History
 ------------------------------------------------------------------------------
 SPAN 1        LP1 HLOS                                          OK         000
               LP2 HLOS                                          OK         000

 HTU-C         LP1 MRGN                                          OK         000
               LP2 MRGN                                          OK         000

 HRE-1         LP1 MRGN                                          OK         000
               LP2 MRGN                                          OK         000


      Press: C to clear history : H to scroll span alarms : M for main menu
```

Figure 17. Alarm History Screen

Set Time/Date/Circuit ID Menu

The Set Time/Date/Circuit ID menu, illustrated in Figure 18, provides access to additional provisioning options.

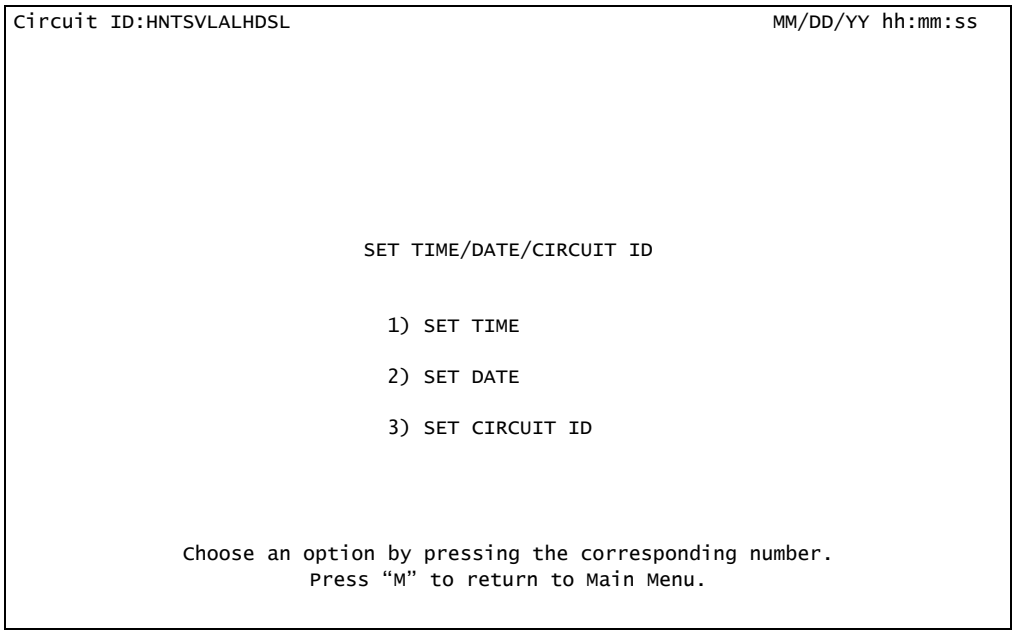


Figure 18. Set Time/Date/Circuit ID Menu

The Set Time/Date/Circuit ID menu options are listed in Table 17.

Table 17. Set Time/Date/Circuit ID Menu Options

Option	Description	Function
1	Set Time	This option displays the "Set Time Screen" on page 32.
2	Set Date	This option displays the "Set Date Screen" on page 32.
3	Set Circuit ID	This option displays the "Set Circuit ID Screen" on page 33.

Set Time Screen

The Set Time screen is illustrated in Figure 19. Enter the time parameters as military time (for example, enter 3:15 p.m. as 15:15:00).

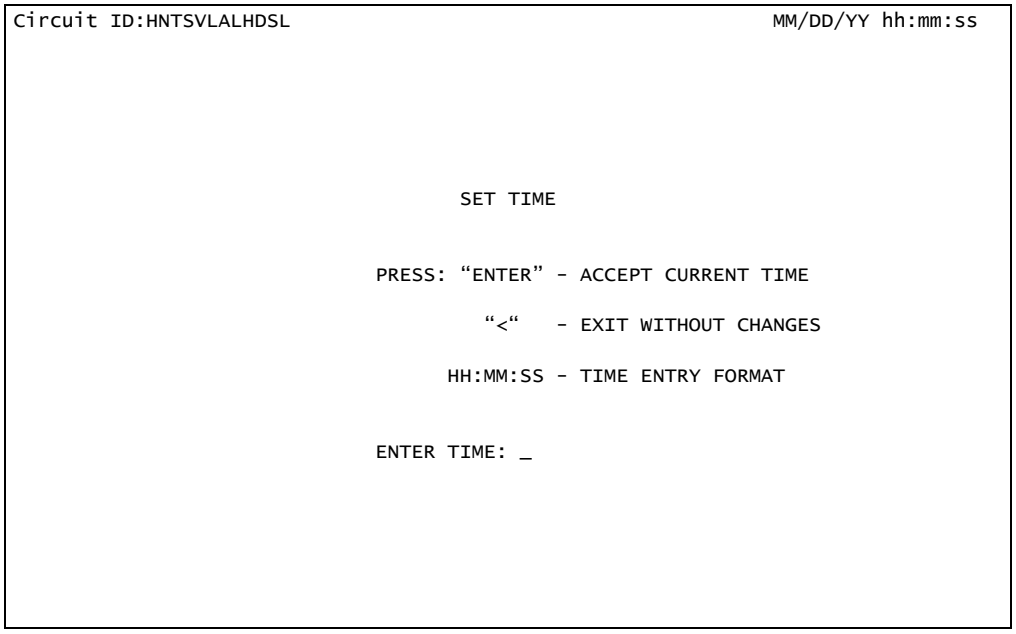


Figure 19. Set Time Screen

Set Date Screen

The Set Date screen is illustrated in Figure 20. Enter the date parameters in MM/DD/YY format.

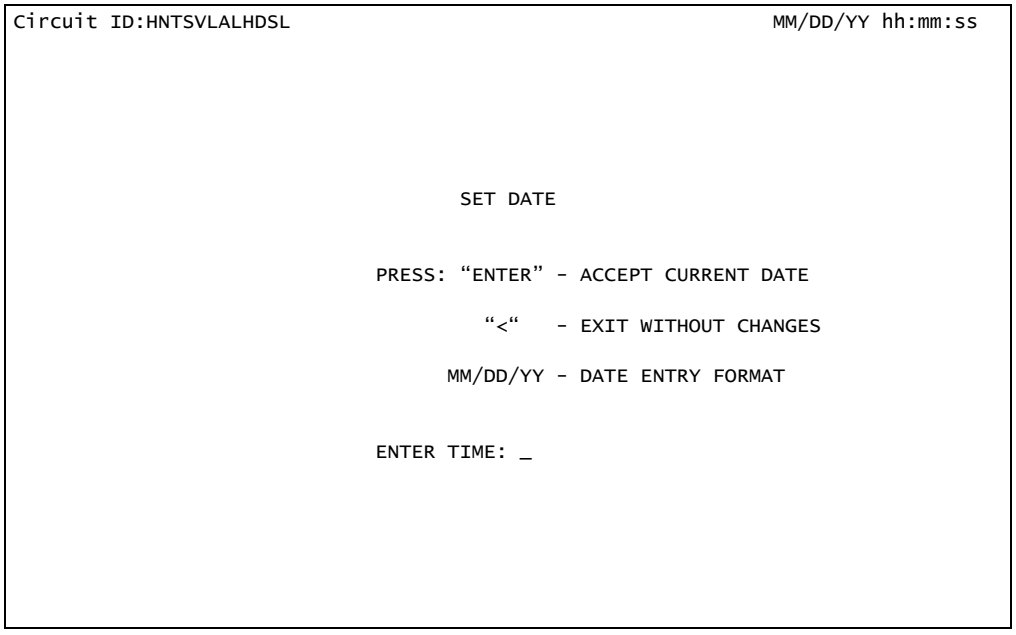


Figure 20. Set Date Screen

Set Circuit ID Screen

The Set Circuit ID screen is illustrated in Figure 21. Enter the Circuit ID as a 25–character alphanumeric string.

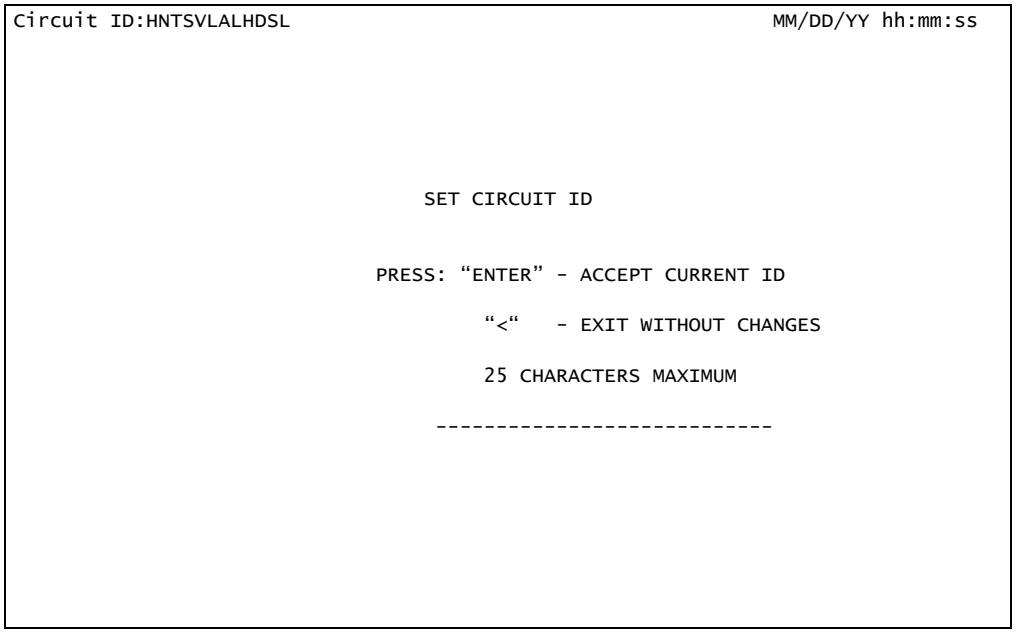


Figure 21. Set Circuit ID Screen

Default Options Screen

The Default Options screen, illustrated in Figure 22, allows the setting of all provisioning options to the factory defaults. Each screen is shown to illustrate all the steps required to accomplish the resetting of these options.

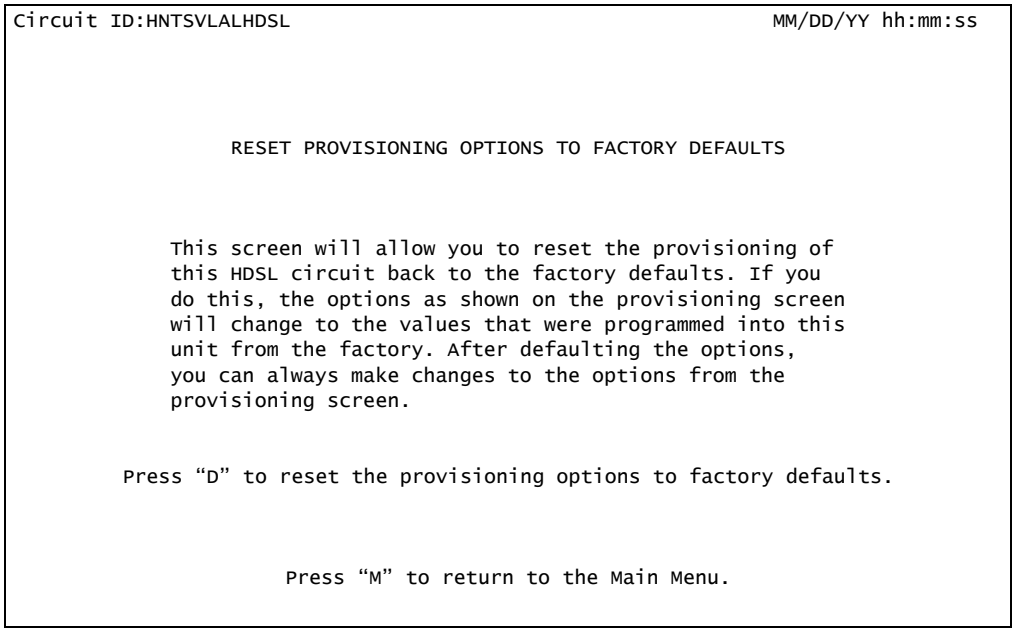


Figure 22. Default Options Screen

Terminal Modes Screen

The Terminal Modes Screen, illustrated in Figure 23, allows the user to set the dumb terminal with Manual Update Mode or Real-Time (VT100) Update Mode. The Manual Update Mode allows print screen and log file utilities.

```
Circuit ID:HNTSVLALHDSL                                        MM/DD/YY hh:mm:ss

                                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 3 spacebars 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 "T" to toggle between the terminal modes.
                       Press "M" to return to the main menu.
```

Figure 23. Terminal Modes Screen

HDSL SYSTEM TESTING

The ADTRAN HDSL system provides extensive ability to monitor the status and performance of the DSX-1 signals, DS1 signals, and HDSL loop signals. Detailed performance monitoring is provided by the front panel 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 HDSL system.

HTU-C Loopbacks

The DDM+ HTU-C responds to three different loopback activation processes. First, a loopback may be commanded manually using the control port interface. Figure 13 on page 27 depicts the Loopback Options Screen which provides for DDM+ HTU-C, HTU-R, and HRE loopbacks.

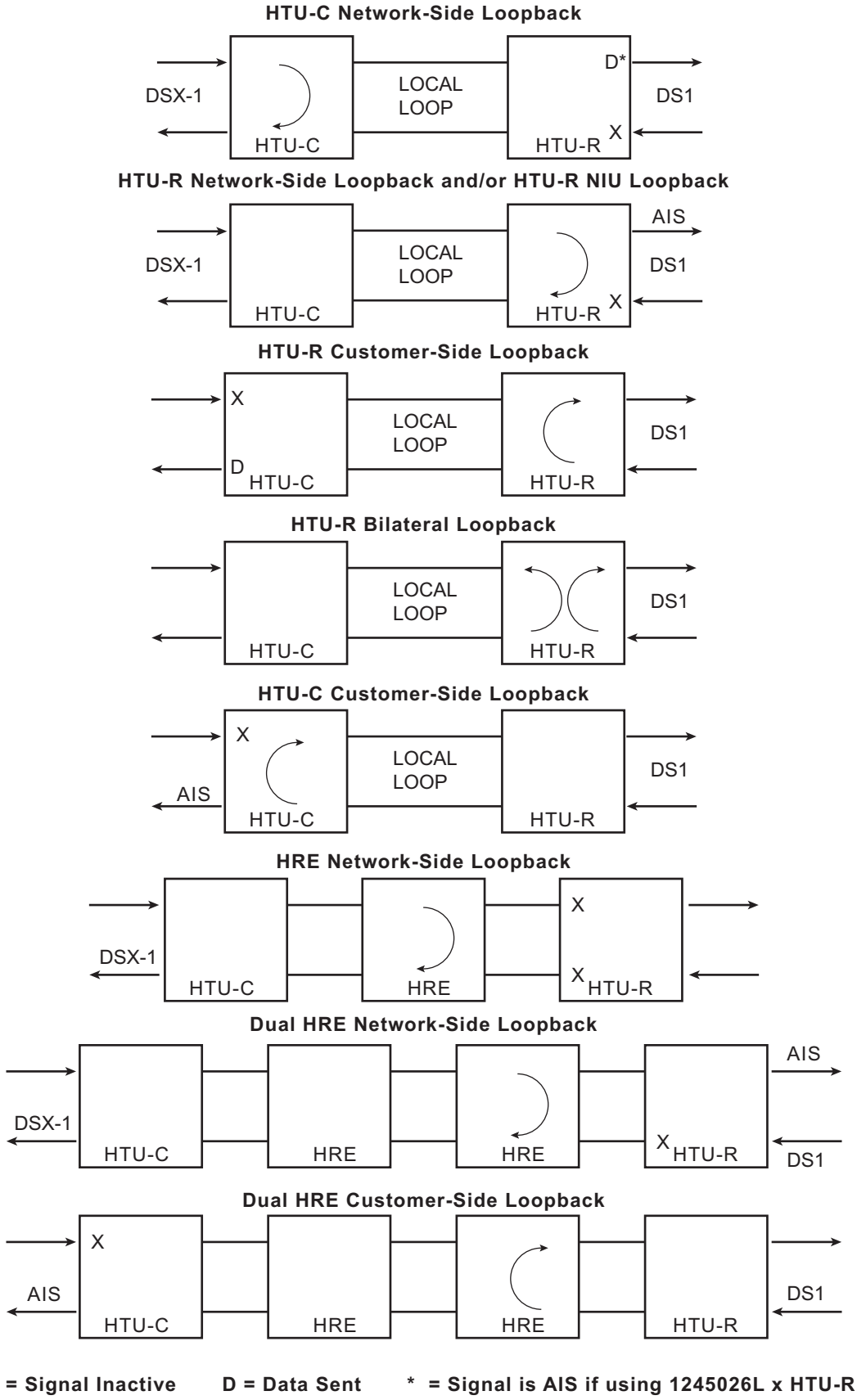
Secondly, the DDM+ HTU-C responds to the defacto industry standard for HDSL loopbacks. A detailed description of these loopback sequences is given in "Appendix A, HDSL Loopbacks".

Third, the DDM+ HTU-C responds to loopbacks initiated using the FCD located on the faceplate of the unit. For more information, refer to "Front Panel Operation" on page 12.

This unit contains smartloop technology. That is, if the unit is optioned to operate in an unframed mode, it constantly monitors the DSX-1 for a framing pattern. If a framed loopback control sequence is sent, then the unit will initiate the proper loopback command. For more information refer to "Appendix A, HDSL Loopbacks".

The loopback condition imposed in both cases is a logic level loopback at the point within the DDM+ HTU-C where the DSX-1 signal passes into the HDSL modulators. Figure 24 depicts all the loopback locations possible with ADTRAN HDSL equipment.

In addition to network-side loopbacks, the DDM+ HTU-C provides customer-side loopbacks initiated by using the terminal control port, as described in "Control Port Operation" on page 16. In this mode, an AIS signal is supplied to the network.



X = Signal Inactive D = Data Sent * = Signal is AIS if using 1245026L x HTU-R.

Figure 24. HDSL Loopbacks

TROUBLESHOOTING PROCEDURES

Table 18 is a troubleshooting guide for the DDM+ HTU-C.

Table 18. Troubleshooting Guide

Condition	Solution
Front Panel **STATUS** Indicator is *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 DDM+ HTU-C into a slot known to be in good working condition; check to see if **STATUS** indicator is on. 4. If steps 1 and 2 pass, but step 3 fails, replace the DDM+ HTU-C.

MAINTENANCE

The HDSL DDM+ Transceiver Unit for Central Office does not require routine maintenance for normal operation. Do not attempt to repair the DDM+ HTU-C in the field. Repair services are obtained by returning the defective unit to ADTRAN. Refer to "Appendix C, Warranty" for further information.

SPECIFICATIONS

Specifications for the DDM+ HTU-C are detailed in Table 19.

Table 19. DDM+ HTU-C Specifications

Specification	Description
Loop Interface	
Modulation Type:	2B1Q
Mode:	Full Duplex, Echo Cancelling
Number of Pairs:	Two
Bit Rate:	784 kbps per pair
Baud Rate:	392 k baud per pair
Service Range:	Defined by Carrier Service Area Guidelines
Loop Loss:	35 db maximum at 196 kHz
Bridged Taps:	Single Taps < 2000 feet, Total taps < 2500 feet
Performance:	Compliant with Bellcore TA-NWT-001210
HDSL Tx Signal Level:	13.5 dBm
Input Impedance:	135 Ω
Return Loss:	20db (40 kHz to 200 kHz)
Network Interface **4-Wire DSX-1**	
DSX-1 Output Level:	0 dB
DSX-1 Line Buildout:	0-133 feet; 133-266 feet; 266-399 feet; 399-533 feet; 533-655 feet
DSX-1 Line Code:	AMI; B8ZS
DSX-1 Format:	Auto; Unframed
DSX-1 Channelization:	Channels 1-12 on Loop 1; Channels 12-24 on Loop 2
Power *(Tested with the ADTRAN Low-Voltage HRE (P/N 1247041) and the ADTRAN Low-Voltage HTU-R (P/N 1247026L5))*	
Total Power:	–48 VDC at 200 mA with HTU-R –48 VDC at 370 mA with HTU-R and HRE –48 VDC at 510 mA with HTU-R and two HREs
HTU-C M R Power Dissipation:	5.2 watts with HTU-R 6.2 watts with HRE and HTU-R 8.6 watts with two HREs and HTU-R
Span Power:	–190 VDC nominal for voltage and current limit at 160 mA ±5% (internally generated)
Fusing:	1.00 amps (not field-replaceable)

Table 19. DDM+ HTU-C Specifications (Continued)

Specification	Description
Clock	
Clock Sources:	Internal DSX-1 Derived
Internal Clock Accuracy:	±25 ppm, (exceeds Stratum 4). Meets T1.101 timing requirements.
Physical	
Dimensions:	Height: 3.51 inches Width: 0.71 inches Depth: 9.89 inches
Weight:	Less than 1 pound
Environmental	
Operating Temperature:	–40°C to 70°C
Storage Temperature:	–40°C to 85°C
Relative Humidity:	95 percent maximum @ 50°C, noncondensing
Maximum Current Draw:	0.025 amps maximum @ –48VDC
Maximum Heat Dissipation:	1.21 watts
Control Port	
Interface:	RS-232 (DB-9)
Terminal Type:	VT-100 or compatible
Async Speed:	2.4 kbps to 19.2 kbps
Data Format:	8 data bits; no parity; 1 stop bit
Part Number	
DDM+ Transceiver Unit for Central Office:	1247003L6

Appendix A
HDSL Loopbacks

HDSL MAINTENANCE MODES

This Appendix describes operation of the HDSL system with regard to detection of in-band and ESF facility data link loopback codes.

Upon deactivation of a loopback, the HDSL system will synchronize automatically. Note that the synchronization process of the HDSL system upon deactivation of the HRE loopback could take up to 15 seconds, ensuring all system elements are synchronized.

Loopback Process Description

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

In-band control code sequences are transmitted over the DS1 link by either the unframed or overwrite method. The HDSL elements respond to either method.

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

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

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

Loopback Control Codes

A summary of control sequences is given in.

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. HDSL Loopback Control Codes

Type	Source	Code	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 first HRE.
	(C)	5in6 (111110)	Loopback data from customer toward customer in second HRE.
Wescom	(N)	FF1E	Loopback data from network toward network at HTU-C.
	(C)	3F1E	Loopback data from customer toward customer at HTU-C.
	(N)	FF04	Loopback data from network toward network at HRE1.
	(N)	FF06	Loopback data from network toward network at HRE2.
	(C)	2F04	Loopback data from customer toward customer at HRE1.
	(C)	3F06	Loopback data from customer toward customer at HRE2.
	(N)	FF02	Loopback data from network toward network at HTU-R.
	(C)	3F02	Loopback data from customer toward customer at HTU-R.
	(C)	FF48 (ESF-DL)	Loopback data from customer toward customer at HTU-R.
	(N)	1in6 (100000)	Loopback data from network toward network at HTU-R.
	(N)	FF48 (ESF-DL)	Loopback data from network toward network at HTU-R.
	(N/C)	1in3 (100)	Loopdown everything.
	(N/C)	FF24 (ESF-DL)	Loopdown everything.

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

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

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

Table A-2. In-band Addressable Loopback Codes

Function	Code	Response
Arm	11000 (also known as a 2-in-5 pattern)	The HTU-R will loop up towards the network. No AIS or errors will be sent as a result of this loopback. The HTU-C and HRE will arm.
Disarm	11100 (also known as a 3-in-5 pattern)	The HTU-C and HRE are removed from the armed state. If any of the units are in loopback when the 11100 pattern is received, they will loop down. The LBK LEDs will turn off on all units.
HTU-C Network Loop-up	D3D3 1101 0011 1101 0011	If the units have been armed and no units are in loopback*, the HTU-C will loopup towards the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and 231 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 231 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 231 bit errors will resume at 20-second intervals.
HRE Network Loop-up	C741 1100 0111 0100 0001	If an HRE is present, the units have been armed, the HRE will loopup towards the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and 10 bit errors will be injected into the DSX- 1 signal. As long as the pattern continues to be sent, 10 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 10 bit errors will resume at 20-second intervals.
HRE2 Network Loop-up	C754 1100 0111 0101 0100	If a second HRE is present, the units have been armed, the HRE will loop up towards the network, 2 seconds of AIS (all 1s) will be sent, 5 seconds of data will pass, and 200 bit errors will be injected into the DSX-1 signal. As long as the pattern continues to be sent, 200 errors will be injected every 20 seconds. When the pattern is removed, the unit will remain in loopback. If the pattern is reinstated, the injection of 200 bit errors will resume at 20-second intervals.
Loopdown	9393 1001 0011 1001 0011	Any HTU-C and HRE units currently in loopback towards the network will loopdown and will retain the armed state.

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

Function	Code	Response
Query Loopback	D5D5 1101 0101 1101 0101	If the units are armed and the HTU-C, HRE, or HTU-R are in network loopback, errors are injected into the DSX-1 signal upon detection of the query loopback pattern. As long as the pattern continues to be sent, errors are injected again every 20 seconds. The number of errors injected each time depends on which unit is in loopback. If the HTU-C is in network loopback, 231 errors are injected, 20 at a time if the HTU-R is in network loopback, 10 at a time if HRE #1 is in network loopback, and 200 at a time if HRE #2 is in network loopback.
Loopback Timeout Override	D5D6 1101 0101 1101 0110	If the units are armed and this pattern is sent, the loopback timeout will be disabled. The timeout option will be updated on the Provisioning menu of the HTU-R (viewable through the RS-232 port) to None. As long as the units remain armed, the timeout will remain disabled. When the units are disarmed, the loopback timeout will return to the value it had before the D5D6 code was sent.
Span Power Disable	6767 0110 0111 0110 0111	If the units are armed and this pattern is sent, the HTU-C will deactivate its span power supply, turning off the HTU-R and HRE (if present). As long as the pattern continues to be sent, the span power supply will remain disabled. When the pattern is no longer being sent, the HTU-C will reactivate its span power supply, turning the remote unit(s) on. All units will retrain and return to the disarmed and unlooped state.

Appendix B
Remote Provisioning

REMOTE PROVISIONING

HDSL circuit provisioning options can be set by using commands sent over the DSX-1 channel. This feature provides the ability to change the circuit configuration from a remote location. There are two types of commands sets that may be used: Unframed in-band 11-bit commands and ESF Facility Data Link (FDL) commands.

Loopback Process Description B-1 Unframed In-band 11-Bit Commands

There are two groups of 11-bit in-band commands:

- ADA Mode Codes
- ADTRAN Mode Codes

The set of commands in Table B-1 and Table B-2 allow the user to provision the HDSL circuit. This set of commands consists of over 100 different 11- bit patterns that may be sent over the DSX-1. Commands exist to set and retrieve the system configuration options, set the time and date, retrieve and clear performance history information, and to retrieve and clear alarm information. This section will only cover those used to set and retrieve the system configuration options.

For an 11-bit command to be detected, the command must be sent in UNFRAMED mode. Upon recognition of the pattern, the HDSL circuit will generate a SF-framed all ones signal toward the DSX-1 interface. The pattern will periodically contain a number of bit errors as a response to the 11-bit code that was sent. The bit error response can indicate a number of things such as current configuration information or a successful provisioning change.

ADA Mode Codes

ADA Mode codes can be used immediately after the unit is powered up. This command is used to enter mode of operation where ADA specific 11-bit commands are defined.

Table B-1. ADA Mode 11-Bit Codes

Function	Description	Command	Response
Set Configuration Commands			
Set to HDSL mode (ADTRAN)		00011111101b	
Stop sending FAOS (and return to ADA mode)		00101101011b	
Arm for Provisioning Change	Prepares the unit to receive a configuration change command to Framing, DS1 Line Build-out, and Line Coding.	00010110111b	5000 Bit Errors (BE) indicates arming completed.
Set Framing to Auto*	Change Framing setting to Auto	00010111001b	FTL0, where F = 1- Auto Framed and Loopback Timeout Enabled 2 - Auto Framed and Loopback Timeout Disabled 7 - Unframed and Loopback Timeout Enabled 8 - Unframed and Loopback Timeout Disabled T = 0 - Loopback is 1 hr. 2 - Loopback is 2 hr. 8 - Loopback is 8 hr. 9 - Loopback is 24 hr. L = 0 - NIU Loopback Enabled 4 - NIU Loopback Disabled
Set Line Code to B8ZS*	Change the Line Coding setting to B8ZS	00111011111b	2000 BE to indicate that the setting has changed to B8ZS mode.
Set Line Code to AMI*	Change the Line Coding setting to AMI.	00111011101b	1000 BE to indicate that the setting has changed to AMI mode.
Set DS1 Line Buildout to 0 dB*	Change the DSL Line Buildout to 0 dB	00111010111b	4000 BE to indicate that the setting has changed to 0 dB

Table B-1. ADA Mode 11-Bit Codes (Continued)

Function	Description	Command	Response
Set Configuration Commands (Continued)			
Set DS1 Line Buildout to -15 dB*	Change the DSL Line Buildout to -15 dB	00111010101b	3000 BE to indicate that the setting has changed to -15 dB
Set Loopback Timeout to None	Change the Loopback Timeout to None	00010011011b	FTL0, where F = 1 - Auto Framed and Loopback Timeout Enabled 2 - Auto Framed and Loopback Timeout Disabled 7 - Unframed and Loopback Timeout Enabled 8 - Unframed and Loopback Timeout Disabled T = 0 - Loopback is 1 hr. 2 - Loopback is 2 hr. 8 - Loopback is 8 hr. 9 - Loopback is 24 hr. L = 0 - NIU Loopback Enabled 4 - NIU Loopback Disabled
Set Loopback Timeout to Enabled	This command is used to change the Loopback Timeout setting to its previous value. When the loopback timeout is changed to None, the last value is saved in memory. When this command is sent, the timeout value reverts to the saved value.	00010011101b	FTL0, where F = 1 - Auto Framed and Loopback Timeout Enabled 2 - Auto Framed and Loopback Timeout Disabled 7 - Unframed and Loopback Timeout Enabled 8 - Unframed and Loopback Timeout Disabled T = 0 - Loopback is 1 hr. 2 - Loopback is 2 hr. 8 - Loopback is 8 hr. 9 - Loopback is 24 hr. L = 0 - NIU Loopback Enabled 4 - NUI Loopback Disabled

Table B-1. ADA Mode 11-Bit Codes (Continued)

Function	Description	Command	Response
Set Configuration Commands (Continued)			
Set Loopback Timeout to 1 Hour	This command is used to change the Loopback Timeout setting to 1 Hour.	00010011111b	FTL0, where F = 1 - Auto Framed and Loopback Timeout Enabled 2 - Auto Framed and Loopback Timeout Disabled 7 - Unframed and Loopback Timeout Enabled 8 - Unframed and Loopback Timeout Disabled T = 0 - Loopback is 1 hr. 2 - Loopback is 2 hr. 8 - Loopback is 8 hr. 9 - Loopback is 24 hr. L = 0 - NIU Loopback Enabled 4 - NUI Loopback Disabled
Set Loopback Timeout to 2 Hours	This command is used to change the Loopback Timeout setting to 2 Hours	00010100011b	Same as above
Set Loopback Timeout to 8 Hours	This command is used to change the Loopback Timeout setting to 8 Hours	00010110101b	Same as above
Set Loopback Timeout to 24 Hours	This command is used to change the Loopback Timeout setting to 24 Hours.	00010110011b	Same as above
Retrieve Configuration Commands			
Retrieve Loopback Timeout, Framing, and NIU Loopback settings	This command is used to retrieve the current Loopback Timeout, Framing and NIU Command.	00010011001b or 00010111101b	Same as above
Retrieve DS1 Line Buildout setting	This command is used to retrieve the current DS1 LBO setting without changing any options.	00111001111b	4000 BE if the setting is 0 dB 3000 BE if the setting is -15 dB

Table B-1. ADA Mode 11-Bit Codes (Continued)

Function	Description	Command	Response
Retrieve Configuration Commands (Continued)			
Retrieve Line Code setting	This command is used to retrieve the current Line Code setting without changing any options.	00111011011b	2000 BE if the setting is B8ZS 1000 BE if the setting is AMI
Retrieve PRM setting	This command is used to retrieve the current PRM setting without changing any options.	00111101101b	1000 BE if the setting is NPRM 2000 BE if the setting is SPRM or NONE
Retrieve pattern responses mode setting (ADA or ADTRAN)		00011111111b	

* Commands must be preceded by the ARMING command (00010110111b).

ADTRAN Mode Codes

To enter the ADTRAN Mode, a “mode change command” must be sent. The unit will remain in ADTRAN Mode until either framed all ones (FAO) is allowed to stop automatically (no 11 bit patterns are sent for 60 seconds), or the STOP FAOS and Return to ADA Mode command is issued.

Table B-2. ADTRAN Mode 11-Bit Codes

Function	Description	Command	Response
Set Configuration Commands			
Set Framing to AUTO	00000000001	001	1000 BE (Bit Error)
Set Framing to UNFRAMED	00000000011	003	2000 BE
Set Line Code to B8ZS	00000000111	007	1000 BE
Set Line Code to AMI	00000001001	009	2000 BE
Set DSX-1 LBO to 0-133 feet	00000001101	00D	1000 BE
Set DSX-1 LBO to 133-266 feet	00000001111	00F	2000 BE
Set DSX-1 LBO to 266-399 feet	00000010001	011	3000 BE
Set DSX-1 LBO to 399-533 feet	00000010011	013	4000 BE
Set DSX-1 LBO to 533-655 feet	00000010101	015	5000 BE
Set DSX-1 to External (220 form factor only)	00000101011	02B	6000 BE
Set Loopback Timeout to NONE	00000011001	019	1000 BE
Set Loopback Timeout to 1 Hour	00000011011	01B	2000 BE
Set Loopback Timeout to 2 Hours	00000011101	01D	3000 BE
Set Loopback Timeout to 8 Hours	00000100001	021	4000 BE
Set Loopback Timeout to 24 Hours	00000100011	023	5000 BE
Set PRM Mode to SPRM	00000100111	027	1000 BE
Set PRM Mode to NPRM	00000101001	029	2000 BE
Set PRM Mode to None	00000101101	02D	4000 BE
Set PRM Mode to Auto	00001101101	06D	5000 BE
Set NIU Loopback to Enabled	00000110001	031	1000 BE
Set NIU Loopback to Disabled	00000110011	033	2000 BE
Set CLOS to AIS	00000111101	03D	1000 BE
Set CLOS to LPBK	00000111111	03F	2000 BE
Set DS1 TX Level to 0 dB	00001001111	04F	1000 BE
Set DS1 TX Level to -15 dB	00001010011	053	3000 BE

Table B-2. ADTRAN Mode 11-Bit Codes (Continued)

Function	Description	Command	Response
Set Configuration Commands (Continued)			
Set Shelf Alarm to Disabled (DDM+ and 3192 form factors)	00001110111	077	1000 BE
Set Shelf Alarm to Enabled (DDM+ and 3192 form factors)	00001111001	079	2000 BE
Set to HDSL mode (ADTRAN)	00011111101	0FD	1500 BE
Set to NIU mode (ADA)	00101101011	16B	3500 BE
Retrieve Configuration Commands			
Retrieve Framing setting	00000000101	005	1000 BE = AUTO 2000 BE = UNFRAMED
Retrieve Line Code setting	00000001011	00B	1000 BE = B8ZS 2000 BE = AMI
Retrieve DSX-1 Line Buildout setting	00000010111	017	1000 BE = 0-133 2000 BE = 133-266 3000 BE = 266-399 4000 BE = 399-533 5000 BE = 533-655 6000 BE = EXTERNAL
Retrieve Loopback Timeout setting	00000100101	025	1000 BE = None 2000 BE = 1 HR 3000 BE = 2 HR 4000 BE = 8 HR 5000 BE = 24 HR
Retrieve PRM Mode setting	00000101111	02F	1000 BE = SPRM 2000 BE = NPRM 4000 BE = NONE 5000 BE = AUTO
Retrieve NIU Loopback setting	00000110101	035	1000 BE = Enabled 2000 BE = Disabled
Retrieve CLOS setting	00001000011	043	1000 BE = AIS 2000 BE = LBK
Retrieve DS1 Tx Level setting	00001010101	055	1000 BE = 0 dB 3000 BE = -15 dB
Retrieve Shelf Alarm	00001110101	075	1000 BE = Disabled 2000 BE = Enabled
Retrieve Provisioning Mode	00101101101	16D	1500 BE = HDSL (ADTRAN) 3500 BE = NIU (ADA)

B-2 ESF FDL Commands

This set of commands consists of different strings that may be sent to set and retrieve provisioning, with the advantage that the FDL commands do not interrupt data since they are out-of-band (Table B-3). The FDL commands are encapsulated in HDLC messages.

Table B-3. ESF FDL Commands

Function	Command	General Response	Timeout	Error Response
Set Loopback Timeout	SND-CMD-COM::: <CTAG>:-SL:;<timeout>;	cr 1f 1f ^ ^ ^ ADA-RM^ YYMM-DD^ hh:mm:ss cr 1f M^ ^ <CTAG> ^ COMPLD cr 1f;	decimal. two digits 00 = NONE 01 = 1 hour 02 = 2 hours 08 = 8 hours 24 = 24 hours	cr 1f 1f ^ ^ ^ ADA-RM ^ YYMM-DD^ hh: mm:ss cr 1f M^ ^ <CTAG> ^ DENYcr 1f ^ ^ ^ SROF cr 1f;
Retrieve Loopback Timeout	SND-CMD-COM::: <CTAG>:-RL;	cr 1f 1f ^ ^ ^ ADA-RM^ YYMM-DD^ hh:mm:ss cr 1f M^ ^ <CTAG> ^ COMPLD cr 1f^ ^ ^ "A::<timeout>" cr 1f	decimal. two digits 00 = NONE 01 = 1 hour 02 = 2 hours 08 = 8 hours 24 = 24 hours	cr 1f 1f ^ ^ ^ ADA-RM ^ YYMM-DD^ hh:mm:ss cr 1f M^ ^ <CTAG> ^ DENYcr 1f ^ ^ ^ SROF cr 1f;
Set TIME/ CPE Status	SND_CMD_COM::: <CTAG>:-ST: YYMMDD, hhmmss	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::<cpefrm>, <cpepr-m> cr lf;	<cpefrm> "X"- Don't know (cpe never framed) "S"- SF "E"- ESF <cpeprm> "1"- CPE generating PRMS "0" CPE not generating PRMS	cr lf lf ^^^ADA-RM^ YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Retrieve Minute	SND_CMD_COM::: <CTAG>:-RM	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::<mm> cr lf;	<mm> = decimal, two digits fixed, 00-59, representing minutes past the hour	cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;

Table B-3. ESF FDL Commands (Continued)

Function	Command	General Response	Timeout	Error Response
Retrieve Blockage Indicator	SND_CMD_COM::: <CTAG>:-RB	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::<BIC>,<BOC>, <-BI1>,<BO1>,<BI2>, <BO-2>,<BI3>,<BO3>" cr lf;	<BIn> = 2 char. Fixed, 00-99 or NA, Blockage Indicator NET IN (current, t-1,t-2,t-3) <BOn> = 2 char. Fixed, 00-99 or NA, Blockage Indicator NET OUT (current, t-1,t-2,t-3)	cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Retrieve 4HR PM	SND_CMD_COM::: <CTAG>:-RP: <DIRECTION>	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::ESC,SESC,UASC,MONC" cr lf ^^^"B::ESC1,SESC1,UASC1,MONC1" cr lf ^^^"C::ESC2,SESC2,UASC2,MONC2" cr lf ^^^"D::ESC3,SESC3,UA-SC3,MONC3" cr lf;	<DIRECTION> = "I" for NET IN "O" for NET OUT	cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Retrieve Valid PM Minutes	SND_CMD_COM::: <CTAG>:-RV	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::<mmm>" cr lf;	<decimal,three digits fixed,000-240	cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Retrieve Sectionalized Events	SND_CMD_COM::: <CTAG>:RS: <VIEW>,<SE>, <EC>	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::cccc,ff, mmmmm" cr lf . . . . ^^^"E::cccc,ff, mmmmm" cr lf;	<VIEW> = "S" for sectionalized data "D" for raw data <SE> = decimal, 00-99,starting event <EC> = decimal, 01-05,event retrieval count	cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;

Table B-3. ESF FDL Commands (Continued)

Function	Command	General Response	Timeout	Error Response
Retrieve Number of Events	SND_CMD_COM::: <CTAG>:-RN	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::<evts> cr lf;		cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Clear PM	SND_CMD_COM::: <CTAG>:-CP	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf;		cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Clear Sectionalizer History	SND_CMD_COM::: <CTAG>:-CS	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf;		cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Set Circuit ID	SND_CMD_COM::: <CTAG>:-SI: <Circuit ID>	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf;		cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;
Retrieve Circuit ID	SND_CMD_COM::: <CTAG>:- RI	cr lf lf ^^^ADA-RM^YY-MM--DD^hh:mm:ss cr lf M^^<CTAG>^COMPLD cr lf ^^^"A::<Circuit ID> cr lf;	<Circuit ID> = Circuit ID up to 20 char, ASCII	cr lf lf ^^^ADA-RM ^YY-MM-DD^ hh:mm:ss cr lf M^^<CTAG> ^DENY cr lf ^^^SROF cr lf;

Appendix C
Warranty

WARRANTY AND CUSTOMER SERVICE

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

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

ADTRAN Sales

Pricing/Availability:

800-827-0807

ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:

800-726-8663

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

ADTRAN Repair/CAPS

Return for Repair/Upgrade:

(256) 963-8722

Repair and Return Address

Contact CAPS prior to returning equipment to ADTRAN.

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