DDM Plus HTU-C
High-bit-rate Digital Subscriber Line Transceiver Unit for the Central Office Installation and Maintenance

Contents

Figures

Tables

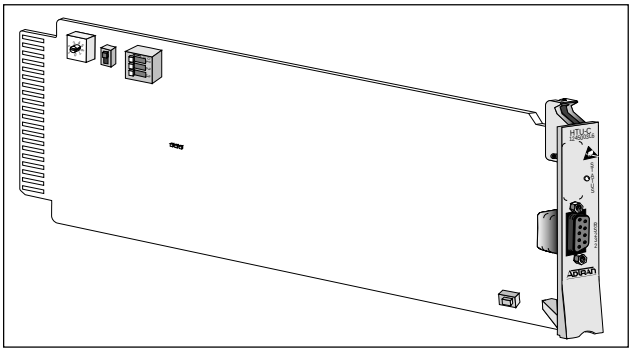

Figure 1. ADTRAN DDM Plus HTU-C

1. GENERAL

The ADTRAN DDM Plus HDSL Transceiver Unit for the Central Office (HTU-C) (ADTRAN P/N 1245003L6) is the Central Office (CO) unit used to deploy a repeaterless T1 circuit using 4-wire metallic facilities. The unit occupies one slot in an AT&T DDM Plus DS1 Extension shelf. The unit is illustrated in **Figure 1**.

DSX-1 signals are provided to and from the network while 2B1Q HDSL signals are provided to the local loop. The ADTRAN 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.

This HTU-C works with multiple list versions of the HTU-R and HRE as listed below:

- 1244021L1, Low Voltage HTU-R T400 CP
- 1244022L1, Low Voltage HTU-R SA
- 1244041LX, Low Voltage T400 HRE
- 1244042L1, Low Voltage 819A HRE
- 1244044L1, Low Voltage 439 HRE
- 1245021L1, Low Voltage HTU-R T200 CP
- 1245022L1, Low Voltage HTU-R SA
- 1245026L1, Low Voltage HTU-R CI
- 1245026L4, Low Voltage HTU-R
- 1245026L5, Low Voltage HTU-R w/PRM

The HTU-C can be deployed in circuits consisting of one HTU-C and one HTU-R. When deployment requires the HRE, the HTU-C can be deployed with one Low Voltage HRE (T400, 239, 439, or 819A) and one Low Voltage HTU-R.

NOTE

When deployment requires the use of two HREs, the HTU-C can be deployed with two T400 HREs (P/N 1244041L2) and one HTU-R (P/N 1245021L1 or 1245026LX).

The HDSL local loop operates as two independent subsystems each operating over a single twisted pair. The 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 Plus 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 Plus 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 Plus HTU-C can span power HREs and HTU-Rs as listed above. When used with HREs and HTU-Rs, the HTU-C can be configured to span power the Low Voltage HTU-R and Low Voltage HRE at either less than -140 Vdc or -190 Vdc (for applications requiring two HREs and an HTU-R). Span powering voltages meet all requirements of Class A2 voltages as specified by Bellcore GR-1089-CORE.

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

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

Revision History

This practice has been reissued to incorporate a CLEI code change.

Electrical Code Compliance

Table 1 shows the UL/CUL Telecommunications Codes for the DDM Plus HTU-C. The DDM Plus HTU-C complies with the requirements covered under UL 1459 third edition and is intended to be installed in an enclosure with an Installation Code (IC) of "B" or "E."

NOTE

- **This product is intended for installation in RESTRICTED ACCESS LOCATIONS only.**
- **Input current at maximun load is 1 A at -48 Vdc.**
- **Maximum output at overcurrent condition is 160 mA at -188 Vdc.**

Table 1. Telecommunications Codes

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

2. INSTALLATION

CAUTION!

SUBJECT TO ELECTROSTATIC DAMAGE OR DECREASE IN RELIABILITY.

HANDLING PRECAUTIONS REQUIRED.

After unpacking the unit, immediately inspect it for possible shipping damage. If damage is discovered, file a claim immediately with the carrier, then contact ADTRAN Customer Service (see subsection 10 of this practice).

The DDM Plus HTU-C plugs directly into the AT&T DDM Plus shelf. The unit may be plugged into any of the 28 numbered slots in this shelf. No installation wiring is required.

One eight-position rotary switch (SW1), one three-position Dip switch pack (SW2), and one three-position slide switch (SW4) are used to configure the mode of operation. **Figure 2** shows the location of these switches.

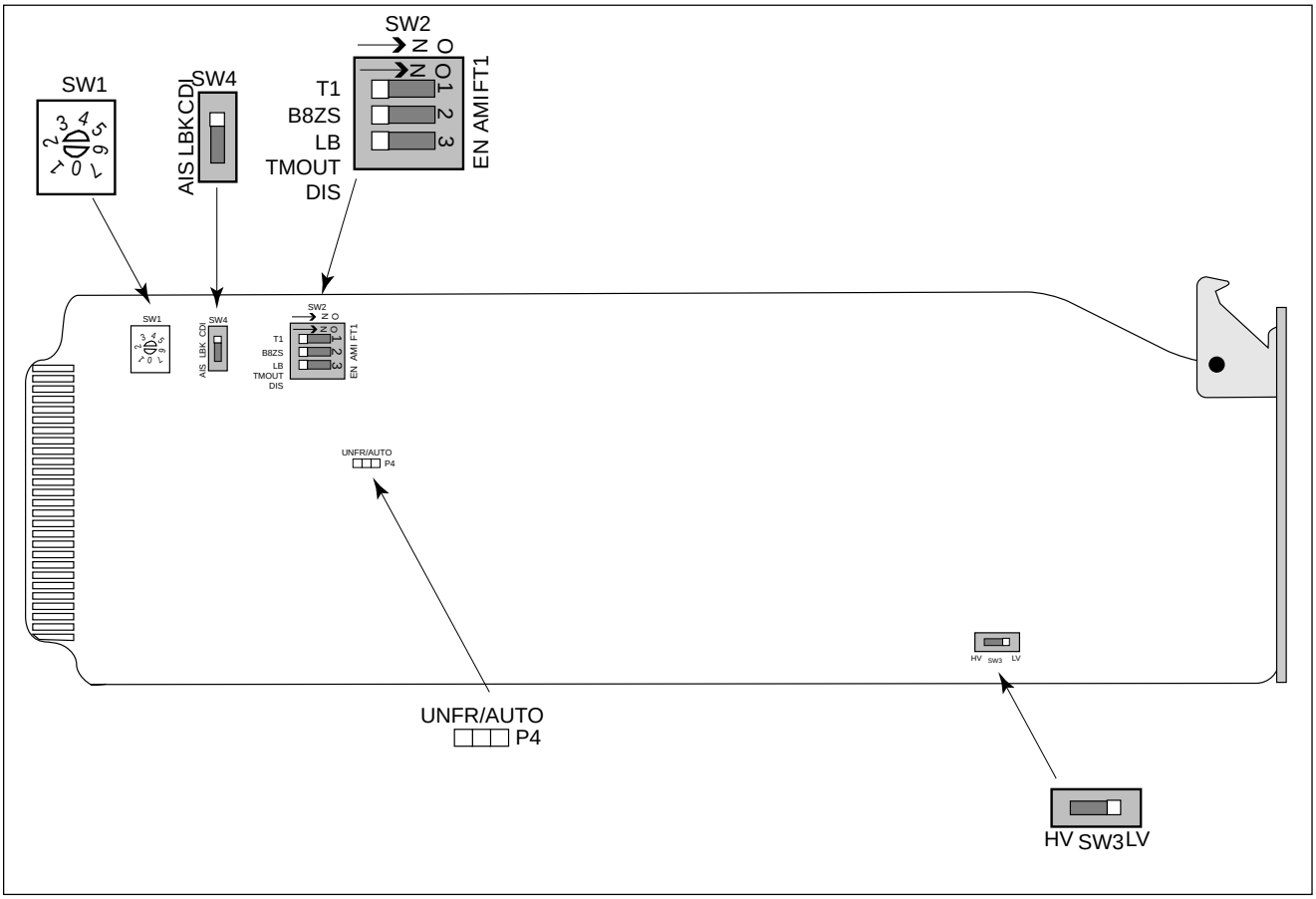

Figure 2. DDM Plus HTU-C Option Switch Locations

The functions of the switches are described in **Tables 2, 3,** and **4**. Configuration may be performed by manually selecting each option switch, or alternatively, may be performed using the RS-232 craft access port.

Table 2. SW1 Rotary Switch Option Settings [1]

(This rotary switch is used to select operation of the line build-out equalizer in series with the DSX-1 output.)

Position	Label	Description
0	0	Line length from 0-133 feet of ABAM cable
1	133	Line length from 133-266 feet of ABAM cable
2	266	Line length from 266-399 feet of ABAM cable
3	399	Line length from 399-533 feet of ABAM cable
4	533	Line length from 533-655 feet of ABAM cable
5		N/A
6		N/A
7		N/A

[1] The HTU-C transfers the local configuration to the HTU-R when circuit synchronization is achieved. The HTU-R then sets its configuration to match the HTU-C.

Table 3. SW2 Option Settings [2]

(Default settings are indicated in **bold** typeface)

Switch	Label	Description
SW2-1		Latching Loopback
	T1	**Selects full T1 loopbacks**
	FT1	Enables DDS Latching Loopback operation
SW2-2		Line Code Select
	AMI	Alternate Mark Inversion is selected
	B8ZS`	**B8ZS line code is selected**
SW2-3		Loopback Timeout
	EN	Loopback Timeout is Enabled [2]
	LB TMOUT DIS	**Loopback Timeout is disabled**

[2] 120-minute timeout is the default for Loopback Timeout Enabled.

Table 4. SW4 Option Settings

Position	Description
CDI [3]	Customer Disconnect Indication. Upon customer Loss of Signal (DS1) at the terminating end of the HDSL circuit, the HTU-R returns DS1 Idle Signal to the network.
LBK	Upon customer Loss of Signal (DS1) at the terminating end of the HDSL circuit, a logical network loopback is initiated at the HTU-R.
AIS	Upon customer Loss of Signal (DS1) at the terminating end of the HDSL circuit, AIS is generated from the HTU-R toward the network.

[3] The CDI 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 millisecond code burst of 7E HEX.

Framing

One jumper (P4) is used to select between Auto-framed and Unframed operation. With the jumper strap applied, Auto-framed operation is selected; with the jumper strap removed, Unframed operation is selected.

Powering Options

Using SW3, illustrated in Figure 2, the HTU-C can be optioned for two different span powering modes. By selecting "LV" span powering mode, the HTU-C will provide span powering at less than -140 Vdc. This mode allows for span powering of circuits without HREs or with one HRE.

By selecting "HV" span powering mode, the HTU-C will provide span powering at -190 Vdc. This mode allows span powering of circuits with two HREs and an HTU-R.

Shelf Population (based on power requirements)

Table 5 can be used to determine the maximum allowable shelf population using the DDM plus shelf.

Typically the AT&T DDM Plus shelf is fused at 10 amps per side (one half of the shelf).

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

Faceplate Indicator

The HTU-C has one faceplate LED which indicates operational status. **Table 6** defines this LED.

Table 5. Power Consumption Worksheet

Step 1	Enter size of fuse for shelf (Amps) .....(A)	_____ Amps
	(Size required for over current protection (i.e., 100%, 75%, 50%) .....(B)	_____ Amps
Step 2	Determine the mix of HDSL circuits in shelf.	
	Percentage of circuits with an HTU-R only .....(C)	_____ %
	Percentage of circuits with one HRE and an HTU-R .....(D)	_____ %
	Percentage of circuits with two HREs and an HTU-R .....(E)	_____ %
Step 3	Determine the current draw of the HDSL circuits.	
	Multiply (C) by 0.2 Amps (with no HRE) .....(F)	_____ Amps/unit
	Multiply (D) by 0.3 Amps (with one HRE) .....(G)	_____ Amps/unit
	Multiply (E) by 0.51 Amps (with two HREs) .....(H)	_____ Amps/unit
Step 4	Add (F) through (H) to get total current draw .....(I)	_____ Amps/unit
Step 5	Divide (B) by (I) to get the number of units per shelf	_____ Units/shelf*

* If the number of units/shelf is greater than or equal to the shelf's slot availability, full shelf population is allowable.

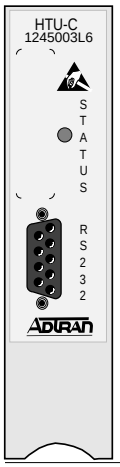

Table 6. Front Panel LED Indicator

Indicator	Description	
STATUS	Blinking Red	Signal Quality of 0 or No Sync on at least one loop
	Solid Red	Alarm on any of HTU-C loops, HRE loops, DSX, or DS1 [4]
	Blinking Amber	In-band loopbacks armed
	Solid Amber	Loopbacks active
	Blinking Green	ES, SES, or BPV occurred
	Solid Green	Everything functioning normally

[4] The DS1 Alarm will be activated if and only if sealing current has been present on the HDSL loops.

3. CONNECTIONS

The DDM Plus HTU-C occupies one card slot in an AT&T DDM Plus 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. See **Figure 3** for HTU-C edge connection wiring.

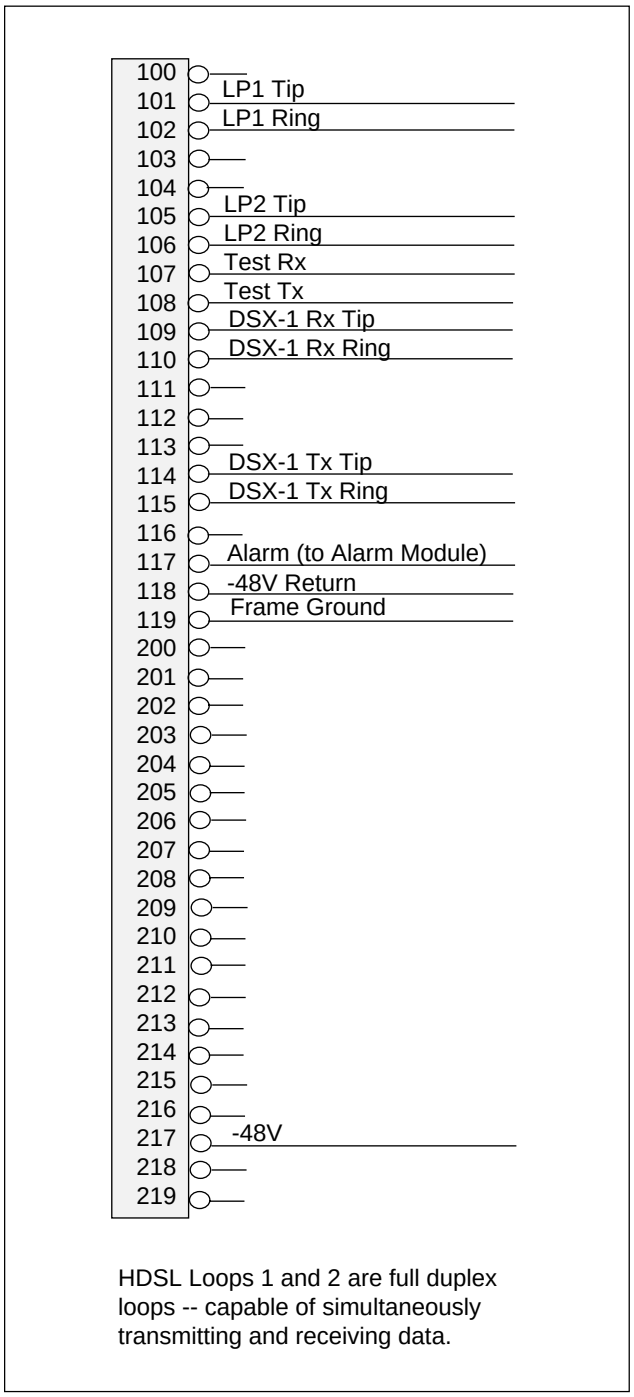

Figure 3. HTU-C Edge Connector Wiring

The HTU-C is capable of span powering the HTU-R by applying simplex current to the local loop. From 30 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 either less than -140 volts or -190 volts with Loop 1 providing the negative voltage and Loop 2 the return (see Figure 4).

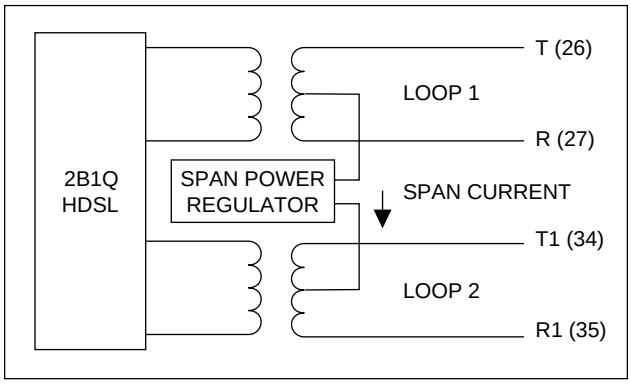

Figure 4. HTU-C Span Powering Diagram

Alarm Connections

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

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

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

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

4. 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 faceplate-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 HDSL system.

HTU-C Loopbacks

The HTU-C responds to two different loopback activation processes. First, loopback may be commanded manually using the control port interface. **Figure 11** depicts the Loopback Options Screen which provides for HTU-C, HTU-R and HRE loopbacks.

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

The loopback condition imposed in both cases is a logic level loopback at the point within the HTU-C where the DSX-1 signal passes into the HDSL modulators. **Figure 5** depicts all the loopback locations possible with ADTRAN HDSL equipment.

In addition to network-side loopbacks, the HTU-C provides customer-side loopbacks initiated by using the terminal control port. In this mode, an AIS signal is supplied to the network.

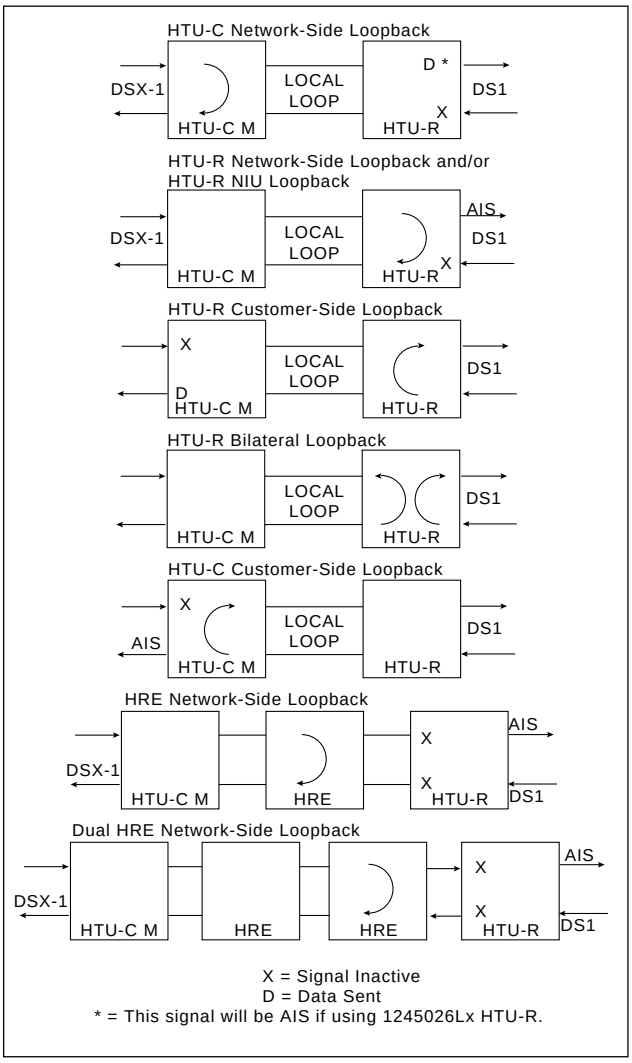

Figure 5. HDSL Loopbacks

5. CONTROL PORT OPERATION

The HTU-C provides a faceplate-mounted DB-9 connector that supplies an RS-232 interface for connection to a controlling terminal. The pinout of the DB-9 is illustrated in **Figure 6**.

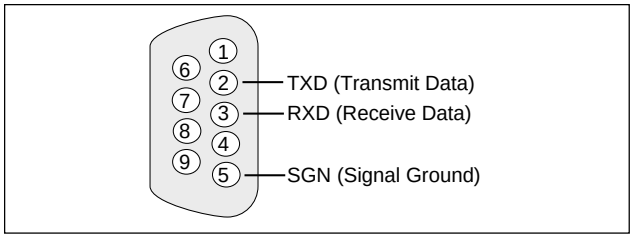

Figure 6. RS-232 (DB-9) Pin Assignments

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

NOTE

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

Operation

For abbreviations used in the screen diagrams, see **Table 7**.

Table 7. Screen Abbreviations Defined

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 occur.
	(ESF) — Second in which 1544 BPVs or 320 CRC errors occur.
	HDSL — Second in which 165 CRC errors occur.
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	Bipolar with 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

The screens illustrated in Figures 7 through 15 are for an HDSL circuit deployed with ADTRAN's Low Voltage HDSL technology. The circuit includes an HTU-C, HTU-R, and HRE. This scenario was chosen for inclusiveness of functionality; however, other configurations are possible and their displays will vary slightly from those shown in this section.

Initiate a terminal session by entering multiple space bar characters, which are used by the HTU-C to determine the speed of the terminal. Then, the Introductory Menu will appear, as illustrated in **Figure 7**.

From the Introductory Menu, the Main Menu may be selected. The Main Menu provides access to detailed performance and configuration information, as illustrated in **Figure 8**, HDSL Main Menu Screen.

From the Main Menu, the following screens can be accessed.

1. Current System Status
2. Performance History
3. ADTRAN Information
4. Loopback Options
5. Self-Test
6. Provisioning
7. Troubleshooting
8. Set Time/Date/Circuit ID

The Current System Status screen, illustrated in **Figure 9**, provides quick access to status information for both the HTU-C M R and the HTU-R. Type "H" once to view the Current System Status screen for the HRE #1; type "H" a second time to view the Current System Status screen for HRE #2. See **Figure 9A** for the HRE Current System Status screen.

At each 15-minute interval, the performance information is transferred to the 15-minute performance data register accessed from the Performance History screen. This unit supports the display of performance information 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 using the Performance History screen, illustrated in **Figure 10**. Type "H" once to view the Performance History screen for HRE #1; type "H" a second time to view the HRE Performance History screen for HRE #2.

Type the letter "Z" at the Current System Status screen in order to reset the current performance registers to zero on both the Current System Status and Performance History screens.

LOSS ..... Pulse Attenuation Measurement [5]
SYNC ..... HDSL Loop 1 and Loop 2 Sync Status
ES 15M/24H ..... Errored Seconds [6]
SES 15M/24H ... Severely Errored Seconds [6]
UAS 15M/24H .. Unavailable Seconds [6]

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

---

[5] 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.

[6] 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).

FRAME ..... T1 Framing Format selected
CODE ..... T1 Line Code 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 is displayed in graphic form on the bottom of the screen. The measure is from 0 (poor signal quality) to 9 (excellent signal quality). Guidelines for interpreting the indicators are given below.

0 ..... Noise margin is ≤ 0 dB (≈ 10^{-7} BER)
1-8 ..... Margin measurement above 10^{-7} BER in dB
9 ..... Margin is ≥ 9 dB (excellent quality) above 10^{-7} BER

The HDSL Loopback and Self-Test Option screens are illustrated in **Figures 11** and **12**. Loopbacks and Self-Test may be evoked or terminated using these screens. A status of current loopback conditions is also provided.

The Provisioning screen, illustrated in **Figure 13**, displays the existing provisioning parameters. These parameters cannot be changed via software but are represented on this screen to inform the craftsperson of the provisioned parameters. Options that can be changed via hardware settings are marked with an asterisk (*).

The Troubleshooting Display, illustrated in **Figure 14**, graphically depicts an HDSL circuit. The unit 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 is highlighted and a message describing the failure will appear.

The Set Time/Date/Circuit ID menu screen, illustrated in **Figure 15**, provides additional provisioning options. The time parameters are to be entered as military time (for example, 3:15 p.m. should be entered as “15:15:00”). The Circuit ID can be entered as a 25-character string of alphanumeric characters.

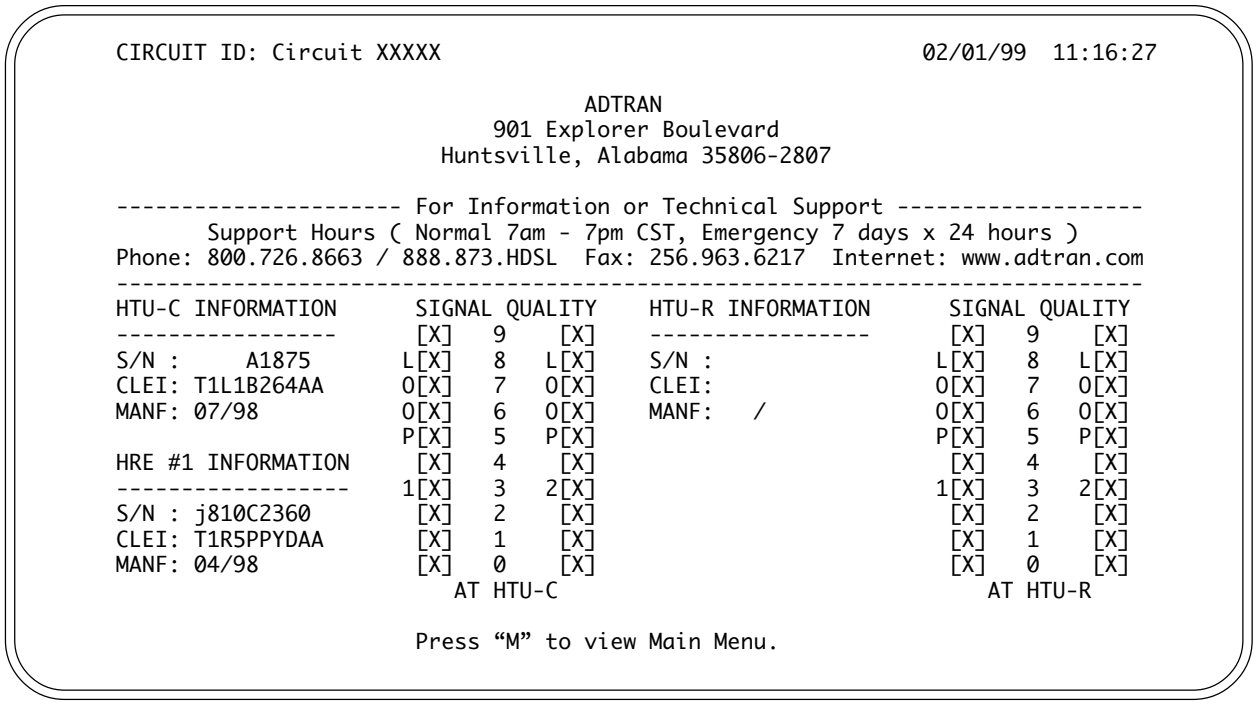

Figure 7. Introductory Menu Screen

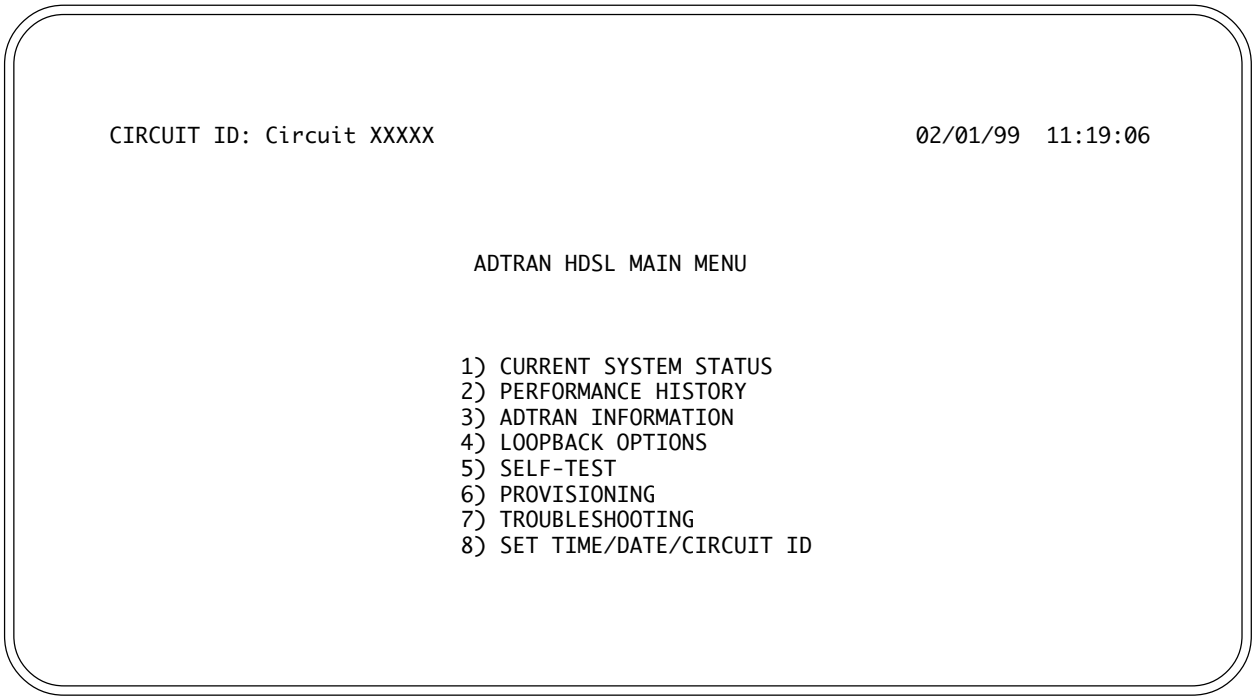

Figure 8. HDSL Main Menu Screen

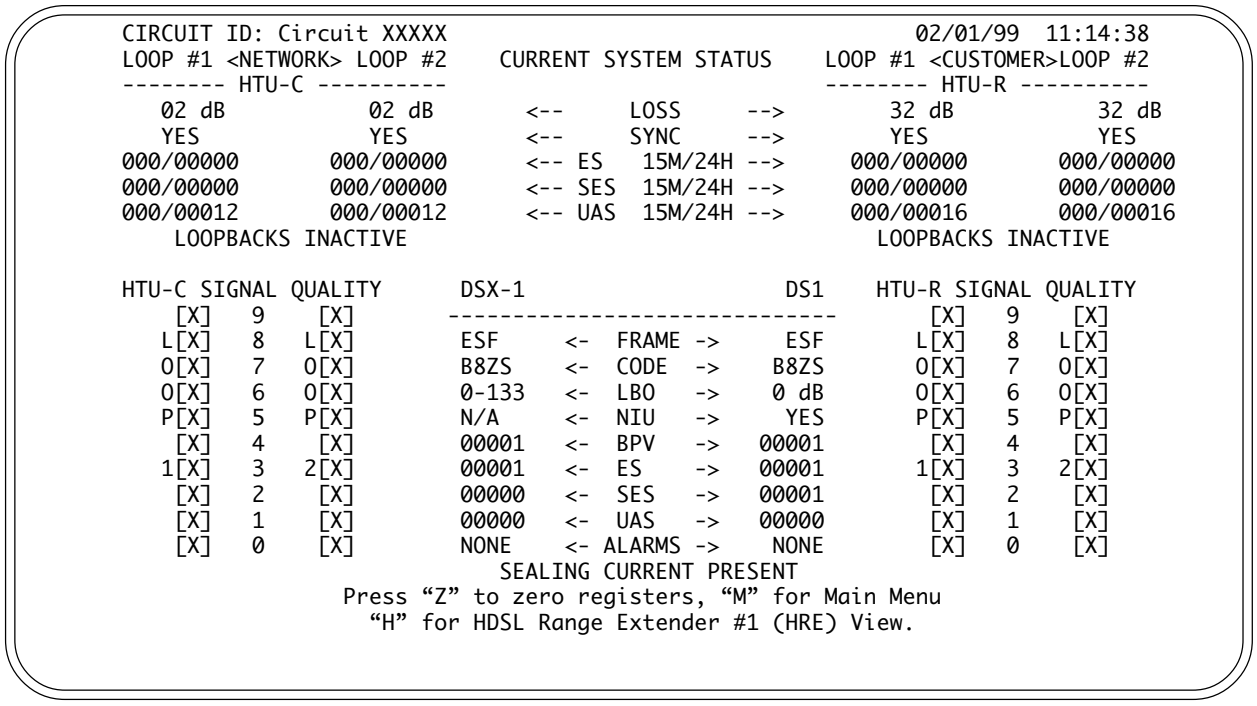

Figure 9. Current System Status Screen

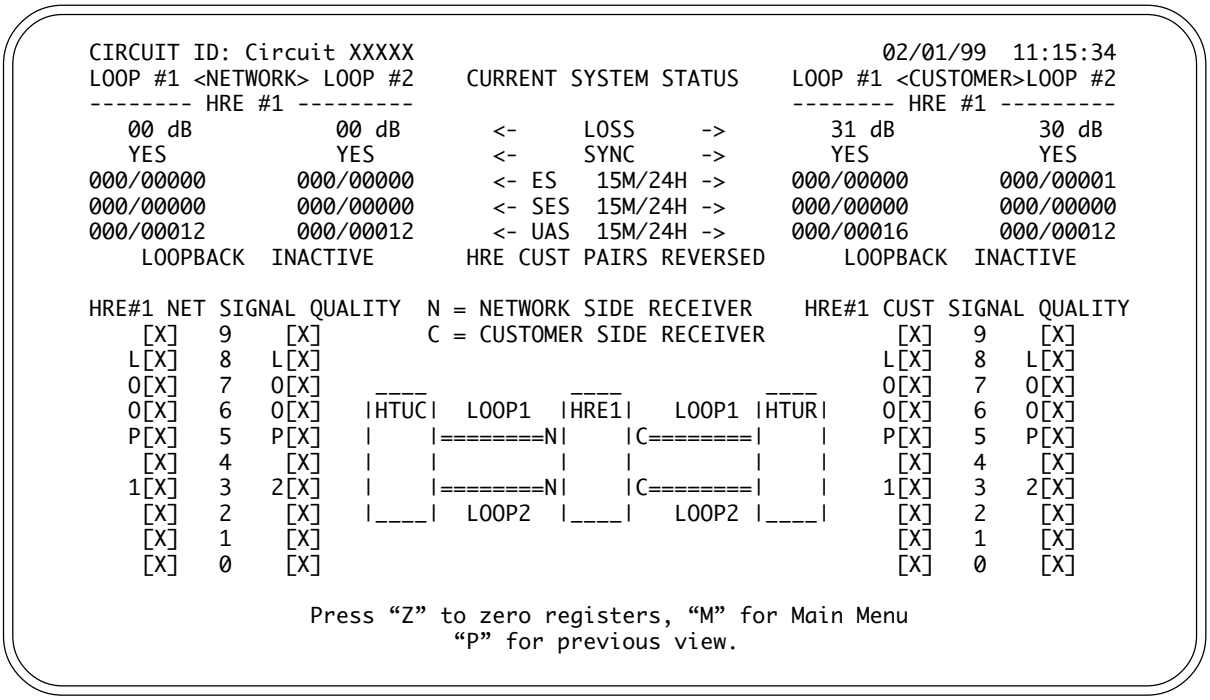

Figure 9A. Current System Status Screen - HRE

```
CIRCUIT ID: Circuit XXXXX                                    02/01/99  11:16:06
     24 HOUR REGISTERS   PERFORMANCE HISTORY        15 MINUTE REGISTERS
        --ES-SES--                                    --ES-SES-----ES-SES--
      00001 00000         <--CURRENT-->        000 000
01/31 ----- -----         <--          -->  11:15 000 000      07:15 --- ---
01/30 ----- -----           |          |    11:00 001 000      07:00 --- ---
01/29 ----- -----           |          |    10:45 --- ---      06:45 --- ---
01/28 ----- -----           |          |    10:30 --- ---      06:30 --- ---
01/27 ----- -----           |PREVIOUS  |    10:15 --- ---      06:15 --- ---
01/26 ----- -----           |          |    10:00 --- ---      06:00 --- ---
01/25 ----- -----         <--          |    09:45 --- ---      05:45 --- ---
                                       |    09:30 --- ---      05:30 --- ---
VIEW 1 : HTU-C DSX-1                   |    09:15 --- ---      05:15 --- ---
                                       |    09:00 --- ---      05:00 --- ---
1-->|H|<--3----|H|-----4-->|H|-->      |    08:45 --- ---      04:45 --- ---
   |T|         |R|         |T|         |    08:30 --- ---      04:30 --- ---
   |U|         |E|         |U|         |    08:15 --- ---      04:15 --- ---
<--|C|<--5-----|1|-----6-->|R|<--2     |    08:00 --- ---      04:00 --- ---
                                       |    07:45 --- ---      03:45 --- ---
Press view number to select view       -->  07:30 --- ---      03:30 --- ---
Press “H” to view HRE #1 history
                                            Press “B” to go back 8 hours

                     Press “M” to return to the Main Menu
```

Figure 10. Performance History Screen

```
CIRCUIT ID: Circuit XXXXX                                    02/01/99  11:25:00
            PERFORMANCE HISTORY <VIEW 1 - HRE NETWORK LP1 RECEIVER>
    24 HOUR REGISTERS                          15 MINUTE REGISTERS
   ---ES---SES--                             --ES-SES----------ES-SES-
    00000 00000         <---CURRENT--->       000 000
-1: ----- -----         <--          -->   -1: 000 000    -17: 000 000
-2: ----- -----           |          |     -2: 000 000    -18: 000 000
-3: ----- -----           |          |     -3: 000 000    -19: 000 000
-4: ----- -----           |          |     -4: 000 000    -20: 000 000
-5: ----- -----           |PREVIOUS  |     -5: 000 000    -21: 000 000
-6: ----- -----           |          |     -6: 000 000    -22: 000 000
-7: ----- -----         <--          |     -7: 000 000    -23: 000 000
                                      |     -8: 000 000    -24: 000 000
     VIEW LOCATION DIAGRAM            |     -9: 000 000    -25: 000 000
                                      |    -10: 000 000    -26: 000 000
-->|H|<-----   |H|-2------>|H|-->     |    -11: 000 000    -27: 000 000
   |T|         |R|         |T|        |    -12: 000 000    -28: 000 000
   |U|         |E|         |U|        |    -13: 000 000    -29: 000 000
<--|C|<-----3->|1|-4------>|R|<--     |    -14: 000 000    -30: 000 000
                                      |    -15: 000 000    -31: 000 000
Press view number to select view.     -->  -16: 000 000    -32: 000 000
Press “H” to view HRE #1 history.          Press “B” to go back 8 hours.

                      Press “M” to return to the Main Menu.
```

Figure 10A. Performance History Screen - HRE

```
CIRCUIT ID: Circuit XXXXX                                  02/01/99  11:18:17
                              PROVISIONING
 _____________________________________________________
|                                                     |
|       PROVISIONS                   SETTINGS         |
|     ------------------------------------------      |
|     * DSX-1 LINE BUILDOUT     =   0-133 FEET        |
|       DS1 OUTPUT LEVEL        =   0 dB              |
|     * DSX-1/DS1 LINE CODE     =   B8ZS              |
|       DSX-1 FRAMING           =   ESF               |
|       DS1 FRAMING             =   ESF               |
|     * LOOPBACK TIMEOUT        =   NONE              |
|     * CUSTOMER LOSS RESPONSE  =   CDI               |
|     * LATCHING LOOPBACK MODE  =   T1                |
|                                                     |
|_____________________________________________________|

Provisions marked with an asterisk (*) can be changed
using switches on the HTU-C.  DSX-1 and DS1 framing are
set automatically based on the received T1 framing.
DS1 output level can be changed using a strap on the
circuit board of the HTU-R.

        Press “M” to return to the Main Menu
```

Figure 11. Provisioning Screen

```
CIRCUIT ID: Circuit XXXXX                                  02/01/99  11:17:30
                              LOOPBACK OPTIONS
                 _____                _____                _____
                |HTU-C|              |HRE 1|              |HTU-R|
                |     |      LP1     |     |     LP1      |     |
             --->|-----|<============>|-----|<============>|-----|<---
                |     |              |     |              |     |
            NET |     |              |     |              |     | CUST
                |     |      LP2     |     |     LP2      |     |
             <---|-----|<============>|-----|<============>|-----|--->
                |     |              |     |              |     |
                |_____|              |_____|              |_____|

          1) LOOPBACK TO NETWORK  AT HTU-C = INACTIVE
          2) LOOPBACK TO CUSTOMER AT HTU-C = INACTIVE
          3) LOOPBACK TO NETWORK  AT HTU-R = INACTIVE
          4) LOOPBACK TO CUSTOMER AT HTU-R = INACTIVE
          5) LOOPBACK TO NETWORK  AT HRE-1 = INACTIVE
          6) LOOPBACK TO CUSTOMER AT HRE-1 = INACTIVE


       Press corresponding number to toggle loopback option.
              Press “M” to return to the Main Menu
```

Figure 12. Loopback Options Screen

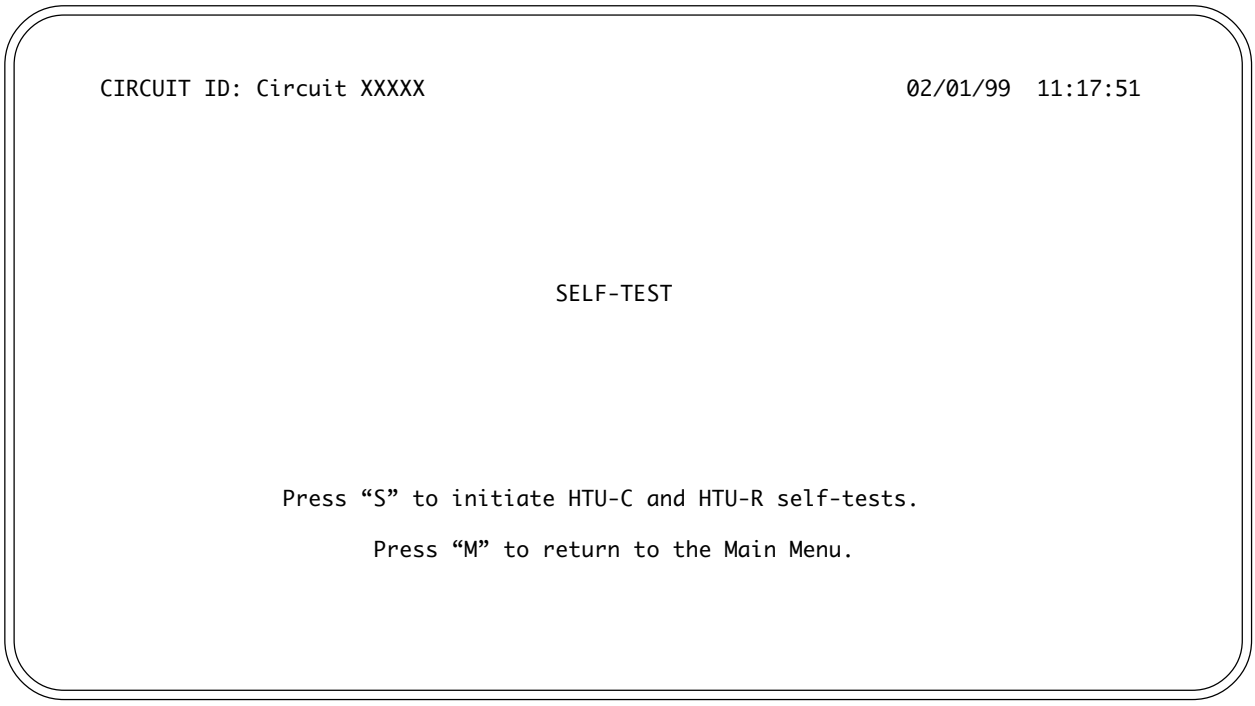

Figure 13. Self-Test Options Screen

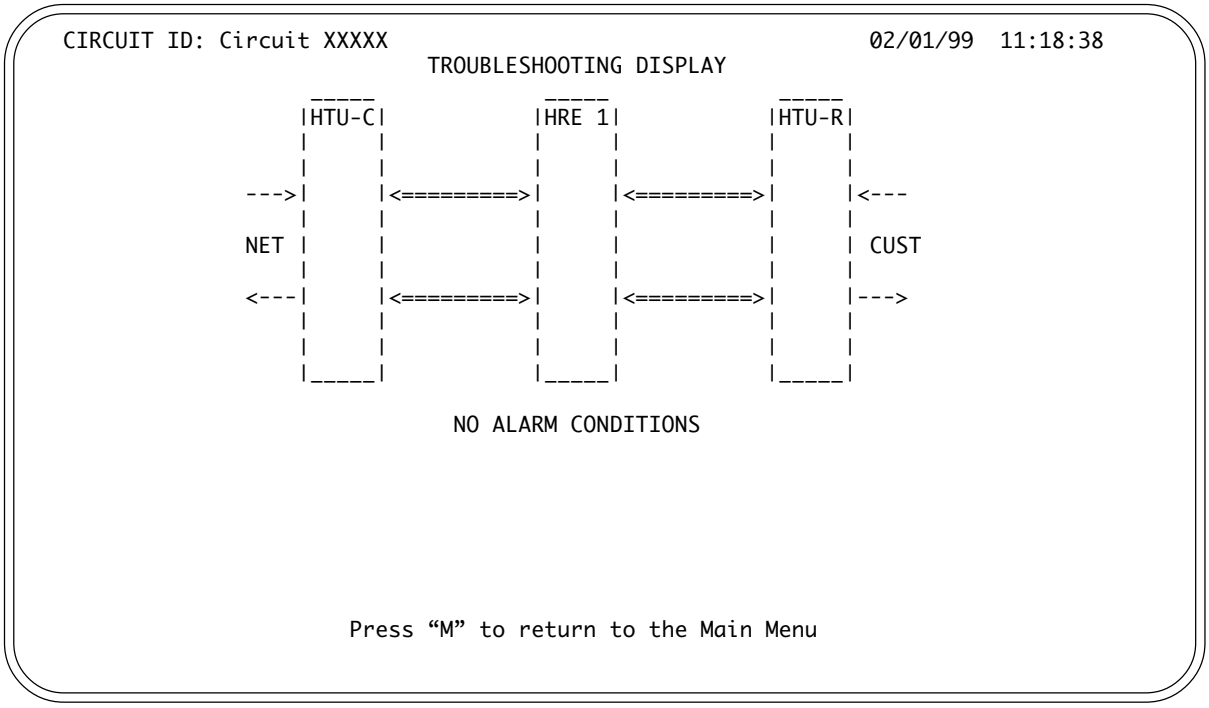

Figure 14. Troubleshooting Display

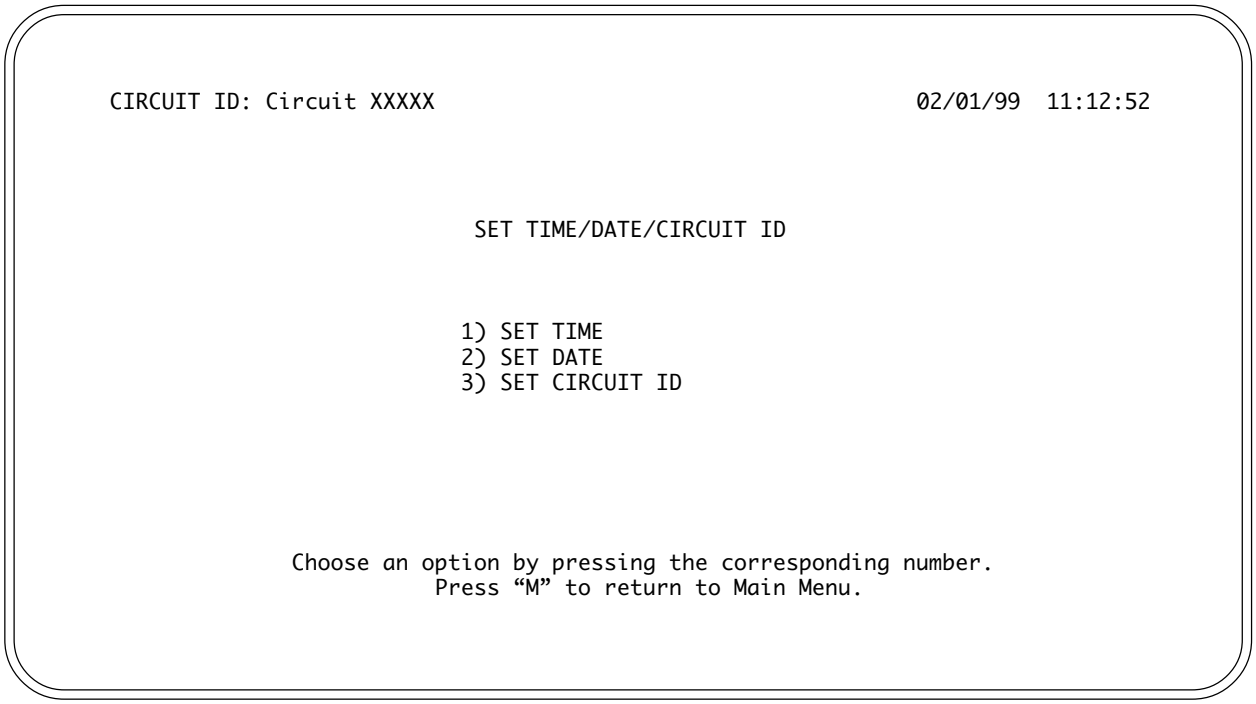

Figure 15. Set Time/Date/Circuit ID Screen

6. 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.

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

$$12 - \{(3*L^{26})/(9 - L^{BTAP})\} \text{ (in kft)}$$

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 16**.

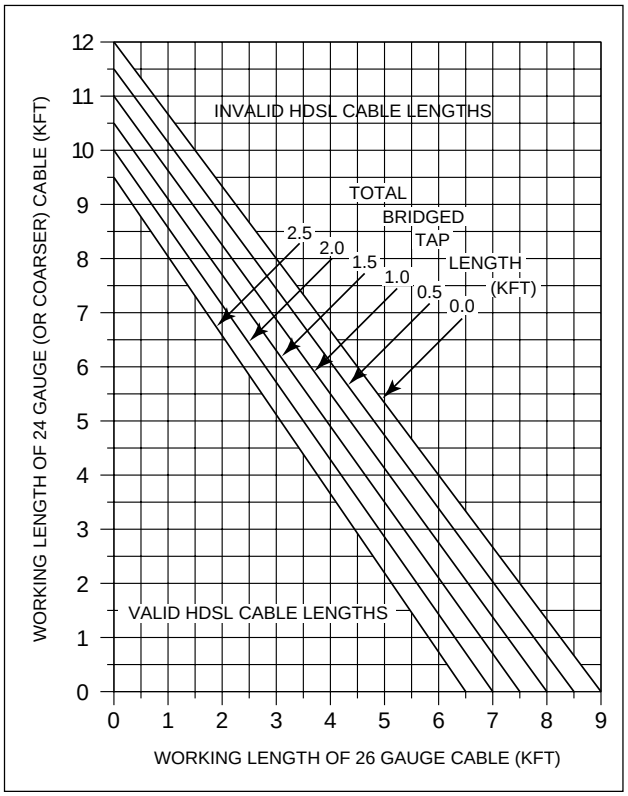

Figure 16. HDSL Deployment Guidelines

Loop loss per Kft for other wire is summarized in **Table 8**.

Table 8. HDSL Loss Values
(200 kHz cable loss in dB/Kft at 135Ω)

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, 135Ω, resistive termination is provided in **Table 9**.

Table 9. Loop Insertion Loss Data

Frequency (Hz)	Maximum Loss (dB)
3,000	12.0
10,000	15.0
50,000	25.5
100,000	30.0
150,000	32.75
200,000	35.25

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

An approximation for the maximum level of impulse noise as measured using a 50 kbps 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.

7. TROUBLESHOOTING PROCEDURES

Table 10 is a troubleshooting guide for the ADTRAN DDM Plus HTU-C.

Table 10. Troubleshooting Guide

Condition: Front panel indicator is *off*.
Solution: 1. Verify that -48 Vdc power is properly connected to the shelf. 2. Inspect the fuse (F1) and verify that it is not blown. 3. Insert the HTU-C into a known good slot and check for *on* condition of the STATUS indicator. 4. If Steps 1 and 2 pass, but Step 3 fails, replace the HTU-C.

8. MAINTENANCE

The ADTRAN DDM Plus HTU-C requires no routine maintenance. In case of equipment malfunction, use the faceplate-mounted DB-9 RS-232 terminal interface to help in troubleshooting 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 the ADTRAN Customer and Product Support (CAPS) Department.

9. PRODUCT SPECIFICATIONS

Product specifications are detailed in **Table 11**.

10. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within 10 years from the date of shipment if it does not meet its published specifications or fails while in service (see *ADTRAN Carrier Networks Equipment Warranty, Repair, and Return Policy and Procedure,* document 60000087-10).

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

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

ADTRAN Sales

Pricing/Availability
(800) 827-0807

ADTRAN Technical Support

Presales Applications/Post-sale Technical Assistance
(800) 726-8663

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

ADTRAN Repair/CAPS

Return for Repair/Upgrade
(256) 963-8722

Repair and Return Address

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

Table 11. HDSL DDM Plus HTU-C Unit Specifications
(Part Number 1245003L6)

Loop Interface

Modulation Type 2B1Q
Mode ..... Full Duplex, Echo Cancelling
Number of Pairs ..... Two
Bit Rate ..... 784 kbps per pair
Baud Rate ..... 392K baud per pair
Service Range ..... Defined by Carrier Service Area Guidelines
Loop Loss ..... 36 dB maximum @ 200 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 ..... 20 dB (40 kHz to 200 kHz)

Network Interface

4-WIRE DSX-1

DSX-1 Output Level ..... 0 dB
DSX-1 Line Build Out ..... 0-133 feet ABAM
134-266 feet ABAM
267-399 feet ABAM
400-533 feet ABAM
534-655 feet ABAM
DSX-1 Line Code ..... AMI, B8ZS
DSX-1 Format ..... SF, ESF, Unframed
DSX-1 Channelization ..... Channels 1-12 on Loop 1, Channels 13-24 on Loop 2

Power

Tested with the ADTRAN Low-Voltage HRE (P/N 1244041L2) and the ADTRAN Low-Voltage HTU-R (P/N 1245021L1)

Total Power ..... -48 Vdc @ 200 *m*A with HTU-R
-48 Vdc @ 300 *m*A with HTU-R and HRE
-48 Vdc @ 510 *m*A 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 ..... -137 or -190 Vdc nominal for voltage and current limit at 125 *m*A +/-5% (internally generated)
Fusing ..... 1.00 A (not field-replaceable)

Clock

Clock Sources ..... Internal, DSX-1 Derived
Internal Clock Accuracy ..... ± 25 ppm, (exceeds Stratum 4). Meets T1.101 timing requirements.

Tests

Diagnostics ..... Self-Test, Local Loopback (HTU-C), Remote Loopback (HTU-R)

Physical

23" DDM Plus Shelf-Mounted
Dimensions ..... 3.51" High, .71" Wide, 9.89" Deep
Weight ..... Less than 1 lb.

Environment

Temperature ..... Operating (Standard): -40°C to +70°C; Storage: -40°C to +85°C

Control Port

Interface RS-232 (DB-9)
Terminal Type ..... VT100 or compatible
Async Speed ..... 2.4 kbps to 19.2 kbps
Data Format ..... 8 data bits, no parity, 1 stop bit

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 $1E^{-03}$ or better is present.

DDS Latching Loopback Operation

If the unit is optioned for FT1 mode, then DDS Latching Loopback operation is supported as described in Bellcore TA-TSY-000077, Issue 3, Section 5.1.3. The HTU-C and any HRE units which are in the HDSL circuit are treated as Identical Tandem Dataports and the HTU-R is treated as a Different Tandem Dataport. For a complete description of the DDS Latching Loopback codes, refer to Bellcore TA-TSY-000077, Issue 3, Section 5.1.3.

Loopback Control Codes

A summary of control sequences is given in **Tables A-1** and **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. 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)	3F04	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.

Notes: 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.

All codes are inband unless labeled ESF-DL

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. Inband Addressable Loopback Codes

Function	Code and 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.
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.

Note: All codes listed above must be sent for a minimum of 5 seconds in order for them to be detected and acted upon.
* If NIU is enabled, then the HTU-R can be in network loopback when the HTU-C or HRE loopup codes are sent.