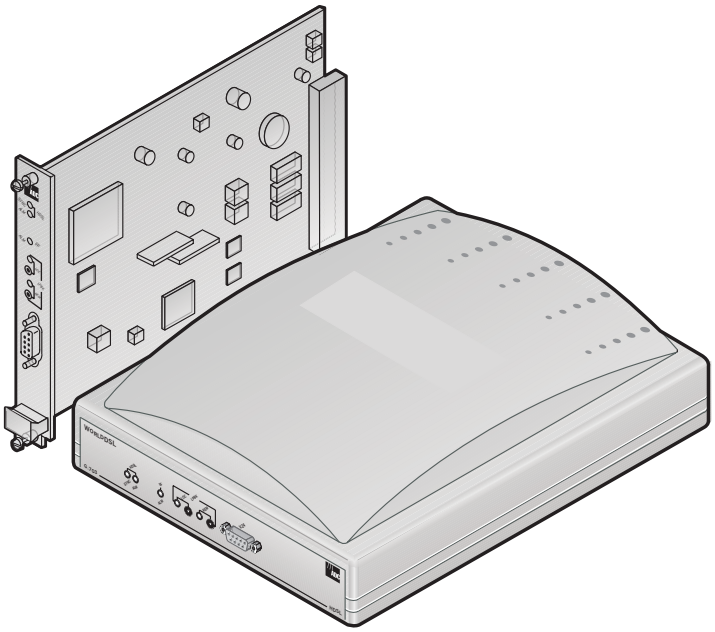
WorldDSL
USER MANUAL



RATE SELECTABLE HDSL LINE AND DESKTOP UNITS

UTU-701C List 1
Universal Termination Unit
Part Number: 150-1422-01C

ETU-751C List 1
ETSI Termination Unit
Part Number: 150-1432-01C

Revision History of This Manual

To order copies of this manual, use document number 700-701-100-02.

Issue	Release Date	Revisions Made
1	January 14, 2000	Initial release
2	August 9, 2002	ADC rebrand

USING THIS MANUAL

The following conventions are used in this manual:

- `Monospace type` indicates screen text.
- Keys you press are indicated by small icons such as Y or ENTER. Key combinations to be pressed simultaneously are indicated with a plus sign as follows: CTRL + ESC.
- Items you select are in **bold**.
- Three types of messages, identified by icons, appear in text.

Notes contain information about special circumstances.

Cautions indicate the possibility of personal injury or equipment damage.

The Electrostatic Discharge (ESD) symbol indicates that a device or assembly is susceptible to damage from electrostatic discharge.

For a list of abbreviations used in this document, refer to "Abbreviations" on page 70.

INSPECTING SHIPMENT

Upon receipt of the equipment:

- Unpack each container and inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC DSL Systems, Inc. Order replacement equipment, if necessary.
- Check the packing list to ensure complete and accurate shipment of each listed item. If the shipment is short or irregular, contact ADC DSL Systems, Inc. as described in "Product Support" on page 69. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

ADC® WorldDSL™ offers High-bit-rate Digital Subscriber Line (HDSL) Line Termination Units (LTUs), Network Termination Units (NTUs), Universal Termination Units (UTUs), and ETSI Termination Units (ETUs). The units are shelf and enclosure mounted, providing full-duplex transmission of up to 2.048 Mbps data over one or two twisted pairs of copper wire. Public carriers and private network providers can use these units to offer low-cost service with fiber-optic quality using the local copper loop without installing repeaters or conditioning the outside plant. The units are used in systems that comply with European Telecommunication Standards Institute (ETSI) specification TS 101 135.

This practice describes the WorldDSL RS UTU-701C List 1 and ETU-751C List 1 Rate Selectable HDSL line and desktop units. The terms for these units are defined as follows:

- LTU and NTU are defined by ETSI to distinguish between the two units in an HDSL system. An LTU is generally located at the Exchange Office end of the circuit and acts as the master unit. The NTU is located at the customer site and acts as the slave unit.
- UTU is defined by ADC. These are programmable HDSL line units that can be configured as an LTU (master) or an NTU (slave). The UTU default configuration is NTU (slave). The UTUs do not provide line power to other HDSL units. All other aspects of UTU functionality are identical to LTUs or NTUs. The UTU-701C has a G.703 interface and must be locally powered from a -36 Vdc to -72 Vdc power supply.
- ETU is defined by ADC. These are programmable HDSL line units housed in plastic enclosures with interface and power connectors for convenient use as integrated desktop units. The ETUs can be configured as an LTU or an NTU. The ETU default configuration is NTU. The ETU-751C does not provide or receive line power; it must be locally powered. All other aspects of ETU functionality are identical to LTUs or NTUs. The ETU-751C has a G.703 interface and contains a power supply that accepts 100 to 240 volt, 50 or 60 Hz, AC power.
- WorldDSL RS (rate selectable) is defined by ADC. WorldDSL RS is a single pair High-bit-rate Digital Subscriber Line (HDSL) solution that offers extended reach capabilities through the use of industry-leading multi-rate DSL technology. The UTU-701C and ETU-751C deploy HDSL in networks using a single pair of copper wire running at speeds between 256 kbps and 2048 kbps. The HDSL payload rates are menu selected in time slot increments of 64 kbps, ranging from 256 kbps to 2048 kbps. Transmission ranges vary according to the rate selected. Depending on noise environment, ranges of up to 7.1 km (4.4 miles) are possible at the lowest-selectable HDSL payload rate (256 kbps) using 0.51 mm wire. Longer ranges are possible with larger wire.
- These HDSL units are configured as Data Communications Equipment (DCE) and respond to data, clock, and control signals from Data Terminal Equipment (DTE).

Use of this product in a manner other than defined in this technical practice may cause equipment damage or injury to personnel.

Gebrauch dieses Produkts in einer Weise anders als definiert kann in dieser technischen Praxis Geräte Schaden oder Verletzung zu Personal verursachen.

RATE SELECTABLE HDSL UNIT FIRMWARE

Version 4.01 is the current release for the rate selectable HDSL unit firmware. This firmware must be installed at each end of the circuit (that is, in both the LTU and NTU).

WorldDSL RS units are not backward compatible with standard HDSL or management unit firmware. The installed firmware must be that designed for RS units.

RS G.703 LTUs can communicate with RS Nx64k NTUs, but only if HDSL unit firmware Version 4.01 or later is installed at each end of the circuit.

EMU FIRMWARE COMPATIBILITY

The EMU-830 Management Unit firmware must be Version 3.22.08 or later to support rate selectable HDSL units.

APPLICATION INTERFACE

The UTU-701C and ETU-751C provide G.703 interface ports with a rate selectable HDSL payload. The only application mode is Single, indicating single pair.

The G.703 E1 application interface conforms with the ITU-T G.703 physical specification and can be configured for an impedance of 75 Ωunbalanced or 120 Ωbalanced. User data can be unstructured or structured according to the G.704 framing standard, and optionally CRC-4 multiframed according to the G.706 standard. Structured mode is automatically invoked when 1 to 29 time slots are selected. Unstructured mode is invoked when 30, 31, or 32 time slots are selected.

The exchange office data terminal equipment (DTE) allocates the 2048 kbps E1 payload to the G.703 port in time-slot increments of 64 kbps each. The number of G.703 time slots allocated by the DTE is determined by the selected HDSL payload rate (the DTE and HDSL payloads must be set to the same rate). Time slots not allocated to the G.703 port are replaced by idle codes at the G.703 output.

The UTU-701C and ETU-751C have HDSL payload rates ranging from 256 kbps to 2048 kbps. The desired HDSL payload rate is selected in time slot increments of 64 kbps from the system settings menu of the LTU-configured unit. The selected payload rate applies to both the receive and transmit directions. The LTU-configured unit automatically configures the NTU-configured unit for the same payload rate. Table 1 lists the characteristics of the rate selectable G.703 line and desktop units covered in this practice.

Table 1. *Rate Selectable G.703 Unit Characteristics*

Model	Interface	User Selected HDSL Payload Rates (kbps)	Actual HDSL Payload Rates (kbps)	LTU/NTU Configurable
UTU-701C	G.703	64 to 2048	256 to 2048	Yes
ETU-751C	G.703	64 to 2048	256 to 2048	Yes

The G.703 units always transmit time slots 0 and 16, which results in 128 kbps being added to the user-selected HDSL payload rate (when 1 to 30 time slots are selected). For example, the lowest-selectable HDSL rates, 64 and 128 kbps, are transmitted at 256 kbps. This 128 kbps increase in payload rate, however, does not affect the rate of the G.703 data received at the customer or network DTE.

Figure 1 shows a single-pair, leased-line data application using 4 time slots for a 256 kbps HDSL payload rate. Customer data is input to the remote G.703 port at the 256 kbps rate, transported over the HDSL loop at an increased 384 kbps rate, and received by the exchange office DTE at the original 256 kbps rate. For more information, see "Rate Selectable Application Modes and Options" on page 14 and "G.704 Framing and Rate Selectable HDSL" on page 17.

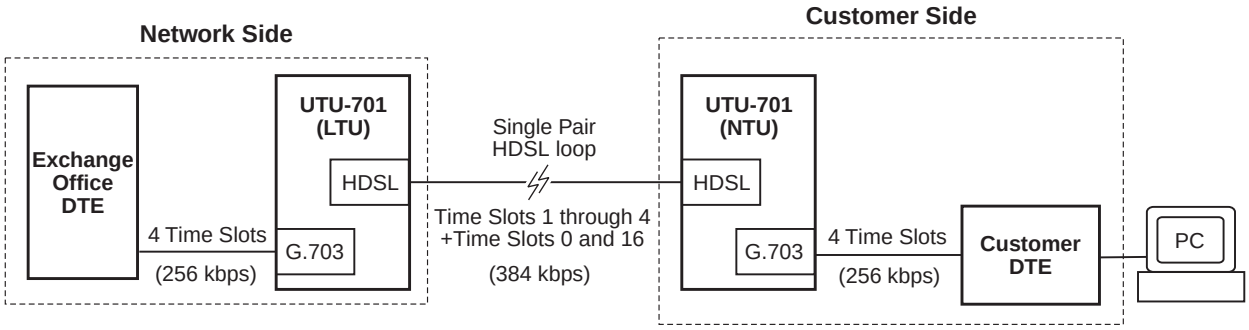

Figure 1. *Leased Line Data Application on a Single-pair G.703 Network*

HDSL TECHNOLOGY

HDSL is the core technology for ADC's WorldDSL line of LTUs, UTUs, and ETUs. Rate selectable HDSL enables these units to transmit and receive digital data at various rates over various distances on one twisted pair of copper wire. Both outbound and inbound signals are delivered on the same pair of wires by using echo cancellation techniques. The transmitted signal is canceled at the receiver by precisely predicting the amount of signal echo, then subtracting it from the overall input signal. ADC's market leading HDSL-based products tolerate crosstalk, and operate not only on continuous unobstructed pairs of wires, but also on cables with mixed wire gauges and bridged taps.

TRANSMISSION RANGES

Transmission ranges assume the presence of noise according to the ETSI model described in TS 101 135. The expected Bit Error Rate (BER) using this model is $1x10^{-7}$. The transmission ranges in such a noise environment at the various HDSL line rates over one twisted-pair of 0.4 mm and 0.51 mm copper wire are listed in Table 2. The no noise transmission ranges are listed in "Specifications" on page 9.

Table 2. *Transmission Ranges with 0 db ETSI Noise*

RS G.703 HDSL Payload Rate		Wire Size and Transmission Range (with 0 dB ETSI Noise)	
User Selected HDSL Payload Rate (kbps)	**Actual HDSL Payload Rate (kbps)[a]**	**0.4mm (26 AWG) Single Twisted-Pair Copper Wire**	**0.51mm (24 AWG) Single Twisted-Pair Copper Wire**
64/128	256	4.1 km (13,451 ft.)	5.1 km (16,730 ft.)
256	384	3.6 km (11,811 ft.)	4.7 km (15,420 ft.)
384	512	3.4 km (11,155 ft.)	4.5 km (14,760 ft.)
640	768	3.0 km (9,842 ft.)	4.2 km (13,779 ft.)
1024	1152	2.6 km (8,530 ft.)	3.4 km (11,155 ft.)
1408	1536	2.2 km (7,218 ft.)	2.9 km (9,515 ft.)
1920/1984/2048	2048[b]	2.0 km (6,562 ft.)	2.4 km (7,874 ft.)

(a) See "G.704 Framing and Rate Selectable HDSL" on page 17.
(b) System operates in unstructured mode when 32 time slots are selected.
(b) The maximum no-noise transmission range is approximately 7.1 km (4.4 miles). See "Specifications" on page 9.

FRONT AND REAR PANEL COMPONENTS

The line and desktop unit front panels are shown in Figure 2 and Figure 3, respectively. The components on these panels are described in Table 3 on page 5 and in Table 4 on page 6.

The ETU-751C desktop unit rear panel is shown in Figure 4 on page 7. The components on this panel are described in Table 5 on page 7. The pinouts for the desktop unit rear panel connectors are listed in Table 34 and Table 35 on page 64.

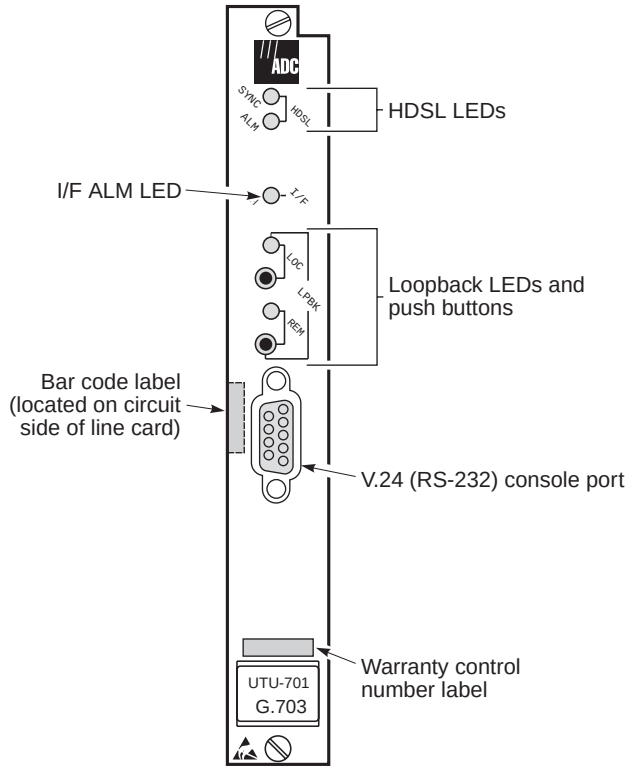

Figure 2. *UTU-701C Line Unit Front Panel*

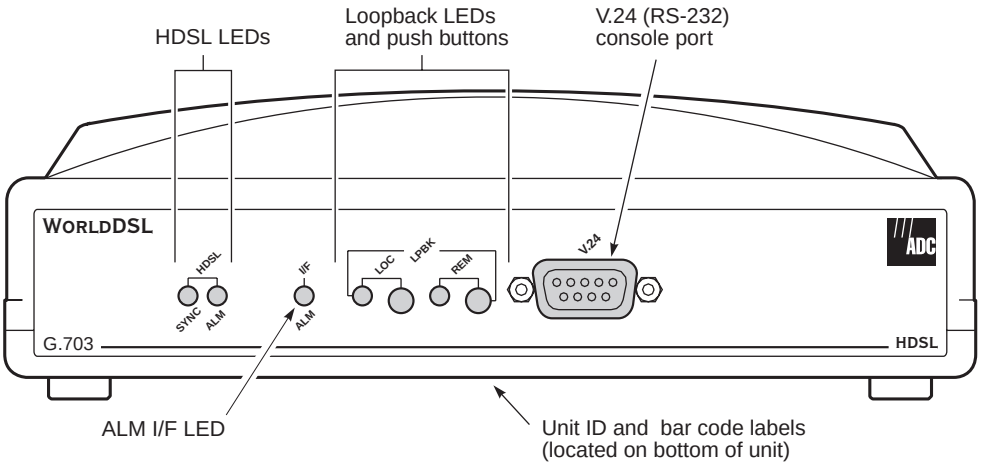

Figure 3. *ETU-751C Desktop Unit Front Panel*

Table 3. *Line and Desktop Unit Front Panel Components*

Name	Function
HDSL SYNC LED	Displays synchronization state for the HDSL loop.
HDSL ALM LED	Displays alarm state for the HDSL loop.
I/F ALM LED	Displays alarm state for the G.703 data port.
LOC LPBK LED	Displays local (LOC) loopback state.
LOC LPBK Button	Activates the local HDSL analog loopback.
REM LPBK LED	Displays remote (REM) loopback state.
REM LPBK Button	Activates the remote interface loopback.
V.24 (RS-232) console port	Provides bi-directional communication between the unit and an external maintenance terminal through a V.24 (RS-232C) interface to allow configuration and performance monitoring through the console screen menus as described in "System Configuration" on page 25. This connector can also be used to download new firmware to the line unit's flash memory as described in "Firmware Download Utility" on page 62. This port is configured as DCE (see "Maintenance Terminal Connection" on page 25 for pinouts).
Bar code label (all units)	Contains the serial number and part number of the unit, as indicated in both bar code and text format. Also contains the configuration number of the unit, as indicated by "CFG: R*nn*," where *nn* is the configuration number. For example, CFG: R07 would indicate configuration number 07.
Warranty control number label (UTU-701C)	Indicates the beginning year and month of the line card warranty. Also indicates the line card revision number. For example, a warranty control number of "803R07" would indicate a warranty beginning in the year 1998 (8), during the month of March (03), and line card revision number R07.
Unit ID label (ETU-751C)	Identifies the model number, manufacturer, part number, and input voltage range of the ETU. Includes the CE mark, certifying that the unit is in compliance with directive EN300 386-2. See "Certification and Warranty" on the inside of the back cover.

Table 4 defines the system states indicated by the front panel LEDs. When power is applied to the unit, one of the LEDs listed in Table 4 will always be on.

Table 4. *Line and Desktop Unit Front Panel LED Indications*

LED	Mode		Description
HDSL SYNC LED	Steady green		HDSL loop is ready to transmit and receive data across all spans.
	Slow blinking		HDSL loop acquisition is in progress for local span.
	Off		HDSL loop is not configured.
HDSL ALM LED	Steady red		Loss of sync word (LOSW); or the margin is below the set margin alarm threshold; or Errored Seconds (ES) count is above threshold on any span.
	Pulsing red		Pulses for every ES on any span.
	Off		Normal transmit or receive data is in progress.
I/F ALM LED	Steady red		Loss of Signal (LOS) alarm due to loss of G.703 signal or Loss of Clock (LOC) alarm due to loss of external clock (when using EXT timing).
LPBK LEDs [(a)]	LOC	REM	
	Steady yellow	Off	Local HDSL analog loopback is active.
	Off	Off	No loopbacks are active.
	Blinking yellow	Off	Local interface loopback is active.
	Off	Steady yellow	Remote loopback is active.
	Blinking yellow	Blinking yellow	A loopback away from the local equipment is active.

(a) The LOC and REM LPBK LEDs are read in unison.

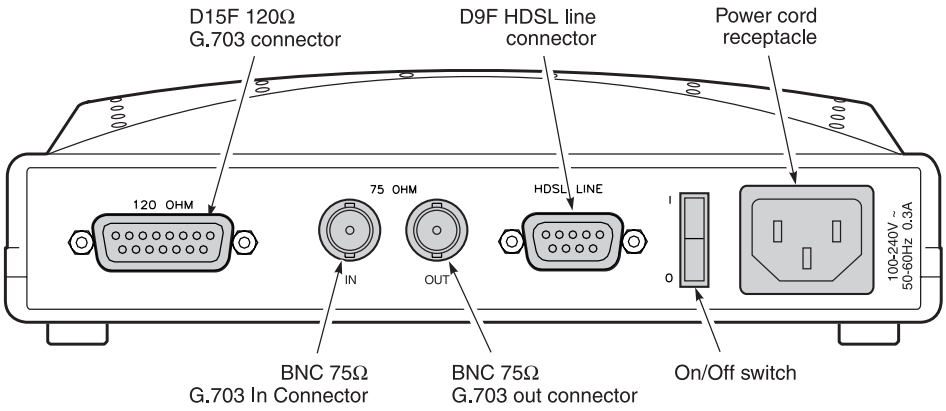

Figure 4. *ETU-751C Desktop Unit Rear Panel*

Table 5. *ETU-751C Desktop Unit Rear-Panel Components*

Item	Description
D15F 120Ω G.703 connector	Connects E1 balanced 120 Ω circuits to the enclosure.
BNC 75Ω In/Out G.703 connectors	Connects E1 unbalanced 75 Ω circuits to the enclosure.
D9F HDSL line connector	Connects the HDSL pair to the enclosure.
On/Off switch	Rocker switch that allows you to turn the externally applied AC power on or off.
Power cord receptacle	Accepts female end of three-prong power cord supplying 100-240 Vac at 50-60 Hz.

WORLDDSL PRODUCT COMPATIBILITY

The line and desktop units are compatible with the WorldDSL products listed in Table 6.

Table 6. *WorldDSL Product Compatibility*

Model	Description	Part Number
	Rate-Selectable HDSL Units	
UTU-702C	Rate-selectable HDSL Line Unit, Nx64k Serial Data Interface, 128 to 2048 kbps HDSL Line Rate	150-1422-02C
UTU-712C	Rate-selectable HDSL Line Unit, Nx64k Serial Data Interface, 128 to 768 kbps HDSL Line Rate	150-1422-12C
UTU-722C	Rate-selectable HDSL Line Unit, Nx64k Serial Data Interface, 128 to 256 kbps HDSL Line Rate	150-1422-22C
ETU-752C	Rate-selectable HDSL Desktop Unit, Nx64k Serial Data Interface, 128 to 2048 kbps HDSL Line Rate	150-1432-02C
ETU-762C	Rate-selectable HDSL Desktop Unit, Nx64k Serial Data Interface, 128 to 768 kbps HDSL Line Rate	150-1432-12C
ETU-772C	Rate-selectable HDSL Desktop Unit, Nx64k Serial Data Interface, 128 to 256 kbps HDSL Line Rate	150-1432-22C
	Shelves and Enclosures for UTU-701C	
EMS-830 List 1 (a)	Exchange office management shelf, rear connector access	150-1400-01
EMS-830 List 2 (b)	Exchange office management shelf, rear connector access	150-1400-11
ERE-811 (c)	Single-slot remote enclosure with internal AC power supply	150-1411-1x
	Connector Adapters for ETU-751C (d)	
ECA-800	D25M to M34F connector adapter (V.35)	150-1470-01
ECA-801	D25M to D15F connector adapter (X.21)	150-1471-01
ECA-802	DB9M to RJ-45 connector adapter (HDSL)	150-1472-01
ECA-804	DB9M to 4-position terminal block connector (HDSL)	150-1474-01
ECA-807	DB25M to DB37F connector adapter (RS-449)	150-1477-01

(a) The EMS-830 List 1 supports protection switching, the EMS-830 List 2 does not.
(b) The EMS-830 List 2 is CE marked. The EMS-830 List 1 is not, and is intended for use in applications where the CE Mark is not required.
(c) The UTU-701C is CE Marked in the ERE-811 List 5 remote enclosure only.
(d) The ECA-80x series of connector adapters and their pinouts are listed in Table 36 through Table 39, beginning on page 65.

SPECIFICATIONS

HDSL Interface

Line Code	2B1Q
Line Rate (selectable in increments of 64 kbps)	Up to 2048 kbps
Protection	K.20, K.21
Compliance	TS 101 135

Transmission Ranges (± 200 m):

HDSL Line Rate (kbps)	Transmission Ranges with 0 dB ETSI Noise		Transmission Ranges with No Noise	
	0.4 mm (26 AWG) Single Twisted-Pair Copper Wire	0.51 mm (24 AWG) Single Twisted-Pair Copper Wire	0.4 mm (26 AWG) Single Twisted-Pair Copper Wire	0.51 mm (24 AWG) Single Twisted-Pair Copper Wire
256	4.1 km (13,451 ft.)	5.1 km (16,730 ft.)	5.3 km (17,388 ft.)	7.1 km (23,294 ft.)
384	3.6 km (11,811 ft.)	4.7 km (15,420 ft.)	4.7 km (15,420 ft.)	6.7 km (21,982 ft.)
512	3.4 km (11,155 ft.)	4.5 km (14,760 ft.)	4.6 km (15,092 ft.)	6.3 km (20,669 ft.)
768	3.0 km (9,842 ft.)	4.2 km (13,779 ft.)	4.3 km (14,108 ft.)	5.9 km (19,357 ft.)
1152	2.6 km (8,530 ft.)	3.4 km (11,155 ft.)	3.7 km (12,139 ft.)	5.3 km (17,388 ft.)
1536	2.2 km (7,218 ft.)	2.9 km (9,515 ft.)	3.3 km (10,827 ft.)	4.7 km (15,420 ft.)
2048	2.0 km (6,562 ft.)	2.4 km (7,874 ft.)	3.0 km (9,842 ft.)	3.2 km (10,499 ft.)

G.703 Interface

Unstructured Leased Line	2.048 Mbps per ETS 300 247 (D2048U)
Structured Leased Line	2.048 Mbps per ETS 300 419 (D2048S)
Fractional E1	User-selectable DS0 blocking, with user-programmable idle code
Line Code	HDB3
Line Rate	2.048 Mbps
Impedance (jumper selectable)	120 Ω balanced (twisted-pair) 75 Ω unbalanced (coax)
CRC-4 mode	User-selectable CRC-4 detection and generation
Compliance	ITU-T G.703, G.704, G.706, G.821, G.823, CTR 12

Timing

Clock Source	G.703 input External 2.048 MHz clock (per G.703 par. 10)
Internal Oscillator	2.048 MHz ± 50 ppm

Performance Monitoring and Diagnostics

HDSL	Noise margin, pulse attenuation, ES, UAS
G.703 Interface	ES, SES, UAS per G.821. CRC-4 errored seconds, BPV seconds
Major Alarm Relay	Form-C relay contacts (NO, NC, C). Fail-safe operation
Loopbacks	Local interface loopback, local HDSL loopback (V.54 loop 3), remote loopback (V.54 loop 2)

Alarms

Can be individually set to Disabled, Minor, or Major (major alarms actuate the LTU or NTU alarm relay)

E1 Interface	Loss of Signal (LOS) Loss of Framing (LFA) Alarm Indication Signal (AIS) Remote Alarm Indication (RAI)
External Clock	Loss of Clock (LOC)
HDSL Loop	Margin, programmable threshold (MAR) Errored Seconds, programmable threshold (ES) Loss of Sync Word (LOSW)

History

E1 and HDSL Interface	24-Hour (15-minute intervals) and 7-Day (24-hour intervals) for ES and UAS
Alarm	Time stamp of first and last occurrence, number of occurrences for all enabled alarms

Power Requirements

UTU-701C	
Local input voltage	-36 Vdc to -72 Vdc (see note at bottom of page)
Consumption (typical)	4.5 W
ETU-751C	
Local input voltage	100 to 240 volt, 50 or 60 Hz, AC power
Consumption (typical)	4.5 W

Environmental

Operating Temperature Range	0 °C to +50 °C (32 °F to 122 °F)
Humidity	Up to 95% non-condensing
Storage Temperature	-40 °C to +70 °C (-40 °F to 158 °F)
Storage Humidity	5% to 95% non-condensing

Regulatory Approvals

CE Mark Certification	EN300 386-2

FUNCTIONAL DESCRIPTION

This section provides a functional description of the line and desktop units, including major components, single-pair application mode, alarms, and testing (including monitoring and loopbacks).

MAJOR COMPONENTS

The major components of the line and desktop units include:

- G.703 interface (75 or 120 Ω)
- rate selectable HDSL interface (including framing, transceiver, and line interface circuits)
- system timing circuits
- processor

Figure 5 is a functional block diagram of the line and desktop units.

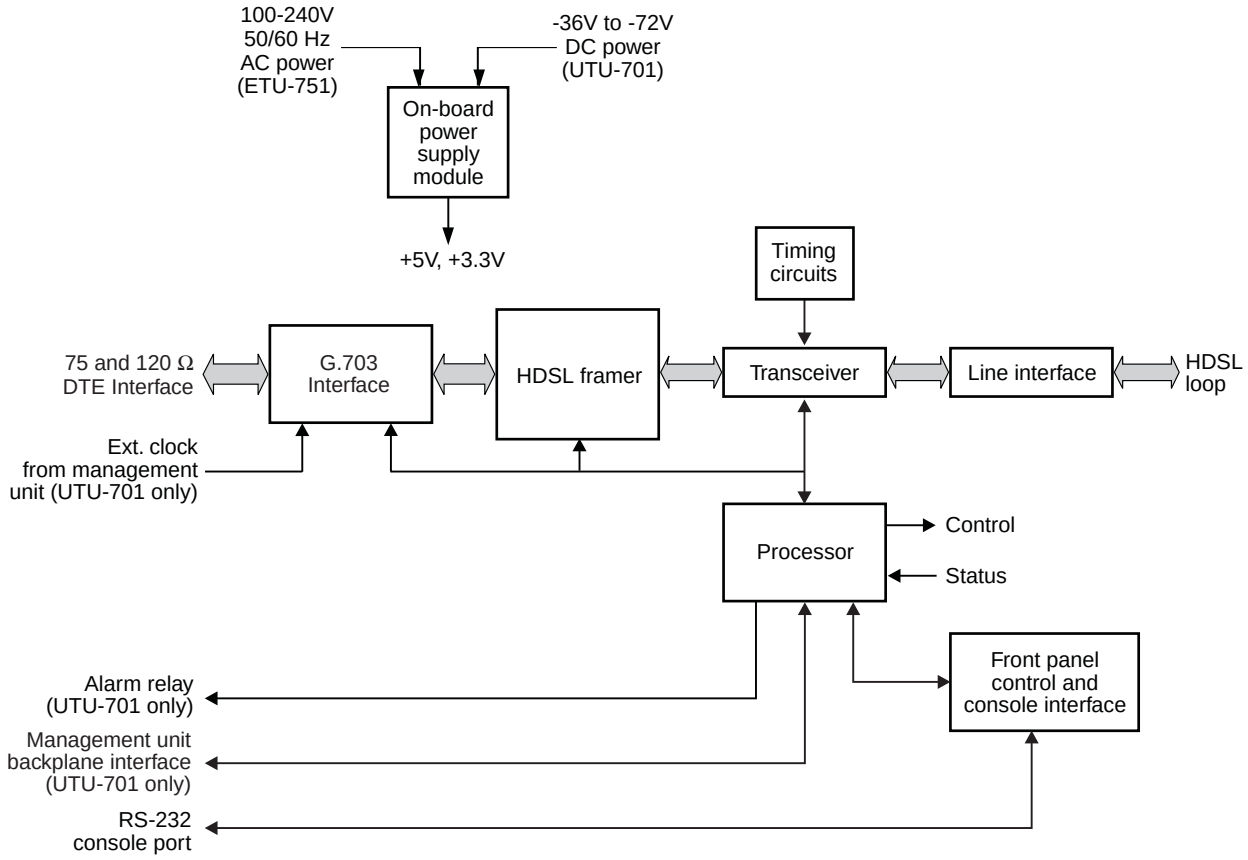

Figure 5. *Line and Desktop Unit Functional Block Diagram*

G.703 Interface

The G.703 interface performs the following functions:

- provides a jumper-selectable 75 or 120 ΩDTE interface (see "Installation and Startup" on page 23 for jumper locations)
- allocates full or fractional portion of the total 2048 kbps bandwidth to and from the G.703 interface
- frames data according to G.704
- inserts an idle code into unused time slots at the G.703 output
- recovers timing from the received G.703 signal
- monitors multiframe CRC-4 errors in the received G.703 signal
- regenerates multiframe (CRC-4) code at the G.703 output
- regenerates time slot 0 at the G.703 output
- transports time slot 16 transparently between G.703 ports

The G.703 interface operates in the structured application mode when less than 32 time slots are selected and in the unstructured mode when 32 time slots are selected (see "System Configuration" on page 25). These modes are described in detail in the "Rate Selectable Application Modes and Options" on page 14.

HDSL Interface

The HDSL interface includes the HDSL framer, which performs HDSL multiplexing and demultiplexing; a firmware-controlled programmable clock, which sets the HDSL line rate at the interface output; and the transceiver and line-interface circuits for the single HDSL pair.

In the transmit direction, the HDSL framer accepts inputs from the G.703 data port as shown in Figure 5. The data is placed on the HDSL pair along with the HDSL overhead bits for presentation to the transceiver. A clock representing the selected HDSL line rate is introduced to the transceiver, which outputs data on the single-pair HDSL line. In the receive direction, overhead bits are stripped and processed, and time slots are output to the G.703 interface.

Reversals of Tip and Ring wires are automatically detected and accommodated. The Monitor HDSL Span screen indicates if the Tip and Ring wires are reversed.

System Timing Circuits

The UTU and ETU units can synchronize to any one of the following timing sources:

- G.703: Timing recovered from G.703 input signal
- EXT: External 2.048 MHz reference (available only for UTUs in a shelf with a management unit installed)

Processor

This device runs a program which in real-time:

- monitors the HDSL framer performance
- responds to user requests
- maintains a history of system performance

Power Sources

The line and desktop units receive power from the following sources:

- A shelf-mounted UTU-701C receives power from a local source of -36 Vdc to -72 Vdc.
- An enclosure mounted UTU-701C receives power from a local source of -36 Vdc to -72 Vdc or from the enclosure's built-in AC-to-DC power supply (when provided).
- The ETU-751C desktop unit receives power from a source of 100 to 240 volt, 50 or 60 Hz, AC power.

Input voltage for the UTU-701C line unit (nominal -48 Vdc, tolerance -36 to -72 Vdc) must be supplied by an isolated DC source that complies with TNV or earthed SELV requirements of the latest version of IEC 950.

The single-pair rate selectable HDSL units (local and remote) must be locally powered.

RATE SELECTABLE APPLICATION MODES AND OPTIONS

Applications for single-pair rate-selectable HDSL are those that require transport of voice and data at various rates over various distances on a single pair of wires. Depending on line noise and the HDSL rate selected, spans of up to 7.1 km (4.4 miles) can be deployed without the use of doublers. The HDSL line rate depends on the number of time slots selected. The UTU-701C and ETU-751C each have 32 time slots with a bandwidth of from 256 kbps to 2048 kbps (1 to 32 time slots selected). Each time slot represents a 64 kbps increment of the available bandwidth.

The available rate selectable application modes and options are:

- single
- structured
- unstructured
- CRC-4

Single Mode

Single is the only application mode displayed in the Config System Settings menu. It means the system uses a single pair of twisted copper wires to transport data.

Structured Mode

When less than 32 time slots are selected, the line and desktop units automatically operate in the structured mode (see "G.704 Framing and Rate Selectable HDSL" on page 17). There is no structured mode menu selection. In structured mode, data at the G.703 interface is framed according to G.704. This permits fractional allocation of the total 2048 kbps bandwidth to and from the G.703 interface, insertion of idle code into unused time slots at the G.703 output, and monitoring of the G.703 input for CRC-4 multiframe errors.

A typical structured mode application is illustrated in Figure 6. The settings for this application are listed in Table 7. Time slots 1-15 and 17-25 are transported as telephony voice channels between the G.703 ports of the two units. Time slots 26-31 are unused and are set to idle code FF. In structured mode, time slot 1 is the beginning time slot; time slot 0 is regenerated at the G.703 output. With the CRC-4 mode enabled, the input G.703 signal is monitored for CRC-4 multiframe errors and at the G.703 output, a new CRC-4 code is generated. Time slot 16 is transported transparently between G.703 ports and may be used for telephony signaling.

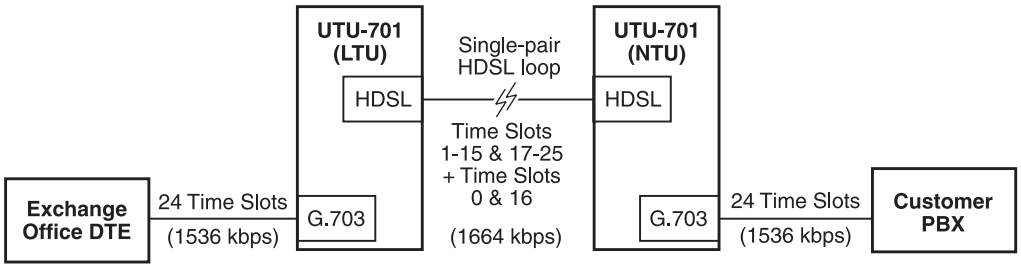

Figure 6. *Typical Structured Mode Application*

Table 7. *Typical Structured Mode System Settings*

Options	Setting
Application Mode	<32 TS (Structured)
LTU Interface	
Primary Timing Source	G.703
G.703 Port	
CRC-4 Mode	Enabled
Idle Code	FF
Data Rate / # of TSs	1536 kbps / 24
Beginning TS	1
NTU Interface	
Primary Timing Source	G.703
G.703 Port	
CRC-4 Mode	Enabled
Idle Code	FF
Data Rate / # of TSs	1536 kbps / 24
Beginning TS	1

For applications requiring fractional use of the G.703 port, embedded generation and detection of CRC-4 information, and A-bit insertion, select less than 32 time slots to invoke the structured mode. In the structured mode time slot 0 is regenerated according to G.704 at the output of the G.703 interface port. The following values apply:

- The Sa bits are always set to 1.
- The A bit is normally set to 0 at the G.703 output port. It is set to 1 during an active Loss of Signal (LOS), Alarm Indicating Signal (AIS), or a Loss of Frame Alignment (LFA) condition, if the alarm associated with the respective condition is not disabled (see "Configure LTU and NTU Interfaces" on page 39).
- When CRC-4 mode is disabled, the Si bit is transparently transmitted (that is, unmodified from the HDSL input data stream).
- When CRC-4 mode is enabled, the Si bit is set to a new CRC-4 multiframe signal and checksum (according to G.706).
- The E-bits are nominally set to 1 and set to 0 for each error in the incoming CRC-4 sub-multiframe.

Match the CRC-4 mode at each interface to the actual type of data present at that node in the system. Otherwise CRC-4 data will not be transparently transmitted in CRC-4 disabled mode. Also, non-CRC-4 data generates an LFA alarm in CRC-4 enabled mode.

Unstructured Mode

When 32 time slots are selected, the line and desktop units automatically operate in the unstructured mode (see "G.704 Framing and Rate Selectable HDSL" on page 17). There is no unstructured menu selection.
In the unstructured mode:

- There is no G.704 framing.
- Time slot 0 is the beginning time slot, and the data rate is fixed at 2048 kbps.
- A transparent transmission channel is provided between the local and remote units.
- CRC-4 detection and generation are not available, and E1 alarms are limited.

Any framing, multiframing, and common-channel signals can be transmitted through the HDSL line units in the unstructured mode, but the units do not monitor for a loss of framing condition.

Table 8 lists system settings for 2048 kbps transport of data between a DTE connected to an UTU-701C and a DTE connected to an ETU-751C. The settings in Table 8 use the G.703 signal from the UTU-side DTE as the primary timing source. Timing at the ETU side is recovered from the received G.703 signal. This application is illustrated in Figure 7.

Table 8. *Typical Unstructured Mode System Settings*

Options	Setting
Application Mode	32 TS (Unstructured)
UTU-701C (LTU) Interface	
Primary Timing Source	G.703
G. 703 Port	
CRC Mode	N/A
Idle Code	FF
Data Rate/# of TSs	2048 / 32 TSs
Beginning TS	0
ETU-751C (NTU) Interface	
Primary Timing Source	G.703
Data Rate / # of TSs	2048 / 32 TSs
Beginning TS	0

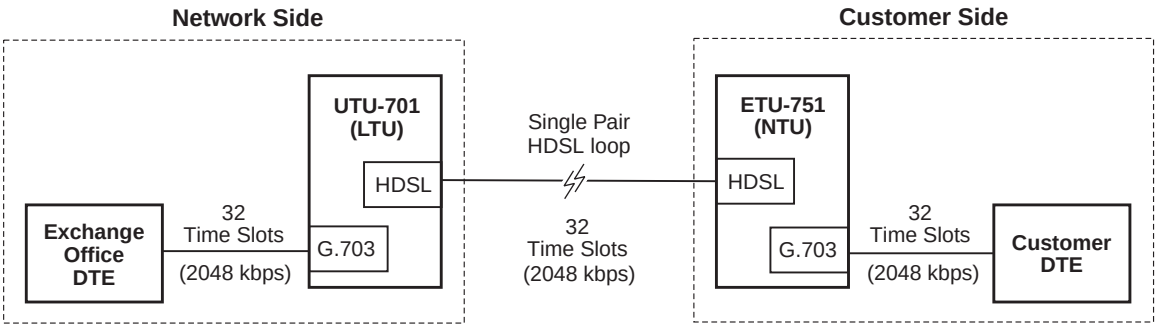

Figure 7. *Unstructured Mode Application*

G.704 Framing and Rate Selectable HDSL

Time slots 0 and 16 are always transported in accordance with the G.704 framing standard. Although not used by G.703 to transport data, the rate-selectable HDSL interface treats time slots 0 and 16 as a 128 kbps increase in the HDSL payload rate. For example, when 4 time slots are selected (256 kbps), time slots 0 and 16 are transported along with the selected time slots, 1 though 4. This results in an HDSL payload rate of 384 kbps (that is, 256 kbps plus the 128 kbps added by time slots 0 and 16). Table 9 lists several examples of selected and actual HDSL payload rates.

In structured mode, time slots 0 and 16 do not contain data and are transparent to the G.703 input. The transmitted G.703 data arrives at both the customer and network DTE at the selected HDSL payload rate. This is illustrated in Figure 6 on page 14.

Table 9. *Examples of Selected and Actual HDSL Payload Rates*

Selected HDSL Payload Rate (kbps) / Number of Time Slots	G.703 Time Slots Transported	Actual HDSL Payload Rate (kbps)
64 / 1	1 (plus 0 and 16)	256
128 / 2	1 and 2 (plus 0 and16)	256
192 / 3	1 through 3 (plus 0 and16)	320
256 / 4	1 through 4 (plus 0 and16)	384
384 / 6	1 through 6 (plus 0 and16)	512
512 / 8	1 through 8 (plus 0 and16)	640
640 / 10	1 through 10 (plus 0 and16)	768
768 / 12	1 through 12 (plus 0 and16)	896
896 / 14	1 through 14 (plus 0 and16)	1024
1024 / 16	1 through 15 and 17 (plus 0 and16)	1152
1152 / 18	1 through 15, 17 through 19 (plus 0 and16)	1280
1536 / 24	1 through 15, 17 through 25 (plus 0 and 16)	1664
1920 / 30	1 through 15, 17 through 31 (plus 0 and 16)	2048
1984 / 31	1 through 31 (plus 0)	2048
2048 / 32	0 through 31 [(a)]	2048

(a) The line and desktop units operate in the unstructured mode when 32 time slots are selected.

HOT SWAPPING

UTUs can be inserted and removed from any compatible shelf or enclosure with the power turned on. This will not cause damage to the units nor will it cause interference to any other HDSL circuits that are operating within the same shelf or enclosure.

PERFORMANCE MONITORING AND HISTORY

The UTU and ETU units provide extensive real time, non-disruptive monitoring of HDSL transmission performance parameters for all units in a circuit. Performance of the user interface ports is also monitored. Current cumulative counts of the past 24 hours and historical data in the form of 24-hour history (in 15-minute increments) and a 7-day history (in 24-hour increments) are available to assist in identifying problem sources during troubleshooting. See "Viewing Status" on page 46 for information on performance screens.

The monitored parameters are described in Table 10.

Table 10. *Monitored HDSL Transmission and Interface Performance Parameters*

Monitored Parameter	Description
HDSL Noise Margin	A measure of the ratio of signal power to noise power, in decibels (dB), at a receiver point. A value of 0 dB means that the predicted transmission BER is equal to 10^{-7}. A value of 6 dB means the predicted transmission BER is equal to 10^{-10}. The Main menu status display continuously updates the margin value.
HDSL CRC-6	A six-bit word in every HDSL frame, representing a calculation based on all the bits in that frame. Any mismatch at the receiver, between the received CRC-6 and the one calculated, based on the received data in the frame, indicates that one or more bits were received in error. The units use this parameter to derive HDSL Errored Seconds (ES).
HDSL Loss of Sync Word (LOSW)	The unit has detected an error in one or more bits in six consecutive HDSL sync words. TS 101 135 requires two consecutive sync words to be received without error to clear this condition. A LOSW condition generally indicates the loop is down, thus data cannot be transmitted.
Based on the monitored parameters, the LTU and NTU units derive the following performance parameters:	
HDSL Errored Second (ES)	An interval of one second during which at least one CRC-6 error is detected at the incoming HDSL port or there is an LOSW condition.
HDSL Unavailable Second (UAS)	A second during which a loop is down.

ALARMS

The UTU and ETU units generate alarms for problem conditions on the HDSL transmission facility and at the local application interface. Alarms can be individually enabled or disabled as well as configured as a Major or Minor alarms. See "System Configuration" on page 25 to configure alarms. See "Viewing Status" on page 46 to view alarm conditions.

The HDSL transmission and application interface alarms are described in Table 11 on page 19.

Table 11. HDSL Transmission and Application Interface Alarms

Alarm	Description
HDSL Alarms	HDSL alarms include:
Margin (MAR)	Margin has fallen below threshold set for the HDSL interface.
Errored Seconds (ES)	Errored seconds count has exceeded threshold set for the HDSL interface.
Loss of Sync Word (LOSW)	Loss of sync word at the HDSL interface. Remains active during restart, but not a cold start.
G.703 Alarms	G.703 alarms include:
Loss of Signal (LOS)	Loss of signal at the G.703 input.
Loss of Frame Alignment (LFA)	Loss of frame alignment at the G.703 input.
Receive Alarm Indication Signal (AIS)	Alarm indication signal (unframed all ones) received at the G.703 input.
Remote Alarm Indication Signal (RAI)	Remote alarm indication signal received at the G.703 input (through A-bit).
Loss of Clock (LOC)	Applies to loss of external clock when EXT timing is used. The external clock was lost for the previous second. This alarm is reset when the clock is active again.

LOOPBACKS

An HDSL system maintains several diagnostic loopback configurations, both toward and away from the local unit, which can be used to verify proper transmission of test data through the local unit, the HDSL facility, and the remote unit. Figure 8 on page 19 shows all possible loopback paths. Table 12 on page 20 lists available loopbacks.

During loopbacks the system generates an Alarm Indication Signal (AIS) past the loopback point toward the far unit. Loopbacks can be activated from the LOC (local) and REM (remote) front-panel pushbuttons, the console Test menus, and the management unit interface. Table 13 on page 21 lists loopback equivalents for different activation methods. Only one loopback option can be enabled at a time. During a loopback, the Loopback LEDs on the front panel indicate the type of loopback currently present in the system. See Table 4, "Line and Desktop Unit Front Panel LED Indications," on page 6.

The system reverts to normal transmission of payload data after the specified timeout period has elapsed. If a timeout period is not specified, the loopback must be manually disengaged before normal transmission of data can resume.

Test loopbacks disrupt normal end-to-end transmission of customer data and are the equivalent of taking the circuit out of service. The circuit does not revert to normal operation until loopbacks are disengaged manually or until after the specified loopback timeout period has expired.

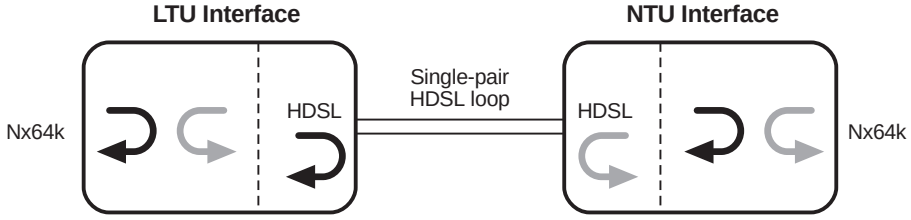

Figure 8. Loopback Operations

Table 12. *Loopbacks Selected at Front Panel Pushbuttons and Console Screens*

Loopback	Description
The two loopbacks that follow can be selected from the LOC and REM front-panel pushbuttons, the console screens, or the management unit interface.	
LOC Pushbutton—Local HDSL Loopback	This is an analog loopback implemented in both HDSL transceivers, and enables a complete checkout of the local equipment by looping back data at the furthest point before the transmission media. The HDSL link goes down as a result of this loopback, and is therefore not selectable from the remote unit console screens.
REM Pushbutton—Remote Loopback	Data is transmitted across the HDSL link and looped back at the remote interface ports. The HDSL link must be up for this loopback to be available. With no HDSL link up, the REM button will not enable any loopbacks.
The three loopbacks that follow are available exclusively from the console screens or management unit interface.	
Local Interface Loopback	Data is looped back at the closest point in the local unit toward customer equipment. This loopback is useful for verification of a proper connection at the local interface between your DTE and the local HDSL card. The HDSL link is maintained during this loopback.
Local or Interface Loopback Away from the Local Equipment	Data is looped back at the local unit or remote unit back toward the remote DTE equipment. This is equivalent to pressing the REM button on the remote unit's front panel, and is made available at the local console screen for ease of installation. The injected test data and loopback verification must still be performed at the remote unit site. Local equipment outputs an AIS for the duration of this test.
Remote Interface Away from the Local Equipment	Data is looped back at the remote unit toward the remote DTE equipment. This is available at the local console screen for the duration of this test. The injected test data and loopback verification must still be performed at the remote unit site. Local equipment outputs an AIS for the duration of this test.

The following applies to LTU and NTU loopbacks:

- No inband loopback codes are recognized or generated.
- A remote HDSL loopback is not available from the local console screen as it causes the HDSL link to go down and requires user action at the remote unit to disengage the loopback.

Table 13 summarizes the equivalent loopbacks for two different activation methods:

- LTU and NTU LOC and REM buttons
- console screen Test menus (see "Testing" on page 60 for loopback operation from the Test menus)

Table 13. *Loopback Equivalents*

Front Panel	Console Screen Test Menu	
	Loopback mode	Loopback Position
LTU LOC button	NETWORK [a]	LTU-HDSL
LTU REM button	NETWORK	NTU-I/F
	NETWORK	LTU-I/F
NTU LOC button	CUSTOMER [b]	NTU-HDSL
NTU REM button	CUSTOMER	LTU-I/F
	CUSTOMER	NTU-I/F

(a) Activated from console screen Test menu at LTU.
(b) Activated from console screen Test menu at NTU.

BER TESTING

The HDSL units provide a mechanism for validating circuit integrity utilizing a pseudorandom bit sequence (PRBS) generator and BER meter internal to the LTU unit. This diagnostic test disrupts the normal flow of payload traffic, and requires the presence of a Network NTU-I/F loopback or an external physical loopback at the NTU interface connector. The test is run at the selected HDSL Payload Rate (see Table 18 on page 38). BER results are accumulated continuously and updated on the console screen at intervals of approximately 16 seconds.

The PRBS data pattern is always generated at the LTU toward the HDSL channel, and the BER is always measured at the LTU based on data received from the HDSL channel. The test may be initiated and stopped from the Test menu at either the LTU or NTU console screen.

The BER test must be stopped before leaving the test menu to restore normal payload transmission. Typing ESC while the BER test is in progress causes the following message to display: "`BER Test in Progress. Must STOP before leaving screen.`"

INSPECTION, SAFETY, AND EQUIPMENT REPAIR

This section describes the procedures to be followed regarding product inspection, safety, and repair.

INSPECTION

Open the line or desktop unit shipping carton and inspect the contents for signs of damage. If the equipment was damaged in transit, immediately report the extent of the damage to the transportation company and to ADC (see "Product Support" on page 69).

SAFETY

To ensure safety of personnel and equipment, carefully observe the following safety rules:

Input voltage for the UTU-701C line unit (nominal -48 Vdc, tolerance -36 to -72 Vdc) must be supplied by an isolated DC source that complies with TNV or earthed SELV requirements of the latest version of IEC 950.

Be careful when installing or modifying telephone lines. Dangerous voltages can be present. It is unsafe to install telephone wiring during a lightning storm.

Always disconnect all telephone lines and power connections before servicing or disassembling this equipment. All wiring external to the product should follow the local wiring codes.

Die Eingangsspannung fuer die UTU-701C Karte is nominell –48 VDC, Toleranz -36 bis –72 VDC. Die Gleichstromquelle muss den Vorschriften gemäß der Norm EN60950 fuer Fernsprechnetzspannung (TNV) und Sicherheitskleinspannung (SELV) entsprechen.

Bitte beachten Sie, dass beim Installieren oder Veraendern von Telefonleitungen gefaehrliche Spannungen entstehen koennen. Es ist ebenfalls gefaehrlich, waehrend eines Gewitters Installationen an Telefondraehten vorzunehmen.

Bei Installation, Wartung oder Veraenderung des Geraetes muessen alle Telefon- und Netzkabel ausgezogen werden. Alle externen Verdrahtungsarbeiten sollten gemaess den Elektrizitaetsvorschriften des jeweiligen Landes ausgefuehrt werden.

EQUIPMENT REPAIR

To ensure the equipment does not become damaged, carefully observe the following cautions:

If a problem has been isolated to this unit, do not attempt to repair it. The unit's components are not user serviceable and, therefore, must not be replaced. Please return the unit to ADC for repairs.

Wenn eine Störung auf dieses Gerät zurückgeführt werden kann, sollte man nicht versuchen es zu reparieren. Die Geräteteile sind nicht vom Endverbraucher zu warten und müssen darum nicht ersetzt werden. Bitte senden Sie das Geräet zur Reparatur zurueck an ADC.

INSTALLATION AND STARTUP

This section describes the installation and startup procedures for the line and desktop units.

UTU-701C LINE UNIT INSTALLATION

Perform the following steps to install the UTU-701C line unit.

The chassis ground of the shelf or remote enclosure receiving these units must be connected to earth ground for protection of the equipment and for safety of personnel.

Primary protection for the HDSL line must be provided by the user. Both primary and secondary protection must be provided by the user if the E1 line runs outside of the building.

1. Align the UTU-701C with the card guides in the shelf or enclosure (see Figure 9).
2. Slide the line unit into the guides, then push the unit inward until it seats firmly in the card-edge connector.
3. Tighten the two captive screws on the UTU-701C front panel to secure the unit in place.
4. If configuring the line unit as an LTU, power up the shelf and proceed as instructed on pages 25 through 27 and 37 to access the Local Unit Role option in the *Config System Settings* menu (the default setting is NTU).
5. Set the TT clock at the DTE for the default HDSL payload rate of 256 kbps (4 time slots).

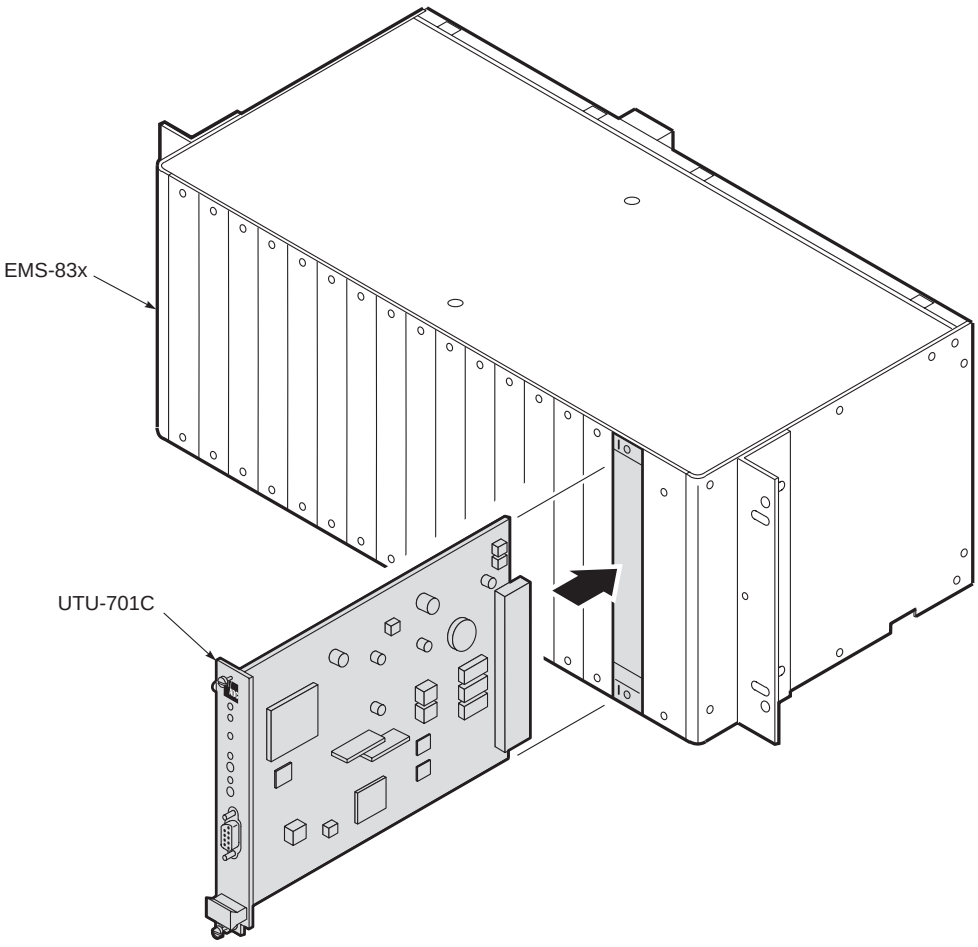

Figure 9. *Installing the UTU-701C Line Unit*

The line and desktop units will reset and their LEDs will sequence through the startup cycle following any change to the Local Unit Role option. If necessary, log on again by pressing the SPACEBAR several times.

ETU-751C DESKTOP UNIT INSTALLATION

Perform the following steps to install an ETU-751C desktop unit.

1. Insert the AC power cord into the power cord receptacle on the ETU rear panel.
2. Plug the power cord into a source of 100 V to 240 V, 50 or 60 Hz AC power.
3. If configuring the desktop unit as an LTU, power up the shelf and proceed as instructed on pages 25 through 27 and 37 to access the Local Unit Role option in the *Config System Settings* menu (the default setting is NTU).
4. Connect the DTE cables to the 120 or 75 Ω connectors on the ETU-751C rear panel.
5. Connect the HDSL line cable to the HDSL line connector on the ETU rear panel.

HDSL STARTUP AND SYNCHRONIZATION

The rate selectable LTU holds the configuration settings for the rate selectable NTU. At startup, the LTU first confirms that the NTU is a rate selectable unit. The LTU then configures the NTU with the required settings.

Power up the rate selectable units and observe the synchronization process as follows:

1. Power up the shelf or enclosure where the units are installed.
2. Confirm the following:
   - The HDSL ALM LED is on and the HDSL SYNC LED flashes once per second as the units self-configure and establish synchronization.
   - After approximately 60 seconds the HDSL ALM LED is off and the HDSL SYNC LED is steady green. The units are now ready for configuration through the console screen menus.

If the HDSL SYNC LED continues to flash after 90 seconds, the HDSL line is faulty or one of the units is not a rate selectable unit. Check for the correct line units. Test the HDSL line using the loopbacks described in "Testing" on page 60. Front panel loopback (LPBK) LED indications are described in Table 4 on page 6.

The LTU and NTU will reset and their LEDs will cycle through the startup sequence following any change to the HDSL Payload Rate option (see "Configure System Settings" on page 37).

SYSTEM CONFIGURATION

Each line unit provides a system-wide view of the entire HDSL circuit, including the remote unit. After establishing communication with the remote line card, provisioning information can be set and performance can be monitored from the local unit. If the HDSL link is down, the only parameters that can be changed are those on the local line unit. The LTU overwrites any NTU settings when the link is re-established. The LTU also provides a special lockout feature that prevents users plugged into the NTU console port from changing the circuit configuration. When enabled, the maintenance terminal connected to an NTU provides a read-only view of the entire HDSL system.

The console screen menus are not available when the HDSL card is under the control of a shelf management unit.

The line unit option settings are stored in non-volatile RAM (NVRAM). No dip switches or jumpers are required to configure these options. These options are set from the console screen menus or management unit interface. Option settings stored in NVRAM are retained if the line unit loses shelf power.

MAINTENANCE TERMINAL CONNECTION

The maintenance terminal (or PC running a terminal emulation program) is used to access the console screen menus. Through these menus, the system is configured, monitored, tested, and its circuit inventory is displayed.

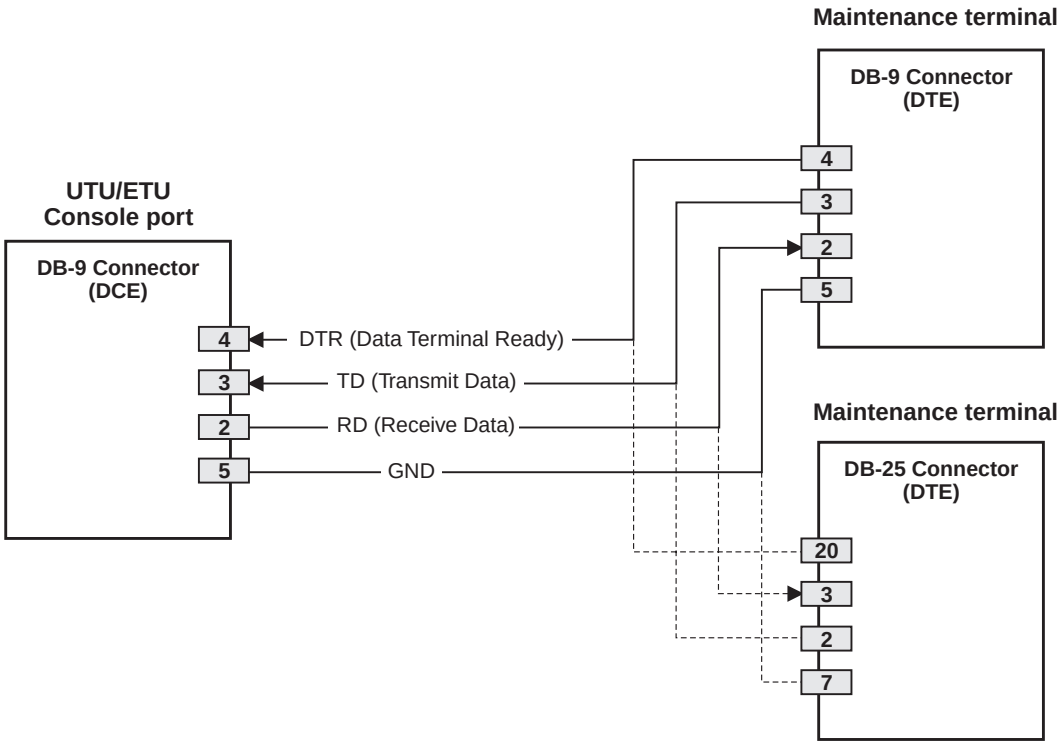

Figure 10. *UTU/ETU Console Port and Maintenance Terminal Connector Pinouts*

To connect and configure a maintenance terminal:

1 Connect a serial cable from the maintenance terminal 9-pin COM port to the line or desktop unit console port connector (Figure 11). Ensure the Data Terminal Ready (DTR) signal from the terminal is connected as the HDSL card will not communicate without it. Data Terminal Ready (DTR) may also be asserted by connecting the DSR output signal (pin 6) to the DTR input (pin 4).

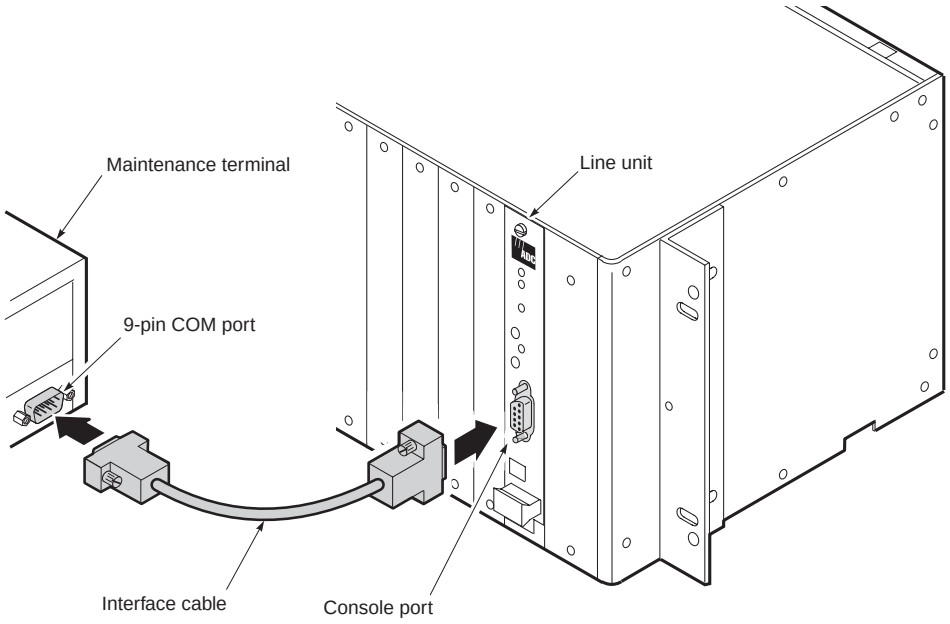

Figure 11. *Connecting a Maintenance Terminal to a Line Unit*

2 Configure the maintenance terminal for the following communication settings:

- VT100 Emulation or ANSI (if VT100 is not available)
- Clear the modem initialization string, if supported by the terminal
- Bits per second: 1200, 2400, 4800, 9600 (default), or 19200 bps (recommended)
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow Control: None

If using a PC and Microsoft Windows terminal emulation program, deselect *Show Scroll Bars and Use Function, Arrow, and Ctrl Keys* from the Settings Terminal Preferences menu in Windows 3.1 or from the Properties menu in Windows 95.

MODEM CONNECTION

For remote access to the line unit, an auto-answer modem can be connected to the console port. Use a null modem cable to connect the WorldDSL line unit and the modem.

LOGGING ON

To log on to the maintenance terminal console screen:

1 Press the SPACEBAR several times to display the Logon Password screen (Figure 12).

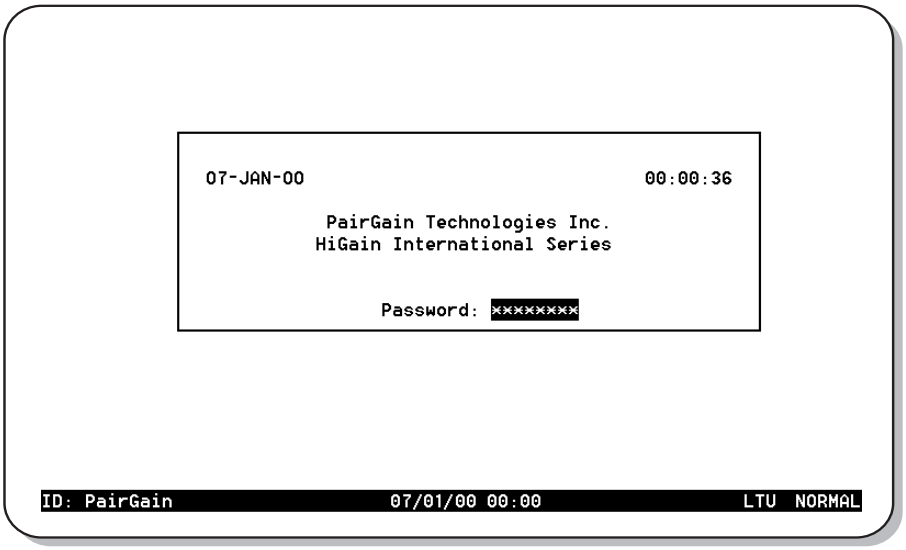

Figure 12. *Logon Password Screen*

The ENTER key is the factory default password. If you establish a different password, you must type the new password (single word, no spaces, up to eight characters) on a subsequent log on. If the system does not respond, verify that the Hardware Flow Control of the maintenance terminal is set to NONE.

2 Type the password at the prompt or press ENTER if a password has not been customized. The console screen menu bar displays (Figure 13).

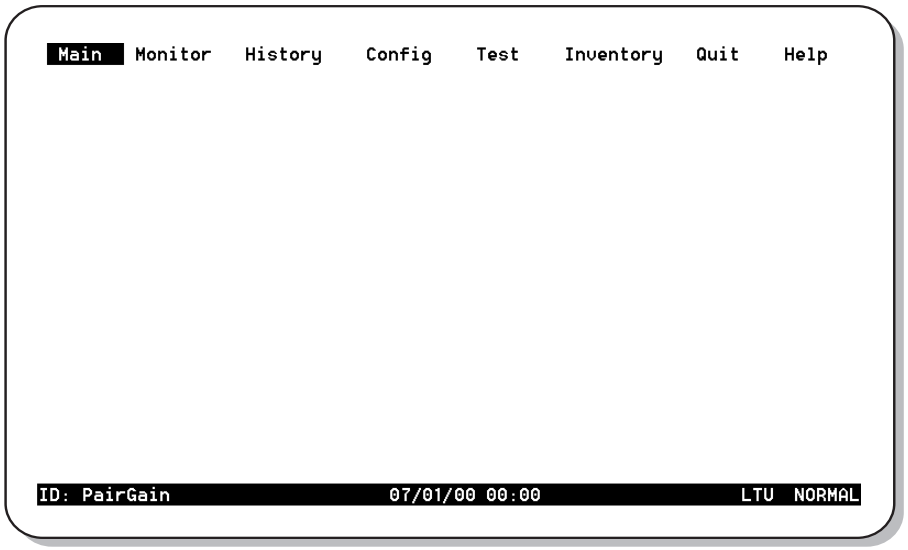

Figure 13. *Console Screen Menu Bar*

CONSOLE SCREEN STRUCTURE

The following sections describe the structure of the console screen and how to navigate through its menus and related displays.

The structure of the console screen displays and drop-down menus is shown in Figure 14. The names in the console screen menu bar identify each display and menu. The arrows in the menu bar following the Monitor, History, and Config names indicate the presence of a drop-down menu or sub-menu. The designations *Display* and *Displays* indicate that one or more displays are associated with the name in the menu bar or its drop-down menu.

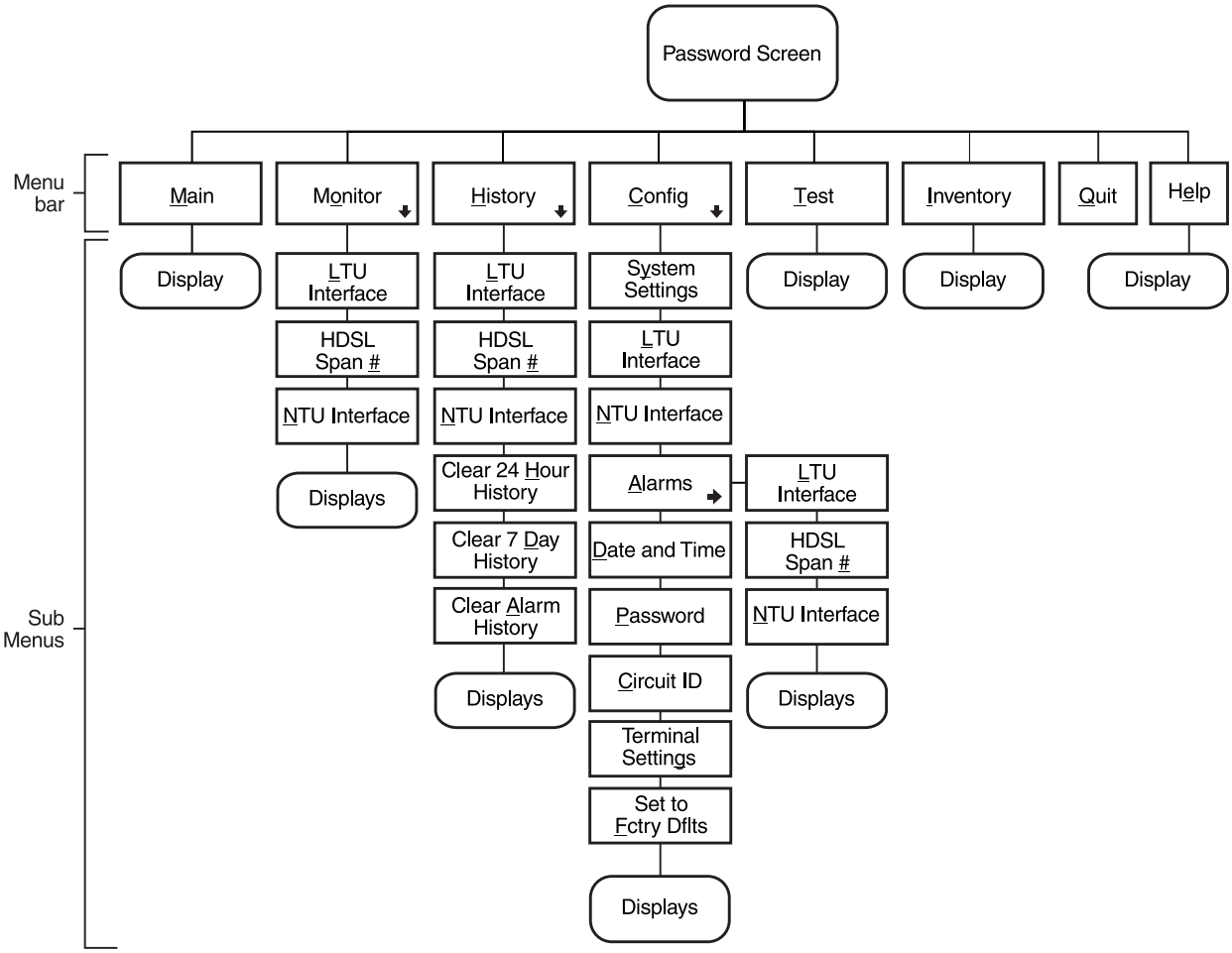

Figure 14. *Console Screen Menu Structure*

Table 14 describes the drop-down menus selected from the console screen.

Table 14. *Console Screen Menus*

Menu Name	Function	Described in this section
Main	Display the Main console screen to: • View the circuit configuration • View performance summary information • View alarm summary information	"Main Console Screen" on page 46
Monitor	Monitor the past 24-hour performance of the LTU interfaces, NTU interfaces, or HDSL spans.	"Monitor Menu" on page 48
History	View 24-hour, 7-day, or alarm history displays for any of the following: • LTU interface • HDSL spans • NTU interface • Clear all the 24-hour, 7-day or alarm histories	"History Menu" on page 52
Config	Perform any of the following system functions: • View or change global operating parameters for the system • View or change LTU interface, HDSL span, or NTU interface operating parameters • View or change alarm parameters • Set the time and date • Set or change the unit password • Change the circuit ID • Configure terminal display • Set all operating parameters to factory defaults	"Config Menu Options" on page 32
Test	Perform any of the following test functions: • Set the loopback mode and location • Set the loopback time-out • Enable or disable loopback operation • Initiate BER test and monitor BER results	"Testing" on page 60
Inventory	Display registration information to track product manufacturing, configuration, and revision state.	"Inventory Screen" on page 58
Quit	Log off the system.	"Logging Off" on page 45
Help	Display a screen of helpful information regarding the product.	-

READING AND NAVIGATING MENUS

The menu and status bars appear on all console screens. The information on the rest of the screen varies depending on the function of the menu or screen.

The menu bar displays the name of each menu. Choosing *Monitor*, *History*, or *Config* from the menu bar drops down a menu of available options. When selected, all options on the *Monitor* drop-down menu, and the *Alarm* option on the *Config* drop-down menu, display drop-down submenus.

The status bar at the bottom of the screen displays the circuit ID, the current date and time, unit type, and current system information. Select *Config* from the console screen menu bar to enter or change the circuit ID and the current date and time. The items described in Table 15 correspond to the numbers in Figure 15.

Table 15. *Console Screen Status Bar Displays*

Item	Field	Description
1	Circuit ID	Shows the user-selected name for the circuit (such as customer name).
2	Date and time	Today's date in dd/mm/yy format. Today's time in 24-hour format.
3	Local unit role	Either LTU or NTU.
4	System information	Displays the current system status. The system information field shows one of the following: • Loop down - At least one configured HDSL channel is down, either due to restart, or startup not completing. • Alarm - A major alarm condition is currently active in the system. In the case of a loopback bringing the loop down, LOSW alarms will be ignored. • Loopback - The system is in a diagnostic loopback configuration. • Update - Circuit-wide provisioning is in progress. • Normal - All configured HDSL channels are up in the circuit, no alarms are present, and provisioning is complete.

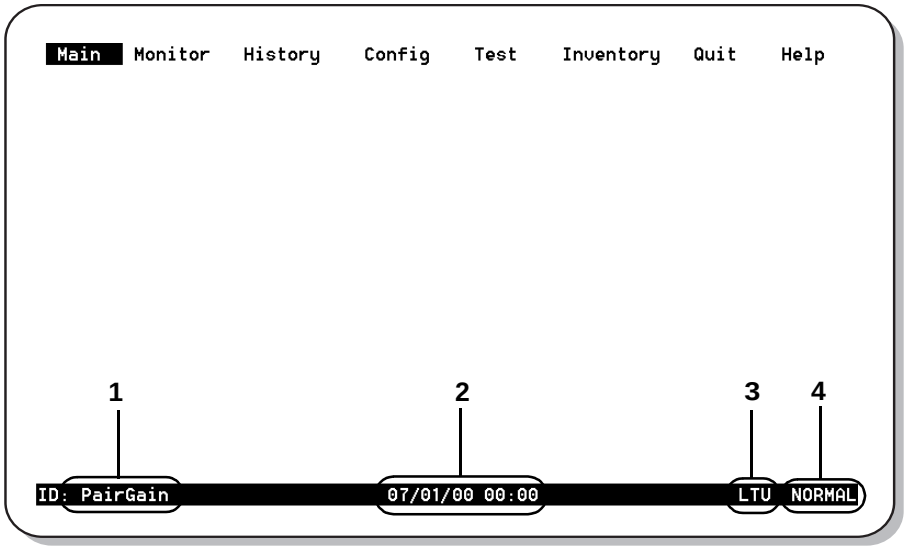

Figure 15. *Items in Console Screen Status Bar*

Use the keys described in Table 16 to navigate the console screen and its menus:

Table 16. *Console Screen Navigation Keys*

Press this Key	To Perform this Function
Alpha-numeric keys	Type the underlined or highlighted letter to select and execute a menu item. For example on the Main console menu, type C to access the *Config* drop-down menu. Also use these key to enter values in text fields. For example, on the *Config Date and Time* menu, type the date in a DD/MM/YY format.
← and → keys	Moves horizontally across the Menu bar, except when in a text entry field.
↑ and ↓ keys	Press the ↑ and ↓ keys from the Main console screen to access drop-down menus and their menu items. For example: • press the ← and → keys to select *Config* in the menu bar and press the ↓ key to access the drop-down configuration menu, then • press the ↑ and ↓ keys to highlight a menu item and press ENTER to select the item.
TAB key	Provides same function as the ↓ key.
CTRL + E	CTRL + E moves up one line in the History screens.
CTRL + X	CTRL + X moves down one line in the History screens.
CTRL + C	CTRL + C performs the page-down function in the History screens.
CTRL + R	CTRL + R performs the page-up function in the History screens.
SPACEBAR	Selects options displayed for current menu item. For example, to select MANUAL or Nx64k AUTO mode from the *Config System Settings* menu: • press the ↓ key to highlight the HDSL Rate Mode option, then • press the SPACEBAR until the desired option (MANUAL or Nx64k AUTO) is highlighted.
ESC	Exits the current screen and returns to the previous screen. Selection changes made on the current screen are discarded. Press ESC while in a text field to cancel the text entry and restore the old value.
ENTER	Applies all selections on the current screen. For example, to select an HDSL payload rate from the *Config System Settings* menu: • press the ↓ key to highlight the HDSL Payload Rate option, then • type the desired number of time slots (1 to 4) and press ENTER to display the selected HDSL payload rate (in MANUAL mode only).

Config Menu Options

Type C at the console screen (Figure 15) to display the *Config* menu (Figure 16). Table 17 lists the *Config* menu options and the order of system configuration.

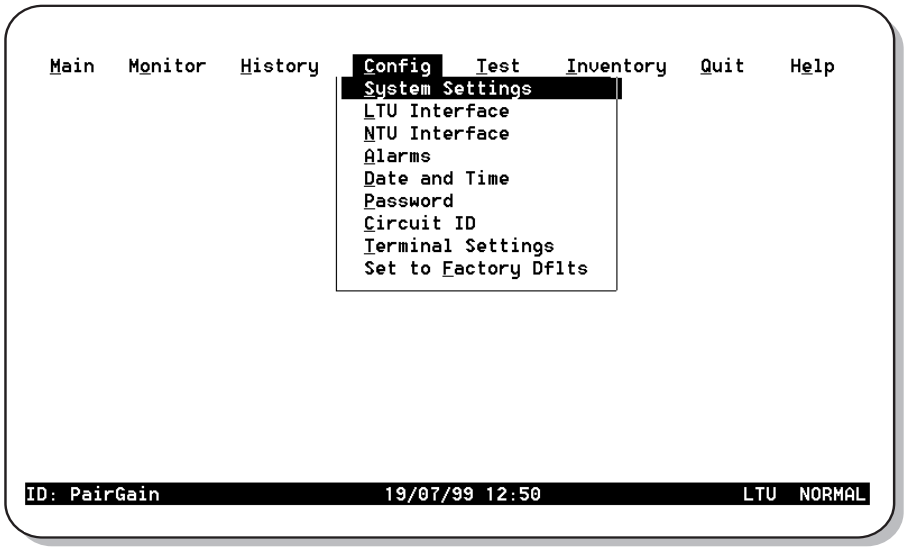

Figure 16. *Console Screen Config Menu*

Table 17. *Config Menu Options and Recommended Order of System Configuration*

Use this Option	To:	See page:
Terminal Settings	Select the best viewing mode for the console screen.	33
Date and Time	Set the system date and time.	34
Password	Set or change the system password.	35
Circuit ID	Assign a circuit ID.	36
System Settings	Select and configure system-wide operating parameters.	37
LTU and NTU Interface	Select and configure LTU/NTU-specific operating parameters.	39
Alarms	Enable or disable alarms and to select alarm severity.	42 and 43
Set to Factory Dflts	Reset all operating parameters to factory settings.	44

Observe the following when configuring a system:

- Configure settings in the order specified in Table 17. The *System Settings* must be configured before the *LTU and NTU Interface* settings. Changing *System Settings* can clear values configured in *LTU and NTU Interface* settings.
- When using a UTU as an LTU, change the Local Unit Role for the unit using the *Config System Settings* menu. Note that changing the Local Unit Role of a UTU causes the unit to reset and the LEDs to cycle.
- When the HDSL units are reset or cycle power, the date field is preserved but the time field is not preserved. Set the time using the *Config Date and Time* display. When the HDSL units are turned off and left off for a longer period of time (more than 24 hours, for example), set both the date and time using the *Config Date and Time* display since neither value was preserved.

Configure Terminal Settings

The console screens use line drawing characters to enclose menu selections and dialog boxes. Because not all maintenance terminals and terminal emulation programs adhere consistently to the VT100 standard, the HDSL card allows you to adjust the display for best results on a given terminal.

1Type T at the *Config* drop-down menu to display the *Config Terminal Settings* menu (Figure 17).

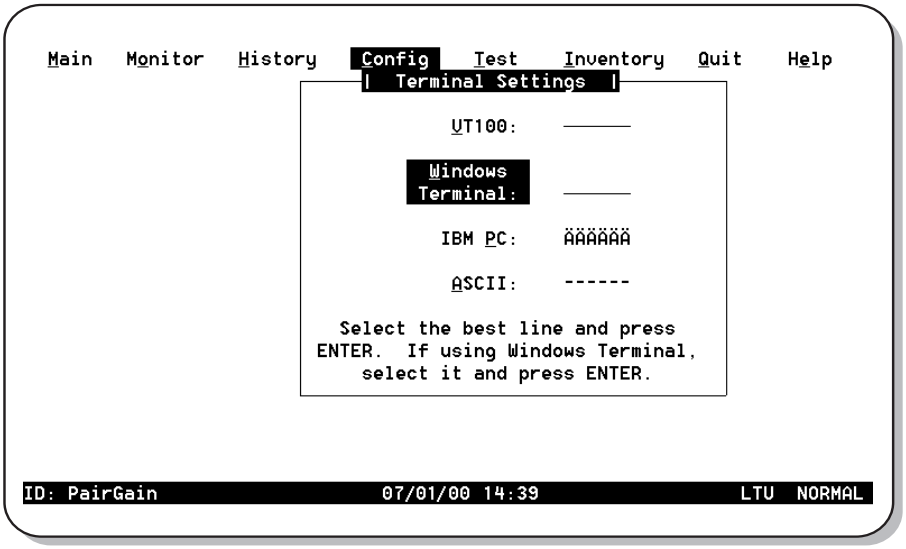

Figure 17. *Config Terminal Settings Menu*

2 Press the ↑ or ↓ key to highlight the selection that matches the terminal configuration (which should also be the selection most clearly displayed on the monitor). The choices are:

- VT100
- Windows Terminal
- IBM PC
- ASCII

3 Press ENTER to confirm the selection.

Configure Date and Time

1Type D at the *Config* drop-down menu to display the *Config Date and Time* menu (Figure 18).

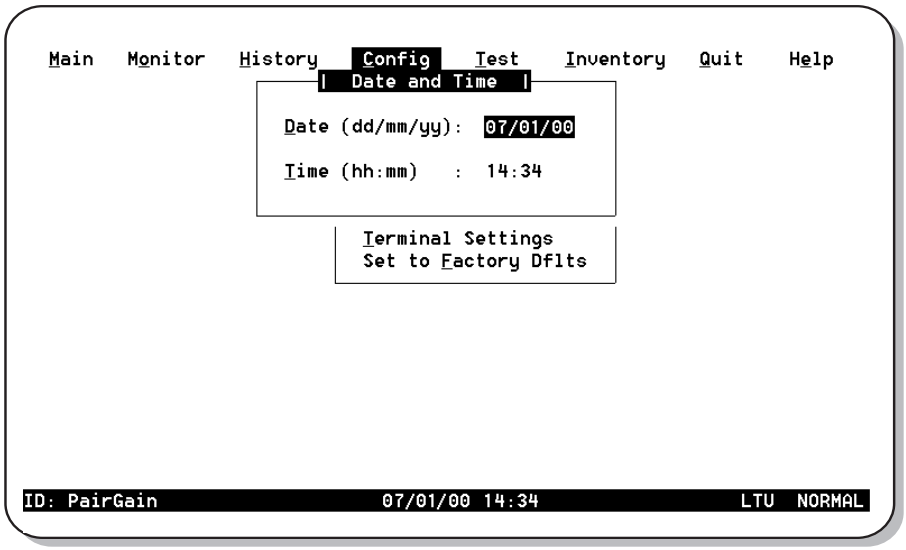

Figure 18. *Config Date and Time Menu*

2 Type the date in DD/MM/YY format, then press ENTER.

3 Type the time in HH : MM format (24-hour clock), then press ENTER.

The system date and time appear on the status line of the console screen and is useful when viewing alarm histories. When the HDSL units are reset or cycle power, the values in the date field are saved but the values in the time field are reset to 00 : 00. Set the time using the *Config Date and Time* display. When the HDSL units are turned off and left off for more than 24 hours, both the date and time must be set using the *Config Date and Time* display (neither value is saved after 24 hours).

Changing the date and time after the system has been running will not automatically clear alarm histories. This must be done after setting the date and time. (See "Clear History Screens" on page 58.)

Change Password

1Type P at the *Config* drop-down menu to display the *Config Change Password* menu (Figure 19).

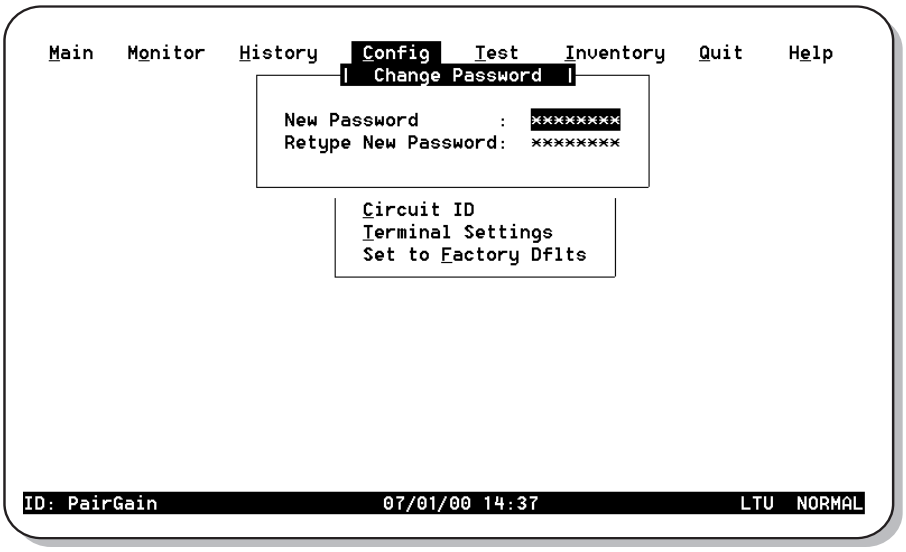

Figure 19. *Config Change Password Menu*

2 Enter a new password (up to eight characters) to change the current system password.

3 Retype the new password (up to eight characters) to confirm its accuracy.

When changing the default password (ENTER), save the new password in a secure place. A password cannot be recovered if it is forgotten. Contact ADC if assistance is needed (see "Product Support" on page 69).

Configure Circuit ID

The circuit ID appears on the status line of each console screen. Choose a unique circuit ID for each HDSL card.

1Type C at the *Config* drop-down menu to display the *Config Circuit ID* menu (Figure 20).

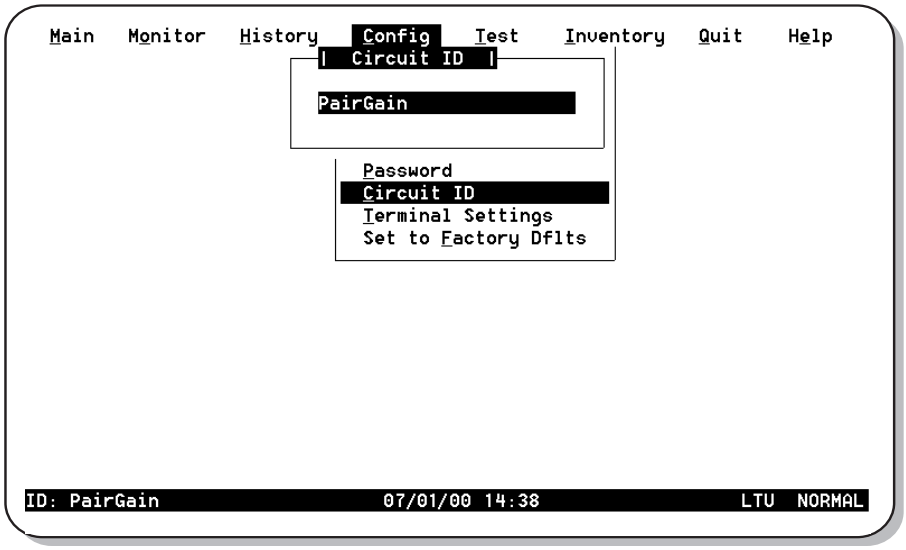

Figure 20. *Config Circuit ID Menu*

2Type a new circuit ID (up to 23 characters) to change the current circuit ID.

Configure System Settings

Use the *System Settings* menu to select and configure system-wide operating parameters. Configure system settings as follows:

1 Type **S** at the *Config* drop-down menu to display the *Config System Settings* menu. Figure 21 shows the *Config System Settings* menu for the UTU-701C and ETU-751C.

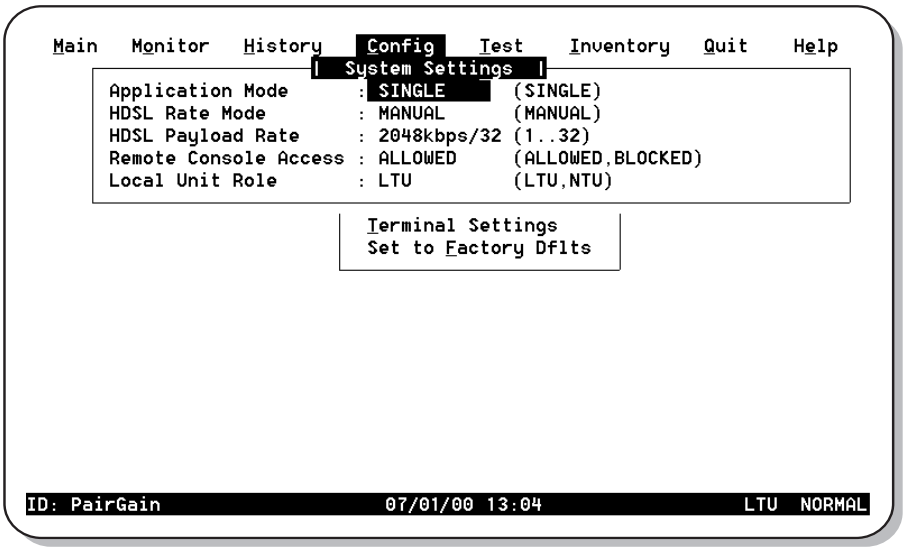

Figure 21. *Config System Settings Menu*

2 Do the following for each system option setting to be changed. Table 18 on page 38 describes the fields and options displayed in the *Config System Settings* menu. The settings in boldface type are factory default settings.

- Use the ↑ or the ↓ key to select the sub-menu item to be changed.
- Use the **SPACEBAR** to toggle to the appropriate option or type in the correct information, then press **ENTER** to select the option.

When using a UTU or ETU as an LTU, configure the Local Unit Role option first.

Table 18. *Fields and Options Displayed in Config System Settings Menu*

Field and Options	Description
Application Mode [a]	
SINGLE	System uses a single-pair of twisted copper wire to transport data. For more information, see "Rate Selectable Application Modes and Options" on page 14.
HDSL Rate Mode [a]	Selects the mode with which the HDSL payload rate will be determined.
MANUAL	HDSL payload rate is set by number of time slots entered for the HDSL Payload Rate option.[b] Each time slot is 64 kbps.
HDSL Payload Rate [c]	Selects the rate and reach at which data will be transported (see Table 2, "Transmission Ranges with 0 db ETSI Noise," on page 3).
256kbps/4	Typing a time slot value of 1 through 32 and pressing ENTER sets and displays the HDSL payload rate. [d] [e]
Remote Console Access	Selects whether a maintenance terminal connected to an NTU can affect system changes or is Read-only. This field may be set only at the LTU.
ALLOWED	NTU console screens can be used to configure the system.
BLOCKED	NTU console screens are read-only. The LOC and REM pushbuttons on the NTU are also disabled. System changes can only be made from the LTU.
Local Unit Role	Configures UTU or ETU as LTU (master) or NTU (slave). The default configuration is NTU (slave). Note that changing the Local Unit Role of a UTU or ETU causes the unit to reset and the LEDs to cycle.
LTU	Configures UTU or ETU as LTU (master). The LTU-configured rate selectable UTU/ETU does not provide line power to other HDSL units.
NTU	Configures UTU or ETU as NTU (slave). The NTU-configured rate selectable UTU/ETU does not provide line power to other HDSL units.

(a) SINGLE is the only application mode and MANUAL is the only rate mode.
(b) UTU-701C and ETU-751C have 32 time slots available for HDSL payload rates of 256 kbps to 2048 kbps.
(c) An HDSL Payload Rate of 64 kbps (1 time slot) is transmitted at 256 kbps (see "G.704 Framing and Rate Selectable HDSL" on page 17).
(d) Payload rates are displayed in the Config LTU and Config NTU Interface menus as Data Rate/# of TSs (data rate/number of time slots).
(e) Changing the HDSL Payload Rate or Local Unit Role causes the unit to reset and the LEDs to cycle. Log on again by pressing the SPACEBAR several times.

Configure LTU and NTU Interfaces

Select and configure the LTU- and NTU-related operating parameters as follows:

1 Type one of the following at the *Config* drop-down menu to display the *Config LTU or NTU Interface* menu:

- L for the *Config LTU Interface* menu (Figure 22).
- N for the *Config NTU Interface* menu (Figure 23).

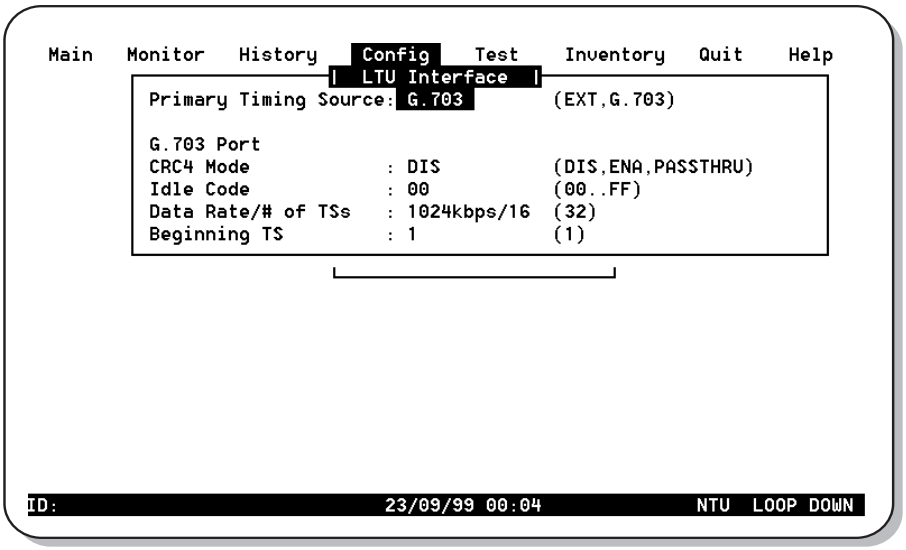

Figure 22. *Config LTU Interface Menu*

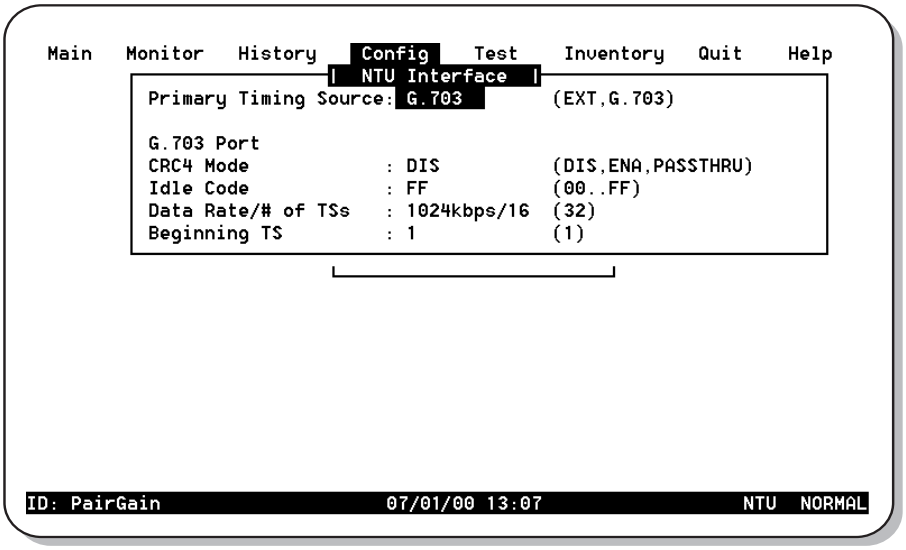

Figure 23. *Config NTU Interface Menu*

The Data Rate/# of TSs and Beginning TS parameters in the Config LTU and NTU Interface menus are read-only displays. The Data Rate/# of TSs value is set in the Config System Settings menu as the "HDSL Payload Rate" (See Figure 21 on page 37). The Beginning TS value is 0 with 32 time slots selected (unstructured mode) and 1 when less than 32 time slots are selected (structured mode).

2 Do the following for each interface option to be changed. Table 19 describes the fields and options displayed in the *Config LTU* and *Config NTU Interface* menus.

- Use the ↑ or the ↓ key to select the sub-menu item to be changed.
- Use the SPACEBAR to toggle to the appropriate option or type in the correct information, then press ENTER to select the option.

The settings in boldface type in Table 16 are factory default settings.

Table 19. *Fields and Options in Displayed Config LTU and Config NTU Interface Menus*

Field and Options	Description
Primary Timing Source	Selects the clock source for the HDSL transmit direction.
EXT	External 2.048 MHz clock (UTU-701C only)
G.703	Input E1 clock
	G.703 Port
CRC-4 Mode	Cyclic Redundancy Check (CRC) to detect errors in transmitted data. Available only when less than 32 time slots are selected (places unit in structured application mode).
DIS	CRC-4 mode is disabled. CRC-4 mode is not available (N/A) when 32 time slots are selected (places unit in unstructured application mode).
ENA	The input G.703 signal is monitored for CRC-4 multiframe errors. A new CRC-4 code is output for use at the remote unit. Detected errors are displayed in the Monitor LTU and NTU Interface screens.
PASSTHRU	All time slot 0 bits are passed unchanged to the remote unit. Useful when detection of CRC-4 errors is performed by customer equipment.
Idle Code	User inputs the idle pattern (from 00 to FF) transmitted in unused time slots from LTU or NTU G.703 port. Factory default setting is **FF**.
Data Rate/# of TSs	Read-only display of indicated HDSL data rate and corresponding number of time slots (TSs) as set with HDSL Payload Rate option in the Config System Settings menu (See "G.704 Framing and Rate Selectable HDSL" on page 17). Default setting is **256kbps/4**.
Beginning TS	Read-only display of beginning time slot. This setting is 0 (zero) in the structured mode and one (1) in the unstructured mode.

Configure Alarms

Use the *Config Alarms* menu to configure LTU and NTU Interface alarm parameters and the HDSL span alarm parameters. When setting alarm parameters for LTUs and NTUs, keep the following rules in mind:

- Disabled alarms do not cause LED indications and are not stored in history. Console screen menu alarm history reports are not generated.
- Minor alarms cause LED indications and are stored in history. Console screen menu alarm history reports are generated.
- Major alarms cause LED indications, actuate the line unit alarm relay, and are stored in history. Console screen menu alarm history reports are generated.
- The LTU alarm relay activates in response to a major alarm at the LTU only.
- The NTU alarm relay activates in response to a major alarm at the NTU only.
- For the duration of a major alarm, the line unit alarm relay contacts are connected as follows:
  - The C (Common) contact is connected to the NO (Normally Open) contact.
  - The NC (Normally Closed) contact is floating.
- With no alarm, the C and NC contacts are connected, and the NO contact remains floating.
- The line unit alarm relay operates in a fail-safe mode. When no power is applied to the line unit, the alarm relay C and NO contacts are connected with the NC contact floating.

Type **A** at the *Config* drop-down menu to display the *Config Alarms* menu (Figure 24).

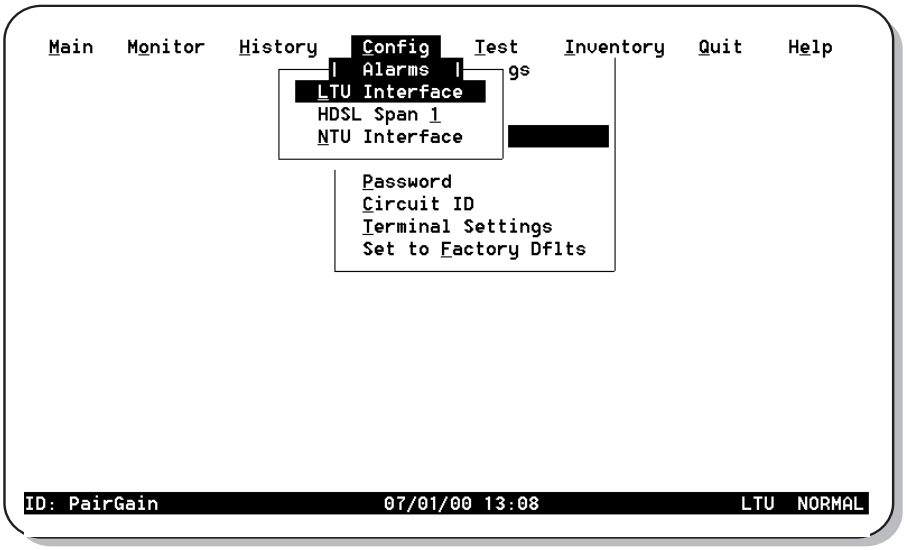

Figure 24. *Config Alarms Menu*

Alarms for LTU and NTU Interface

1 Type one of the following at the *Config Alarms* drop-down menu to display the *Config Alarms LTU* or *Config Alarms NTU Interface* menu:

- L for the *Config Alarms LTU Interface* menu (Figure 25)
- N for the *Config Alarms NTU Interface* menu (Figure 26)

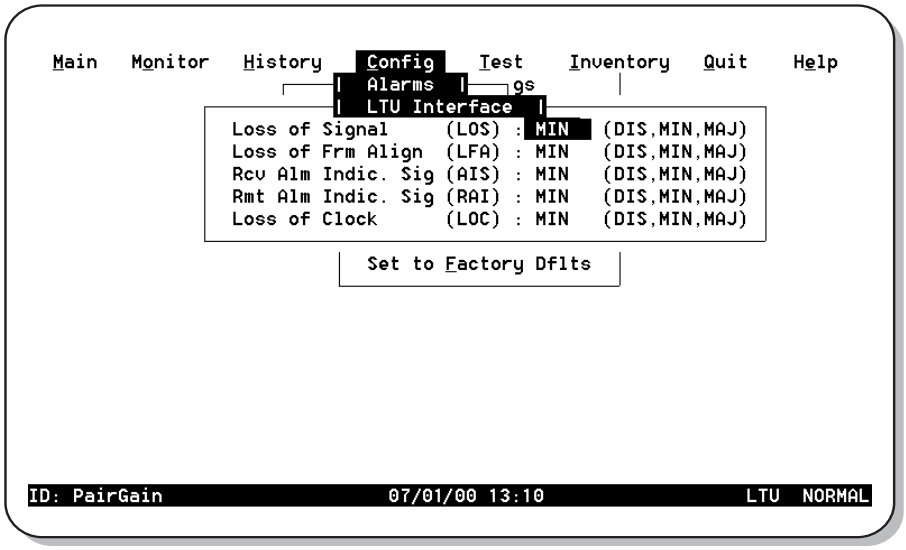

Figure 25. *Config Alarms LTU Interface Menu*

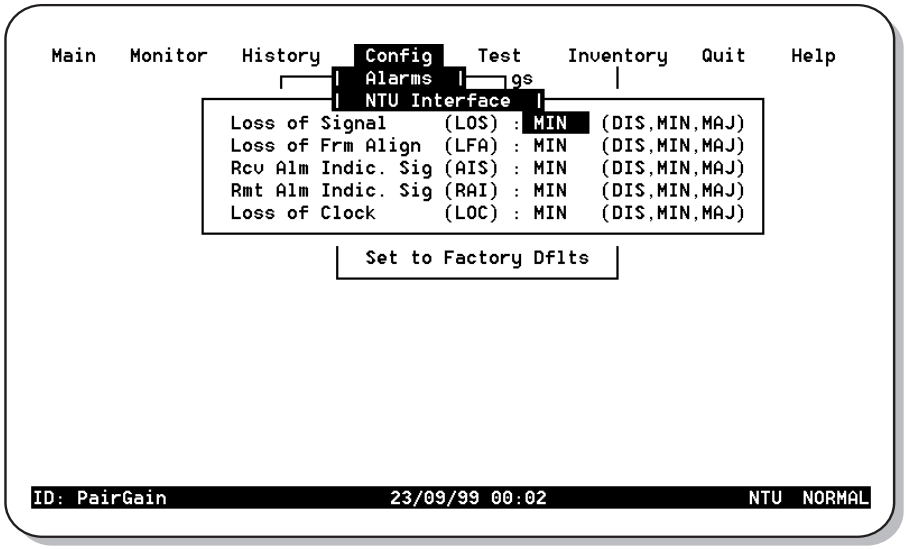

Figure 26. *Config Alarms NTU Interface Menu*

2 Do the following for each interface option to be changed. The fields displayed in the *Config Alarms LTU* and *Config Alarms NTU Interface* menus are described in Table 20.

- Use the ↑ or ↓ key to select the sub-menu item to be changed.
- Use the SPACEBAR to toggle to the appropriate option or type in the correct information, then press ENTER to select the option.

Table 20. *Fields Displayed in Config Alarms LTU and Config Alarms NTU Interface Menus*

Field	Description
Loss of Signal (LOS)	Loss of signal at the G.703 input.
Loss of Frame Alignment (LFA)	Loss of frame alignment at the G.703 input.
Receive Alarm Indication Signal (AIS)	Alarm indication signal (unframed all ones) received at the G.703 input.
Remote Alarm Indication Signal (RAI)	Remote alarm indication signal received at the G.703 input (through A-bit).
Loss of Clock (LOC)	Applies to loss of external clock when EXT timing is used. The external clock was lost for the previous second. This alarm is reset when the clock is active again.

HDSL Span 1 Alarms

1 Type 1 at the *Config Alarms* drop-down menu to display the *Config Alarms HDSL Span 1* menu (Figure 27).

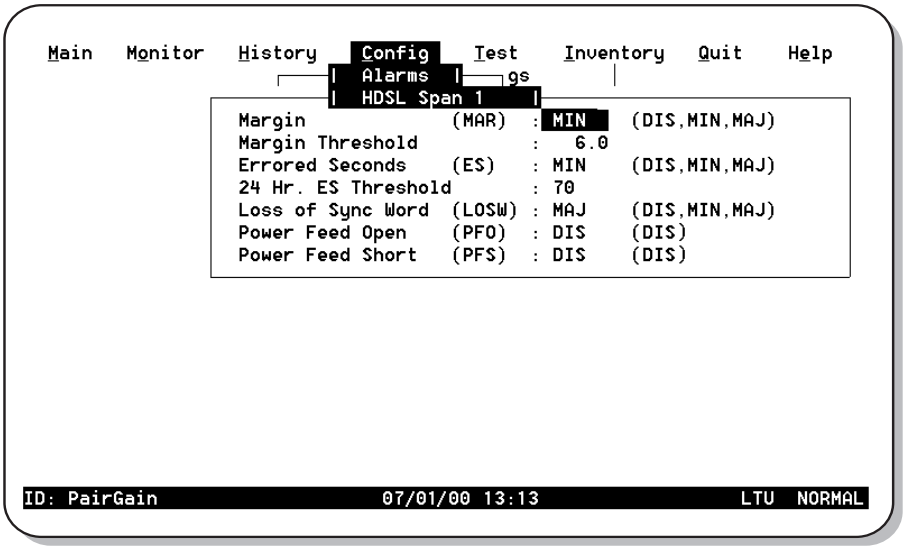

Figure 27. *Config Alarms HDSL Span 1 Menu*

2 Do the following for each interface option to be changed. The fields displayed in the *Config Alarms HDSL Span 1* menu are described in Table 21 on page 44.

- Use the ↑ or ↓ key to select the sub-menu item to be changed.
- Use the SPACEBAR to toggle to the appropriate option or type in the correct information, then press ENTER to select the option.

Table 21. *Fields Displayed in Config Alarms HDSL Span 1 Menu*

Field	Description
Margin (MAR)	Selects whether the alarm is disabled *(DIS*), or enabled and reported as a Minor *(MIN)* or Major *(MAJ*) Alarm when the margin falls below the threshold. This indicates a potential degradation of line quality. If an alarm is configured as a protection switch *(PSW),* it will behave as a Major *(MAJ)* Alarm, and cause protection switching to engage.
Margin Threshold	Selects the margin alarm threshold (from *0* dB to *15* dB) for all four margin measurements of the span.
Errored Seconds (ES)	Selects whether the alarm is disabled *(DIS),* or enabled and reported as a Minor *(MIN)* or Major *(MAJ*) Alarm when 24-hour ES count exceeds the threshold.
24 HR ES Threshold	Selects the errored seconds threshold *(0 to 255*) for all four errored seconds measurements of the span measured over a 24-hour period.
Loss of Sync Word (LOSW)	Selects whether the alarm is disabled *(DIS),* or enabled and reported as a Minor *(MIN)* or Major *(MAJ)* Alarm when the LOSW condition (HDSL loop down) occurs.
Power Feed Open	Not supported. These units do not supply power to other units.
Power Feed Short	Not supported. These units do not supply power to other units.

SET TO FACTORY DEFAULTS

Set to Factory Dflts is the screen from which all operating options can be reset to the ADC factory defaults.

1 Type **F** at the *Config* drop-down menu to display the *Set to Factory Dflts* screen (Figure 28).

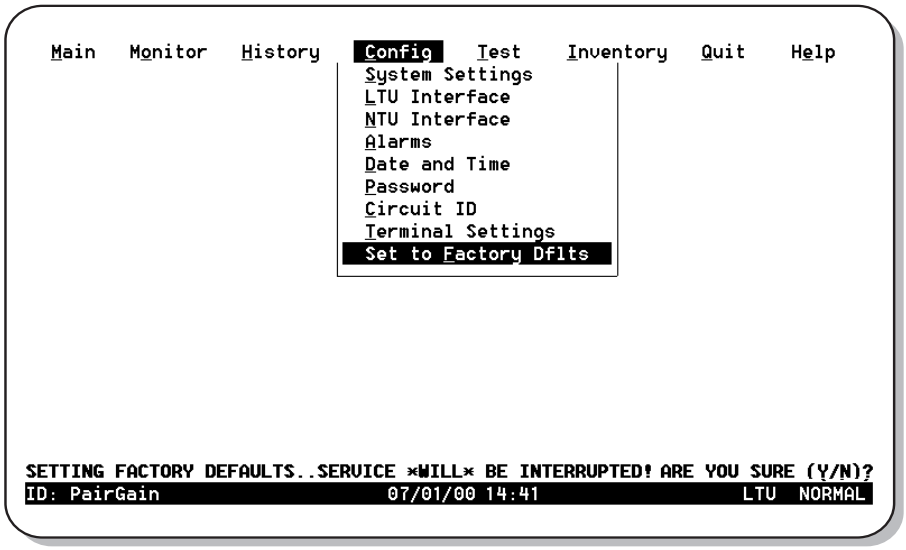

Figure 28. *Set to Factory Defaults Screen*

2 Press **ENTER** to reset value to factory defaults. A confirmation message appears at the bottom of the display:

SETTING FACTORY DEFAULTS ... SERVICE *WILL* BE INTERRUPTED! ARE YOU SURE(Y/N)?

3 Do one of the following:

- Type **N** to keep the current settings.
- Type **Y** to reset values to factory defaults. The system resets and both LTU and NTU units go through their respective synchronization processes. If loops are down or are in update mode while *Set to Factory Dflts* is enabled, only the local unit will restart. If the loops are up, both the LTU and NTU will restart.

The factory default system settings are listed in Table 22.

Table 22. *Factory Default System Settings*

Operating Option	Default Setting
System Settings	
Application Mode	SINGLE
HDSL Rate Mode	MANUAL
HDSL Payload Rate	256kbps/4
Remote Console Access	ALLOWED
Protect Switch Command	Not supported on these units.
Local Unit Role	NTU
LTU/NTU Interface	
G,703 port	
Interface Type	G.703
Data Rate/# of TSs	256 / 4
Beginning TS	0 (structured mode) 1 (unstructured mode)
Alarms LTU/NTU Interface	
Loss of Clock (LOC)	MIN (Minor)
Alarms HDSL Spans	
Margin (MAR)	MIN (Minor)
Margin Threshold	6
Errored Seconds (ES)	MIN (Minor)
24 Hour ES Threshold	70
Loss of Sync Word (LOSW)	MAJ (Major)
Power Feed Open (PFO)	Not supported on these units.
Power Feed Short (PFS)	Not supported on these units.

LOGGING OFF

If the maintenance terminal must be left unattended for any length of time, log off until work resumes. This prevents unauthorized persons from inadvertently changing operating parameters.

Log off by choosing *Quit* from the menu bar or by disconnecting the cable connecting the maintenance terminal to the line or desktop unit. Automatic log off occurs after 20 minutes of keyboard inactivity.

VIEWING STATUS

The following sections describe the screens that display status and system information, such as current alarm status, performance history, product, and configuration information.

View status using a maintenance terminal or PC running a terminal emulation program connected to the V.24 (RS-232) console port. See page 25 for instructions on connecting a maintenance terminal or PC.

MAIN CONSOLE SCREEN

The *Main* console screen displays a summary of LTU and NTU circuit configuration, performance statistics, and alarm status for each interface in the circuit.

Type **M** to display the *Main* console screen (Figure 29). The screen shown in Figure 29 is a display of the LTU and NTU in the single-pair application. The numbered fields are described in Table 23.

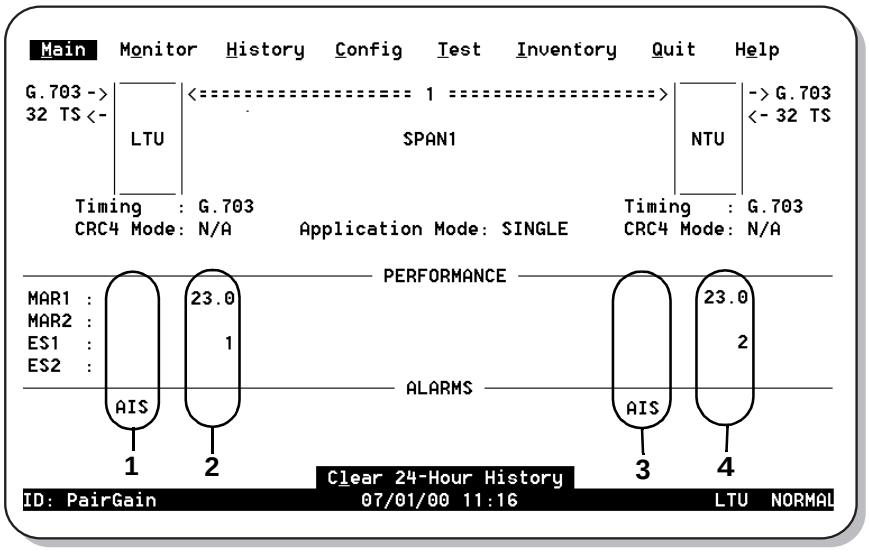

Figure 29. *Main Console Screen*

Table 23. *Reading the Main Console Screen*

Field	Description
1	Shows performance and alarms for the LTU user interface.
2	Shows performance and alarms for the LTU HDSL interface.
3	Shows performance and alarms for the NTU HDSL interface.
4	Shows performance and alarms for the NTU user interface.

Table 24 describes the fields displayed on the *Main* console screen.

Table 24. *Fields Displayed in Main Console Screen*

Field	Description
	Circuit Configuration
G.703	Indicates the interface standard for G.703 data port.
n TS	Indicates the number of time slots (*n*) mapped to the G.703 interface.
Timing	Indicates the primary source the unit uses for clock synchronization:
EXT	External 2.048 MHz clock.
G.703	G.703 port receive clock.
Application mode	Indicates that the Single Pair (SINGLE) application mode is in effect.
	Performance
MAR1	Displays the Margin value for each HDSL interface or displays link status (SIG, ACQ, etc.) if the link is not up.
MAR2	Reserved
ES1	Displays the Errored Seconds (ES) counts for each HDSL interface. The counts are for the latest 24-hour period, calculated as the sum of the counts in the previous 95 15-minute intervals, plus the count in the current 15-minute interval.
ES2	Reserved
	Alarms The Alarms field displays a list of all active alarms at each LTU/NTU and HDSL interface.
	Possible LTU/NTU Interface Alarms
Loss of Signal (LOS)	Loss of signal at the G.703 input.
Loss of Frame Alignment (LFA)	Loss of frame alignment at the G.703 input.
Receive Alarm Indication Signal (AIS)	Alarm indication signal (unframed all ones) received at the G.703 input.
Remote Alarm Indication Signal (RAI)	Remote alarm indication signal received at the G.703 input (through A-bit).
Loss of Clock (LOC)	Applies to loss of external clock when EXT timing is used. The external clock was lost for the previous second. This alarm is reset when the clock is active again.
	Possible HDSL alarms
Margin (MAR)	Margin has fallen below threshold set for the HDSL interface.
Errored Seconds (ES)	Errored seconds count has exceeded threshold set for the HDSL interface.
Loss of Sync Word (LOSW)	Loss of sync word at the HDSL interface. Remains active during restart, but not a cold start.

MONITOR MENU

The Monitor menu contains the following options:

- LTU Interface screen that displays the 24 hour and cumulative count of errors at the LTU G.703 port.
- NTU Interface screen that displays the 24 hour and cumulative count of errors at the NTU G.703 port.
- HDSL Span 1 screen that displays the circuit performance and 24-hour error counts at the HDSL span 1 interface.

Type `0` at the console screen to display the *Monitor* menu (Figure 30).

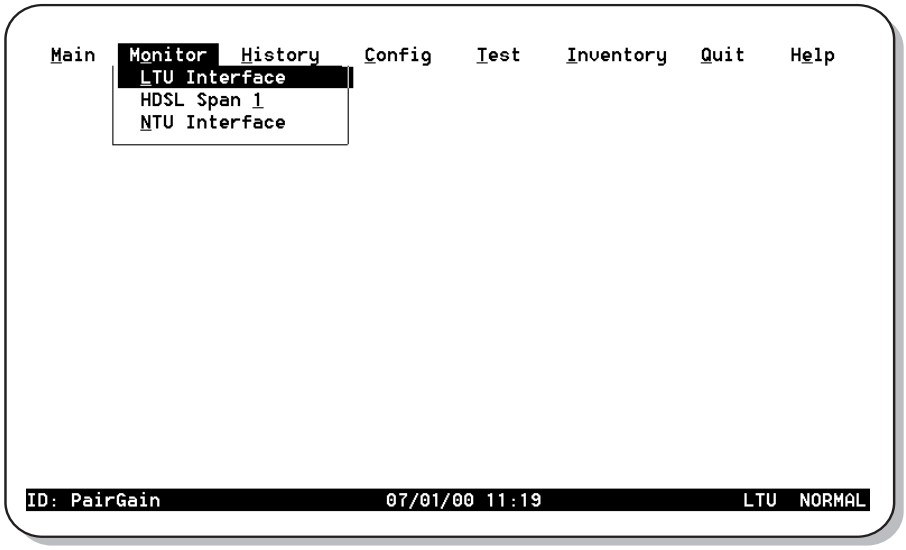

Figure 30. *Monitor Menu*

Monitor LTU Interface Screen

At the *Monitor* menu (Figure 30), type L to display the *Monitor LTU Interface* screen (Figure 31). Table 25 describes the fields displayed in the *M*onitor *LTU and M*onitor *NTU Interface* screens.

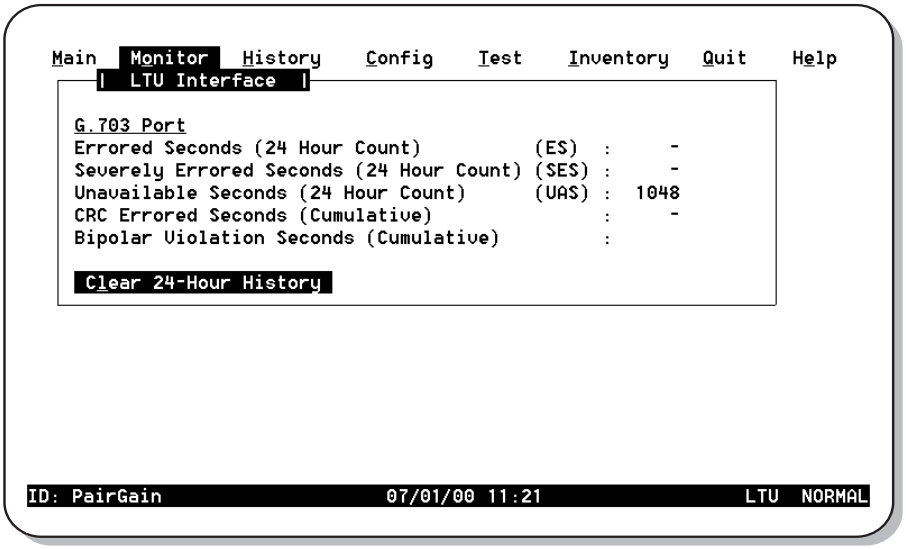

Figure 31. *Monitor LTU Interface Screen*

Table 25. *Fields Displayed in Monitor LTU and Monitor NTU Interface Screens*

Field	Description
	G.703 Port
Errored Seconds (ES) 24 Hour Count	The number of one-second intervals in which at least one bipolar violation (BPV) or one CRC-4 error was detected at the G.703 input port during the last 24hours.
Severely Errored Seconds (SES) 24 Hour Count	The number of one second intervals during which a Loss of Signal (LOS), an Alarm Indication Signal (AIS), or a Loss of Frame (or CRC-4 Multiframe) Alignment (LFA) occurred at the incoming port.
Unavailable Seconds (UAS) 24 Hour Count	The number of seconds that G.703 input signals were unavailable during the last 24 hours. After ten consecutive SESs, the system is deemed unavailable, and the current UAS counter begins counting from ten. After ten consecutive non-SESs, the system returns to availability, and the ten counts representing the non-SESs are removed from the UAS counter.
CRC Errored Seconds (Cumulative)	The number of CRC-4 errors that were detected at the G.703 port since error counters were last cleared. Turning CRC-4 mode on (ENA) and off (DIS) clears the CRC-4 error counter.
Bipolar Violation Seconds (Cumulative)	The number of seconds in which bipolar violations were detected at the G.703 port since error counters were last cleared.
Clear 24-Hour History	The date and time that the 24-hour histories were last cleared are displayed here. Enable this function by pressing L or ENTER to clear all 24-hour history counters (including HDSL). This action must be confirmed by pressing Y.

Monitor NTU Interface Screen

At the *Monitor* menu (Figure 30), type **N** to display the *Monitor NTU Interface* screen (Figure 32).

The fields displayed in the Monitor NTU Interface screen are identical to those displayed in the Monitor LTU Interface screen (see Table 25 on page 49).

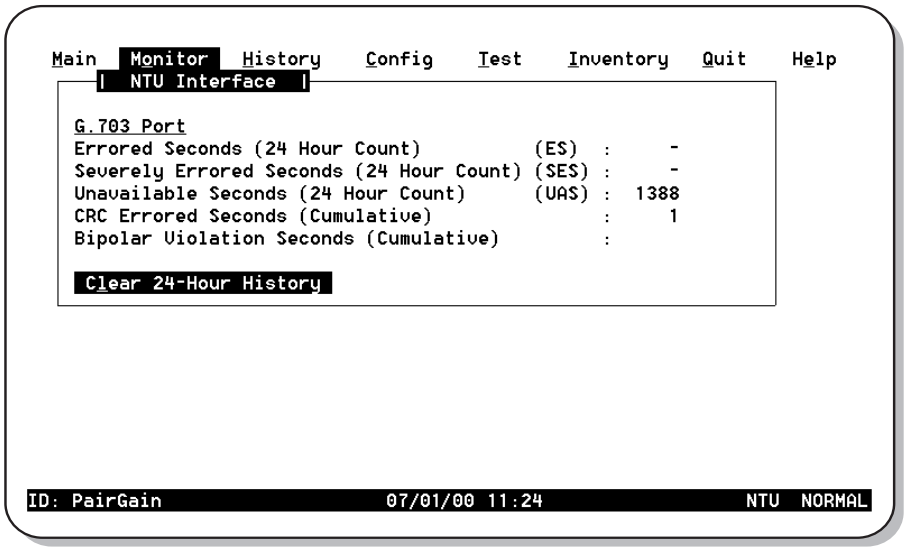

Figure 32. *Monitor NTU Interface Screen*

Monitor HDSL Span 1 Screen

The HDSL Span 1 screen (Figure 33) displays the circuit performance and 24-hour error counts at the HDSL span 1 interface. A span is defined as the link between two HDSL units (that is, from an LTU to an NTU) which, in this case, is comprised of a single loop (that is, one twisted-copper pair). The values under the LTU-1 column represent HDSL Span 1 as measured by the LTU. The values under the NTU-1 column represent HDSL Span 1 as measured by the NTU.

At the *Monitor* menu (Figure 30), type 1 to select the *Monitor HDSL Span 1* screen (Figure 33). The fields displayed in the *Monitor HDSL Span 1* screen are described in Table 26.

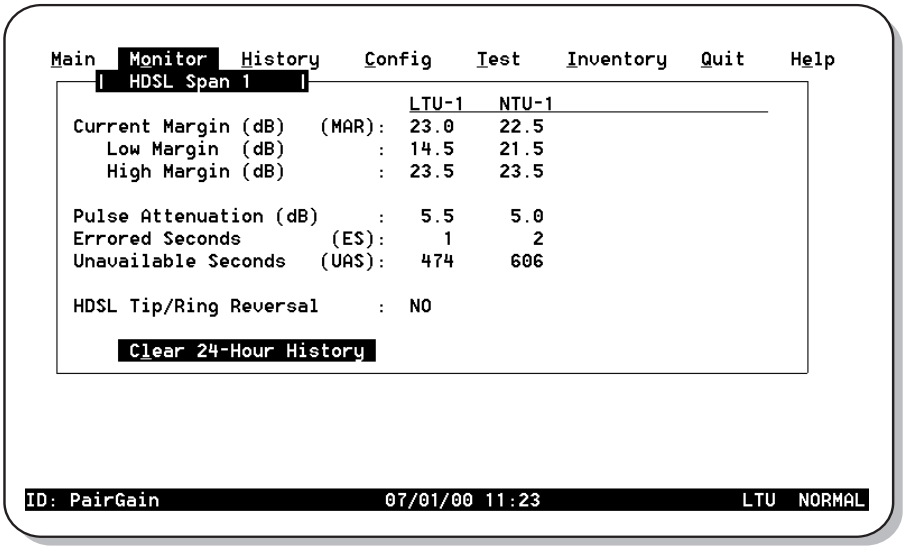

Figure 33. *Monitor HDSL Span 1 Screen*

Table 26. *Fields in Monitor HDSL Span 1 Screen*

Field	Description
Current Margin (dB) (MAR)	Indicates the excess signal-to-noise ratio relative to a 10^{-7} bit error rate. The normal range of a typical margin is from 6 to 22 dB, with a value of 6 dB corresponding to a predicted BER of 10^{-10}.
Low Margin (dB)	Indicates the lowest margin since startup or the last 24-hour history clear.
High Margin (dB)	Indicates the highest margin since startup or the last 24-hour history clear.
Pulse Attenuation (dB)	Indicates the attenuation of the 2B1Q pulse from the distant end. This value is related to the cable pair's loss at 292 KHz. The normal range of pulse attenuation is from 1 to 41 dB.
Errored Seconds (ES)	The number of one-second intervals in which at least one HDSL CRC-6 error or loss of Sync Word (LOSW) was detected on the HDSL span during the last 24 hours.
Unavailable Seconds (UAS)	The number of seconds that the HDSL span was down during the last 24 hours.
HDSL Tip/Ring Reversal	Indicates whether the two conductors of the HDSL span are correctly connected or have been interchanged. The system automatically compensates for an interchange of wire leads.
Clear 24-Hour History	The date and time that the 24-hour histories were last cleared are displayed here. Enable this function by pressing L or ENTER to clear all 24-hour history counters (including HDSL). This action must be confirmed by pressing Y.

HISTORY MENU

The History menu contains the following status screens:

- LTU/NTU Interfaces that display alarm performance history for the LTU and NTU interface.
- HDSL Span that displays 24-hour, 7-day, and alarm performance history for the HDSL span.

The History menu also provides the option to clear the 24-hour, 7-day, and alarm history screens. This option is described on page 58.

Type **H** to select the *History* menu (Figure 34).

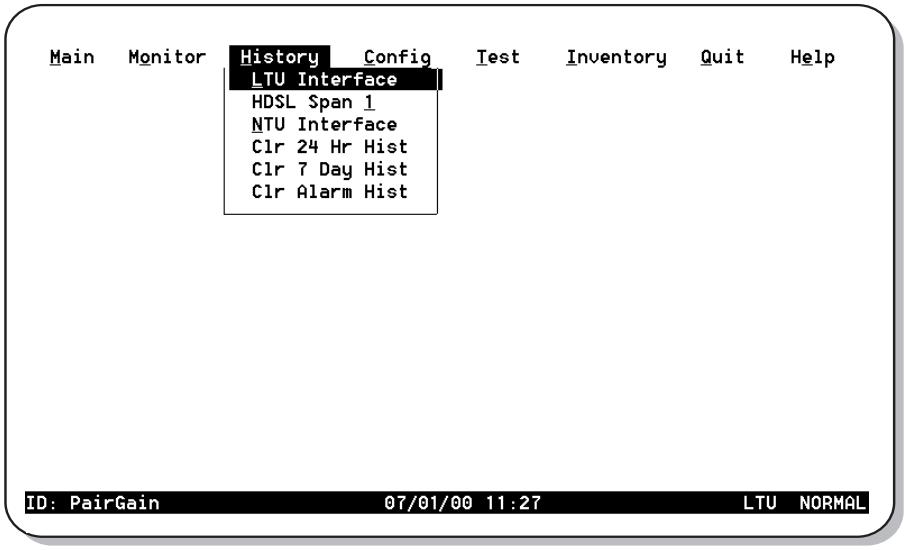

Figure 34. *History Menu*

LTU and NTU Interface Performance History Screens

At the *History* menu (Figure 34), type L to select the *History LTU Interface* menu (Figure 35).

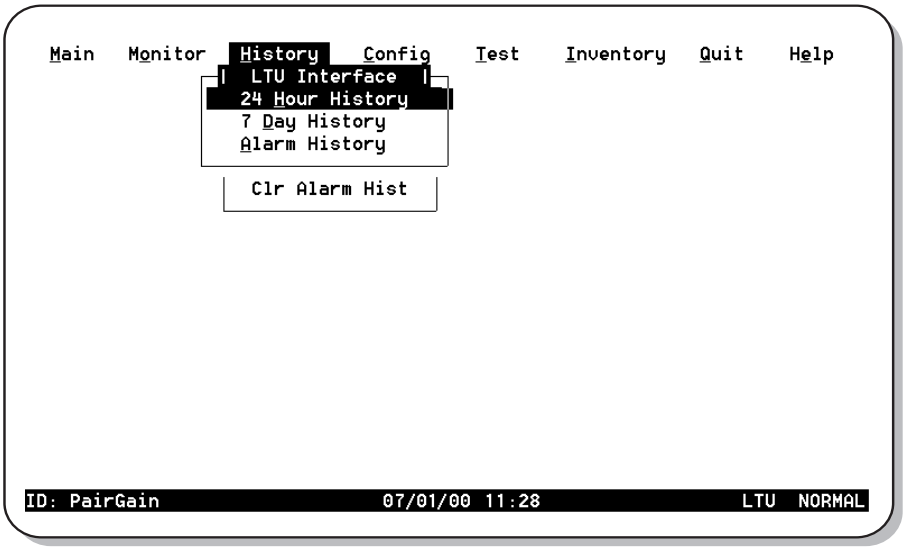

Figure 35. *History LTU Interface Menu*

At the *History* menu (Figure 34), type N to select the *History NTU Interface* menu (Figure 36).

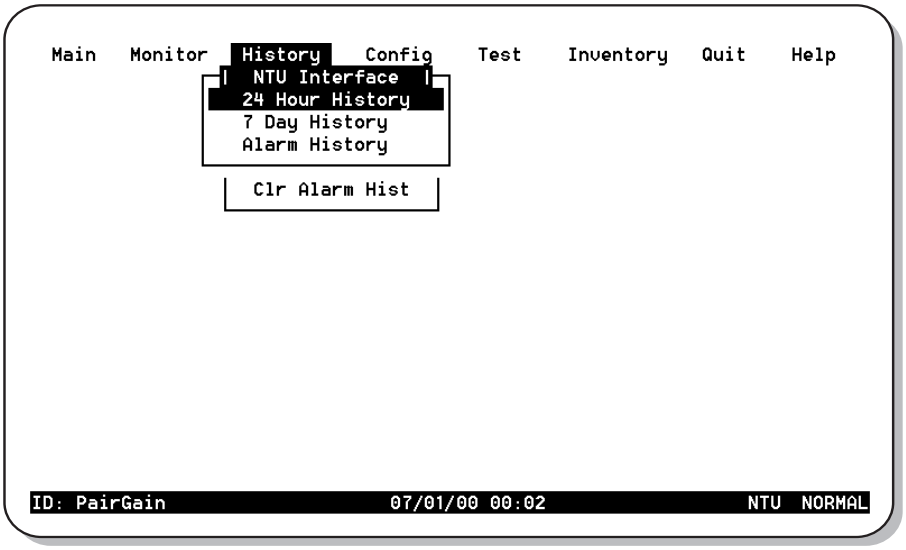

Figure 36. *History NTU Interface Menu*

Only the Alarm History screen is available for the LTU and NTU interfaces. The 24 Hour and 7 Day History screens, as well as the Alarm History screen, are available for HDSL Span 1.

LTU and NTU Interface Alarm History Screens

At the *History LTU* or *History NTU Interface* menu, type the **A** key to select an *Alarm History* status screen. The *LTU Interface Alarm History* screen is shown in Figure 37.

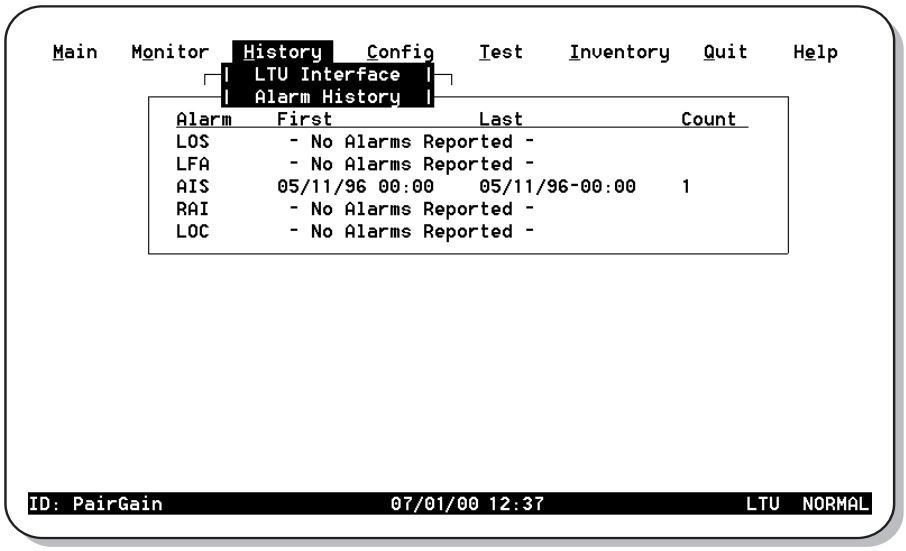

Figure 37. *LTU Interface Alarm History Screen*

Table 27 describes the four columns of data contained in the LTU Interface and NTU Interface Alarm History screens. If no alarm has occurred since the last alarms were cleared, the message "No alarms reported" displays on the appropriate line for each alarm.

Table 27. *LTU Interface and NTU Interface Alarm History Data*

Column	Description
Alarm	Type of alarm: LOS, LFA, AIS, RAI, and LOC
First	Date and time the alarm first occurred
Last	Date and time the alarm last occurred
Count	Number of times the alarm has occurred since the alarms were last cleared

(a) Not available on Nx64k serial data port units.

HDSL Span Performance History Screens

At the *History* menu (Figure 34), type 1 to select the *History HDSL Span 1* menu (Figure 38).

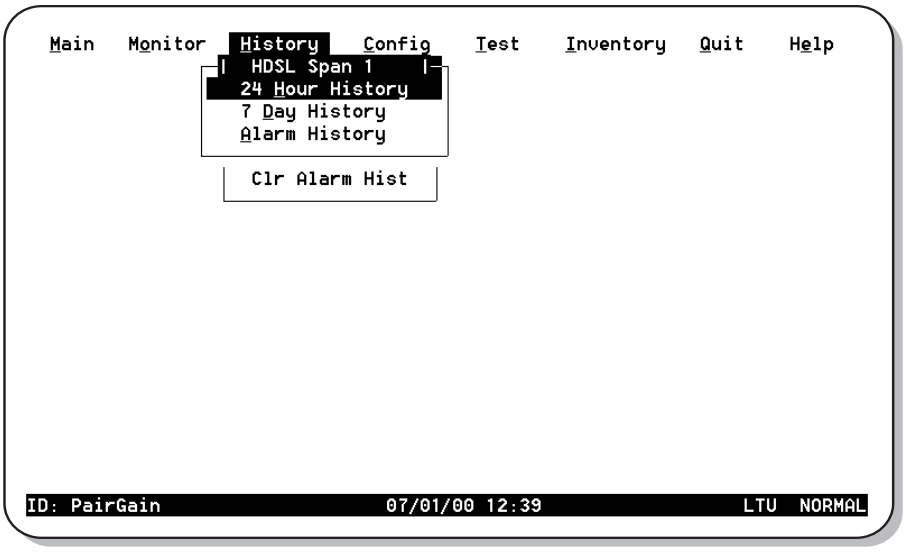

Figure 38. *History HDSL Span 1 Menu*

The *History HDSL Span 1* menu contains three viewing options:

- 24 Hour History
- 7 Day History
- Alarm History

HDSL Span 1 24 Hour History Screen

At the *History HDSL Span 1* menu (Figure 38), type H to select the *24 Hour History* screen for HDSL Span 1 (Figure 39).

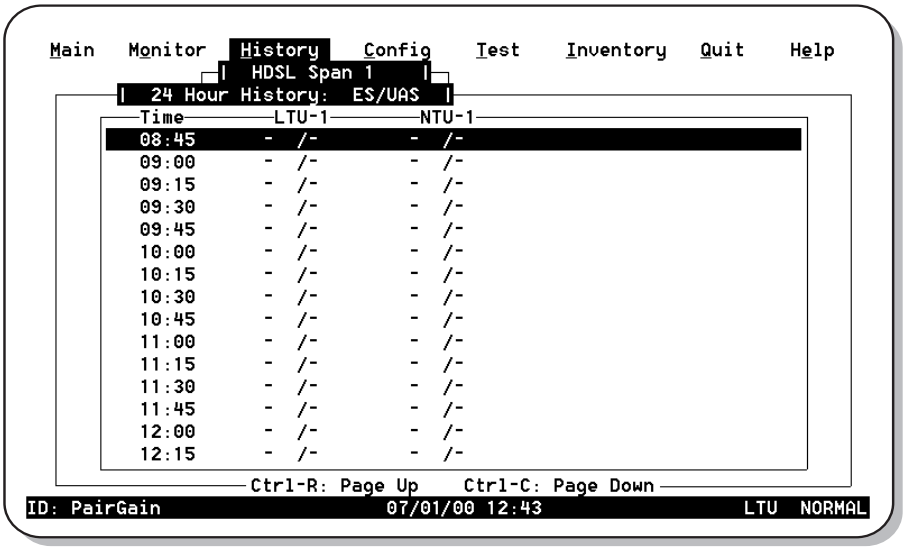

Figure 39. *24 Hour History Screen for HDSL Span 1*

The *24 Hour History* screen for *HDSL Span 1* contains three columns of data that show (from left to right) the:

- Starting time of each 15-minute interval.
- Number of ES/UAS at the LTU end of the HDSL span (LTU-1) for each interval. A dash (-) represents a count of zero.
- Number of ES/UAS at the NTU end of the HDSL span (NTU-1) for each interval. A dash (-) represents a count of zero.

The entire display consists of six screens, each showing sixteen 15-minute intervals (4 hours) of performance history.

Type CTRL+R or CTRL+C to display the previous or next screen in the sequence, respectively. Press the ↑ or ↓ key to scroll the screen up or down by one line, respectively.

7 Day HDSL Span 1 Performance History Screens

At the *History HDSL Span 1* menu (Figure 38), type D to select the *7 Day History* status screen for HDSL Span 1 (Figure 40).

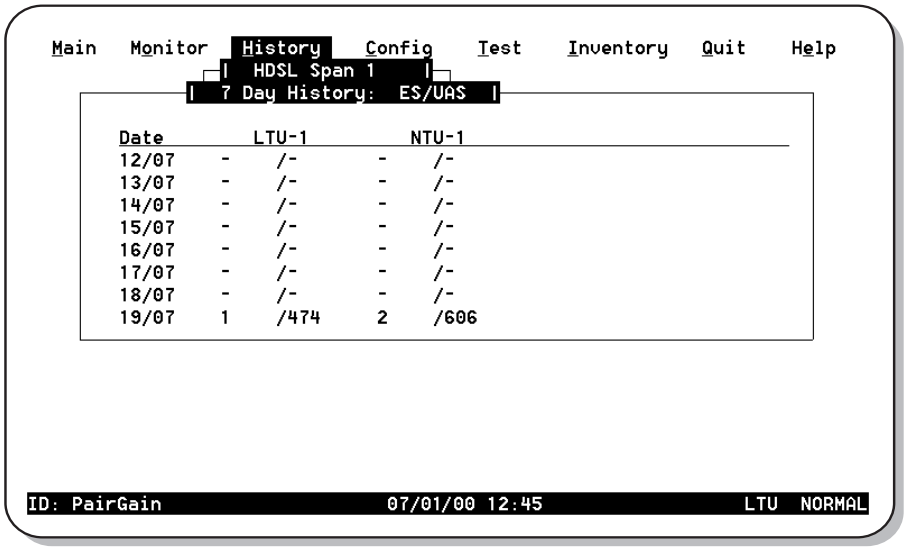

Figure 40. *7 Day History Status Screen for HDSL Span 1*

Each HDSL Span 7-Day History screen contains three columns of data showing (from left to right) the:

- date of each completed day within the 7-day interval
- number of ES/UAS at the LTU end of the HDSL span (LTU-1) for each interval. A dash (-) represents a count of zero
- number of ES/UAS at the NTU end of the HDSL span (NTU-1) for each interval. A dash (-) represents a count of zero

HDSL Span 1 Alarm History Screens

At the *History HDSL Span 1* menu (Figure 38), type **A** to select the *Alarm History* status screen for HDSL Span 1 (Figure 41).

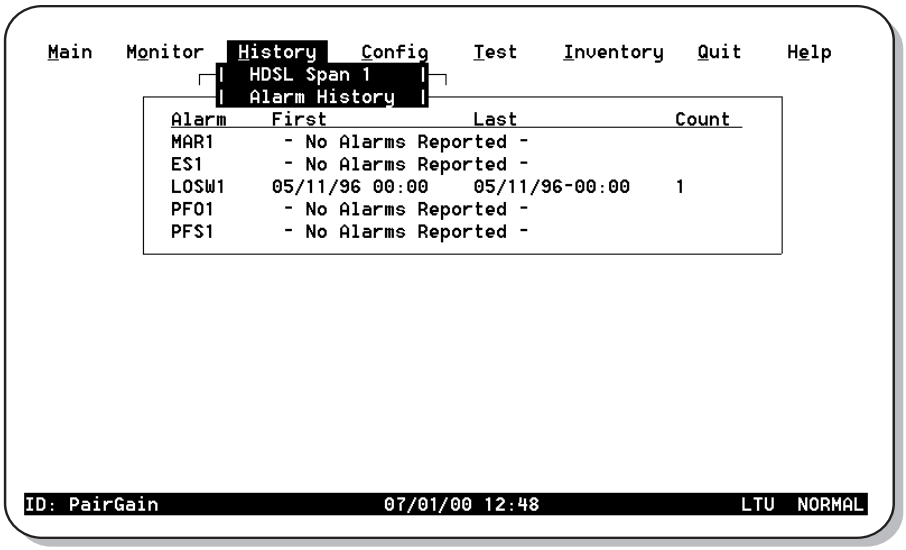

Figure 41. *Alarm History Status Screen for HDSL Span 1*

Table 28 describes the four columns of data contained in each HDSL Span Alarm History screen.

Table 28. *HDSL Span Alarm History Data*

Column	Description
Alarm	Type of alarm: MAR1 (Margin Span 1), ES1 (Errored Seconds Span 1), LOSW1 (Loss of Sync Word Span 1), PFO1 [(a)] (Power Feed Open Span 1), PFS1 [(a)] (Power Feed Short Span 1)
First	Date and time the alarm first occurred
Last	Date and time the alarm last occurred
Count	Number of times the alarm has occurred since the alarms were last cleared

(a) Not supported. These units do not supply power to other units.

If no alarm has occurred since the last alarms were cleared, the message "No alarms reported" displays on the appropriate line for each alarm.

Clear History Screens

Use the following options to clear the 24 Hour, 7 Day, or Alarm History status screens:

- Clr 24 Hr Hist: clears all of the 24-hour history error counters
- Clr 7 Day Hist: clears all of the 7-day history error counters
- Clr Alarm Hist: clears all alarm history logs

To clear the status screens:

1Select the alarm history option to be cleared with the ↑ and ↓ keys, then press ENTER. The following confirmation message displays:

```
ALL (24-HOUR, or 7 DAY, or ALARM) HISTORIES WILL BE CLEARED. CONTINUE (Y/N)?
```

2Do one of the following:

- Type N to cancel the operation.
- Type Y to clear the screen. Typing Y displays the following confirmation message:

  ```
  24-HOUR HISTORIES CLEARED
  ```

INVENTORY SCREEN

The Inventory screen permits tracking of the system's inventory, service, and revision state. Table 29 on page 59 describes the fields displayed in each Inventory screen. Type I to display the Inventory screen (Figure 42).

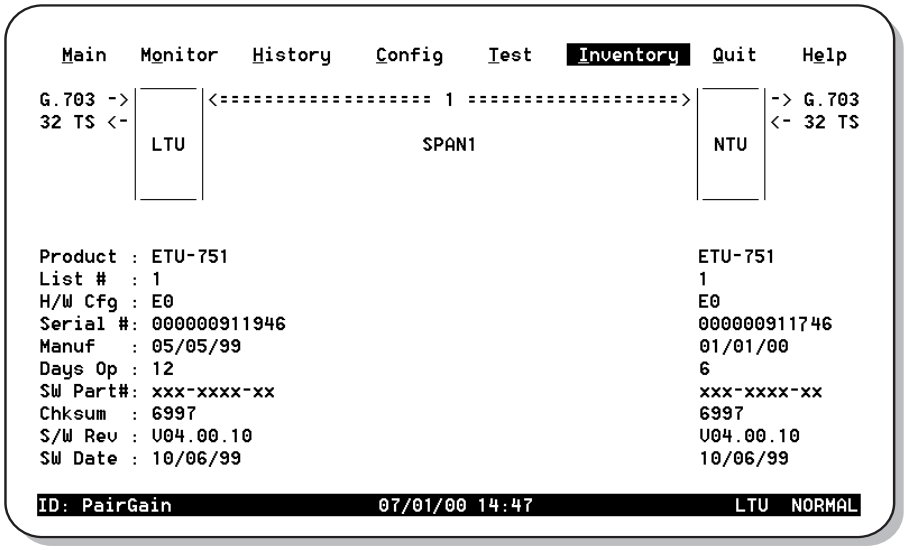

Figure 42. *Inventory Screen*

Table 29. *Inventory Screen Data*

Field	Description
Network Diagram	Displays the configuration of the LTU or NTU circuit.
Product	Displays the model numbers of the LTU, NTU, and any doubler units that comprise the channel.
List #	Displays the LTU, NTU, and doubler unit list numbers, which identify the particular unit versions.
H/W Cfg	Displays the LTU, NTU, and doubler unit hardware configuration level.
Serial #	Displays the unique serial number of the LTU, NTU and any doubler units for inventory and service tracking.
Manuf	Displays the date the LTU, NTU, and any doubler units were manufactured.
Days Op	Displays the number of days the LTU, NTU, and any doubler units have been in operation.
SW Part #	Displays the ADC part number of the firmware.
Chksum	Displays the checksum of the LTU, NTU, and doubler unit proms.
S/W Rev	Displays the currently installed firmware version level of the LTU, NTU and any doubler units.
SW Date	Displays the date that the firmware was released.

TESTING

From the main console screen (Figure 29), type T to display the *Test* menu from which you can set and run loopback and BER tests (Figure 43).

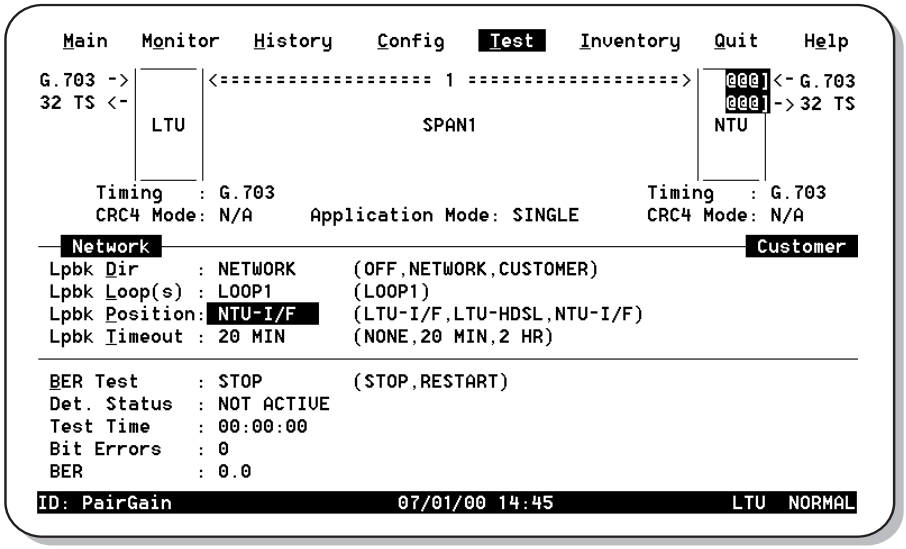

Figure 43. *Test Menu Screen*

Table 30 on page 61 lists the *Test* menu options. Table 31 lists the fields displayed in the Bit Error Rate (BER) section of the test menu.

Loopbacks remain active until the timeout elapses or the configuration changes. The loopback location and status are indicated on the network diagram portion of the test menu, with "@@]"characters as follows:

- Flashing reverse video for active loopbacks
- Solid reverse video for disabled loopbacks

Front panel loopback (LPBK) LED indications are described in Table 4 on page 6. See page 19 for a description of loopbacks.

Table 30. *Test Menu Options*

Operating Option	Default Setting
Network Diagram	Shows the loopback position and direction when the loopback is enabled and active.
Lpbk Dir	Selects one of three loopback direction modes:
OFF	No loopbacks are active.
NETWORK	The loopback selected in Loopback Position is directed toward the network equipment connected to the LTU.
CUSTOMER	The loopback selected in Loopback Position is directed toward the customer's equipment connected to the NTU.
Lpbk Loop(s)	Selects the loops used in the loopback test:
NONE	Option not available with single-pair HDSL card.
Lpbk Position	Selects the possible loopback positions:
NONE	Option not available with single-pair HDSL card.
Lpbk Timeout	Selects one of three loopback timeouts:
NONE	Disables automatic timeout cancellation of all loopbacks.
20	Automatically cancels any loopback 20 minutes after initiation.
120	Automatically cancels any loopback 120 minutes after initiation.

Table 31. *BER Section of Test Menu*

Field	Description
BER Test	Selects the state of the BER test.
STOP	Terminates the current test and resumes normal transmission of user payload. Prior BER tests are maintained for reference on the screen. *STOP* must be selected to terminate the BER test prior to exiting the screen.
RESTART	Begins BER test. This disrupts user payload traffic and inserts a pseudo-random bit sequence (PRBS) at the LTU toward the NTU. The actual pattern used is a $2x10^{15}$ pattern as defined by reselecting this option (pressing the ENTER key) while the test is running. This entry reinitiates the BER values and restarts the test.
Det. Status	Displays the current status of the BER detector at the LTU.
NOT ACTIVE	Displays while the BER is not running.
SYNCING	Indicates that the BER qualification period is in progress (128 received bits are compared to the PRBS).
IN SYNC	Indicates that the BER test is in progress. The BER meter accumulates errors once per test interval (16 seconds). In a high bit error environment the test interval is shortened and the BER meter is updated every second.
Test Time	Displays the elapsed test time for the BER test.
Bit Errors	Displays the number of bits received that did not match the PRBS pattern. This field is updated every 30 seconds, with a maximum value of 255 per update.
BER	Displays the Bit Error Rate computer for the current test. This field is updated very 16 seconds, as is displayed in exponential form. The lowest positive displayable value is $1x10^{-11}$.

FIRMWARE DOWNLOAD UTILITY

The Firmware Download Utility is a separate program and is not available from the console screen menus.

This section describes the ETSI Firmware Download utility and how to use it to upgrade the line and desktop unit firmware. The ETSI Firmware Download utility is a program you can run on a PC to download new firmware to the LTU or NTU by connecting a standard RS-232 interface cable to the unit front panel V.24 console port. When using the ETSI Firmware Download utility, follow these rules:

- Make sure the destination unit where the new firmware is to be upgraded is correct before pressing the ENTER key.
- Do not disconnect the interface cable during the download process.
- Do not abort the download once it has started.

Figure 44 shows the menu for the ETSI Firmware Download Utility. The upper area of the ETSI Firmware Download Utility menu displays the configuration options, and the lower area displays messages during the download process.

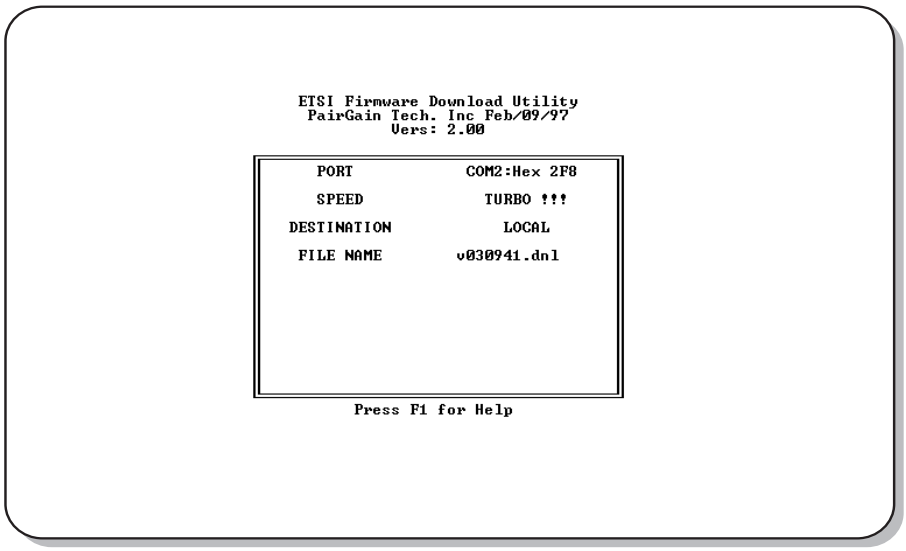

Figure 44. *ETSI Firmware Download Utility Menu*

Initiate the Download and Navigate the Menus

To initiate the download process, go to the DOS prompt and type: `dnl.` Table 32 describes ETSI Firmware User Selectable Download Menu Options.

Table 32. *ETSI Firmware User Selectable Download Menu Options*

Option	Description
PORT	Provides support for two communication ports: COM1 at Hex 3F8 COM2 at HEX 2F8
SPEED	Supports *Standard* (9600 bit/s), *Medium* (19.2K kbps), *Fast* (38.4 kbps), *Faster* (57.6 kbps) and *TURBO* (115.2 kbps) speeds. The number of data bits is fixed at 8, with no parity and 1 stop bit.
DESTINATION	The destination can be set to one of the following: *LOCAL* (unit connected to the maintenance terminal) *LTU* (LTU unit) *NTU* (NTU unit) *NTU2* (NTU2 unit, in case of point-to-multipoint download) *REGENERATOR1* *REGENERATOR2*
FILE NAME[(a)]	Enter the firmware download file name.

(a) FILE NAME can be changed by pressing the DEL key, then typing the new file name. Once in the FILE NAME field, the download setup can be aborted only by typing CTRL + C. After typing the new file name, press the ENTER key to start the download sequence.

Table 33 describes how to navigate within the ETSI Firmware Download menu.

Table 33. *Navigating the ETSI Firmware Download Menu*

Keystroke	Result
PAGE UP or PAGE DOWN	Change a setting, with the exception of the FILE NAME setting.
↑ and ↓	Move from field to field.
ESC	Abort setup and returns to the DOS prompt.
ENTER	Start the download process.

Download progress messages include:

- program size
- download time
- program checksum
- line-unit response
- time out message (posted if the line unit does not response within five seconds; when this occurs, the download operation is aborted).

While downloading, the line or desktop unit front panel LEDs all light, then a binary count sequence indicates progress. When downloading is complete, the unit resets.

REFERENCE INFORMATION

This section lists the pinouts for the ETU-751C rear panel connectors and the ECA-80x connector adapters.

ETU-751C CONNECTOR PINOUTS

The pinouts for the ETU-751C rear panel connectors are listed in Table 34 and Table 35.

Table 34. *D9F HDSL Line Connector Pinouts*

Pin [(a)]	Signal	Description
4	HDSL_RING_A	HDSL Loop 1 (Ring)
9	HDSL_TIP_A	HDSL Loop 1 (Tip)
1	HDSL_RING_B	HDSL Loop 2 (Ring)
6	HDSL_TIP_B	HDSL Loop 2 (Tip)

(a) All other pins are not used. Pins 1 and 6 not used on single-pair HDSL cards.

Table 35. *D25F Data Port Connector Pinouts*

Pin [(a)]	Signal Name	V.35	V.36	X.21	DCE Input/Output
7	Signal Ground	SG	SG	SG	
2 14	Send Data	SD_A SD_B	SD_A SD_B	T_A T_B	Input
3 16	Receive Data	RD_A RD_B	RD_A RD_B	R_A R_B	Output
15 12	Send Timing	SCT_A SCT_B	ST_A ST_B	S_A S_B	Output
17 9	Receive Timing	RCT_A RCT_B	RT_A RT_B	not used	Output
24 11	Terminal Timing	SCTE_A SCTE_B	TT_A TT_B	TT_A TT_B	Input
5 13	Clear to Send	CTS	CTS	not used	Output
6 22	Data Set Ready	DSR	DSR	not used	Output
8 10	Received Line Signal Detect	RLSD	RLSD	I_A I_B	Output
25	Test Mode	TM	TM	not used	Output
4 19	Request to Send	RTS	RTS	C_A C_B	Input
20 23	Data Terminal Ready	DTR	DTR	not used	Input
18	Local Loopback	LL	LL	not used	Input
21	Remote Loopback	RL	RL	not used	Input

(a) All other pins are not used.

ECA-800 CONNECTOR ADAPTER (DB25M TO M34F FOR V.35)

The ECA-800 connector adapter (Figure 45) converts the DB25F data port connector on the desktop unit rear panel to a standard V.35 34-pin female connector. Table 36 lists the ECA-800 pinouts.

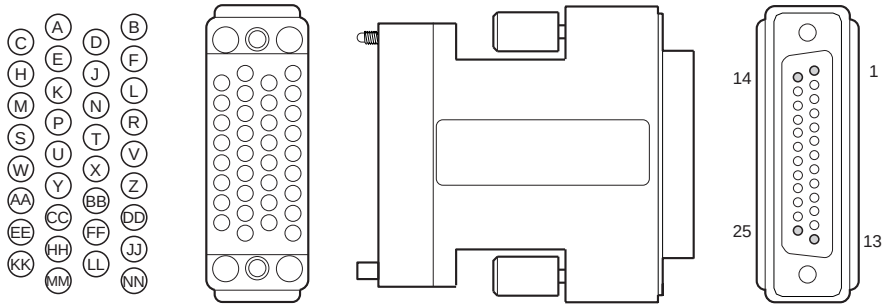

Figure 45. *ECA-800 DB25M to M34F (V.35) Connector Adapter, Part Number 150-1470-01*

Table 36. *ECA-800 DB25M to M34F (V.35) Connector Adapter Pinouts*

DB25M Connector		M34F (V.35) Connector	
Signal	**Pin**	**Pin**	**Signal**
Shield	1	A	Frame ground
Send Data A	2	P	Send Data A
Send Data B	14	S	Send Data B
Receive Data A	3	R	Receive Data A
Receive Data B	16	T	Receive Data B
Request to Send A	4	C	Request to Send
Clear to Send A	5	D	Clear to Send
Data Set Ready A	6	E	Data Set Ready
Data Terminal Ready A	20	H	Data Terminal Ready
Signal Ground	7	B	Signal Ground
Received Line Signal Detect A	8	F	Received Line Signal Detect
Send Timing A	15	Y	Serial Clock Transmit A
Send Timing B	12	AA	Serial Clock Transmit B
Receive Timing A	17	V	Serial Clock Receive A
Receive Timing B	9	X	Serial Clock Receive B
Terminal Timing A	24	U	Serial Clock Transmit External A
Terminal Timing B	11	W	Serial Clock Transmit External B
Local Loopback	18	L	Local Loopback
Remote Loopback	21	N	Remote Loopback
Test Mode	25	NN	Test Mode

ECA-801 CONNECTOR ADAPTER (DB25M TO DB15F FOR X.21)

The ECA-801 connector adapter (Figure 46) converts the DB25F data port connector on the desktop unit rear panel to a standard X.21 15-pin female connector. Table 37 lists the ECA-801 pinouts.

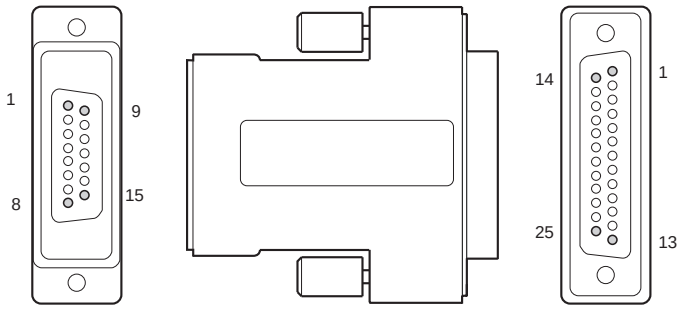

Figure 46. *ECA-801 D25M to DB15F (X.21) Connector Adapter, Part Number 150-1470-01*

Table 37. *ECA-801 DB25M to DB15F (X.21) Connector Adapter Pinouts*

DB25M Connector		DB15F (X.21) Connector	
Signal	**Pin**	**Pin**	**Signal**
Send Data A	2	2	Send Data A
Send Data B	14	9	Send Data B
Receive Data A	3	4	Receive Data A
Receive Data B	16	11	Receive Data B
Request to Send A	4	3	Control A
Request to Send B	19	10	Control B
Signal Ground	7	8	Signal Ground
Receive Line Signal Detect A	8	5	Indication A
Receive Line Signal Detect B	10	12	Indication B
Receive Timing A	17	6	Signal Element Timing A
Receive Timing B	9	13	Signal Element Timing B
Terminal Timing A	24	1	DTE Signal Element Timing A
Terminal Timing B	11	15	DTE Signal Element Timing A

ECA-802 CONNECTOR ADAPTER (DB9M TO RJ-45)

The ECA-802 connector adapter (Figure 47) converts the DB9F HDSL line connector on the desktop unit rear panel to an RJ-45 modular style connector. Table 38 lists the ECA-802 pinouts.

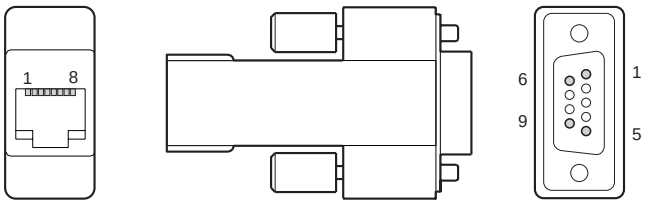

Figure 47. *ECA-802 DB9M to RJ-45 Connector Adapter, Part Number 150-1472-01*

Table 38. *ECA-802 DB9M to RJ-45 Connector Adapter Pinouts*

DB9M Connector		RJ-45 Connector	
Signal	**Pin [a]**	**Pin [a]**	**Signal**
HDSL Loop 1 (Ring)	4	1	HDSL Loop 1 (Ring)
HDSL Loop 1 (Tip)	9	2	HDSL Loop 1 (Tip)
HDSL Loop 2 (Ring)	1	4	HDSL Loop 2 (Ring)
HDSL Loop 2 (Tip)	6	5	HDSL Loop 2 (Tip)

(a) Pins 1, 6, 4, and 5 not used on single-pair HDSL cards.

ECA-804 CONNECTOR ADAPTER (DB9M TO FOUR-POSITION TERMINAL BLOCK)

The ECA-804 connector adapter (Figure 48) converts the DB9F HDSL line connector on the desktop unit rear panel to a four-position terminal-block style connector. Table 39 lists the ECA-804 pinouts.

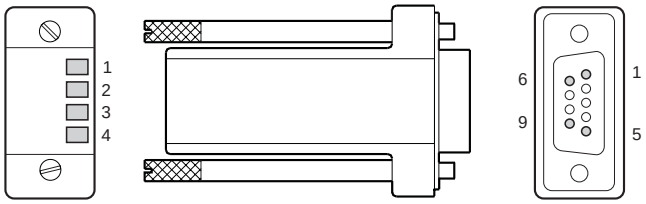

Figure 48. *ECA-804 DB9M to Four-Position Terminal Block Connector Adapter, Part Number 150-1474-01*

Table 39. *ECA-804 DB9M to Four-Position Terminal Block Connector Adapter Pinouts*

Four-Position Terminal Block		D9M Connector	
Signal	**Pin [(a)]**	**Pin [(a)]**	**Signal**
HDSL Loop 1 (Ring)	1	4	HDSL Loop 1 (Ring)
HDSL Loop 1 (Tip)	2	9	HDSL Loop 1 (Tip)
HDSL Loop 2 (Ring)	3	1	HDSL Loop 2 (Ring)
HDSL Loop 2 (Tip)	4	6	HDSL Loop 2 (Tip)

(a) Pins 3, 4, 1, and 6 not used on single-pair HDSL cards.

PRODUCT SUPPORT

ADC Customer Service Group provides expert pre-sales and post-sales support and training for all its products.

Technical support is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center at the number listed below.

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Product Return Department 800.366.3891 ext. 73748 (USA and Canada) or 952.917.3748 Fax: 952.917.3237 Email: repair&return@adc.com	• ADC Return Material Authorization (RMA) number and instructions must be obtained before returning products.
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ABBREVIATIONS

AIS	Alarm Indication Signal
ALM	Alarm
ANSI	American National Standards Institute
AWG	American Wire Gage
BER	Bit Error Rate
C	Centigrade
COM	Communication
CRC	Cyclic Redundancy Check
CTS	Clear To Send
D15F	D-type 15-pin Female Connector
D25F	D-type 25-pin Female Connector
D9F	D-type 9-pin Female Connector
dB	Decibel
DCE	Data Communications Equipment
Det	Detector
dnl	Download
DS0	Digital Service, Level 0 (64 kbps)
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EMC	Electromagnetic Compliance
EMI	Electromagnetic Interference
EMS	Exchange Office Management Shelf
EMU	Exchange Office Management Unit
ES	Errored Second
ETR	ETSI Technical Report
ETSI	European Telecommunications Standards Institute
ETU	ETSI Termination Unit
EXT	External
H/W	Hardware
HDSL	High-bit-rate Digital Subscriber Line
Hz	Hertz
I/F	Interface
ID	Identification
INT	Internal
kbps	kilobytes per second
km	kilometers
LED	Light Emitting Diode
LL	Local Loopback
LOC	Local
LOC	Loss of Clock
LOSW	Loss of Sync Word
LPBK	Loopback
LTU	Line Termination Unit
M34F	M-type 34-pin Female Connector
MAR	Margin
Mbps	Megabits per second
MHz	Megahertz
mm	millimeter
NC	Normally Closed
NO	Normally Open
NTU	Network Termination Unit
NVRAM	Non-volatile Random Access Memory
Nx64k	Number (N) of 64 kbps DS0 time slots mapped to a data port.
Op	Operation
PFO	Power Feed Open
PFS	Power Feed Short
ppm	pulse per minute
PRBS	Pseudorandom Bit Sequence
RAM	Random Access Memory
REM	Remote
RL	Remote Loopback
RLSD	Received Line Signal Detector
RTS	Ready to Send
S/W	Software
SD	Transmit Data
ST	Send Timing
SYNC	Synchronization
TM	Test Mode
TT	Terminal Timing
UAS	Unavailable Seconds
UTU	Universal Termination Unit
V	Volts
Vdc	Volts direct current
VT100	A terminal-emulation system
W	Watts

CERTIFICATION AND WARRANTY

DIRECTIVE EN300 386-2 COMPLIANCE

To indicate compliance with EN300 386-2, these products have been affixed with the CE mark.

LIMITED WARRANTY

ADC DSL Systems, Incorporated (“ADC”) warrants that, for a period of sixty (60) months from the date of shipment, the hardware portion of its products will be free of material defects and faulty workmanship under normal use. ADC's obligation, under this warranty, is limited to replacing or repairing, at ADC's option, any such hardware product which is returned during the 60-month warranty period per ADC's instructions and which product is confirmed by ADC not to comply with the foregoing warranty.

ADC warrants that, for a period of 90 days from the date of purchase, the software furnished with its products will operate substantially in accordance with the ADC published specifications and documentation for such software. ADC’s entire liability for software that does not comply with the foregoing warranty and is reported to ADC during the 90-day warranty period is, at ADC’s option, either (a) return of the price paid or (b) repair or replace of the software. ADC also warrants that, for a period of thirty (30) days from the date of purchase, the media on which software is stored will be free from material defects under normal use. ADC will replace defective media at no charge if it is returned to ADC during the 30-day warranty period along with proof of the date of shipment.

The transportation charges for shipment of returned products to ADC will be prepaid by the Buyer. ADC will pay transportation charges for shipment of replacement products to Buyer, unless no trouble is found (NTF), in which case the Buyer will pay transportation charges.

ADC may use reconditioned parts for such repair or replacement. This warranty ***does not*** apply to any product which has been repaired, worked upon, or altered by persons not authorized by ADC or in ADC's sole judgment has been subjected to misuse, accident, fire or other casualty, or operation beyond its design range.

Repaired products have a 90-day warranty, or until the end of the original warranty period—whichever period is greater.

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MODIFICATIONS

Any changes or modifications made to these devices that are not expressly approved by ADC DSL Systems voids the user's warranty.

All wiring external to the product should follow local wiring codes.

For technical assistance, refer to “Product Support” on page 20.

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Technical Assistance

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