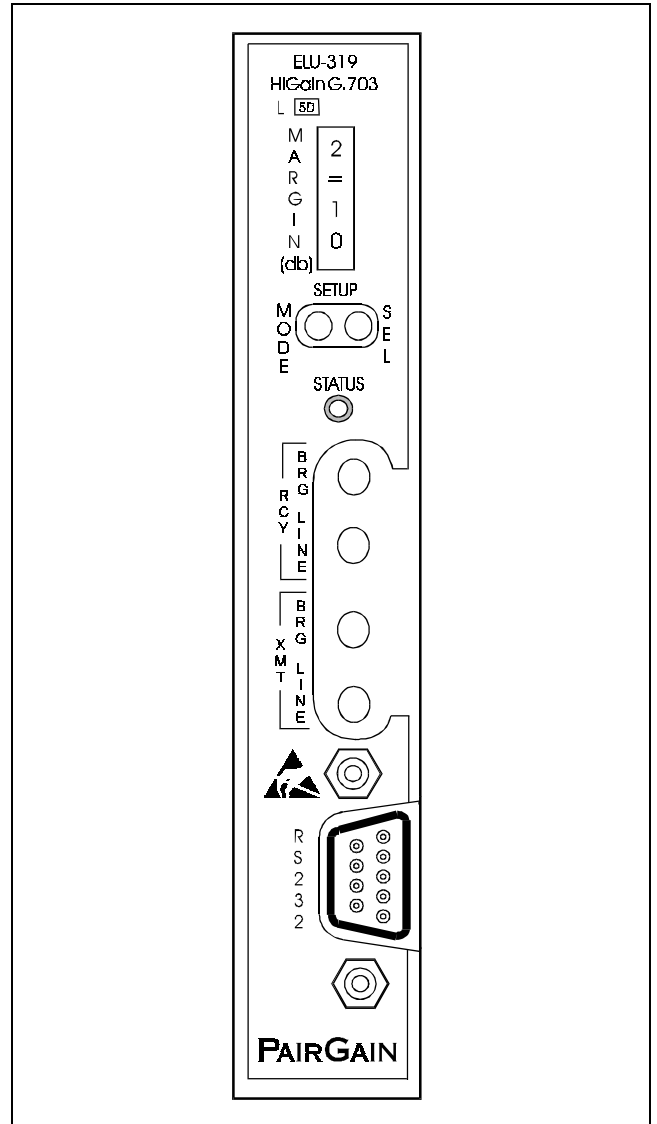


PAIRGAIN TECHNOLOGIES HiGAIN™ LINE UNIT MODEL ELU-319

List 5D, PairGain #150-1236-54 (75 Ohm)

List 6D, PairGain #150-1236-64 (120 Ohm)

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CAUTION

This product incorporates static sensitive components. Proper electrostatic discharge procedures must be followed.

Figure 1. ELU-319, List 5D and 6D Front Panel. The PairGain ELU-319, List 5D and 6D can be used in conjunction with the ERU-412 remote unit and either one or two EDU-451 doubler units to provide a complete HiGain HDSL system over extended distances.

A. GENERAL

1. INTRODUCTION

1.01 PairGain's HiGain Line Units Model ELU-319, Lists 5D and 6D (Figure 1), are the Public Exchange side of a repeaterless G.703 transmission system. When used with an ERU-412 HiGain Remote Unit (ERU), the system provides 2.048 Mbps transmission on two unconditioned copper pairs. The "D" designation in the list number indicates that this line unit can be used in doubler applications to line power one doubler and one ERU remote unit or two doublers. This is in contrast to the ELU-319 List 5 and 6 which can only line power one doubler or one ERU remote unit. The HiGain system uses HDSL (High-bit-rate Digital Subscriber Line) transmission technology as recommended by Bellcore TA-TSY-001210. HiGain complies with TR-TSY-000063 (Network Equipment Building System (NEBS) Generic Equipment requirements) and TR-TSY-000499 (Transport System Generic Requirements—TSGR) common requirements.

1.02 Revision History of this practice.

Revision 02—February 22, 1996

a) Numerous updates to tables, figures, also screen captures to include HiGain Doubler EDU-451.

1.03 The ELU-319 is compatible with the PairGain 22-slot HMS-318 shelf and the associated G.703 HiGain connector panel HCP-322.

1.04 ELU-319 Product Family:

- List 5D: 75-ohm G.703 Impedance
- List 6D: 120-ohm G.703 Impedance

1.05 ELU-319 Issue 1 features:

- -130V dc or -200V dc line power for ERU-412 or EDU-451
- **Optimal symmetric or ?symmetric HDSL line voltage**
- Four-digit front panel display for HDSL signal/noise (S/N) margin, configuration, and alarms
- RS-232 maintenance port
- Non-volatile configuration memory
- Front panel splitting and bridging access to G.703 interface
- Lightning and power cross protection on HDSL interfaces

- 1040 kbps full-duplex two-bits one-quaternary (2B1Q) HDSL transmission on each of two pairs
- Front panel status-indicating light-emitting diode (LED) indicator
- On / Off front-panel display power cycling
- G.703 Loss of Signal (LOS) detector (125 consecutive zeros)
- Margin threshold alarm
- Single step default setting option
- Circuit ID option
- Improved tolerance to cable noise
- Line powers two EDU-451 doublers or one EDU and ERU.

TABLE 1. HDSL CABLE LOSS

Cable Gauge	Loss @ 260 kHz(db/km)	Ohms per km
26/0.4 mm	13.94	272
24/0.51 mm	10.47	171
22/0.61 mm	8.14	105
19/0.91 mm	5.74	52

TABLE 2. HIGAIN E1 RANGES (KM) ON UNIMPAIRED CABLES VS AVERAGE MARGIN(M) IN DB

Cable Gauge	M = 11	M = 7	M = 3
0.4 mm / #26 AWG	2.7 km	3.0 km	3.3 km
0.51 mm / #24 AWG	3.6 km	4.0 km	4.4 km
0.61 mm / #22 AWG	4.7 km	5.2 km	5.7 km
0.81 mm / #19 AWG	6.6 km	7.3 km	8.0 km

2. APPLICATIONS

2.01 The HiGain System provides a cost-effective, easy-to-deploy method for delivering G.703 High Capacity Digital Service (HCDS) over metallic pairs. The fiber-like quality service is deployed over two unconditioned, non-loaded copper pairs. Conventional span repeaters are not required. Cable pair conditioning, pair separation and bridged tap removal, are also not required.

2.02 The HiGain system operates with any number of other G.703, Plain Old Telephone System (POTS), digital or analog data service or other HiGain Systems sharing the same cable binder group. HiGain provides a means of quickly deploying service in advance of fiber-optic transmission systems. By using HiGain G.703, you can connect service within a few days or even a few hours. You can install fiber optic systems at a leisurely pace and cut-over from HiGain when the time allows. You can then easily remove the HiGain and utilize it elsewhere.

2.03 Table 1 provides a guide for the loss of various cable gauges at the HDSL line rate of 260 kHz and 135 ohms. The table applies to the

HDSL cable pairs between the ELU and the EDU-451 as well as between the EDU-451 and a second EDU-451 or the ERU-412. Add 3 dB for each bridged tap and 1 dB for each cable gauge change.

2.04 The ELU to ERU operating ranges, on unimpaired cable pairs, are shown in Table 2 as a function of cable gauge and average margin.

2.05 The ELU-319, List 5D and 6D line units support both one and two doubler applications. For two doubler applications the ERU must be locally powered. For one doubler applications both the EDU and ERU can be line powered.

3. FUNCTIONAL OPERATION

3.01 HiGain utilizes PairGain's 2-Bits-1-Quaternary (2B1Q) HDSL transceiver systems to establish two full-duplex 1040 Kbps data channels between the ELU-319 and an ERU-412 HiGain Remote Unit or EDU-451 doubler unit. This provides a total capacity of 2.080 Mbps between the two units: 2.048 Mbps for the G.703 interface and 32 Kbps of overhead.

3.02 A block diagram of the ELU-319 is shown in Figure 2. The HiGain ELU-319 receives a 2.048 Mbps data stream from the G.703 digital cross-connect interface.

3.03 The ELU-319 contains a demultiplexer that generates two parallel 1040 kbps data streams. Each data stream consists of HDSL frames that are nominally 4704 bits (4.5 milliseconds) in length. Each frame contains a 14-bit Frame Sync Word (FSW), a 6-bit Cyclic Redundancy Check (CRC), a 21-bit operations channel and 16 of the 32 G.703 timeslots. The demultiplexer provides frame synchronization for each of the two HDSL channels. The multiplexer and HDSL transceivers work under control of the ELU-319 microprocessor and compensate for data inversions caused by tip-ring reversals and for channel swaps caused by pair reversals. The HiGain system tolerates tip-ring reversals, HDSL cable pair reversals but does not tolerate split pairs.

3.04 The two formatted HDSL channels pass to the HDSL transceivers, which convert them to 2B1Q format. The 2B1Q line code operates in full-duplex mode on unconditioned pairs. The transceiver's digital echo cancelers and adaptive equalizers receive the signal from the remote end in the presence of impairments and noise on the

copper pairs. Each of the two HDSL channels contain 16 G.703 timeslots. **3.05** The transceiver processes the HDSL channels it receives and passes them on to the ELU-319 multiplexer. The multiplexer removes data link messages from the HDSL channels and passes them to the microprocessor. This enables the ELU-319 and the ERU-412 Remote Unit to exchange operations messages and status. By synchronizing to the FSW of each channel, the multiplexer can reconstruct the original 2.048 Mbps G.703 stream from the payloads of the two HDSL channels. The CRC fields on the HDSL streams enable the ELU-319 to determine if errors are present on the channel due to excessive impairments caused by impulse or crosstalk noise.

3.06 The reconstructed HDSL data channel is buffered in a first-in-first-out (FIFO) buffer within the multiplexer. A frequency synthesizer in conjunction with the buffer regulates the output bit rate and reconstructs the G.703 clock at the exact rate received from the remote end. The HiGain system operates at G.703 rates of 2.048 Mbps with up to ± 50 ppm of offset.

3.07 A G.703 interface driver converts the G.703 channel to a High Density Bipolar 3 (HDB3) format.

3.08 The transmit and receive G.703 ports have splitting access and bridging "Bantam"-type jacks. Connecting one cable between the two BDG jacks and another between the two LINE jacks splits the XMT and RCV, creating metallic loopbacks towards the customer equipment and HDSL line.

3.09 The ELU-319 contains two separate power converters. The main power supply converts -48V local battery to logic power for the ELU-319 circuits. The line power supply converts the -48V battery to either -130V for non-doubler applications or -200V for doubler applications **there** provides simplex power feed on the HDSL loops. The line power can be turned on or off by the microprocessor and automatically shuts down in the presence of line short-circuits or microprocessor failure.

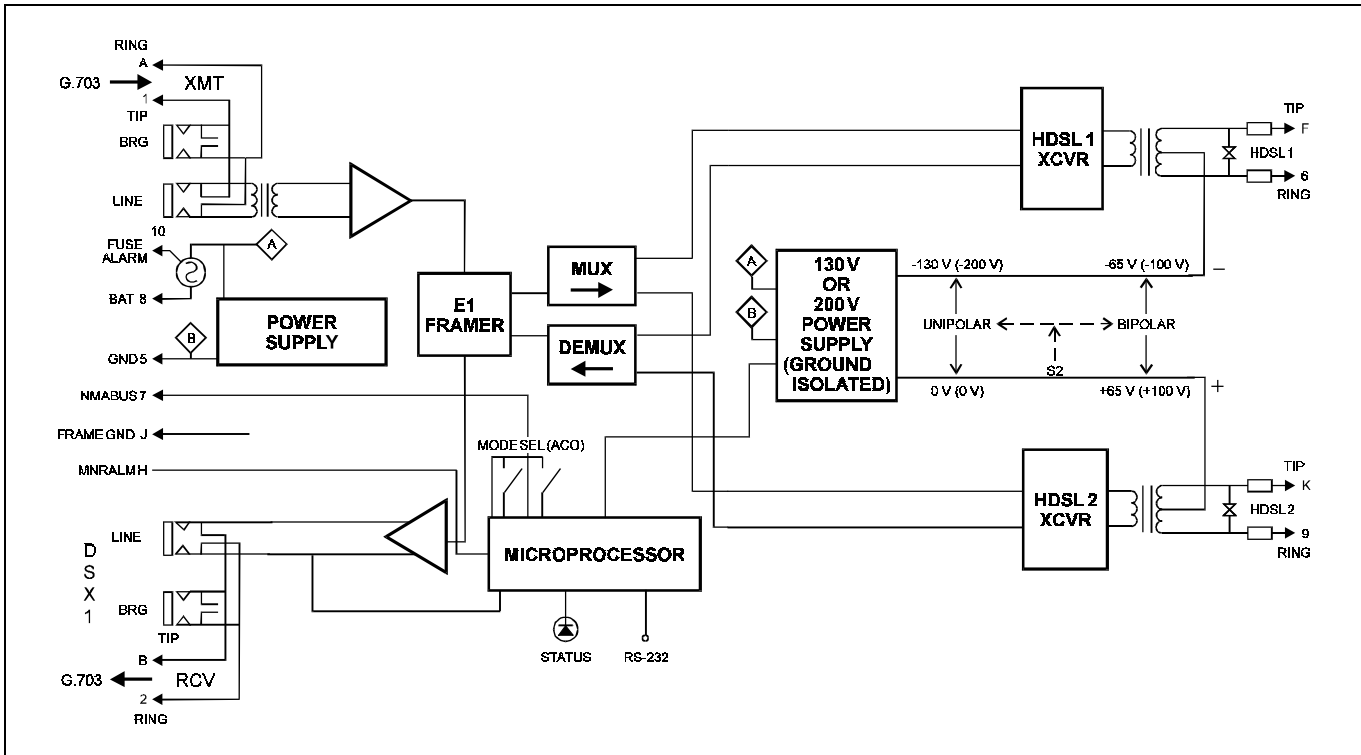


Figure 2. ELU-319 Block Diagram. PairGain's HDSL technology provides full-duplex services at 2.048 Mbps over copper wires between an ELU-319 and an ERU-412 or EDU-451.

4. ALARMS

4.01 An RS-232 connector (DB-9) on the front panel provides access to HiGain maintenance, provisioning and performance monitoring interface. Basic functionality is available via a 'dumb terminal'. For 'dumb terminal' operation procedures, refer to Sections A.5.07 through A.5.11, B.3, and C.3.

4.02 Pin H of the ELU-319 is the minor alarm (MNRALM) output pin. This pin must never operate above 0V or below -60V. The ELU-319 forces pin H to ground (maximum of 10 mA) for any of the conditions listed below, with the accompanying front panel message in bold letters. More than one alarm condition can exist at any given time, but the unit can display only one message. For multiple alarms, only the highest priority alarm appears. The alarms are listed in their order of priority:

- 1) **ALRM LOSW**: Loss of synchronization in either HDSL loop.
- 2) **ALRM LLOS**: Loss of ELU-319 G.703 input signal.
- 3) **ALRM RLOS**: Loss of ERU-412 G.703 input signal.
- 4) **ALRM H1ES**: An HDSL Loop 1 transceiver has exceeded the 24-hour user-selected Errored-Seconds threshold.
- 5) **ALRM H2ES**: An HDSL Loop 2 transceiver has exceeded the 24-hour user-selected Errored-Seconds threshold.
- 6) **ALRM G.703**: The total number of bipolar violations (BPV) at the ELU or ERU G.703 inputs exceeded the 24-hour user-selected threshold.
- 7) **ALRM MAL1 (2)**: The margin on HDSL Loop 1 (Loop 2) has dropped below the Margin Alarm Threshold value set from the Maintenance Port menu.

4.03 Pin H (Figure 3) (MNRALM) of the ELU-319 remains grounded for the duration of the alarm condition. The ELU-319 **STATUS** LED flashes red for the duration of a minor alarm condition. You can retire the MNRALM by pressing the front panel **SEL**(ect) button, thus executing the

alarm cut-off (ACO) option. This turns the alarm off and replaces the ALRM message with ACO. The part of the message that defines the alarm remains until the alarm condition clears or another alarm occurs. Disabling the ALM also retires an ACO condition.

4.04 Setting the ALM option to DIS(able) only prevents the unit from activating the MNRALM output alarm bus on pin H on a minor alarm event. The **STATUS** LED still flashes red and the ALRM message still appears.

4.05 The ELU-319 drives pin 10 (FUSEALARM) to -48V whenever its on-board fuse opens. Its normally floating output must never operate above ground or below -80V. It can sink a current of 10 mA.

4.06 The ELU-319 Line Unit front panel tri-color **STATUS** LED has the following states:

- GREEN - Normal operation
- FLASHING GREEN - HDSL acquisition
- FLASHING RED - MNRALM (For all alarm conditions)
- RED - FUSEALRM
- YELLOW - Self-test in progress or an ELU-319 loopback in effect (CREM or Network Local Loopback (NLOC))

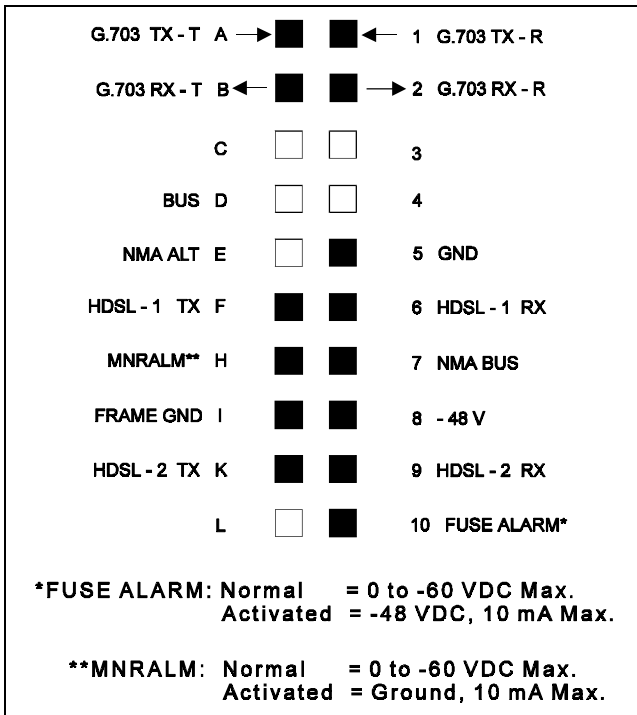


Figure 3. ELU-319 Pin-Outs. The active pins are highlighted in black in this illustration.

TABLE 3. SYSTEM PARAMETER OPTION SETTINGS

<i>Parameter</i>	<i>Option</i>	<i>Description</i>
PWRP (Power Feed)	DIS	Disables powering to the ERU over the HDSL pairs.
	ENA*	Enables powering to the ERU over the HDSL pairs.
ESAL (Errored Seconds Alarm Threshold)	17	Activates MNRALM (on pin H) after 17 Errored Seconds (17 HDSL CRC errors on either HDSL loop or a total of 17 BPVs and FERR) occur within 24 hours.
	170	Activates MNRALM (on pin H) when 170 Errored Seconds occur within 24 hours.
	NONE*	Prevents generation of a minor alarm due to excessive Errored Seconds.
LBTO (Loopback Timeout)	NONE	Disables automatic time-out cancellation of all loopbacks.
	20	Sets automatic cancellation of all loopbacks to 20 minutes after initiation.
	60*	Sets automatic cancellation of all loopbacks to 60 minutes after initiation.
	120	Sets automatic cancellation of all loopbacks to 120 minutes after initiation.
ALM (Minor Alarm)	DIS*	Retires an existing minor alarm on pin H by disabling its signal, and prevents another minor alarm from occurring.
	ENA	Enables pin H to be grounded when a minor alarm condition occurs.
CONF (Confirm)	YES	Confirms that all 4 operating modes are to be updated to their current choices.
	NO*	Prevents the most recently selected operating mode choices from being updated. They remain as they were prior to entry of system option settings procedure.
MARG (Margin Alarm Threshold)	0 to 15	Displays the Margin Alarm Threshold (in dB), that is set using the RS-232 Maintenance port. If the margin on either loop drops below this value, a minor alarm is reported (MAL1 or MAL2). The factory Default is 4.
	4*	

* Indicates the ELU-319 factory settings.

5. OPTIONS

5.01 The operating mode of the ELU-319 depends on the settings of the following system operating parameters:

- PWRF—Power Feed (HDSL line power)
- ESAL—Errored Seconds Alarm Threshold
- LBTO—Loopback Timeout
- ALM—Minor Alarm
- MARG—Margin Alarm Threshold

5.02 Table 3 lists the ELU-319 system parameters and their optional settings. The ELU-319 stores the settings of the system parameters in non-volatile RAM to prevent their loss in the event that shelf power is lost or the ELU-319 is unplugged.

5.03 No DIP-switches or jumpers are required to set the ELU-319 configuration. You can set all the system parameter options with the front panel pushbuttons (**MODE** and **SEL**) except the MARG threshold. The latter can be set from the maintenance terminal through the ELU-319 RS-232 interface.

5.04 To initiate the Option Set mode from the ELU-319 front panel, press and hold the **MODE** button for one second. The front panel message alternates between the system parameter and its current setting. Press the **SEL** button to step through all possible values (in sequence) of the parameter being displayed. Press **MODE** when the desired setting is displayed. This selects the next configurable parameter. When you have selected the last parameter, the display displays “CONF/NO”. To return to original settings, press the **MODE** button. To accept the new settings, press the **SEL** button. This displays “CONF/YES”, installs the changes, and returns to normal display mode. If you do not press either button within 30 seconds, the parameters return to their original values, and the display returns to normal mode.

5.05 To set all parameters to their default values, press and hold the **SEL** button for six or more seconds. The message “DFLT/NO” appears when you release the button. Press **SEL** again to display “DFLT/YES” and accept the default values. Press **MODE** to cancel and return to the original values.

5.06 Press the **MODE** button for 3 or more seconds to scroll through the ELU-319

software version number, List #, and all parameter option settings.

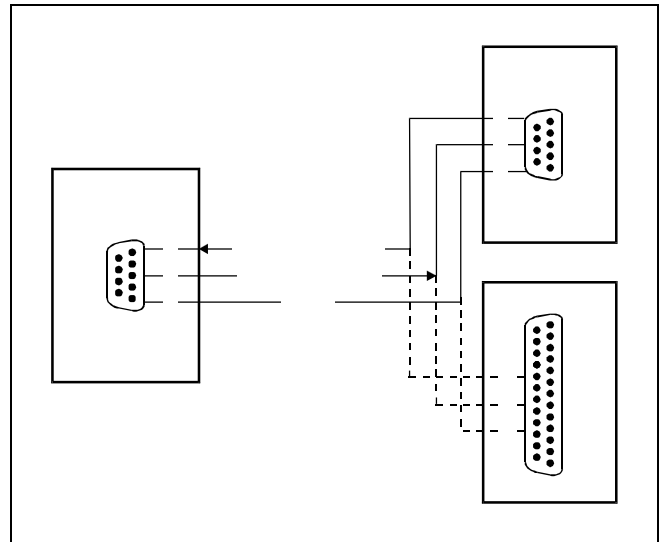


Figure 4. ELU-319 DB-9 Pin-Outs. A standard RS-232 (DB-9) connector on the front panel provides access to the menu interface feature via a dumb terminal.

5.07 To configure the ELU-319 from the Maintenance port, connect an ASCII display terminal to the RS-232 Maintenance port with a cable configured as shown in Figure 4. The maintenance port is configured as Data Communications Equipment (DCE) with 8 data bits, 1 stop bit and no parity. Striking the SPACE bar several times invokes the “autobaud” function over a range of 1200 to 9600 bps.

5.08 The menus and informational screens displayed by the terminal are shown in Figures 6 through 13 for non-doubler applications. Figures 15 through 31 show the screens for doubler applications. From the Main Menu (Figure 6 or 15), select C—SYSTEM SETTINGS. Entering the letter in parenthesis of the parameter you want to change scrolls the parameter through its options. When you have made the new settings, enter C to confirm.

5.09 Two user settings, Circuit ID, and Margin Alarm Threshold, must be set from the display terminal.

5.10 To set the Circuit ID, select H from the Main Menu to display “Enter circuit ID # (24 characters max)”. Enter the circuit ID, press ENTER, then press C to confirm the entry. If you enter more than 24 characters, the terminal beeps and accepts only the first 24 characters. The circuit ID appears in all screens, and you cannot reset it to a default as described in Paragraph 5.05.

5.11 To set the Margin Alarm Threshold, select G–SYSTEM SETTINGS and then select G–MAR(G)IN ALM THRES. Enter the minimum acceptable alarm threshold, from 0 to 15 dB. If the margin for HDSL Loop 1 or 2 drops **below this value**, the ELU-319 triggers a minor alarm, and the front panel and status screen displays “MAL1” (Loop 1) or “MAL2” (Loop 2). Because a margin can never be less than zero, setting a threshold of zero turns this feature off.

6. HDSL LINE VOLTAGE OPTION

6.01 The symmetry of the HDSL line powering voltage can be set by the S2 switch, located on the printed circuit board, as shown in Figure 5.

6.02 The factory default setting is unipolar (-). It sets the HDSL line voltage to 0 V on loop 2 and to either -130 V (for non-doubler applications) or -200 V (for doubler applications) on loop 1. This setting keeps the HDSL cable pair voltage at or below ground potential, thereby avoiding corrosion problems caused by cable voltages more positive than ground.

6.03 The bipolar selection sets the HDSL line voltage to +65 V on loop 2 and -65 V on loop 1, for non-doubler applications. Doubler applications will have +100 V on loop 2 and -100 V on loop 1. This setting reduces the maximum ground referenced voltage to 100 V, but applies positive voltage to the cable pairs, which could accelerate corrosion on the cable pairs.

6.04 The line voltage power supply, used for both options, is ground referenced, but also ground isolated by 200 kohms. This ground isolation reduces problems due to induced noise currents and large surge voltages, which are ground referenced. It also reduces ground fault currents, which improves the product’s safety. The safety issue thus depends solely on the differential voltage across loop 1 and loop 2, and is independent of S2’s setting.

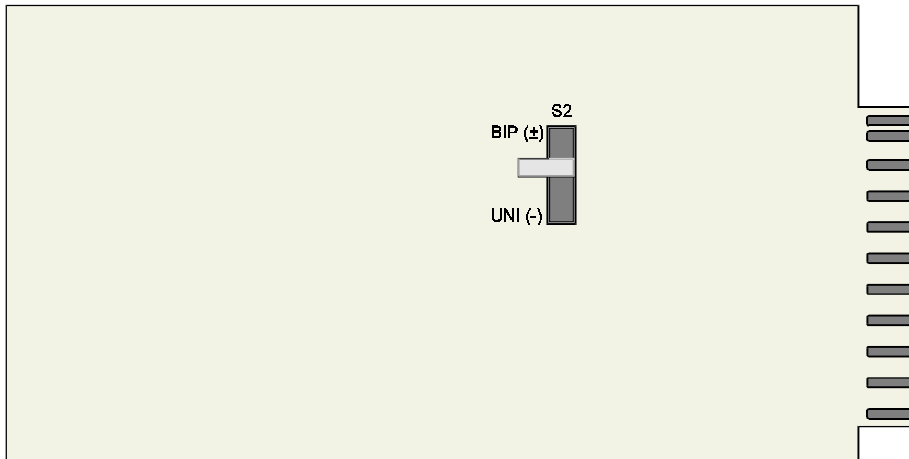


Figure 5. HDSL Line Voltage

Switch S2

7. INSTALLATION

7.01 Upon receipt of equipment, visually inspect it for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to PairGain Technologies.

7.02 The ELU-319 mounts in the PairGain HMS-318 shelf. The auxiliary PairGain connector panel, HCP-322, connects to the HMS-318 shelf and provides G.703, BNC connector access (75 ohm or 120 ohm) to each of the 22 slots. The ELU-319 slot pin-outs are shown in Figure 3.

8. SPECIFICATIONS

HDSL Line Code

1040 kbps, 2B1Q

HDSL Output

+13.5 dBm \pm 0.5 dB @ 135 ohms

HDSL Line Impedance

135 ohms

Line Clock Rate

Internal Stratum 4 clock

HDSL Startup Time

30 seconds (typical), 60 seconds (maximum)

One-way G.703 Delay

Less than 220 microseconds

G.703 Line Impedance

List 5D: 75 ohms

List 6D: 120 ohms

G.703 Input Level

+1.5 to -7.5 dB

G.703 Line Rate

2.048 Mbps \pm 200 bps

G.703 Line Format

HDB3

Power Consumption

12 watts (no doubler), 21 watts (doubler)

Heat Dissipation

6 watts (no doubler), 8 watts (doubler)

Fusing

Internal, 1.25 A at 125 V, connected to FUSEALARM output on pin 10

Span Voltage

-130V dc or 200V dc

Margin Indicator

Displays loop SNR margin for both loops relative to 10^{-7} BER operation

Electrical Protection

Secondary surge protection on G.703 and HDSL ports

Power cross protection on HDSL ports

Operating Temperature and Humidity

-40° to 65° Celsius, 5% to 95% (non-condensing)

Mounting

HMS-318 shelf with HCP-322 connector panel

Dimensions

Height: 4.75 in. (12.07 cm)

Width: 0.7 in. (1.78 cm)

Depth: 10.5 in. (26.67 cm)

9. CERTIFICATION

9.01 FCC compliance: The ELU-319 has been tested and found to comply with the limits for Class A digital devices pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

10. WARRANTY

10.01 PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of 36 months from the date of original shipment, given proper installation. PairGain will repair or replace any unit without cost during this period if the unit is found to be defective for any reason other than abuse or improper use or installation.

10.02 This module should not be field repaired. If it fails, replace it with another unit and return the faulty unit to PairGain for repair. Any modifications of the unit by anyone other than an authorized PairGain representative voids the warranty.

10.03 If a unit needs repair, call PairGain for a Return Material Authorization (RMA) number and return the defective unit, freight prepaid, along with a brief description of the problem, to:

PairGain Technologies, Inc.
14402 Franklin Avenue
Tustin, CA 92680
ATTN: Repair and Return Dept.
(714) 832-9922

(800) 638-0031

11. TECHNICAL ASSISTANCE

11.01 PairGain Technical Assistance is available 24-hours-a-day, 7-days-a-week by contracting PairGain's Customer Service Engineering group at one of the following numbers:

Telephone: (800) 638-0031 or (714) 832-9922
Fax: (714) 832-9924

During normal business hours (8:00 AM to 5:00 PM, Pacific Time, Monday - Friday, excluding holidays), technical assistance calls are answered directly by a Customer Service Engineer. At other times, a request for technical assistance is handled by an on-duty Customer Service Engineer through a callback process. This process results in a callback within 30 minutes of initiating the request. In addition, PairGain maintains a computer bulletin board system for obtaining current information on PairGain products, product troubleshooting tips and aids, accessing helpful utilities, and for posting requests or questions. This system is available 24-hours-a-day by calling (714) 730-3299. Transmission speeds up to 28.8 kbps are supported with a character format of 8-N-1.

B. APPLICATIONS WITHOUT USING HIGAIN DOUBLER EDU-451

1. GENERAL

1.01 This section addresses ELU-319 List 5D and 6D operation when used without doublers. For applications without Doublers, the ELU is directly connected to the ERU-412 by the two cable pairs.

2. POWER CONSUMPTION

2.01 The three most important power demands of an ELU-319 on the shelf power supply are its maximum power consumption, its maximum power dissipation and its maximum current drain. These three parameters for the ELU-319 on a per slot and per shelf basis, are as follows:

Maximum Power Dissipation:

- Per Slot = 6 Watts
- Per Shelf = 132 Watts

Maximum Power Consumption:

- Per Slot = 12 Watts
- Per Shelf = 264 Watts

Maximum Current Drain:

- Per Slot = 0.28 A
- Per Shelf = 6.2 A

Note that the worst case conditions under which these parameters were measured include a 3.3 km, 0.4 mm loop, a fully loaded 22-slot shelf and a -42.5 V shelf battery voltage.

2.02 The Maximum Power Dissipation measures the power that is converted into heat build up within the unit. It contributes to the total heat generated in the space around the unit. It is used to determine the maximum number of fully loaded shelves per bay that does not exceed the maximum allowable power dissipation density in Watts/sq. ft.

2.03 The thermal loading limitations imposed when using the ELU-319 in Controlled Environmental Vault (CEV) or other enclosures are determined by applying the ELU-319 power parameters to the manufacturer's requirements for each specific housing.

2.04 The Maximum Power Consumption is the total power that the ELU-319 consumes or draws from its -48 V shelf power source. This parameter is needed when the 319 is located remote to its serving CO. It determines the battery capacity required to maintain an 8-hour stand-by battery reserve for emergency situations. It thus limits the maximum number of plugs per remote enclosure. Use the above data to perform this analysis on a case by case basis.

2.05 The Maximum Current Drain is the maximum current drawn from the shelf power supply when it is at its minimum voltage (-42.5 V). This determines the shelf fusing requirements. The PairGain **HMS-318 and 317 ELU-319** shelves are partitioned into two equal halves; each should be fused at 10 A for a total of 20 A per shelf. A fully loaded shelf draws 6.2 A worse case. This is within the 10 A fuse limit.

3. LOOPBACK DESIGN DESCRIPTION

3.01 All HiGain ELU/ERU system loop-up codes must be initiated from either the front panel pushbuttons or from the maintenance terminal. The HiGain E1 system does not respond to any **in-band codes**.

3.02 Depressing both the **MODE** and **SEL** pushbuttons on the front panel for at least

three seconds initiates a MANUAL loopback session. This session allows the user to **SEL** one of four HiGain loopbacks (see Figure 5). The message "MAN LPBK" appears on the front panel display followed by the message "NLO?" If the **SEL** button is now pressed, an NLOC loopback is executed and the message changes from "NLO?" to "NLOC". If the **MODE** button is pressed instead of **SEL** button, "NLO?" is replaced by "NRE?" If this same routine is followed, all four loopbacks (NLOC, NREM, CLOC, and CREM) are presented and can be initiated in the sequence listed. Once a loopback is executed, it can be terminated and the next loopback option presented by pressing the **MODE** button. If neither button is pressed for 30 seconds and no loopback is in effect, this manual loopback session terminates and the normal margin displays reappear. If any loopback is in effect, this 30-second time-out is inhibited. The active loopback and the manual loopback session continue until the loopback times out in accordance with the user LBTO setting. Only one loopback may exist at any given time. Depressing both buttons again for three seconds terminates any active loopback, ends the MANUAL loopback session, and returns the display to normal.

3.03 Note that these same four loopbacks can be initiated from the RS-232 maintenance port by choosing LOOPBACK MODE, option D, from the main menu. This displays the Loopback Menu, shown in Figure 10, from which you can initiate any of the four loopbacks.

3.04 The TLOS loopback (shown in Figure 5) is controlled by a user switch option in the ERU-412. When this option is **enabled** it forces the ERU-412 into a logic loopback state when its G.703 input signal is lost. When this TLOS option is **disabled**, no loop back occurs. When a LOS condition exists the ELU-319 simply outputs the AIS signal which alerts the network that a LOS condition exists at the input to the ERL.

3.05 If the system should ever fail to respond to any loopback command, go to the front panel Option Setting mode and execute the "DFLT/YES" command described in Section A, paragraph 5.05. This will allow the system to respond to the loopback commands. Reset the parameters to their original non default values, if needed, at your convenience, after the system resumes its proper response to loopback commands.

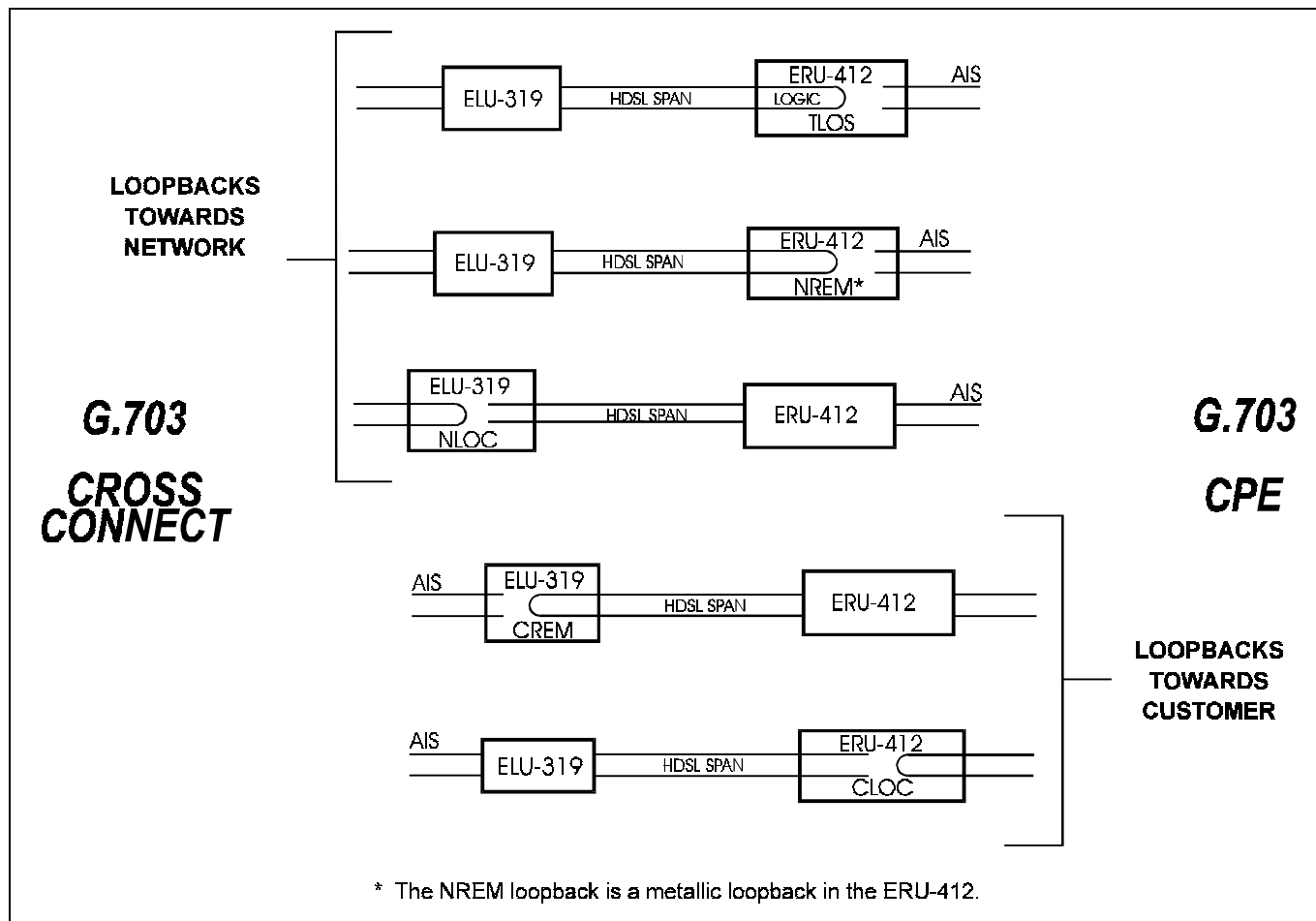


Figure 5. ELU-319 Loopback Configurations. All loopbacks (with the exception of the TLOS logic loopback) can be initiated from the front panel pushbuttons or from the maintenance terminal.

4. TESTING

4.01 Table 4 lists the four-character front panel message displays of the ELU-319. This display energizes when power is initially applied to the ELU-319; it indicates system status and error conditions. In order to conserve power, the display de-energizes after five minutes if neither **MODE** or **SEL** are pressed. The use of either button restarts the 5-minute power-control timer.

4.02 If you encounter trouble with the G.703 interface, verify that the unit is making a positive connection with the mounting assembly's connector.

4.03 The transmit and receive G.703 ports have splitting access and bridging miniature 210-type jacks as shown in Figure 2. Connecting one cable between the two BRG jacks and another cable between the two SPAN jacks splits the XMT and RCV jacks and creates metallic loopbacks towards both the G.703 cross connect and the ELU-319.

TABLE 4. ELU-319 FOUR-CHARACTER FRONT PANEL MESSAGES

<i>Message</i>	<i>Full Name</i>	<i>Description</i>
CREM	Customer Remote Loopback	Signal from customer is looped back to customer at ELU-319.
NLOC	Network Local Loopback	G.703 signal is looped back to G.703 at ELU-319.
CLOC	Customer Local Loopback	Signal from Customer is looped back to customer at ERU-412.
NREM	Network Remote Loopback	Network signal is looped back to network at the ERU-412.
TLOS	Transmit Loss Of Signal	ERU-412 is in a logic network loopback state caused by a loss of its G.703 input at the ERU-412, if enabled via the ERU-412 TLOS switch option set to ON .
LBPV	Local Bipolar Violation	A bipolar violation has been received at the G.703 input to the ELU-319.
SIG 1 or 2	Signal 1 or Signal 2	The ELU and ERU transceivers are trying to establish contact with each other on Loops 1 or 2 of Span 1.
ACQ 1 or 2	Acquisition 1 or Acquisition 2	The ELU and ERU multiplexers are trying to establish synchronization over each of Loops 1 or 2 of Span 1
H1ES	HDSL Loop 1 errored second	HDSL CRC error on Loop 1. Also displays when 24 hour ES threshold has been exceeded.
H2ES	HDSL Loop 2 Errored second	HDSL CRC error on Loop 2. Also displays when 24 hour ES threshold has been exceeded.
ACO	Alarm CutOff	An MNRALM has occurred, and was retired to an ACO condition by pressing the SEL button on the ELU-319 front panel.
SELF TEST		The ELU-319 is in a self test mode. This occurs every power ON cycle. The self-test sequence includes the input G.703 transceiver chip when the HDSL loops are not in sync. This can cause the AIS pattern, normally transmitted from the ELU during this time, to exhibit bipolar violations (BPVs).
ALRM	Alarm Condition Exists	A minor alarm MNRALM condition is in effect.
1=xx or 2=yy	HDSL Loop Margins	Indicates the worst-case signal-to-noise ratio measured for each loop. A value of '06' or greater is adequate for reliable system operation.

Table continued on next page

TABLE 4. ELU-319 FOUR-CHARACTER FRONT PANEL MESSAGES (CONTINUED)

PWR FEED SHRT	Power Feed Short	Indicates a short-circuit between the two HDSL pairs, or the ERU-412 cannot communicate with the ELU-319 over good cable.
PWR FEED OPEN	Power Feed Open	Indicates an open circuit in the Tip and Ring of either HDSL pair.
BAD RT?	No response from ERU	The ELU-319 does not receive any response from the ERU-412. Thus, the ERU's integrity is questionable.
VER	ELU Software Version #	This is displayed during the System Settings review mode. Press the Mode button for 3 seconds.
LIST 000X	ELU's List #	Displayed during System Settings review mode defined above.
LOSW	Loss of Sync Word	Indicates that one of the HDSL loops has lost synchronization. Causes a minor alarm.
LLOS	Local Loss of Signal	Indicates that no signal is detected at the G.703 input to the ELU-319. Causes a minor alarm.
RLOS	Remote Loss of Signal	Indicates that no signal is detected at the G.703 input to the ERU-412. Causes a minor alarm.
G.703	G.703 BPV errors	Indicates that the number of BPVs at the ELU-319 or ERU-412 G.703 inputs have exceeded the 24-hour ES threshold. Causes a minor alarm.
MAL1(2)	Margin Alarm Loop 1 or 2	The margin on HDSL loop 1 (2) has dropped below the threshold (1 to 15 dB) set by the user.

TABLE 5. ELU-319 STATUS MENU DEFINITIONS

<i>Message</i>	<i>Full Name</i>	<i>Description</i>
ALARMS		
NONE	No Alarms	
LLOS	Local Loss of Signal	No signal from local G.703 interface.
RLOS	Remote Loss of Signal	No signal from remote G.703 interface.
LOSW 1 (2)	Loss of (HDSL) Sync Word 1 or 2	HDSL LOOP 1 or 2 has lost frame sync.
H1ES	HDSL Loop 1 Errored Second	The number of Loop 1's Errored Seconds has exceeded the user-selected Errored Seconds threshold.
H2ES	HDSL Loop 2 Errored Second	The number of Loop 2's Errored Seconds has exceeded the user-selected Errored Seconds threshold.
G.703	G.703	G.703 input BPVs have exceeded the user selected ES threshold.
MAL1	Margin Alarm (HDSL Loop 1)	The margin on HDSL Loop 1 dropped below the Margin Alarm Threshold (1 to 15). Setting the threshold to 0 (zero) inhibits the alarm.
MAL2	Margin Alarm (HDSL Loop 2)	The margin on HDSL Loop 2 dropped below the user Margin Alarm Threshold (1 to 15). Setting the threshold to 0 (zero) inhibits the alarm.
ACO	Alarm Cut Off	AM Alarm cut-off is in effect.
LAIS	Local Alarm Indicating Signal	Indicates an AIS (all 1's) pattern is being transmitted from the local G.703 output port.
RAIS	Remote Alarm Indicating Signal	Indicates an AIS (all 1's) pattern is being transmitted from the remote G.703 output port.
LOOPBACKS		
NREM	Network Remote Loopback	Loopback at ERU-412 (remote) towards network initiated from ERU-412 front panel pushbutton, or maintenance terminal, or by pressing both the MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 5.
NLOC	Network Local Loopback	Loopback at ELU-319 (local) towards network by pressing both the MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 5.
CLOC	Customer Local Loopback	Loopback at ERU-412 (local) towards customer interface (CI) initiated from the maintenance terminal or by pressing both the MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 5.
CHREV	Channels Reversed	Channel (loop) 1 and 2 HDSL pairs are reversed at the ERU-412 line input ports.
CREM	Customer Remote Loopback	Loopback at ELU-319 towards customer interface (CI) initiated from the maintenance terminal or by pressing both MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 5.

TABLE 6. GLOSSARY OF HIGAIN TERMS

<i>Term</i>	<i>Definition</i>
MARGINS	Indicates the excess signal to noise ratio, at either the ELU-319 or ERU-412, relative to a 10^{-7} Bit Error Rate. 1st value is current margin, 2nd value is minimum margin since (C)leared last, 3rd value is maximum value since cleared, and NA means Not Available (loops are not synchronized). The normal range of a typical margin is from 6 to 22 dB.
PULSE ATTENUATION	Indicates the attenuation of the 2B1Q pulse from the distant end. HiGain operates with pulse attenuations in excess of 30 dB. This value is related to the cable pair's loss at 260 kHz. The pulse attenuation is a more direct indication of the loop attenuation to the 2B1Q signal than the 260 kHz loss. The normal range of pulse attenuation is from 1 to 32 dB.
PPM	Indicates the relative offset (in parts per million) of the crystal oscillator in the ERU-412 from the ELU-319's crystal oscillator. Any value between -64 and +64 is adequate. Values outside this range indicate out-of-tolerance components or excessive temperature drift of critical components.
HDSL 24 Hour ES (Errored Seconds)	The number of 1-second intervals that contained at least 1 CRC error. This value is a running total of the last 24 hours.
HDSL 24 Hour UAS (Unavailable Seconds)	The number of seconds the HDSL loop was out of synchronization.
G.703 BPV Seconds (ES)	The number of seconds during which at least 1 bipolar violation was detected at the G.703 input.
G.703 UAS Count	The number of seconds during which the G.703 input signal was absent (125 or more consecutive zeroes).
ELU/Ver x.x-yyyy ERU/ver x.x-yyyy	"x.x" = the software version number of the ELU-319 or ERU-412. "yyyy" = the list number of the ELU-319 or ERU-412.

5. SYSTEM MAINTENANCE MENU SCREENS

5.01 Figure 6 is the Maintenance Terminal MAIN MENU Screen. Its eight sub-menus provide many useful provisioning, test and monitoring tools. Figure 7 shows the ELU-319 SPAN STATUS Screen.

5.02 Figure 8 shows the SET CLOCK menu. Both the Time and Date are set with this menu. Set the hours and minutes, using the military (24-hour) convention. Setting the seconds is optional. Enter the date in the sequence and format shown. The ERU-412 unit can also be set to the same time and date as the ELU-319 by entering a **U** to the "Update Remote" query. All time information is lost when power is removed. The last date, however, is retained in NVRAM and reappears when power is restored.

5.03 Figure 9 shows the SYSTEM SETTINGS Screen. All 5 user options can be set from this screen. To change any option, enter its character key which is shown inside the parenthesis within each parameter description. This causes the screen to refresh with the new parameter. After all parameters have been selected, press **E** (Exit) then **C** (Confirm). The newly selected parameters are now activated.

5.04 Figure 10 shows the LOOPBACK MENU Screen for non-Doubler applications. Loopbacks NLOC, NREM, CLOC and CREM are available.

5.05 Figure 11 shows the PERFORMANCE DATA screen for non-Doubler applications. Both the Errored and Unavailable Seconds for both HDSL loops and each G.703 input are listed at 15-minute intervals over a four hour time interval. Earlier and later data, in four-hour chunks on six different screens, can be accessed by pressing **P** (Previous) or **N** (Next) respectively. All of the counters can be set to zero by pressing **C** (Clear) from the ELU-319 SPAN STATUS Screen shown in Figure 7. Note that since the ELU is considered the master module, this clears *all* performance data screens at both the ELU-319 and the ERU-412. The RS-232 terminal interface at the ERU-412 does not allow the counters to be cleared.

5.06. Figure 12 shows the 7-DAY PERFORMANCE HISTORY Screen. The “Errored Seconds” and “Unavailable Seconds” for both HDSL loops and each of the two G.703 inputs are listed for the current and previous seven days. All of the counters can be set to zero by pressing **C** (Clear) on the SPAN STATUS Screen (Figure 7).

Note that since the ELU is considered the master module, this clears *all* performance data screens at both the ELU and the ERU. The RS-232 terminal interface at the ERU-412 does not allow the counters to be cleared.

5.07 Figure 13 shows the ALARM HISTORY Screen for non-Doubler applications. The alarms are defined in Section A Paragraph 4.02. The “First” and “Last” columns contain the time and date stA of the first and last occurrence of each alarm. The “Current” column shows the status of each alarm. The “Count” column lists the number of times each alarm occurred. All the data can be cleared by pressing **C** (Clear). The maximum non-overflowing count is 999.

5.08 Selection “H” from the main menu allows the Circuit ID # to be set. It is limited to 24 alpha- numeric characters. It, like the system settings, is stored in NVRAM and thus remains when power is lost. Note that the Circuit ID # is not available at the ERU-412 Maintenance Port.

```

HI-GAIN ELU-319 (G.703)  MAINTENANCE TERMINAL MAIN MENU  (ver U1.7L-005D)
                        CIRCUIT ID#: ELU-1262 TEST

A. VIEW SPAN STATUS
B. SET CLOCK
C. SYSTEM SETTINGS
D. LOOPBACK MODE: NONE
E. VIEW PERFORMANCE DATA
F. VIEW PERFORMANCE HISTORY
G. VIEW ALARM HISTORY
H. ENTER CIRCUIT ID #
    
```

Figure 6. Main Menu.

```

                        SPAN STATUS
                ( ELU/ver1.7-005D: ERU/ver1.0-0001)

TIME: 01:09:21
DATE: 07/12/95                CIRCUIT ID#: ELU-1262 TEST

ALARMS:  CHREV LAIS RLOS
LOOPBACK: OFF

                        ELU                                ERU
                HDSL-1  HDSL-2  HDSL-1  HDSL-2
                cur/min/max cur/min/max cur/min/max cur/min/max
MARGIN:         08/08/08   08/08/08   11/11/12   10/09/10 dB
PULSE ATTN:     33        33        33        33 dB
PPM OFFSET:     00        00        -09       -09 ppm
24 HOUR ES:     00000    00000    00000    00000 seconds
24 HOUR UAS:    00000    00000    00000    00000 seconds

                        G.703 STATUS
                ELU                                ERU
24 HOUR BPV Seconds:  00000                        00000
24 HOUR UAS Count:   00000                        00270

                (E)xit (C)lear (U)pdate
    
```

Figure 7. Span Status Display (no Doubler).

```
                                SET CLOCK

TIME: 13:21:17
DATE: 05/18/95
CIRCUIT ID#: Slot #8

Format: HH:MM
        MM/DD/YY

NEW TIME:

NEW DATE:

(U)PDATE REMOTE?█
```

Figure 8. Set Clock Menu.

```
                                SYSTEM SETTINGS

TIME: 13:20:02
DATE: 05/18/95                                CIRCUIT ID#: Slot #8

(P)OWER:          ENABLE
ES ALARM TH(R)ES: NONE
LOOPBACK (T)IMEOUT: 120
(A)LARM:          DISABLE
MAR(G)IN ALM THRES: 4

                                (E)xit
Enter the letter in parenthesis (X) to change any setting█
```

Figure 9. System Settings Menu.

```

                                LOOPBACK MENU

TIME: 13:40:19
DATE: 05/18/95
CIRCUIT ID#: Slot #8

A. DISABLE LOOPBACKS
B. ELU LOOP TO NETWORK      (NLOC)
C. ERU LOOP TO NETWORK      (NREM)
G. ELU LOOP TO CUSTOMER     (CREM)
H. ERU LOOP TO CUSTOMER     (CLOC)

                                (E)xit
    
```

Figure 10. Loopback Menu (no Doubler).

```

Date: 05/18/95          PERFORMANCE DATA
CIRCUIT ID#: Slot #8
                        ERRORED SECONDS/UNAVAILABLE SECONDS

                        G.703          HDSL-1          HDSL-2
                        ELU    ERU    ELU    ERU    ELU    ERU
09:45    000/000    000/000    000/000    000/000    000/000    000/000
10:00    000/000    000/000    000/000    000/000    000/000    000/000
10:15    000/000    000/000    000/000    000/000    000/000    000/000
10:30    000/000    000/000    000/000    000/000    000/000    000/000
10:45    000/000    000/000    000/000    000/000    000/000    000/000
11:00    000/000    000/000    000/000    000/000    000/000    000/000
11:15    000/000    000/000    000/000    000/000    000/000    000/000
11:30    000/000    000/000    000/000    000/000    000/000    000/000
11:45    000/000    000/000    000/000    000/000    000/000    000/000
12:00    000/000    000/000    000/000    000/000    000/000    000/000
12:15    006/000    004/004    001/016    003/001    001/016    003/000
12:30    000/000    000/000    000/000    000/000    000/000    000/000
12:45    000/000    000/000    000/000    000/000    000/000    000/000
13:00    000/000    000/000    000/000    000/000    000/000    000/000
13:15    000/000    000/000    000/000    000/000    000/000    000/000
13:30    000/000    000/000    000/000    000/000    000/000    000/000

                        (E)xit (P)revious (N)ext
    
```

Figure 11. Performance Data Display (no Doubler).

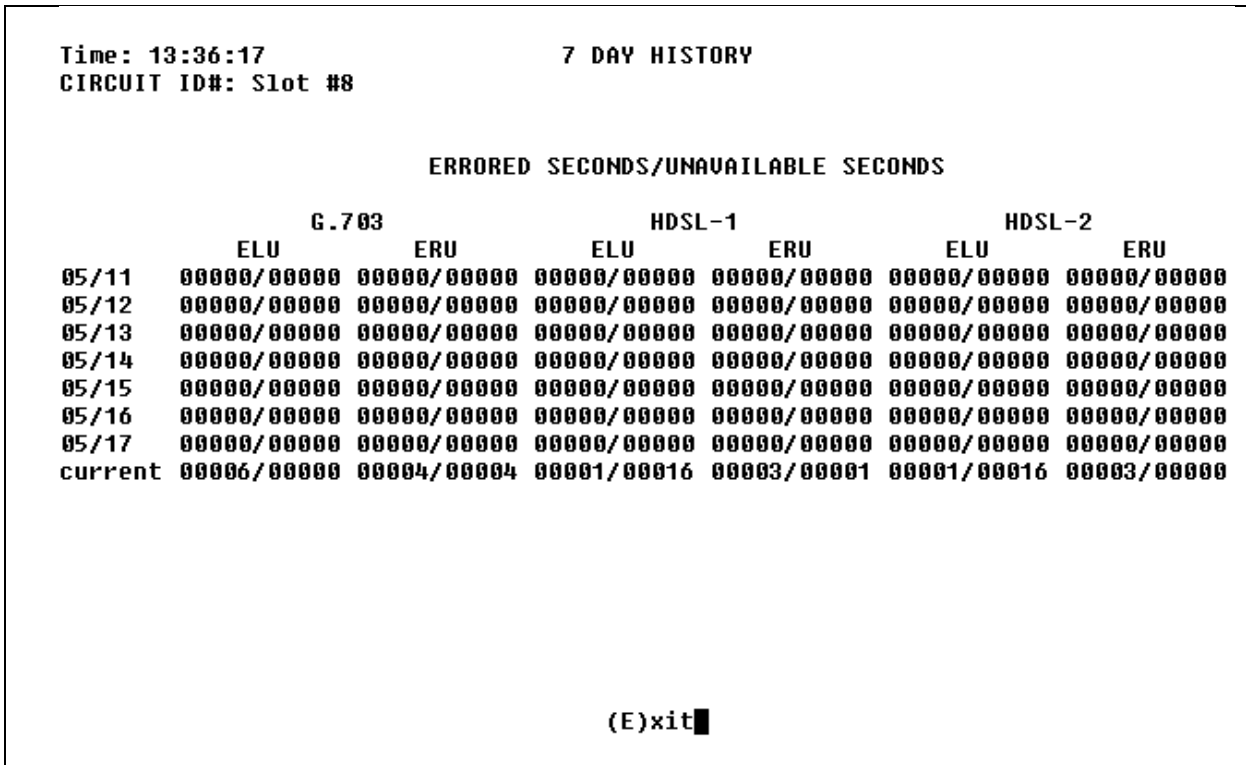


Figure 12. Performance Data History Display (no Doubler).

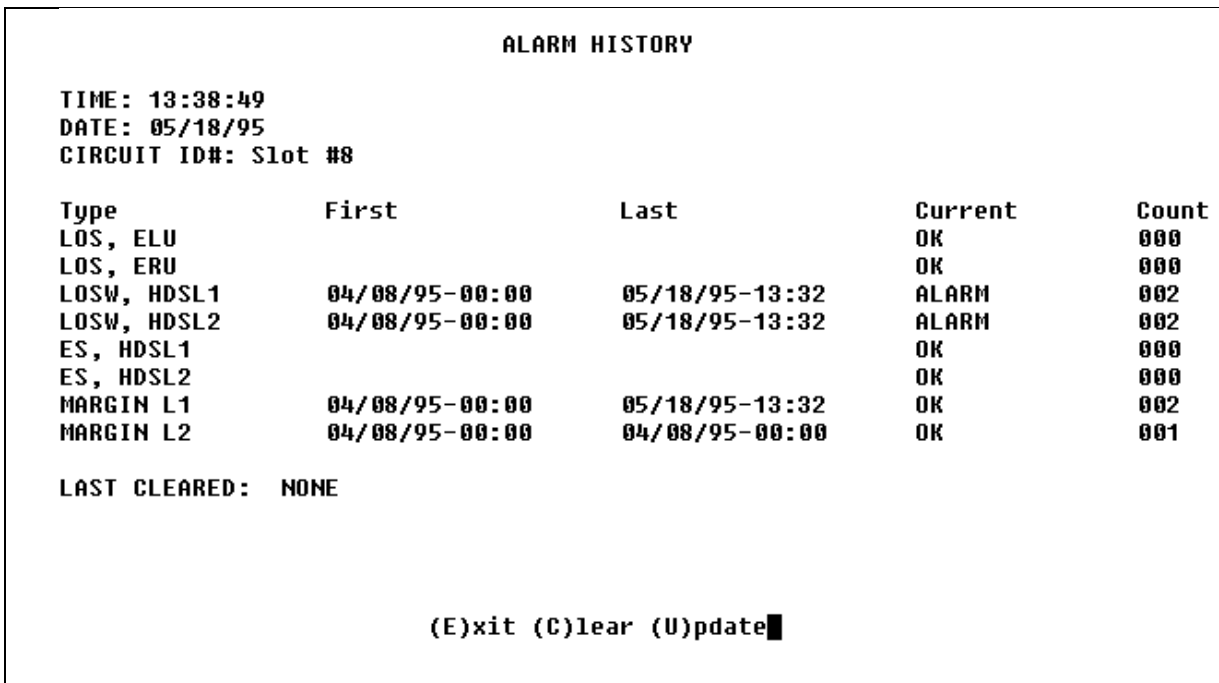


Figure 13. Alarm History (no Doubler)

**C. APPLICATIONS USING HIGAIN DOUBLER
EDU-451**

1. GENERAL

1.01 For Doubler applications, one or two Doublers (EDU-451) may be used in the HDSL loops between the ELU-319 and the ERU-412. When one doubler is used, the ELU can line power both the EDU and the ERU. When using two Doublers in a HDSL loop, the ERU-412 must be locally powered.

2. POWER CONSUMPTION

2.01 The maximum current drain is the current drawn from the shelf power supply when it is at minimum voltage (-42.5 VDC) under a worst case application. The following analysis assumes a 22 slot PairGain HMS-318 shelf. The worst case application for the ELU-319 occurs on a loop with one EDU-451 Doubler and four 3.3 km foot, 0.4 mm spans. Under these conditions the ELU-319 current drain from the -42.5 VDC battery is 0.44 A. This CO current and other related power parameters for this doubler application are listed in Table 7.

2.02 The maximum ELU-319 power dissipation is the power that is converted into heat within the unit. It contributes to the total heat generated and is used to determine the maximum number of shelves per bay that do not exceed the maximum power dissipation density in Watts/sq. ft.

2.03 The thermal loading limitations imposed when using the ELU-319 in Controlled Environmental Vaults (CEV) or other enclosures are determined by applying the ELU-319 power parameters to the manufacturer requirements for each specific housing.

**TABLE 7. ELU-319, LIST 5D and 6D
POWER PARAMETERS WITH EDU-451**

CO Voltage Volts	CO Current Amperes	Power Consumption Watts	ELU Power Dissipation Watts
42.50	0.50	21.00	8
48.00	0.44	21.00	8
56.00	0.38	21.00	8

2.04 The power consumption listed in Table 7 is the total power that the ELU-319 consumes or draws from its -48 VDC shelf power source. This parameter is needed when the ELU-319 is located remote to its serving CO. It determines the battery capacity required to maintain a stand-by battery reserve for emergency situations. It thus limits the maximum number of plugs per remote enclosure. Use this data to perform other appropriate analysis on a case by case basis.

2.05 The maximum Current Drain is the maximum current drawn from the shelf power supply when it is at its minimum voltage (-42.5 V). This determines the shelf fusing requirements. The PairGain **HMS-318 ELU-319** shelf is partitioned into two equal halves, each should be fused at 10 A for a total of 20 A per shelf. A full shelf containing 22 doubler units slot draws 11 A worst case (5.5 A per fuse). This is within the 10 A fuse limit.

3. LOOPBACK DESIGN DESCRIPTION

3.01 All HiGain ELU/ERU system loop-up codes must be initiated from either the front panel pushbuttons or from the maintenance terminal. The HiGain E1 system does not respond to any *in-band codes*.

3.02 Two additional loopback points are added for each EDU-451 doubler that is used as shown in Figure 14. NDU1 and NDU2 are executed towards the network. CDU1 and CDU2 are towards the customer. NDU1 and NDU2, along with the rest of the loopbacks towards the network, can be issued from the Loopback Menu shown in Figure 22.

3.03 Depressing both the **MODE** and **SEL** push-buttons on the front panel for at least three seconds initiates a MANUAL loopback session. This session allows the user to **SEL** one of eight HiGain system loopbacks. The message, "MAN LPBK", appears on the front panel display followed by the message "NLO?". If the SEL push-button is now pressed, an "NLOC" loopback is executed and the message changes from "NLO?" to "NLOC". If the **MODE** button is pressed instead of the **SEL** push-button, "NLO?" is replaced by "ND1?". This now allows an 'NDU1' loopback to be executed (if it is a Doubler application) with the **SEL** push-button. If this same routine is followed, all eight loopbacks (NLOC, NDU1, NDU2, NREM, CLOC, CDU2, CDU1 and CREM) are presented and can be initiated in the sequence listed. Pressing the MODE push-button two more times yields the CRE and CLO loopback options in the sequence listed. This interactive push-button procedure permits any of the eight HiGain loopbacks to be executed/activated. The

next loopback option is presented by pressing the MODE push-button however, the previously executed loopback will remain active until the SEL push-button is pressed and a different loopback is activated. If neither button is pressed for a period of 30 seconds and no loopback is in effect, the manual loopback session terminates and the normal margin displays reappear. If any loopback is in effect, the 30-second time-out is inhibited. The active loopback and the manual loopback session continue until the loopback times out in accordance with the user selected LBTO setting. Only one loopback can exist at any given time. Pressing both buttons again for three seconds, terminates any active loopback, ends the MANUAL loopback session and returns the display to normal mode.

3.04 Note that these loopbacks can be initiated from the RS-232 maintenance port by choosing LOOPBACK MODE, option D, from the main menu. This displays the Loopback Menu, shown in Figure 22 from which you can initiate any of the six loopbacks for this single doubler application.

3.05 If the system should ever fail to respond to any loopback command, go to the front panel Option Setting mode and execute the "DFLT/YES" command described in paragraph 5.05. This will allow the system to respond to the loopback commands. Reset the parameters to their original non default values, if needed, at your convenience, after the system resumes its proper response to loopback commands.

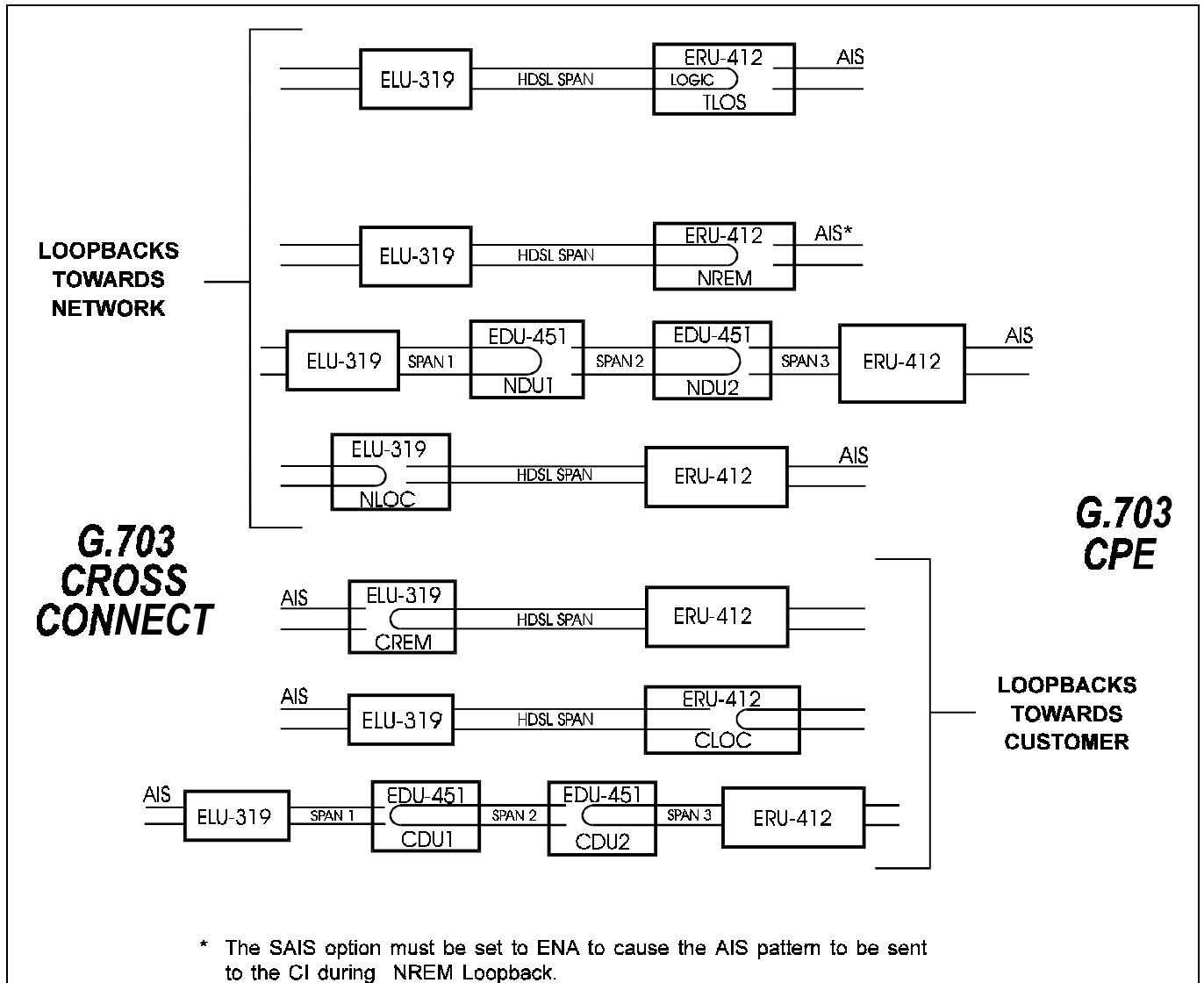


Figure 14. ELU-319 Doubler Loopback Configurations. Each module (four in a full two-doubler system) can be looped back toward either the network or customer.

4. TESTING PROCEDURES

4.01 Table 8 lists the four-character front panel message displays of the ELU-319. This display energizes when power is initially applied to the ELU-319; it indicates system status and error conditions. In order to conserve power, the display de-energizes after five minutes if neither **MODE** or **SEL** are pressed. The use of either button restarts the 5-minute power-control timer.

4.02 If you encounter trouble with the G.703 interface, verify that the unit is making a positive connection with the mounting assembly's connector.

4.03 The transmit and receive G.703 ports have splitting access and bridging miniature 210-type jacks as shown in Figure 2. Connecting one cable between the two BRG jacks and another cable between the two SPAN jacks splits the XMT and RCV jacks and creates metallic loopbacks towards both the G.703 and the ELU-319.

TABLE 8. ELU-319 FOUR-CHARACTER FRONT PANEL MESSAGES

<i>Message</i>	<i>Full Name</i>	<i>Description</i>
CREM	Customer Remote Loopback	Signal from customer is looped back to customer at ELU-319.
NLOC	Network Local Loopback	G.703 signal is looped back to G.703 at ELU-319.
HDU1	Network Doubler 1 Loopback	Loopback at Doubler #1 towards network initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons or maintenance terminal (Figure 14).
HDU2	Network Doubler 2 Loopback	Loopback at Doubler #2 towards network initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons or maintenance terminal (Figure 14).
CDU 1	Customer Doubler 1 Loopback	Loopback at Doubler 1 towards CI initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons or maintenance terminal (Figure 14).
CDU 2	Customer Doubler 2 Loopback	Loopback at Doubler 2 towards CI initiated by ILR code, ELU-319 front panel MANUAL LOOPBACK push-buttons or maintenance terminal (Figure 14).
CLOC	Customer Local Loopback	Signal from Customer is looped back to customer at ERU-412.
NREM	Network Remote Loopback	G.703 signal is looped back to G.703 at the ERU-412.
TLOS	Transmit Loss Of Signal	ERU-412 is in a logic loopback state caused by a loss of its G.703 input from the NI, if enabled via the ERU-412 TLOS switch option set to ON .
LBPV	Local Bipolar Violation	A bipolar violation has been received at the G.703 input to the ELU-319.
SIG 1 or 2	Signal 1 or Signal 2	The ELU and first doubler transceivers are trying to establish contact with each other on Loops 1 or 2 of Span 1.
S2L1 or 2	Signal 2 Loop 1 or Loop 2	The 1st doubler and ERU or 2nd Doubler transceivers are trying to establish contact with each other on Loops 1 or 2 of Span 2.
S3L1 or 2	Signal 3 Loop 1 or Loop 2	The 2nd doubler and ERU transceivers are trying to establish contact with each other on Loops 1 or 2 of Span 3.

Table continued on next page

TABLE 8. ELU-319 FOUR-CHARACTER FRONT PANEL MESSAGES (CONTINUED)

<i>Message</i>	<i>Full Name</i>	<i>Description</i>
ACQ 1 or 2	Acquisition 1 or Acquisition 2	The ELU and first Doubler multiplexers are trying to establish synchronization over each of Loops 1 or 2 of Span 1.
A2L1 or 2	Acquisition 2 Loop 1 or Loop 2	The 1st Doubler and ERU or 2nd Doubler multiplexers are trying to establish synchronization with each other on Loops 1 or 2 of Span 2
A3L1 or 2	Acquisition 3 Loop 1 or Loop 2	The 2nd Doubler and ERU multiplexers are trying to establish synchronization with each other on Loops 1 or 2 of Span 3.
H1ES	HDSL Loop 1 Errored Second	HDSL CRC error on Loop 1.
H2ES	HDSL Loop 2 Errored Second	HDSL CRC error on Loop 2.
ACO	Alarm CutOff	An MNRALM has occurred, and was retired to an ACO condition by pressing the SEL button on the ELU-319 front panel.
SELF TEST		The ELU-319 is in a self test mode. This occurs every power ON/OFF cycle. The self-test sequence includes the input G.703 transceiver chip when the HDSL loops are not in sync. This can cause the AIS pattern, normally transmitted from the ELU during this time, to exhibit bipolar violations (BPVs).
ALRM	Alarm Condition Exists	A minor alarm MNRALM condition is in effect.
1=xx or 2=yy	HDSL Loop Margins	Indicates the worst-case signal-to-noise ratio measured for each loop. A value of '06' or greater is adequate for reliable system operation.
PWR FEED SHRT	Power Feed Short	Indicates a short-circuit between the two HDSL pairs, or the ERU-412 cannot communicate with the ELU-319 over good cable.
PWR FEED OPEN	Power Feed Open	Indicates an open circuit in the Tip and Ring of either HDSL pair.
BAD RT?	No response from ERU	The ELU-319 does not receive any response from the ERU-412. Thus, the ERU's integrity is questionable.
VER	ELU Software Version #	This is displayed during the System Settings review mode. Press the Mode button for 3 seconds.
LIST 0xL	ELU's List #	Displayed during System Settings review mode defined above.
LOSW	Loss of Sync Word	Indicates that one of the HDSL loops has lost synchronization. Causes a minor alarm.
LLOS	Local Loss of Signal	Indicates that no signal is detected at the G.703 input to the ELU-319. Causes a minor alarm.
RLOS	Remote Loss of Signal	Indicates that no signal is detected at the G.703 input to the ERU-412. Causes a minor alarm.
G.703	G.703 BPV errors	Indicates that the number of BPVs at the ELU-319 and ERU-412 G.703 inputs that have exceeded the 24-hour ES threshold. Causes a minor alarm.
MAL1(2)	Margin Alarm Loop 1 or 2	The margin on HDSL loop 1 (2) has dropped below the threshold (1 to 15 dB) set by the user.

TABLE 9. ELU-319 STATUS MENU DEFINITIONS

<i>Message</i>	<i>Full Name</i>	<i>Description</i>
ALARMS		
NONE	No Alarms	
LLOS	Local Loss of Signal	No signal from local G.703 interface.
RLOS	Remote Loss of Signal	No signal from remote G.703 interface.
LOSW 1 (2)	Loss of (HDSL) Sync Word 1 or 2	HDSL LOOP 1 or 2 has lost frame sync.
H1ES	HDSL Loop 1 Errored Second	The number of Loop 1's Errored Seconds has exceeded the user-selected Errored Seconds threshold.
H2ES	HDSL Loop 2 Errored Second	The number of Loop 2's Errored Seconds has exceeded the user-selected Errored Seconds threshold.
G.703	G.703	G.703 input BPVs have exceeded the user selected ES threshold.
MAL1	Margin Alarm (HDSL Loop 1)	The margin on HDSL Loop 1 dropped below the Margin Alarm Threshold (1 to 15). Setting the threshold to 0 (zero) inhibits the alarm.
MAL2	Margin Alarm (HDSL Loop 2)	The margin on HDSL Loop 2 dropped below the user Margin Alarm Threshold (1 to 15). Setting the threshold to 0 (zero) inhibits the alarm.
ACO	Alarm Cut Off	AI Alarm cut-off is in effect.
LAIS	Local Alarm Indicating Signal	Indicates an AIS (all 1's) pattern is being transmitted from the local G.703 output port.
RAIS	Remote Alarm Indicating Signal	Indicates an AIS (all 1's) pattern is being transmitted from the remote G.703 output port.
LOOPBACKS		
NREM	Network Remote Loopback	Loopback at ERU-412 (remote) towards network initiated from ERU-412 front panel pushbutton, or maintenance terminal, or by pressing both the MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 4.
NLOC	Network Local Loopback	Loopback at ELU-319 (local) towards network by pressing both MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 4.
NDU1	Network Doubler 1 Loopback	Loopback at Doubler #1 towards network initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons or maintenance terminal (Figure 14).
NDU2	Network Doubler 2 Loopback	Loopback at Doubler #2 towards network initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons or maintenance terminal (Figure 14).

Table continued on next page

TABLE 9. ELU-319 STATUS MENU DEFINITIONS (CONTINUED)

<i>Message</i>	<i>Full Name</i>	<i>Description</i>
CDU 1	Customer Doubler 1 Loopback	Loopback at Doubler 1 towards CI initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons, or maintenance terminal (Figure 14).
CDU 2	Customer Doubler 2 Loopback	Loopback at Doubler 2 towards CI initiated by ELU-319 front panel MANUAL LOOPBACK push-buttons, or maintenance terminal (Figure 14).
CLOC	Customer Local Loopback	Loopback at ERU-412 (local) towards customer interface (CI) initiated from the maintenance terminal or by pressing both MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 4.
CHREV	Channels Reversed	Channel (loop) 1 and 2 HDSL pairs are reversed at the ERU line input ports.
CREM	Customer Remote Loopback	Loopback at ERU-412 (local) towards customer interface (CI) initiated from the maintenance terminal or by pressing both MODE and SEL pushbuttons on the ELU-319 front panel. See Figure 4.

TABLE 10. GLOSSARY OF HIGAIN TERMS

<i>Term</i>	<i>Definition</i>
MARGINS	Indicates the excess signal to noise ratio, at either the ELU-319 or ERU-412, relative to a 10^{-7} Bit Error Rate. 1st value is current margin, 2nd value is minimum margin since (C)leared last, 3rd value is maximum value since cleared, and NA means Not Available (loops are not synchronized). The normal range of a typical margin is from 6 to 22 dB.
PULSE ATTENUATION	Indicates the attenuation of the 2B1Q pulse from the distant end. HiGain operates with pulse attenuations in excess of 30 dB. This value is related to the cable pair's loss at 260 kHz. The pulse attenuation is a more direct indication of the loop attenuation to the 2B1Q signal than the 260 kHz loss. The normal range of pulse attenuation is from 1 to 32 dB.
PPM	Indicates the relative offset (in parts per million) of the crystal oscillator in the ERU-412 from the ELU-319's crystal oscillator. Any value between -64 and +64 is adequate. Values outside this range indicate out-of-tolerance components or excessive temperature drift of critical components.
HDSL 24 Hour ES (Errored Seconds)	The number of 1-second intervals that contained at least 1 CRC error. This value is a running total of the last 24 hours.
HDSL 24 Hour UAS (Unavailable Seconds)	The number of seconds the HDSL loop was out of synchronization.
G.703 BPV Seconds (ES)	The number of seconds during which at least 1 bipolar violation was detected at the G.703 input.
G.703 UAS Count	The number of seconds during which the G.703 input signal was absent (125 or more consecutive zeroes).
ELU/Ver x.x-yyyy ERU/ver x.x-yyyy	"x.x" = the software version number of the ELU-319 or ERU-412. "yyyy" = the list number of the ELU-319 or ERU-412.

5. SYSTEM MAINTENANCE MENU SCREENS

5.01 Figure 15 is the Maintenance Terminal MAIN MENU Screen. Its eight sub-menus provide many useful provisioning, test and monitoring tools.

5.02 Selection "H" from the MAIN MENU Screen allows the Circuit ID# to be set. It is limited to 24 alphanumeric characters. It, like the system settings, is stored in NVRAM and thus remains when power is lost. Note that the Circuit ID# is not available at the ERU-412 Maintenance Port.

5.03 Figure 16 through Figure 19 show the ELU-319 SPAN STATUS screens for Twin Doubler applications. The SPAN 1 Screen contains data on the two HDSL loops between the ELU-319 and the first Doubler. The SPAN 2 Screen refers to the loops between the first Doubler and the ERU-412 for single-Doubler circuits or between the first and second Doublers for two-Doubler circuits. The

SPAN 3 screen refers to the loops between the second Doubler and the ERU-412 for two-Doubler circuits. All status screens contain the same G.703 interface information.

5.04 Figure 20 shows the SET CLOCK Menu Screen. Both the Time and Date are set with this menu. Set the hours and minutes, using the military (24-hour) convention. Setting the seconds is optional. Enter the date in the sequence and format shown. The ERU-412 unit can be set to the same time and date as the ELU-319 by entering a **U** to the "Update Remote" query. All time information is lost when power is removed. The last date is retained in NVRAM and reappears when power is restored.

5.05 Figure 21 shows the SYSTEM SETTINGS Menu Screen. All 5 user options can be set from this screen. To change any option, enter its character key which is shown inside the parenthesis within each parameter description. This causes the screen to refresh with the new. After all parameters have been selected, press **E** (Exit) then **C** (Confirm). The newly selected parameters are now activated.

5.06 Figure 22 shows the LOOPBACK MENU Screen for a two-Doubler system. Each of the four modules can be looped back towards the network or the customer from this screen. NDU2 and CDU2 are not available for single Doubler applications and only NLOC, NREM, CLOC and CREM are available for non-Doubler applications.

5.07 Figure 23 through Figure 26 show the PERFORMANCE DATA screens for Doubler applications. Both the Errored and Unavailable Seconds for both HDSL loops and each G.703 input are listed at 15-minute intervals over a four hour time interval. The SPAN 1 Screen contains data on the two HDSL loops between the ELU-319 and the first Doubler (EDU1). The SPAN 2 Screen refers to the loops between the first Doubler (EDU1) and the ERU-412 for one Doubler circuits or between the first and second Doublers (EDU1 and EDU2) for two-Doubler circuits. The SPAN 3 Screen refers to the loops between the second Doubler and the ERU-412 for two-Doubler circuits. All status screens contain the same G.703 interface errors. Earlier and later data, in four-hour chunks on six different screens per span, can be accessed by pressing **P** (Previous) or **N** (Next) respectively. Performance data from the different spans can be accessed by entering **S** (Span). All of the counters can be set to "0" by pressing **C** (Clear) from the ELU-319 SPAN STATUS Screen shown in Figure 16 through Figure 19. Note that since the ELU-319 is considered the master module, this clears all performance data screens at both the ELU-319 and the ERU-412. The RS-232 terminal interface at the ERU-412 does not allow the counters to be cleared.

5.08 Figure 27 through Figure 30 show the 7-DAY PERFORMANCE HISTORY screens for Doubler applications. The "Errored Seconds" and "Unavailable Seconds" for both HDSL loops and each of the two G.703 inputs are listed for the

current and previous seven days. The SPAN 1 Screen contains data on the two HDSL loops between the ELU-319 and the first Doubler (EDU1). The SPAN 2 Screen refers to the loops between the first Doubler (EDU1) and the ERU-412 for one-Doubler circuits or between the first and second Doublers (EDU1 and EDU2) for two-Doubler circuits. The SPAN 3 Screen refers to the loops between the second Doubler and the ERU-412 for two-Doubler circuits. All status screens contain the same DS-1 interface errors. All of the counters can be set to "0" by pressing **C** (Clear) on the ELU-319 SPAN STATUS Screen (Figure 16 through Figure 19). Note that since the ELU-319 is considered the master module, this clears all performance data screens at both the ELU-319 and the ERU-412. The RS-232 terminal interface at the HRU-412 does not allow the counters to be cleared.

5.09 Figure 31 through Figure 33 show the ALARM HISTORY screens for Doubler applications. The alarms are defined in Section 4 Paragraph 4.01. The LOS and PWR system alarms are common to all spans. Only the LOSW, ES and MARGIN are span specific alarms. The PWR-OPEN and PWR-SHRT alarms indicate alarm conditions on the ELU-319 List. Neither PWR alarm is available on the other spans. In Figure 31 through Figure 33, the "First" and "Last" columns contain the time and date stA of the first and last occurrence of each alarm. The "Current" column shows the status of each alarm. The "Count" column lists the number of times each alarm occurred. All the data can be cleared by pressing **C** (Clear). The maximum non-overflowing count is 999. The SPAN 1 Screen concerns alarms that occurred on the two HDSL loops between the ELU-319 and the first Doubler (EDU1). The SPAN 2 Screen refers to the loops between the first Doubler (EDU1) and the ERU-412 for one-Doubler circuits or between the first and second Doublers (EDU1 and EDU2) for two-Doubler circuits. The SPAN 3 Screen refers to the loops between the second Doubler and the ERU-412 for two-Doubler circuits.

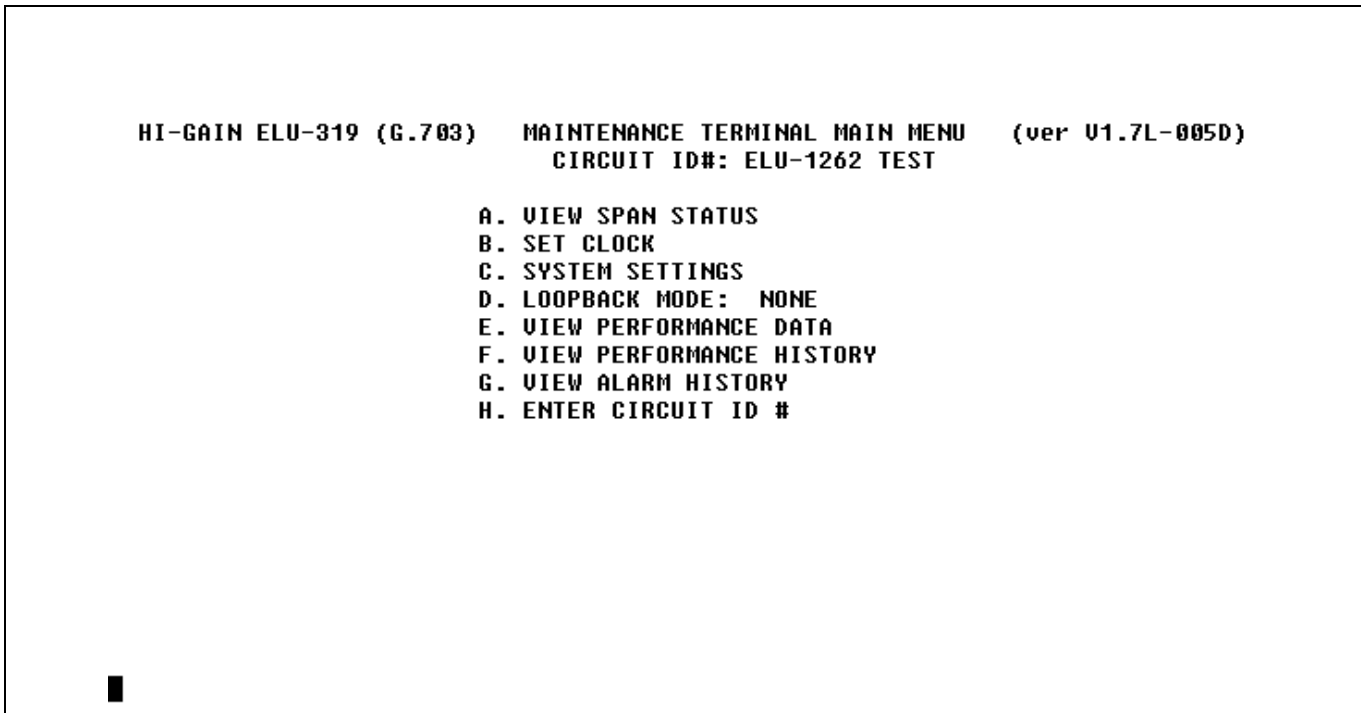


Figure 15. Main Menu.

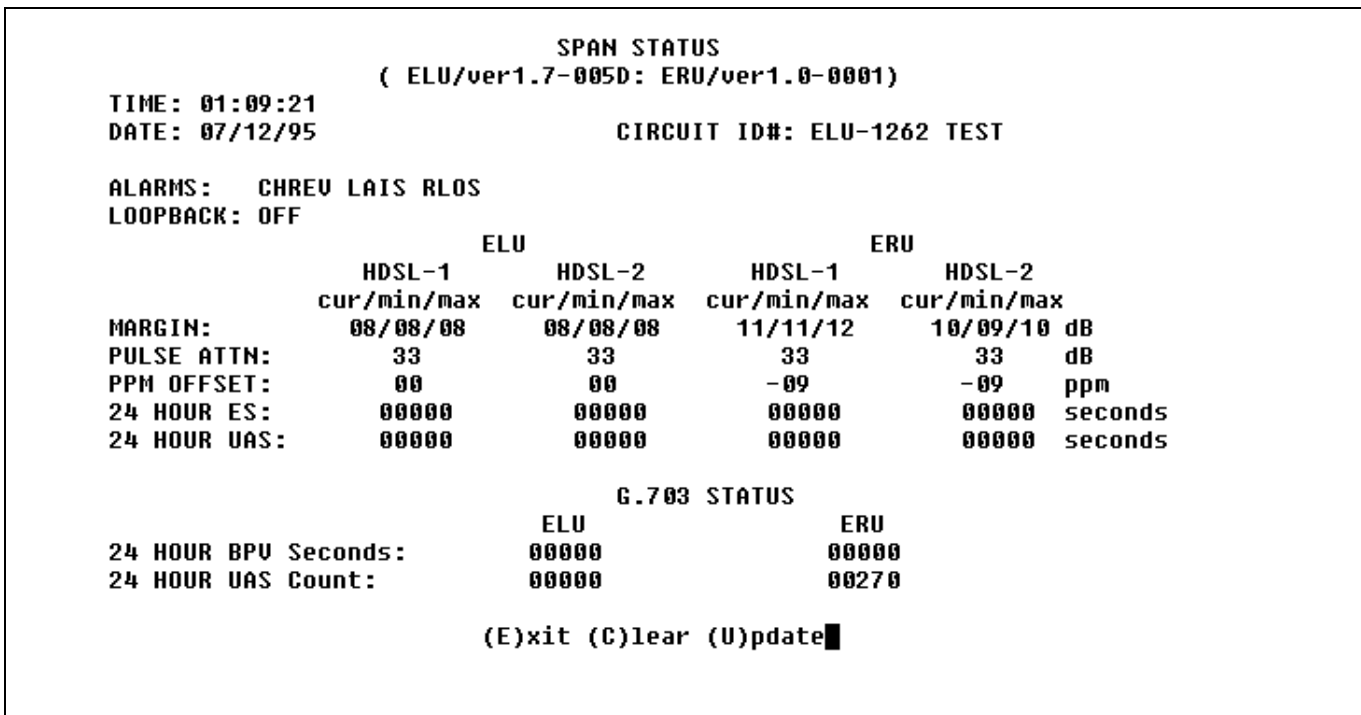


Figure 16. Span Status Display (no Doublers).

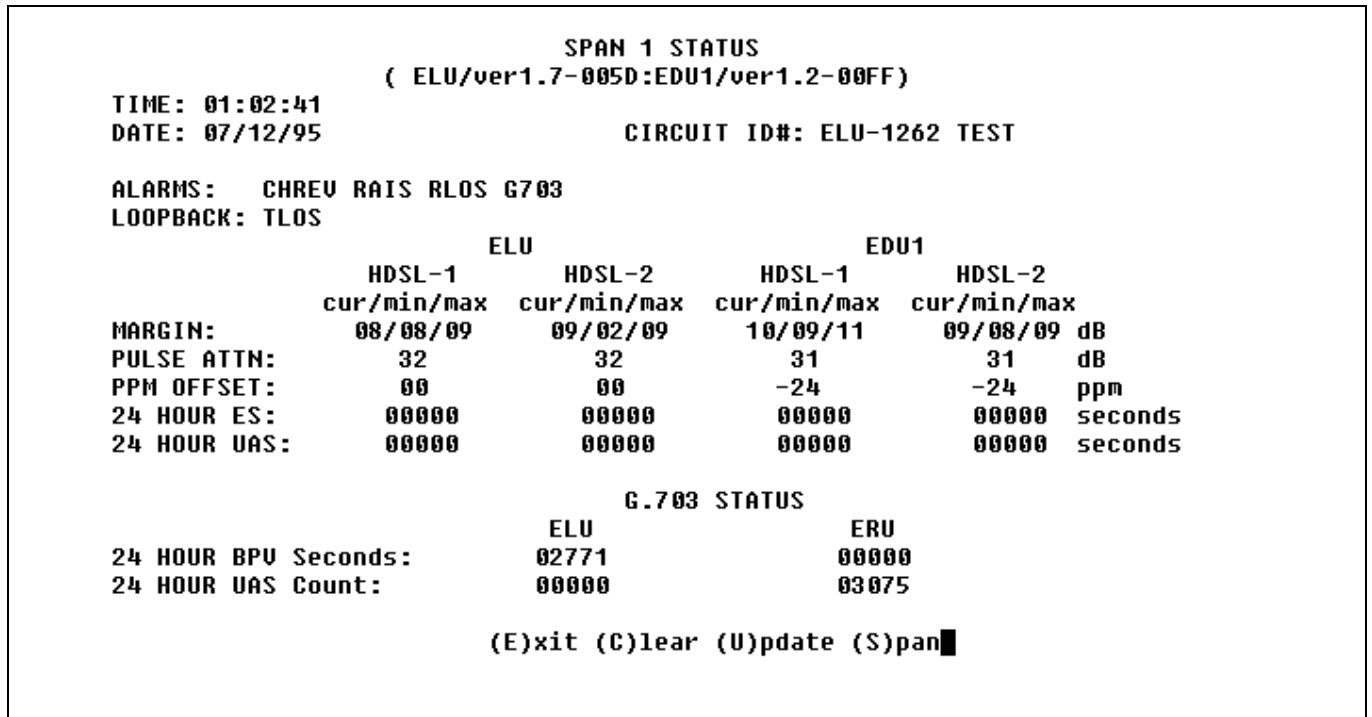


Figure 17. Span 1 Status Display (one or two Doublers).

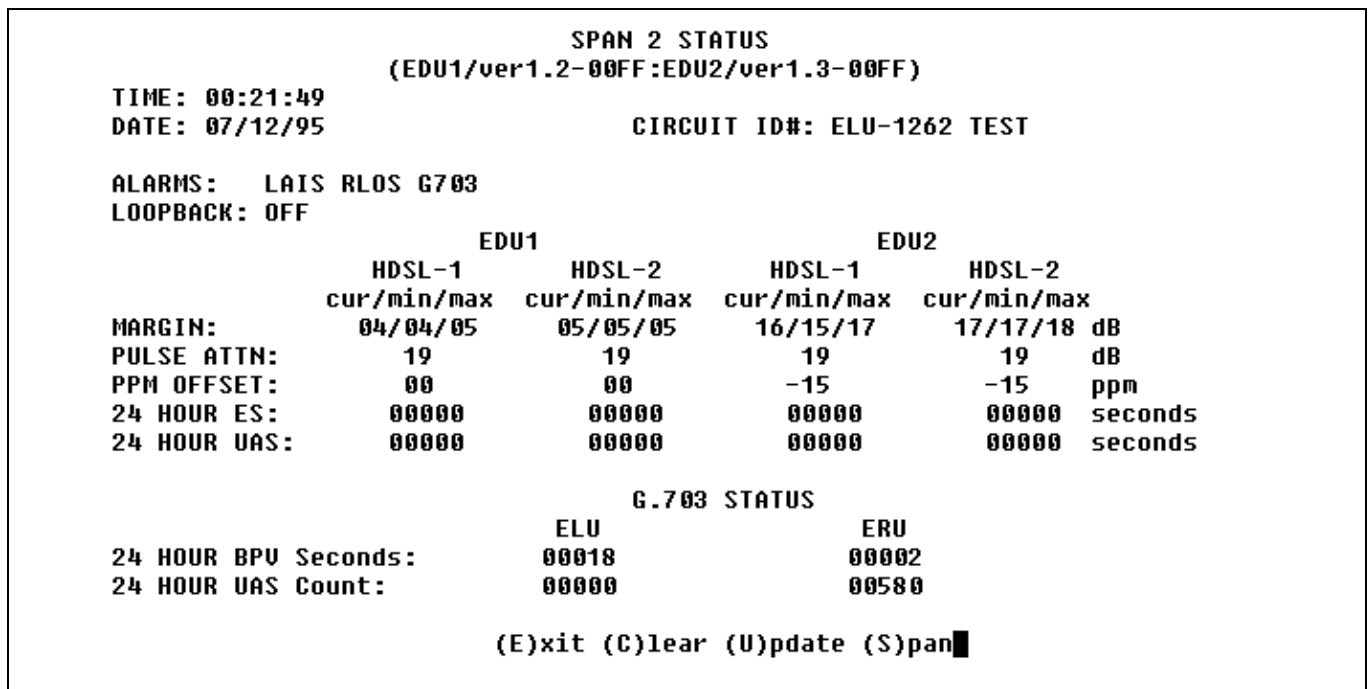


Figure 18. Span 2 Status Display (two Doublers).

```

                                SPAN 3 STATUS
                                (EDU2/ver1.3-00FF: ERU/ver1.0-0001)
TIME: 00:23:05
DATE: 07/12/95                                CIRCUIT ID#: ELU-1262 TEST

ALARMS:  CHREV LAIS RLOS G703
LOOPBACK: OFF

                                EDU2                                ERU
                                HDSL-1                                HDSL-2
                                cur/min/max                                cur/min/max
MARGIN:                                13/12/13                                16/15/16                                18/17/19                                16/15/17 dB
PULSE ATTN:                                23                                23                                24                                24 dB
PPM OFFSET:                                00                                00                                30                                30 ppm
24 HOUR ES:                                00000                                00000                                00000                                00000 seconds
24 HOUR UAS:                                00000                                00000                                00000                                00000 seconds

                                G.703 STATUS
                                ELU                                ERU
24 HOUR BPU Seconds:                                00021                                00002
24 HOUR UAS Count:                                00000                                00656

                                (E)xit (C)lear (U)pdate (S)pan

```

Figure 19. Span 3 Status Display (two Doublers).

```

                                SET CLOCK

TIME: 01:04:09
DATE: 07/12/95
CIRCUIT ID#: ELU-1262 TEST

Format: HH:MM
        MM/DD/YY

NEW TIME:
NEW DATE:

(U)PDATE REMOTE?

```

Figure 20. Set Clock Menu.

```
                                SYSTEM SETTINGS

TIME: 00:56:36
DATE: 07/12/95

                                CIRCUIT ID#: ELU-1262 TEST

(P)OWER:                ENABLE
ES ALARM TH(R)ES:      17
LOOPBACK (T)IMEOUT:    60
(A)LARM:                DISABLE
MAR(G)IN ALM THRES:    4

                                (E)xit
Enter the letter in parenthesis (X) to change any setting█
```

Figure 21. System Settings Menu.

```
                                LOOPBACK MENU

TIME: 01:07:59
DATE: 07/12/95
CIRCUIT ID#: ELU-1262 TEST

                                A. DISABLE LOOPBACKS
                                B. ELU LOOP TO NETWORK      (NLOC)
                                C. ERU LOOP TO NETWORK      (NREM)
                                D. DOUBLER 1 LOOP TO NETWORK (NDU1)
                                G. ELU LOOP TO CUSTOMER     (CREM)
                                H. ERU LOOP TO CUSTOMER     (CLOC)
                                I. DOUBLER 1 LOOP TO CUSTOMER (CDU1)

                                (E)xit█
```

Figure 22. Loopback Menu (one Doubler).

```

Date: 07/12/95          SPAN 1 PERFORMANCE DATA
CIRCUIT ID#: ELU-1262 TEST
                ERRORED SECONDS/UNAVAILABLE SECONDS

                G.703                HDSL-1                HDSL-2
                ELU    ERU    ELU    EDU1    ELU    EDU1
20:45    000/000    000/000    000/000    000/000    000/000    000/000
21:00    000/000    000/000    000/000    000/000    000/000    000/000
21:15    000/000    000/000    000/000    000/000    000/000    000/000
21:30    000/000    000/000    000/000    000/000    000/000    000/000
21:45    000/000    000/000    000/000    000/000    000/000    000/000
22:00    000/000    000/000    000/000    000/000    000/000    000/000
22:15    000/000    000/000    000/000    000/000    000/000    000/000
22:30    000/000    000/000    000/000    000/000    000/000    000/000
22:45    000/000    000/000    000/000    000/000    000/000    000/000
23:00    000/000    000/000    000/000    000/000    000/000    000/000
23:15    000/000    000/000    000/000    000/000    000/000    000/000
23:30    000/000    000/000    000/000    000/000    000/000    000/000
23:45    000/000    000/000    000/000    000/000    000/000    000/000
00:00    000/000    000/000    000/000    000/000    000/000    000/000
00:15    003/000    002/163    007/005    000/000    000/000    000/000
00:30    051/000    000/900    597/000    000/000    000/000    000/000

                (E)xit (P)revious (N)ext (S)pan
    
```

Figure 23. Performance Data Span 1.

```

Date: 07/12/95          SPAN 2 PERFORMANCE DATA
CIRCUIT ID#: ELU-1262 TEST
                ERRORED SECONDS/UNAVAILABLE SECONDS

                G.703                HDSL-1                HDSL-2
                ELU    ERU    EDU1    EDU2    EDU1    EDU2
20:30    000/000    000/000    000/000    000/000    000/000    000/000
20:45    000/000    000/000    000/000    000/000    000/000    000/000
21:00    000/000    000/000    000/000    000/000    000/000    000/000
21:15    000/000    000/000    000/000    000/000    000/000    000/000
21:30    000/000    000/000    000/000    000/000    000/000    000/000
21:45    000/000    000/000    000/000    000/000    000/000    000/000
22:00    000/000    000/000    000/000    000/000    000/000    000/000
22:15    000/000    000/000    000/000    000/000    000/000    000/000
22:30    000/000    000/000    000/000    000/000    000/000    000/000
22:45    000/000    000/000    000/000    000/000    000/000    000/000
23:00    000/000    000/000    000/000    000/000    000/000    000/000
23:15    000/000    000/000    000/000    000/000    000/000    000/000
23:30    000/000    000/000    000/000    000/000    000/000    000/000
23:45    000/000    000/000    000/000    000/000    000/000    000/000
00:00    000/000    000/000    000/000    000/000    000/000    000/000
00:15    003/000    002/163    000/000    000/000    000/000    000/000

                (E)xit (P)revious (N)ext (S)pan
    
```

Figure 24. Performance Data Span 2.

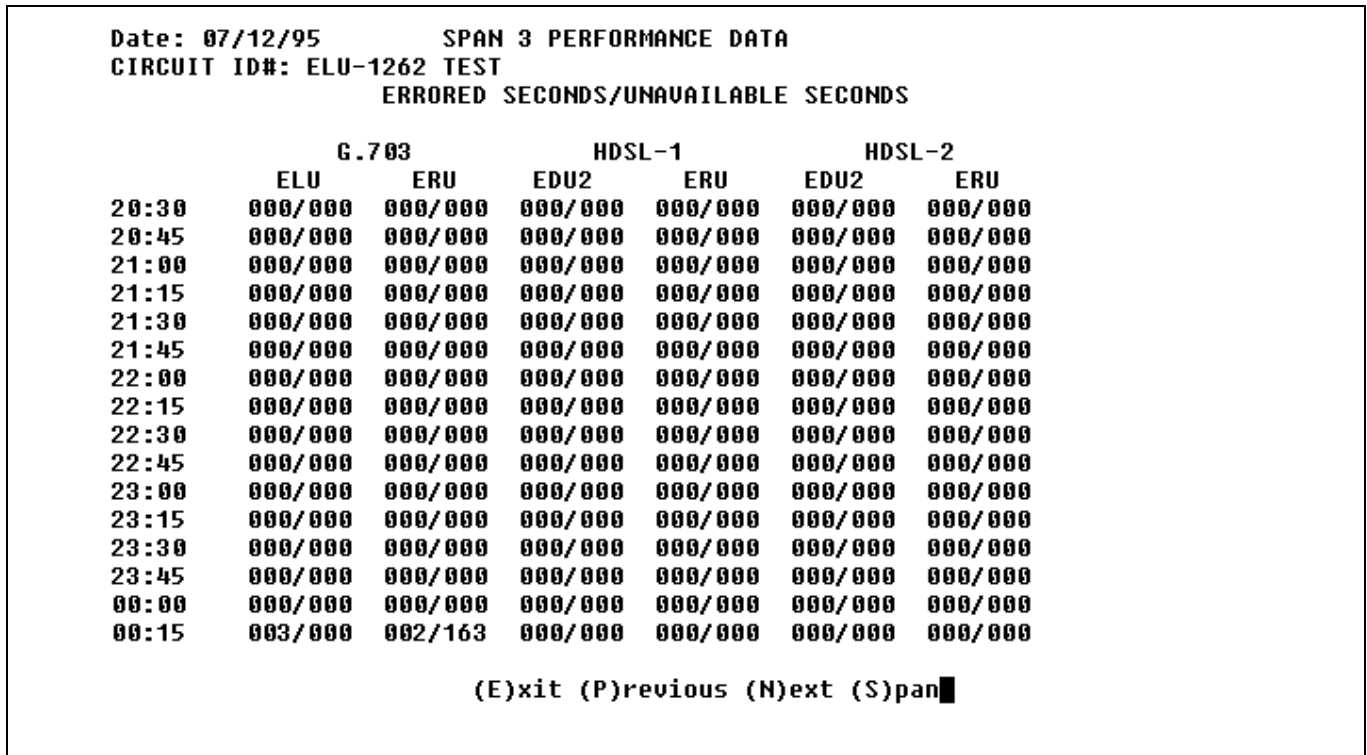


Figure 25. Performance Data Span 3.

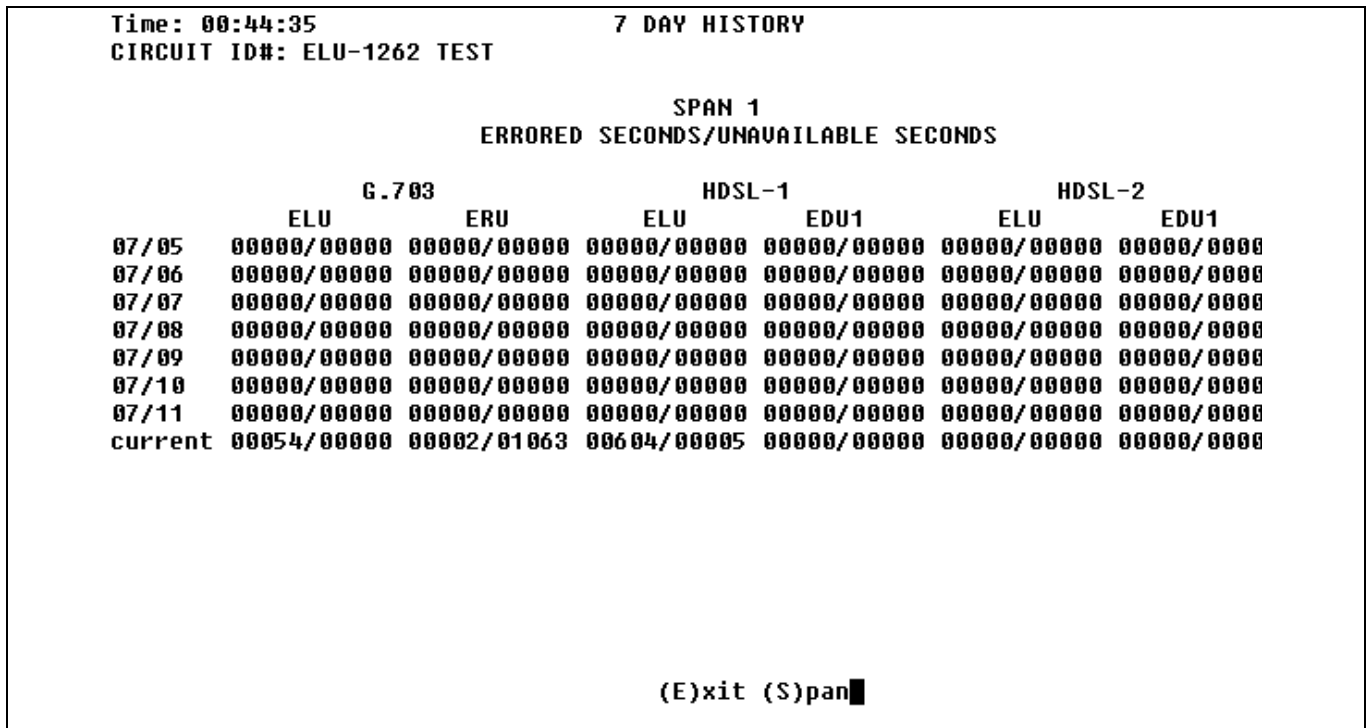


Figure 26. Performance History Span 1.

```

Time: 00:33:19                7 DAY HISTORY
CIRCUIT ID#: ELU-1262 TEST

                                SPAN 2
                                ERRORED SECONDS/UNAVAILABLE SECONDS

                                G.703
                                ELU          ERU          HDSL-1
                                ELU1        EDU2        EDU1        EDU2
07/05  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/06  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/07  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/08  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/09  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/10  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/11  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
current 00054/00000  00002/01063  00000/00000  00000/00000  00000/00000  00000/00000

                                (E)xit (S)pan
    
```

Figure 27. Performance History Span 2

```

Time: 00:35:10                7 DAY HISTORY
CIRCUIT ID#: ELU-1262 TEST

                                SPAN 3
                                ERRORED SECONDS/UNAVAILABLE SECONDS

                                G.703
                                ELU          ERU          HDSL-1
                                EDU2        ERU          EDU2        ERU
07/05  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/06  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/07  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/08  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/09  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/10  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
07/11  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000  00000/00000
current 00054/00000  00002/01063  00000/00000  00000/00000  00000/00000  00000/00000

                                (E)xit (S)pan
    
```

Figure 28. Performance History Span 3

ALARM HISTORY				
TIME: 01:22:16				
DATE: 07/12/95				
CIRCUIT ID#: ELU-1262 TEST				
Type	First	Last	Current	Count
LOS, ELU			OK	000
LOS, ERU	07/12/95-00:00	07/12/95-00:01	ALARM	012
SPAN1 LOSW, HDSL1	07/12/95-00:00	07/12/95-00:00	OK	001
SPAN1 LOSW, HDSL2	07/12/95-00:00	07/12/95-00:00	OK	001
SPAN1 ES, HDSL1			OK	000
SPAN1 ES, HDSL2			OK	000
SPAN1 MARGIN L1	07/12/95-00:00	07/12/95-00:00	OK	001
SPAN1 MARGIN L2	07/12/95-00:00	07/12/95-00:20	OK	004
LAST CLEARED: NONE				
(E)xit (C)lear (U)pdate (S)pan█				

Figure 29. Alarm History Span 1.

ALARM HISTORY				
TIME: 00:37:34				
DATE: 07/12/95				
CIRCUIT ID#: ELU-1262 TEST				
Type	First	Last	Current	Count
LOS, ELU			OK	000
LOS, ERU	07/12/95-00:10	07/12/95-00:14	ALARM	002
SPAN2 LOSW, HDSL1	07/12/95-00:00	07/12/95-00:00	OK	001
SPAN2 LOSW, HDSL2	07/12/95-00:00	07/12/95-00:00	OK	001
SPAN2 ES, HDSL1			OK	000
SPAN2 ES, HDSL2			OK	000
SPAN2 MARGIN L1	07/12/95-00:02	07/12/95-00:02	OK	001
SPAN2 MARGIN L2	07/12/95-00:02	07/12/95-00:02	OK	001
LAST CLEARED: NONE				
(E)xit (C)lear (U)pdate (S)pan█				

Figure 30. Alarm History Span 2.

ALARM HISTORY				
TIME: 00:39:19				
DATE: 07/12/95				
CIRCUIT ID#: ELU-1262 TEST				
Type	First	Last	Current	Count
LOS, ELU			OK	000
LOS, ERU	07/12/95-00:10	07/12/95-00:14	ALARM	002
SPAN3 LOSW, HDSL1	07/12/95-00:02	07/12/95-00:02	OK	001
SPAN3 LOSW, HDSL2	07/12/95-00:02	07/12/95-00:02	OK	001
SPAN3 ES, HDSL1			OK	000
SPAN3 ES, HDSL2			OK	000
SPAN3 MARGIN L1	07/12/95-00:10	07/12/95-00:10	OK	001
SPAN3 MARGIN L2			OK	000
LAST CLEARED: NONE				
(E)xit (C)lear (U)pdate (S)pan				

Figure 31. Alarm History Span 3