PG-FLEX 32 CHANNEL CENTRAL OFFICE TERMINAL LINE UNIT

Model	List Number	Part Number	CLEI Code
FLL-716	3	150-1316-03	N/A

PAIRGAIN TECHNOLOGIES, INC.
ENGINEERING PLANT SERIES TECHNICAL PRACTICE
SECTION 363-716-103-01

Revision History of this practice.
Revision 01—November 26, 1997
A) Initial Release

PAIRGAIN
THE COPPEROPTICS COMPANY

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USING THIS TECHNICAL PRACTICE

Two types of messages, identified by icons, appear in the text:

A note informs you of special circumstances.

Cautions indicate the possibility of damage to equipment or the possibility of personal injury.

A. PRODUCT OVERVIEW

1. Description and Features

1.1 The PairGain® PG-Flex FLL-716 List 3 Central Office Terminal (COT) Line Unit is the Central Office (CO) end of the PG-Flex subscriber carrier system. The FLL-716 Line Unit carries up to 32 subscriber channels between a COT and a Remote Terminal (RT). The FLL-716 COT Line Unit resides in a PairGain COT 19 inch shelf. Each system in the shelf requires one FLL-716 COT Line Unit. The FLL-716 Line Unit provides access through the RS-232 port to provision the PG-Flex system using an ASCII terminal. However, installing an FPI-729 or FAU-728 List 2 unit in the shelf disables the RS-232 port on the FLL-716 Line Unit. The FPI-729 or FAU-728 List 2 unit will then provide access through its RS-232 port to provision the PG-Flex system using an ASCII terminal.

The FLL-716 COT Line Unit uses PairGain's High-bit-rate Digital Subscriber Line (HDSL) 2B1Q (2 binary 1 quaternary line code) technology to provide the equivalent of 2.048 Mbps digital transmission rates, plus signaling, over two copper pairs. The HDSL line can include unterminated bridge taps. The technology is implemented:

- without using repeaters
- without loop conditioning
- without pair selection

The FLL-716 supports the use of PG-Flex doublers to extend the range of a PG-Flex subscriber carrier system.

1.2 The FLL-716 COT Line Unit:

- supports 32 subscriber channels
- supports 4Tel compatible Loop Test Systems
- compatible with Mechanical Loop Testing (MLT) and Pair Gain Test Controller (PGTC)
- supports ISDN channel units
- supports loop start/ground start channel units

2. Front Panel

Figure 1 shows the FLL-716 front panel. Table 1 lists the indicators and indicator states for the FLL-716 front panel LEDs.

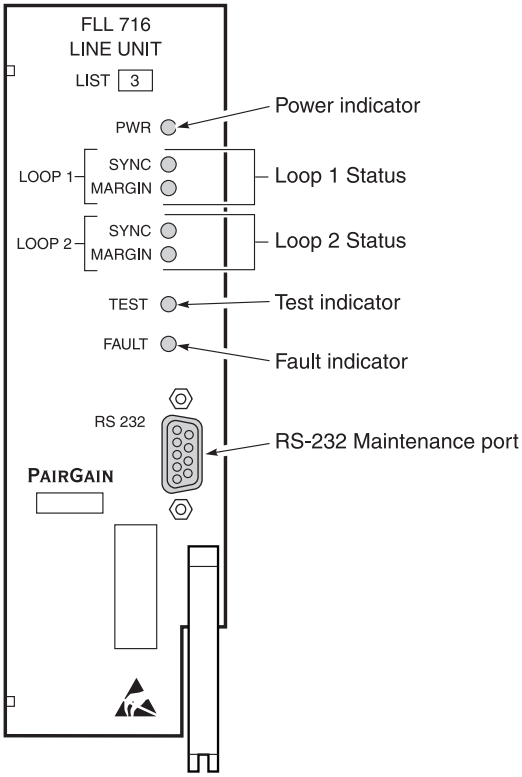


Figure 1 . *FLL-716 List 3 Front Panel*

Table 1. *FLL-716 Front Panel LEDs*

LED	LED State	Indicates
PWR	Solid Green	Power applied and line feed operating normal.
	Flashing Green	Power applied to the RT and testing for overloads.
	OFF	Not receiving power. COT Line Unit fuse may be blown.
LOOP 1 SYNC	Solid Green	HDSL line 1 is in sync between the COT and RT.
	Flashing Green	HDSL line 1 is attempting to sync with remote unit.
	OFF	HDSL line 1 does not detect an active remote unit.
LOOP 1 MARGIN	Solid Yellow	HDSL line 1 is below present margin threshold.
	OFF	HDSL line 1 margin is above the preset margin threshold.
LOOP 2 SYNC	Solid Green	HDSL line 2 is in sync between the COT and RT.
	Flashing Green	HDSL line 2 is attempting to sync with remote unit.
	OFF	HDSL line 2 does not detect an active remote unit.
LOOP 2 MARGIN	Solid Yellow	HDSL line 2 is below present margin threshold.
	OFF	HDSL line 2 margin is above the margin threshold.
TEST	Flashing yellow	Metallic access in progress.
	OFF	No metallic access active in system.
FAULT	Solid Red	System alarm/fault detected.
	OFF	No faults are detected in system.

3. Specifications

Electrical Characteristics

Input Voltage..... -40 to -72 Vdc

Input Power ..... 145 Watts (maximum)

Input Protection ..... Fuse (3A GMT)

Output Voltage ..... ± 130 Vdc (maximum) ground fault protected

Output Power..... 100 Watts (maximum)

Environmental

Operating Elevation..... -200 ft to 13,000 ft (-60 m to 4,000 m)

Operating Temperature & Humidity ..... -40° F to +150° F (-40° C to +65° C)
5% to 95% (non-condensing)

Physical

Dimensions

Height:.....	6.75 in.	(17.2 cm)
Width:.....	2.00 in.	(5.1 cm)
Depth:.....	10.50 in.	(26.7 cm)
Weight.....	2.0 lb.	(0.9 kg)

B. FUNCTIONAL DESCRIPTION

4. Applications

4.1 Overview. PG-Flex is a small-capacity, universal subscriber carrier system that can support up to 32 channels including Plain Old Telephone Service (POTS), Ground Start/Loop Start, and Integrated Services Digital Network (ISDN) services.

PG-Flex systems easily mount into 19-inch COT Shelves. A system is comprised of one Line Unit and at least one Channel Unit. A Line Unit or Channel Unit(s) can be hot-swapped without affecting other systems in the same shelf. The POTS Channel Units use a pulse coded modulation (PCM) encoding scheme that allows high speed modem and group 3 facsimile operation on all channels.

PG-Flex uses HDSL transmission technology over two unconditioned copper pairs. Power is supplied from the CO to the Remote Terminal (RT) over the HDSL transmission lines. The maximum distance from the CO to the RT is 10.7 kft (3.3 km) using 24 AWG cable (0.5 mm).

4.2 System Flex Configuration. A PG-Flex system, shown in Figure 2, consists of:

- COT. The 19-inch COT Shelf accommodates two systems. Each system requires one COT Line Unit and up to six Channel Units. A common Alarm Unit or Pair Gain Test Controller Interface Unit in each shelf provides an interface for maintenance alarm relays and metallic access to the remote subscriber lines.
- RT. The RT Enclosure provides a weatherproof housing for the PG-Flex remote electronics and subscriber terminations. The enclosure accepts one common RT Line Unit and up to four Channel Units.

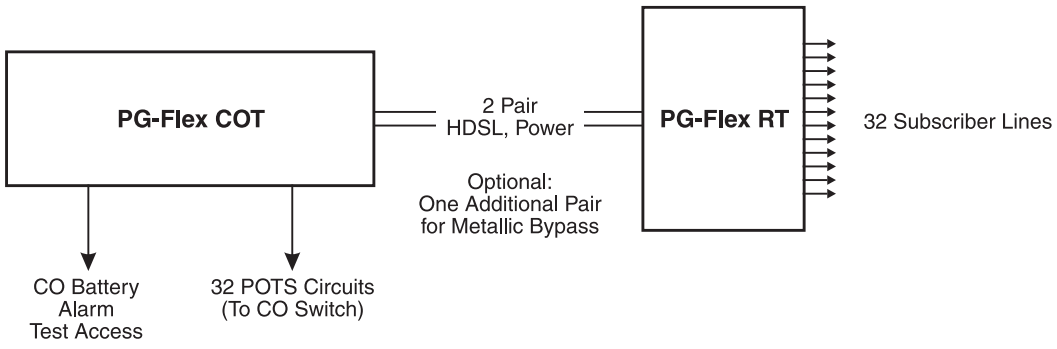


Figure 2. *Typical PG-Flex Configuration*

4.3 HDSL Transmission. PG-Flex uses HDSL transmission technology between the COT and RT. This technology provides up to 32 DS0s, plus signaling, over two copper pairs without using repeaters, loop conditioning, or pair selection. Adaptive equalization, scrambling, and a four-level 2B1Q line coding scheme increase range and minimize crosstalk.

The line interface is a two-pair, 1110-kbps full-duplex 2B1Q transmission format. The dual HDSL lines provide 32 channels at 64-kbps, with signaling and an operations channel for management control. The signal characteristics on the carrier pairs comply with TR-NWT-001210, *Generic Requirements for High-bit-rate Digital Subscriber Line (HDSL) Systems.*

Table 2 shows the maximum distance between the COT and the RT for various gauge wire. Because of HDSL transmission technology, the HDSL lines require no special conditioning and may include unterminated bridge taps, but cannot include load coils.

Table 2. *PG-Flex Distances*

Wire Gauge	Loop Length		DC Resistance
	16/32 Channel System		
26 AWG (0.4 mm)	8.1 kft	(2.5 km)	686 Ω*
24 AWG (0.5 mm)	10.7 kft	(3.3 km)	569 Ω
22 AWG (0.6 mm)	13.7 kft	(4.2 km)	457 Ω
19 AWG (0.9 mm)	19.4 kft	(5.9 km)	322 Ω

* Loops over 570 Ω will not provide full loop current and ring voltage with all 32 channels off-hook simultaniously.

Do not share metallic bypass pairs between PG-Flex systems and between PG-Flex and other Digital Loop Carrier (DLC) systems.

4.4 **Subscriber Drop Testing.** For subscriber drop testing from the Central Office, PG-Flex is able to select and connect any subscriber drop to a metallic bypass pair at the RT. PG-Flex extends this connection back to the COT where it switches it to the test jack on the FAU-728 or FPI-729 units or to the corresponding subscriber line on the COT channel card.

Metallic access is performed by momentarily placing +116 V(from the CO) on the subscriber's Tip lead. (The Ring lead should be between GND and the Tip value.) With POTS, Ground Start/Loop Start, and ISDN channel cards, the selected subscriber drop (assuming a working metallic bypass pair) connects to the corresponding COT subscriber line.

The metallic connection drops when -116 V is momentarily applied to the subscriber's COT Tip.

Metallic access may also be activated through an ASCII terminal connected to the RS-232 Maintenance port located on the front of the FLL-716 line unit or through the FAU-728 or FPI-729 units.

5. Operational Capabilities

5.1 The FLL-716 COT Line Unit provides the following functions for each 32-channel system in a single COT shelf:

- system power supply
- HDSL line transceivers and simplex RT power
- front-panel status indicators
- RS-232 Maintenance Interface (DCE)
- switched access to the metallic bypass pair
- loop test system compatibility

5.2 The RS-232 maintenance port (Figure 1) provides access to provision and monitor the performance of the PG-Flex system using an ASCII terminal (see Section 9). Installation of a PG-Flex system does not require the use of an ASCII terminal.

5.3 Figure 3 shows a block diagram of the FLL-716. The power supply converts CO battery into voltages necessary to power the PG-Flex electronics including ±130 Vdc. During power-up, the system checks the HDSL lines for hazardous conditions or other line faults which might effect the system. If a fault condition is detected, the system stops the power-up sequence and the LED indicators on the front panel indicate a line fault problem.

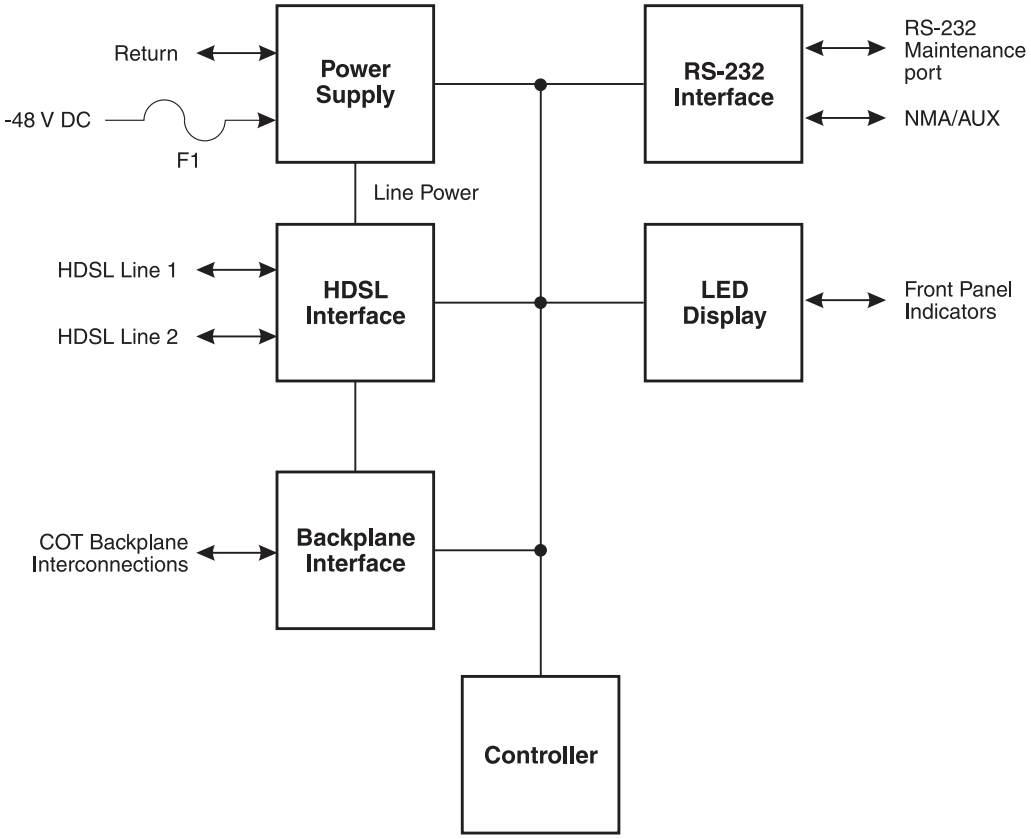


Figure 3. *FLL-716 COT Line Unit Block Diagram*

6. Terminal Management

6.1 The terminal management function allows the technician to manage the entire PG-Flex system using an ASCII terminal (or modem with a null modem cable) connected to the Maintenance port. With this function, the technician can:

- view system status
- set configuration parameters
- set up metallic access connections
- monitor performance
- obtain an inventory report

6.2 **Connecting FLL-716 to a Terminal or Modem.** A standard RS-232 (DB-9) connector on the front panel provides access to the menu interface feature through an ASCII terminal. Figure 4 shows the pinouts for connecting the FLL-716 RS-232 (DB-9) maintenance port to an ASCII terminal.

The FLL-716 Line unit will not automatically log off when a terminal is unplugged from the maintenance port unless the DTR signal is connected between the terminal and the maintenance port. The technician must manually log off the line unit before unplugging from the port. Otherwise, the line unit remains logged in. The next time a terminal is connected, the terminal session will still be in the same place.

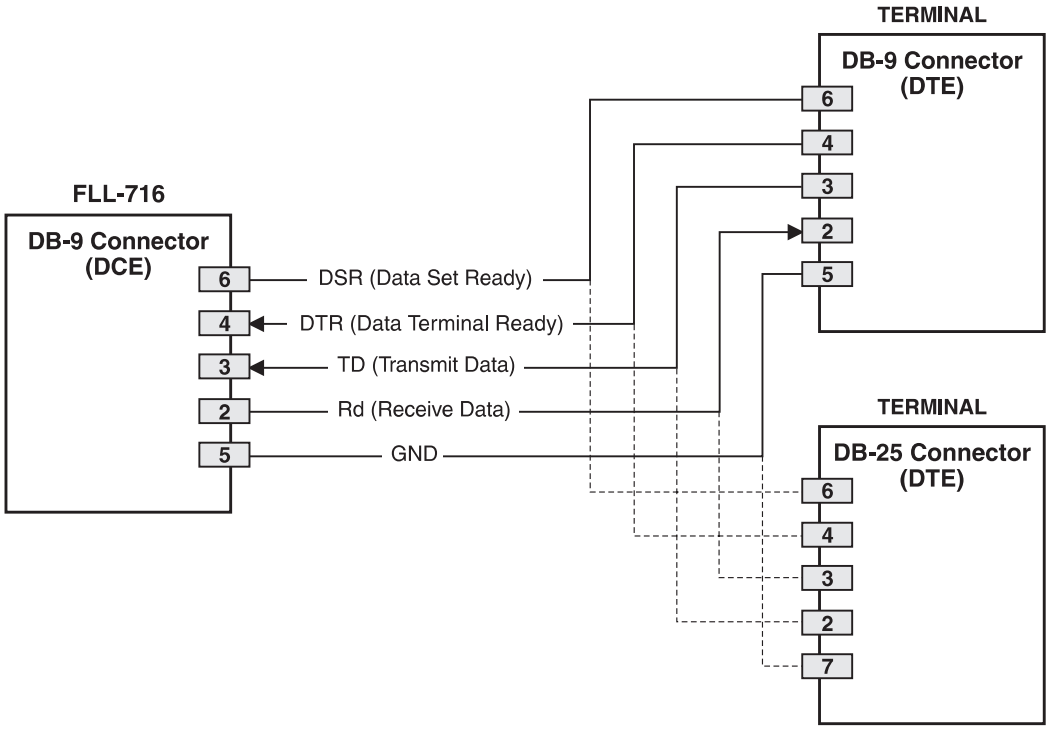


Figure 4. *Connecting FLL-716 to an ASCII Terminal*

Figure 5 shows the pinouts for connecting the FLL-716 to a modem using a null-modem cable. Using Data Carrier Detect (DCD) from the modem ensures that the FLL-716 logs off if the carrier signal disappears.

When configuring a modem, ensure that either the DIP switches or the software configuration is set OFF for Carrier Detect (CD) override. This causes the modem to send Carrier Detect (CD) signal when it connects with another modem and to drop CD when it disconnects. Otherwise, if set ON, the FLL-716 connection will function properly but will not log out properly when disconnected.

It is recommended that Data Terminal Ready (DTR) override be OFF. This allows a modem call to terminate properly when the FLL-716 drops Data Set Ready (DSR); which is null-modemed to a Data Terminal Ready (DTR) input on the modem.

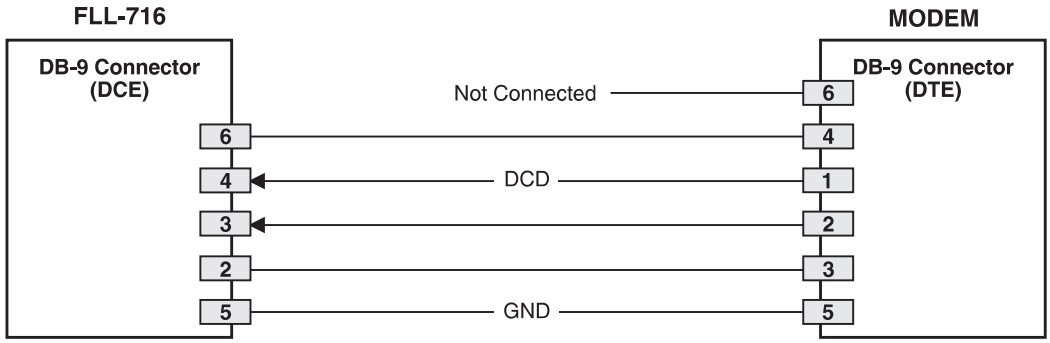


Figure 5. *Connecting the FLL-716 to a Modem*

The connection is set up as:

- DCE with 8 data bits
- 1 stop bit
- no parity
- 1200 to 9600 baud (9600 baud recommended)

The connector requires DTR active from the terminal to prevent automatic log off.

6.3 Menus and Display Structure. Figure 6 shows the menu structure of the terminal management system.

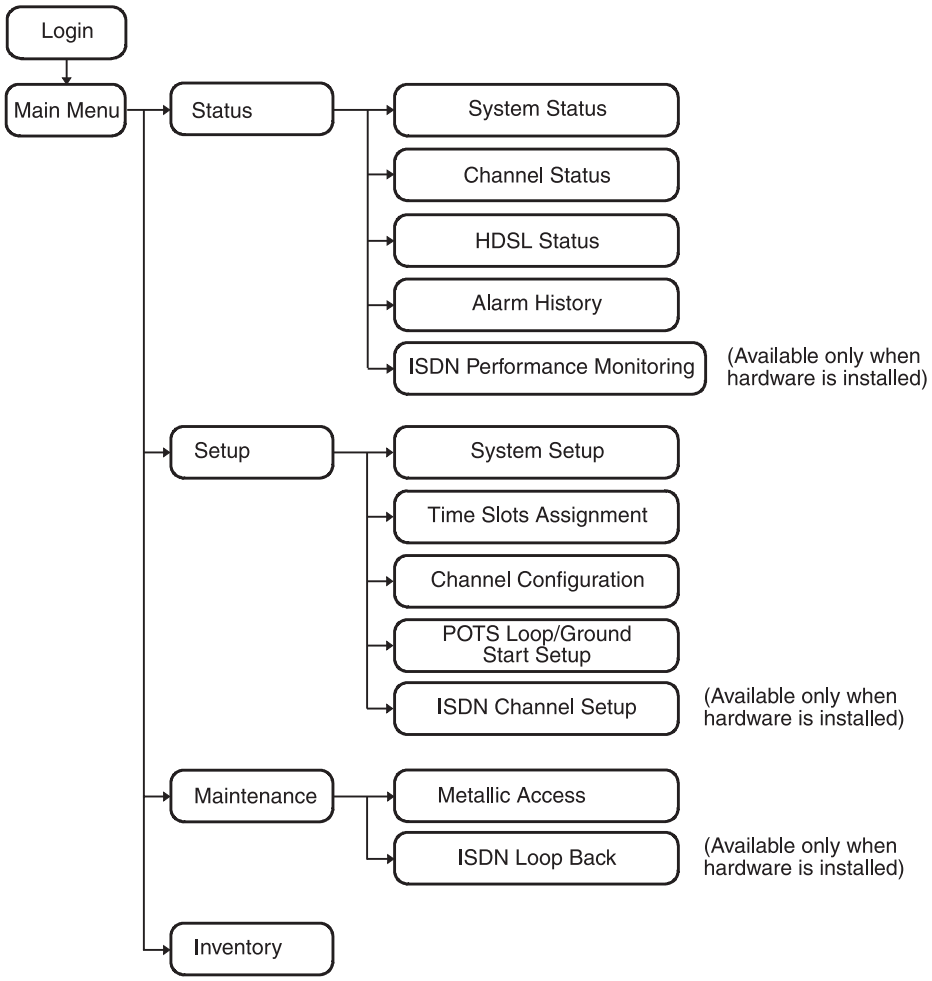


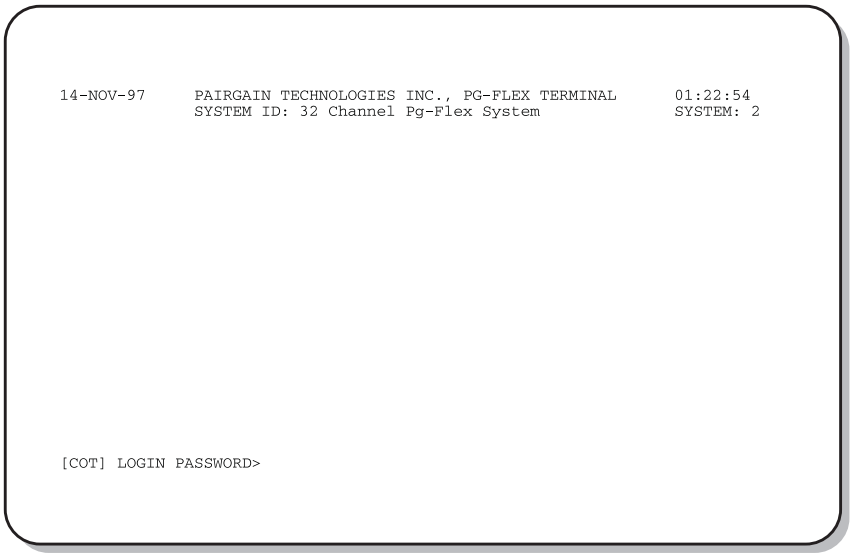
Figure 6. *Terminal Menu and Display Structure*

6.4 Power-Up and Connection Screen. The Power-Up and Connection screen appears after connecting the ASCII terminal to the FLL-716:

6.5 Log On Screen. The FLL-716 displays a log on screen when it detects user input from the maintenance port (while idle).

1 Press the <Spacebar> rapidly several times to start the autobaud feature. Autobaud covers transmission rates of 1,200, 2,400, 4,800 and 9,600 bps only.

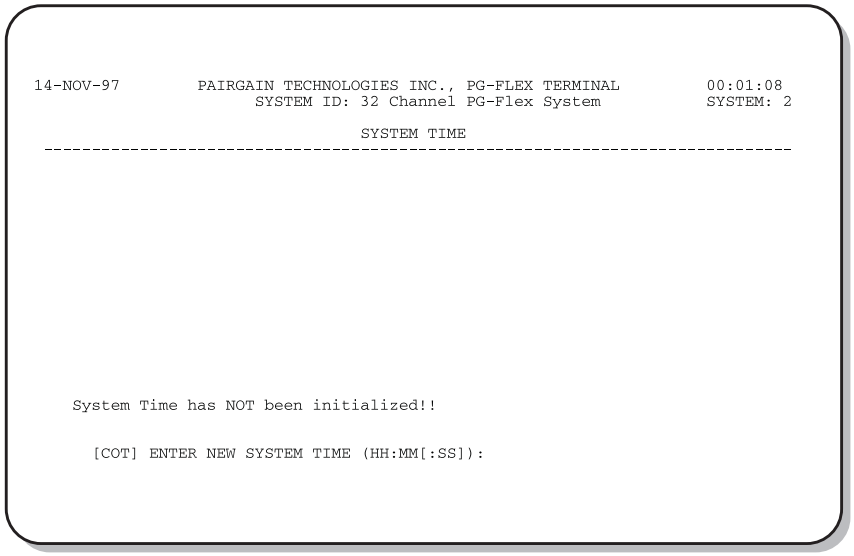
This input causes the log on screen to appear:



2 Enter your password. For security reasons, the password input is echoed back to your terminal screen with "*" characters.

If you do not have your login password, contact the PairGain Customer Service Engineering group (see Technical Support) for access using a Master Password.

6.6 System Time Set Screen. The System Time screen appears the first time you log on, or after the power has been turned off. Enter the new system time in hours (HH), minutes (:MM), and seconds ([:SS]); seconds are optional and are not required to set the system time:



This screen will not appear the next time you log on unless the PG-Flex system has lost power or has been turned off.

6.7 Main Menu. From the Main Menu, you access other menus where you can configure a PG-Flex system, initiate or view metallic access connections, and view status information. The Main Menu appears after a successful log on:

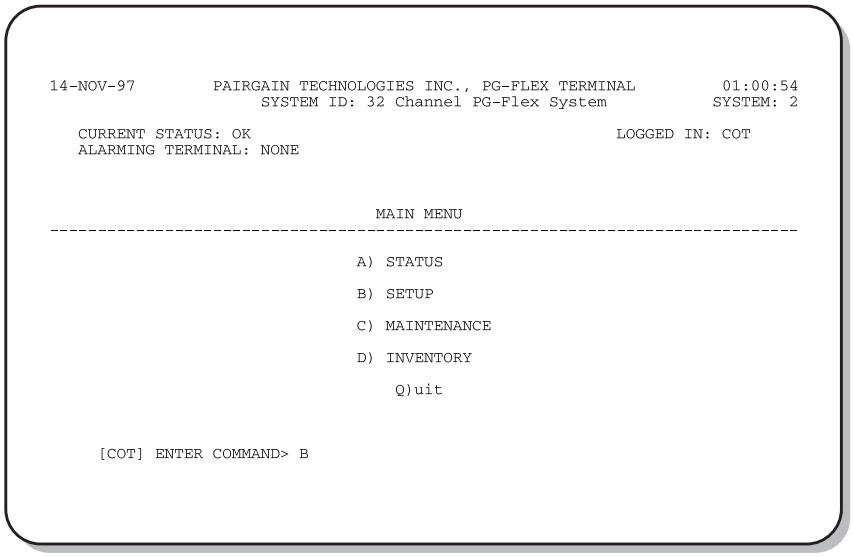


Table 3 describes the functions associated with these four main menu options (A through D).

Table 3. *Main Menu Options*

Main Menu Option	Function
Status	Select the Status option (A) from the Main Menu to display: • System Status to show the equipment installed in the system and the current status (in alarm or not) of the equipment. • Channel Status to show the current status of all channels in the system. Each channel has a status condition. Status conditions vary for the different types of channel cards. Examples of status are: IDLE: channel is not off-hook or ringing RING: channel is ringing BUSY: channel is off-hook OPEN: no connection to CO switch TEST: in test mode TREQ: 116 volts test request SERR: PCM bus frame sync error FIDL: forced idle TDSB: time slots disabled RBAT: reverse battery ****: unknown • HDSL Status to show the status of the HDSL span. You can view either a 24-hour or 7-day performance history. • Alarm History to display the status history of COT, RT, and span alarms. • ISDN Performance Monitoring Menu to show PM error count and PM threshold for a specific ISDN card and channel.
Setup	Select the Setup option (B) from the Main Menu to view the current setup and set or change the following configurable items: • System Setup • Time Slots Assignment (view only) • Channel Configuration • POTS Loop/Ground Start Setup • ISDN Channel Setup
Maintenance	Select the Maintenance option (C) from the Main Menu to setup a metallic access connection to a PG-Flex system. Metallic Access includes: COT bridging, COT looking in, COT looking out, RT looking out, RT looking in, RT bridging, and subscriber bypass. Additionally, there is an ISDN loop back configuration option available.
Inventory	Select the Inventory option (D) from the Main Menu to view manufacturing information and version information for all the units in the system (except FPI). At the CO Line Unit terminal or the RT Line Unit terminal, the command displays all units in the system.

C. INSTALLATION AND TEST

7. Unpacking

7.1 Upon receipt of the equipment, proceed as follows:

1 Unpack each container and 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. Order replacement equipment if necessary.

2 Check the contents versus the packing list to ensure complete and accurate shipment. If the shipment is short or irregular, contact PairGain as described in Section 5. If you must store the equipment for a prolonged period, store the equipment in its original container.

8. Installation

Observe normal electrostatic discharge precautions when handling electronic equipment. Do not hold electronic plugs by their edge. Do not touch components or circuitry.

An FPI-729 List 1 PGTC Interface Unit or and FAU-728 List 2 Alarm Unit must be installed at all times when ISDN channel units are installed. These units provide the composite clock reference source for the ISDN channel units and are required for normal operation of the ISDN channel units. Removing the FPI-729 List 1 or FAU-728 List 2 during an ISDN call will terminate the call.

8.1 Install FLL-716 COT Line Unit and verify operation as follows:

1 Insert the FLL-716 COT Line Unit into the COT shelf and verify:

- all LEDs on the Line Card turn on for about one second
- PWR and FAULT LEDs turn on

If line powering fails, 1 minute must pass before COT can attempt again. If line powering succeeds, HDSL communications begin synchronization and LOOP 1 SYNC and LOOP 2 SYNC flash.

- after four seconds, the COT starts its power management routine and the PWR LED flashes

2 Verify the following front panel indications after the system powers up and establishes HDSL synchronized communications, and when no calls are in progress:

- POWER is on
- LOOP 1 SYNC is on
- LOOP 1 MARGIN is off
- LOOP 2 SYNC is on
- LOOP 2 MARGIN is off
- TEST is off
- FAULT is off

3 Measure the following voltages on the COT shelf backplane:

- -105 Vdc (±10%) for a short loop, and -130 Vdc (±10%) for a long loop or with doublers; measured between the HDSL_T1 pin and chassis ground.
- +105 Vdc (±10%) for a short loop, and +130 Vdc (±10%) for a long loop or with doublers; measured between the HDSL_T2 pin and chassis ground.

9. Provisioning

9.1 Configure System Settings. Perform system setup, if not previously accomplished.

1 Type <B> and press <Enter> at the Main Menu to display the Setup Menu:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:07:32
                      SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

   CURRENT STATUS: OK                                        LOGGED IN: COT
   ALARMING TERMINAL: NONE


                                  SETUP MENU
--------------------------------------------------------------------------------

                       A) SYSTEM SETUP
                       B) TIME SLOTS ASSIGNMENT
                       C) CHANNEL CONFIGURATION
                       D) POTS LOOP/GROUND START SETUP
                       E) ISDN CHANNEL SETUP

                         CTRL-X) Main Menu    e(X)it



     [COT] ENTER COMMAND> A
```

2 Type <A> and press <Enter>. The System Settings menu appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:07:36
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2
                                  SYSTEM SETTINGS
 ------------------------------------------------------------------------------
    A) SYSTEM DATE: .   .   .   .   .   14-NOV-97
    B) SYSTEM TIME: .   .   .   .   .   01:07:36
    C) SYSTEM ID:   .   .   .   .   .   32 Channel PG-Flex System
    D) SET PASSWORD .   .   .   .   .
    E) AUTO LOGOUT TIME (min.): .   .   30          (DISABLED,5,30,60)
    F) METERED TONE FREQUENCY (kHz):    12          (DISABLED,12,16)
    G) RING FREQUENCY (Hz): .   .   .   30          (20,25,30)
    H) HDSL ES ALARM THRESHOLD: .   .   DISABLED    (DISABLED,17,170)
    I) HDSL MARGIN THRESHOLD:   .   .   4           (0-15,0=DISABLED)
    J) ALARM ON HDSL THRESHOLD: .   .   DISABLED    (DISABLED,ENABLED)
    K) LOCAL LOOP LENGTH:   .   .   .   SHORT       (SHORT,LONG)
    L) ALARM ON CONFIGURATION:  .   .   ENABLED     (DISABLED,ENABLED)
    M) ALARM ON INSUFFICIENT TIMESLOT:  ENABLED     (DISABLED,ENABLED)
    N) ALARM ON ISDN PM THRESHOLD:  .   ENABLED     (DISABLED,ENABLED)


                          CTRL-X) Main Menu    e(X)it


      [COT] ENTER CHOICE> X
```

3 Type a letter (A through N) and press <Enter> to select a parameter to change (Table 4). You get a separate screen for the parameter selected. It prompts you to input the change.

4 Type <Ctrl+X> to return to the Main Menu.

Table 4. *System Settings Menu Options*

Parameter	Default Value	Description
A) System Date	01-JAN-00	The System Date must be set for each system individually and is displayed as dd-mmm-yy. It will increment automatically each midnight, as long as the COLU is inserted in a shelf that has power. If the COLU is removed from a powered shelf, then re-inserted in a powered shelf, the date will be the same as it was when the COLU was pulled out of the shelf or when its power was removed. It will then continue to increment to successive dates each midnight, as indicated by the System Time. All years which are evenly divisible by 4 (including the default year "00") are considered leap years. In such years, the date will increment from 28-FEB-yy to 29-FEB-yy (where "yy" represents the last two digits of the year, such as 00, 04, 08, etc.). This product meets or exceeds the current technical quality requirements for Year 2000 compliance and will properly process dates up to, and beyond, December 31, 1999.
B) System Time	00:00:00 at power on	The System Time must be set for each system individually and is displayed as hh:mm:ss. System Time will be lost (default back to 00:00:00) whenever power is removed from the system shelf or the COLU module is removed and reinserted.
C) System ID	(all spaces)	The System ID is supplied to indicate the physical location of the PG-Flex system (central office or remote terminal). Each PG-Flex system should have a unique System ID. The default for System ID is "blank" (all spaces). This can be left blank or set to any desired name of 24 or fewer characters (including spaces). This name can be any mixture of alphanumeric characters (including upper case, lower case, numerals, punctuation, etc.). For example if System ID is set to "shelf 25 system A", this ID will appear at the top of each screen when accessing this system. This parameter is stored in the CO line unit NVRAM and therefore will not change when power is cycled or cards are removed and reinserted. If the CO line unit should be replaced, it would be necessary to reenter the appropriate system ID.

D) Set Password	(all spaces)	If there is an FPI card present in the system, you will be connected to the system through the connector on the FPI card front panel and will be prompted for a password only on initial logon to the FPI card, before accessing a specific system in the shelf. You will not be asked for an additional password when accessing a system. However if there is no FPI card, you will connect to each system individually through its front panel connector and will be prompted for the individual system Password The Password default is <ENTER>. This can be left at this default or set to any desired password of 10 or fewer characters (including spaces). This name can be any mixture of alphanumeric characters (including upper case, lower case, numerals, and punctuation marks). This parameter is stored in the CO line unit card NVRAM and therefore will not change when power is cycled or cards are removed and reinserted All of the parameters discussed in the remainder of this table are stored in the CO line unit card NVRAM and therefore will not normally change when power is cycled or cards are removed and reinserted.
E) Auto Logout Time	DISABLED	After logging on to a system, you will be automatically logged out after a time determined by the Auto Logout Time parameter: • DISABLED: The user will never be automatically logged out. (Note: If the user leaves the system without logging out, and if Auto Logout Time is "DISABLED", the next person who accesses the system can do so without logging on and will not need a password). • 5: The user will be automatically logged out after 5 minues. • 30: The user will be automatically logged out after 30 minues. • 60: The user will be automatically logged out after 60 minues.
F) Metered Tone Frequency	12	Metered tones are used for out-of-band signaling with coin telephones, typically in international markets. A special channel card is required to support this function.
G) Ring Frequency	20	Determines the frequency of the ringing voltage on the subscriber line. Can be configured for the following: • 20: The ring generator is set to 20 Hz. • 25: The ring generator is set to 25 Hz. • 30: The ring generator is set to 30 Hz.

H) HDSL ES Alarm Threshold	DISABLED	This parameter sets the number of Error Seconds required before a minor alarm is generated (dependent on the setting of the Alarm on HDSL Threshold parameter). The count of Error Seconds is reset to zero when the "reset" function is used on the HDSL Performance History status screen. Can be set to one of the following parameters: • DISABLED: No minor alarm is generated, regardless of the number of error seconds. • 17: A minor alarm is generated after 17 error seconds. • 170: A minor alarm is generated after 170 error seconds.
I) HDSL Margin Threshold	4	This parameter sets the HDSL margin threshold. If the HDSL margin attains a value equal to or less than the setting for this parameter, a minor alarm is generated (dependent on the setting of the Alarm on HDSL Threshold parameter). A default setting of 4 indicates that a minor alarm will occur when the HDSL margin is # 4 dB. The HDSL Margin Threshold can be set between 1 dB and 15 dB.
J) Alarm on HDSL Threshold	DISABLED	This parameter controls whether a minor alarm is generated if the HDSL ES Alarm Threshold or HDSL Margin Threshold is exceeded. Can be set to one of the following parameters: • DISABLED: A minor alarm will not occur when the HDSL ES Alarm Threshold and/or HDSL Margin Threshold is exceeded. • ENABLED: A minor alarm will occur when the HDSL ES Alarm Threshold and/or HDSL Margin Threshold is exceeded.
K) Local Loop Length	Long	The length of subscriber loop supported by PG-Flex is determined by this parameter and affects all subscriber loops within a single PG-Flex system. The length of the loop affects the total power required by the PG-Flex system; the shorter the loop, the less the power required. For the majority of applications, the power saved is relatively insignificant and the default value ("LONG") should be selected. Can be set to the following parameters: • LONG: The PG-Flex system can support subscriber loops with a line resistance of 530 W or less. • SHORT: The PG-Flex system can support subscriber loops with a line resistance of 400 W or less.

L) Alarm on Configuration	DISABLED	Each channel card in a PG-Flex system must have a corresponding channel card type at the opposite node. A mismatch condition will result when a card does not have the correct corresponding card at the other end due to channel unit removal, type mixing, or failure. Can be set to the following parameters: • DISABLED: A minor alarm will not occur if there is a mismatch of channel units. • ENABLED A minor alarm will occur if there is a mismatch of channel units.
M) Alarm on Insufficient Time Slot	DISABLED	This parameter determines whether a minor alarm is generated if more circuits have been enabled than there are time slots available. This could occur when enabling ISDN circuits without first disabling a sufficient number of POTS circuits to ensure that there are enough time slots available to support the ISDN circuits. Can be set to the following parameters: • DISABLED: A minor alarm will not occur if more circuits have been enabled than there are available time slots. • ENABLED: A minor alarm will occur if more circuits have been enabled than there are available time slots.
N) Alarm on ISDN PM Threshold	DISABLED	This parameter determines whether a minor alarm occurs if any of the PM thresholds are exceeded. Can be set to the following parameters: • DISABLED: A minor alarm will not occur if any of the ISDN PM thresholds are exceeded. • ENABLED: A minor alarm will occur if any of the ISDN PM thresholds are exceeded.

9.2 **Configure an ISDN Channel Unit.** To configure and view the status of an ISDN Channel unit, follow the instructions in paragraphs 9.2.1 through 9.2.5.

9.2.1 Set up the ISDN module, starting from the Setup Menu:

1 Type <E> and press <Enter> for the ISDN Channel Setup menu:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:08:12
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

                                ISDN CHANNEL SETUP
 ------------------------------------------------------------------------------

                     Press ESCAPE to return to previous menu









   Enter Card and Channel To Setup (CARD,CHANNEL): 2,3
```

If there are no ISDN cards present in the system, the display will indicate that there are no ISDN cards installed, and not allow you to continue to the ISDN Channel Setup menu.

2 Type the card number followed by a comma, and then type the channel numbers and press <Enter> for the ISDN module you want to configure. The ISDN Channel Setup menu appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:08:18
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

                                ISDN CHANNEL SETUP
------------------------------------------------------------------------------
   CARD:2    CHANNEL:3
------------------------------------------------------------------------------
   A) PM Mode: .   .   .   .   .   Interim Path(Interim Path, Segmented)
   B) eoc Mode:    .   .   .   .   Normal      (Normal, Transparent)
   C) B1 <-> B2 Swap:  .   .   .   Normal      (Normal, Swap)
   D) Sealing Current: .   .   .   Off         (Off, On)
   E) Zero Byte Substitution:  .   Off         (Off, Enabled)

                         S)ELECT NEW CARD AND CHANNEL

                         CTRL-X) Main Menu    e(X)it









     [COT] ENTER CHOICE>
```

3 From the ISDN Channel Setup menu type a letter (A through E) and press <Enter> to choose a setup parameter. Select one of the two options available for each parameter (Table 5):

Table 5. *ISDN Channel Unit Configuration Options*

Parameter	Description	Options	
A) PM Mode	Performance monitoring of the ISDN channels is done considering the channel as one path (Interim Path) or several separate sections (Segmented).	**Interim**	Performance monitoring is done considering the channel as one path and collects the end-to-end error rate for the entire transport path.
		Segmented	Performance monitoring is done considering the channel as separate sections, and collects error rates for each DSL loop individually
B) eoc mode	This parameter determines how ISDN eoc messages are handled by the PG-Flex system.	**Normal**	ISDN eoc messages are decoded and re-transmitted within the PG-Flex system.
		Transparent	ISDN eoc messages are not decoded and are passed through the PG-Flex system transparently.
C) B1<->B2 Swap	This parameter determines whether the B channels are swapped between the PG-Flex CO ISDN "U" interface and the RT ISDN "U" interface. The "D" signaling channel is unaffected by this parameter.	**Normal**	ISDN channel "B1" and "B2" at the CO ISDN "U" interface are routed to channels "B1" and "B2" at the RT ISDN "U" interface.
		Swap	ISDN channel "B1" and "B2" at the CO ISDN "U" interface are routed to channels "B2" and "B1" at the RT ISDN "U" interface.
D) Sealing Current	This parameter determines whether sealing current is applied to the ISDN subscriber loop.	**Off**	No sealing current is applied to the ISDN subscriber loop.
		On	A constant current of approximately 5 ma. flowing in the ISDN subscriber loop at all times.
E) Zero Byte Substitution	This parameter determines how ISDN eoc messages are handled by the PG-Flex system.	**Off**	The PG-Flex system passes all data through without any special encoding.
		On	The PG-Flex system will use a ZBS code to prevent long string of zeros in the data.

4 From the ISDN Channel Setup menu type <S> and press <Enter> to select a new ISDN channel unit and channel to configure.

Type the channel unit number followed by a comma, then type the channel for the new ISDN channel unit. That is, type "2, 3" for ISDN card number 2 on channel 3.

9.2.2 Configure channels, starting at the Setup Menu:

There are 32 time slots available. Enable is the default for the channels. Disable channels only when the time slots are required by another channel unit.

ON means the channel is enabled with a time slot. OFF means the channel is enabled but does not have a time slot assigned.

1 Type <C> and press <Enter>. The Channel Configuration menu appears:

```
 14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:07:54
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2
                                  CHANNEL CONFIGURATION
--------------------------------------------------------------------------------

                           CU1       CU2       CU3       CU4
       Channel    COT      (POTS8)   (POTS8)   (POTS8)   (ISDN4)
                  RT       (POTS8)   (POTS8)   (POTS8)   (ISDN4)
--------------------------------------------------------------------------------
           1               ON        ON          ON        ON
           2               ON        ON          ON        OFF
           3               ON        ON        DISABLED  DISABLED
           4               ON        ON        DISABLED  DISABLED
           5               ON        ON        DISABLED    -
           6               ON        ON        DISABLED    -
           7               ON        ON        DISABLED    -
           8               ON        ON        DISABLED    -


                          2 Time slots Available

                      D)isable Channel   E)nable Channel
                         CTRL-X) Main Menu    e(X)it

      [COT] ENTER COMMAND>
```

3 Type <D> to disable a channel or type <E> to enable a channel and then press <Enter>.

You get a prompt to enter the card and channel number.

4 At the prompt for the system to be configured, enter the card number followed by a comma, and then enter the channel number and press <Enter>, (that is, type “1,1” for card 1 on channel 1).

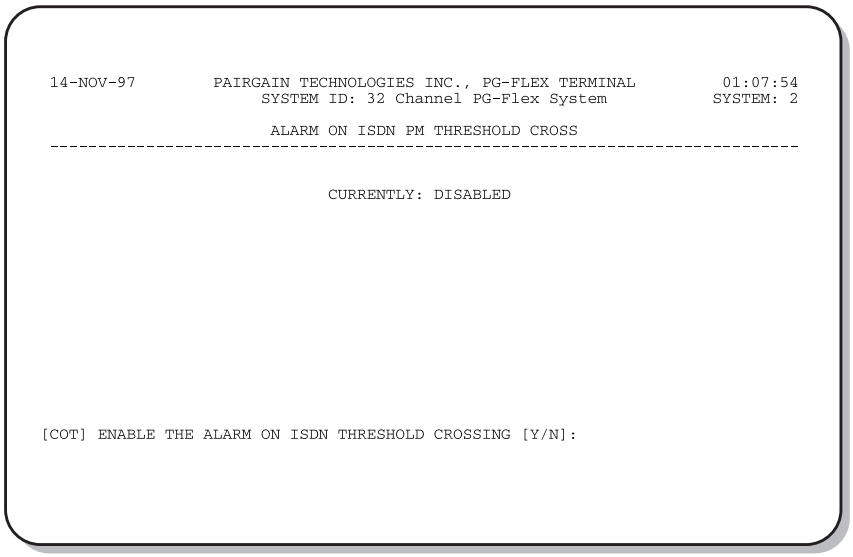
9.2.3 Enable alarms, if required by local practice (start at the Setup Menu):

1 Enable/disable the Alarm On ISDN PM Threshold Cross:

a Type <A> and press <Enter> to display the System Settings menu.

b Type <N> and press <Enter> to display the Alarm On ISDN PM Threshold Cross menu.

The following screen appears:



c Type <Y> and press <Enter> to enable the alarm, or type <N> and press <Enter> to disable the alarm.

9.2.4 Time Slot Assignment. View time slot assignments, starting at the Setup Menu**.** Type <B> and press <Enter> to display the Time Slots Assignment menu:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          01:07:46
                       SYSTEM ID: 32 Channel PG-Flex System            SYSTEM: 2
                                TIME SLOTS ASSIGNMENT
 ------------------------------------------------------------------------------
  TIME     CHANNEL      TIME     CHANNEL      TIME     CHANNEL      TIME     CHANNEL
  SLOT   ASSIGNMENT     SLOT   ASSIGNMENT     SLOT   ASSIGNMENT     SLOT   ASSIGNMENT
 ------------------------------------------------------------------------------
    1:   CU1  CH1        9:   CU2  CH1       17:   CU3  CH1       25:   CU4  CH1
    2:   CU1  CH2       10:   CU2  CH2       18:   CU3  CH2       26:   CU4  CH1
    3:   CU1  CH3       11:   CU2  CH3       19:   CU3  CH3       27:   CU4  CH1
    4:   CU1  CH4       12:   CU2  CH4       20:   CU3  CH4       28:   CU4  CH2
    5:   CU1  CH5       13:   CU2  CH5       21:   CU3  CH5       29:   CU4  CH2
    6:   CU1  CH6       14:   CU2  CH6       22:   CU3  CH6       30:   CU4  CH2
    7:   CU1  CH7       15:   CU2  CH7       23:   CU3  CH7       31:     ----
    8:   CU1  CH8       16:   CU2  CH8       24:   CU3  CH8       32:     ----
 ------------------------------------------------------------------------------

                          CTRL-X) Main Menu    e(X)it


      [COT] ENTER COMMAND>
```

Timeslots are automatically assigned by the PG-Flex system. However, when you cycle power to the system or hot plug a new channel unit, these values can change. Since PG-Flex is a universal carrier system, specific time slot assignments do not affect subscriber termonology; this information is provided for diagnostic purposes only.

9.2.5 Performance Monitoring. Access these menus for performance monitoring of the ISDN channel units, starting from the Status Menu.

1 Type <E> and press <Enter> for the ISDN Performance Monitoring Menu:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:03:14
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

                          ISDN PERFORMANCE MONITORING MENU
 ------------------------------------------------------------------------------

                      Press ESCAPE to return to previous menu









    Enter Card and Channel (CARD,CHANNEL): 2,3
```

2 Type the ISDN channel unit number and the channel number and press <Enter>.

The following menu appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:03:20
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

                          ISDN PERFORMANCE MONITORING MENU
 ------------------------------------------------------------------------------
     INTERIM PATH ENABLED   CARD:2   CHANNEL:3
 ------------------------------------------------------------------------------

                           A) SELECT NEW CARD AND CHANNEL

                           B) PM ERROR COUNT

                           C) PM THRESHOLD/ALERT INFO

                            CTRL-X) Main Menu    e(X)it









       [COT] ENTER COMMAND>
```

3 Type a letter (B or C) and press <Enter> to view status for the channel unit and channel you selected.

4 Type <A> and press <Enter> to select a new ISDN channel unit and channel.

9.3 **Configure Loop Start/Ground Start Channel Units.** To configure and test a POTS Loop Start/Ground Start Channel unit follow the procedures in paragraphs 9.3.1 through 9.3.4.

Some screens may be different when channel units are installed in a 19-inch or 23-inch shelf. A 19-inch shelf has two systems where each has from one to six channel units. A 23-inch shelf has four systems where each has from one to three channel units. The example screens, where appropriate, show only a 23-inch shelf with three channel units.

9.3.1 Set up the channels for loop start or ground start:

1 From the Main Menu, type <B> and press <Enter>. The Setup Menu appears.

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:07:32
                      SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

   CURRENT STATUS: OK                                          LOGGED IN: COT
   ALARMING TERMINAL: NONE


                                  SETUP MENU
--------------------------------------------------------------------------------

                        A) SYSTEM SETUP
                        B) TIME SLOTS ASSIGNMENT
                        C) CHANNEL CONFIGURATION
                        D) POTS LOOP/GROUND START SETUP
                        E) ISDN CHANNEL SETUP

                          CTRL-X) Main Menu    e(X)it


     [COT] ENTER COMMAND> D
```

2 From the Setup Menu, type <D> and press <Enter>. The Pots Loop/Ground Start Configuration menu appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:08:06
                      SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2

                        POTS GROUND/LOOP START CONFIGURATION
-------------------------------------------------------------------------------
                    CU1        CU2        CU3        CU4
   Channel COT   (POTG8)    (POTG8)    (POTS8)    (ISDN4)
             RT  (POTG8)    (POTG8)    (POTS8)    (ISNN4)
-------------------------------------------------------------------------------
         1          GND        LOOP       LOOP       N/A
         2          LOOP       GND        LOOP       N/A
         3          LOOP       LOOP       LOOP       N/A
         4          LOOP       LOOP       LOOP       N/A
         5          LOOP       LOOP       LOOP
         6          LOOP       LOOP       LOOP
         7          LOOP       LOOP       LOOP
         8          LOOP       LOOP       LOOP

                          L) Change to Loop Start
                          G) Change to Ground Start
                        CTRL-X) Main Menu    e(X)it


   [COT] ENTER COMMAND>
```

3 Type <L> and press <Enter> to change the channel to loop start, or type <G> and press <Enter> to change the channel to ground start. You get a prompt to enter the card and channel numbers.

4 At the prompt, type the card number followed by a comma, and then type the channel number for the channel unit and channel you want to disable/enable and press <Enter> (that is, type “1,1” for card 1 on channel 1).

9.3.2 Configure channels, starting at the Setup Menu:

There are 32 time slots available. Enable is the default for the channels. Disable channels only when the time slots are required by another channel unit.

1 Type <C> and press <Enter>. The Channel Configuration menu appears:

```
 14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:07:54
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2
                                CHANNEL CONFIGURATION
-------------------------------------------------------------------------------

                           CU1       CU2       CU3       CU4
       Channel    COT      (POTS8)   (POTS8)   (POTS8)   (ISDN4)
                  RT       (POTS8)   (POTS8)   (POTS8)   (ISDN4)
-------------------------------------------------------------------------------
             1             ON        ON          ON        ON
             2             ON        ON          ON        OFF
             3             ON        ON        DISABLED  DISABLED
             4             ON        ON        DISABLED  DISABLED
             5             ON        ON        DISABLED    -
             6             ON        ON        DISABLED    -
             7             ON        ON        DISABLED    -
             8             ON        ON        DISABLED    -


                          2 Time slots Available

                     D)isable Channel   E)nable Channel
                        CTRL-X) Main Menu    e(X)it

      [COT] ENTER COMMAND>
```

2 Type <D> (disable) or <E> (enable) and press <Enter>. You get a prompt to enter the card and channel numbers.

3 At the prompt, type the card number followed by a comma, and then type the channel number for the channel unit and channel you want to disable/enable and press <Enter> (that is, type “1,1” to disable/enable card 1 on channel 1).

9.3.3 **Time Slot Assignments.** View time slot assignments, starting at the Setup Menu**.** Type <B> and press <Enter>. The Time Slot Assignment menu appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:07:46
                      SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2
                              TIME SLOTS ASSIGNMENT
-------------------------------------------------------------------------------
 TIME    CHANNEL     TIME    CHANNEL     TIME    CHANNEL     TIME    CHANNEL
 SLOT  ASSIGNMENT    SLOT  ASSIGNMENT    SLOT  ASSIGNMENT    SLOT  ASSIGNMENT
-------------------------------------------------------------------------------
   1:   CU1  CH1       9:   CU2  CH1      17:   CU3  CH1      25:   CU4  CH1
   2:   CU1  CH2      10:   CU2  CH2      18:   CU3  CH2      26:   CU4  CH1
   3:   CU1  CH3      11:   CU2  CH3      19:   CU3  CH3      27:   CU4  CH1
   4:   CU1  CH4      12:   CU2  CH4      20:   CU3  CH4      28:   CU4  CH2
   5:   CU1  CH5      13:   CU2  CH5      21:   CU3  CH5      29:   CU4  CH2
   6:   CU1  CH6      14:   CU2  CH6      22:   CU3  CH6      30:   CU4  CH2
   7:   CU1  CH7      15:   CU2  CH7      23:   CU3  CH7      31:     ----
   8:   CU1  CH8      16:   CU2  CH8      24:   CU3  CH8      32:     ----
-------------------------------------------------------------------------------

                          CTRL-X) Main Menu    e(X)it
```

These assignments are automatically generated. However, when you cycle power to the system or hot plug a new channel unit, these assignments can change.

9.3.4 Test the loop start and ground start channels:

1 Verify that front panel ACTIVE indicators are OFF and FAULT indicator is off.

2 Test circuits for loop start.

3 Test circuits for ground start.

9.4 **View Doubler Status.** Paragraphs 9.4.1 through 9.4.2 provide steps for viewing the status of a doubler unit(s).

9.4.1 View status for the doubler unit(s) through the HDSL status menu.

1 Starting at the Main Menu, type <A> and press <Enter>. The Status Menu appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         01:01:50
                      SYSTEM ID: 32 Channel PG-Flex System          SYSTEM: 2

   CURRENT STATUS: OK                                          LOGGED IN: COT
   ALARMING TERMINAL: NONE


                                  STATUS MENU
--------------------------------------------------------------------------------

                          A) SYSTEM STATUS
                          B) CHANNEL STATUS
                          C) HDSL STATUS
                          D) ALARM HISTORY
                          E) ISDN PERFORMANCE MONITORING

                           CTRL-X) Main Menu    e(X)it


     [COT] ENTER COMMAND> c
```

2 Type <C> and press <Enter> at the Status Menu. The HDSL Status menu appears:

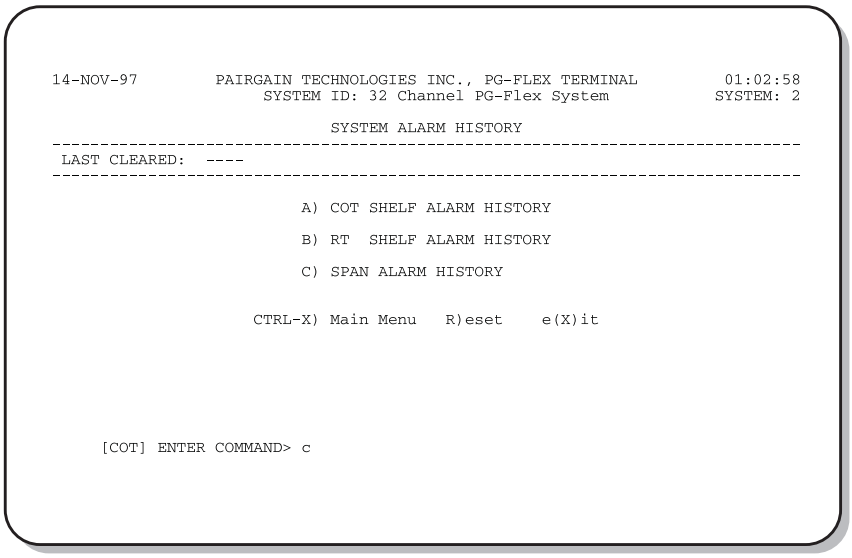
```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          01:01:54
                       SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2
                                    HDSL STATUS
--------------------------------------------------------------------------------
   ALARMS: NONE
--------------------------------------------------------------------------------
                        COT HDSL-1    COT HDSL-2     RT HDSL-1     RT HDSL-2
                         mn/cr/mx      mn/cr/mx      mn/cr/mx      mn/cr/mx
     MARGIN (db):       21/22/23      21/22/23      21/22/24      21/22/23
     PULSE ATTN (db):          1             1             1             1
     PPM OFFSET (ppm):         0             0            27            27
     24 HOUR ES:               0             1             2             2
     24 HOUR UAS:             57            55             2             0
--------------------------------------------------------------------------------
          LAST CLEARED: NONE
--------------------------------------------------------------------------------

                        A) 24-HOUR PERFORMANCE HISTORY
                        B) 7-DAY PERFORMANCE HISTORY


                     CTRL-X) Main Menu   R)eset    e(X)it

     [COT] ENTER COMMAND> a
```

3 Type a letter at the prompt to accomplish one of the following:

Type this letter	To get this response
A	Shows a performance history for 24 hours.
B	Shows a performance history for seven days.
CTRL-X	Exits the current screen and returns to the Main Menu.
R	Resets minimum and maximum margins, 24-Hour ES, 24-Hour UAS, and 24-Hour Performance History. A prompt has you type Y to confirm the reset or type N to cancel the reset.
X	Exits this screen and returns to status menu.
S	Shows doubler spans not seen on the current screen. The first screen shows the span from the COT to the doubler and the second screen shows the span from the doubler to the RT. Another screen appears when using two doublers.

9.4.2 View status for the doubler unit(s) through the alarm history menu by completing the following.

1 Type <D> and press <Enter> at the Main Menu. The System Alarm History menu appears:



2 Type <C> and press <Enter> at the Main Menu. The Span 1 Alarm History appears:

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:18:12
                       SYSTEM ID: 32 Channel PG-Flex System             SYSTEM: 2

                                SPAN-1 ALARM HISTORY
 ------------------------------------------------------------------------------

    Type          First           Last            Status     Current   Count
    ------        --------------  --------------  ----------  -------    -----

    HDSL1 UAS     DEC 24, 00:00   DEC 24, 00:00    ENABLED     NONE       1
    HDSL2 UAS     DEC 24, 00:00   DEC 24, 00:00    ENABLED     NONE       1









      e(X)it  (S)pan > s
```

3 Type <S> and press <Enter> to get the additional screens for the doubler spans.

The following Alarm History menu (Span 2) is only available when a doubler is present in the circuit.

```
14-NOV-97        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:18:16
                       SYSTEM ID: 32 Channel PG-Flex System             SYSTEM: 2

                                SPAN-2 ALARM HISTORY
 ------------------------------------------------------------------------------

    Type          First           Last            Status     Current   Count
    ------        --------------  --------------  ----------  -------    -----
    HDSL2 UAS     DEC 24, 00:00   DEC 24, 00:00    ENABLED     NONE       1









      e(X)it  (S)pan > s
```

10. Troubleshooting

10.1 Table 6 provides troubleshooting procedures based on indications displayed by the front panel indicators of FLL-716 COT Line Unit.

Table 6. *FLL-716 COT Line Unit Troubleshooting*

Indication	Problem	Action
POWER LED off	The COT Shelf is no longer receiving CO battery.	Verify that the fuse on the CO fuse panel is good. Verify wiring between the COT shelf and the CO fuse panel, and from the panel to the CO battery.
	The COT Line Unit fuse F1 has blown.	Replace the fuse.
LOOP 1 (2) SYNC LED flashing or off	The HDSL line is attempting to synchronize with the remote terminal line unit or cannot detect the HDSL signal from the remote terminal line unit. This is usually an indication that there is a problem with the HDSL circuit between the COT and RT (assuming the FAULT LED is *off*). COLU and RTLU incompatible. That is, one is a T1 version and the other is an E1 version.	Verify the HDSL circuits are terminated properly and with the correct orientation. Measure the loop resistance of each HDSL circuit (shorting the pair at the far end). The loop resistance must be less than that shown in Table 2.
LOOP 1 (2) MARGIN LED on	The HDSL line margin level is below a preset level.	See the previous discussion on the SYNC LED *flashing* or *off*.
FAULT LED on	Faulty FLL-716 COT Line Unit.	Check that none of the HDSL pairs are shorted to ground. Check for continuity from COT to RT on all HDSL lines. Replace the COT Line Unit, if the RT line unit is confirmed good. Otherwise, replace the RT line unit.

D. TECHNICAL SUPPORT

11. Technical Support

11.1 PairGain Technical Assistance is available 24-hours-a-day, 7-days-a-week by contacting PairGain Customer Service Engineering group at:

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

Fax: (714) 832-9924

11.2 During normal business hours (8:00 AM to 5:00 PM, Pacific Time, Monday - Friday, excluding holidays), technical assistance calls are normally 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 normally results in a callback within 30 minutes of initiating the request.

11.3 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.

E. CERTIFICATION AND WARRANTY

12. Certification

12.1 **FCC Compliance.** The FLL-716 List 3 COT Line Unit complies 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. Operating this equipment in a residential area can cause harmful interference in which case the user will be required to correct any interference at his own expense.

12.2 For information on cabling, proper connections, grounding and line power, refer to the appropriate instruction manual for the unit being installed.

12.3 All external wiring must follow the provisions in the current edition of the National Electrical Code.

13. Warranty

13.1 PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of 5 years from the date of original shipment, given proper customer installation and regular maintenance. 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.

13.2 Only an authorized PairGain representative can perform repairs. If unit fails, replace it with another unit and immediately report failure to PairGain. Any repairs or modifications made to the unit by unauthorized field personnel will void the warranty.

13.3 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 Repair Center
14352 Franklin Avenue
Tustin, CA 92780-7013

FAX: (714) 730-2961
Phone: (714) 730-2800 or (800) 370-7670

13.4 PairGain will continue to repair faulty modules beyond the warranty program for a nominal charge. Contact your PairGain sales representative for details and pricing.

F. ABBREVIATIONS AND GLOSSARY

14. Abbreviations

CO	Central Office
COT	Central Office Terminal
LU	Line Unit
MLT	Mechanized Loop Testing
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
PGTC	Pair Gain Test Controller
POTS	Plain Old Telephone Service
RMA	Return Material Authorization
RT	Remote Terminal

15. Glossary

Margins	Indicates the excess signal to noise ratio, at either the COT or RT, relative to a 10^{-7} Bit Error Rate. *cr* is the current margin, *mn* is the minimum margin since last cleared, *mx* is the maximum value since cleared, and N/A means Not Available. The normal range of a typical margin is from 22 to 6 dB.
Pulse Attenuation	Indicates the attenuation of the 2B1Q pulse from the distant end. PG-Flex operates with pulse attenuations in excess of 30 dB. This value is related to the cable pair's 272-kHz loss. The pulse attenuation is a more direct indication of the loop attenuation to the 2B1Q signal than the 272-kHz loss. The normal range of pulse attenuation is from 1 to 32 dB.
PPM	Indicates the relative offset of the crystal oscillator in the RT Line Unit from the COT Line Unit'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	The number of 1-second intervals that contained at least one CRC error. This value is a running total of errored seconds (ES) for the last 24 Hours.
HDSL 24 Hour UAS	The number of seconds (unavailable seconds) the HDSL loop was out of synchronization.

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ISO 9001
DNV
DNV Certification, Inc.
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