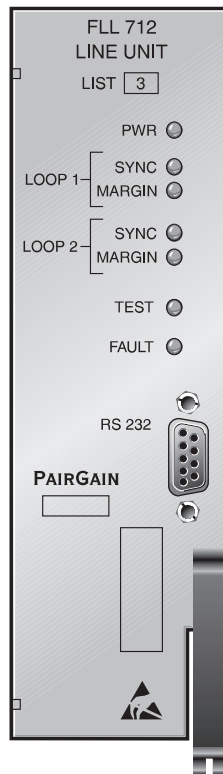


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# PG-FLEX 24 CHANNEL CENTRAL OFFICE TERMINAL LINE UNIT

Model	List Number	Part Number	CLEI Code
FLL-712	3	150-1312-03	VACHDFHCAA



**PAIRGAIN TECHNOLOGIES, INC.**  
**ENGINEERING PLANT SERIES TECHNICAL PRACTICE**  
**SECTION 363-712-103-01**

Revision History of this practice.  
Revision 01—June 27, 1997  
A) Initial Release

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## USING THIS TECHNICAL PRACTICE

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



**A note informs you of special circumstances.**



**A caution indicates the possibility of damage to equipment.**



**A warning indicates the possibility of personal injury.**

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## A. PRODUCT OVERVIEW

---

### 1. Description and Features

- 1.1** The PairGain® PG-Flex FLL-712 List 3 Central Office Terminal (COT) Line Unit is the Central Office (CO) end of the PG-Flex subscriber carrier system. The FLL-712 Line Unit carries up to 24 subscriber channels between a COT and a Remote Terminal (RT). The FLL-712 COT Line Unit resides in a PairGain COT 19- or 23-inch shelf. Each system in the shelf requires one FLL-712 COT Line Unit. The FLL-712 Line Unit provides access through the RS-232 port to provision the PG-Flex system using an ASCII terminal. However, installing an FPI-729 unit in the shelf disables the RS-232 port on the FLL-712 Line Unit. The FPI-729 unit will then provide access through its RS-232 port to provision the PG-Flex system using an ASCII terminal.

The FLL-712 COT Line Unit uses PairGain's High-bit-rate Digital Subscriber Line (HDSL) 2B1Q technology to provide the equivalent of 1.544 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

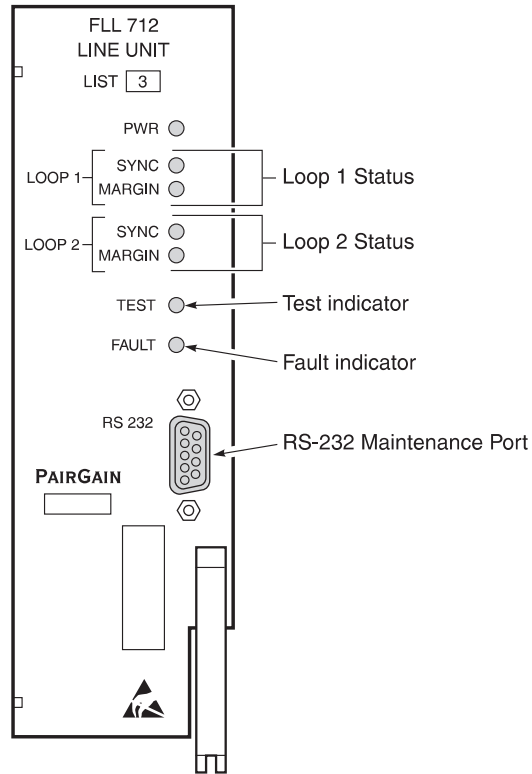
The FLL-712 supports the use of a PG-Flex FDU-451 doubler to extend the range of a PG-Flex subscriber Carrier system.

- 1.2** Features of the FLL-712 COT Line Unit are:

- supports 24 subscriber channels in the CO
- supports 4Tel compatible Loop Test Systems
- compatible with Mechanized Loop Testing (MLT) and Pair Gain Test Controller (PGTC) when an FPI-729 List 1 PGTC Interface Unit is installed in the shelf.
- supports ISDN channel units
- supports loop start/ground start channel units
- uses distributed subscriber carrier system architecture

## 2. Front Panel

Figure 1 shows the front panel for the FLL-712 Line Unit. Table 1 lists the indicators and indicator states for the FLL-712 front panel LEDs. Figure 1 also shows the RS-232 maintenance port on the FLL-712 front panel used to provision a PG-Flex system or activate system test access.



**Figure 1 . FLL-712 List 3 Front Panel.**

**Table 1. FLL-712 Front Panel LEDs.**

<b>LED</b>	<b>LED State</b>	<b>Indicates</b>
POWER	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	Test in progress.
	OFF	No tests active in system.
FAULT	Solid Red	System alarm/fault detected.
	OFF	No faults are detected in system.

### 3. Specifications

#### Electrical Characteristics

COT Power Supply Input Voltage.....	-40 to -72 Vdc
COT Power Supply Input Power .....	145 Watts (maximum)
COT Power Supply Input Protection .....	Fuse (3A GMT)
COT Power Supply Output Voltage .....	$\pm 130$ Vdc (maximum)
COT Power Supply 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:.....	6.7 in.	(17.2 cm)
Width:.....	2.00 in.	(5.1 cm)
Depth:.....	10.5 in.	(26.7 cm)
Weight.....	2.0 lb.	(0.9 kg)

## B. FUNCTIONAL DESCRIPTION

### 4. Applications

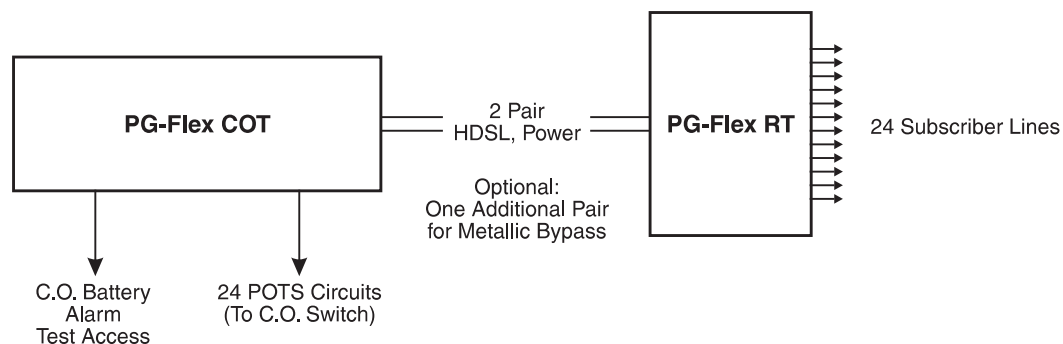
- 4.1 Overview.** PG-Flex is a small-capacity, universal subscriber carrier system supporting up to 24 channels including both Plain Old Telephone Service (POTS) and Integrated Services Digital Network (ISDN) services.

PG-Flex systems easily mount in either 19 or 23-inch COT Shelves. A system comprises 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 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. Over the HDSL transmission lines, power is supplied from the CO to the Remote Terminal (RT). The maximum distance from the CO to the RT is 12.3 kft (24 AWG cable).

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

- Central Office Terminal (COT). The 19-inch COT Shelf accommodates two complete systems and the 23-inch COT Shelf accommodates four complete systems. Each system requires one COT Line Unit and up to six (19-inch shelf) or three (23-inch shelf) 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.
- Remote Terminal (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 24 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, 784-kbps full-duplex 2B1Q transmission format. The dual HDSL lines provide 24 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		
		12/24 Channel System		DC Resistance
26 AWG	(0.4 mm)	9.0 kft	(2.8 km)	750 $\Omega$
24 AWG	(0.5 mm)	12.3 kft	(3.8 km)	638 $\Omega$
22 AWG	(0.6 mm)	16.1 kft	(5.0 km)	521 $\Omega$
19 AWG	(0.9 mm)	22.8 kft	(7.0 km)	367 $\Omega$



**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 test pair at the RT. PG-Flex extends this connection back to the COT where it switches onto the test access bus or to the corresponding subscriber line on the COT channel card.

Test access is performed by placing +116 V on the subscriber's COT tip lead, then removing the +116 V. (The Ring lead should be between GND and the Tip value.) Depending on the PG-Flex system configuration, the selected subscriber drop (assuming a working metallic bypass pair) connects to the corresponding COT subscriber line.

The test connection drops when -116V is applied to the subscriber's COT tip for 1.5 seconds, and again, when removing the -116 V.

Test access can also be activated through the RS-232 Maintenance Port located on the front of the COT Line Unit using an ASCII terminal.

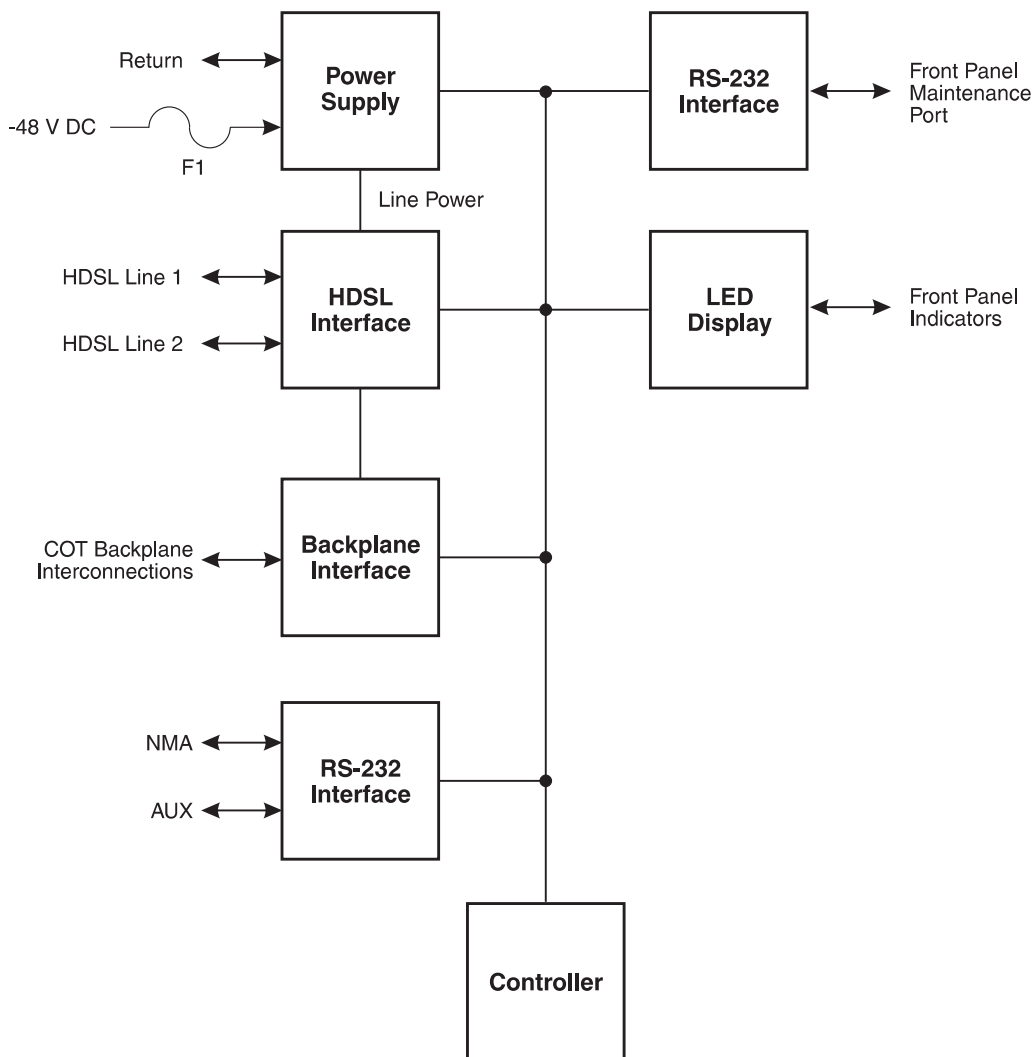
## 5. Operational Capabilities

- 5.1** The FLL-712 COT Line Unit provides the following functions for each 24-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
- MLT/PGTC loop test system compatibility
- 4Tel loop test system compatibility



- 5.2** The RS-232 Maintenance Port (Figure 1) provides access to provision and test the PG-Flex system using an ASCII terminal (see Section 9). For HDSL lines, use the ASCII terminal for troubleshooting procedures only. Installation of HDSL lines does not require the use of an ASCII terminal.
- 5.3** Figure 3 shows a block diagram of FLL-712. The power supply converts CO battery into voltages necessary to power the PG-Flex electronics including  $\pm 130$  Vdc. During power-up, the system checks the HDSL lines for hazardous voltages 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-712 COT Line Unit Block Diagram

## 6. Terminal Management

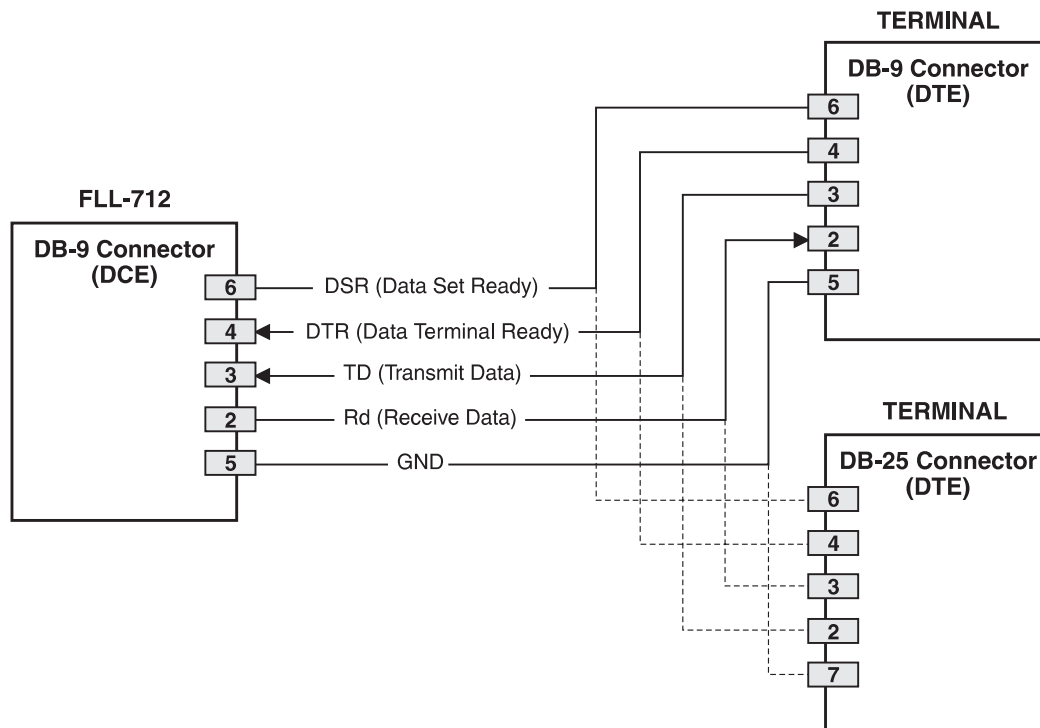
**6.1** The terminal management function allows the technician to manage the entire PG-Flex system using an ASCII terminal (or modem with a null modem cable) connected to the maintenance port. With this function, the technician can:

- view system status
- set configuration parameters
- conduct testing
- monitor performance
- obtain an inventory report

**6.2** **Connecting FLL-712 to a Terminal or Modem.** A standard RS-232 (DB-9) connector on the front panel provides access to the menu interface feature via an ASCII terminal. Figure 4 shows the pinouts for connecting the FLL-712 standard RS-232 (DB-9) maintenance port to an ASCII terminal.



**The FLL-712 line unit will not automatically log off when a terminal is unplugged from the craft 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.**

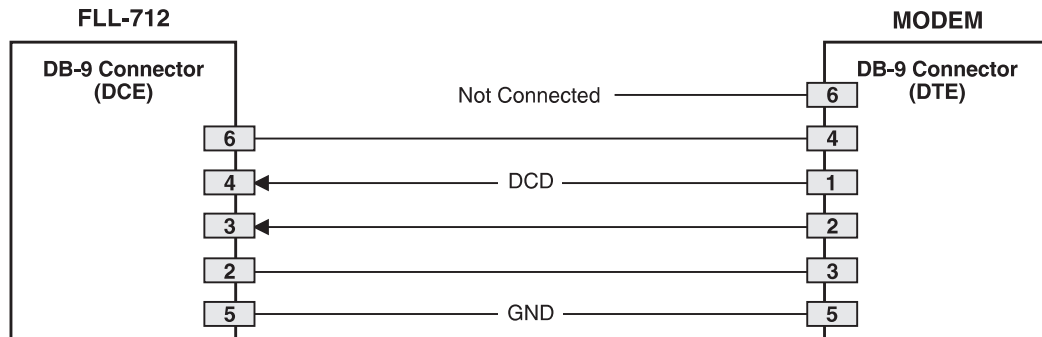


**Figure 4.** Connecting FLL-712 to an ASCII Terminal

Figure 5 shows the pinouts for connecting the FLL-712 to a modem using a null-modem cable. Using Data Carrier Detect (DCD) from the modem ensures that the FLL-712 Line Unit 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 CD signal when it connects with another modem and to drop CD when it disconnects. Otherwise, if set ON, the FLL-712 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-712 drops DSR (which is null-modemmed to DTR input on the modem).



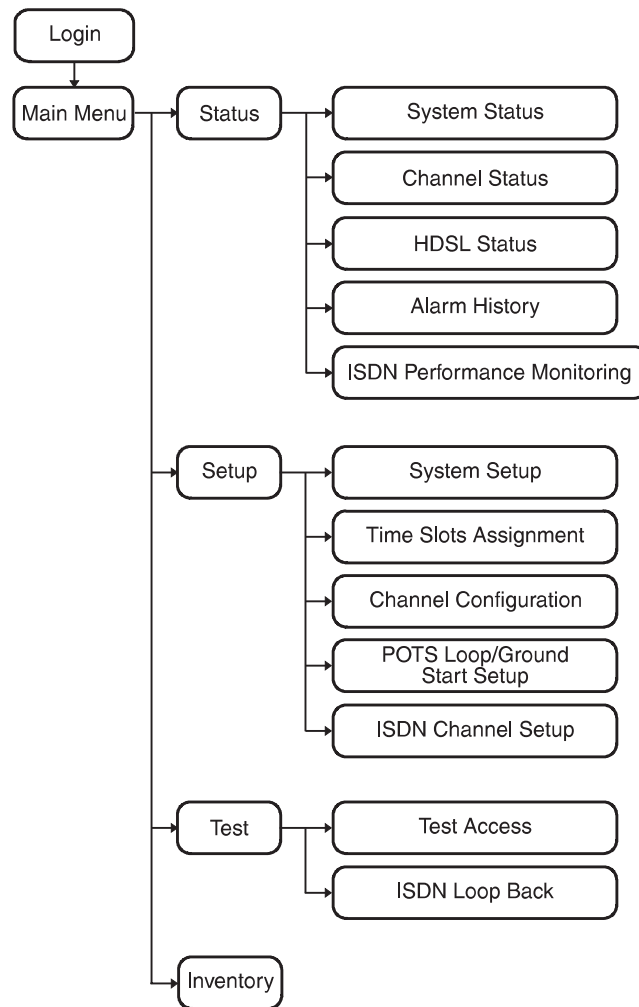
*Figure 5. Connecting the FLL-712 to a Modem*

The connector is set up as:

- DCE with 8 data bits
- 1 stop bit
- no parity

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. The Main Menu has four menu options from which the technician can select.



**Figure 6.** Terminal Menu and Display Structure

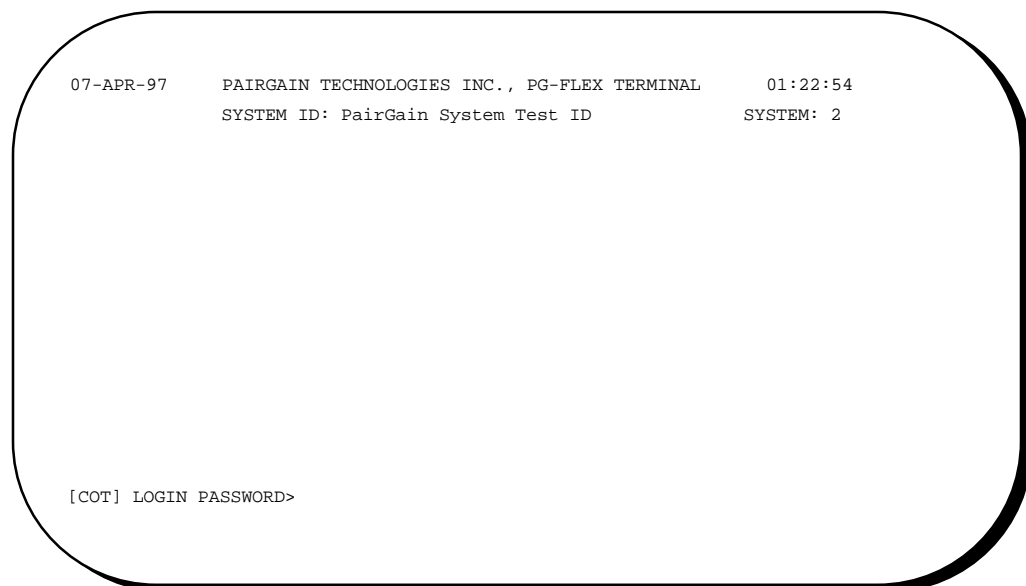
- 6.4 Power-Up and Connection Screen.** The Power-Up and Connection screen appears after connecting the ASCII terminal to the FLL-712 Line Unit:



- 6.5 Log On Screen.** The FLL-712 Line Unit displays a log on screen when it detects user input from the maintenance port (while idle).

- 1 Press the SPACE bar 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 with "\*" characters.



**If you do not have your login password, contact the 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]):

```

12-JUN-97          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:01:08
                   SYSTEM ID: THIS IS IT!!!                            SYSTEM: 1

                   SYSTEM TIME
                   -----

System Time has NOT been initialized!!

[COT] ENTER NEW SYSTEM TIME (HH:MM[:SS]):

```

This screen will not appear the next time you log on unless the power 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 test procedures, and view status information. The Main menu appears after a successful log on:

```

12-JUN-97          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          05:09:16
                   SYSTEM ID: THIS IS IT!!!                            SYSTEM: 1
CURRENT STATUS: OK                                     LOGGED IN: COT
ALARMING TERMINAL: NONE                               HDLS PAIRS REVERSED

                   MAIN MENU
                   -----

                   A) STATUS
                   B) SETUP
                   C) TEST
                   D) INVENTORY
                   Q)uit

[COT] ENTER COMMAND>

```

. 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	<p>By selecting the Status option (A) from the Main Menu, the technician can display:</p> <ul style="list-style-type: none"> <li>• System Status to show the equipment installed in the system and the current status (in alarm or not) of the equipment.</li> <li>• 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: <ul style="list-style-type: none"> <li>IDLE: channel is not off-hook or ringing.</li> <li>RING: channel is ringing.</li> <li>BUSY: channel is off-hook.</li> <li>OPEN: no connection to CO switch.</li> <li>TEST: in test mode</li> <li>TREQ: 116 volts test request</li> <li>SERR: PCM bus frame sync error</li> <li>FIDL: forced idle</li> <li>TDSB: time slots disabled</li> <li>RBAT: reverse battery</li> <li>****: unknown</li> </ul> </li> <li>• HDSL Status to show the status of the HDSL span. You can view either a 24-hour or 7-day performance history.</li> <li>• Alarm History to display the status history of COT, RT, and span alarms.</li> <li>• ISDN Performance Monitoring Menu to show PM error count and PM threshold for a specific ISDN card and channel.</li> </ul>
Setup	<p>Select the Setup option (B) from the Main Menu, the technician can view the current setup and set or change the following configurable items:</p> <ul style="list-style-type: none"> <li>• System Setup</li> <li>• Time Slots Assignment (view only)</li> <li>• Channel Configuration</li> <li>• POTS Loop/Ground Start Setup</li> <li>• ISDN Channel Setup</li> </ul>
Test	<p>Select the Test option (C) from the Main Menu for testing a PG-Flex system. Tests include: 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 test option available.</p>
Inventory	<p>Selecting 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.</p>

## 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 is 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-712 COT Line Unit and verify operation as follows:
- 1 Insert the FLL-712 COT Line Unit into the COT shelf and verify:
    - all LEDs on the Line Card turn on for about seven seconds, then scan from top to bottom
    - 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 begins synchronizing 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:
  - -130 Vdc ( $\pm 10\%$ ) between the HDSL\_T1 pin and chassis ground
  - 0 Vdc to +120 Vdc 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.

The Setup menu appears:

```
06-FEB-96   PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL   03:39:50
              SYSTEM ID: 123456789012345678901234         SYSTEM: 2
CURRENT STATUS: OK                               LOGGED IN: COT
ALARMING TERMINAL: NONE                           HDSL PAIRS REVERSED

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

              e(X)it

[COT] ENTER COMMAND> A
```

**2** Type A and press <Enter>.

The System Settings menu appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:39:52
                   SYSTEM ID: 123456789012345678901234                SYSTEM: 2

                   SYSTEM SETTINGS
-----
A) SYSTEM DATE:   . . . . .          06-FEB-96
B) SYSTEM TIME:   . . . . .          03:39:52
C) SYSTEM ID:    . . . . .          123456789012345678901234
D) SET PASSWORD  . . . . .
E) AUTO LOGOUT TIME (min.): . . . . . 5          (DISABLED,5,30,60)
F) METERED TONE FREQUENCY (kHz): . . . . . N/A
G) RING FREQUENCY (Hz): . . . . . 20          (20,25,30)
H) HDSL ES ALARM THRESHOLD: . . . . . 17          (DISABLED,17,170)
I) HDSL MARGIN THRESHOLD: . . . . . 6          (0-15,0=DISABLED)
J) ALARM ON HDSL THRESHOLD: . . . . . ENABLED          (DISABLED,ENABLED)
K) LOCAL LOOP LENGTH: . . . . . LONG          (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)

                   e(X)it

[COT] ENTER CHOICE> A

```

**3** Type a letter (A through N) and press <Enter> to select a parameter to change.

You get a separate screen for the parameter selected. It prompts you to input the change.

## 9.2 Configure an ISDN Channel Unit. Sections 9.2.1 through 9.2.5 accomplish configuration and viewing of status for an ISDN channel unit.

### 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.

The following screen appears:

```

07-APR-97          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          01:44:42
                   SYSTEM ID: 123456789012345678901234                SYSTEM: 2

                   ISDN CHANNEL SETUP
                   -----

                   Press ESCAPE to return to previous menu

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

```

- 2 Type the card and channel numbers and press <Enter> for the ISDN module you want to configure.

The following screen appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:39:52
                   SYSTEM ID: 123456789012345678901234                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 . . On (Off, On)
                   E) Zero Byte Substitution . Off (Off, Enabled)

                   S) SELECT NEW CARD AND CHANNEL
                   e(X)it

[COT] ENTER CHOICE> A

```

- 3 Type a letter (A through E) and press <Enter> to choose a set up a parameter. Select one of the two options available for each parameter (Table 4):

**Table 4. ISDN Channel Unit Configuration Choices**

<b>Parameter</b>	<b>Options</b>
A) PM Mode	Interim Path performance monitoring collects the end-to-end error rate for the entire transport path. Segmented monitoring collects error rates for each DSL loop individually.
B) Current eoc mode	Normal Transparent
C) Current B1, B2 settings	Use Normal option.
D) Current Sealing Current Setting	Off - none On - sealing current applied ( $\approx 5\text{mA}$ ).
E) Current Zero Byte Substitution Setting	Use Off option.

- 4 Type S and press <Enter> to select a new ISDN channel unit and channel to configure.  
Type the channel unit number and channel for the new ISDN channel unit.

## 9.2.2 Configure channels, starting at the setup menu:



**There are 24 time slots available. Enable is the default for the channels. Disable channels only when the time slots are required by another channel unit.**

**For channel configuration, 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> for the channel configuration menu.

The Channel Configuration menu appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:20
                   SYSTEM ID: 123456789012345678901234              SYSTEM: 2
                   CHANNEL CONFIGURATION
-----
Channel          COT          CU1          CU2          CU3
                  (POTS8)    (POTS8)    (POTS8)    (ISDN4)
                  RT          (POTS8)    (POTS8)    (ISDN4)    (---)
-----
1                 ON           ON           ON
2                 ON           ON           OFF
3                 ON           ON           DISABLED
4                 ON           ON           DISABLED
5                 ON           ON           -
6                 ON           ON           -
7                 ON           ON           -
8                 ON           ON           -

                2 Time-Slots Available
                D)isable Channel    E)nable Channel
                e(X)it

[COT] ENTER COMMAND> D

```

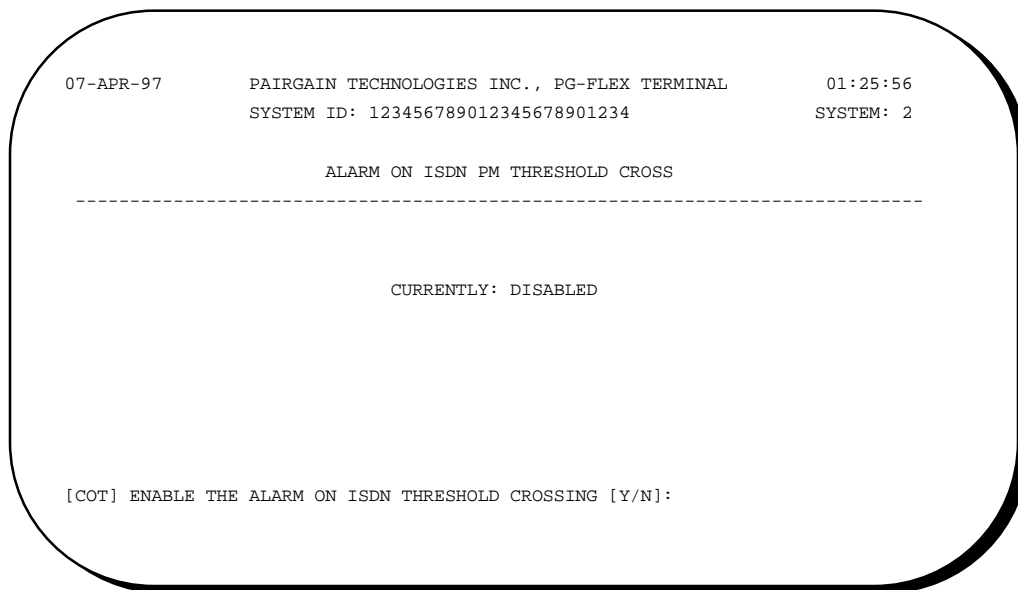
- 3 Type D (disable) or E (enable) and press <Enter>.
 

You get a prompt.
- 4 Type the numbers for the channel unit and channel you want to disable/enable specified x, x (e.g., channel unit,channel) and press <Enter>.

**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 following screen:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:10
                   SYSTEM ID: 123456789012345678901234                    SYSTEM: 2

                   TIME SLOTS ASSIGNMENT
-----
TIME  CHANNEL      TIME  CHANNEL      TIME  CHANNEL      TIME  CHANNEL
SLOT  ASSIGNMENT    SLOT  ASSIGNMENT    SLOT  ASSIGNMENT    SLOT  ASSIGNMENT
-----
 1:   CU1 CH1       7:   CU1 CH7       13:   CU2 CH5       19:   CU3 CH1
 2:   CU1 CH2       8:   CU1 CH8       14:   CU2 CH6       20:   CU3 CH2
 3:   CU1 CH3       9:   CU2 CH1       15:   CU2 CH7       21:   CU3 CH2
 4:   CU1 CH4      10:   CU2 CH2       16:   CU2 CH8       22:   CU3 CH2
 5:   CU1 CH5      11:   CU2 CH3       17:   CU3 CH1       23:   ----
 6:   CU1 CH6      12:   CU2 CH4       18:   CU3 CH1       24:   ----
-----

                                e(X)it

[COT] ENTER COMMAND> X

```



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

**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 ISDN performance monitoring menus.

The following menu appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:36
                   SYSTEM ID: 123456789012345678901234                SYSTEM: 2

                   ISDN PERFORMANCE MONITORING MENU
                   -----

                   Press ESCAPE to return to previous menu

Enter Card and Channel (CARD,CHANNEL):

```

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

The following menu appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:36
                   SYSTEM ID: 123456789012345678901234                SYSTEM: 2

                   ISDN PERFORMANCE MONITORING MENU
                   -----

INTERIM SEGMENTED ENABLED          CARD: 2          CHANNEL: 3
                   -----

                   A) SELECT NEW CARD AND CHANNEL
                   B) PM ERROR COUNT
                   C) PM THRESHOLD/ALERT INFO

                   e(X)it

[COT] ENTER COMMAND> B

```

- 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.** Paragraphs 9.3.1 through 9.3.4 accomplish configuration and testing for a loop start/ground start channel unit.



Some screens can 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> for the Setup menu.

The following menu appears:

```
06-FEB-96      PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      03:39:50
                SYSTEM ID: 123456789012345678901234          SYSTEM: 2

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

                HD SL PAIRS REVERSED

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

                e(X)it

[COT] ENTER COMMAND> D
```

- 2 Type D and press <Enter> for pots loop/ground start setup.

The following menu appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:20
                   SYSTEM ID: 123456789012345678901234                SYSTEM: 2
                   POTS GROUND/LOOP START CONFIGURATION
-----
Channel            COT          CU1          CU2          CU3
                   RT          (POTS8)     (POTS8)     (ISDN4)
                   (POTS8)     (POTS8)     (ISDN4)     (---)
-----
1                   LOOP          GND          N/A
2                   LOOP          GND          N/A
3                   LOOP          GND          N/A
4                   LOOP          GND          N/A
5                   LOOP          GND          -
6                   LOOP          GND          -
7                   LOOP          GND          -
8                   LOOP          GND          -

                L) Change to Loop Start
                G) Change to Ground Start
                e(X)it

[COT] ENTER COMMAND>L

```

- 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.
- 4 Type the numbers for the channel unit and channel you want to disable/enable specified x, x (e.g., channel unit,channel) and press <Enter>.

### 9.3.2 Configure channels, starting at the setup menu:



**There are 24 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> for the Channel Configuration menu.

The following menu appears:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:20
                   SYSTEM ID: 123456789012345678901234              SYSTEM: 2
                   CHANNEL CONFIGURATION
-----
Channel            COT          CU1          CU2          CU3
                   RT          (POTS8)     (POTS8)     (ISDN4)     (---)
-----
1                   ON           ON           ON           ON
2                   ON           ON           ON           ON
3                   ON           ON           ON           DISABLED
4                   ON           ON           ON           DISABLED
5                   ON           ON           ON           -
6                   ON           ON           ON           -
7                   ON           ON           ON           -
8                   ON           ON           ON           -

                   2 Time-Slots Available
                   D)isable Channel      E)nable Channel
                   e(X)it

[COT] ENTER COMMAND> D

```

- 2 Type D (disable) or E (enable) and press <Enter>. You get a prompt.
- 3 Type the numbers for the channel unit and channel you want to disable/enable specified x, x (e.g., channel unit,channel) and press <Enter>.

**9.3.3 Time Slot Assignments.** View time slot assignments, starting at the Setup menu. Type B and press <Enter> to display the following screen:

```

06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:41:10
                   SYSTEM ID: 123456789012345678901234              SYSTEM: 2

                   TIME SLOTS ASSIGNMENT
-----
TIME  CHANNEL      TIME  CHANNEL      TIME  CHANNEL      TIME  CHANNEL
SLOT  ASSIGNMENT    SLOT  ASSIGNMENT    SLOT  ASSIGNMENT    SLOT  ASSIGNMENT
-----
  1:  CU1 CH1       7:   CU1 CH7       13:  CU2 CH5       19:  CU3 CH1
  2:  CU1 CH2       8:   CU1 CH8       14:  CU2 CH6       20:  CU3 CH2
  3:  CU1 CH3       9:   CU2 CH1       15:  CU2 CH7       21:  CU3 CH2
  4:  CU1 CH4      10:  CU2 CH2       16:  CU2 CH8       22:  CU3 CH2
  5:  CU1 CH5      11:  CU2 CH3       17:  CU3 CH1       23:  ----
  6:  CU1 CH6      12:  CU2 CH4       18:  CU3 CH1       24:  ----
-----

                                e(X)it

[COT] ENTER COMMAND> X

```



**These values are automatically generated. However, when you cycle power to the system or hot plug a new channel unit, these values 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 circuit for ground start.

**9.4 View Doubler FDU-451 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 following screen appears:

```
24-DEC-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:15:52
                   SYSTEM ID: PairGain 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

                   e(X)it

[COT] ENTER COMMAND> c
```

**2** Type C and press <Enter> at the Status menu.

The following screen appears:

```

24-DEC-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:16:36
                   SYSTEM ID: PairGain PG-Flex System                  SYSTEM: 2

                   HDSL STATUS
-----
ALARMS: NONE
-----
                   COT HDSL-1   COT HDSL-2   DB1 HDSL-1   DB1 HDSL-2
                   mn/cr/mx    mn/cr/mx    mn/cr/mx    mn/cr/mx
MARGIN (db):      19/20/21     19/20/21     21/21/22     21/21/22
PULSE ATTN (db):      0         0         0         0
PPM OFFSET (ppm):    0         0        -5        -5
24 HOUR ES:         7         4         0         0
24 HOUR UAS:         0         0         0         0
-----
                   LAST CLEARED: DEC 24, 00:13
-----

                   A) 24-HOUR PERFORMANCE HISTORY
                   B) 7-DAY PERFORMANCE HISTORY
                   R)reset e(X)it (S)pan

[COT] ENTER COMMAND> r   DO YOU WISH TO RESET THE PERFORMANCE HISTORY? [Y/N] y

```

**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.
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 following screen appears:

```
12-JUN-97          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:01:54
                   SYSTEM ID: THIS IS IT!!!                               SYSTEM: 1

                   SYSTEM ALARM HISTORY
-----
LAST CLEARED:  ----
-----

                   A) COT SHELF ALARM HISTORY
                   B) RT SHELF ALARM HISTORY
                   C) SPAN ALARM HISTORY

                   R)reset      e(X)it

[COT] ENTER COMMAND> c
```

- 2 Type C and press <Enter> at the main menu.

The Alarm History menu appears:

```

24-DEC-96      PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      00:18:12
                SYSTEM ID: PairGain 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.**

```

24-DEC-96      PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      00:18:16
                SYSTEM ID: PairGain 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 5 provides troubleshooting procedures based on indications displayed by the front panel indicators of FLL-712 COT Line Unit.

*Table 5. FLL-712 COT Line Unit Troubleshooting*

<b>Indication</b>	<b>Problem</b>	<b>Action</b>
POWER LED off	<ol style="list-style-type: none"> <li>1 The COT Shelf is no longer receiving CO battery.</li> <li>2 The COT Line Unit fuse F1 has blown.</li> </ol>	<ol style="list-style-type: none"> <li>1 Verify that the fuse on the CO fuse panel is good.</li> <li>2 Verify wiring between the COT shelf and the CO fuse panel, and from the panel to the CO battery.</li> </ol> <p>Replace the fuse.</p>
LOOP 1 (2) SYNC LED flashing or off	<ol style="list-style-type: none"> <li>1 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 <i>off</i>).</li> <li>2 COLU and RTLU incompatible. That is, one is a T1 version and the other is an E1 version.</li> </ol>	<ol style="list-style-type: none"> <li>1 Verify the HDSL circuits are terminated properly and with the correct orientation.</li> <li>2 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.</li> </ol>
LOOP 1 (2) MARGIN LED on	The HDSL line margin level is below a preset level.	See the previous discussion on the SYNC LED <i>flashing or off</i> .
FAULT LED on	Faulty FLL-712 COT Line Unit.	<ol style="list-style-type: none"> <li>1 Check that none of the HDSL pairs are shorted to ground.</li> <li>2 Check for continuity from COT to RT on all HDSL lines.</li> <li>3 Replace the COT Line Unit, if the RT line unit is confirmed good. Otherwise, replace the RT line unit.</li> </ol>

## D. TECHNICAL SUPPORT

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### 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

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### 12. Certification

- 12.1 FCC Compliance.** The FLL-712 List 3COT 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 Technologies, Inc.  
14402 Franklin Avenue  
Tustin, CA 92780-7013  
Attn: Customer Repair Facility.
- 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

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### 14. Abbreviations

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

### 15. Glossary

<b>Margins</b>	Indicates the excess signal to noise ratio, at either the COT or RT, relative to a $10^{-7}$ Bit Error Rate. <i>cr</i> is the current margin, <i>mn</i> is the minimum margin since last cleared, <i>mx</i> 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.
<b>Pulse Attenuation</b>	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 196-kHz loss. The pulse attenuation is a more direct indication of the loop attenuation to the 2B1Q signal than the 196-kHz loss. The normal range of pulse attenuation is from 1 to 32 dB.
<b>PPM</b>	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.
<b>HDSL 24 Hour ES</b>	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.
<b>HDSL 24 Hour UAS</b>	The number of seconds (unavailable seconds) the HDSL loop was out of synchronization.



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THE COPPEROPTICS COMPANY