PG-FLEX 24 CHANNEL REMOTE TERMINAL LINE UNIT

Model	List Number	Part Number	CLEI Code
FRL-742	3A	150-1342-31	VARHCFMCAA

FRL 742
LINE UNIT
LIST 3A

PWR
LOOP 1 — SYNC
MARGIN
LOOP 2 — SYNC
MARGIN
FAULT
TEST
ACO

RS 232

PAIRGAIN

PAIRGAIN TECHNOLOGIES, INC.
ENGINEERING PLANT SERIES TECHNICAL PRACTICE
SECTION 363-742-131-01

Revision History of this practice.
Revision 01—February 24, 1998
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™ FRL-742 List 3A Remote Terminal (RT) line unit is the remote end of the PG-Flex subscriber carrier system and resides in a RT enclosure. The FRL-742 line unit carries up to 24 subscriber channels between a COT and an RT. The FRL-742 line unit provides access through the Craft port to display system options, performance, and status using an ASCII terminal.

The FRL-742 RT line unit uses PairGain's High-bit-rate Digital Subscriber Line (HDSL) 2B1Q technology to provide the equivalent of 1.544 Mbps digital transmission rate, plus signaling, over two copper pair wires. The HDSL line can include unterminated bridge taps. The technology is implemented:

- without using repeaters

- without loop conditioning

- without pair selection

The FRL-742 line unit supports PG-Flex doublers to extend the range of a PG-Flex subscriber carrier system to 24 kft (7.3 km) of 24 AWG or 18 kft (5.4 km) of 26 AWG loops. Two doublers can triple the range to 36 kft (10.9) of 24 AWG or to 27 kft (8.2 km) of 26 AWG loops.

1.2   Features of the FRL-742 RT line unit are:

- supports 24 subscriber channels in the RT

- supports PG-Flex doublers in systems transporting POTS and ISDN circuits

- supports 4Tel compatible Loop Test Systems

- compatible with Mechanized Loop Testing (MLT) and Pair Gain Test Controller (PGTC) when an FP1-729 List 1 PGTC Interface Unit is installed in the COT shelf.

- supports ISDN channel units

- supports loop start/ground start channel units

2. Front Panel

Figure 1 shows the FRL-742 front panel. Table 1 lists the indicators and states for the FRL-742 front panel LEDs.
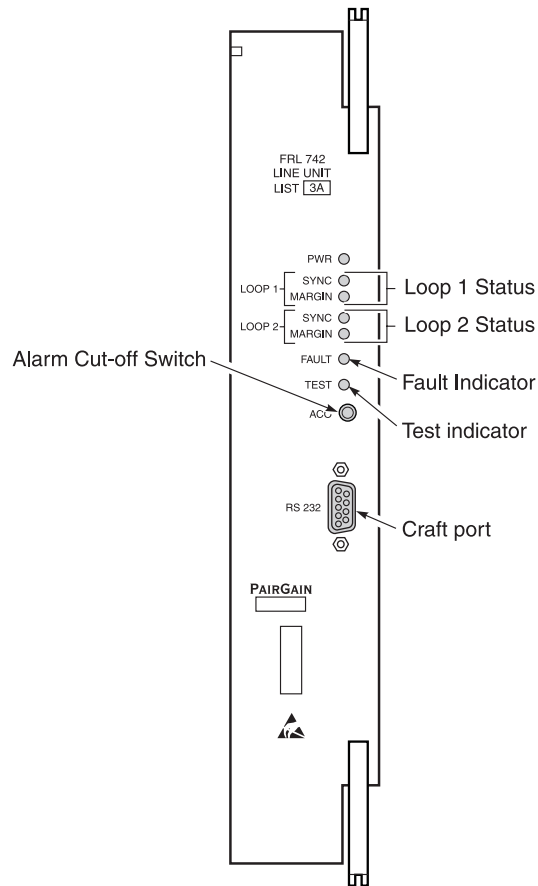
Figure 1. *FRL-742 List 3 Front Panel*

Table 1. FRL-742 Front Panel LEDs

LED	LED State	Indicates
PWR	Solid Green	Power applied and line feed operating normal.
	OFF	Not receiving power from COLU.
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 between COT and RT.
	OFF	HDSL line 1 does not detect an active CO Line 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 between COT and RT.
	OFF	HDSL line 2 does not detect an active CO line unit.
LOOP 2 MARGIN	Solid Yellow	HDSL line 2 is below present margin threshold.
	OFF	HDSL line 2 margin is above the preset margin threshold.
TEST	Blinking Yellow	A subscriber test connection has been established.
	OFF	No tests active in system.
FAULT	Solid Red	Fault in the system.
	OFF	No faults are detected in system.

3. Specifications

Electrical Characteristics

RT Power Supply Input Voltage..................+130 to +65 Vdc (Line 1)
                                          -130 to 0 Vdc (Line 2)

RT Power Supply Input Power ....Less than 40 Watts

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: ....12.00 in.   (30.5 cm)

    Width: .... 2.25 in.   (5.7 cm)

    Depth: .... 4.50 in.   (11.4 cm)

Weight .... 1.4 lb.   (0.6 kg)

B. FUNCTIONAL DESCRIPTION

4. Applications

4.1   **Overview.** PG-Flex is a small-capacity, universal subscriber carrier system supporting up to 24 DS0 channels including both Plain Old Telephone Service (POTS) and Integrated Services Digital Network (ISDN) services. The system is based on HDSL transmission technology. Remote power is supplied from the Central Office (CO).

A PG-Flex system is comprised of one line unit and one (or more) channel units at both the CO and the RT (Figure 2). Line units and channel units can be hot-swapped without affecting other systems in the same shelf. The POTS channel units use a Pulse Code Modulation (PCM) encoding scheme and supports high speed modem and group 3 facsimile operation on all channels.

The CO-side of a PG-Flex system mounts into a COT shelf and supports up to four systems. An alarm unit or Pair Gain Test Controller (PGTC) interface unit (common to all systems installed in the shelf) provides an interface for maintenance alarm relays and metallic access to the remote subscriber lines.

The remote side of a PG-Flex system mounts into an FRE-765 RT enclosure. The RT enclosure supports one system, which includes one line unit and up to three channel units. The channel units must be the same type of card as the channel units installed at the CO.

PG-Flex uses HDSL transmission technology over two unconditioned copper pairs. Power is supplied from the CO to the RT over the HDSL transmission lines. The maximum distance (without doublers) from the CO to the RT is 12.3 kft (3.7 km) using 24 AWG cable (0.5 mm).
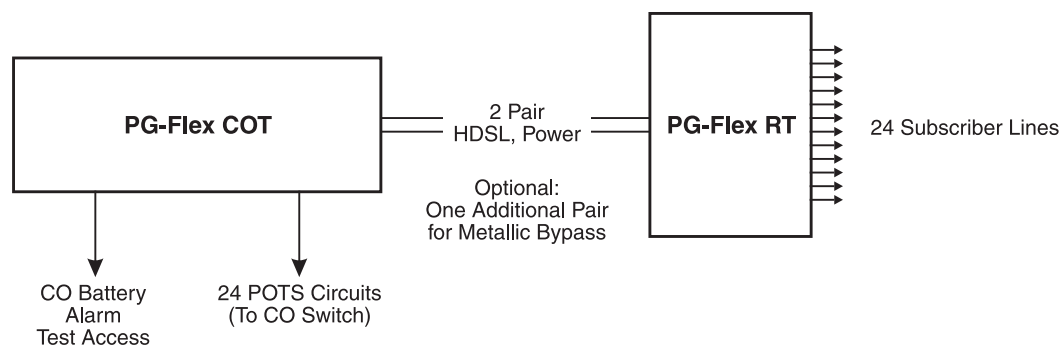
Figure 2. *Typical PG-Flex Configuration*

4.2   **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		DC Resistance
		12/24 Channel System		
26 AWG	(0.4 mm)	9.0 kft	(2.8 km)	750 Ω
24 AWG	(0.5 mm)	12.3 kft	(3.8 km)	638 Ω
22 AWG	(0.6 mm)	16.1 kft	(5.0 km)	521 Ω
19 AWG	(0.9 mm)	22.8 kft	(7.0 km)	367 Ω

4.3 **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 from the subscriber's COT. Refer to the FLL-712 CO line unit technical practice for more information.

5. Operational Capabilities

5.1   The FRL-742 RT line unit provides the following functions for each 24-channel system:

- power supply

- HDSL line transceivers

- front-panel status indicators

- alarm cut-off switch (used to perform a lamp test)

- RS-232 Maintenance Interface (DCE)

- line and drop test circuits

- MLT/PGTC loop test system compatibility

- 4Tel loop test system compatibility

5.2　　　Figure 3 shows a block diagram of the FRL-742. The power is supplied from the COT line unit to power the remote terminal. During power-up, the system checks the HDSL lines for hazardous voltages or other line faults that may 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.
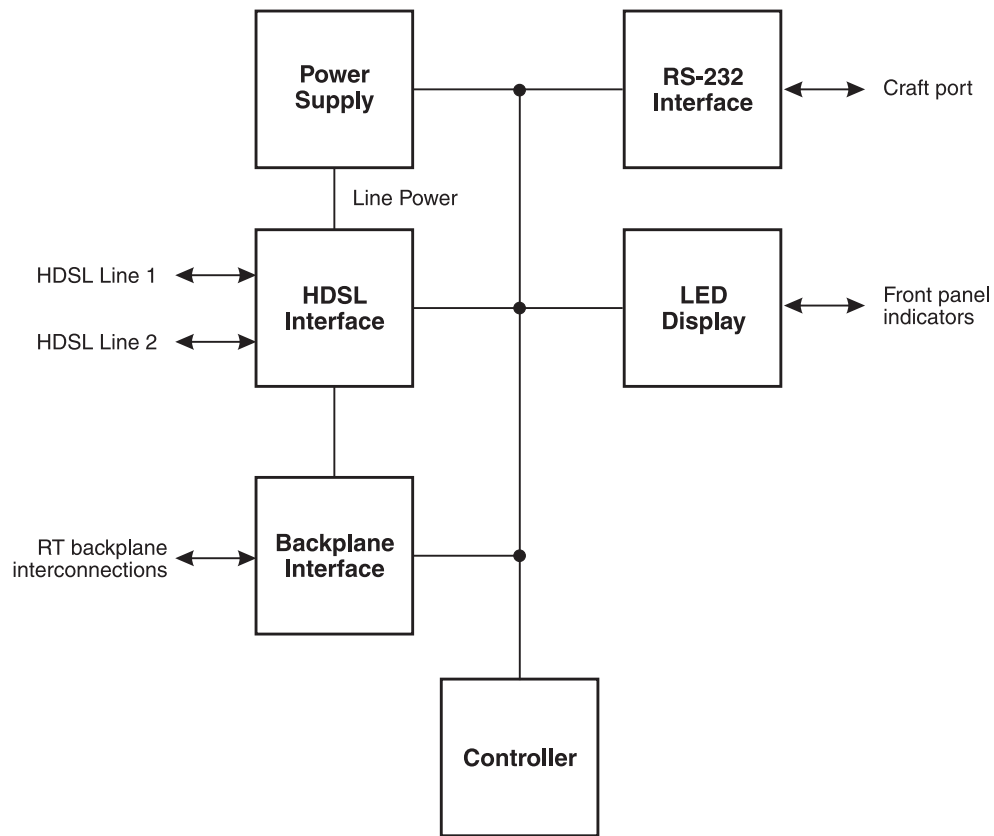
Figure 3. FRL-742 RT Line Unit Block Diagram

6. Terminal Management

6.1   The terminal management function at the RT allows a technician to display information about the PG-Flex system using an ASCII terminal (or modem with a null modem cable) connected to the Craft port. With this function, the technician can:

- view system status

- view system options

- monitor performance

- obtain an inventory report

6.2   **Connecting FRL-742 to a Terminal or Modem.** Figure 4 shows the pinouts for connecting the FRL-742 standard RS-232 (DB-9) maintenance port to an ASCII terminal.

> **The FRL-742 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 RS232 craft maintenance port. Technicians must manually log off the line unit before unplugging from the port. Otherwise, the line unit remains logged in, and the terminal session will still be in the same place.**
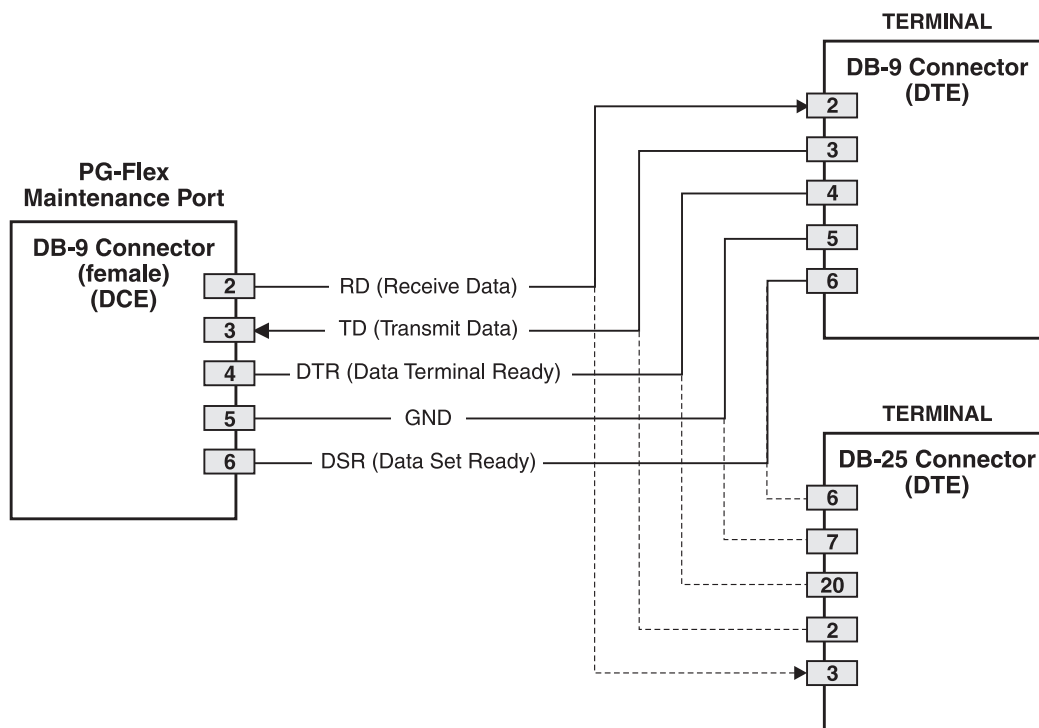
Figure 4. *Connecting the FRL-742 to an ASCII Terminal*

Figure 5 shows the pinouts for connecting the FRL-742 to a modem using a null-modem cable. Using Data Carrier Detect (DCD) from the modem ensures that the FRL-742 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 a CD signal when it connects with another modem and to drop CD when it disconnects. Otherwise, if set ON, the FRL-742 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 FRL-742 drops DSR (which is null-modemed to DTR input on the modem).
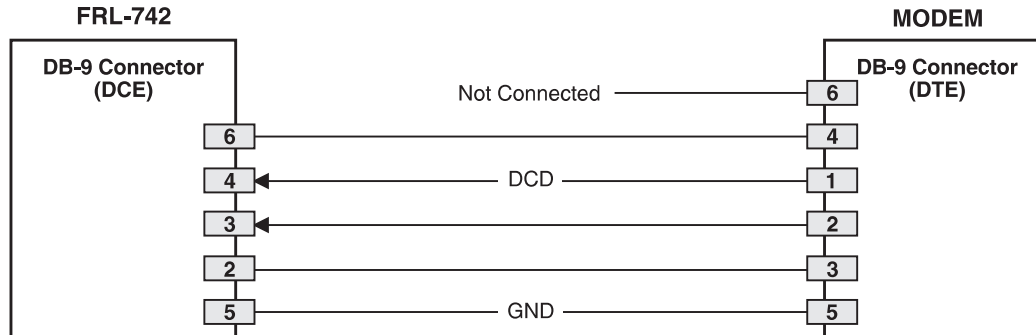
Figure 5. *Connecting the FRL-742 to a Modem*

The connection is set up as:

• DCE with 8 data bits

• 1 stop bit

• no parity

• 1200 to 9600 baud (9600 recommended)

The protocol 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.** After connecting the ASCII terminal to the FRL-742 line unit, press the Spacebar several times to start the autobaud feature. Autobaud covers transmission rates of 1,200, 2,400, 4,800 and 9,600 bps only.
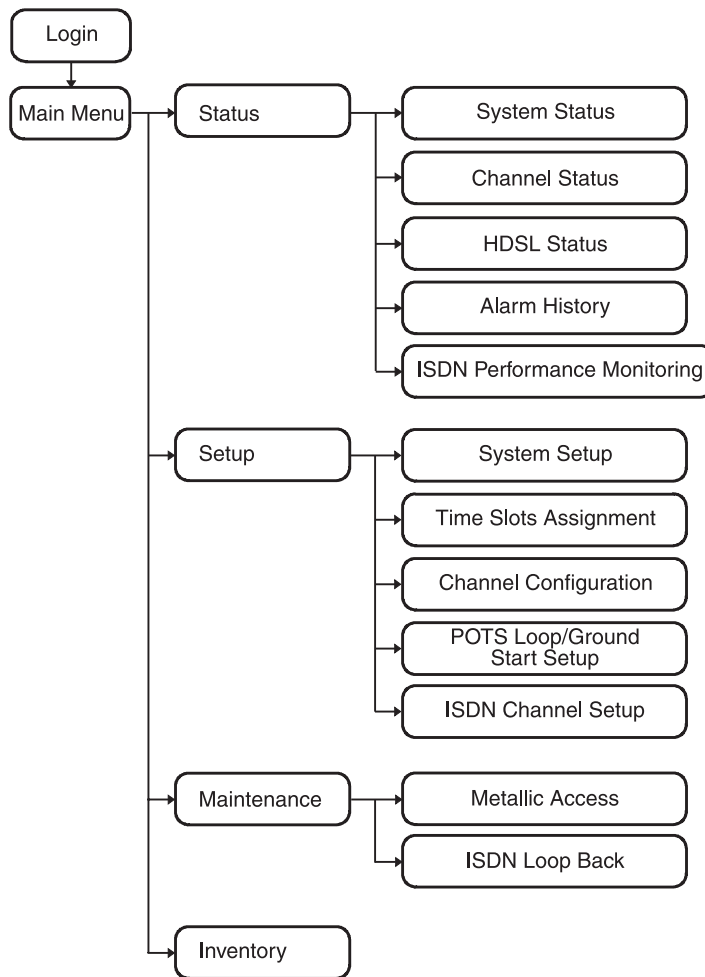
The Power-Up and Connection screen appears:

```
        [RT] READY
```

6.5   **Main Menu.** From the Main Menu, you access other menus where you can view a PG-Flex system, view test procedures, and view status information. The Main Menu appears after a successful log on:

```
  11-FEB-98        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL        05:09:16
                       SYSTEM ID: 24 Channel PG-Flex System        SYSTEM: 2
      CURRENT STATUS: OK                                       LOGGED IN: RT
      ALARMING TERMINAL: NONE
                                                            CHREV: SPAN 1

                                 MAIN MENU
  ----------------------------------------------------------------------------

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


         [RT] ENTER COMMAND>
```
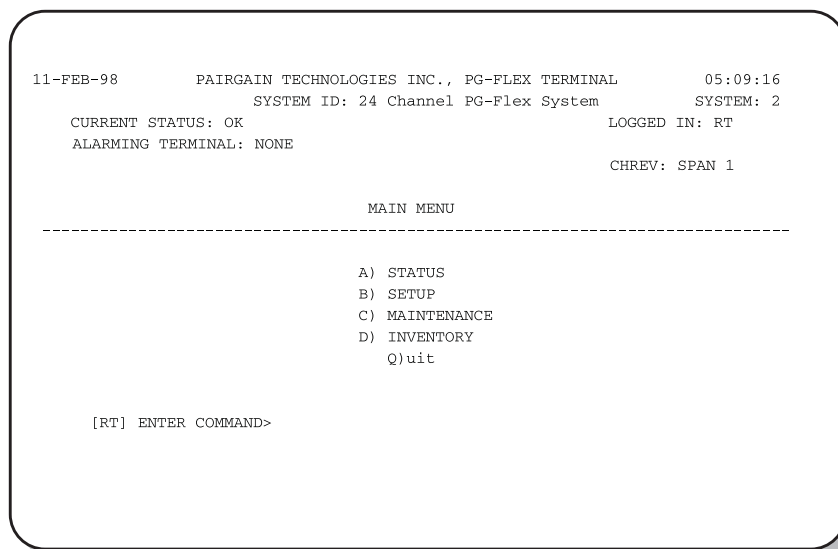
Table 3 describes the functions associated with these four main menu options (A through D).

Table 3. *Main Menu Options*

Main Menu Option	Function

A) 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 Vdc 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.

B) Setup	Select the Setup option (B) from the Main Menu to view the current setup: • System Setup • Time Slots Assignment (view only) • Channel Configuration • POTS Loop/Ground Start Setup • ISDN Channel Setup
C) Maintenance	Select the Maintenance option (C) from the Main Menu to view a metallic access connection to a subscriber circuit or to view an ISDN loop back test for 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.
D) 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 the FPI unit). 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 13. 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 an 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.

The following procedure assumes that an FLL-712 is installed in the system.

8.1   To install the FRL-742 and verify operation:

1   Insert the FRL-742 RT line unit into the RT enclosure and verify:

- all LEDs turn on for about seven seconds, then scan from top to bottom

- PWR LED remains on

- after about 30 seconds, SYNC LEDs for Line 1 and Line 2 begin to flash (both COT and RT)

- within 35 seconds, SYNC LEDs for Line 1 and Line 2 turn on

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

- PWR 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

9. Provisioning

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 four 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.

9.1 **View System Settings.** View the system settings.

1 Type <B> then press <Enter> at the Main Menu. The Setup Menu displays:

```
11-FEB-98        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL        05:09:16
                     SYSTEM ID: 24 Channel PG-Flex System          SYSTEM: 2
    CURRENT STATUS: OK                                     LOGGED IN: RT
ALARMING TERMINAL: NONE
                                                          CHREV: SPAN 1


                                 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


          [RT] ENTER COMMAND> A
```

2   Type <A> then press <Enter>. The System Settings menu displays (see Table 4 for System Settings menu descriptions):

```
11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         05:09:16
                        SYSTEM ID: 24 Channel PG-Flex System          SYSTEM: 2


                                SYSTEM SETTINGS
   ----------------------------------------------------------------------------
    SYSTEM DATE:    .    .    .    .    .    .    .    . 06-FEB-96
    SYSTEM TIME:    .    .    .    .    .    .    . 03:39:52
    SYSTEM ID: .    .    .    .    .    . 24 Channel PG-Flex System
    AUTO LOGOUT TIME (min.):   .    .          5              (DISABLED,5,30,60)
    METERED TONE FREQUENCY (kHz):  .          DISABLED        (DISABLED,12,16)
    RING FREQUENCY (Hz):   .    .    .         20             (20,25,30)
    HDSL ES ALARM THRESHOLD:   .    .          17             (DISABLED,17,170)
    HDSL MARGIN THRESHOLD: .    .    .          6             (0-15,0=DISABLED)
    ALARM ON HDSL THRESHOLD:   .    .          ENABLED        (DISABLED,ENABLED)
    LOCAL LOOP LENGTH:    .    .    .    .      LONG           (SHORT,LONG)
    ALARM ON CONFIGURATION:    .    .          ENABLED        (DISABLED,ENABLED)
    ALARM ON INSUFFICIENT TIMESLOT:            ENABLED        (DISABLED,ENABLED)
    ALARM ON ISDN PM THRESHOLD:                ENABLED        (DISABLED,ENABLED)


                        CTRL-X) Main Menu     e(X)it


        [RT] ENTER CHOICE> A
```

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

Table 4. *System Settings Menu Options*

Parameter	Default Value	Description
System Date	01-JAN-00	The System Date is set for each PG-Flex system individually and displays as dd-mmm-yy. It increments automatically each midnight, as long as the COLU and RTLU are installed in the shelf and CO battery is connected to the COLU. If the COLU or the RTLU is removed from a powered shelf, then reinserted, the date will be the same as it was when the COLU or RTLU was pulled out of the shelf or when its power was removed. It then continues 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 increments 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 properly processes dates up to, and beyond, December 31, 1999.
System Time	00:00:00 at power on	The System Time must be set for each PG-Flex system individually and displays as hh:mm:ss. System Time is lost (default back to 00:00:00) whenever power is removed from the system shelf or the COLU or RTLU module is removed and reinserted.
System ID	(all spaces)	The System ID is supplied to indicate the physical location of the PG-Flex system (CO or RT 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.). If System ID is set to "shelf 25 system A", this ID appears at the top of each screen when accessing this system. This parameter is stored in the CO line unit NVRAM and therefore does not change when power is cycled or cards are removed and reinserted. If the CO line unit is replaced, it is necessary to reenter the appropriate system ID.

⚠ **All 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.**

Parameter	Default Value	Description
Auto Logout Time	DISABLED	After logging on to a system, you are automatically logged out after a time determined by the Auto Logout Time parameter: • DISABLED: The user is never 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 does not need a password). • 5: Automatically logs out after 5 minutes. • 30: Automatically logs out after 30 minutes. • 60: Automatically logs out after 60 minutes.

Table 4. *System Settings Menu Options (continued)*

Parameter	Default Value	Description
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.
Ring Frequency	20	Determines the frequency of the ringing voltage on the subscriber line. The values can be set to one of the following parameters: • 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.
HDSL ES Alarm Threshold	DISABLED	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. The values 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.
HDSL Margin Threshold	4	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.
Alarm on HDSL Threshold	DISABLED	Controls whether a minor alarm is generated if the HDSL ES Alarm Threshold or HDSL Margin Threshold is exceeded. The values can be set to one of the following parameters: • DISABLED: A minor alarm does not occur when the HDSL ES Alarm Threshold and/or HDSL Margin Threshold is exceeded. • ENABLED: A minor alarm occurs when the HDSL ES Alarm Threshold and/or HDSL Margin Threshold is exceeded.

Table 4. *System Settings Menu Options (continued)*

Parameter	Default Value	Description
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. The values can be set to one of 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.
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 results when a card does not have the correct corresponding card at the other end due to channel unit removal, type mixing, or failure. Note if a mismatch condition exists, between the CO and RT, replace the corresponding channel with a matching channel unit. The values can be set to one of the following parameters: • DISABLED: A minor alarm does not occur if there is a mismatch of channel units. • ENABLED: A minor alarm occurs if there is a mismatch of channel units.
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. The values can be set to one of the following parameters: • DISABLED: A minor alarm does not occur if more circuits have been enabled than there are available time slots. • ENABLED: A minor alarm occurs if more circuits have been enabled than there are available time slots.
Alarm on ISDN PM Threshold	DISABLED	This parameter determines whether a minor alarm occurs if any of the PM thresholds are exceeded. The values can be set to one of the following parameters: • DISABLED: A minor alarm does not occur if any of the ISDN PM thresholds are exceeded. • ENABLED: A minor alarm occurs if any of the ISDN PM thresholds are exceeded.

9.2   **Viewing Configuration for an ISDN Channel Unit.** To view the status of an ISDN channel unit, follow the instructions in paragraphs 9.2.1 through 9.2.3.

9.2.1   View the set up for an ISDN module, starting from the Setup menu:

    1   Type <E> then press <Enter> to view the ISDN Channel Setup selection menu:

```
 11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          05:09:16
                          SYSTEM ID: 24 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 your PG-Flex system, the display indicates that no ISDN cards are installed, and does not allow you to continue to the ISDN Channel Setup menu.

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

```
 06-FEB-96          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          03:39:52
                          SYSTEM ID: 24 Channel PG-Flex System            SYSTEM: 2

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

                          S) SELECT NEW CARD AND CHANNEL
                             CTRL-X) Main Menu     e(X)it

        [RT] ENTER CHOICE> A
```

3 Table 5 describes the ISDN channel unit configuration options:

The options in Table 5 listed in bold type are the default settings.

Table 5. ISDN Channel Unit Configuration Options

Parameter	Description	Options	
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
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.
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.
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.
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 another ISDN channel unit and channel to view.

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

9.2.2   View channel configuration, starting at the Setup Menu (refer to Table 6 for channel configuration options):

> 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> then press <Enter> to access the Channel Configuration menu:

```
11-FEB-98         PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      05:09:16
                       SYSTEM ID: 24 Channel PG-Flex System        SYSTEM: 2

                             CHANNEL CONFIGURATION
-------------------------------------------------------------------------------
                         CU1           CU2           CU3
Channel        COT     (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

                      CTRL-X) Main Menu    e(X)it


        [RT] ENTER COMMAND> D
```

2   Type <Ctrl + X> then press <Enter> to return to the Main Menu.

Table 6. *Channel Configuration Options*

Parameter	Default Value	Function
Channel Configuration	ENABLED	Each channel is individually enabled or disabled through the COLU. This configuration is stored in both the COLU and the COCU. If any one card (COLU, RTLU, COCU, or RTCU) is removed, replaced, or reinserted, the Channel Configuration will automatically be preseved. The values can be set to one of the following parameters: • DISABLED: The selected channel is disabled. • ENABLED: The selected channel is enabled.

9.2.3   View time slot assignment, starting at the Setup Menu. Type <B> then press <Enter> to display the
Time Slot Assignment menu:

```
11-FEB-98         PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         05:09:16
                        SYSTEM ID: 24 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         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:    ----
 -------------------------------------------------------------------------------


                        CTRL-X) Main Menu     e(X)it



         [RT] 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 may change.

Since PG-Flex is a universal subscriber carrier system, the specific time slot assigned to a channel is irrelevant—this screen is provided for informational purposes only.

9.2.4 View the ISDN performance, starting from the Status Menu.

1 Type <E> then press <Enter> to display the ISDN Performance Monitoring Menu:

```
11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          05:09:16
                        SYSTEM ID: 24 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
```

If there are no ISDN cards present in your PG-Flex 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 channel unit number followed by a comma, then type the channel for the selected ISDN channel unit. That is, type "2, 3" for ISDN card number 2 on channel 3.

```
5-DEC-97           PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          00:01:08
                        SYSTEM ID: 24 Channel PG-Flex System          SYSTEM: 1

                        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

                           CTRL-X) Main Menu     e(X)it



          [COT] ENTER COMMAND> B
```

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

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

9.3   **View Loop Start/Ground Start Channel Units.** To view the configuration for a loop start/ground start channel unit, follow the instructions in paragraphs 9.3.1 through 9.3.2.

> **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 four 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   View the channels for loop start or ground start:

1   From the Main Menu, type <B> then press <Enter> to display the Setup Menu:

```
11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          05:09:16
                        SYSTEM ID: 24 Channel PG-Flex System          SYSTEM: 2
     CURRENT STATUS: OK                                       LOGGED IN: RT
ALARMING TERMINAL: NONE
                                                              CHREV: SPAN 1


                                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


         [RT] ENTER COMMAND> A
```

2 Type <D> then press <Enter> to display the Pots Ground/Loop Start Configuration menu:

```
11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          05:09:16
                      SYSTEM ID: 24 Channel PG-Flex System              SYSTEM: 2
                      POTS GROUND/LOOP START CONFIGURATION
-------------------------------------------------------------------------------
                     CU1              CU2              CU3
Channel      COT    (POTS8)          (POTS8)          (ISDN4)
             RT     (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               -



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

9.3.2 View channel configuration for a loop start/ground start channel unit, starting at the Setup Menu (refer to Table 6 on page 20 for channel configuration options).

> **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> then press <Enter> to display the Channel Configuration menu:

```
11-FEB-98       PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL        05:09:16
                 SYSTEM ID: 24 Channel PG-Flex System          SYSTEM: 2
                          CHANNEL CONFIGURATION
--------------------------------------------------------------------------------
                      CU1           CU2            CU3
Channel       COT    (POTS8)       (POTS8)        (ISDN4)
              RT     (POTS8)       (POTS8)        (ISDN4)        (---)
--------------------------------------------------------------------------------
1                     ON            ON             ON
2                     ON            ON             ON
3                     ON            ON           DISABLED
4                     ON            ON           DISABLED
5                     ON            ON             -
6                     ON            ON             -
7                     ON            ON             -
8                     ON            ON             -


                       2 Time-Slots Available
                    CTRL-X) Main Menu    e(X)it

           [RT] ENTER COMMAND> D
```

2 Type <Ctrl + X> then press <Enter> to return to the Main Menu.

9.3.3   View time slot assignments for a loop start/ground start channel unit, starting at the Setup Menu. Type <B> then press <Enter> to display the Time Slots Assignment menu:

```
 11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL        05:09:16
                         SYSTEM ID: 24 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        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:    ----
 ------------------------------------------------------------------------------

                      CTRL-X) Main Menu    e(X)it


         [RT] 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.

Since PG-Flex is a universal subscriber carrier system, the specific time slot assigned to a channel is irrelevant—this screen is provided for informational purposes only.

9.4   **View Maintenance Tests.** The following paragraphs provide procedures for viewing the metallic access and test options of a PG-Flex system. Paragraph 9.4.1 describes the steps for viewing the metallic access options, and paragraph 9.4.2 describes the steps for viewing an ISDN loopback test.

Type <C> then press <Enter> from the Main Menu to access the Maintenance Menu:

```
11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         05:09:16
                          SYSTEM ID: 24 Channel PG-Flex System         SYSTEM: 2
   CURRENT STATUS: OK                                         LOGGED IN: COT
ALARMING TERMINAL: NONE
                                                             CHREV: SPAN 1


                                MAINTENANCE MENU
  ----------------------------------------------------------------------------

                              A) METALLIC ACCESS
                              B) ISDN LOOP BACK

                          CTRL-X) Main Menu    e(X)it



         [RT] ENTER COMMAND> a
```

9.4.1   **Viewing Metallic Access.** A metallic access connection to a subscriber circuit can be viewed through the Metallic Access Menu:

1   From the Maintenance Menu, type <A> then press <Enter>. The Metallic Access Menu displays:

```
11-FEB-98          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL         05:09:16
                          SYSTEM ID: 24 Channel PG-Flex System         SYSTEM: 2
   CURRENT STATUS: OK                                         LOGGED IN: COT
ALARMING TERMINAL: NONE
                                                             CHREV: SPAN 1

                              METALLIC ACCESS MENU
  ----------------------------------------------------------------------------
                              COT - BRIDGING
                              COT - LOOKING IN
                              COT - LOOKING OUT
                              RT  - LOOKING OUT
                              RT  - LOOKING IN
                              RT  - BRIDGING
                              SUBSCRIBER BYPASS


                          CTRL-X) Main Menu    e(X)it

         [RT] ENTER COMMAND> a
```

Table 7 defines the functions of the metallic access menu parameters.

Table 7. *Metallic Access Menu Options*

Parameter	Function
COT - Bridging	Provides the ability to monitor a subscriber circuit connection between the switch and the specified CO channel unit Tip/Ring pair.
COT - Looking In	Provides the ability to verify the connection between the switch and the specified CO channel unit tip/ring pair. The channel under test is disconnected from the switch for this function. The technician will be able to verify connectivity of the channel under test back to the switch.
COT - Looking Out	Provides the ability to stimulate the subscriber connection through the CO channel unit. The switch is disconnected from PG-Flex for this function.
RT - Looking In	Provides the ability to monitor the subscriber circuit at the RT channel unit Tip/Ring pair with the subscriber terminal equipment disconnected.
RT - Looking Out	Provides the ability to verify the subscriber drop with the RT channel unit disconnected.
RT - Bridging	Provides the ability to monitor the connection between the RT channel unit and the subscriber terminal equipment.
Subscriber Bypass	Provides a metallic connection from the switch to the subscriber's terminal equipment for the selected channel, bypassing the PG-Flex carrier transport. This is the only access connection that can be maintained after you log off from the Craft port.

9.4.2 **View ISDN Loopback Tests.** View ISDN loop back tests starting at the Maintenance Menu.
Type <B> then press <Enter>. The ISDN Loopback Menu displays:

```
  11-FEB-98        PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL        05:09:16
                        SYSTEM ID: 24 Channel PG-Flex System          SYSTEM: 2
                                ISDN LOOPBACK MENU
 -------------------------------------------------------------------------------
 COT LOOPBACK MAP    CARD:1
 -------------------------------------------------------------------------------
 LOOPBACK              CH1           CH2           CH3           CH4
 -------------------------------------------------------------------------------
 B1 DSL              normal        normal        normal        normal
 B2 DSL              normal        normal        normal        normal
 2B+D DSL            normal        normal        normal        normal
 B1 DC               normal        normal        normal        normal
 B2 DC               normal        normal        normal        normal
 2B+D DC             normal        normal        normal        normal

                      P)revious Card  or  N)ext Card


                        CTRL-X) Main Menu    e(X)it

         [RT] ENTER COMMAND> s
```

10. Troubleshooting

10.1   Table 8 provides troubleshooting procedures based on indications displayed by the FRL-742 front panel indicators.

Table 8. *FRL-742 RT Line Unit Troubleshooting*

Indication	Problem	Action
PWR LED off	**1** One or both HDSL lines are not connected between the COT and RT. Verify the connections at the RT and COT.	**1** Measure for 130 Vdc to 250 Vdc between HDSL_T and HDSL_T on the RT enclosure backplane. **2** On the COT shelf backplane, measure for -130 Vdc, ±10% between HDSL_T1 and chassis ground and 0 Vdc to +120 Vdc between HDSL_T2 and chassis ground.
	2 COT line unit fuse F1 has blown.	Replace the fuse.
	3 RT line unit power supply failed.	Replace RT line unit.
	4 COT HDSL power supply failed.	Replace COT line unit.
LOOP 1 (2) SYNC LED flashing or off	**1** The HDSL line is attempting to synchronize with the CO unit or cannot detect the HDSL signal from the CO 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*). **2** COLU and RTLU incompatible (i.e., one is a T1 version and the other is an E1 version.	**1** Verify the HDSL circuits are terminated properly and with the correct orientation. **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 1.
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 FRL-742 RT line unit.	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 FRL-742 RT line unit complies with the limits for Class B 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 the unit fails, replace it with another unit and immediately report the 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. 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.
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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