
PG-FLEX 32 CHANNEL REMOTE TERMINAL LINE UNIT

Model	List Number	Part Number	CLEI Code
FRL-746	3	150-1346-03	N/A



PAIRGAIN TECHNOLOGIES, INC.
ENGINEERING PLANT SERIES TECHNICAL PRACTICE
SECTION 363-746-103-01

Revision History of this practice.

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A) Initial Release

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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.

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A. PRODUCT OVERVIEW

1. Description and Features

- 1.1** The PairGain® PG-Flex™ FRL-746 List 3 Remote Terminal (RT) Line Unit is the remote end of the PG-Flex subscriber carrier system and resides in a RT enclosure. The FRL-746 Line Unit carries up to 32 subscriber channels between a Central Office Terminal (COT) and an RT. The FRL-746 Line Unit provides access through the RS-232 port to display system options, performance, and status using an ASCII terminal.

The FRL-746 RT Line Unit uses PairGain's High-bit-rate Digital Subscriber Line (HDSL) 2B1Q (2 binary 1 quaternary line code) technology to provide the equivalent of 2.048 Mbps digital transmission 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-746 List 3 RT line units can be used with PG-Flex doublers to extend the range of a PG-Flex subscriber carrier system, but will not report doubler or span data. The operator must access this data from the COT line unit.

- 1.2** Features of the FRL-746 RT Line Unit are:

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

2. Front Panel

Figure 1 shows the FRL-746 Line Unit front panel. Table 1 lists the indicators and states for the FRL-746 front panel LEDs.

Figure 1 shows the RS-232 craft maintenance port on the FRL-746 front panel that is used by an ASCII terminal to display system options, performance, and status. Also, it includes the Alarm Cut-off switch (ACO), which is used to perform a lamp test (that is, turn all the Remote Terminal Line Unit (RTL) and Remote Terminal Channel Unit (RTC) LEDs on).

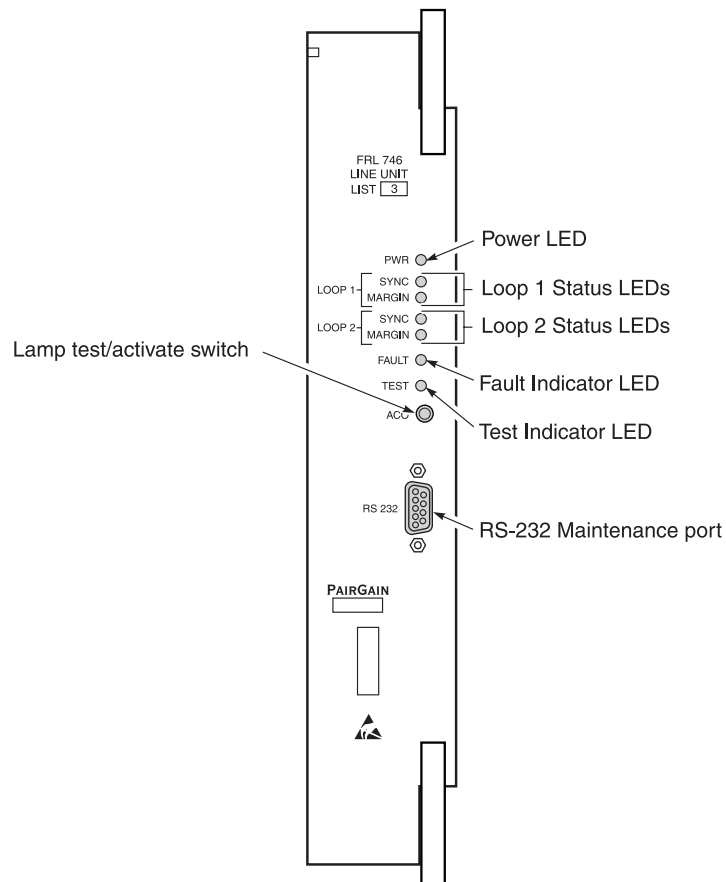


Figure 1. FRL-746 List 3 Front Panel

Table 1. FRL-746 Front Panel LEDs

LED	LED State	Indicates
PWR	Solid Green	Power applied and line feed operating normal. After the system is powered on for about two minutes, the POWER LED turns off. Pressing the ACO button turns it back on for another two minutes.
	OFF	Not receiving power from COLU or normal operation after 2 minutes.
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.....+100 Vdc to +130 Vdc (Line 1)
 -100 Vdc to -130 Vdc (Line 2)

RT Power Supply Input PowerLess than 45 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 that can support up to 32 channels including Plain Old Telephone Service (POTS), Ground Start/Loop Start, and Integrated Services Digital Network (ISDN) services.

PG-Flex systems mounts into 19-inch COT Shelves on the CO-side, and FRE-765 enclosures on the RT-side. A PG-Flex system is comprised of one Line Unit and one (or more) channel units at both the CO and RT. Line Units or Channel Units can be hot-swapped without affecting other systems in the same shelf. The POTS Channel Units use a pulse coded modulation (PCM) encoding scheme that allows high speed modem and group 3 facsimile operation on all channels.

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

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

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

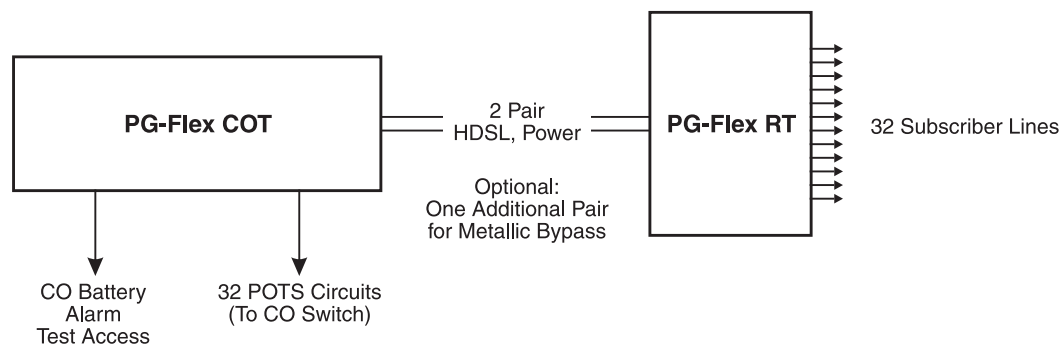


Figure 2. Typical PG-Flex Configuration

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

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

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

Table 2. PG-Flex Distances

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

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

4.4 Subscriber Drop Testing. For subscriber drop testing from the CO, 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.

Metallic access is performed from the subscriber's COT. Refer to the FLL-716 technical practice for more information.

5. Operational Capabilities

5.1 The FRL-746 RT Line Unit provides the following functions:

- 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
- loop test system compatibility

5.2 The RS-232 Maintenance Port (Figure 1) provides access to display system options, performance, and status of the PG-Flex system using an ASCII terminal (see Section 9).

Figure 3 shows a block diagram of the FRL-746.

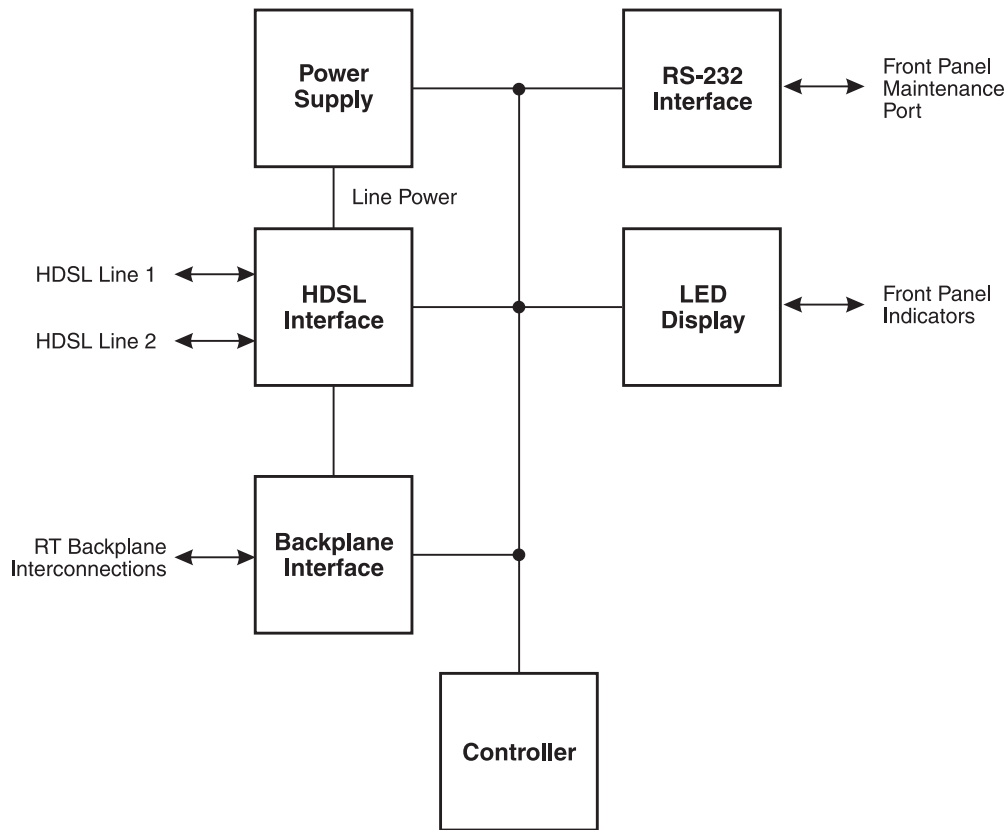


Figure 3. FRL-746 RT Line Unit Block Diagram

6. Terminal Management

6.1 The terminal management function at the RT allows the technician to display information about the PG-Flex system using an ASCII terminal (or modem with a null modem cable) connected to the RS-232 Maintenance port. With this function, the technician can:

- view system status
- view system options
- monitor performance
- obtain an inventory report

6.2 Connecting FRL-746 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 FRL-746 RS-232 (DB-9) craft maintenance port to an ASCII terminal.



The FRL-746 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 RS-232 craft 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.

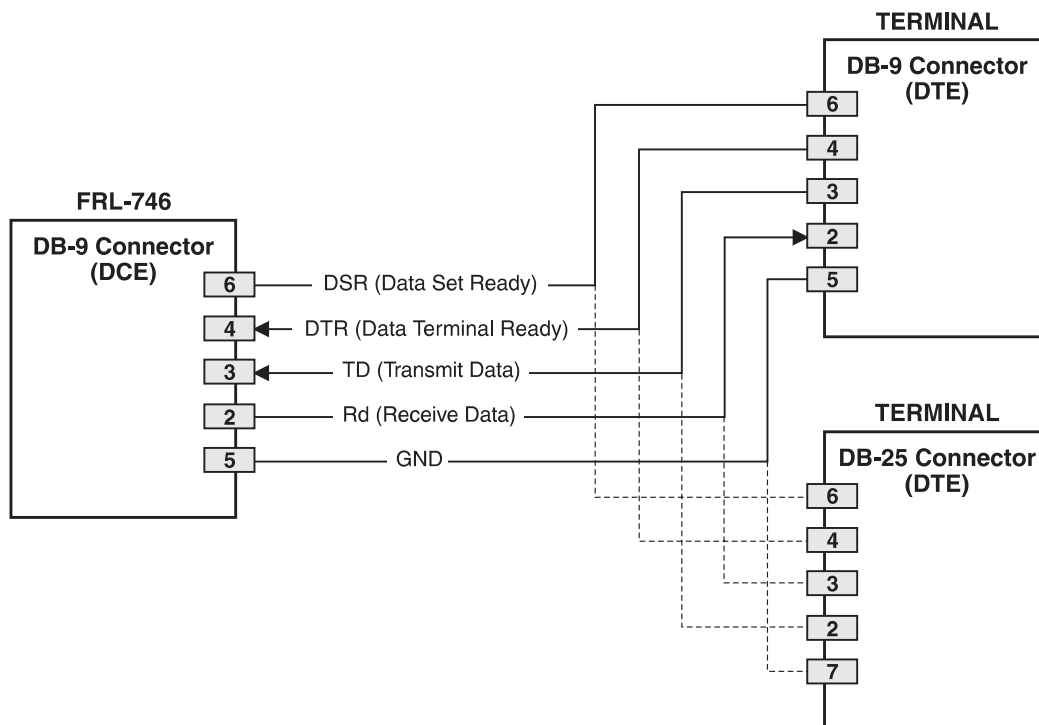


Figure 4. Connecting the FRL-746 to an ASCII Terminal

Figure 5 shows the pinouts for connecting the FRL-746 to a modem using a null-modem cable. Using Data Carrier Detect (DCD) from the modem ensures that the FRL-746 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 FRL-746 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-746 drops DSR (which is null-modemmed to DTR input on the modem).

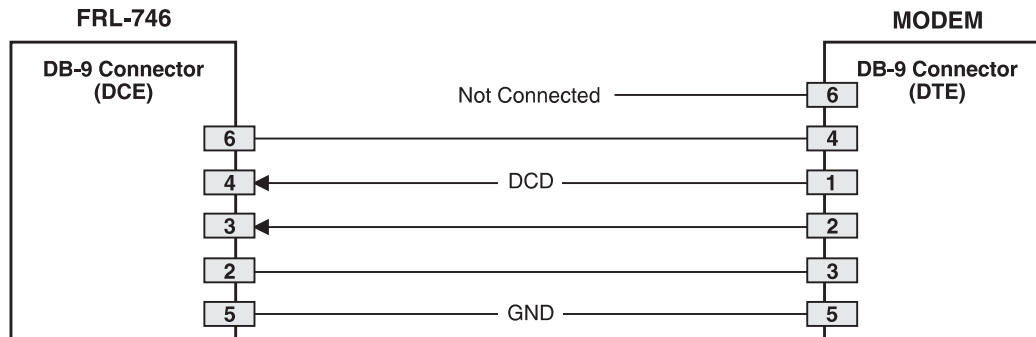


Figure 5. Connecting the FRL-746 to a Modem

The connection is set up as:

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

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

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

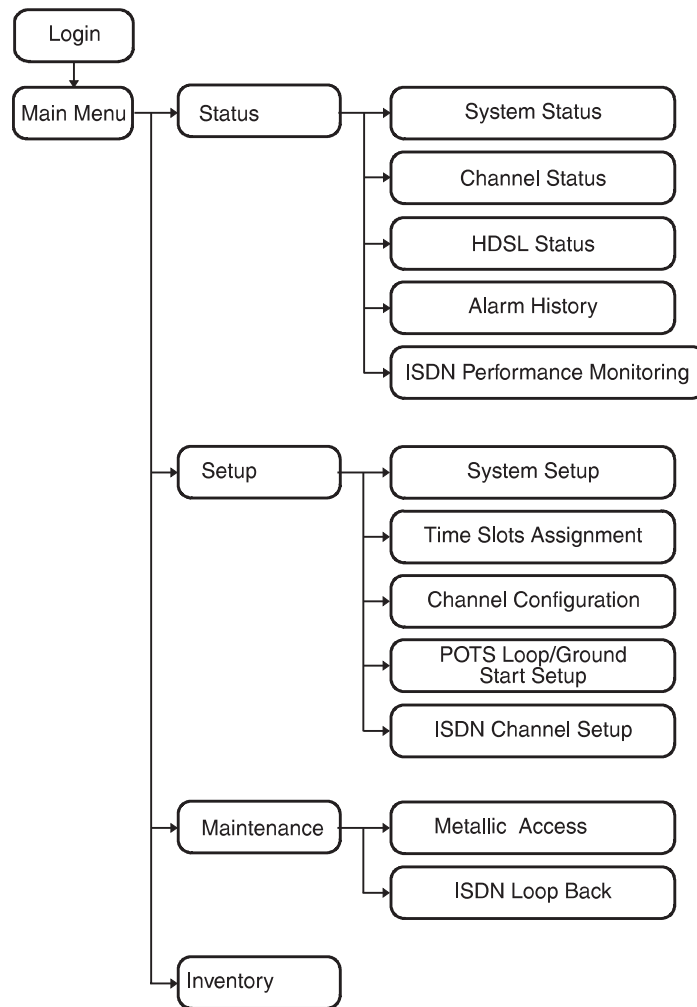


Figure 6. Terminal Menu and Display Structure

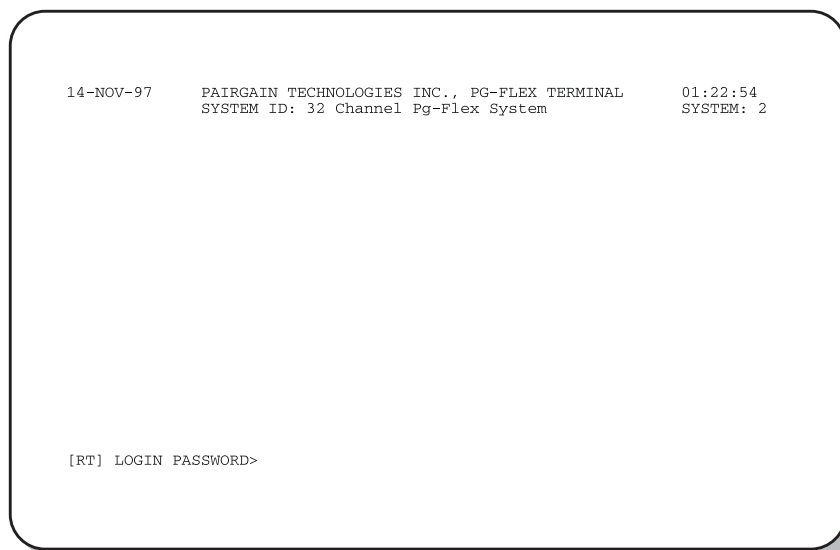
- 6.4 Power-up and Connection Screen.** After connecting the ASCII terminal to the FRL-746 Line Unit, the Power-Up and Connection screen appears:



- 6.5 Log On Screen.** The FRL-746 displays a log on screen when it detects user input from the maintenance port (while idle).

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

This input causes the log on screen to appear:



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



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

6.6 Main Menu. The Main Menu appears after a successful log on:

```
14-NOV-97      PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      01:00:54
                SYSTEM ID: 32 Channel PG-Flex System            SYSTEM: 2

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

-----
                MAIN MENU
-----
                A) STATUS
                B) SETUP
                C) MAINTENANCE
                D) INVENTORY
                Q)uit

[RT] ENTER COMMAND> B
```

From the Main Menu, you access other menus where you can view PG-Flex system setup and configurations, view system inventory, and view status information. 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"> • 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: <ul style="list-style-type: none"> IDLE: channel is not off-hook or ringing RING: channel is ringing BUSY: channel is off-hook OPEN: no connection to CO switch (Forward Disconnect) TEST: in test mode 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 show the status history of COT, RT, and Span alarms. • ISDN Performance Monitoring Menu to show PM error count and PM threshold for a specific ISDN card and channel.
Setup	<p>Select the Setup option (B) from the Main Menu, the technician can view the current setup:</p> <ul style="list-style-type: none"> • System Setup • Time Slots Assignment (view only) • Channel Configuration • POTS Loop/Ground Start Setup • ISDN Channel Setup
Maintenance	<p>Select the Maintenance option (C) from the Main Menu for viewing ISDN loopbacks.</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).</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 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.

8.1 Install FRL-746 and verify operation as follows:



The FRL-746 will not operate until a COT line unit has been installed.

- 1 Insert the FRL-746 into the RT enclosure and verify:
 - all LEDs turn on for about one second
 - PWR and FAULT LEDs remain 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:
 - POWER is on (turns off after about two minutes, but pressing the ACO button may turn it back 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

9.1 View System Settings. View the System Settings starting at the Main Menu.

- 1 Type and press <Enter>, the Setup Menu appears:

```

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

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

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

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

                CTRL-X) Main Menu      e(X)it

[RT] ENTER COMMAND> A

```

- 2 Type <A> and press <Enter> at the Setup Menu, the System Settings menu appears:

```

14-NOV-97      PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      01:07:36
                SYSTEM ID: 32 Channel PG-Flex System            SYSTEM: 2
                SYSTEM SETTINGS
-----

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

                CTRL-X) Main Menu      e(X)it

[RT] ENTER CHOICE> X

```


9.2 Viewing ISDN Channel Setup. To view the configuration and 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:



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

1 Type <E> and press <Enter> at the Setup Menu.

The ISDN Channel Setup menu appears:

```

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

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

                Press ESCAPE to return to previous menu

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

```

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

```

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

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

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

[RT] ENTER CHOICE>

```

- 3 From the ISDN Channel Setup menu you can view the parameters set up for the ISDN channel unit (Table 4):

Table 4. ISDN Channel Unit Configuration Options

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

9.2.2 View channel configuration, starting at the Setup Menu:



**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> at the Setup Menu. The Channel Configuration menu appears:

```

14-NOV-97          PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL          01:07:54
                   SYSTEM ID: 32 Channel PG-Flex System              SYSTEM: 2
                   CHANNEL CONFIGURATION
-----
Channel    RT          CU1          CU2          CU3          CU4
           RT          (POTS8)     (POTS8)     (POTS8)     (ISDN4)
           RT          (POTS8)     (POTS8)     (POTS8)     (ISDN4)
-----
      1          ON          ON          ON          ON
      2          ON          ON          ON          OFF
      3          ON          ON          DISABLED   DISABLED
      4          ON          ON          DISABLED   DISABLED
      5          ON          ON          DISABLED   -
      6          ON          ON          DISABLED   -
      7          ON          ON          DISABLED   -
      8          ON          ON          DISABLED   -

                2 Time slots Available

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

[RT] ENTER COMMAND>

```

- 2 Type <X> and press <Enter> to go back one screen.

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

```

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

                CTRL-X) Main Menu      e(X)it

[RT] ENTER COMMAND>

```



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

- 9.3 View Loop Start/Ground Start Channel Units.** To view the configuration of Loop Start/Ground unit, follow the instructions in paragraphs 9.3.1 through 9.3.3.



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 View the channels for loop start or ground start

- 1 From the Setup Menu, type <D> and press <Enter>, the POTS Ground/Loop Start Configuration menu appears:

```

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

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

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

[RT] ENTER COMMAND>

```

- 3 Type <X> and press <Enter> to go back one screen.

9.3.2 View channel configuration, starting at the Setup Menu:



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

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>. The Channel Configuration menu appears:

```

14-NOV-97      PAIRGAIN TECHNOLOGIES INC., PG-FLEX TERMINAL      01:07:54
                SYSTEM ID: 32 Channel PG-Flex System           SYSTEM: 2
                CHANNEL CONFIGURATION
-----
Channel      COT          CU1          CU2          CU3          CU4
              RT          (POTS8)     (POTS8)     (POTS8)     (ISDN4)
              (POTS8)     (POTS8)     (POTS8)     (ISDN4)
-----
      1              ON          ON          ON          ON
      2              ON          ON          ON          OFF
      3              ON          ON          DISABLED   DISABLED
      4              ON          ON          DISABLED   DISABLED
      5              ON          ON          DISABLED   -
      6              ON          ON          DISABLED   -
      7              ON          ON          DISABLED   -
      8              ON          ON          DISABLED   -

                2 Time slots Available

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

[RT] ENTER COMMAND>

```

- 2 Type <X> and press <Enter> to go back one screen.

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

```

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

                   CTRL-X) Main Menu      e(X)it

[RT] ENTER COMMAND>

```



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

10. Troubleshooting

10.1 Table 5 provides troubleshooting procedures based on indications displayed by the front panel indicators of FRL-746 RT Line Unit.

Table 5. FRL-746 RT Line Unit Troubleshooting

Indication	Problem	Action
POWER LED off	1 This is the normal condition of the RT LEDs after the time-out period.	Press the ACO button on the RT line unit to enable the LEDs on the RT line unit.
	2 One or both HDSL lines are not connected between the COT and RT. Verify the connections at the RT and COT.	Measure for 130 Vdc to 250 Vdc between HDSL-T1 and HDSL-T2 on the RT enclosure backplane. On the COT shelf backplane, measure -65 Vdc to -130 Vdc, $\pm 10\%$ between HDSL_T1 and chassis ground and +65 Vdc to +120 Vdc between HDSL_T2 and chassis ground.
	3 COT Line Unit fuse F1 has blown.	Replace the fuse.
	4 RT Line Unit power supply failed.	Replace RT Line Unit.
	5 COT HDSL power supply failed.	Replace COT Line Unit.
LOOP 1 (2) SYNC LED flashing or off	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). COLU and RTLU incompatible (i.e., one is a T1 version and the other is an E1 version).	Verify the HDSL circuits are terminated properly and with the correct orientation. Measure the loop resistance of each HDSL circuit (shorting the pair at the far end). The loop resistance must be less than that shown in Table 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-746 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-746 RT Line Unit complies with the limits for Class A digital devices pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operating this equipment in a residential area can cause harmful interference in which case the user will be required to correct any interference at his own expense.
- 12.2** For information on cabling, proper connections, grounding and line power, refer to the appropriate instruction manual for the unit being installed.
- 12.3** All external wiring must follow the provisions in the current edition of the National Electrical Code.

13. Warranty

- 13.1** PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of 5 years from the date of original shipment, given proper customer installation and regular maintenance. PairGain will repair or replace any unit without cost during this period if the unit is found to be defective for any reason other than abuse or improper use or installation.
- 13.2** Only an authorized PairGain representative can perform repairs. If unit fails, replace it with another unit and immediately report failure to PairGain. Any repairs or modifications made to the unit by unauthorized field personnel will void the warranty.
- 13.3** If a unit needs repair, call PairGain for a Return Material Authorization (RMA) number and return the defective unit, freight prepaid, along with a brief description of the problem, to:
- PairGain Repair Center
14352 Franklin Avenue
Tustin, CA 92780-7013
- FAX: (714) 730-2961
Phone: (714) 730-2800 or (800) 370-7670
- 13.4** PairGain will continue to repair faulty modules beyond the warranty program for a nominal charge. Contact your PairGain sales representative for details and pricing.

F. ABBREVIATIONS AND GLOSSARY

14. Abbreviations

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

15. Glossary

Margins	Indicates the excess signal to noise ratio, at either the COT or RT, relative to a 10^{-7} Bit Error Rate. <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.
Pulse Attenuation	Indicates the attenuation of the 2B1Q pulse from the distant end. PG-Flex operates with pulse attenuations in excess of 30 dB. This value is related to the cable pair's 272-kHz loss. The pulse attenuation is a more direct indication of the loop attenuation to the 2B1Q signal than the 272-kHz loss. The normal range of pulse attenuation is from 1 to 32 dB.
PPM	Indicates the relative offset of the crystal oscillator in the RT Line Unit from the COT Line Unit's crystal oscillator. Any value between -64 and +64 is adequate. Values outside this range indicate out of tolerance components or excessive temperature drift of critical components.
HDSL 24 Hour ES	The number of 1-second intervals that contained at least one CRC error. This value is a running total of errored seconds (ES) for the last 24 Hours.
HDSL 24 Hour UAS	The number of seconds (unavailable seconds) the HDSL loop was out of synchronization.

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