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# PG-FLEX ISDN BASIC RATE INTERFACE CENTRAL OFFICE TERMINAL CHANNEL UNIT

Model	List #	Part Number	CLEI Code
FLC-706	1	150-1306-01	VACHEGJCAA



**PAIRGAIN TECHNOLOGIES, INC.**  
**ENGINEERING SERVICES TECHNICAL PRACTICE**  
**SECTION 363-706-100-01**

**Revision History of this practice.**

Revision 01—June 9, 1997

A) Initial Release.

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## USING THIS TECHNICAL PRACTICE

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



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



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



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

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## A. PRODUCT OVERVIEW

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### 1. Description and Features

**1.1** The PairGain® PG-Flex FLC-706 List 1 ISDN Basic Rate Interface (BRI) Channel Unit (Figure 1) provides an interface to North American Integrated Services Digital Network (ISDN) Basic Access services through a PG-Flex Central Office Terminal (COT). The FLC-706 accommodates four ISDN channels and provides ISDN Line Unit Network Termination (LUNT) at the COT. The FLC-706 installs into a single slot of a PG-Flex Shelf.

**1.2** Features of the FLC-706 Channel Unit are:

- four ISDN U-interfaces
- Mechanized Loop Testing (MLT) compatible and metallic test access
- dc resistive test signature
- mp/pp-eoc slave mode in 3DS0 format
- segmented path performance monitoring
- interim path performance monitoring
- software provisioning
- loopbacks
- Pair Gain Test Controller (PGTC) compatible

## 2. Front Panel

2.1 Figure 1 shows the FLC-706 front panel. Table 1 lists the different states and indications for the FLC-706 front panel LEDs.

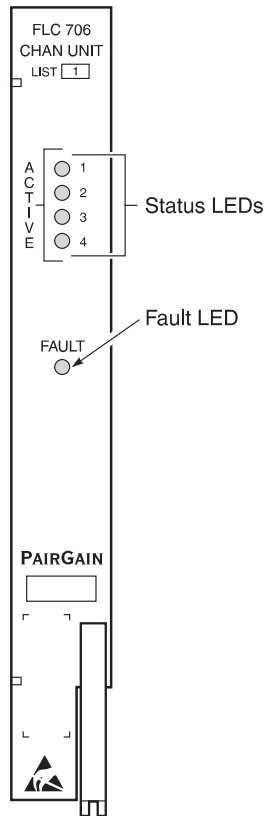


Figure 1. FLC-706 ISDN Channel Unit Front Panel

Table 1. FLC-706 Front Panel LEDs

LED	LED State	Indicates
ACTIVE* (1 through 4)	Solid green	Channel is in sync
	Fast-flashing green	Channel is attempting to sync
	Slow-flashing green	Channel is in a maintenance state which is either loopback or subscriber circuit testing
FAULT	Solid red	A fault has been detected on the unit during powerup
	Off	No faults have been detected on the unit during powerup

\* Each LED for the four channels has the same states and indications

### 3. Specifications

#### Transmission

- Code .....2B1Q (2 binary, one quaternary) at 160 kbps
- Network Interface .....3DS0 format
- Basic Rate Interface .....2B+D (2 B channels at 64 kbps, one D channel at 16 kbps)
- dc Resistive Test Signature ..... 120 kΩ
- Terminal Impedance ..... 135 Ω

#### Environmental

- Temperature Range .....-40° F to +150° F (-40° C to +65° C)
- Altitude.....-200 ft. to 13,000 ft. (-60 m to 4,000 m)

#### Dimensions

- Height .....06.75 in. (17.15 cm)
- Depth ..... 10.50 in. (26.67 cm)
- Width.....01.00 in. (02.54 cm)
- Weight .....00.80 lb (00.40 kg)

## B. FUNCTIONAL DESCRIPTION

### 4. Applications

4.1 ISDN is a networking standard that provides end-to-end, simultaneous handling of digitized voice and data traffic on the same link. Figure 2 shows a typical ISDN configuration. The FLC-706 connects an ISDN Digital Subscriber Line (DSL) to the Central Office (CO). Line Termination (LT) in the CO occurs at the ISDN switch. The DSL loops are U-interface. The FRC-756 Channel Unit provides Line Unit Line Termination (LULT) at the RT. The subscriber site has the Network Termination (NT1).

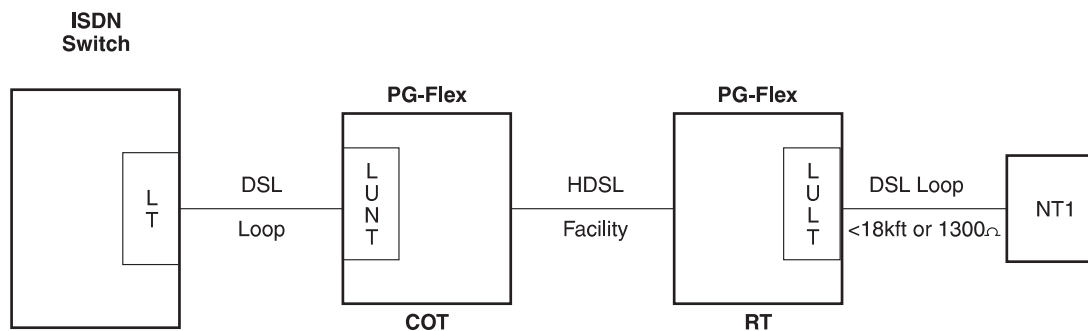


Figure 2. Typical ISDN Configuration

- 4.2** Set all options for the FLC-706 through the PG-Flex COT Line Unit or PGTC unit RS-232 maintenance port. Disable ISDN via the maintenance port to prevent time slots from being assigned to them when they are not in use. The FLC-706 must be plugged into a shelf before any ISDN provisioning screens can be displayed.
- 4.3** To provide clocking to the ISDN FLC-706 Channel Unit, ensure the:
- composite clock on the PG-Flex COT shelf is connected and properly terminated
  - FPI-729 card is installed
  - FAU-728 List 2 card is installed

## 5. Operational Capabilities

- 5.1** The FLC-706 ISDN Channel Unit supports two-wire DSL 2B+D data or subsets of that rate. The B channels (B1 and B2) carry digitized voice and data. The D channel communicates control signaling and low-speed, packet-switched data.
- Segmented path performance monitoring collects the error rates for each DSL loop individually. Interim path performance monitoring collects the end-to-end error rate for the entire transport path.
- 5.2** For system isolation and system tests, the FLC-706 provides:
- a hybrid transformer that isolates the equipment from the facility and provides coupling and impedance matching at 135  $\Omega$
  - metallic test access through the FPI-729 PGTC Interface Unit
  - MLT compatibility
  - a DC resistive test signature of 120 k $\Omega$  for out-of-service system tests
- 5.3** The FLC-706 meets the following requirements:
- ANSI T1.601-1992 Layer 1
  - TR-NWT-000397 ISDN Basic Access Transport System Requirements
  - TR-NWT-000393 ISDN Basic Access Digital Subscriber Lines
  - TR-TSY-000829 Embedded Operations Channels

## C. INSTALLATION AND TEST

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### 6. Unpacking

- 6.1** Upon receipt of the equipment, visually inspect it for signs of damage. If damage is observed, report it immediately to the transportation company and PairGain. Order replacement equipment if necessary.
- 6.2** Check the contents against the packing slip to ensure complete and accurate shipment. If shipment is short or irregular, contact PairGain as described in Section 10.3. If you must store the equipment for a prolonged period, store it in the original box.

## 7. Installation

**7.1 Integration Parameters.** Install the FLC-706 into PG-Flex systems with:

- List 3 or higher PG-Flex CO Line Unit
- List 3 or higher PG-Flex RT Line Unit
- an FPI-729 unit (used for clocking) in the COT shelf



**Observe normal electrostatic discharge precautions when handling electronic equipment. Do not hold electronic plug-ins by their edge. Take care not to touch components or circuitry.**

**7.2 Install.** Insert the FLC-706 into the COT shelf. Ensure the LED indicators:

- turn ON for about 2 seconds
- turn OFF for about 2 seconds
- scan ON from top to bottom
- turn OFF

If the LEDs do not follow the above sequence, see Table 2.

**7.3 Provision the FLC-706.** Provision the FLC-706 using a List 3 or higher CO Line Unit practice. Access the ISDN Channel Setup menu and select the appropriate options.

**7.4 Connect cabling.** Connect the DSL and FLC-706:

- 1 Connect the DSL switch in the CO to the appropriate PairGain COT shelf termination for the ISDN FLC-706 circuit(s) selected. The FLC-706 has four separately configurable circuits.



**In step 2, the FRC-756 RT ISDN Channel Unit must be installed and connected to an NT1 device for the following LED sequence to occur. Otherwise, the LED on the FLC-706 will continue to fast-flash green and will not synchronize.**

- 2 Connect and provision the CO DSL switch termination. Observe, for the channel(s) connected, that the ACTIVE LED:
  - is fast-flashing green while the circuit is attempting to synchronize to the CO switch
  - goes to steady green when the circuit is synchronized to the CO switch

**7.5 Verify operation.** Verify incoming and outgoing calls for both B channels (where B1 is the digitized voice channel and B2 is the data channel):



**When verifying the B1 and B2 channels, only the B channel used for digitized voice will have dial tone. The data channel does not have dial tone.**

**For the verify operation steps, use a Tektronic Craftec CT-100 ISDN type test set (or equivalent) that can generate a PRBS/2047 pattern to perform a data Bit Error Rate Test (BERT) when the circuit connects to the far end. This is the most stressful pattern for ISDN circuits. A test result that does not exceed  $10^{-7}$  Bit Error Rate (BER) must be demonstrated.**

**7.5.1 Outgoing calls.** Verify outgoing calls for both B channels (i.e., calls from the NT1 to the LT per Figure 2):

- 1 Originate an outgoing B1 voice call and make sure that:
  - dial tone is present
  - the number you called is displayed (when answered)
  - the number from which you called is displayed as the originating number
- 2 Hold up the B1 voice circuit, then switch to the B2 data circuit.
- 3 Originate an outgoing B2 data call to the data loopback (LPBK) test line and perform the BER test (after the data call is established).
- 4 After the B2 data test is completed, drop the B2 data line, then drop the B1 voice line.
- 5 Return all circuits to normal.

**7.5.2 Incoming calls.** Verify incoming calls for both B channels (i.e., calls from the LT to the NT1 per Figure 2):

- 1 To test an incoming B1 voice call:
  - draw dial tone from another ISDN or POTS circuit
  - dial the ISDN B1 voice circuit number
  - verify that the number you called is displayed (when answered)
  - verify that the number from which you called is displayed as the originating number
- 2 Hold up the B1 voice circuit, then switch to the B2 data circuit.
- 3 Originate an outgoing call on the B2 data circuit using another ISDN data circuit and call the B2 data circuit under test. Then, perform the BER test.
- 4 Drop the B2 data line after the B2 test is completed. Then drop the B1 voice line.
- 5 Return all circuits to normal.



## 8. Troubleshooting

- 8.1** Table 2 provides troubleshooting procedures using the front panel LEDs and customer reports. The FLC-706 supports CO initiated loopbacks.

**Table 2.** FLC-706 COT Channel Unit Troubleshooting

Indication	Problem	Action
FAULT LED	Fault detected in the PG-Flex system	Replace channel unit.
FAULT LED +ACTIVE 1	Internal fault on the FLC-706	Replace channel unit.
FAULT LED +ACTIVE 2	Internal fault on the FLC-706	Replace channel unit.
FAULT LED +ACTIVE 3	Internal fault on the FLC-706	Replace channel unit.
FAULT LED +ACTIVE 4	Internal fault on the FLC-706	Replace channel unit.
ACTIVE LED SLOW-FLASH	Circuit is in either Loopback or PairGain Test Controller (PGTC) test setup state	Access the circuit via the PG-Flex Line Unit maintenance port and release the circuit or wait for the test originator to complete testing.
ACTIVE LED FAST-FLASH	ISDN circuit lost sync	Check loop or for network termination (NT1) removal by customer.
Customer Reports No Dial Tone	Off-hook not extended to CO	Check status LEDs. Clear any indicated trouble. Use PG-Flex Line Unit maintenance port as required.
Customer Reports Data Transmission Errors	Customer experiencing errors	Perform test step 3 from section 7.4. Check performance monitoring record.
Technician Establishes Loopback	Loopback customer circuit at various points	Use loopback portion of PG-Flex Line Unit maintenance port to select and activate loopbacks.

## D. TECHNICAL SUPPORT

### 9. Technical Support

- 9.1** 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
- 9.2** 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.

- 9.3** 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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### **10. Certification**

- 10.1** FCC compliance: The PG-Flex FLC-706 List 1 ISDN BRI Channel Unit was tested and found to comply with the limits for Class A digital devices, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause electrical interference in which case the user will be required to correct the interference at his own expense.

### **11. Warranty**

- 11.1** PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of five 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.
- 11.2** The FLC-706 should not be field repaired. If it fails, replace it with another unit and return the faulty unit to PairGain for repair. Any modifications of the unit by anyone other than an authorized PairGain representative voids the warranty.
- 11.3** If a unit needs repair:
- 1** Call PairGain for a Return Material Authorization (RMA) number at (800) 638-0031.
  - 2** 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: Repair and Return Dept.
- 11.4** PairGain continues to repair faulty units beyond the warranty program at a nominal charge. Contact your PairGain sales representative for details and pricing.

## F. ABBREVIATIONS

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### 12. Abbreviations

<b>BER</b>	Bit Error Rate
<b>BERT</b>	Bit Error Rate Test
<b>CO</b>	Central Office
<b>COT</b>	Central Office Terminal
<b>DSL</b>	Digital Subscriber Line
<b>eoc</b>	Embedded Operations Channel
<b>ISDN</b>	Integrated Services Digital Network
<b>LUNT</b>	Line Unit Network Termination
<b>MLT</b>	Mechanized Loop Testing
<b>mp-eoc</b>	Multipoint embedded operations channel
<b>NSYN</b>	No synchronization
<b>NT1</b>	Network Termination (type 1)
<b>pp-eoc</b>	Point to point embedded operations channel
<b>RMA</b>	Return Material Authorization
<b>RT</b>	Remote Terminal

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**PAIRGAIN**  
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