PG-FLEX ISDN BASIC RATE INTERFACE REMOTE TERMINAL CHANNEL UNIT

Model	List #	Part Number	CLEI Code
FRC-756	1	150-1356-01	VARHEJJCAA

PAIRGAIN TECHNOLOGIES, INC.
ENGINEERING SERVICES TECHNICAL PRACTICE
SECTION 363-756-100-01

Revision History of this practice.
Revision 01—June 9, 1997
A) Initial Release.

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USING THIS TECHNICAL PRACTICE

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.

A. PRODUCT OVERVIEW

1. Description and Features

1.1 The PairGain® PG-Flex FRC-756 List 1 ISDN Channel Unit (Figure 1) provides an interface to the North American Integrated Services Digital Network (ISDN) Basic Access services through a PG-Flex Remote Terminal (RT). The FRC-756 accommodates four ISDN channels and provides ISDN Line Unit Line Termination (LULT) at the RT. The FRC-756 installs into a single slot of an RT Enclosure.

1.2 Features of the FRC-756 Channel Unit are:

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

2. Front Panel

2.1 Figure 1 shows the FRC-756 front panel. Table 1 lists the different states and indications for the FRC-756 front panel LEDs.

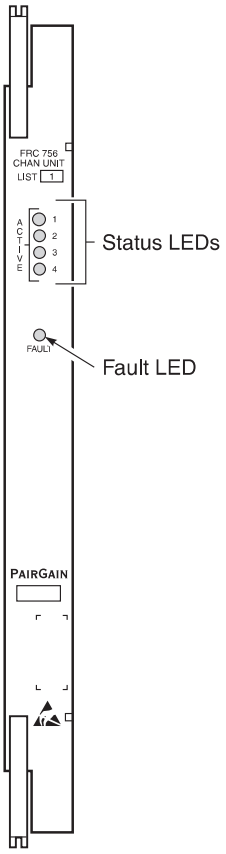

Figure 1. *FRC-756 ISDN Channel Unit (Front Panel)*

Table 1. *FRC-756 Front Panel LEDs*

LED	LED State *	Indicates
ACTIVE	Solid green	Channel is in sync
(1 through 4)	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 at 160 kbps

Network Interface ..... 3DS0 format

Basic Rate Interface ..... 2B+D (2 B channels at 64 kbps, 1 D channel at 16 kbps)

Distance (to NT1) ..... Up to 18 kft or 1300 Ω

dc Resistive Test Signature ..... 30 kΩ

Maximum Line Loss ..... 42 dB @ 40 kHz

Sealing Current ..... 4.8 mA (nominal)

Facility Impedance ..... 135 Ω

Environmental

Temperature Range ..... –40º F to +150º F (–40º C to +65º C)

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

Dimensions

Height ..... 12.00 in. (30.48 cm)

Depth ..... 04.50 in. (11.43 cm)

Width ..... 01.00 in. (02.54 cm)

Weight ..... 00.60 lb. (00.30 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 FRC-756 (LULT) extends the ISDN connection from the RT to the subscriber network termination (NT1) device. The Digital Subscriber Line (DSL) loop is a non-loaded twisted pair up to 18 kft with mixed gauges. The total resistance limitation is 1300 Ω. Bridged taps greater than 6 kft are not allowed.

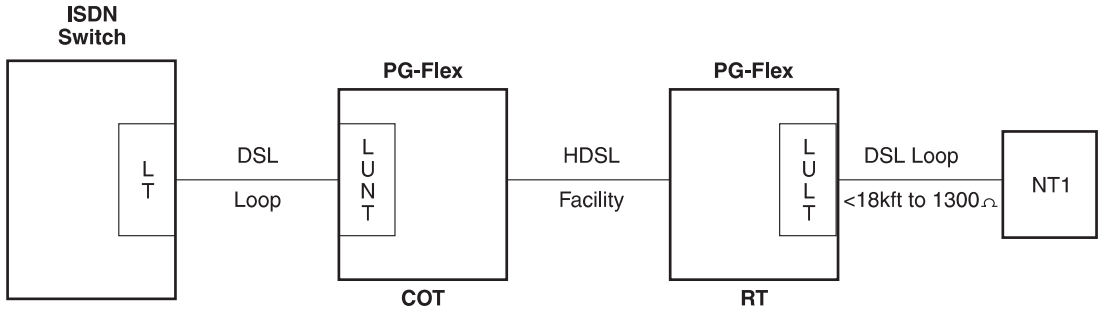

***Figure 2**. Typical ISDN Configuration*

4.2 Set all options for the FRC-756 through the PG-Flex COT Line 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 FRC-756 must be plugged into a shelf before any ISDN provisioning screens can be displayed.

4.3 To provide clocking to the ISDN FRC-756 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 FRC-756 ISDN Channel Unit supports two-wire DSL 2B+D data or subsets of that rate. The B channels (B1 and B2) are used for digitized voice or data. Zero Byte Substitution is used for the transmission of a clear channel in B1 and B2. The D channel communicates control signaling and low-speed, packet-switched data.

Segmented 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 FRC-756 provides:

- a hybrid transformer that isolates the equipment from the facility and provides coupling and impedance matching at 135 Ω
- metallic test access through the FPI-729 PGTC Interface Unit
- MLT compatibility
- dc resistive test signature of 30 kΩ

5.3 The FRC-756 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

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 11.3. If you must store the equipment for a prolonged period, store it in the original box.

7. Installation

7.1 **Integration Parameters.** Install the FRC-756 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 FRC-756 into the RT Enclosure. 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 FRC-756.** Provision the FRC-756 using the List 3 (or higher) CO Line Unit practice. Select the ISDN setup menu and select the appropriate options.

7.4 **Connect cabling.** Connect the subscriber loop from the network termination (NT1) device to the output cabling of the FRC-756 circuit chosen (1 of 4). Observe that the appropriate ACTIVE LEDs are OFF.

7.5 Verify operation. Verify the operation of both the B channels (where B1 is the digitized voice channel and B2 is the data channel).

When verifying 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 channel (i.e., calls from the NT1 to the LT per Figure 2):

1 Originate an outgoing B1 voice call and observe the following:

- dial tone is present
- number you called is displayed (when answered)
- 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
- ensure number you called is displayed (when answered)
- ensure 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 With another ISDN data circuit, originate an outgoing call on the B2 data circuit and call the B2 data circuit under test. Perform the BER test.

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.

8. Troubleshooting

8.1 Table 2 provides troubleshooting procedures using the front panel LEDs and customer reports. The FRC-756 supports CO initiated loopbacks and circuit metallic test access.

Table 2. *FRC-756 RT 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 (NT-1) 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

10. Certification

10.1 FCC compliance: The FRC-756 List 1 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 FRC-756 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

12. Abbreviations

BER	Bit Error Rate
BERT	Bit Error Rate Test
CO	Central Office
COT	Central Office Terminal
DSL	Digital Subscriber Line
eoc	Embedded Operations Channel
ISDN	Integrated Services Digital Network
LULT	Line Unit Line Termination
MLT	Mechanized Loop Testing
mp-eoc	Multipoint embedded operations channel
NT1	Network Termination (type 1)
pp-eoc	Point to point embedded operations channel
RMA	Return Material Authorization

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