PG-FLEX

EIGHT CHANNEL REMOTE TERMINAL
LOOP START/GROUND START UNIT

Model	List Number	Part Number	CLEI Code
FRC-753	4B	150-1353-42	VARHCKTC--

PAIRGAIN TECHNOLOGIES, INC.
ENGINEERING SERVICES TECHNICAL PRACTICE

SECTION 363-753-142-01

PAIRGAIN

Revision History of This Practice

Revision	Release Date	Revisions Made
01	July 23, 1999	Initial Release

USING THIS TECHNICAL PRACTICE

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

Notes indicate information about special circumstances.

Cautions indicate the possibility of equipment damage or the possibility of personal injury.

Electrostatic Discharge (ESD) Susceptibility symbols indicate that a device or assembly is susceptible to damage from electrostatic discharge.

INSPECTING YOUR SHIPMENT

Upon receipt of the equipment:

- 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.
- Check the packing list to ensure complete and accurate shipment of each listed item. If the shipment is short or irregular, contact PairGain as described in the Warranty. If you must store the equipment for a prolonged period, store the equipment in its original container.

TABLE OF CONTENTS

OVERVIEW

The PairGain® PG-Flex® FRC-753 List 4B Loop Start/Ground Start Channel Unit provides eight loop start or ground start (LS/GS) channel interfaces for POTS between a PG-Flex Remote Terminal (RT) and subscribers. You can provision each of the eight circuits separately for either loop start or ground start services. Provisioning is done through the PG-Flex Line Unit Maintenance port.

DESCRIPTION AND FEATURES

The FRC-753 provides metallic test access to the subscriber line connection through an optional metallic bypass pair. Perform metallic bypass testing either manually or through the Pair Gain Test Controller (PGTC). Features of the FRC-753 are:

- eight LS/GS POTS subscriber interfaces
- 64 kbps m-Law Pulse Code Modulation (PCM) encoding
- front panel Active LEDs
- front panel Fault LED
- PGTC compatibility
- Custom Local Area signalling Services (CLASS) support (for example, caller ID)
- line-side answer supervision support (reverse battery)
- forward disconnect
- distinctive ringing
- protection against secondary surges and power cross
- connection for a subscriber loop to a metallic bypass test pair
- application of ringing voltage
- detection of loop off-hook, ground start seizure, and Ring-Tip conditions

APPLICATIONS

The FRC-753 can be configured to provide service in any one of the following ways:

- eight independent loop start subscriber lines
- eight ground start PBX lines
- a mixture of both loop start subscriber lines and ground start PBX lines

Figure 1 shows a typical system with loop start and ground start services.

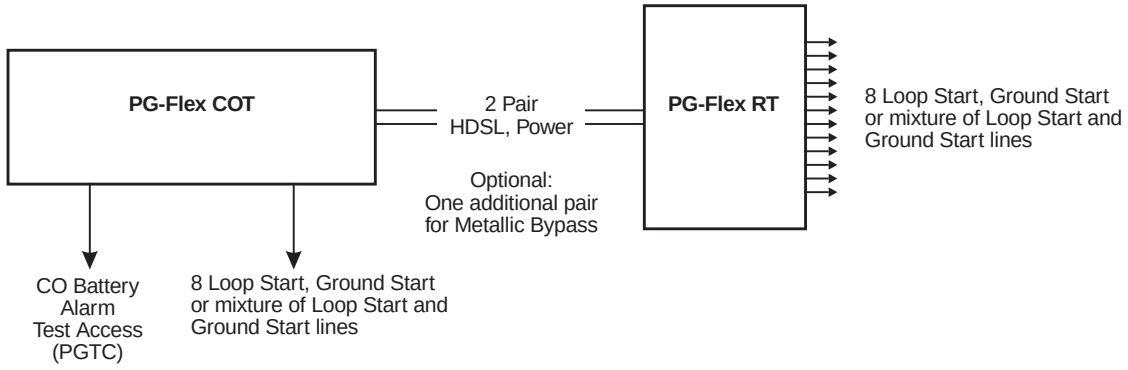

Figure 1. *Typical System with Loop Start and Ground Start Capabilities*

Operational Capabilities

FRC-753 Functions

The FRC-753 provides eight POTS channel interfaces between the RT and the subscriber. Each FRC-753 detects:

- loop current
- Ring tip
- Ring ground

The subscriber line battery is supplied by a constant current supply. It is sufficient to operate a telephone set over the indicated loop. The battery feed can be disconnected and the loop opened to a drop connection when a forward disconnect signal is received from the FLC-703. The battery feed can also reverse the polarity of the output as a physical signal of far end supervision.

The FRC-753 has protection from lightning and power crosses.

Circuit Operation

The following paragraphs define the FRC-753 circuit operation when using loop start for subscriber lines or ground start for PBX lines. Each FRC-753 circuit has an associated LED that indicates when the line is off-hook, idle, ringing, or under test. See Table 1 on page 4.

Loop Start Idle. Loop start idle condition is a Ring lead negative and Tip lead positive from the COT shelf with the same conditions out of the RT toward the subscriber. The following occurs when the calling line goes off-hook:

- loop current flows and is detected by the FRC-753
- FLC-703 receives an off-hook signal from the RT
- FLC-703 generates an off-hook signal to the CO to begin current flow
- CO sends dial tone
- FRC-753 recognizes dial pulses or Dual Tone Multi Frequency (DTMF) signalling, from the subscriber and forwards these as loop current breaks, or DTMF signalling, to the CO

The following occurs for an incoming call:

- FLC-703 detects a ringing signal from the CO
- FLC-703 signals the FRC-753 which then connects ringing to the subscriber
- subscriber line goes off-hook and the FRC-753, by means of the FLC-703, signals the CO to disconnect ringing and establish an audio path

Ground Start Idle. Ground start idle condition is a Tip lead open and Ring lead negative into the COT and Tip lead open and Ring lead negative at the RT. The following occurs when a PBX requests service for an outgoing call by grounding the Ring lead at the RT:

- FRC-753 signals the FLC-703
- FLC-703 operates a Ring ground relay that requests dial tone from the CO (this makes the circuit busy, or seizes it, for outgoing calls to prevent others from using it, for example, prevents glare where different users can seize a line at the same time)
- CO sends dial tone and grounds the Tip to signal the PBX to begin dialing
- FLC-703 detects Tip ground, closes the loop between Tip and Ring, and signals the FRC-753 to send Tip ground to the PBX
- PBX removes the original Ring ground condition and completes the loop (Tip and Ring)

The following occurs for an incoming call:

- FLC-703 detects a ringing signal from the CO, along with Tip ground
- FLC-703 signals the FRC-753 which then connects Tip ground and ringing to the PBX
- PBX goes off-hook and the FRC-753, by means of the FLC-703, signals the CO to disconnect ringing and establish an audio path

Caller ID. When caller ID (a CLASS feature) is activated, the CO generates a signal to the subscriber between the first and second bursts of the ringing signal only (for example, PG-Flex supports on-hook transmission).

Forward-Disconnect Function. The forward-disconnect function releases a called line that was left on hold or an answering set that requires a loop open to be able to turn off.

FRONT PANEL

Figure 2 shows the FRC-753 front panel. Table 1 lists the different states and indications for the FRC-753 Channel Unit front panel LEDs.

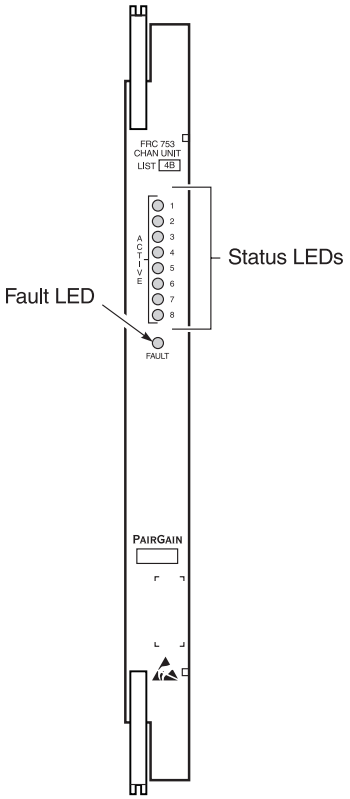

Figure 2. *FRC-753 Front Panel*

To reduce power at the RT, the LEDs extinguish after a 2-minute timeout period. Press and hold the ACO button on the RTLU for two seconds to re-activate the LEDs for another two minutes.

Table 1. *FRC-753 Front Panel LEDs*

LEDs	State	Indicates
ACTIVE (1 through 8)	Solid green	Channel is off hook.
	Fast flashing green	Channel is switched to the test pair.
	Slow flashing green	Channel is ringing.
	Off	Channel is on hook.
FAULT	Red	Fault detected by the unit.
	Off	No faults detected.

SPECIFICATIONS

Electrical Characteristics

Analog Impedance	600 Ω
Subscriber Drop	530 Ω + 430 Ω handset
DC Loop Current	23 mA
Ringer Output	40 V RMS, 3 lines simultaneous, 5 REN each
End-to-End Loss	-2.5 dB ± 1.0 dB
Lightning Protection	GR-CORE-1089, Section 4

Environmental

Operating Elevation	-200 ft. to 13,000 ft. (-60 m to 4,000 m)
Temperature	-40° F to +150° F (-40° C to +65° C)
Humidity	5 percent to 95 percent noncondensing

Physical Characteristics

Weight	0.6 lb. (0.3 kg)
Height	12.0 in. (30.5 cm)
Width	1.0 in. (2.5 cm)
Depth	4.5 in. (11.4 cm)

INSTALLATION AND TEST

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

INSTALLING THE FRC-753 INTO THE RT ENCLOSURE

1 Insert the FRC-753 into the RT Enclosure and observe that all LEDs:

- turn On for approximately two seconds
- scan from top to bottom
- turn Off

If the LEDs do not follow the above sequence, refer to Table 1 on page 4.

Use List 3 or higher PG-Flex CO and RT LUs when activating the ground start feature.

Provisioning the FRC-753

Provision the FRC-753 using the FLL-712 List 3 CO Line Unit practice. For each channel provisioned, select loop start or ground start.

Verify Operation

Verify the following after the system is powered up and HDSL communication is synchronized:

1 Observe that the front panel Active indicators are all off and the Fault indicator is off (no calls are in progress).

2 Test circuits for loop start:

a Place an outgoing call for each subscriber circuit provisioned and observe that the Active LED tracks the progress of the call.

b Place an incoming call for each subscriber circuit provisioned and observe that the Active LED tracks the progress of the call.

3 Test circuits for ground start, circuits must be provisioned for ground start:

a Place an outgoing call for each subscriber circuit provisioned and observe that the Active LED tracks the progress of the call.

b Place an incoming call for each subscriber circuit provisioned and observe that the Active LED tracks the progress of the call.

TROUBLESHOOTING

SUBSCRIBER DROP TESTING

For PG-Flex subscriber drop testing from the CO, select and connect any subscriber drop to a metallic test pair at the RT. PG-Flex extends this connection to the COT where it can be switched onto the test access bus or to the corresponding subscriber line on the COT channel card.

Activate test access through the RS-232 maintenance port located on the front of the COT Line Unit using an ASCII terminal.

The FRC-753 Channel Unit front panel Fault LEDs is On. The FRC-753 has detected a fault. Remove and re-insert the Channel Unit. If the Fault LED does not extinguish, replace the Channel Unit.

CUSTOMER REPORTED PROBLEMS

Table 2 provides troubleshooting procedures based on customer reported problems.

Table 2. *FRC-753 RT Channel Unit Troubleshooting*

Problem	Cause	Action
No dial tone, can not dial	• faulty RT or COT Channel Unit • facility short/open • CO switch problem	**1** Lift the subscriber pair at the network interface. If dial tone is present and you can place a call, refer the problem to the customer per local practice. **2** If you cannot hear dial tone or cannot place a call at the network interface (with the subscriber pair lifted), check for dial tone at the RT. If dial tone is present, check the pair between the RT and the network interface. If no dial tone is present, replace the RT Channel Unit. **3** If the problem still exists, re-insert the original RT Channel Unit and replace the COT Channel Unit. Test for operation. **4** If the problem still exists, refer the problem to the CO switch.
Phone does not ring	• high-resistance subscriber line short • faulty RT or CO Channel Unit • •loop length too long	**1** Lift the subscriber pair at the network interface. If ringing is present, refer the problem to the customer per local practice. **2** If ringing is not present, check for ringing at the RT. If ringing is present, check the pair between the RT and the network interface. If no ringing is present, replace the RT Channel Unit. If ringing is still not present, check a circuit on another Channel Unit. If ringing is still not present, replace the RTLU. **3** If ringing is still not present at the RT, re-insert the original Channel Unit and Line Unit. Test for ringing at the COT shelf. **4** Test for ringing into the COT from the CO switch. If no ringing is present, refer the trouble to the CO switch. If ringing is present, replace the COT Channel Unit. Test again for ringing at the network interface. If ringing is still not present, contact PairGain technical assistance (refer to "Technical Support" on Inside back cover). **5** Verify the resistance of the copper loop between the RT Enclosure and the network interface is less than 530 Ω.
Phone does not stop ringing	• faulty subscriber instrument • faulty RT Channel Unit • loop length too long	**1** Test for ring trip at the network interface. If the ringing is tripped, refer the trouble to the customer per local practice. **2** If the ringing is not tripped, test for tripping at the RT. If ring trip does occur, check the loop for excessive length. If ring trip does not occur, replace the RT Channel Unit. If ring trip still does not occur, contact PairGain technical assistance (refer to "Technical Support" on Inside back cover). **3** Verify the resistance of the copper loop between the RTE and the network interface is less than 530 Ω.
Can not hear, can not be heard	• subscriber problem • faulty RT or COT Channel Unit	**1** Lift the subscriber line at the network interface and check the signal level. If correct, refer trouble to the customer per local practice. **2** If the level is too low, check the level at the RT. If the level is correct at the RT, check the pair between the RT and the network interface. If the level is too low at the RT, replace the RT Channel Unit. **3** If the level is still too low, re-insert the original RT Channel Unit. **4** Check the level at the COT shelf coming from the CO switch. If it is correct, replace the COT Channel Unit. If it is not correct, refer the problem to the CO regarding the switch. **5** If the level is still not correct, re-insert the original COT Channel Unit. Contact PairGain technical assistance (refer to "Technical Support" on Inside back cover).

ABBREVIATIONS

ACO	Alarm Cut-off Switch
CLASS	Custom Local Area Signalling Services
CO	Central Office
COLU	Central Office Line Unit
COT	Central Office Terminal
DTMF	Dual Tone Multi Frequency
LS/GS	Loop Start/Ground Start
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

PRODUCT SUPPORT

TECHNICAL SUPPORT

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

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.

WARRANTY

PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of 60 months 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.

Do not try to repair the unit. 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.

If a unit needs repair, call PairGain for a Return Material Authorization (RMA) number at (800) 638-0031.

Return the defective unit, freight prepaid, along with a brief description of the problem, to:

PairGain Technologies, Inc.
14352 Franklin Avenue
Tustin, CA 92780
ATTN: Repair and Return Dept.

PairGain continues to repair faulty modules beyond the warranty program at a nominal charge. Contact your PairGain sales representative for details and pricing.

FCC COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class A digital device, 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 harmful interference in which case the user will be required to correct the interference at his own expense.

MODIFICATIONS

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by PairGain Technologies, Inc. may void the user's authority to operate the equipment.

All wiring external to the product(s) should follow the provisions of the current edition of the National Electrical Code.

Corporate Office

14402 Franklin Avenue
Tustin, CA 92780

Tel: (714) 832-9922
Fax: (714) 832-9924

For Technical Assistance:

(800) 638-0031

ISO 9001
DNV
DNV Certification, Inc.
Certificated Firm