

# PG-FLEX

## TECHNICAL PRACTICE



### **Eight Channel LoopStart/GroundStart Remote Terminal**

Model: FRC-753 List 4C  
Part Number: 150-1353-43  
CLEI Code: VARHCKTCAB



363-753-143-01

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## Revision History of This Practice

Revision	Release Date	Revisions Made
01	April 25, 2000	Initial Release

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## 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 [“Limited Warranty” on page 11](#). If you must store the equipment for a prolonged period, store the equipment in its original container.

# TABLE OF CONTENTS

<b>Overview</b> .....	<b>1</b>
Description and Features.....	1
Applications .....	2
Operational Capabilities .....	2
FRC-753 Functions .....	2
Circuit Operation.....	3
Front Panel .....	4
Specifications .....	5
<b>Installation and Test</b> .....	<b>6</b>
Installing the FRC-753 into the RT Enclosure.....	6
Provisioning the FRC-753 .....	6
Verify Operation .....	6
<b>Troubleshooting</b> .....	<b>7</b>
Subscriber Drop Testing .....	7
Customer Reported Problems .....	8
<b>Abbreviations</b> .....	<b>9</b>
<b>Product Support</b> .....	<b>11</b>
Technical Support .....	11
World Wide Web .....	11
Limited Warranty .....	11
Returns .....	12
FCC Class A Compliance .....	13
Modifications .....	13

# OVERVIEW

The PairGain® PG-Flex® FRC-753 List 4C 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:

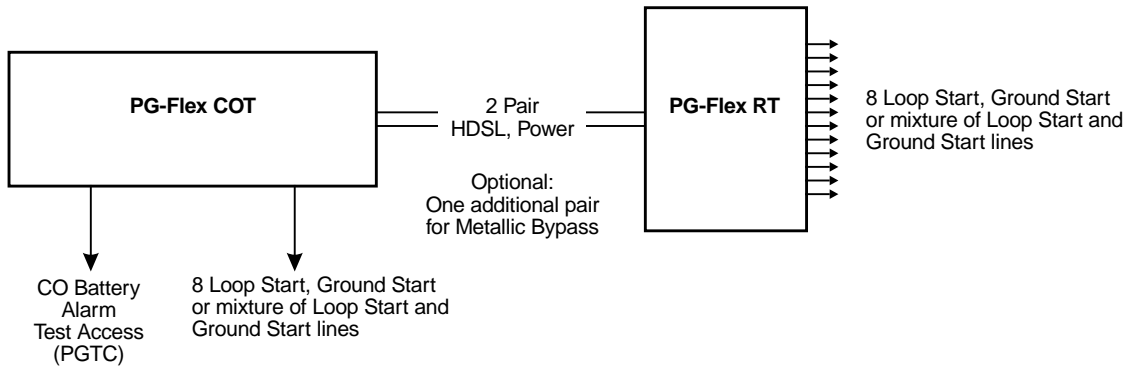
- eight LS/GS POTS subscriber interfaces
- 64 kbps m-Law Pulse Code Modulation (PCM) encoding
- front panel Active LEDs
- front panel Fault LED
- PGTC compatibility
- Custom Local Area signalling Services (CLASS) support (for example, caller ID)
- line-side answer supervision support (reverse battery)
- 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.

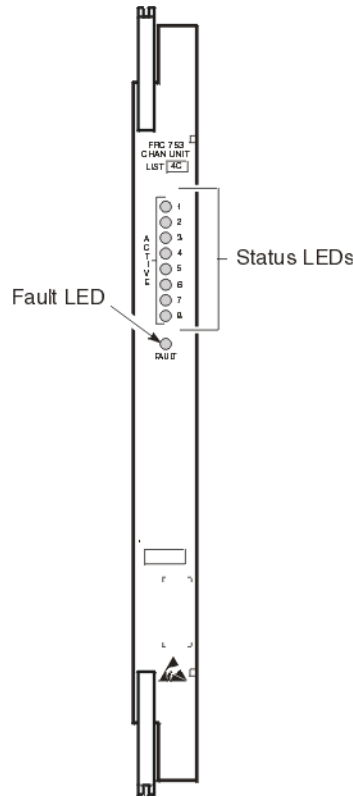


Figure 2. FRC-753 Front Panel

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 $\Omega$
Subscriber Drop	530 $\Omega$ + 430 $\Omega$ handset
DC Loop Current	23 mA
Ringer Output	40 V RMS, 3 lines simultaneous, 5 REN each
End-to-End Loss	-2.5 dB $\pm$ 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.

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# 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, cannot dial	<ul style="list-style-type: none"> <li>faulty RT or COT Channel Unit</li> <li>facility short/open</li> <li>CO switch problem</li> </ul>	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>If the problem still exists, re-insert the original RT Channel Unit and replace the COT Channel Unit. Test for operation.</li> <li>If the problem still exists, refer the problem to the CO switch.</li> </ol>
Phone does not ring	<ul style="list-style-type: none"> <li>high-resistance subscriber line short</li> <li>faulty RT or CO Channel Unit</li> <li>loop length too long</li> </ul>	<ol style="list-style-type: none"> <li>Lift the subscriber pair at the network interface. If ringing is present, refer the problem to the customer per local practice.</li> <li>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.</li> <li>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.</li> <li>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 <a href="#">“Limited Warranty” on page 11</a>).</li> <li>Verify the resistance of the copper loop between the RT Enclosure and the network interface is less than 530 Ω.</li> </ol>
Phone does not stop ringing	<ul style="list-style-type: none"> <li>faulty subscriber instrument</li> <li>faulty RT Channel Unit</li> <li>loop length too long</li> </ul>	<ol style="list-style-type: none"> <li>Test for ring trip at the network interface. If the ringing is tripped, refer the trouble to the customer per local practice.</li> <li>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 <a href="#">“Limited Warranty” on page 11</a>).</li> <li>Verify the resistance of the copper loop between the RTE and the network interface is less than 530 Ω.</li> </ol>
Cannot hear, cannot be heard	<ul style="list-style-type: none"> <li>subscriber problem</li> <li>faulty RT or COT Channel Unit</li> </ul>	<ol style="list-style-type: none"> <li>Lift the subscriber line at the network interface and check the signal level. If correct, refer trouble to the customer per local practice.</li> <li>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.</li> <li>If the level is still too low, re-insert the original RT Channel Unit.</li> <li>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.</li> <li>If the level is still not correct, re-insert the original COT Channel Unit. Contact PairGain technical assistance (refer to <a href="#">“Limited Warranty” on page 11</a>).</li> </ol>

# ABBREVIATIONS

<b>ACO</b>	Alarm Cut-off Switch
<b>CLASS</b>	Custom Local Area Signalling Services
<b>CO</b>	Central Office
<b>COLU</b>	Central Office Line Unit
<b>COT</b>	Central Office Terminal
<b>DTMF</b>	Dual Tone Multi Frequency
<b>LS/GS</b>	Loop Start/Ground Start
<b>MLT</b>	Mechanized Loop Testing
<b>PBX</b>	Private Branch Exchange
<b>PCM</b>	Pulse Code Modulation
<b>PGTC</b>	Pair Gain Test Controller
<b>POTS</b>	Plain Old Telephone Service
<b>RMA</b>	Return Material Authorization
<b>RT</b>	Remote Terminal



# PRODUCT SUPPORT

## TECHNICAL SUPPORT

Technical assistance is available 24 hours a day, 7 days a week by contacting PairGain Customer Service Group at:

**Telephone:** 800.638.0031 or 714.730.3222  
The 800 telephone support line is toll-free in the U.S. and Canada.

**Fax:** 714.832.9924

**Email:** support@pairgain.com

During normal business hours (7:30 AM to 5:30 PM, Pacific Time, Monday through 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.

## WORLD WIDE WEB

PairGain product and company information can be found at <http://www.pairgain.com> using any Web browser. To download PairGain product manuals from the Customer Site portion of the PairGain Web page, you need to provide a customer password. If you do not have a password, contact your PairGain sales representative.

## LIMITED WARRANTY

PairGain Technologies, Inc. ("PairGain") warrants that, for a period of sixty (60) months from the date of shipment, the hardware portion of its products will be free of material defects and faulty workmanship under normal use. PairGain's obligation, under this warranty, is limited to replacing or repairing, at PairGain's option, any such hardware product which is returned during the 60-month warranty period per PairGain's instructions and which product is confirmed by PairGain not to comply with the foregoing warranty.

PairGain warrants that, for a period of 90 days from the date of purchase, the software furnished with its products will operate substantially in accordance with the PairGain published specifications and documentation for such software. PairGain's entire liability for software that does not comply with the foregoing warranty and is reported to PairGain during the 90-day warranty period is, at PairGain's option, either (a) return of the price paid or (b) repair or replace of the software. PairGain also warrants that, for a period of thirty (30) days from the date of purchase, the media on which software is stored will be free from material defects under normal use. PairGain will replace defective media at no charge if it is returned to PairGain during the 30-day warranty period along with proof of the date of shipment.

The transportation charges for shipment of returned products to PairGain will be prepaid by the Buyer. PairGain will pay transportation charges for shipment of replacement products to Buyer, unless no trouble is found (NTF), in which case the Buyer will pay transportation charges.

PairGain may use reconditioned parts for such repair or replacement. This warranty **does not** apply to any product which has been repaired, worked upon, or altered by persons not authorized by PairGain or in PairGain's sole judgment has subjected to misuse, accident, fire or other casualty, or operation beyond its design range.

Repaired products have a 90-day warranty, or until the end of the original warranty period—whichever period is greater.

PAIRGAIN DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A

PARTICULAR PURPOSE, WITH RESPECT TO ITS PRODUCTS AND ANY ACCOMPANYING WRITTEN MATERIALS. FURTHER, PAIRGAIN DOES NOT WARRANT THAT SOFTWARE WILL BE FREE FROM BUGS OR THAT ITS USE WILL BE UNINTERRUPTED OR REGARDING THE USE, OR THE RESULTS OF THE USE, OF THE SOFTWARE IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY OR OTHERWISE.

## RETURNS

To return equipment to PairGain:

- 1 Locate the number of the purchase order under which the equipment was purchased. To obtain a return authorization number, you need to provide the original purchase order number to PairGain's Return Material Authorization (RMA) Department.
- 2 Call or write PairGain's RMA Department to ask for an RMA number and any additional instructions. Use the telephone number, fax number or email address listed below:
  - Telephone: 800.370.9670
  - Fax: 714.832.9923
  - Email Address: rma@pairgain.com
- 3 Include the following information, in writing, along with the equipment you are returning:
  - Company name and address.
  - Contact name and telephone number.
  - The shipping address to which PairGain should return the repaired equipment.
  - The original purchase order number.
  - A description of the equipment that includes the model and part number of each unit being returned, as well as the number of units that you are returning.
  - The reason for the return. For example:
    - The equipment needs an ECO/ECN upgrade.
    - The equipment is defective.



**If the equipment is defective, please tell us what you observed just before the equipment malfunctioned. Be as detailed in your description as possible.**

- If there is another reason for returning the equipment, please let us know so we can determine how best to help you.

- 4 Pack the equipment in a shipping carton.
- 5 Write PairGain's address and the RMA Number you received from the RMA Department clearly on the outside of the carton and return to:

PairGain Technologies, Inc.  
14352 Franklin Ave.  
Tustin, CA 92780-7013

Attention: RMA (Number)



**All shipments are to be returned prepaid. PairGain will not accept any collect shipments.**



## **FCC CLASS A 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. voids the user's warranty.

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

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**Corporate Office**

14402 Franklin Avenue  
Tustin, CA 92780

Tel: 714.832.9922

Fax: 714.832.9924

**For Technical Assistance:**

800.638.0031

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