PG-FLEX

TECHNICAL PRACTICE

ISDN

BASIC RATE INTERFACE

REMOTE TERMINAL CHANNEL UNIT

Model	List	CLEI Code
FRC-756	1A	VARHEJRC~~

SECTION SCP-FRC756-011-03H

Revision History of This Practice

Revision	Release Date	Revisions Made
01	July 23, 1999	Initial Release
02	January 10, 2002	Release to rebrand document to comply with ADC standards
03	January 6, 2003	Updated Product Support Information

USING THIS 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.You must wear an antistatic wrist strap connected to the appropriate ground connection prior to performing installation procedures. You must also observe normal ESD precautions when handling electronic equipment. Do not hold electronic plugs by their edges. Do not touch components or circuitry.

INSPECTING YOUR SHIPMENT

Upon receipt of the equipment:

- Unpack each container and visually inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC. 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 ADC as described in "Returns" on page 8. If you must store the equipment for a prolonged period, store the equipment in its original container.

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OVERVIEW

The ADC® PG-Flex® FRC-756 List 1A ISDN Basic Rate Interface Remote Terminal Channel Unit provides an interface to the North American ISDN Basic Access services through a PG-Plus 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.

DESCRIPTION AND FEATURES

The FRC-756 ISDN Channel Unit supports two-wire DSL 2B+D data or subsets of that rate. The B1 and B2 channels 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 signalling 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.

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
- Vdc resistive test signature of 30 kΩ

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 3-DS0 format
- segmented performance monitoring
- interim path performance monitoring
- software provisioning
- loopbacks
- sealing current
- Pair Gain Test Controller (PGTC) compatible

APPLICATIONS

ISDN is a networking standard that provides end-to-end, simultaneous handling of digitized voice and data traffic on the same link. Figure 1 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.

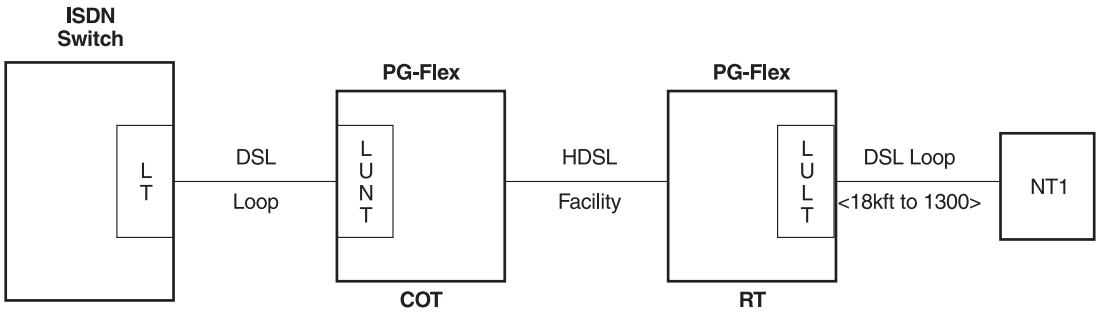

Figure 1. *Typical ISDN Configuration*

Set all options for the FRC-756 through the PG-Flex COT Line Unit RS-232 maintenance port. Disable ISDN by means of 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.

To provide clocking to the ISDN FRC-756 Channel Unit, ensure the:

- composite clock on the PG-Flex COT shelf is connected and correctly terminated
- FPI-729 or FAU-728 List 2 card is installed

FRONT PANEL

Figure 2 shows the FRC-756 front panel. Table 1 lists the different states and indications for the FRC-756 LEDs.

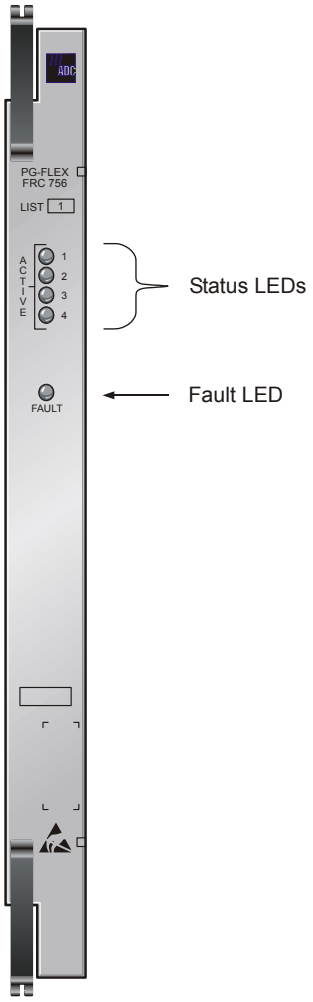

Figure 2. *FRC-756 ISDN Channel Unit*

Each Active LED for the four channels has the same states and indications.

Table 1. *FRC-756 Front Panel LEDs*

LEDs	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 power-up
	Off	No faults have been detected on the unit during power-up

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
Vdc Resistive Test Signature	30 kΩ
Maximum Line Loss	42 dB @ 40 kHz
Sealing Current	4.8 mA (nominal)
Facility Impedance	135 Ω

Code 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

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	12.0 in. (30.5 cm.)
Depth	4.50 in. (11.4 cm.)
Width	1.0 in. (2.5 cm.)
Weight	0.6 lb. (0.3 kg.)

INSTALLATION AND TEST

INTEGRATION PARAMETERS

Install the FRC-756 into PG-Flex systems with:

- List 3 or higher PG-Flex COLU
- List 3 or higher PG-Flex RT LU
- an FPI-729 or FAU-728 List 2 card (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.

INSTALLING THE FRC-756 INTO THE RT ENCLOSURE

Insert the FRC-756 into the RT Enclosure. Ensure the LEDs:

- 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, refer to Table 2.

Provisioning the FRC-756

Provision the FRC-756 using the List 3 (or higher) COLU practice. Select the ISDN setup menu and select the appropriate options.

Verify Operation

Verify the operation for both 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.

To verify the operation steps, use a Tektronix 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} BER must be demonstrated.

Outgoing Calls

Verify outgoing calls for both B channels, FRC-756, for example, calls from the NT1 to the LT as illustrated in Figure 1 on page 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.

lncoming Calls

Verify incoming calls for both B channels, for example, calls from the LT to the NT1 as shown in Figure 1 on page 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.

TROUBLESHOOTING

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. *RT Channel Unit Troubleshooting*

LEDs	Condition	Indicates	Action
FAULT	On	Fault detected in the PG-Flex system	Replace channel unit.
FAULT + ACTIVE 1	On	Internal fault on the FRC-756	Replace channel unit.
FAULT + ACTIVE 2	On	Internal fault on the FRC-756	Replace channel unit.
FAULT + ACTIVE 3	On	Internal fault on the FRC-756	Replace channel unit.
FAULT + ACTIVE 4	On	Internal fault on the FRC-756	Replace channel unit.
ACTIVE	Slow-Flash	Circuit is either in Loopback or PGTC test setup state	Access the circuit by means of the COLU maintenance port and release the circuit or wait for the test originator to complete testing.
ACTIVE	Fast-Flash	ISDN circuit lost SYNC	Check loop or for network termination (NT-1) removal by customer.
Problem Reported		**Condition**	**Action**
Customer reports no dial tone		Off-hook not extended to CO	Check status LEDs. Clear any indicated trouble. Use COLU maintenance port as required.
Customer reports data transmission errors		Customer experiencing errors	Perform test Step 3 on page 6. Check performance monitoring record.
Technician establishes loopback		Loopback customer circuit at various points	Use loopback portion of COLU maintenance port to select and activate loopbacks.

PRODUCT SUPPORT

TECHNICAL SUPPORT

Technical Assistance is available 24 hours a day, 7 days a week by the contacting Customer Service Engineering group at:

Telephone:	800.366.3891 The 800 telephone support line is toll-free in the U.S. and Canada.
Email:	wsd_support@adc.com
Knowledge Base:	http://adc.com/Knowledge_Base/index.jsp
Web:	www.adc.com

LIMITED WARRANTY

Product warranty is determined by your service agreement. Refer to the ADC Warranty/Software Handbook for additional information, or contact your sales representative or Customer Service for details.

RETURNS

To return equipment to ADC:

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 ADC's Return Material Authorization (RMA) Department.

2 Call or write ADC'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: 800.366.3891
- Email Address: rma@ADC.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 ADC 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 ADC's address and the RMA Number you received from the RMA Department clearly on the outside of the carton and return to:

ADC DSL Systems, Inc.
14352 Franklin Ave.
Tustin, CA 92780-7013

Attention: **RMA (Number)**

All shipments are to be returned prepaid. ADC 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 use 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 ADC 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.

ACRONYMS

BER	Bit Error Rate
BERT	Bit Error Rate Test
CO	Central Office
COLU	Central Office Line Unit
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)
PGTC	Pair Gain Test Controller
pp-eoc	Point To Point Embedded Operations Channel
RMA	Return Material Authorization
RT	Remote Terminal

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