PG-Flex® FLL-812 24 Channel Universal COLU – Quick Installation Guide

The PG-Flex FLL-812 24 channel Universal Central Office Line Unit (COLU) is located at the CO end of the PG-Flex subscriber carrier system, and transports 24 DS0s between the Central Office (CO) and a Remote Terminal (RT). It supports Plain Old Telephone Service (POTS) and Integrated Services Digital Network (ISDN) services.

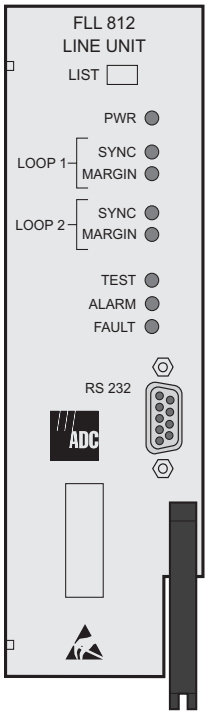

Figure 1
FLL-812 24 Ch. Universal COLU

Overview

PG-Flex is a small-capacity, universal subscriber carrier system that transports 24 DS0 channels and supports POTS and ISDN services. PG-Flex uses HDSL transmission technology over two unconditioned copper pairs.

Power is supplied from the CO to the RT over the HDSL transmission lines. The maximum distance from the CO to the RT is 12.3 kft using 24 AWG cable.

A PG-Flex system is comprised of one line unit and from one to three channel units at both the CO and the RT. Line units and channel units can be hot-swapped without affecting other systems in the same shelf. The POTS channel units support high-speed modem and group 3 facsimile on all channels.

The CO side of a PG-Flex system mounts into a COT shelf and supports up to four systems. An FPI-829 Pair Gain Test Controller (PGTC) Interface Unit (common to all systems installed in the shelf) provides an interface for maintenance alarm relays and metallic access to the remote subscriber lines.

The remote side of a PG-Flex system mounts into a PG-Flex RT enclosure. RT enclosures support from one to four systems, where each system is comprised of one Remote Terminal Line Unit (RTLU) and up to three Remote Terminal Channel Units (RTCUs). The channel units must be the same type of card (that is, POTS or ISDN) as the channel units installed at the CO.

The FLL-812, in combination with the FRL-842 RTLU, eliminates the need for a metallic bypass pair for subscriber drop testing by using a test head in the FRL-842. Results of subscriber drop tests are reported back to the central office test equipment through the FPI-829 PGTC Interface Unit with three-terminal signature resistors complying with TR-NWT-000909 specifications. The FLL-812 and FRL-842 can also be configured to support the metallic bypass pair instead of using the test head in the FRL-842.

Note: The FLL-812 COLU must be used with the FRL-842 List 1B (or greater) RTLU. The FLL-812 is not compatible with the FRL-742 RTLU.

Note: The FLL-812 COLU must be used with the FPI-829 PGTC Interface Unit. The FLL-812 is not compatible with the FAU-728 Alarm Unit or FPI-729 PGTC Interface Unit.

Circuit Criteria

The HDSL and Auxiliary power pairs should be tested and qualified before connecting the RT and installing the FLL-812:

- ❑ < 3 Vdc TR, TG, RG
- ❑ < 3 Vac TR, TG, RG
- ❑ > 3 MΩ TR, TG, RG
- ❑ < 2.5 kft total bridged taps (remove all bridged taps if possible, especially those close to the CO or RT)
- ❑ No load coils

The signal loss on the HDSL pairs and the length of the pairs should be no more than the value indicated in Table 1.

Table 1
HDSL Distance

DS0s	Freq.	Loss	26 AWG	24 AWG	22 AWG	19 AWG
24	196 kHz	35.0 dB	9.0 kft	12.3 kft	16.1 kft	22.8 kft

Doublers

The PG-Flex system supports up to two doublers between the COLU and RTLU. For each doubler installed in the HDSL circuit, two auxiliary power pairs are required between the CO and RT. These power pairs should meet the same criteria as the HDSL pairs.

Install the FLL-812

The FLL-812 can be installed in any slot in the COT shelf that is labeled LU *n*, where "*n*" is the line unit slot number. Refer to the documentation accompanying the COT shelf for information on line unit slot numbering and wiring.

Note: You must wear an antistatic wrist strap connected to the appropriate ground connection prior to installing or removing the FLL-812. 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 on the plug.

1. Insert the FLL-812 into a vacant line unit slot in the Shelf that corresponds to the location of the wiring for the service being activated.
2. Engage the retaining latch to hold the card in place.

POWER-UP

Note: The COLU initialization and power up sequence described below assumes that the HDSL and auxiliary power pairs (if required) are wired from the COT shelf, through doubler housings (if required) and terminated at the RT enclosure. It also assumes the COT shelf has been wired to CO battery, the bay fuses have been installed, and the doublers (if required) and RTLU have been installed.

1. When the COLU is installed with power applied to the COT shelf, all LEDs turn on for about 1 second then go off, except for the PWR LED.
2. After approximately 5 to 19 seconds, the PWR LED will flash.
3. The COLU will attempt to power up the RTLU or Doubler Unit. Depending on the condition of the HDSL and auxiliary power pairs, one of the following will occur:

   a) One, or more, pairs are open between the COLU and RTLU or Doubler Unit:
   - ❑ The PWR LED will flash for approximately 12 seconds, then remain on.
   - ❑ The SYNC LEDs will flash for approximately 6 seconds, then remain off.
   - ❑ A DSL Power Feed Open (PFO) alarm will be indicated on the "COLU System History Screen".
   - ❑ The COLU will wait 1 minute, then go back to step 3.

   b) One, or more, pairs are shorted or grounded between the COLU and RTLU or Doubler Unit:
   - ❑ The PWR LED will flash for approximately 12 seconds, then remain on.
   - ❑ A DSL Power Feed Short (PFS) alarm will be indicated on the "COLU System History Screen".
   - ❑ The SYNC LEDs will flash for approximately 6 seconds, then remain off.
   - ❑ The COLU will wait 1 minute, then go back to step 3.

   c) All pairs are good and properly wired between the COLU and RTLU or Doubler Unit:
   - ❑ The PWR LED will flash for approximately 12 seconds, then remain on.
   - ❑ The SYNC LEDs will flash and the COLU will attempt to synchronize with the RTLU or Doubler Unit. One of the following will occur:
     - – The COLU does not detect, or is unable to synchronize with, an RTLU or Doubler Unit:

       The SYNC LEDs will flash for approximately 1 minute, then remain off.

       The COLU will wait 1 minute, then go back to step 3.
     - – The COLU detects, and is able to synchronize with, an RTLU or Doubler Unit:

       Within 1 minute, the SYNC LEDs will remain on and the COLU will establish synchronized HDSL communications with the RTLU or Doubler Unit. Assuming the HDSL margins are above alarm thresholds, and there are no subscriber drop tests or other alarms or faults in the system, the COLU LEDs will be as follows:

       PWR is on
       LOOP 1 SYNC is on
       LOOP 1 MARGIN is off
       LOOP 2 SYNC is on
       LOOP 2 MARGIN is off
       TEST is off
       ALARM is off
       FAULT is off

Note: All HDSL alarms are suppressed when the FLL-812 is initially installed and powered up. One minute after HDSL has achieved synchronization, outstanding alarms that were suppressed are made active and reported to the FPI.

Table 2 describes the LED indicator status on the front panel of the FLL-812. Refer to Table 5 for fault isolation and troubleshooting procedures.

Table 2
FLL-812 LED Indicators

LED	Color	State	Description
PWR	Green	On	FLL-812 is powered
		Off	FLL-812 is not powered
		Flashing	FLL-812 is attempting to power up the RT
SYNC *n*	Green	On	HDSL in sync to RT
		Flashing	HDSL attempting to sync with RT
		Off	No RT detected
MARGIN *n*	Yellow	On	CO margin below threshold
		Flashing	RT margin below threshold
		Off	CO and RT margins above threshold
TEST	Yellow	On	Subscriber drop test in progress
		Off	No drop test in progress
ALARM	Red	On	Alarm in FLL-812
		Flashing	Alarm in FRL-842
		Off	No alarms detected in system
FAULT	Red	On	Fault in unit
		Off	No fault in unit

Table 3 lists the LED indications for the FLL-812 diagnostic and maintenance modes.

Table 3
FLL-812 Diagnostic Indicators

Indicator	Description	Action
PWR LED On, all other LEDs Flashing	FLL-812 is running in Boot Mode.	Application software must be re-installed. Contact Technical Support for additional information.
PWR LED On, all other LEDs sequencing downward	Software download to FLL-812.	Wait for download to complete and FLL-812 to re-start.
PWR LED On, all other LEDs sequencing upward	Software download to the RTLU connected to FLL-812.	Wait for download to complete and FLL-812 to re-start.

SUBSCRIBER DROP TESTING

Test results on POTS subscriber drops can be displayed through a maintenance screen in the FPI-829 or as three-terminal signature resistances reported back to the Mechanized Loop Test (MLT) system through the PGTC. Wire the PG-Flex COT Shelf to the PGTC following local practice.

Table 4 shows the signature resistances that are presented to the CO test system for various line conditions.

Table 4
DC Resistive Signatures

Test	Failure Condition	TR (kΩ)	TG, RG (kΩ)
RT Equipment Failure	RT detected, but no response from RT.	17.8	90.9
Foreign Voltage on Drop	TG or RG > 10 V_{rms} TG or RG > 6 Vdc	27.8	90.9
All Tests OK	No failures detected.	38.3	90.9
Ringer Test	REN > 5.0 or REN < 0.2	48.3	90.9
Resistive Fault on Drop	TG, RG, or TR ≥ 150 kΩ	58.0	90.9
Receiver Off-hook	Phone is off-hook.	68.0	90.9
Hazardous Potential on Drop	TG or RG > 50 V_{rms} TG or RG > 135 Vdc	78.5	90.9
COTS-RT Facility Failure	RT not detected.	≥ 1,000	90.9

Note: The signatures for the FPI-829 List 3 are biased to -14 Vdc.

FAULT ISOLATION AND TROUBLESHOOTING

Table 5 provides fault isolation and troubleshooting procedures for the FLL-812.

Table 5
FLL-812 Troubleshooting and Fault Isolation

Indicator	Probable Cause	Solution
All LEDs Off	No input power, FLL-812 power fuse blown, or FLL-812 processor stopped.	Verify fuses on bay fuse panel. Check input power on the COT Shelf battery terminations. Remove and re-insert the FLL-812. Verify that no alarms exist on the FLL-812 main screen. Replace the FLL-812.
PWR LED On, ALARM LED Flashing SYNC LEDs Off	HDSL loop open or HDSL ground fault detector activated.	Check HDSL loop continuity and length. FLL-812 power supply or RTLU fault. Replace FLL-812, then the RTLU.
FAULT LED On	FLL-812 fault detected.	Remove and re-insert the FLL-812. Replace the FLL-812.
ALARM LED On	FLL-812 alarm condition exists.	On the FLL-812 main screen, display alarm conditions and correct causes Replace FLL-812.
ALARM LED Flashing	RTLU alarm condition exists.	On the FLL-812 main screen, display alarm conditions and correct causes Replace RTLU.
MARGIN LED On	HDSL distance limit exceeded, HDSL loop fault, or FLL-812 fault.	Verify that no alarms exist on the FLL-812 main screen. Check engineering records for distance between FLL-812 and RT. Check HDSL loss on FLL-812 HDSL performance screen to ensure maximum attenuation has not been exceeded. Replace FLL-812, then the RTLU.
MARGIN LED Flashing	HDSL distance limit exceeded, HDSL loop fault, or RTLU fault.	Verify that no alarms exist on the FLL-812 main screen. Check engineering records for distance between FLL-812 and RT. Check HDSL loss on FLL-812 HDSL performance screen to ensure maximum attenuation has not been exceeded. Replace FLL-812, then the RTLU.
SYNC LED Off	HDSL loop has lost synchronization with the RTLU, HDSL distance limit exceeded, HDSL loop fault, or FLL-812 or RTLU fault.	Verify that no alarms exist on the FLL-812 main screen. Check engineering records for distance between FLL-812 and the RTLU. Check HDSL loss on FLL-812 HDSL performance screen to ensure maximum attenuation has not been exceeded. Replace FLL-812, then the RTLU.

SPECIFICATIONS

Table 6 lists the specifications for the FLL-812 COLU.

Table 6
FLL-812 Specifications

Electrical	Input Voltage	-42.5 Vdc to –56.5 Vdc
	Input Power	145 W (maximum)
	Output Voltage	±140 Vdc (maximum)
	Output Power	100 W (maximum)
	Voltage Safety	A2 compliant per GR-1089-CORE
Compliance	NEBS	SR-3580 Level 3
	Human Safety	UL-1950 for Restricted Access
	Emissions Radiation and Immunity	GR-1089-CORE for Class A equipment
HDSL	Line Interface	Two pair full duplex 2B1Q transmission format
	Signal Characteristics	TR-NWT-001210, Generic Requirements for HDSL Systems
Environmental	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% to 95% (non-condensing)
Physical	Height	5.50 in. (14.0 cm.)
	Width	2.00 in. (5.1 cm.)
	Depth	10.5 in. (26.7 cm.)
	Weight	2.0 lbs. (0.9 kg.)

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.

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 ADC 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.

TECHNICAL SUPPORT

Technical assistance is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center (TAC) at:

Telephone: 800.366.3891
(toll-free in the U.S. and Canada)
E-mail: wsd_support@adc.com
Knowledge Base: http://adc.com/Knowledge_Base/index.jsp
Web: www.adc.com

REVISION HISTORY

Rev	Date	Revisions
01	12/18/01	Initial release.
02	2/8/02	Modify note on page 1 to indicate FLL-812 must be used with FRL-842 List 1B (or greater) RTLU.
03	1/20/03	Updated Product Support Information.
04	1/28/03	Modified DC Resistive Signatures note under Table 4.

PG-Flex FLL-812 24 Channel Universal Central Office Line Unit Quick Installation Guide

Section SCP-FLL812-010-04Q
Issued January 28, 2003

1255872

This document applies to the following products:

Model	CLEI	Description
FLL-812 List 1	VACHDTNC~~	24 Channel Universal Central Office Line Unit

ISO 9001
DNV
DNV Certification, Inc.
Certificated Firm

ADC