PG-Flex*Plus* 24 Channel Central Office Line Unit – Quick Installation Guide

Overview

The PG-Flex^{PlusTM} Integrated Central Office (CO) Line Unit is located in a Central Office Terminal (COT) Shelf. The system uses High-bit-rate Digital Subscriber Line (HDSL) 2B1Q technology to transport 24 DS0s of Plain Old Telephone Service (POTS) and Integrated Services Digital Network (ISDN) services between the FLL-814 and Remote Terminal (RT) Line Unit. The RT Line Unit can be line powered from the FLL-814 or locally powered.

The FLL-814 L1B and L2 CO Line Units are compatible with the FRL-842 L1A or later RT Line Unit. The FLL-814 L1B and L2 cannot be used in conjunction with the FRL-842 L1 RT Line Unit unless the application software on the FRL-842 L1 has been upgraded to 2.X or later.

If a single CO Line Unit or RT Line Unit has to be replaced, the new card does not have to be reconfigured because the existing settings are maintained.

Description

The integrated system is comprised of a line unit in the CO and line and channel units at the RT. Up to eight integrated systems can be supported in a 23" PCS-719 COT shelf. A Management Unit, common to all systems installed in the COT shelf, provides an interface for alarm relays and testing of subscriber circuits.

If the FLL-814 is connected to an FRL-842 List 2, the power pairs will not be needed since the FRL-842 List 2 is locally powered.

The remote end of the system is housed in a RT enclosure. RT enclosures are designed for outdoor and indoor applications and are provided with a diverse selection of mounting options. These enclosures support one or more systems that include one RT Line Unit and up to three RT Channel Units.

Features

Features supported by the FLL-814 include:

- Front panel status indicators
- Downloadable firmware
- Mechanized Loop Test (MLT)
- TR-909 Resistive Signatures

Subscriber Drop Testing

The FLL-814 supports subscriber drop testing using an internal test head in the RT line unit that eliminates the metallic bypass pair.

This test head reports its results using three-terminal signature resistors that are measured and converted to subscriber drop condition messages that can be viewed on the VT-100 terminal.

HDSL Transmission

The system uses HDSL 2B1Q technology to transport 24 DS0s plus signaling over two copper pairs. The HDSL circuits can be used without repeaters or loop conditioning. Adaptive equalization, scrambling, and a four-level 2B1Q line coding scheme are used to maximize distance and minimize crosstalk.

Table 1 shows the maximum distance between the COT and RT for various wire gauges and with up to two doubler combinations in the circuit. These distances are shown for a cable temperature of 68° F (20° C). As the temperature of the cable increases, the distance decreases.

Table 1. HDSL Distances

Wire Gauge	HDSL Distance (6 dB Margin / 35 db Loss / 68° F)			Analog Drop (530 Ω)
	No Doubler	1 Doubler	2 Doublers	
26 AWG 0.4 mm	9.0 kft 2.8 km	18.0 kft 5.6 km	27.0 kft 8.4 km	6.3 kft 1.9 km
26 AWG 0.5 mm	12.3 kft 3.8 km	24.6 kft 7.6 km	36.9 kft 11.4 km	10.2 kft 3.1 km
22 AWG 0.6 mm	16.1 kft 5.0 km	32.2 kft 10.0 km	48.3 kft 15.0 km	16.3 kft 5.0 km
19 AWG 0.9 mm	22.8 kft 7.0 km	45.6 kft 14.0 km	67.4 kft 21.0 km	32.9 kft 10.0 km

When the RT is powered from the COT, two auxiliary power pairs are required between the COT and RT for each doubler installed in the HDSL circuit. The power pairs should meet the same criteria as the HDSL pairs. Refer to the COT Shelf or RT Enclosure technical practices for additional information on the power pairs. The RT can also be locally powered to eliminate the need for auxiliary power pairs.

Sealing Current

The FLL-814 provides line powering voltage even if the RT Line Unit is locally powered. In this configuration, the locally powered RT Line Unit draws no current on the HDSL pairs. In order to allow the operating company to "wet" the HDSL lines, the locally powered RT Line Unit provides a provisionable sealing current load circuit. This feature is provisionable as ENABLED or DISABLED. The default is DISABLED.

DISABLED

If a single span system is used, no current flows in the span between the RT and the CO. If doublers are used, no current flows in the span between the last doubler and the RT. Current does flow in the spans between the CO and doublers since the doublers are still line powered.

ENABLED

The Sealing Current load is automatically applied for a period of 15-20 seconds, once every 24 hours at the system clock time of 00:05. A minimum of 20 mA is drawn through each conductor of HDSL A and B during the time the sealing current feature is active. The current flow is ramped at a rate less than 20 mA/second to meet industry standard requirements for pulsed sealing current.

FRONT PANEL

Figure 1 shows the FLL-814 front panel.

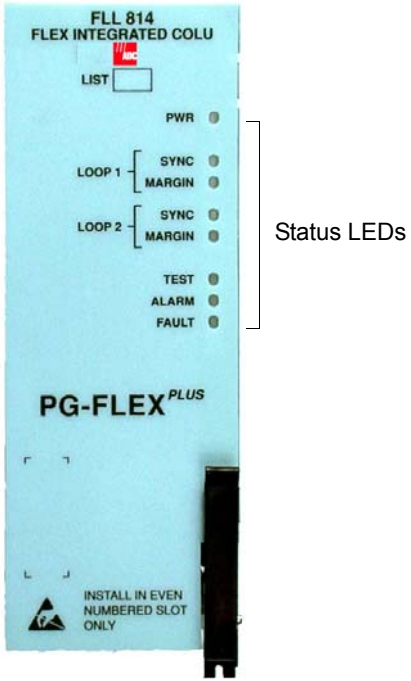

Figure 1. FLL-814 Front Panel

Table 2 lists the front panel LED indications for the FLL-814.

Table 2. FRL-842 Front Panel LEDs

LED	Color	State	Function
PWR	Green	On	FLL-814 is receiving power
		Flashing	FLL-814 is attempting to power-up the FRL-842 or Doubler Unit
		Off	FLL-814 is not receiving power or internal fault
LOOP 1/ LOOP 2 SYNC	Green	On	Loop 1/Loop 2 is in synchronization between the FLL-814 and FRL-842 or Doubler Unit
		Flashing	Loop 1/Loop 2 is attempting to synchronize with the FRL-842 or Doubler Unit
		Off	FRL-842 or Doubler Unit is not detected
LOOP 1/ LOOP 2 MARGIN	Yellow	On	Loop 1/Loop 2 margin at the FLL-814 is equal to or below the provisioned threshold level
		Flashing	Loop 1/Loop 2 margin at the FRL-842 or Doubler Unit is equal to or below the provisioned threshold level
		Off	Loop 1/Loop 2 margin at the FLL-814 and FRL-842 or Doubler Unit is above the provisioned threshold level
TEST	Yellow	On	Test active
		Off	Test not active
ALARM	Red	On	FLL-814 alarm condition exist
		Flashing	FRL-842 alarm condition exist
		Off	No alarm conditions exist
FAULT	Red	On	Fault in the FLL-814
		Off	No fault is detected

INSTALLATION

No special tools or equipment are required for installing the FLL-814.

INTIALIZE AND POWER-UP THE FLL-814

By default, the FLL-814 periodically attempts to power up and synchronize with the FRL-842 and the Doubler Units in the circuit until end-to-end HDSL synchronization is established. If the FLL-814 is unable to establish synchronization, it powers down the loops and waits approximately one minute before re-trying. The FLL-814 repeats this process continuously until it is able to synchronize with the FRL-842 or doubler.

The FLL-814 initialization and power up sequence described below assumes:

- **HDSL pairs are wired from the COT shelf, through doubler housings (if required) and terminated at the RT enclosure**
- **Auxiliary Power pairs (if required) are wired from the COT shelf and terminated at the RT enclosure (these pairs do not need to pass through the Doubler housing)**
- **COT shelf has been wired to CO battery**
- **Bay fuses have been installed**
- **Doubler(s) (if required) have been installed**
- **FRL-842 has been installed**

1. When the FLL-814 is installed with power applied to the COT shelf, all LEDs turn on for one second, then go off.
2. After a few seconds, the PWR LED flashes.

To prevent all FLL-814s from attempting to power up simultaneously, there is a two second delay between each system in the COT shelf. For example, a FLL-814 installed in slot 4 will power up two seconds after the system installed in slot 2, and a system installed in slot 12 will power up ten seconds after the system installed in slot 2. This delay is dependent on the slot in the COT shelf that the FLL-814 is installed, rather than on the number of FLL814s already installed in the COT shelf.

3. The FLL-814 attempts to power up the FRL-842 or Doubler Unit. Depending on the condition of the HDSL and auxiliary power pairs, one of the following scenarios occur:

   a. One of more pairs are opened between the FLL-814 and the FRL-842 or Doubler Unit:

      - PWR LED flashes for approximately 12 seconds, then remains on
      - SYNC LEDs flash for approximately six seconds, then remains off
      - DSL Power Feed Open (PFO) alarm is indicated in ALARMS - COLU System History menu
      - FLL-814 waits one minute, then FLL-814 repeats startup sequence

   b. One or more pairs are shorted or grounded between the FLL-814 and the FRL-842 or Doubler Unit:

      - PWR LED flashes for approximately 12 seconds, then remains on
      - SYNC LEDs flash for approximately six seconds, then remains off
      - DSL Power Feed Short (PFS) alarm indicated in ALARMS - COLU System History menu
      - FLL-814 waits one minute, then FLL-814 repeats startup sequence

   c. All pairs are good and properly wired between the FLL-814 and the FRL-842 or Doubler Unit:

      - PWR LED flashes for approximately 12 seconds, then remains on
      - SYNC LEDs flash and the FLL-814 attempts to synchronize with the FRL-842 or Doubler Unit. One of the following occurs:
        – FLL-814 does not detect or is not able to synchronize with the FRL-842 or Doubler Unit: SYNC LEDs flash for approximately one minute, then remain off - FLL-814 waits one minute, then FLL-814 repeats startup sequence.
        – FLL-814 detects and is able to synchronize with the FRL-842 or Doubler Unit: Within a few minutes, the SYNC LEDs remain on and the FLL-814 establishes synchronized HDSL communications with the FRL-842 or Doubler Unit. Assumption: The HDSL margins are above alarm thresholds and there are no subscriber drop tests or other alarms/faults in the system. Therefore, verify Table 3 front panel indications after the system powers up and establishes HDSL synchronized communications.

Table 3. FRL-842 LED Status

LED	State
PWR	On
LOOP 1/LOOP 2 SYNC	On
LOOP 1/LOOP 2 MARGIN	Off
TEST	Off
ALARM	Off
FAULT	Off

It takes approximately two minutes before end-to-end synchronization is established with two doublers installed in the circuit. However, depending on the condition of the cable plant and length of the spans, it may take up to four minutes before synchronization is established.

SPECIFICATIONS

Table 4 lists the specifications for the FLL-814.

Table 4. FLL-814 Specifications

Category	Item	Value
Electrical	Input Voltage	-42.5 Vdc to -56.5 Vdc
	Input Power	98 Watts (maximum), cooled by natural convection
	Output Voltage	± 130 Vdc
	Output Power	100 Watts (maximum)
	Heat Dissipation	16.5 Watts (maximum)
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, 784-kbps 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	5.5 in. (14.0 cm.)
	Width	2.2 in. (5.6 cm.)
	Depth	10.25 in. (26.0 cm.)
	Weight	1.2 lbs. (0.5 kg.)

Power Consumption and Heat Dissipation

Table 5 lists the power consumption and heat dissipation for the FLL-814 on a per slot and per COT shelf basis.

The worst case conditions under which these parameters are measured include:

*** 9,000 ft., 26 AWG loop**

*** fully loaded COT shelf**

*** -42.5 Vdc COT shelf battery voltage**

*** 104° F outdoor temperature**

Table 5. Power Consumption and Heat Dissipation

Power	FLL-814 Slot	19-inch COT[a]	23-inch COT[b]
Maximum Heat Dissipation			
HDSL Line Power Off	5.0 W	50.0 W	60.0 W
HDSL Line Power On	16.5 W	119.0 W	152.0 W
Maximum Power Consumption			
HDSL Line Power Off	5.0 W	50.0 W	60.0 W
HDSL Line Power On	98.0 W	625.0 W	822.0 W
Maximum Current Drain			
HDSL Line Power Off	0.1 A	1.2 A	1.4 A
HDSL Line Power On	1.9 A	11.9 A	15.8 A

a. Indicates the COT shelf with one PMU-712, two PMX-744 and six FLL-814.

b. Indicates the COT shelf with one PMU-712, two PMX-744 and eight FLL-814.

Fault Isolation and Troubleshooting

Table 6 provides fault isolation and troubleshooting for the FLL-814.

Table 6. Fault Isolation and Troubleshooting

LED	Probable Cause	Solution
No LEDs On	• No input power • FLL-814 power fuse blown • FLL-814 processor stopped	Check input power at COT shelf backplane with FLL-814 removed
		If power is present at COT shelf backplane, replace the FLL-814
		If power is not present at COT shelf backplane, replace the fuse in the backplane
PWR LED off	No input power	Check input power at COT shelf backplane with FLL-814 removed
	On-board fuse is blown on FLL-814	If power is present at COT shelf backplane, replace the FLL-814
		If power is not present at COT shelf backplane, replace the fuse in the backplane
Fault LED On	Indicates an fault condition on the FLL-814 has been detected	Replace the FLL-814
Alarm LED On	Indicates an existing alarm condition on the FLL-814	From the Main Menu (Performance sub-menu), determine the cause of the alarm. Correct the condition, if possible. If you cannot view the FLL-814 Main screen, a communication error exists.
		Remove and re-insert the FLL-814
		If the communication error still exists, replace the FLL-814
Alarm LED Flashing	Indicates an existing alarm condition on the FRL-842	From the Main Menu (Performance sub-menu), determine the cause of the alarm. Correct the condition, if possible. If you cannot view the FLL-814 Main screen, a communication error exists.
		Remove and re-insert the FLL-814
		If the communication error still exists, replace the FLL-814
Margin LED On	Distance limitation	From the Main Menu (Performance sub-menu), verify that no alarms exist.
	Fault in HDSL line	Initial installation, verify the distance between COT shelf and RT. Also, view HDSL loss.
	Faulty FLL-814	If existing installation, view loss of HDSL line to ensure that the maximum allowable loss has not been exceeded
		Replace FLL-814 and/or the RT
SYNC LED Off	HDSL line has lost synchronization	Initial installation, check engineering records for distance between COT shelf and RT
	Distance limitation may have been exceeded	
	Faulty FLL-814	If existing installation, view loss of HDSL line to ensure that the maximum allowable loss has not been exceeded

Subscriber Reported Faults

Table 7 on page 5 provides fault isolation procedures for the system. Problems are listed in decreasing order of probability; the most likely action to resolve the problem is listed first. It is assumed that the system has successfully powered up, the HDSL circuits are synchronized end-to-end, there are no ES, UAS, or margin errors occurring, and no Fault LEDs are illuminated on the units installed in the COT Shelf or RT Enclosure.

Table 7. Subscriber Fault Isolating

LED	Probable Cause	Solution
All subscriber circuits cannot draw dial tone, telephones are not ringing, and ISDN circuits are not synchronizing	Incorrect provisioning of the PMX-744(s) and/or FLL-814	PMX-744 - Verify the system options are set correctly FLL-814 - Verify the system options are set correctly
	Problem with the DS1 signals	DS1 - Verify the presence and integrity of the DS1 signals terminated on the COT shelf
	Undetected hardware problem	Replace the following units with known good units in the following order: • FLL-814 • FRL-842 • PMX-744(s) • RT channel units
One, or more, subscriber circuits cannot draw dial tone, telephones are not ringing and ISDN circuits are not synchronizing	Undetected hardware problem	Replace the following units with known good units in the following order: • RT channel unit on which the failures are occurring • FRL-842 • All RT channel units of the same type on which the failures are occurring

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 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 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	4/22/2003	Initial Release

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This document applies to the following products:

Model	List	CLEI
FLL-814	1B	VACJK88E~~
	2	VACJKPFE~~

ISO 9001
DNV
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