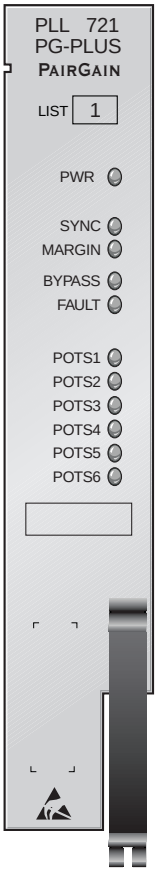
PG-PLUS

6 POTS CENTRAL OFFICE LINE UNIT

Model	List Number	Part Number	CLEI Code
PLL-721	**1**	**150-1621-01**	**S9L1AB0AAA**



PAIRGAIN TECHNOLOGIES, INC.
ENGINEERING SERVICES TECHNICAL PRACTICE

SECTION 950-721-100-04

PAIRGAIN

Revision History of This Practice

Revision	Release Date	Revisions Made
01	March 15, 1997	Initial release
02	August 28, 1997	Corrected screen captures and technical data
03	March 9, 1998	Added metallic fallback
04	February 26, 1999	Metric values and V2 compliancy for voltage safety added to specifications table

USING THIS TECHNICAL PRACTICE

Two 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.

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 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.

ABBREVIATIONS

ACO	alarm cut-off
AWG	American wire gauge
BER	bit error ratio
CEV	controlled environmental vault
CO	central office
COLU	PG-Plus Central Office Line Unit
COTS	PG-Plus Central Office Terminal Shelf
CPE	customer premises equipment
CR	critical
DDS	digital data service
ES	errored seconds count
FCC	Federal Communications Commission
HDSL	high bit-rate digital subscriber line
LCFO	loop current feed open
LED	light emitting diode
LOSW	HDSL loss of SYNC word
mA	milli-Amps
mV_{pp}	milli-volts peak-to-peak
MAR	HDSL line margin
MISPWRA	power A missing
MISPWRB	power B missing
MJ	major
MLT	mechanized loop test
MN	minor
NA	not alarmed
NORLUSW	no RT software
NR	not reported
NT1	network termination type-1
PAU	PG-Plus Alarm Unit
PFO	power feed open
PFS	power feed short
PGF	power feed ground fault
PMX	PG-Plus Multiplexer Unit
POTS	plain old telephone service
RLU	PG-Plus Remote Line Unit
RMA	return material authorization
RT	PG-Plus Remote Terminal
SDT	subscriber drop testing
SES	severely errored seconds
SYNC	synchronization
UAS	unavailable seconds count

TABLE OF CONTENTS

OVERVIEW

This practice describes the PairGain® PG-Plus® 6 POTS COLU, PLL-721 List 1, a COLU that provides interfaces with the RT for six POTS subscribers.

DESCRIPTION AND FEATURES

A PG-Plus application, consisting of one COTS, one COLU and one RT, (see Figure 1) provides bidirectional transport of multiple DS0, over a single, unconditioned wire pair using HDSL technology. Using existing cable, PG-Plus provides for higher bandwidth needs of residential and business customers by providing multiple POTS interfaces on a single HDSL twisted-pair wire.

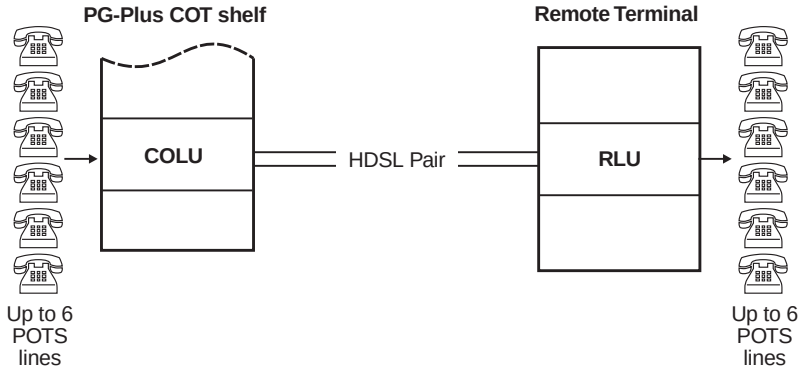


Figure 1. *Typical PG-Plus Application*

The COLU uses PairGain's HDSL technology to provide digital transmission without the need for repeaters, loop conditioning, or pair selection. The COLU can be installed in the PCS-718 19-inch or the PCS-719 23-inch COTS. The COLU operates in the standalone mode with no other COTS circuit cards required. Advanced features such as performance monitoring, alarm reporting, and testing require the addition of the PG-Plus PAU or PMU. Line power is provided to the RT by the COLU.

The COLU performs the interface functions between the analog POTS circuits of the CO switching system by mapping one POTS line onto one DS0 for transmission to the RT on the HDSL pair. To obtain maximum reach, the HDSL line to the RT is operated at the minimum rate to support the payload.

METALLIC FALLBACK

Metallic fallback provides a direct connection from the CO to one subscriber under fault conditions. Service is provided to the first POTS subscriber on the affected system. At the RT, the system exits metallic fallback and attempts to synchronize if either the first POTS or the HDSL Tip to Ring pair is shorted for at least 3 seconds, and then released for at least 3 seconds. Otherwise, the COLU checks for the presence of an RT every 5 minutes. If an RT is present, the system begins HDSL synchronization acquisition.

Relays in the COLU and RT provide a path for SDT and metallic fallback operation. These relays are used to establish a circuit to POTS # 1 during fault conditions and to provide for drop testing of the selected subscriber line from the CO location.

SPECIFICATIONS

System	
Resistive Signature	Tip to Ground 162 K; Ring to Ground 453 K
Power Supply	
Voltage Safety	A2 compliant per GR-1089-CORE
Input Voltage	-42 Vdc to -56.5 Vdc
HDSL Line	
Output Voltage	± 140 Vdc maximum
Output Power	27 Watts maximum
HDSL Line Code	2B1Q
HDSL Line Rate	196 K symbols/sec (392 K/bps)
HDSL Reach	12.5 kft (3.81 km), 26 AWG; 18.0 kft (5.48 km), 24 AWG; 25.2 kft (7.68 km), 22 AWG; 37.8 kft (11.5 km) 19 AWG
Maximum Line Attenuation	41.6 dB at 98 kHz
POTS	
Analog Impedance	900 Ω
DC On-hook Resistance	4 M Ω minimum
DC Off-hook Resistance	1000 Ω maximum
COTS Input Impedance	0.9 REN @ 20 Hz maximum
COTS Ring Detection	65 Vrms minimum @ 15 to 50 Hz
Environment	
Operating Temperature	-40° F to +150° F; -40° C to +65° C
Operating Humidity	5 percent to 95 percent noncondensing
Altitude	-200 ft. to 13,000 ft.; -60 m to 4,000 m
Vibration	NEBS
ESD	Per GR-1089-CORE
Power and Lightning	Per GR-1089-CORE
Human Safety	UL 1950 for Restricted Access
Emissions Radiation and Immunity	Per GR-1089-CORE for class A equipment
Connector	50 gold-plated card edge fingers
Dimensions	
Height	5.5 in., 13.97 cm
Width	1.1 in., 2.79 cm
Depth	10.25 in., 26 cm
Weight	2.0 lbs., 0.9072 kg

POWER CONSUMPTION AND HEAT DISSIPATION

The three most important power demands of a COLU on the COTS power supply are its maximum power consumption, heat dissipation, and current drain. Table 1 lists the power consumption and heat dissipation for the COLU, on a per slot and per COTS basis.

The worst case conditions under which these parameters are measured include a 12,500 ft., 26 AWG loop, a fully loaded COTS, and a -42.5 Vdc COTS battery voltage. The remote is assumed to be ringing two lines with a combined load of 10 REN, with four lines off hook. Loop current sink at the COTS is assumed to be 23 mA. Higher loop current feed than 23 mA restricts the number of COTS in a bay due to heating.

Table 1. *Power Consumption and Heat Dissipation*

Power	COLU Slot	COTS	
		19-inch	23-inch
Maximum Heat Dissipation			
HDSL Line Power Off	3.1 W	37.2 W	49.6 W
HDSL Line Power On	6.5 W	78 W	104 W
Maximum Power Consumption			
HDSL Line Power Off	3.1 W	37.2 W	49.6 W
HDSL Line Power On	31.25 W	375 W	500 W
Maximum Current Drain			
HDSL Line Power Off	73 mA	0.875 A	1.17 A
HDSL Line Power On	735 mA	8.82 A	11.76 A

Maximum Heat Dissipation

The maximum heat dissipation measures the power converted into heat that is built up within the COLU. It contributes to the total heat generated in the space around the COLU. It is used to determine the maximum number of fully loaded COTS per bay that will not exceed the maximum allowable power dissipation density in Watts per square foot.

In CO locations, the maximum heat dissipation for open-faced, natural convection-cooled mountings is limited to 134.7 W per square foot per Section 4.1.4 of the NEBS standard GR-63-CORE. The footprint of a standard 16-slot, 23-inch COTS is 7.042 square foot. The maximum bay dissipation is therefore limited to 948.6 W. At 104 W per COTS, this limits the number of fully loaded COTS to nine per bay with a heat baffle above each COTS.

PairGain recommends that the number of COTS per bay be limited to eight, to allow the flexibility to deploy the widest range of PG-Plus services from each COTS.

This is a worst case situation in that it assumes the entire CO is subjected to the maximum power density. Conditions other than worst case would permit increasing the number of COTS per bay without jeopardizing the CO thermal integrity. Due to the chimney effect, PairGain recommends you install one heat-dissipating baffle between every COTS. This action would prevent exceeding the rated operating temperature of the COLU units.

Thermal Loading Limitations

The thermal loading limitations imposed when using the COLU in a CEV or other enclosures are determined by applying the COLU power parameters to the manufacturer's requirements for each specific housing.

Maximum Power Consumption

The maximum power consumption is the total power that the COLU consumes or draws from its -48 Vdc COTS power source. This parameter is needed when the COLU is located remotely from its serving CO. It determines the battery capacity required to maintain an 8-hour standby battery reserve for emergency situations. This limits the maximum number of line units in an RT.

Maximum Current Drain

The maximum current drain is the maximum current drawn from the COTS power supply when it is at its minimum voltage (-42.5 Vdc). This determines the COTS fusing requirements.

MONITORING, HISTORY AND DIAGNOSTICS

COLUs provide extensive real-time, non-disruptive monitoring of HDSL transmission performance parameters for all units in a circuit. PG-Plus allows user-selectable threshold settings for performance monitoring measurements. This allows alarms to be activated at the designated threshold setting. Performance of the user interface ports is also monitored. Monitored parameters include the following:

- HDSL Noise margin, pulse attenuation, ES, UAS
- Interface ES, SES, UAS, BPV seconds
- Major Alarm Relay Form-C relay contacts (NO, NC, C). Fail-safe operation
- Loopbacks Local interface loopback, local HDSL loopback, remote loopback
- Test Jacks Bridge jack on the front panel

Performance Parameters

Based on the monitored parameters, the COLUs derive the following performance parameters:

- MAR - A measure of the ratio of signal power to noise power, in dB, at a receiver point. A value of 0 dB means that the predicted transmission BER is equal to 10^{-7}, a value of 6 dB means the predicted transmission BER is equal to 10^{-10}. The Main menu status display of the console continuously updates the margin value.

  HDSL CRC-6: A 6-bit word in every HDSL frame, representing a calculation based on all the bits in that frame. Any mismatch at the receiver, between the received CRC-6 and the one calculated, based on the received data in the frame, indicates that one or more bits were received in error. The units use this parameter to derive the HDSL ES performance parameter.

- LOSW - The COLU has detected an error in one or more bits in six consecutive HDSL SYNC words. Two consecutive SYNC words must be received without error to clear this condition. A LOSW condition generally indicates the loop is down, thus data cannot be transmitted. The COLU use this parameter to derive UAS performance parameter.
- HDSL ES - An interval of 1 second during which at least one error is detected at the incoming HDSL port or there is an LOSW condition.
- HDSL UAS - An interval of 1 second during which a loop is down.

Alarms Names and Types

The COLUs generate alarms for problem conditions on the HDSL transmission facility and at the application interface. From the "System Alarm Types Screen" on page 22, you can set the alarms to the value types of Critical, Major, Minor, Not Alarmed, and Not Reported. You can view the alarm status from the "COLU Summary Screen" on page 13.

- MAR
- ES
- LOSW
- PFO
- PFS
- PGF
- MISMATCH
- NORLUSW
- MISPWRA
- MISPWRB

History

Current cumulative counts of the past twenty-four hours and historical data in the form of 24-hour history and a 7-day history are available to assist in identifying problem sources. You can view the HDSL history from the "HDSL History Screen" on page 19.

LEDs Descriptions

Table 2, in which *n* equals the POTS line, describes the COLU front-panel LEDs depicted in Figure 2. For further details on the LEDs activities, refer to "Initialization Sequence" on page 8 and the "COLU and RT Fault Indicators" on page 30.

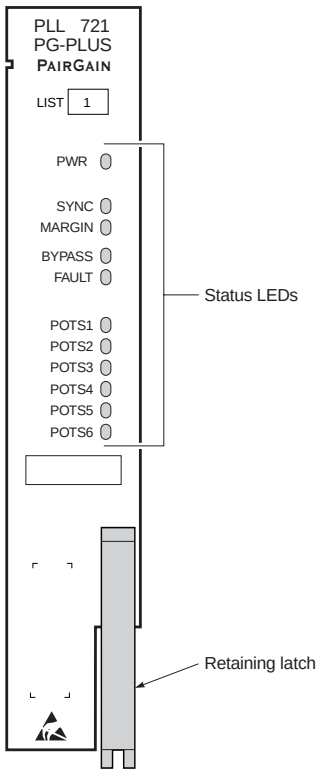


Figure 2. *COLU Front Panel LEDs*

Table 2. *LEDs Descriptions*

LEDs	Condition	Mode
PWR	On	COLU is powered and the dc power provided to the HDSL pair is normal
	Flashing	One battery feed is missing or a battery feed fuse on the COLU is blown
	and FAULT Flashing	The dc power provided to the HDSL pair is out of normal range
	On, all other LEDs flashing at 1 Hz	Running in Boot Mode due to invalid Application Program
	On, all other LEDs running downward at 1 Hz	Active software download of the COLU
	On, all other LEDs running upward at 1 Hz	Active software download of the RT connected to the COLU
SYNC	On	HDSL is in synchronization between COLU and RT
	Flashing	COLU and RT are attempting to synchronize
MARGIN	On	COLU HDSL margin is equal to or below the threshold value
	Flashing	RT HDSL margin is equal to or below the threshold value.
BYPASS	On	COLU in Metallic Fallback
	and POTS *n* Flashing	SDT is occurring on POTS *n*
FAULT	On	COLU has a fault
	Flashing	Alarm condition exists on the COLU
POTS*n*	On	Channel is off-hook
	Flashing with Ring Cadence	Channel is ringing

INSTALLATION AND TEST

REQUIRED TOOLS AND TEST EQUIPMENT

No tools are required to install the COLU. For testing, the following tools may be utilized:

- Telephone test set
- Optional, PSU-795 List 1 COTS Continuity Test Card, part number 150-1695-01

INSTALLING THE COLU

You can install the COLU in any slot except the three positions labeled COMMON, MUX 1, and MUX 2. Refer to the cabling tables provided in the COTS documentation for slot and Telco cabling assignment.

1 Open the retaining latch on the front of the COLU.

2 Insert the COLU into the card guides in a vacant slot in the COTS that corresponds to the location of the wiring from the CO switch (see Figure 3).

3 Engage the retaining latch to hold the card in place.

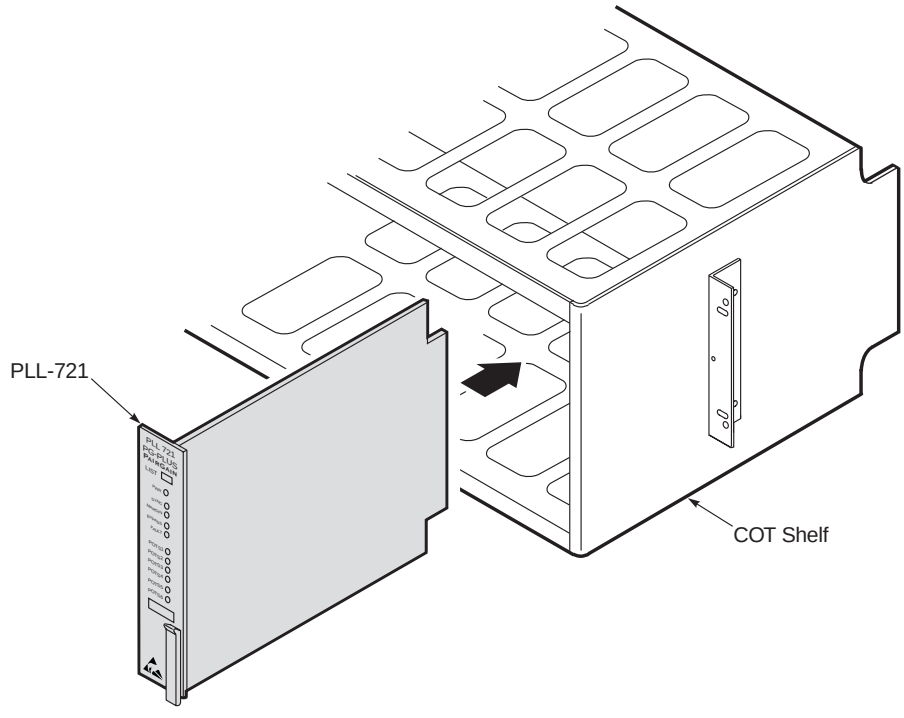


Figure 3. *Installing the COLU*

All alarms in the PG-Plus application are suppressed when initially installed and powered up. Any alarms that are generated during this process are suppressed. When the HDSL is synchronized and the COLU and RT margin has cleared; outstanding suppressed alarms are made active and reported to the PAU or the PMU, based upon their provisioned types.

INITIALIZATION SEQUENCE

When the COLU is correctly seated in the COTS, the following events occur in the order listed:

- All LEDs briefly blink On and then Off, with the exception of the PWR and FAULT LEDs that remain Flashing.
- After about 5 seconds, the COLU applies power and goes into start-up mode. If an RT is present and no PFSs, PFOs, or PGFs are detected, the PWR LED is On green. If the line is Offhook, the HDSL power is not applied until it goes Onhook for at least 3 seconds. There is a 5 second delay before turning on the HDSL power.
- After applying the HDSL power, the tests for overload or underload conditions are performed. If the HDSL line power is normal, the PWR LED is On and HDSL start-up is initiated.
- As the COLU continues with start-up mode, the SYNC LED Flashes, indicating the HDSL line is attempting to acquire synchronization. When synchronization is complete, the SYNC LED is On. It takes approximately 10 to 15 seconds from the system power-up until the HDSL power is normal. If the first HDSL synchronization attempt fails, the system is powered down and put into the Metallic Fallback state. After a 5 minute period, HDSL power is applied again and a second attempt is made to acquire HDSL synchronization. If the second attempt fails, the system goes into Metallic Fallback state.
- The MARGIN LED is On yellow indicating the COLU signal-to-noise ratio is equal or below the selected signal-to-noise ratio threshold on the COLU. The MARGIN LED Flashes if the signal-to-noise ratio of the HDSL line is equal or below the selected signal-to-noise ratio threshold on the RT.

SUBSCRIBER DROP TESTS

You can perform this function in one of two ways:

- Initiate a SDT by applying a test voltage on the Tip at the COLU through an MLT set
- With the VT-100 Terminal connected to the PAU or PMU maintenance port, select the *Subscriber Drop Test* feature from the *Test* menu. Relays on the RT provide a path for performing a SDT. The results are reported to the PAU or the PMU and presented as TA-909 resistive signatures.

ADMINISTRATION

Performance monitoring is built into PG-Plus applications. You can access the VT-100 port of the PAU or the PMU to review performance measurements that provide an indication of the quality of transmission to the subscriber. You can perform system administration functions, such as alarm checking and clearing, configuration changes, performance monitoring, and testing for the COLU through the COLU screens.

Connect a VT-100 terminal to the RS-232 interface on the front panel of either the PAU or the PMU to access the COLU screens. If the system does not respond, verify the following values are present:

- VT-100 terminal Hardware Flow Control is set to On
- XON/XOFF is enabled
- ASYNC parameters: Data = 8, Parity = None, Start/Stop = 1.

For further information on connecting a terminal and accessing the screens refer to the PAU or the PMU Technical Practice.

The factory defaults given in this document are standard factory defaults. You may have a customized version of the product, in which case, refer to the PG-Plus Customized Factory Defaults for the values appropriate to the product version you have.

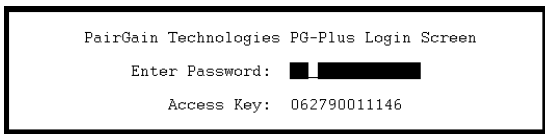
CONVENTIONS USED IN THIS DOCUMENT

Some screen shots in this document come from a prototype setup and may appear slightly different from what you see on your Craft interface screen. The basic information and contents should be similar. This document uses the following conventions for menus and shortcuts:

Example	Describes
menu	name of menu item
submenu	name of submenu item
prompts	the place where you answer yes or no or type some other response
error	the name of what's wrong
error text	an explanation of what's wrong
nnnn	a variable, such as POTS unit 1 in a 6 POTS unit

LOGGING ON

1 Press the SPACEBAR several times to activate the Autobaud feature. Supported baud rates are 1200, 2400, 4800, 9600, and 38400. The Logon Password screen displays.



2 Type the default password and press ENTER to view the PAU or PMU Main menu bar.

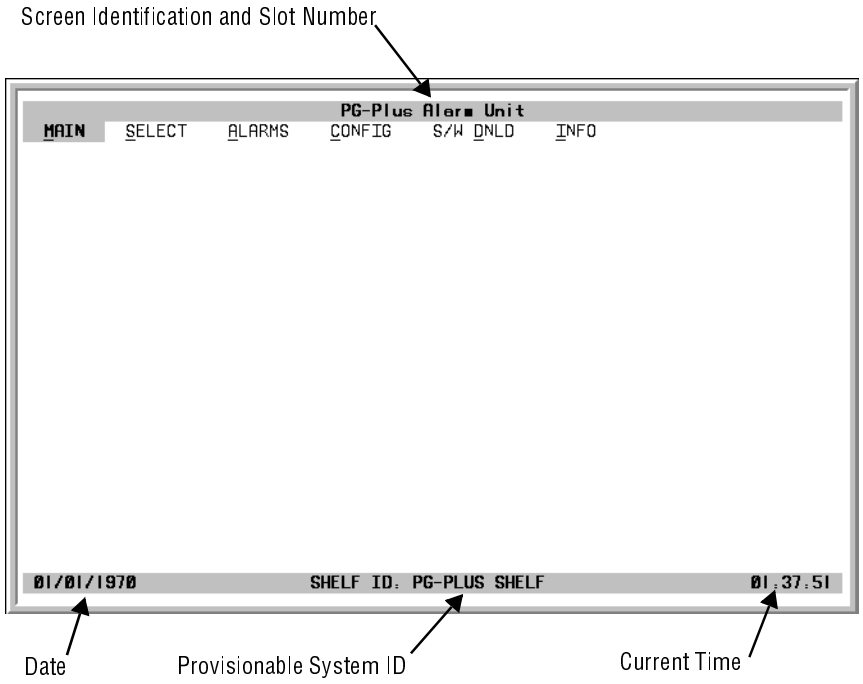
The factory-default password is `password#1`**. If you establish a different password, you must type the new password at a subsequent log on. Passwords are not case sensitive. The password must use at least 6 and no more than 10 characters, and the new password must contain at least 1 alpha, 1 numeric, and 1 special character. If the system does not respond, verify that the Hardware Flow Control of the VT-100 terminal is set to On.**

LOGGING OFF

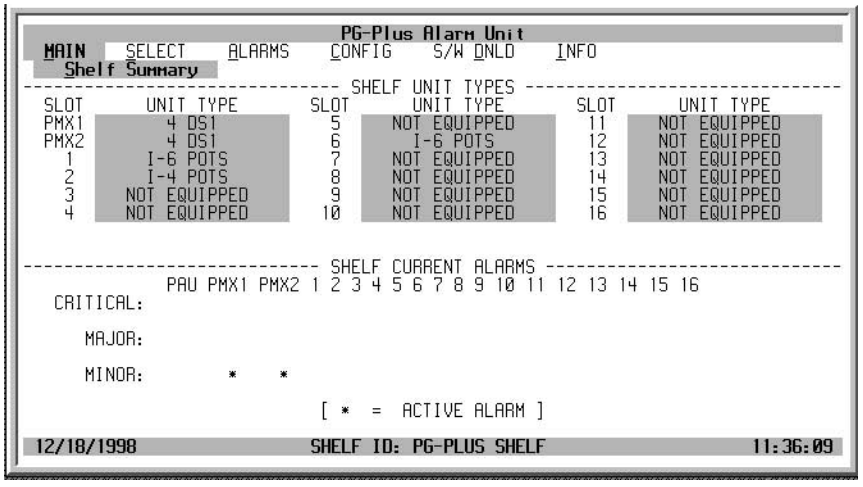
If you must leave your VT-100 terminal unattended, it is good practice to log out until you are ready to resume work. This prevents unauthorized persons from inadvertently changing any of your operating parameters. Log out by choosing *Logout* from the PAU Main menu bar or by disconnecting the cable connecting the console to the PAU/PMU.

PAU OR PMU MAIN SUBMENU

The first screen displays the COTS Main menu bar. The screens are identified by the COTS slot number at the top of each screen. The provisionable System ID string displays at the bottom center, the date displays at the lower left of the screen, and the time in military format displays at the lower right of the screen.



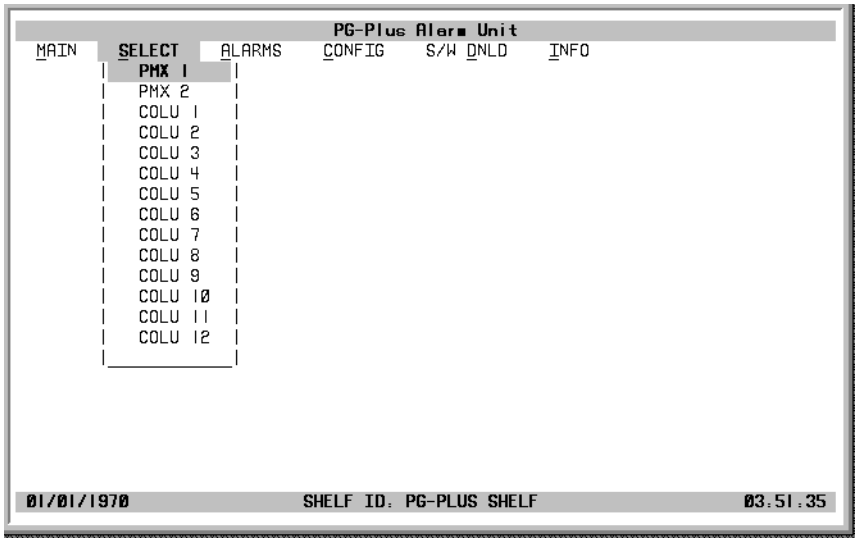
1 To access the PLL-721 when you do not know the PAU/PMU slot number, press **ENTER** to view the COTS summary screen. Note the slot number of the desired COLU. There may be more than one of the COLU type you are installing.



2 Press **ESC** to return to the PAU/PMU Main menu bar.

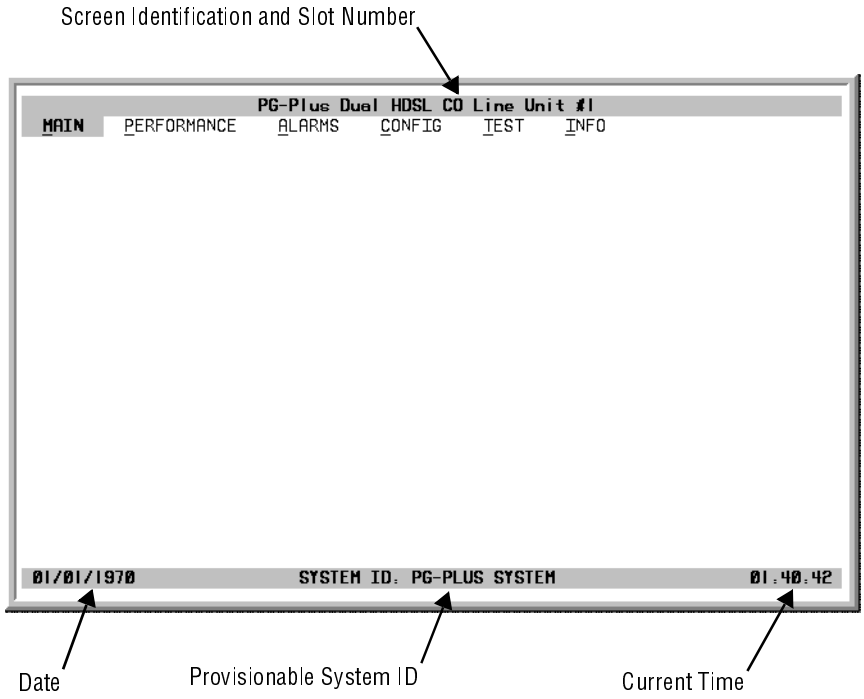
3 Scroll to the *Select* option and press ENTER to access the submenu.

4 Scroll to the desired COLU slot number noted above and press ENTER.



COLU MAIN MENU

When you select the COLU from the PAU or PMU *Select* option, the COLU Main menu displays. You can perform any of the functions listed in Table 3 from this screen.



Navigational Methods

The following keyboard keys are your means to navigate through the menus and screens:

A - Z keys	Selects and executes an underlined or highlighted menu item.
←	Moves left across main menu. Moves the cursor to the left.
→	Moves right across main menu. Moves the cursor to the right.
↑	Moves up the submenu selection. Moves the cursor up the screen items.
↓	Moves down the submenu selection. Moves the cursor down the screen items.
CTRL+R	Returns to the PAU or PMU Main screen. The PairGain banner appears briefly and then the Main menu bar displays.
SPACEBAR	No effect. At COLU screen cycles through choices.
ESC	Exits the current screen and returns to the previous screen. Selection changes made on the current screen are discarded. Press ESC in a text field to cancel the text entry and restore the old value.
ENTER	Moves to submenu or screen selected. At the screen, it submits all selection changes on the current screen and makes them effective in the system.

Menu Bar Selections

Table 3 describes the menus and submenus selectable from the COLU menu bar.

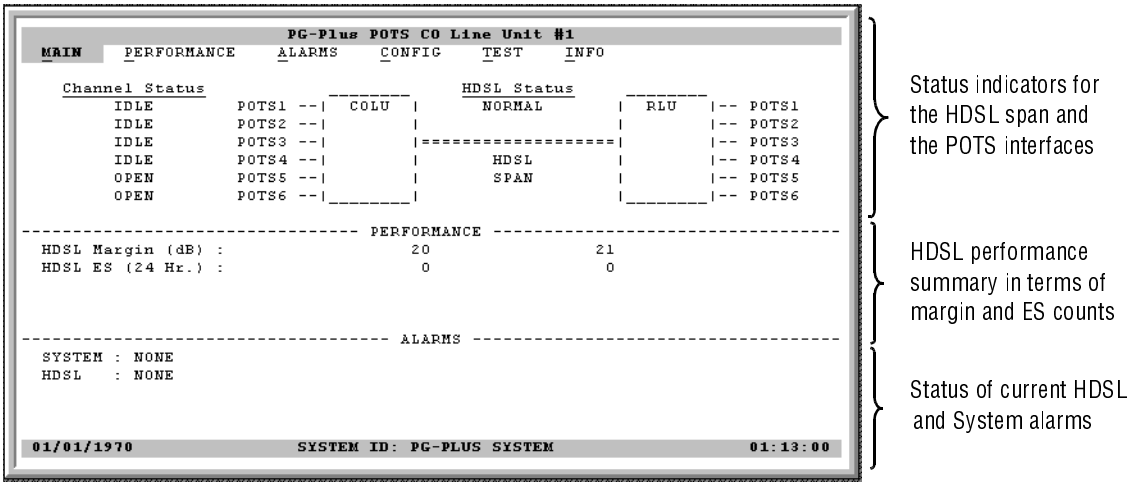
Table 3. *Menu Bar Selections*

Select the underlined alpha character:	To:
Main	View the circuit configuration. View performance summary information. View alarm summary information.
Performance	View HDSL Summary and reset the minimum and maximum margin counts. View date and time of the last reset of the minimum and maximum margin counts. View information about the HDSL span, 24-hours of performance history including ES, UAS and validity of counts. Clear the history screens. View 7-day history plus current day's accumulated performance information including ES, UAS and validity of counts. View POTS signal history on any of the POTS units, and clear the Trace buffer.
Alarms	View the HDSL History screen detailing, number of times each alarm occurred, time and date of first and last occurrence, provisioned notification type, and current status. Clear the alarm history.
Config	View or change options such as SDT, HDSL Periodic Power Up, and System ID. View or change alarm types of all System alarms. View or change threshold crossing values for the 24-hour ES count and low margin dB. View or change the HDSL and DSL line power alarms. Set or change POTS signaling transmit level at the RT. Set all operating parameters to factory defaults.
Test	Test subscriber drop by either of two methods. View results that include hazardous voltages, foreign voltages, resistive faults, and CPE termination status.
Info	Summary of navigational methods. Display registration information to track product manufacturing, configuration, and revision state.

COLU Summary Screen

This screen details the performance condition of the COLU and RT.

1 Select *Main* from the menu bar and press ENTER to view this screen.



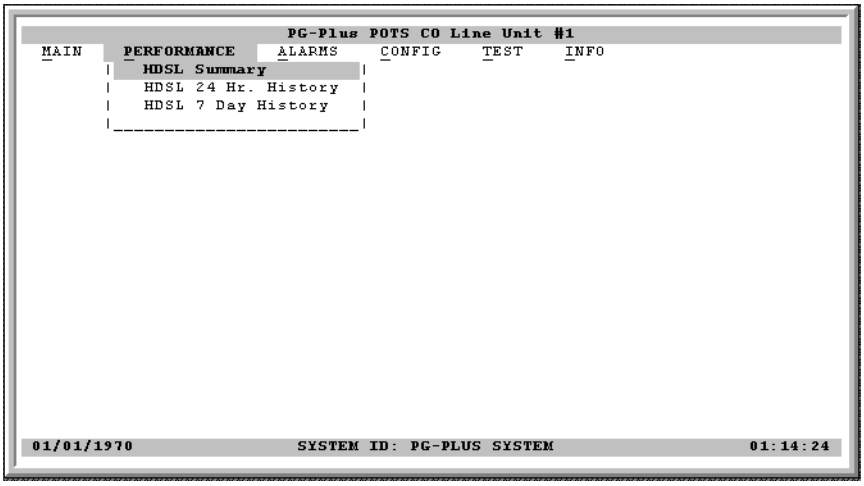
2 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu. Refer to the Performance and Alarms screens for a detailed description of data displayed in these areas.

Table 4. *System Status*

System Status	Description
HDSL Line Status	Displays a representation of the HDSL link.
HDSL Link Down	HDSL link is down and System is not in Metallic Fallback.
Metallic Fallback	HDSL link is down and System is in Metallic Fallback.
Start-up	System in start-up mode where the HDSL link is acquiring synchronization.
Normal	System running normal where the HDSL link is synchronized and speech and signaling data are flowing between the COLU and the RT.
POTS during Metallic Fallback and HDSL Startup	
N/A	Not applicable, that is, invalid until HDSL is in SYNC.
Metallic Fallback	POTS #1 line status when system is in Metallic Fallback.
HDSL in SYNC; each POTS Line Status	
Open	No CO battery detected. If No CO battery is detected, then the Line Status will be Open. This status will not change except for Test status.
Idle	CO battery detected and line is Onhook at RT
Ringing	Line is ringing
Busy	Line is Offhook at RT
Test	Line is under SDT or line is connected to PMU Test Access Port

PERFORMANCE SUBMENU

The Performance submenu provides access to the COLU performance screens. Select *Performance* at the menu bar and press ENTER to display the submenu.

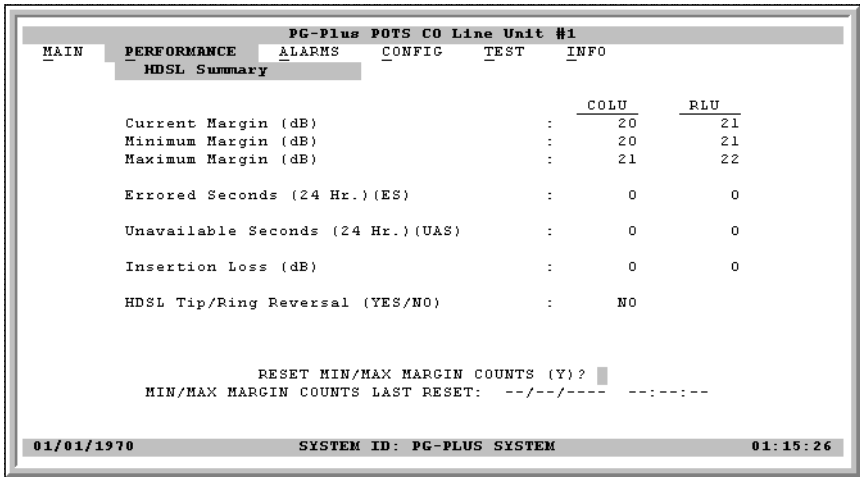


HDSL Summary Screen

This screen depicts an HDSL performance summary in terms of the margin and UAS and ES count. Use the available options to reset the minimum and maximum margin counts.

1 Select *Performance* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *HDSL Summary* option and press ENTER to view the screen.



The following performance parameters are reported:

- Margins: A measure of the ratio of signal power to noise power, in dB, at a receiver point.

  –Current Margin: The way the line looks now

  –Maximum Margin: The maximum value measured

  –Minimum Margin: The minimum value measured

- ES: An interval of 1 second during which at least 1 error is detected at the incoming HDSL port or there is an LOSW condition.
- UAS: An interval of 1 second during which a loop is down.
- Insertion Loss: dB measurement of signal loss

  If your COLU has an earlier software version your screen will display the following two lines instead of the Insertion Loss line:

  –Pulse Attenuation: dB measurement of signal loss

  –PPM Offset: the measure of the PPM difference between the RT and the COLU

- HDSL Tip and Ring Reversal

3 To reset the counts, type Y at the Reset MIN/MAX Margin Counts prompt. The current 15-minute interval information shows the real-time updates. The first 15-minute interval is marked 00:00 and represents 12:00-12:15 AM of the current day.

If there are active alarms associated with the current 15-minute and 24-hour performance history information, those alarms become inactive when the 24-hour performance history is cleared. The date and time the 15-minute and 24-hour performance historys were last cleared appears at the bottom of the screen.

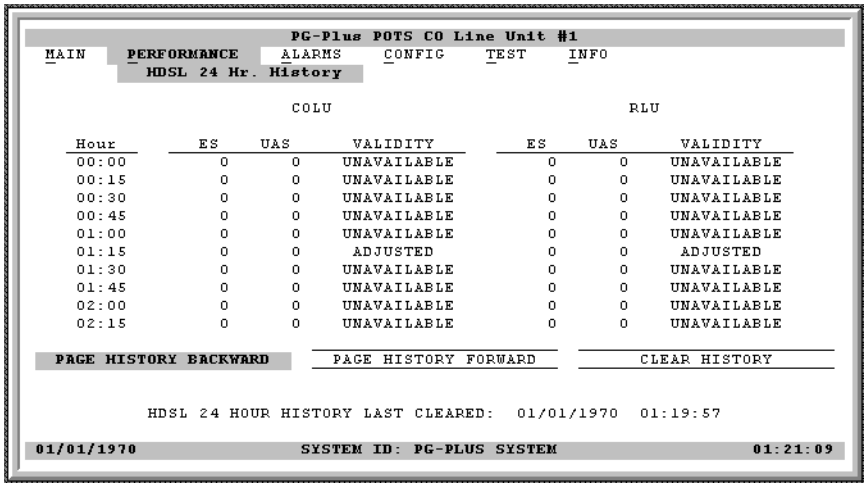
4 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

HDSL 24-Hour History Screen

This screen shows twenty-four hours of HDSL performance history. The performance history data displayed includes ES counts, UAS counts, and the validity of the counts.

1 Select *Performance* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *HDSL 24 Hr. History* option and press ENTER to view the screen:



The COLU derives the ES and UAS performance parameters with the following field values:

- Unavailable: The system has not run long enough to fill this register.
- Partial: Data is being collected for this register.
- Complete: Data is saved in the history register for the complete interval.
- Adjusted: The time or date has been changed on the system during the interval.

3 Highlight either of the paging fields and press ENTER to scroll through all ninety-six 15-minute intervals.

4 To clear the history, highlight the Clear History field and press ENTER. The current 15-minute interval information shows the real-time updates. The first 15-minute interval is marked 00:00 and represents 12:00-12:15 AM of the current day.

If there are active alarms associated with the current 15-minute and 24-hour performance history information, those alarms become inactive when the 24-hour performance history is cleared. The date and time the 15-minute and 24-hour performance history was last cleared appears at the bottom of the screen.

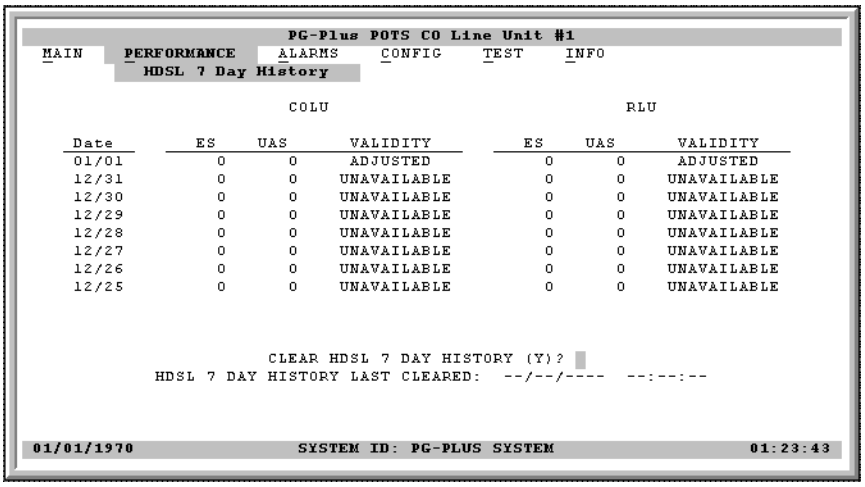
5 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

HDSL 7-day History Screen

The performance history screen shows seven days of history plus the current day's accumulated performance information. The information displayed includes ES counts, UAS counts, and the validity of the counts.

1 Select *Performance* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *HDSL 7 Day History* option and press ENTER to view the screen:



The COLU derives the following performance parameters:

- ES: An interval of 1 second during which at least one error is detected at the incoming HDSL port or there is an LOSW condition.
- UAS: An interval of 1 econd during which a loop is down.
- Validity field values are as follows:

  –Unavailable: The system has not run long enough to fill this register.

  –Partial: Data is being collected for this register.

  –Complete: Data is saved in the history register for the complete interval.

  –Adjusted: The time or date has been changed on the system during the interval.

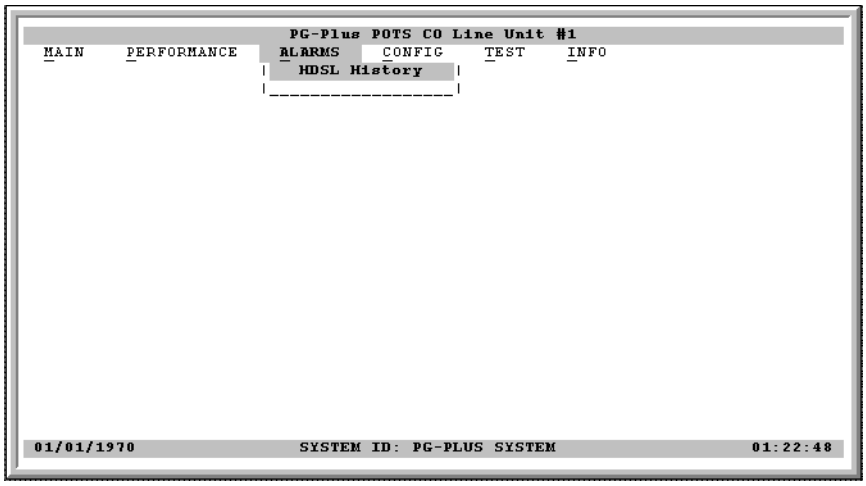
3 To clear the 7-day history information, type Y at the Clear HDSL 7 day History prompt. The current day performance information shows real-time updates. At midnight of every day, the current day performance information is moved into the previous day slot and the current day performance information is cleared.

Clearing the 7-day performance history does not clear the current day performance information. The current day performance information may only be cleared through the HDSL 24-hour performance history screen. The date and time that the 7-day performance history was last cleared appears at the bottom of the screen.

4 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

ALARMS SUBMENU

The COLU detects and reports HDSL, POTS, and System related alarmed events to the PAU/PMU (if present). Only events provisioned for Major or Minor notification types are reported. Select *Alarms* at the menu bar and press ENTER to view the submenu.

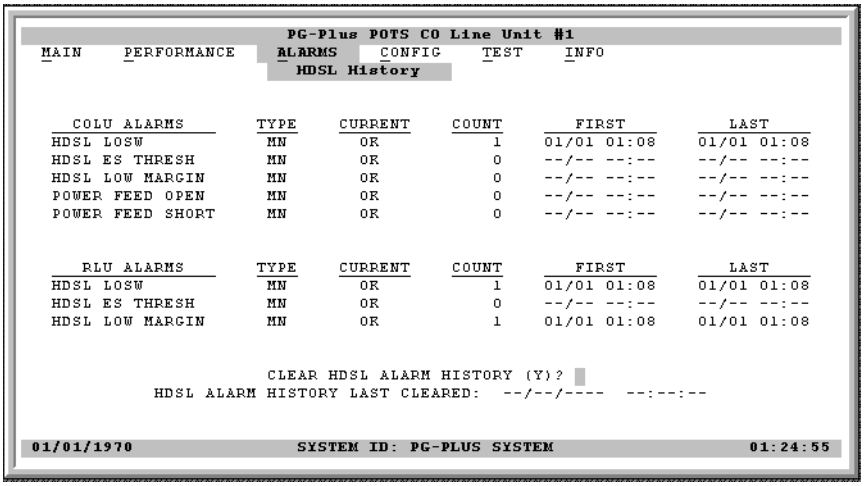


HDSL History Screen

The HDSL history maintained on the COLU contains a count of the number of times each alarm occurred, the time and date of the first and last occurrence, the provisioned notification type, and the current status (see Table 5). Here you see the results of the alarms set at the Configuration submenu "HDSL Alarm Types Screen" on page 24.

1 Select *Alarms* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *HDSL History* option and press ENTER to view the screen:



If there are no active alarms, the status OK appears in the Current column.

3 To clear the information, type Y at the Clear HDSL Alarm History? prompt.

Clearing the alarm history clears the RT and the COLU alarm history, regardless of whether you clear it from the COLU or the RT page of the history screen. If there is an active alarm, then the count is set to 1 and the value in the Last date and time field is set to the First date and time field.

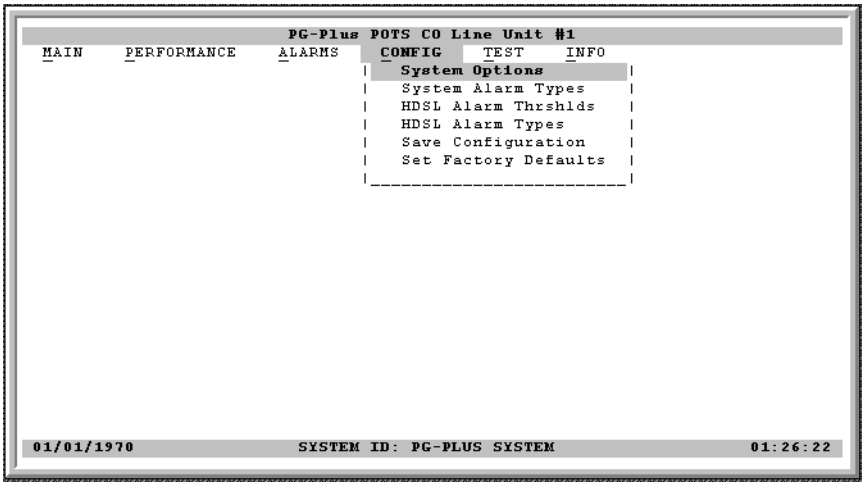
4 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

Table 5. *HDSL Alarms Screen*

Alarm	Description	Default
LOSW	COLU cannot receive data over the given HDSL loop. COLU and RT cannot synchronize and are out of service.	MN
ES-24 Hr.	Number of HDSL ES exceeded the user-configurable threshold to give advance warning that HDSL performance is deteriorating. Set this threshold from 0-255 ES over a 24-hour period, or disable the alarm completely.	MN
MAR	HDSL noise margin of the loop has fallen below the user-configurable threshold. HDSL margin reaches or drops below the current threshold value.	MN
PFO	COLU cannot power the RT due to an open circuit. An undercurrent condition as detected by the RT exists for the given pair (<20 mA). A possible cause is that there is no RT at the other end of the circuit. No user intervention is required	MN
PFS	COLU cannot power the RT due to a short circuit. An excessive current condition as detected by the COLU exists for either pair (>50 mA). PFS alarm indicates an overcurrent condition due to wire shorting or an RT failure. COLU automatically turns off power feeding to both loops in response to a PFO or PFS condition on a single loop. No user intervention is required.	MN

CONFIGURATION SUBMENU

Provides access to system provisioning screens, and an easy means of resetting all options to factory defaults. Select *CONFIG* at the menu bar and press ENTER to view the submenu.

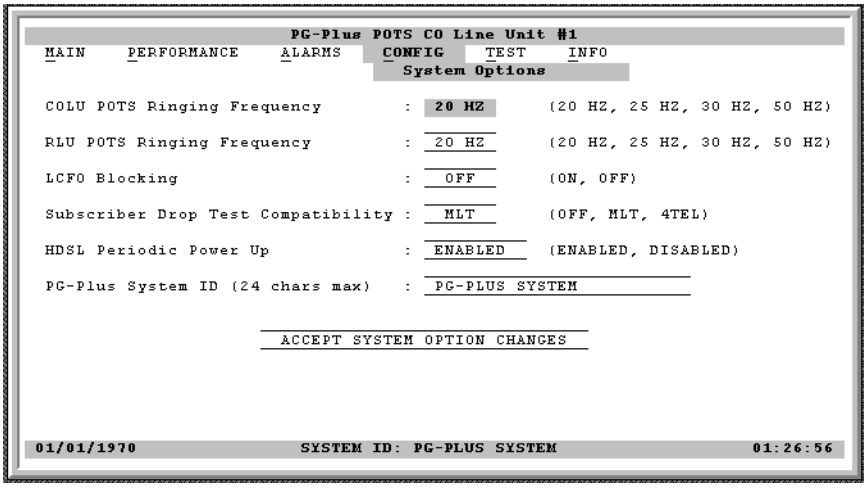


System Options Screen

System Options screen allows the provisioning of options such as ringing frequency, SDT, HDSL Periodic Power Up, and a System ID. Table 6 shows the configured system option and the factory default value.

1 Select *CONFIG* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *System Options* line and press ENTER to view the screen:



3 With the desired field highlighted, press the SPACEBAR to toggle to the desired value.

4 Move to the next option and continue until you have completed the changes.

5 Move to the Accept System Option Changes field, and press ENTER to accept the changes.

6 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

Table 6. *System Options Configuration Fields*

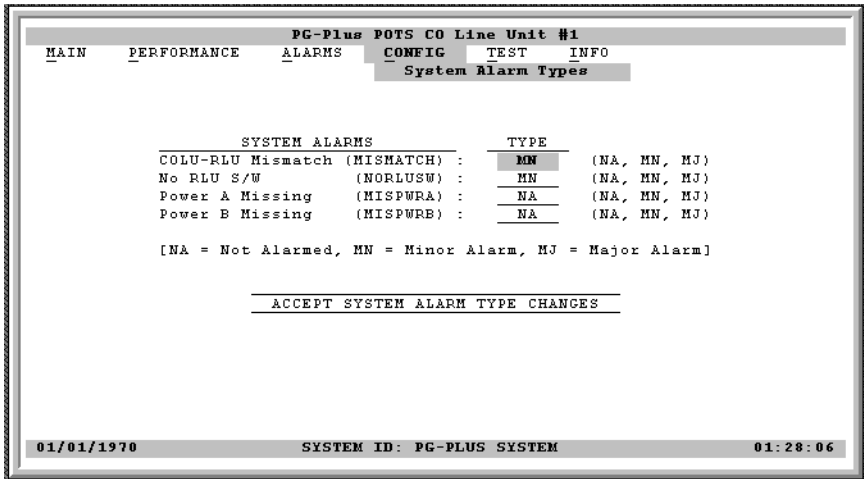
Options	Description	Default
POTS Ringing Frequency	Ringing frequency sent from the RT to the subscriber. Possible values include 20 Hz, 25 Hz, 30 Hz, and 50 Hz.	20 Hz
SDT Compatibility	Specifies whether the PG-Plus initiates and operates with MLT or 4TEL loop test systems. Possible values include Off, MLT, and 4TEL. Craft initiated drop tests work in any selection.	MLT
LCFO Blocking	OFF, Detecting Removal of Battery command from CO causes RT to remove battery feed to the subscriber pair. ON, the detection of Removal of Battery command from CO does not cause the RT to remove battery feed to the subscriber pair.	Off
HDSL Periodic Power Up	ENABLED, PG-Plus in Metallic Fallback attempts to power up the HDSL line every 5 minutes or anytime the HDSL pair is shorted for 2 seconds and then opened. DISABLED inhibits the power-up sequence under any circumstances and the system remains in Metallic Fallback.	Enabled
PG-Plus System ID	Configurable identification string for system can be up to 24 characters. Because the System ID is always visible at every COLU screen, it is easy to know which COLU screens are displayed. There are no special rules for changing the System ID. Any printable character, including space, is valid.	PG-Plus System

System Alarm Types Screen

Allows the provisioning of the alarm types of all system alarms. Table 7 shows the System Alarm fields and their default settings. You can view the results of these settings from the "COLU Summary Screen" on page 13.

1 Select *CONFIG* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *System Alarm Types* option and press ENTER to view the screen:



3 Highlight the COLU RLU Mismatch option and press the SPACEBAR to toggle to the desired value for the Alarm Type.

4 Move to the next option. Continue until you have made all the desired changes.

5 Move to the Accept System Alarm Types Changes field, and press ENTER to accept the changes.

6 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

Table 7. *System Alarm Types Configuration Fields*

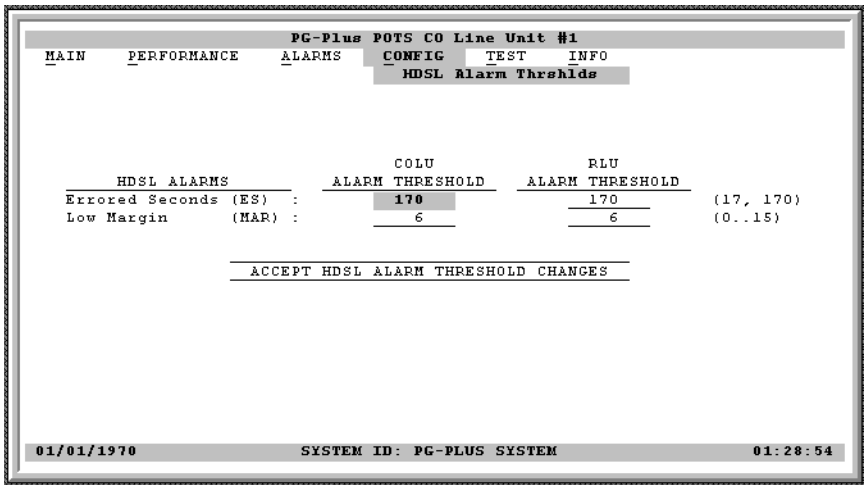
Alarms	Description	Default
MISMATCH	Incompatible COLU and RT units installed, for example, a 6 POTS COLU is connected to a 2 ISDN RT.	MN
NORLUSW	RT has no application software and is awaiting software download.	MN
MISPWRA	COLU detected missing A -48 V power source. If power is verified at the unit, then the unit must be replaced, because it has a blown fuse.	NA
MISPWRB	COLU has detected missing B -48V power source. If power is verified at the unit, then the unit must be replaced, because it has a blown fuse.	NA

HDSL Alarm Thresholds Screen

Provides a means to provision the threshold crossing values for the 24-hour ES count and low margin dB. Table 8 lists the fields of the HDSL Alarm Thresholds and the default factory values.

1 Select *CONFIG* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *HDSL Alarm Thrshlds* option and press ENTER to view the screen:



3 With the desired field highlighted, press SPACEBAR to toggle to the correct value for that field.

4 Move to the next option and continue until you have completed the changes.

5 Move to the Accept System Option Changes field and press ENTER to accept the changes.

6 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

Table 8. *HDSL Alarm Threshold Fields*

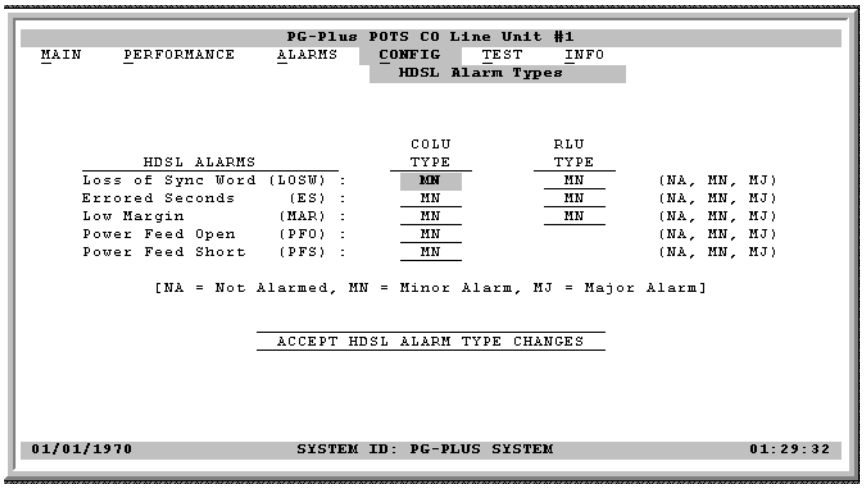
Thresholds	Description	Defaults
ES (24 hour count)	HDSL ES alarm is set active if ES counts become equal to or greater than this threshold. Possible HDSL ES threshold values include 17 and 170.	170
Low Margin (dB)	HDSL Low Margin alarm is set active if margin drops equal to or less than this threshold. Possible HDSL low margin threshold values include values from 0 through 15.	6

HDSL Alarm Types Screen

Allows the provisioning of the alarm types for all HDSL Alarms.Table 8 lists the Alarm Reports and Table 5 shows the HDSL Alarms, the possible alarm Types, and the default factory settings. You can view the results of these settings from the "HDSL History Screen" on page 19.

1 Select *CONFIG* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *HDSL Alarm Types* option and press ENTER to view the screen:



3 At the LOSW field in the COLU Type column, press TAB to toggle to the desired value.

4 Move to the next option and continue until you have completed the changes.

5 Move to the Accept HDSL Alarm Type Changes field, and press ENTER to accept the changes.

6 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

Table 9. *Alarm Reports*

Settings	PAU/PMU Reports	Fault LED Affected	Main Summary Listing	History Updated
CR/MJ/MN	Yes	Yes	Yes	Yes
NA	No	No	No	No
NR	No	Yes	Yes	Yes

Table 10. *HDSL Alarm Types*

Alarm	Description	Default
LOSW	COLU cannot receive data over the given HDSL loop. COLU and RT cannot synchronize and are out of service.	MN
ES	Number of HDSL ES has exceeded the user-configurable threshold to give advance warning that HDSL performance is deteriorating. You can set this threshold from 0-255 ES over a 24-hour period, or disable the alarm completely. 24 hour ES alarm threshold reached or exceeded.	MN
MAR	HDSL noise margin of the loop has fallen below the user-configurable threshold. HDSL margin reaches or drops below the current threshold value.	MN
PFO	COLU cannot power the RT due to a short circuit. An excessive current condition as detected by the COLU exists for either pair (>50 mA). A PFS alarm indicates an overcurrent condition due to wire shorting or an RT failure. COLU automatically turns off power feeding to both loops in response to a PFO or PFS condition on a single loop. No user intervention is required.	MN
PFS	COLU cannot power the RT due to a ground fault.	MN

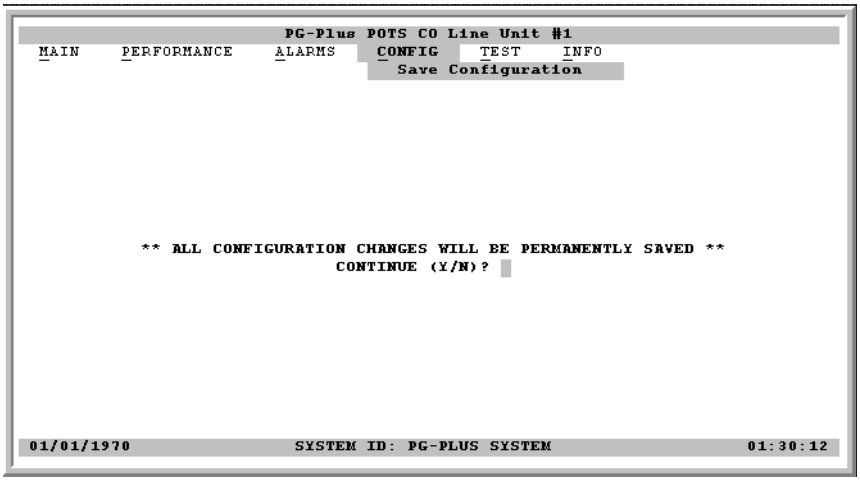
Save Configuration Screen

Saves configuration changes in nonvolatile memory.

Changes made through all other configuration screens do not become permanent changes until the changes are saved through the Save Configuration option.

1 Select *CONFIG* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *Save Configuration* option and press ENTER to view the screen:



3 Type Y at the Continue? prompt to save the changes to nonvolatile memory, or N to maintain the current defaults.

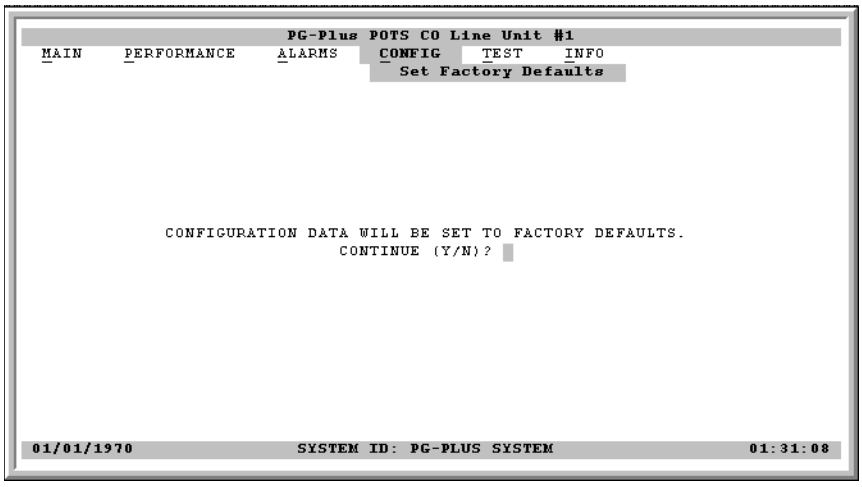
4 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

Set Factory Defaults Screen

Sets all configuration data back to factory default values.

1 Select *CONFIG* at the menu bar and press ENTER to display the submenu.

2 Scroll to the *Set Factory Defaults* option and press ENTER to view the screen:



3 Type Y at the Continue? prompt to reset the system to the default values, or N to maintain the current defaults.

This does not make the configuration changes permanent. The *Save Configuration* option must be used to make the changes permanent.

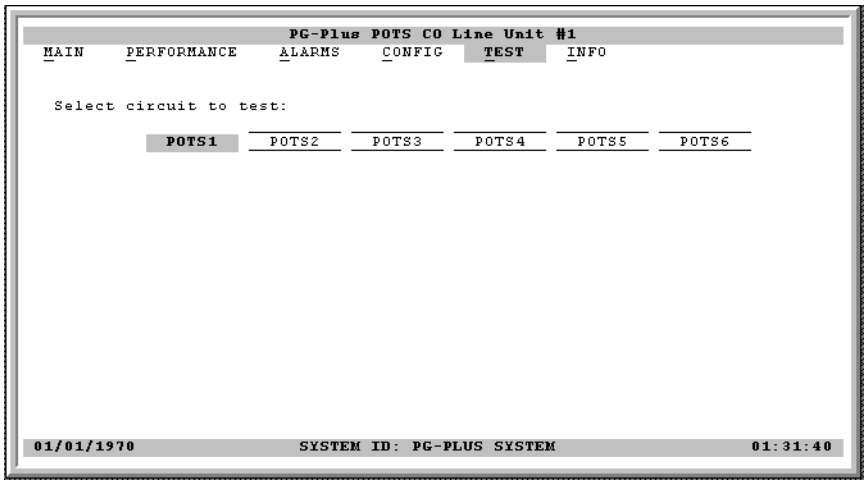
4 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

TEST SUBMENU

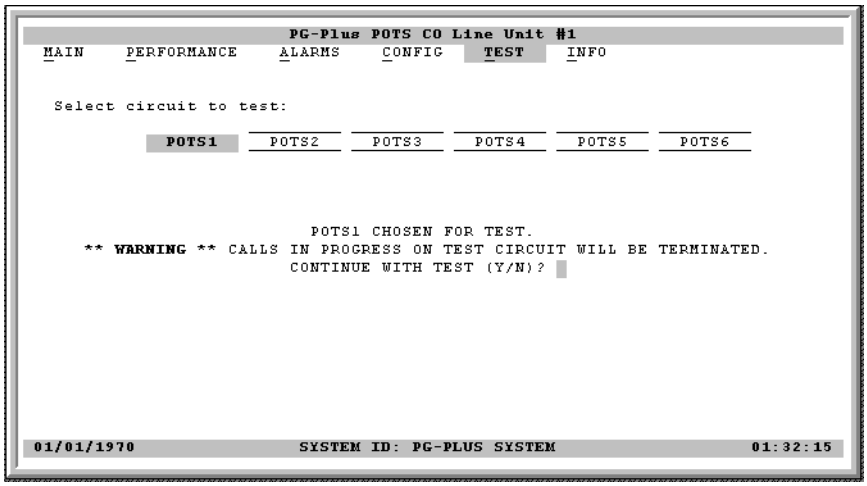
PG-Plus supports testing of a subscriber drop in two ways. A test can be initiated by applying a test voltage between the Tip and Ring at the COLU through an MLT test set or by selecting it from the menu item through the VT-100 terminal connected to the PAU or PMU Craft port. The relays in the COLU and RT provide a path for performing a SDT.

1 Select *Test* at the menu bar and press **ENTER** to display the submenu.

2 Use the **TAB** key to move to the desired circuit to test and press **ENTER**.



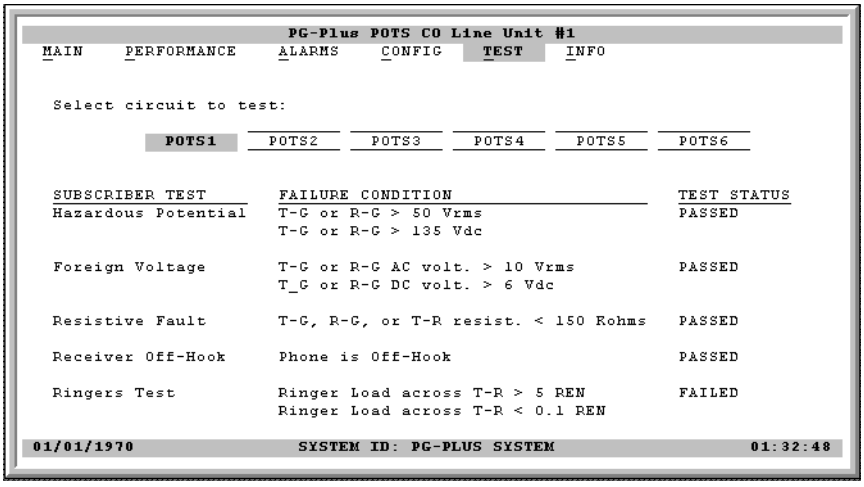
3 A warning displays when a POTS channel is selected for the test.



4 To continue with the test type **Y**, or type **N** to halt the test. A Test In Progress `message` displays on the screen throughout the test.

Performing a SDT on one of the POTS channel interrupts service on the line under test. The remaining lines on the PG-Plus system remains in service.

When the tests are complete, the Drop Tests Results screen displays. The results contains Subscriber Test, Failure Condition, and Test Status. Tests are performed in the order of display. If a test fails, the remaining tests are not performed (as per TR-909). It takes approximately seven to eight seconds for all tests to complete.

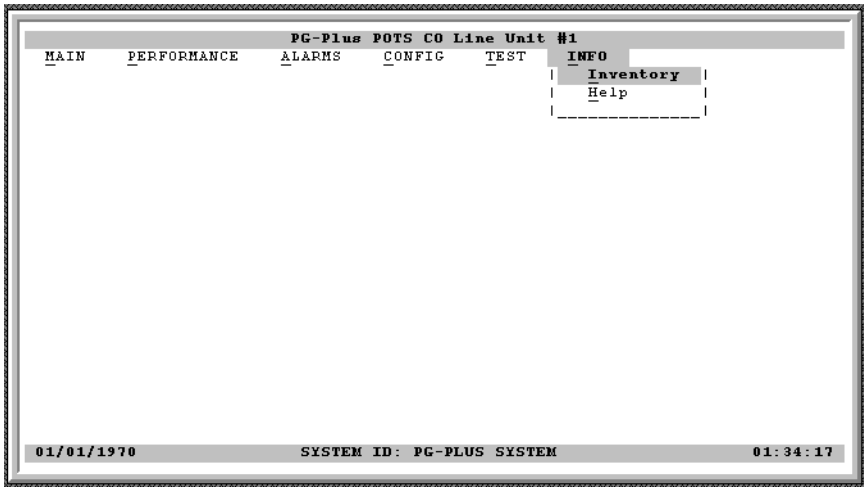


5 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

INFORMATION SUBMENU

Provides technical information about the COLU and contact information for PairGain Technologies, Inc.

1 Select *INFO* from the menu and press ENTER to display the submenu.

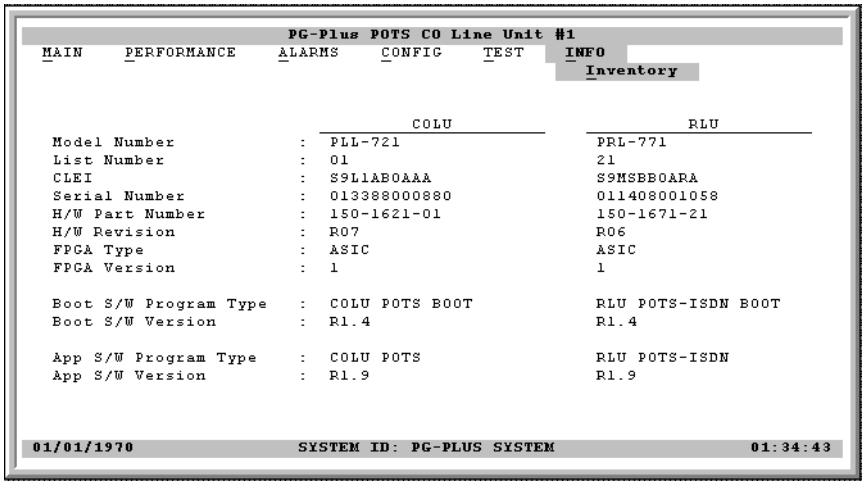


2 Select either *Inventory* or *Help* to view the associated screen.

3 Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.

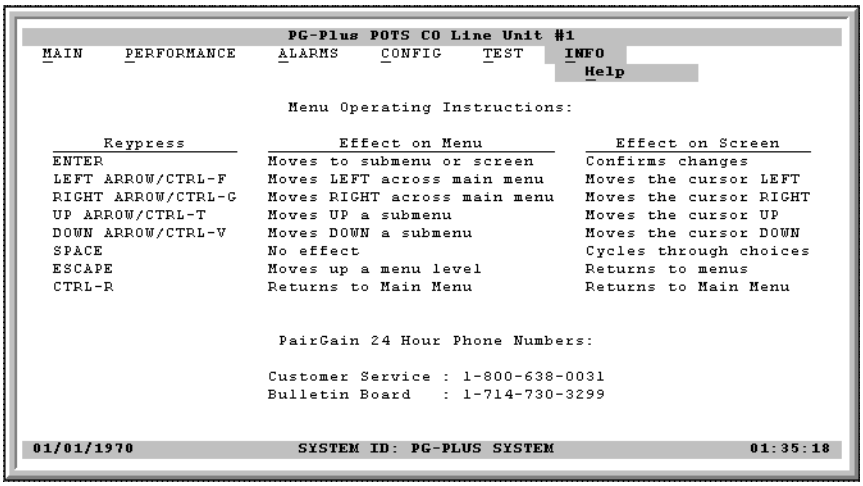
Inventory Screen

Displays all the critical information about the COLU and RT. Press ESC to move up a menu level, or CTRL+R to return to the PAU or PMU Main menu.



Help Screen

Provides information on using the screens and menus. The Help screen also lists the PairGain Customer Support and Bulletin Board telephone numbers. Press ESC to move up a menu level, or CTRL+R to return to the PAU/PMU Main menu.



FAULT ISOLATION

The following sections detail the fault isolation procedures. For the values to correct such conditions as "distance limitation exceeded," refer to the section "Specifications" on page 2.

COLU AND RT FAULT INDICATORS

At the CO, you can use the Craft interface to initiate a SDT to determine the cause of any of the following problems. The SDT performs Hazardous Potential, Foreign Voltage, Resistive Faults, Receiver Off-Hook, and Ringers Tests. At the customer site, the following sections provide procedures for isolating faults indicated by the COLU LEDs.

LED	Mode	Condition	Procedure
None	On	processor in the COLU stopped	**1** Remove and re-insert the COLU. **2** At the VT-100 interface, go to the COLU Main screen to view the Performance report to verify that no alarms exist. If the COLU Main screen cannot be viewed, a communication error exists, indicating a faulty COLU. **3** If the LEDs do not illuminate, replace the COLU.
Fault	On	indicates an existing alarm condition on the COLU	**1** At the VT-100 interface, go to the COLU Main screen to view the Performance report to determine the cause of the alarm. Correct the condition, if possible. If the COLU Main screen cannot be viewed, a communication error exists. **2** Remove and re-insert the COLU. **3** If the communication error still exists, replace the COLU.
Margin	On	distance limitation exceeded fault in HDSL line faulty COLU	**1** At the VT-100 interface, go to the COLU Main screen to view the Performance report to verify that no alarms exist. **2** Initial installation, check engineering records for distance between COTS and RT. **3** If existing installation, measure loss of HDSL line to ensure that the maximum attenuation value has not been exceeded. **4** Replace COLU or the RT or both.
Margin	Flashing	distance limitation exceeded fault in HDSL line faulty RT	**1** Initial installation, check engineering records for distance between COTS and RT. **2** If existing installation, measure loss of HDSL line to ensure that the maximum attenuation value has not been exceeded. **3** Replace the COLU or the RT or both.
SYNC	Off	HDSL line has lost synchronization distance limitation may have been exceeded COLU is faulty	**1** Initial installation, check engineering records for distance between COTS and RT. **2** If existing installation, measure loss of HDSL line to ensure that the maximum attenuation value has not been exceeded. **3** Replace the COLU or the RT or both.

LED	Mode	Condition	Procedure
PWR	Off	no input power	**1** Ground fault condition exists.
		on-board fuse is blown on COLU	**2** Check input power at COTS backplane with COLU removed.
			3 If power is present at COTS backplane, replace the COLU.
PWR	Flashing	HDSL line open	**1** Check line continuity and resistance.
		an overload exists	**2** COLU power supply or RT may be faulty.

SUBSCRIBER REPORTED FAULTS

At the CO, you can use the Craft interface to initiate a SDT to determine the cause of any of the following problems. The SDT test performs Hazardous Potential, Foreign Voltage, Resistive Faults, Receiver Off-Hook, and Ringers Tests. At the customer site, the following sections provide procedures for isolating faults, based on subscriber reports.

Conditions	Causes	Procedures
no dialtone, can not dial	Short-circuit or open-circuit	**1** At the CO using the Craft interface, select *TEST* option, and view the test results. The tests run are for Hazardous Potential, Foreign Voltage, Resistive Fault, and CPE Termination.
	faulty COLU or RT	**2** At the RT, lift the subscriber pair at the RT by opening the RJ-11 connector on the Integrated Protector Module. If dialtone is present at the RT and calls can be placed, the fault is in the subscriber side. Check for shorts or opens towards the subscriber or on the customer premise.
		3 If dialtone is not present with the RJ-11 test connector lifted, lift the jumper in the CO between the CO switch and the COTS. If dialtone is present at the switch, replace the COLU.
		4 If after replacing the COLU the dialtone is still not present, the fault is in the RT. Replace the RT.
Phone does not ring	high-resistance short on subscriber drop (REN load exceeded, see Specifications)	**1** At the CO, using the Craft interface, go to the COLU Main screen to verify the correct operation of the COLU. If you cannot view the COLU Main screen, a communication error exists indicating a faulty COLU. Remove and re-insert the COLU.
	faulty RT or COLU	**2** Go to the *Test* option, and select the desired circuit to test.
		3 View the SDT results. Refer to the Test Submenu section for specific results.
		4 At the RT, check for ringing at the RT with the RJ-11 test jack open. If ringing is not present, check for ringing on another line terminated on the same RT. If ringing is present on other lines, check for high-resistance shorts on the subscriber drop. If no high resistance shorts, replace the RT.
		5 If ringing is not present on another circuit terminated on the RT, lift the jumper between the CO switch and the COTS. If ringing is present, replace the COLU. If ringing is not present, the fault is in the switch.
Phone does not stop ringing	faulty subscriber station instrument	**1** If phone stops ringing when using a butt set at the subscriber location, the subscriber's station internal resistance is too high. Replace phone.
	loop length too long	**2** If phone does not stop ringing when using a butt set at the subscriber location, one or both of these conditions exist:
	faulty RT	• loop length is too long (refer to Specifications) • or the RT is faulty

Conditions	Causes	Procedures
Can not hear,can not be heard	subscriber problem	**1** Open the RJ-11 test jack at the RT. If audible level is acceptable, the problem is with subscriber equipment.
	faulty COLU or RT	**2** If audible level is too low at the RT with the RJ-11 test jack lifted, lift the jumper in the CO between the CO switch and the COTS. • If audible level is acceptable, replace the COLU or RT • otherwise, the problem is in the CO switch

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.

In addition, PairGain maintains a computer bulletin board system for obtaining current information on PairGain products, product troubleshooting tips and aids, accessing helpful utilities, and for posting requests or questions. This system is available 24-hours-a-day by calling (714) 730-3299. Transmission speeds up to 28.8 kbps are supported with a character format of 8-N-1.

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.
(800) 638-0031

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 unit is designed 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 in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the situation by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Consult the dealer or an experienced radio or television technician for help.

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

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DNV Certification, Inc.
Certificated Firm