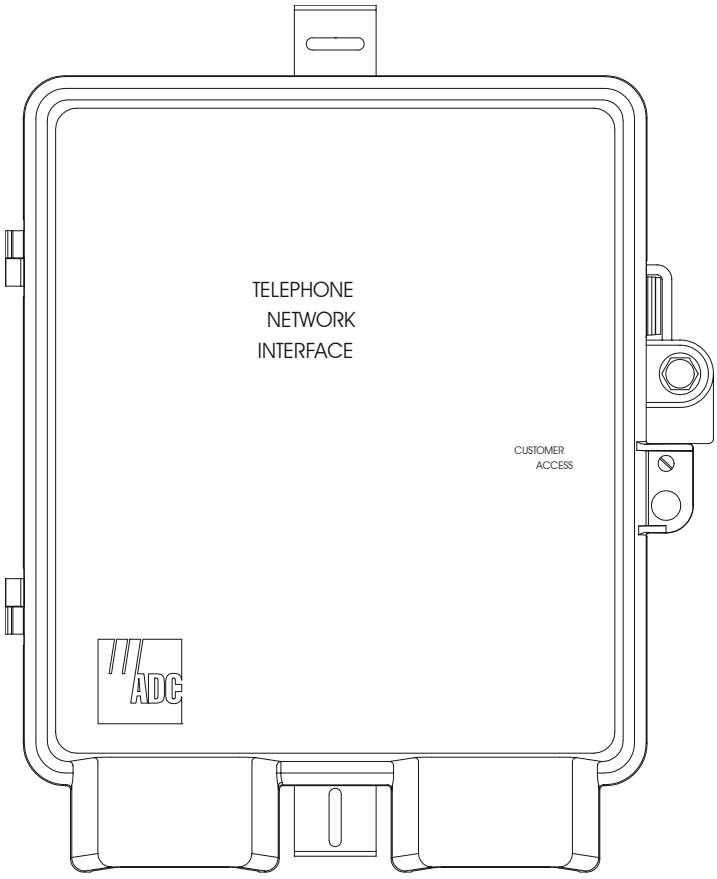
PG-PLUS

TECHNICAL PRACTICE



6 UVG OUTDOOR/INDOOR NID

Model	List	CLEI Code
PRL-779	1C	S9MSCHAA~~

SECTION SCP-PRL779-013-03H

Revision History of This Practice

Revision	Release Date	Revisions Made
01	October 8, 1999	Initial Release
02	January 30, 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 15. 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-Plus® PRL-779, List 1C, provides interfaces for UVG subscribers. The RT supports Loop Start and Ground Start (LS/GS) POTS, allows Tip and Ring polarity reversal for support of Millennium payphones, and implements TR-08 channel testing. The PRL-779 is a 4 UVG Remote Terminal.

DESCRIPTION

A PG-Flex system provides bidirectional transport of multiple DS0s over a single, unconditioned wire pair using HDSL technology. Using an existing cable, PG-Flex provides for higher bandwidth needs of residential and business customers by providing multiple UVG interfaces on a single HDSL twisted-pair wire. Figure 1 shows a minimally configured PG-Flex application that consists of one COTS, one COLU, and one RT.

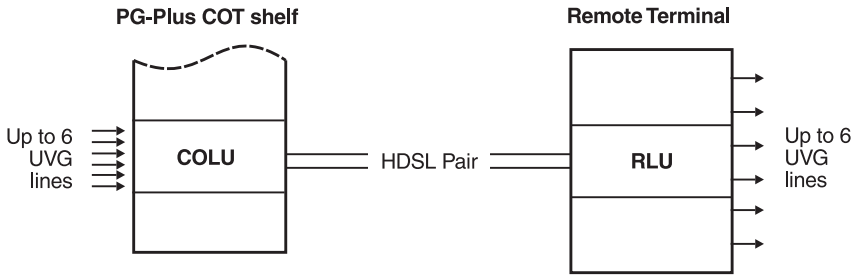

Figure 1. *Typical PG-Plus Application*

Each COLU housed in a COTS interfaces with a corresponding RT. Using one pair of 24-gauge wire, the RT can be located up to 21.7 kft from the COTS. UVG or digital lines from a CO switching system connect to the COTS and are sent by means of the COLU and the HDSL wire pair to an RT. As an example, a 23-inch COTS can interface with sixteen different RTs providing up to six UVG lines each, for as many as 96 subscriber lines. The COTS operates on standard -48 Vdc CO battery and supplies power to the RT, eliminating the need and expense of providing local power. A PG-Plus system with HDSL transmission and line-powered RTs results in fast, cost-effective solutions to UVG deployment over minimal copper facilities.

Integrated Channel Testing

The UVG RT supports channel testing as described in TR-TSY-000008 and TR-TSY-000465 when the PG-Flex system is configured to interface to a TR-08 compliant digital switch. During the channel test, a sequence of hand-shaking messages and tones are exchanged between the PG-Flex system and the switch, and the UVG RT responds by applying the appropriate absorbtive (600 Ω) or reflective (0 Ω) test terminations to the remote channel under test, thus allowing for both transmission and signalling tests to be performed on that specific channel. The transmission tests verify the transmission parameters, such as channel loss, return loss, and idle channel noise are within the required limits, and the signalling tests, that consist of off-hook detection and a ringing test, ensure that the channel can detect and produce the correct signalling states. In addition to the channel testing, the UVG RT works in conjunction with the switch to provide SDT.

Metallic Fallback

Metallic fallback provides a direct connection from the CO to one subscriber under fault conditions. The metallic fallback feature is a provisionable item. You can be disable this feature through the user screens.

Service is provided to the subscriber assigned to the UVG line in the affected COLU. At the RT, the system exits metallic fallback and attempts to synchronize if either UVG 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 under control of the PG-Flex PAU or PMU provide a path for SDT and metallic fallback operation. These relays are used to establish a path to channel 1 of the UVG RT during fault conditions and to provide for drop testing of the selected subscriber line from the CO location.

SPECIFICATIONS

Power	
Voltage Safety	A2 compliant per GR-1089-CORE
HDSL Line Input Voltage	+/-135 Vdc Tip to Ring, maximum
HDSL Line Start-up Voltage	+/- 100 Vdc Tip to Ring, minimum
RT Input Power	10.2 Watts typical; 11.2 Watts Tip to Ring, maximum with 4 offhook, 2 ringing 5 REN
HDSL	
Line Code	2B1Q
Line Rate	130.6 K symbols/sec; 262 Kbps
Line Reach	26 AWG (0.4 mm),15.0 kft (4.57 km) 24 AWG (0.5 mm), 21.7 kft (6.61 km) 22 AWG (0.6 mm), 31.2 kft (9.51 km) 19 AWG (0.9 mm), 49.7 kft (15.1 km)
Maximum Attenuation	45.9 dB at 65 kHz
Environment	
Temperature	-40° F to +149° F (-40° C to + 65° C)
Humidity	5% to 95% noncondensing
Altitude	-200 ft. to 13,000 ft. (-60 m to 4,000 m)
Compliance	NEBS Level 3 per SR-3580
Human Safety	UL 1950
Emissions Radiation and Immunity	GR-1089 Core Class B and FCC Part 15 for Class B compliant

UVG Interface

Analog Impedance	600 Ω
RT supervisory range	300 Ω plus 430 Ω for handset; or 3.5 kft on 26 AWG; 5.7 kft on 24 AWG; 9.2 kft on 22 AWG
Detection of Loop Open	≥10 kΩ
Idle State Voltage	-48 V minimum
Loop Current	23 mA minimum
Ring Generation	Unbalanced Trapezoidal 40 Vrms minimum @ 20 ± 3 Hz up to 5 REN per line (10 REN total at RT)
Ring Trip	Removed in 200 ms after Loop Closure

Connectors

HDSL	3-terminal station protector, 3/8-inch hex nut
UVG	Screw Terminals on RJ-11 line interface

Dimensions

Height	10.25 in. (26.0 cm.)
Width	8.5 in. (21.6 cm.)
Depth	4.75 in. (12.1 cm.)
Weight	3.0 lb. (1.4 kg.)

INSTALLATION AND TURN-UP

To ensure the safety of personnel and equipment, observe the following safety rules:

Be careful when installing or modifying telephone lines. Dangerous voltages can be present. It is unsafe to install telephone wiring during a lightning storm. Always disconnect all telephone lines and power connections before servicing or disassembling this equipment.

All wiring external to the product should follow the local wiring codes.

Always treat the HDSL pair as if it were live with high voltage present. Use caution when installing an HDSL pair that is already connected to a COLU, because dangerous voltages are present on the HDSL pair.

The COLU, unless previously disabled by means of Craft provisioning, periodically attempts to power up the RT by applying +/-130 Vdc to the HDSL pair. The COLU also initiates a start-up after a short of at least 3 seconds has been applied to the HDSL pair. The COLU responds with start-up voltage 3 seconds after removal of the short.

The installation of an RT, described in the following sections, involves the following procedures:

- preparing the RT for wiring
- mounting the RT
- opening the RT housing
- wiring the RT
- turn-up and testing
- closing the housing

REQUIRED TOOLS AND TEST EQUIPMENT

- UVG telephone set
- $^{1}/_{4}$-inch flat-head screwdriver
- No. 1 Phillips screwdriver
- insulated-handle $^{3}/_{8}$-inch nut driver
- insulated-handle wire stripper
- insulated-handle needlenose pliers
- insulated-handle wire cutter

PREPARING THE RT

HDSL and subscriber wiring are threaded through rubber grommets at the bottom of the RT. Subscriber line connections are made through the right-hand side of the Line Modules. Use a No. 1 Phillips screwdriver to punch two small holes in the bottom of the rubber grommet on the left-hand bottom side and one small hole in the right-hand grommet of the RT.

The RT is now prepared for mounting.

Cutting the grommet with a utility knife or something similar is not recommended, because this can cause too large an opening thus allowing contaminants to enter.

MOUNTING THE RT

Use the two No. 10 x 1.5-inch wood screws and flat washers provided in the Mounting Kit to attach the RT to the side of the customer residence (see Figure 2). For mounting on stucco or other suitable surfaces, use the two No. 10 x 1-inch anchor nuts from the kit.

Mount the RT only as shown, with all access openings facing down. Otherwise, possibly damaging materials (such as fluids) can enter the RT.

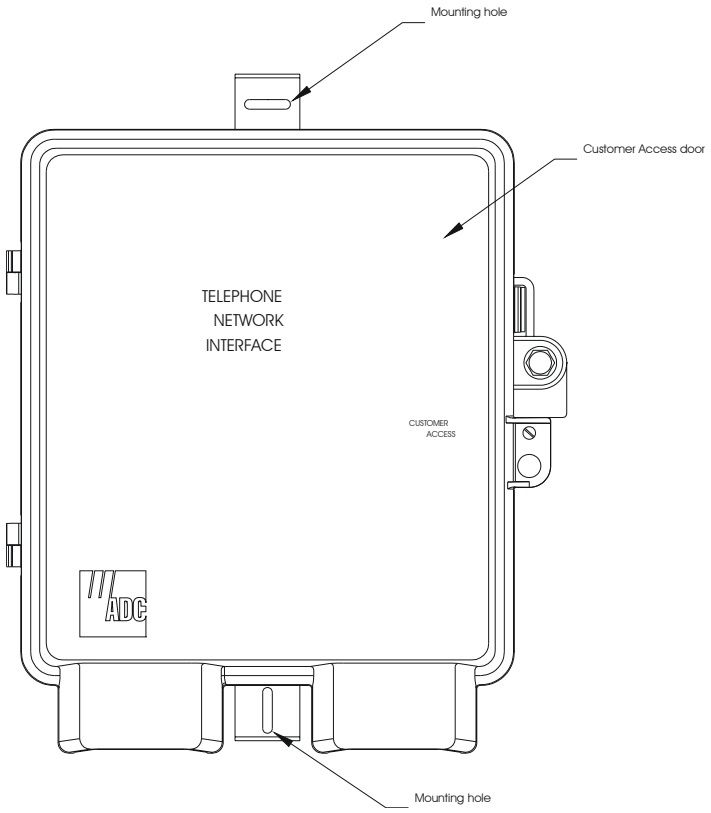

Figure 2. *Mounting the RT*

OPENING THE RT HOUSING

To gain access to the interior of the RT and to each Line Module, use a $^{3}/_{8}$-inch nut driver to loosen the Telco override screw.

For installations that service more than one subscriber from a single RT, plug the customer-padlock hole in the Customer Access door hasp with a $^{3}/_{8}$-inch diameter hole plug (see Figure 3) to prevent the use of a padlock. When the RT services only one subscriber, that subscriber can place a padlock through the customer-padlock hole drilled into the Access door hasp to secure the Customer Access door.

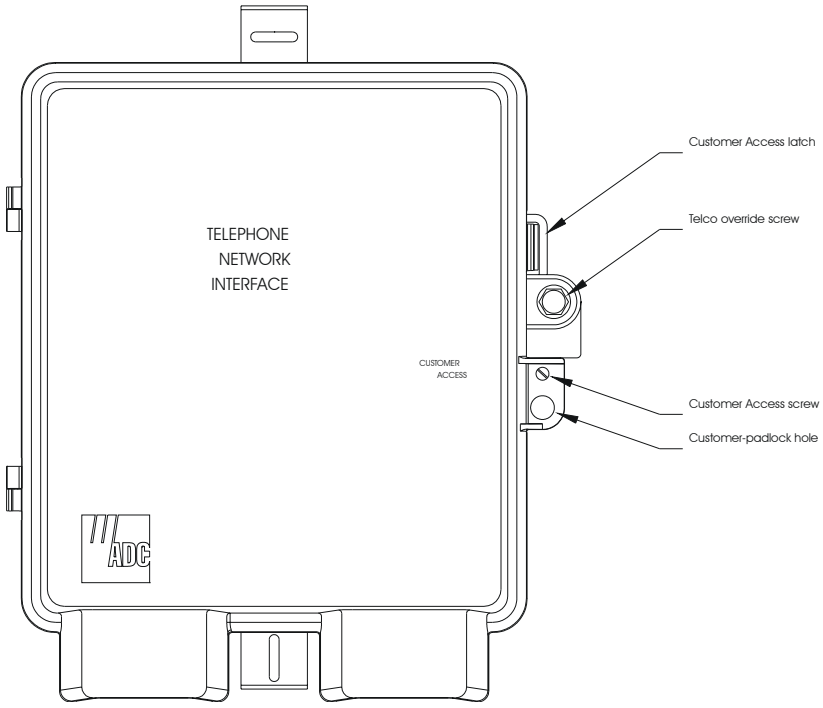

Figure 3. *Securing the Customer Access Door*

WIRING THE RT

Wiring the RT consists of three major steps:

- attaching the frame-ground wire
- attaching the HDSL Tip and Ring wires
- attaching the subscriber line wires

A wiring harness, consisting of a cable for the subscriber pairs, a cable for the HDSL pair, and a frame ground wire, is held with a strain relief as it exits the RT frame. The harness is factory-wired to the primary protection devices for the HDSL pairs and to the FGND bus. The subscriber wiring harness connects directly to the line modules. An additional frame ground is attached to the inner RT frame.

During installation, refer to the RT Reference label (see Figure 4) affixed inside the Customer Access door. The middle section of the Reference label identifies the Frame Ground and HDSL Tip and Ring wires, and the wire color code for the subscriber lines.

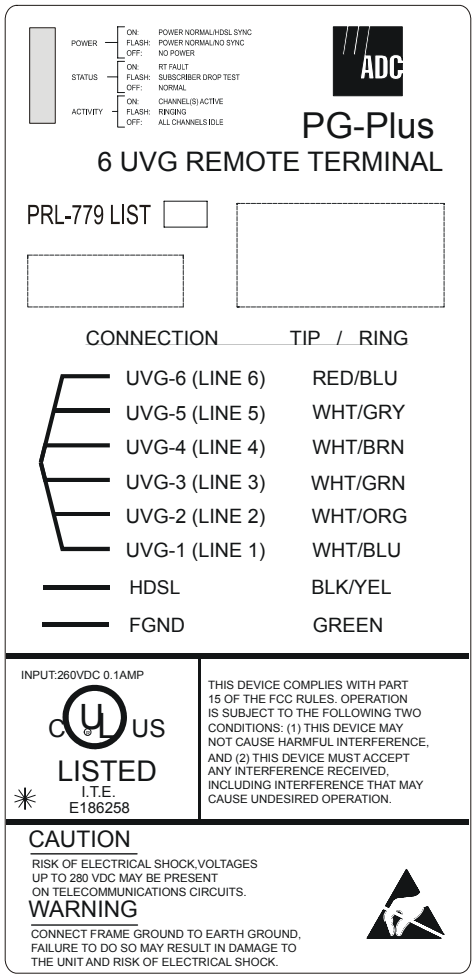

Figure 4. *Reference Label*

Attach the Frame-Ground Wire

1 Use the $^{3}/_{8}$-inch nut driver to open the Telco Access door.

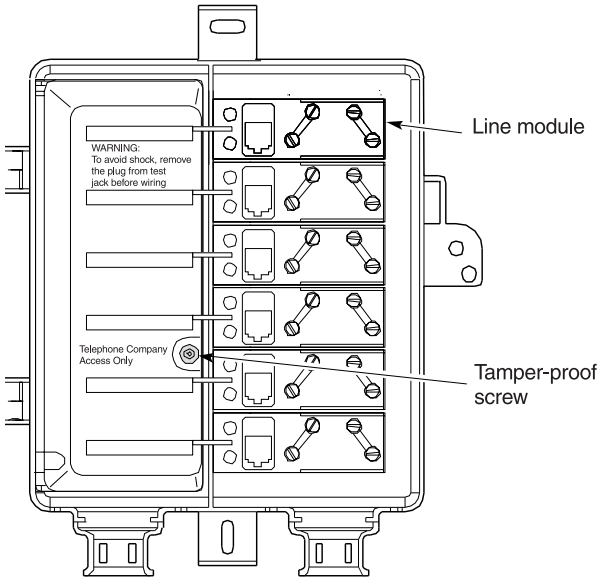

Figure 5. *Accessing a Line Module*

2 Insert the FGND wire through one of the holes in the left-hand rubber grommet. A 10 AWG (25.8 mm) solid copper ground wire is recommended.

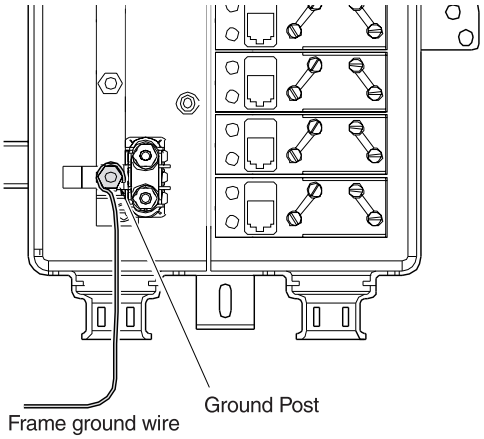

Figure 6. *Attaching the Frame-Ground Wire*

3 Loosen and remove the top nut and three flat washers from the ground-binding post.

4 Loop the FGND wire around the ground-binding post. Replace and tighten, in reverse order, the hardware removed earlier.

Attach the HDSL Tip and Ring Wires

HDSL and subscriber wiring are threaded through rubber grommets at the bottom of the RT. The HDSL pair from the COTS is terminated on an over-voltage-protected threaded binding post at the bottom of the enclosure and connected to the HDSL pair in the wiring harness.

Always treat the HDSL pair as if it were live with high voltage present. Review the safety precautions at the beginning of this section before proceeding.

1 Insert the service cable containing the HDSL Tip and Ring wires into the second hole in the bottom of the left-hand rubber grommet.

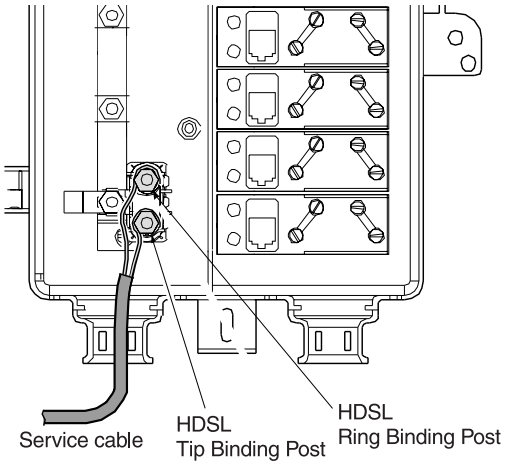

Figure 7. *Attaching the HDSL Tip and Ring Wires*

2 Loosen the top nuts on the Tip and Ring gas-tube protection binding posts (see Figure 7).

3 Remove the service cable outer jacket from the cable inside the RT, strip the insulation from the end of the HDSL Ring wire using an insulated-handle wire stripper, then carefully insert and loop the HDSL Ring wire in a clockwise direction between the top two washers on the HDSL Ring binding post.

To avoid electrical shock, handle the stripped HDSL wire by it's insulation with insulated-handled needlenose pliers.

4 Tighten the HDSL Ring binding post nut with an insulated-handle nut driver, then trim any excess uninsulated wire with an insulated-handle wire cutter.

5 Connect the Tip conductor as done with the Ring conductor.

Attach the Subscriber Line Wires

Subscriber line connections are made through the right-hand side of the Line Modules. An RJ-11 jack allows the subscriber line to be disconnected from the network, or allows for a test set to be plugged in as an aid to diagnostic tests.

This RT does not provide primary protectors on the subscriber pairs. It is to be mounted in a location where the subscriber wiring is entirely within or directly enters the customer premises.

If this RT is mounted in a location where the subscriber wiring is outside the plant or in an aerial location, ADC requires that primary gas tube protectors be installed on the subscriber wiring. The gas tube protectors should be mounted under the Telco access door. ADC recommends using Seicor SPD 126-TX gas tube protectors or the equivalent.

1 Thread the subscriber line pairs through the hole made earlier in the right-hand rubber grommet (see Figure 8).

2 Insert the subscriber line pair through the cutout on the right side of the Line Module. The HDSL Tip and Ring wires, which you installed in the previous section, are not shown in this graphic.

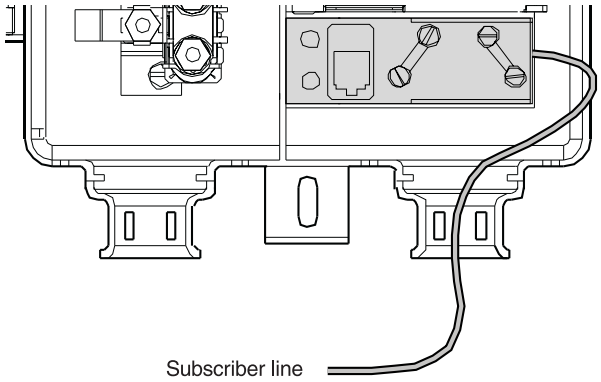

Figure 8. *Inserting the Subscriber Line Pairs*

3 Connect the Tip conductor to the Line Module binding post, connect the Ring conductor to the red terminal binding post(see Figure 9).

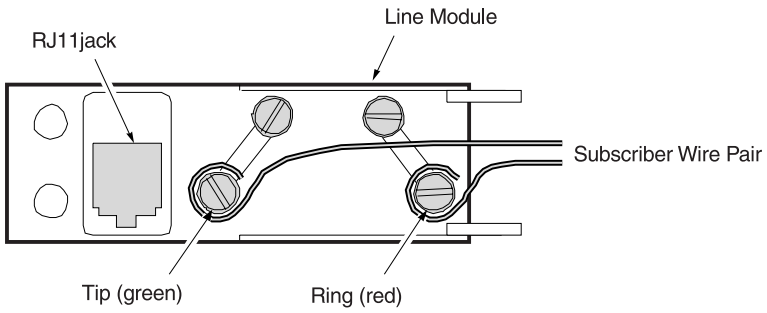

Figure 9. *Attaching the Subscriber Line Pair*

4 Repeat the steps for each additional subscriber line being installed.

TURN UP AND TESTING

1 Unplug each RJ-11 jack to ensure there are no wiring errors from the subscriber lines (see Figure 10).

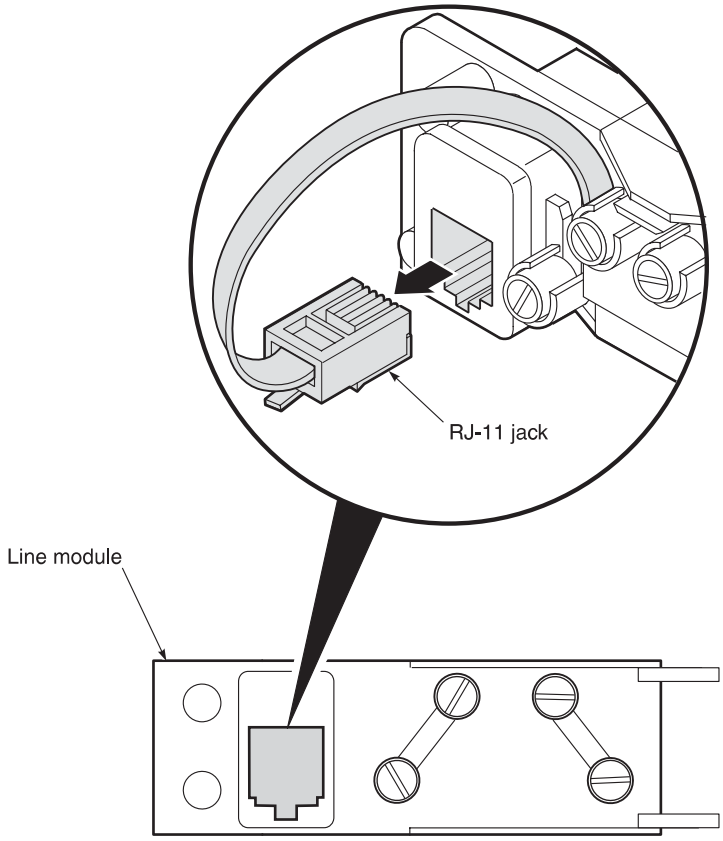

Figure 10. *Unplugging the RJ-11 Jack*

2 Open the Telco Access door and, at the Tip and Ring posts, apply a short between the HDSL Tip and Ring conductors for at least for 3 seconds. The following start-up sequence occurs after a 3-second delay:

- COLU responds with start-up voltage immediately
- RT detects HDSL line voltage, then initiates the HDSL start-up sequence
- PWR LED Flashes green

Start-up is complete when the PWR LED is On green and the ACTIVITY and STATUS LEDs are Off.

3 Reconnect the RJ-11 jacks and close the Telco Access door.

4 Follow standard procedures to check the overall performance of the subscriber channel coming in and out, including ringing, dialing, and transmission. Use the customer's telephone if possible.

CLOSE THE HOUSING

1. If you have not already done so, close the Telco Access door.
2. To avoid interference with the RT cover, tighten the screw on the Telco Access door until it is completely seated.
3. Close the RT housing cover and secure both the Telco override screw and the slotted-head Customer Access screw.

FAULT ISOLATION

The following sections detail the fault isolation procedures. For sections that indicate a condition such as distance limitation exceeded, refer to "Specifications" for the correct values.

RT STATUS INDICATORS

You can view the LEDs status through the window of the RT case. These LEDs indicate system states and subscriber line activity. The top portion of the label is a guide to the meaning of the Status LEDs (see Figure 11).

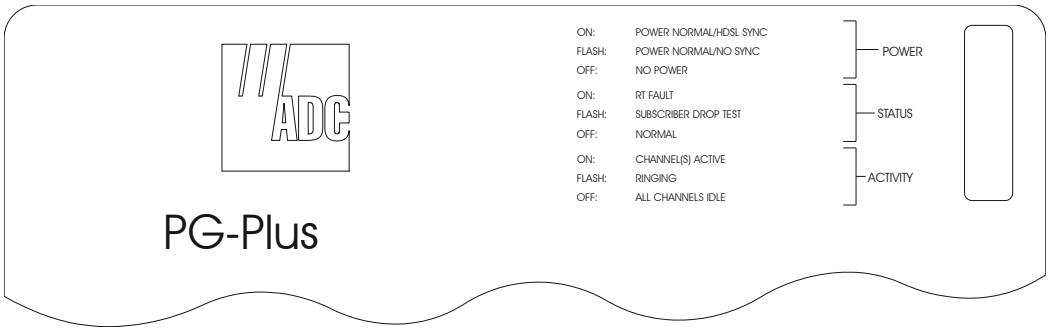

Figure 11. *Status Window*

If the PWR LED is Off, perform the following operations:

1. Verify that the RT and its corresponding COLU are installed on the same pair.
2. Verify the COLU is installed and turned up, and the HDSL Periodical Power Up option is enabled.
3. Verify that the signal loss on the pair is no more than 41.6 dB at 98 kHz.
4. Check for a short placed on the HDSL Tip and Ring conductors, and remove if necessary.
5. Check for HDSL cable fault, and replace if necessary.
6. Verify that the line length does not exceed the values supported (see "Specifications"). The distances provide 10^{-7} BER with 6 dB of margin. The distances supported over single-gauge cable, without the use of bridge taps, for the RT are listed in the Specifications.
7. Replace the RT and if necessary, replace the corresponding COLU.

COLU FAULT INDICATORS

At the CO, you can use the VT-100 terminal to initiate a SDT to determine the cause of any of the following problems. 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 and/or the RT.
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.
PWR	Off	• no input power • on-board fuse is blown on COLU	**1** Ground fault condition exists. **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 • an overload exists	**1** Check line continuity and resistance. **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 • faulty COLU or RT	**1** At the CO using the Craft interface, select Test menu option, and view the test results. The tests run are for Hazardous Potential, Foreign Voltage, Resistive Fault, and CPE Termination. **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) • faulty RT or COLU	**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. **2** Go to the Test menu 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 • loop length too long • faulty RT	**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. **2** If phone does not stop ringing when using a butt set at the subscriber location, one or both of these conditions exist: • loop length is too long (refer to Specifications) • or the RT is faulty
Can not hear, can not be heard	• subscriber problem • faulty COLU or RT	**1** Open the RJ-11 test jack at the RT. If audible level is acceptable, the problem is with subscriber equipment. **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

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 B COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class B 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 interference by one or more of the following measures:

* Reorient or relocate the receiving antenna.
* Increase the separation between the equipment and receiver.
* Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
* Consult the dealer or an experienced radio/TV 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 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.

ACRONYMS

AWG	American Wire Gauge
CO	Central Office
COLU	PG-Plus Central Office Line Unit
COTS	PG-Plus Central Office Terminal
ESD	Electrostatic Discharge
HDSL	High-bit-rate Digital Subscriber Line
LED	Light-Emitting Diode
MLT	Mechanized Loop Test
PAU	PG-Plus Alarm Unit
PMU	PG-Plus Management Unit
PMX	PG-Plus Multiplexer Unit
POTS	Plain Old Telephone Service
REN	Ringer Equivalence
RLU	PG-Plus Remote Line Unit
RMA	Return Materials Authorization
RT	PG-Plus Remote Terminal
SDT	Subscriber Drop Test
UVG	Universal Voice Grade

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