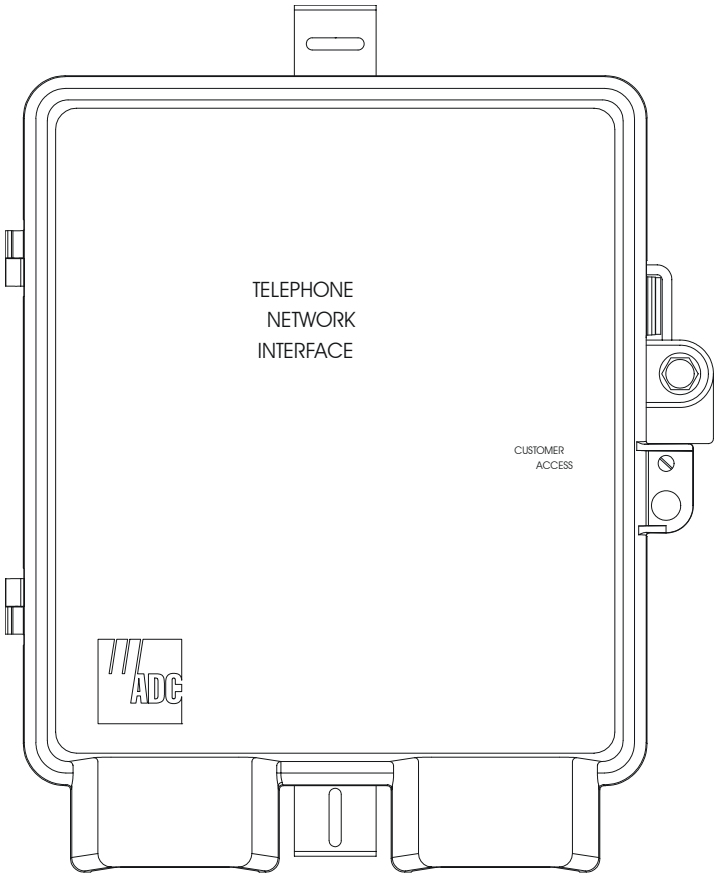
# PG-PLUS

## TECHNICAL PRACTICE




# 2 ISDN NID

| Model | List | CLEI Code |
|---|---|---|
| PRL-773 | 1B | S9MSBC0A~~ |

**SECTION SCP-PRL773-012-04H**

## Revision History of This Practice

| Revision | Release Date | Revisions Made |
|---|---|---|
| 01 | September 19, 1997 | Preliminary Release |
| 02 | February 19, 1999 | Correct Specification Table |
| 03 | January 29, 2002 | Release to rebrand document to comply with ADC standards |
| 04 | 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 14. If you must store the equipment for a prolonged period, store the equipment in its original container.

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# OVERVIEW

This practice describes the ADC® PG-Plus® PRL-773 List 1B, a PG-Plus PRL-773 (RT) that houses one RLU and provides two ISDN interfaces between the RT and two ISDN subscribers.

## DESCRIPTION AND FEATURES

The PRL-773 works in conjunction with the PLL–723 COLU to interface the ISDN subscriber to the PG-Flex COTS over a single twisted-pair of wire. A PG-Flex system (see Figure 1) provides bidirectional transport of multiple DS0s over a single, unconditioned wire pair using HDSL technology. Using existing cable, PG-Flex provides for higher bandwidth needs of residential and business customers by providing an ISDN interface on a single HDSL twisted-pair wire. A minimally configured PG-Flex system consists of one COTS, one COLU, and one RT.

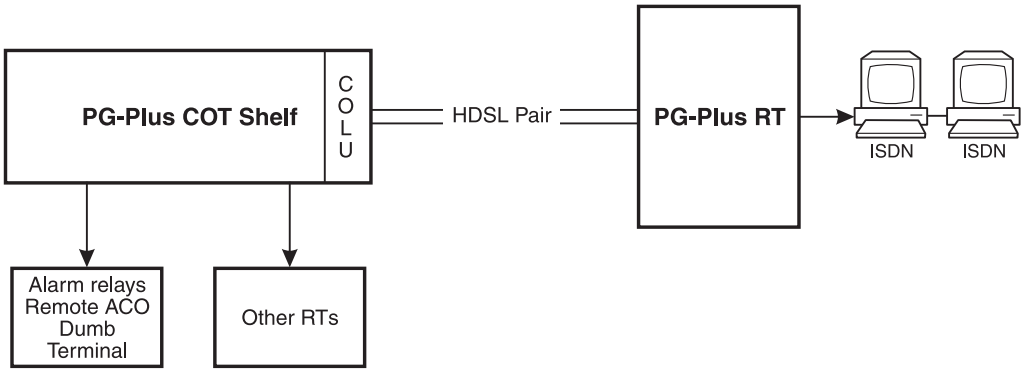


***Figure 1.*** *Typical PG–Plus Application*

Each COLU housed in a COTS interfaces with a corresponding RT. POTS 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. 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-Flex system with HDSL transmission and line-powered RTs result in fast, cost-effective solutions to data deployment over minimal copper facilities.

## METALLIC FALLBACK

Metallic fallback provides a direct connection from the CO to one subscriber under fault conditions. Service is provided to the subscriber assigned to the ISDN line in the affected COLU. At the RT, the system exits metallic fallback and attempts to synchronize if either the subscriber 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 circuit during fault conditions and to provide for drop testing of the selected subscriber line from the CO location.

# SPECIFICATIONS

| | |
|---|---|
| **Power Supply** | |
| 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 | 5.8 Watts typical, 6.28 Watts with 2 ISDN sealing current enabled |
| **HDSL Line** | |
| Line Code | 2B1Q |
| Line Rate | 196 K symbols/sec; 392 Kb/sec |
| 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), 19 AWG |
| Maximum Attenuation Rate | 41.6 dB at 98 kHz |
| **Environment** | |
| Temperature | -40°F to +149°F; -40°C to + 65°C |
| 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 |
| Emissions Radiation and Immunity | Per FCC Part 15 for Class A digital devices |
| **ISDN Interface** | |
| Interface/Line code | U Interface/2B1Q |
| Analog Impedance | 135 Ω |
| Idle State Voltage | 48 V minimum |
| Provisional Sealing Current | 9 mA minimum |
| Bit Error Rate for ANSI 601 Loops | $< 10^{-7}$ |
| Performance Monitoring | Interim Path |
| Provisional EOC | Multipoint EOC mp-eoc; transparent |
| Maximum Loop Length | 18 kft, conforms to ANSI T1-601 Loops |
| **Connectors** | |
| HDSL | 3-terminal station protector, 3/8-inch hex nut |
| ISDN | 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 | 4.0 lb. (1.8 kg.) |

# INSTALLATION

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 the Craft interface, periodically attempts to power up the RT by applying +/-130 Vdc to the HDSL pair. The COLU also initiates a start-up after a momentary short 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 involves the following procedures, which are described in the following sections:

- 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

- ISDN U-Interface Basic Rate test set
- 1/4-inch flat-head screwdriver
- No. 1 Phillips screwdriver
- insulated-handle 3/8-inch nut driver
- 5/32-inch hex key, drilled for tamper-proof fasteners
- insulated-handle wire stripper
- insulated-handle needlenose pliers
- insulated-handle wire cutter

# PREPARING THE RT FOR WIRING

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.**

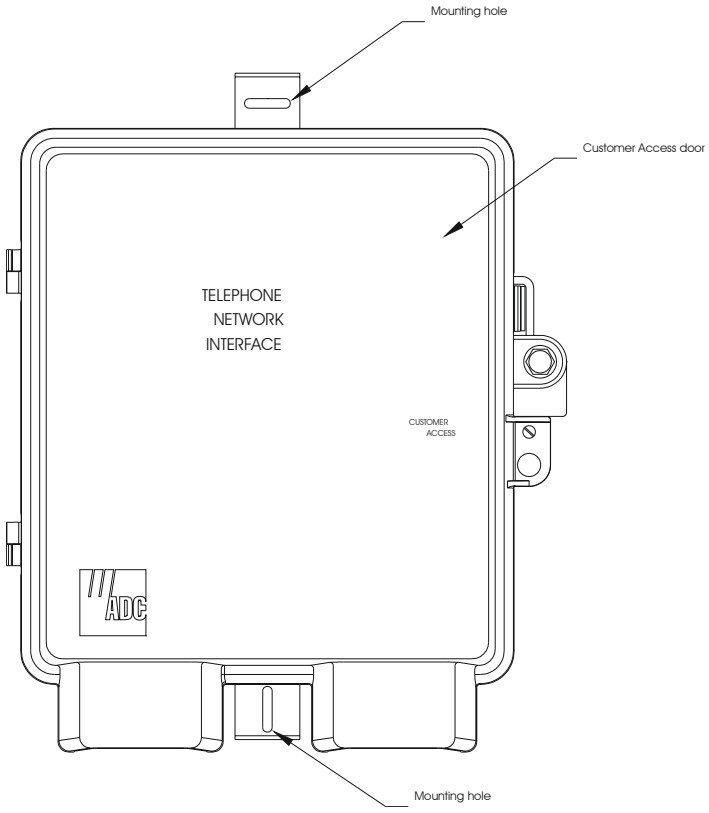


***Figure 2.*** *Mounting the RT*

# OPENING THE RT HOUSING

To gain access to the interior of the RT and to each Line Module, use a 5/32-inch drilled hex key to loosen and then remove the Telco override screw from the Customer Access or Telco Access door.

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 Customer Access door hasp to secure the Customer Access door.

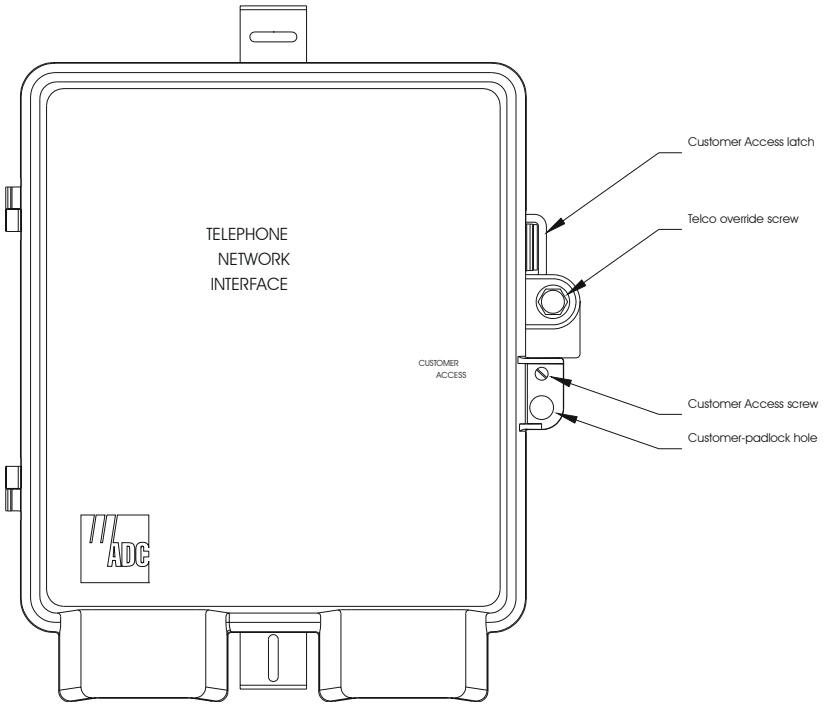


***Figure 3.*** *Securing the Customer Access Door*

Loosen the Telco override screw from the Customer Access door, or the tamper-proof screw from the Telco Access door (see Figure 4) to gain access to a Line Module. The tamper-proof screw can be one of the following:

- No. 8 pan-head pin and socket type that requires a 5/32-inch drilled hex key. The No. 8 pan-head pin and socket type screw is preferred for improved security.
- 3/8-inch hex-head screw requires a 3/8-inch nut driver (216 tool or can wrench).

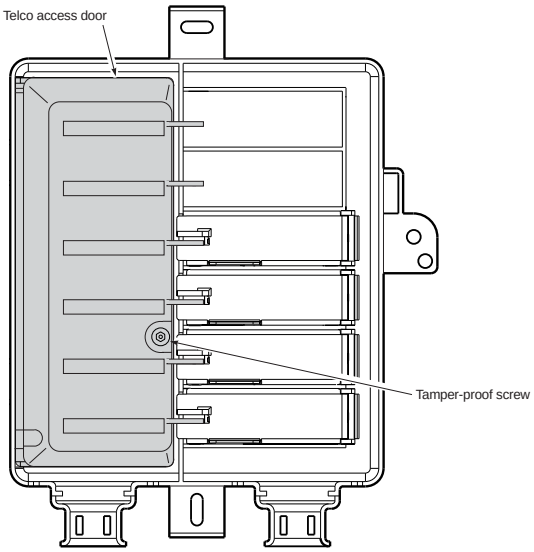


***Figure 4.*** *Accessing a Line Module*

# 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 drop 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 inner metal frame. The wiring harness is factory-wired to the primary protection devices for the subscriber and HDSL pairs and to the FGND bus. An additional frame ground is attached to the inner metal frame. The Line Modules on the scriber lines provide an RJ-11 test jack for isolating trouble to the network or subscriber. Each subscriber line is protected by a over-voltage-protected threaded binding post under the Telco cover.

During installation, refer to the RT Reference label (see Figure 5) 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.

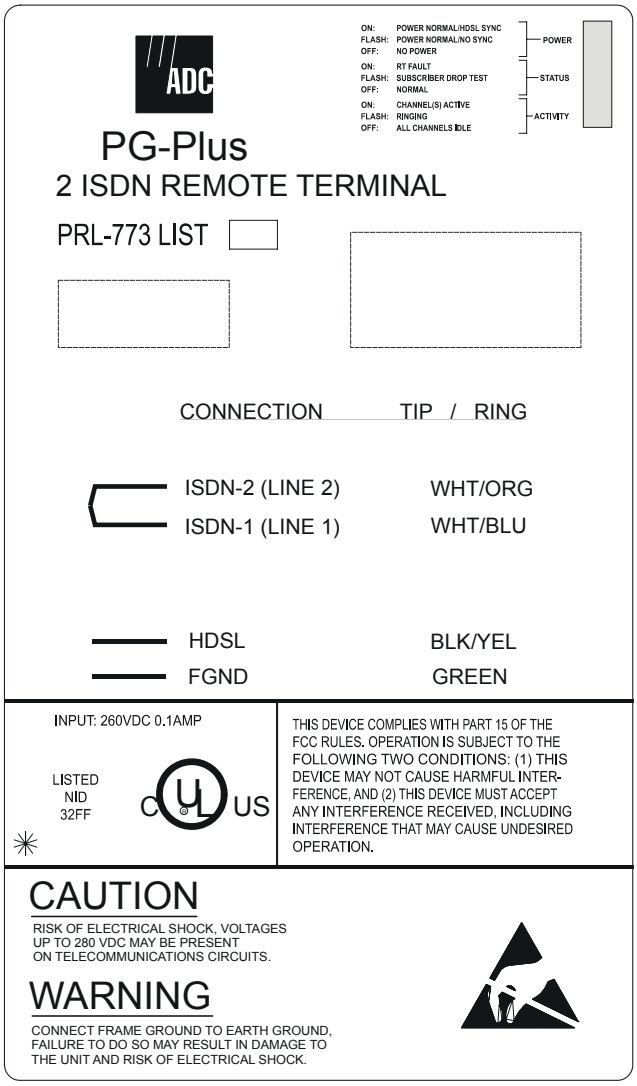


***Figure 5.*** *Reference Label*

## Attach the Frame-Ground Wire

**1** Open the Telco Access door.

**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.

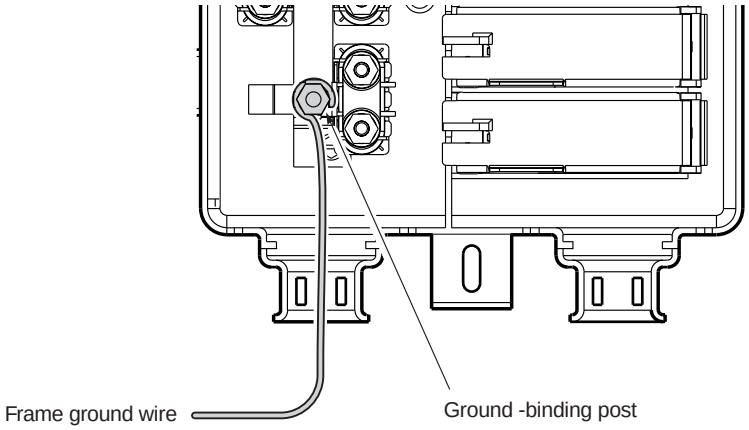


***Figure 6.*** *Attaching the Frame-Ground Wire*

**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. Then 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.

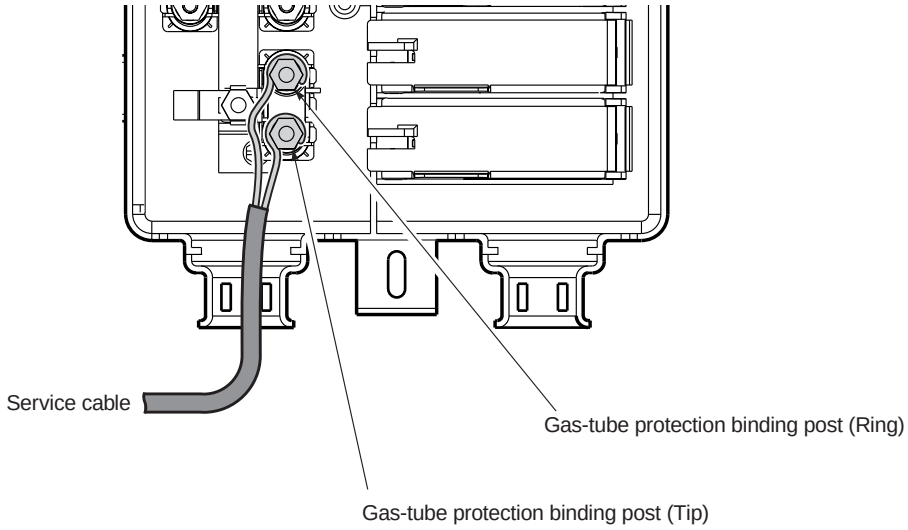


***Figure 7.*** *Attaching the HDSL Tip and Ring Wires*

**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 Drop 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.

Each subscriber line is protected by an over-voltage-protected threaded binding post under the Telco cover. If this unit has been pole mounted, ADC recommends that the subscriber drop wires be connected directly to the appropriate gas-tube protection binding posts.

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

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

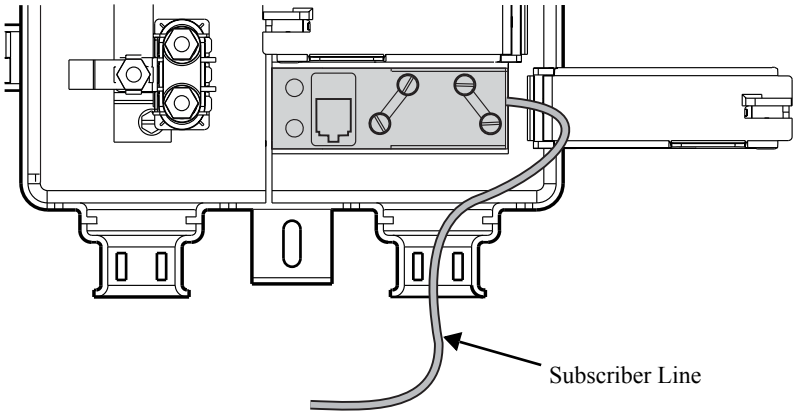


***Figure 8.*** *Inserting the Subscriber Wires*

**3** Connect the Tip conductor to the Line Module green terminal gas-tube protection binding post, connect the Ring conductor to the red terminal gas-tube protection binding post, then close the Line Module door (see Figure 9).

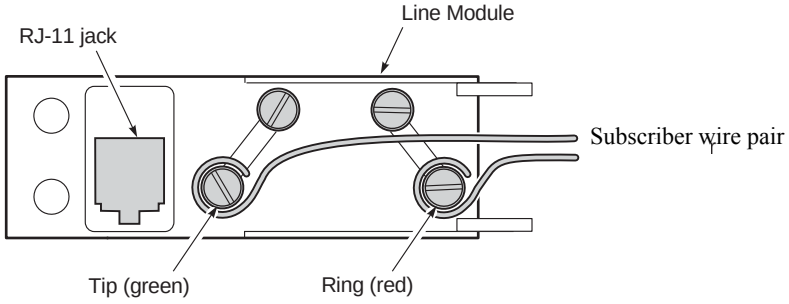


***Figure 9.*** *Attaching the Subscriber Wire Pair*

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

**5** Close the Line Module door.

# TURN UP AND TESTING

**1** Open the line module door and disconnect all the ISDN RJ-11 jacks (see Figure 10). The Activity LED is Off.

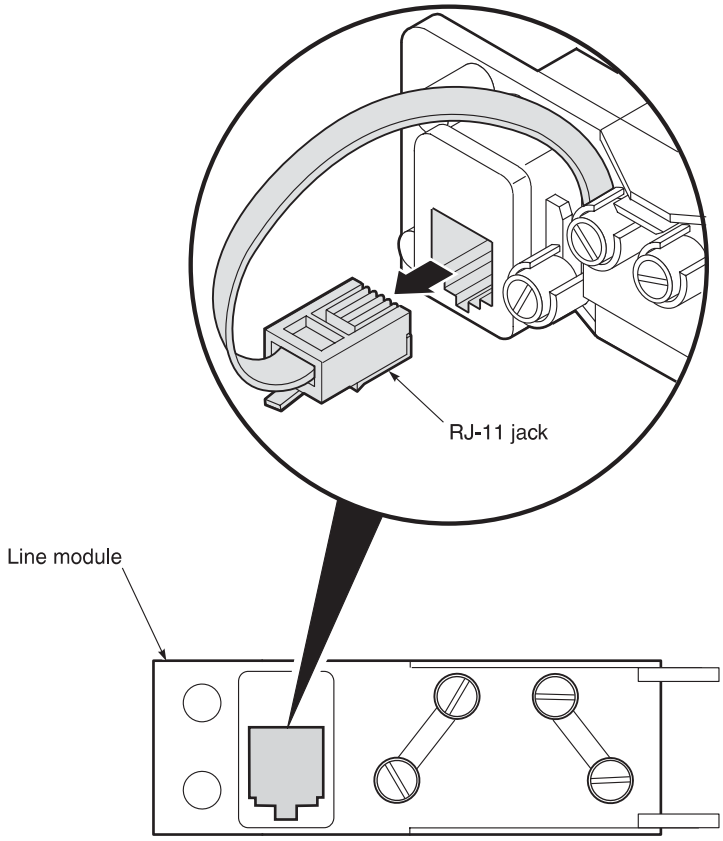


***Figure 10.*** *Unplugging the RJ-11 Jack*

**2** Configure the ISDN U-Interface Basic Rate test set appropriately.

**3** Connect the ISDN test set to the ISDN RJ-11 jack.

**4** The ISDN test set should acquire synchronization in approximately 30 to 60 seconds.

**5** Verify that the Activity LED is On green. This happens only if, on the CO end, the ISDN is connected to the ISDN switch.

**6** Perform the necessary ISDN turn-up tests through the ISDN test set.

**7** Disconnect the ISDN test set from the ISDN RJ-11 jack.

**8** Reconnect the ISDN RJ-11 jacks and close all the Line Module doors and the Telco Access door.

## CLOSE THE HOUSING

1. If you have not already done so, close the Line Module door.
2. If you have not already done so, close the Telco Access door.
3. To avoid interference with the RT cover, tighten the screw on the Telco Access door until it is completely seated.
4. 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 2 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).

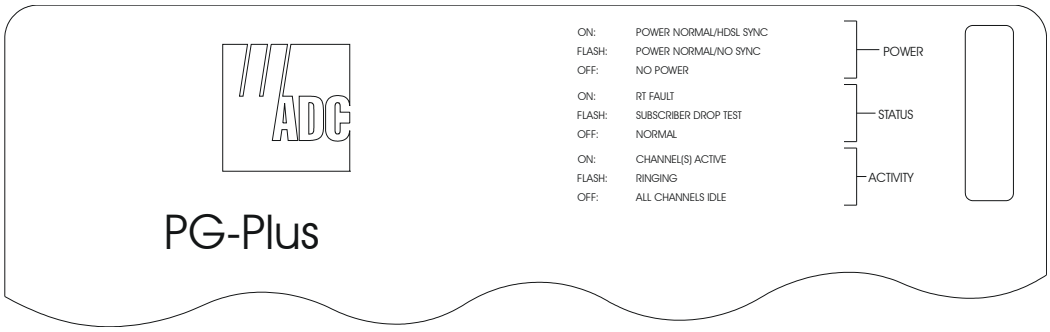


***Figure 11.*** *RT Status Window*

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 that 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 2). 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.<br>**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.<br>**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.<br>**2** Remove and re-insert the COLU.<br>**3** If the communication error still exists, replace the COLU. |
| **Margin** | On | • distance limitation exceeded<br>• fault in HDSL line<br>• 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.<br>**2** Initial installation, check engineering records for distance between COTS and RT.<br>**3** If existing installation, measure loss of HDSL line to ensure that the maximum attenuation value has not been exceeded.<br>**4** Replace COLU and/or the RT. |
| **Margin** | Flashing | • distance limitation exceeded<br>• fault in HDSL line<br>• faulty RT | **1** Initial installation, check engineering records for distance between COTS and RT.<br>**2** If existing installation, measure loss of HDSL line to ensure that the maximum attenuation value has not been exceeded.<br>**3** Replace the Colu or the RT or both. |
| **SYNC** | Off | • HDSL line has lost synchronization<br>• distance limitation may have been exceeded<br>• COLU is faulty | **1** Initial installation, check engineering records for distance between COTS and RT.<br>**2** If existing installation, measure loss of HDSL line to ensure that the maximum attenuation value has not been exceeded.<br>**3** Replace the Colu or the RT or both. |
| **PWR** | Off | • no input power<br>• on-board fuse is blown on COLU | **1** Ground fault condition exists.<br>**2** Check input power at COTS backplane with COLU removed.<br>**3** If power is present at COTS backplane, replace the COLU. |
| **PWR** | Flashing | • HDSL line open<br>• an overload exists | **1** Check line continuity and resistance.<br>**2** COLU power supply or RT may be faulty. |

# 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<br>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

| | |
|---|---|
| **ACO** | Alarm Cut-Off. Reset and test switch for Alarm Unit of PG–Plus. |
| **CO** | Central Office |
| **COLU** | Central Office Line Unit |
| **COTS** | Central Office Terminal Shelf. PG–Plus Central Office Shelf including line units and common equipment. |
| **DS0** | Digital Signal Zero. A single 64 kbs channel of a DS1 signal. |
| **DS1** | Digital Signal One. A 1.544 Mbps digital carrier signal. |
| **ESD** | Electrostatic Discharge |
| **HDSL** | High-bit-rate Digital Subscriber Line |
| **ISDN** | Integrated Services Digital Network |
| **LED** | Light Emitting Diode |
| **MLT** | Mechanized loop Testing. Per TA297, description of subscriber loop method. |
| **MSL** | Mean Sea Level |
| **NEBS** | Network Equipment-Building System. Bellcore Generic Requirements GR-63-CORE. |
| **PAU** | PG–Plus Alarm Unit. PG–Plus Alarm and Systems Interface Unit. |
| **PMU** | PG-Plus Management Unit |
| **PMX** | PG-Plus Multiplexer Unit |
| **POTS** | Plain Old Telephone Service |
| **REN** | Ringer Equivalence. A number. |
| **RLU** | Remote Line Unit. PG–Plus HDSL Interface Unit. |
| **RMA** | Return Materials Authorization |
| **RT** | Remote Terminal (enclosure and RLU inclusive) |
| **SDT** | Subscriber Drop Test |

**World Headquarters:**
ADC Telecommunications, Inc.
12501 Whitewater Drive
Minnetonka, Minnesota USA 55343

**For Technical Assistance:**
800.366.3891

ISO 9001
DNV
DNV Certification, Inc.
Certificated Firm

1251806