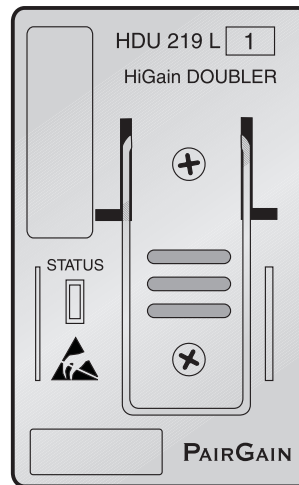
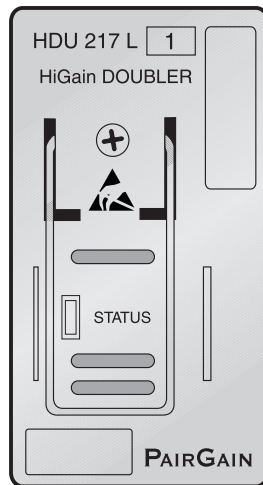


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# PAIRGAIN TECHNOLOGIES

## HIGAIN<sup>®</sup> MINI DOUBLERS

Model	List Number	Part Number	CLEI Code
HDU-217	1	150-1506-01	T1R5AS0EAA
HDU-219	1	150-1501-01	T1R5AR0EAA
HCC-239	1	150-1550-01	N/A



### PAIRGAIN TECHNOLOGIES, INC. ENGINEERING SERVICES TECHNICAL PRACTICE SECTION 150-219-100-02

#### Revision History of this practice.

Revision 02—December 22, 1997

- A) Added references to new HCC-239 List 1
- B) Added reference to AT&T 809 cabinet

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Other product names mentioned in this practice are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

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## **USING THIS TECHNICAL PRACTICE**

Two types of messages, identified by icons, appear in the text:



**A note informs you of special circumstances.**



**Cautions indicate the possibility of damage to equipment or the possibility of personal injury.**

## PRODUCT OVERVIEW

### Description and Features

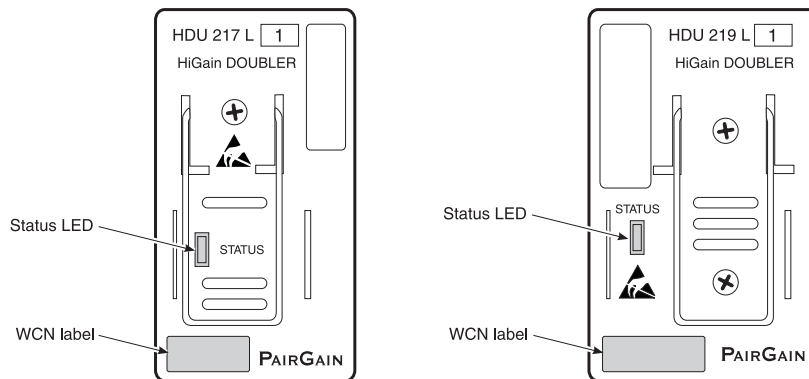


**This product incorporates static sensitive components. Proper electrostatic discharge procedures must be followed.**

The PairGain® HiGain® Models HDU-217 List 1 and HDU-219 List 1 are low power single-pair doubler units in mini-repeater packages. Each extends the range of a HiGain repeaterless fractional T1 transmission system.

HDU-217 and HDU-219 HiGain Mini Doubler features include (Figure1):

- Front-panel LED status display
- Lightning and power cross-protection on both HDSL interface ports
- Remote power capability from the HDU-D41 (HiGain Doubler Unit D41) List 2D and the EPH-220 (EtherPhone™ 220) and MM-220 (Megabit Modem™ 220) line units
- Low-power dissipation



**Figure 1.** HDU-217 and HDU-219 List 1 Front Panels

The HDU-217 and HDU-219 HiGain doubler units (HDUs) extend the delivery of fractional T1 High-Capacity Digital Service (HCDS) to customers over metallic cable pairs. The HDUs are installed between a HLU-D41 List 2D (HiGain line unit) and a HRU-512 (HiGain remote unit).

The HDU-217 and HDU-219 allow 784 Kbps transmission over twice the normal Carrier Serving Area (CSA) range to 24,000 feet (7.315 km) of 24 AWG or 18,000 feet (5.486 km) of 26 AWG copper loops. Two doubler units can triple the CSA range to 36,000 feet (10.97 km) of 24 AWG loops or to 27,000 feet (8.22 km) of 26 AWG loops.

The HCC-239 (HiGain Cut-through Card) is provided with the HDU-219. The HDU-219 mounts into two adjacent slots of a standard 239 mini-T1 repeater apparatus case and blocks one slot. The HCC-239 allows pair cut-through on the blocked repeater slot. The HDU-217 doubler units occupy one slot of the original DDS or ISDN repeater apparatus case—these slots are about twice the width of a 239 T1 repeater. All HiGain modules comply with the applicable requirements of Network Equipment Building System (NEBS) Generic Equipment requirements TR-TSY-000063 and Transport System Generic Requirements TSGR TR-TSY-000499.

## About the Mini Doubler

HiGain uses PairGain's Two-Binary, One-Quaternary (2B1Q) High-bit-rate Digital Subscriber Line (HDSL) transceiver systems to establish a full-duplex, 784 kbps data channel between the line units and the remote units. Each HDU-217 and HDU-219 increases the maximum range of a new doubler circuit by approximately 12,000 feet (3.66 km) for 24 AWG cable or 9,000 feet (2.74 km) for 26 AWG cable.

A block diagram of the HDU-217 and HDU-219 with pinouts is shown in Figure 2. The HDU-217 and HDU-219 power supplies use the 200 Vdc power feed voltage received on the HDSL pair to produce the +5 Vdc and -5 Vdc required by the HDU-217 and HDU-219 electronics. The power feed continues through the HDSL output pair to a second doubler or to the remote HRU-512.

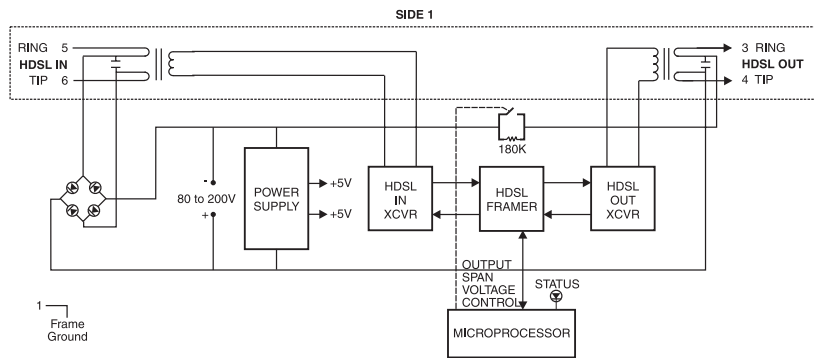


Figure 2. Mini Doubler Block Diagram

### Compatibility

These HiGain mini doublers operate with any number of other T1, POTS (Plain Old Telephone Service), Digital Data Service (DDS), or other HiGain systems sharing the same cable binder group.

A list of HDSL signal cable losses for various cable gauges at 196 kHz and 135 Ohms is shown in Table 1. The table applies to the HDSL cable pair between the HLU-D41 and the HDU as well as between the HDU and the HRU-512.

Table 1. HDSL Signal Cable Loss

Cable Gauge	Ohms/Thousand Feet (0.3048 km)	Loss @ 196 kHz (dB/thousand ft)*
26 AWG/0.4 mm	83.3	3.880
24 AWG/0.51 mm	51.9	2.841
22 AWG/0.61 mm	32.4	2.177
19 AWG/0.91 mm	16.1	1.535

\*Add 3 dB for each bridged tap and 1 dB for each cable gauge change.

## Specifications

### HDSL

Line Code.....	784 kbps, 2B1Q full duplex
Output .....	+13 dBm
Line Impedance .....	135 Ohms
Line Input DC Resistive Signature.....	25 Ohms
Line Output DC Resistive Signature .....	25 Ohms
Startup Time (per span) .....	15 seconds (typical), 30 seconds (maximum)

### Line Clock Rate

Internal Stratum 4 clock

### Maximum Power Consumption

3.6 watts

### Maximum Provisioning Loss

35 dB @ 196 kHz, 135 Ohms

### Mounting

HDU-217.....	Single slot of original DDS/IDSN Repeater Mechanics
HDU-219.....	Dual 239 T1 Mechanics

### Electrical Protection

Secondary surge and power cross protection on all HDSL ports



**Environmental**

Operating Temperature .....	-40° to +149° F (-40° to +65° C)
Operating Humidity (non-condensing) .....	5% to 95%
Operating Temperature in Outside Enclosures .....	Complies with Section 10.2.1.3 of TA-NWT-001210
Operating Elevation .....	200 feet (60.96 m) below sea level to 13,000 feet (3.96 km) above sea level

**Dimensions****HDU-217**

(Single slot of original DDS/IDSN Repeater Mechanics)

Height.....	2.6 in. (6.6 cm)
Width .....	1.45 in. (3.7 cm)
Depth.....	6.5 in. (16.5 cm)
Weight.....	1.8 lb (0.8165 kg)

**HDU-219**

(Dual 239 T1 Mechanics)

Height.....	2.6 in. (6.6 cm)
Width .....	1.65 in. (4.2 cm)
Depth.....	6.5 in. (16.5 cm)
Weight.....	1.8 lb (0.8165 kg)

## **INSTALLING THE MINI DOUBLER**

### **Inspecting Your Shipment**

When you receive the equipment, inspect it 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.

Your shipment should consist of:

- One of the following doubler units
  - One HDU-217 List 1
  - One HDU-219 List 1 with one HCC-239 List 1
- This document

### **Installing the Mini Doubler**

To install the HDU-217 or the HDU-219 in an enclosure, refer to the installation manual of the enclosure for information about:

- Cabling
- Proper connections
- Grounding
- Line and local power



**All wiring external to the product(s) should follow the provisions of the current edition of the National Electrical Code.**

Once the HDU-217 or HDU-219 is installed in the enclosure, the front-panel LED flashes and then lights a steady green. If the LED continues to flash, or changes colors, refer to "Fault Isolation," in this practice.

The HDU-217 and HDU-219 doubler units can be housed in a variety of outdoor apparatus cases manufactured by various vendors. The capacity of the doubler units in several of these standard enclosures is listed in Table 2, Table 3, and Table 4. The number of doubler units that can be plugged into each enclosure is limited by mandatory thermal constraints. The constraints are imposed to avoid overheating that may result in damage to the doubler units.

You must observe these constraints for reliable service under worst-case conditions. Consult PairGain when using the enclosures in environments that are more hostile than those allowed by the constraints or when using unlisted enclosures. Deployment rules for determining the the best location for the enclosures are provided in "Locating Doubler Unit Enclosures" in this practice.

The number of doubler units used in any of the enclosures depends on the maximum outside ambient temperature. The capacities listed in Table 2, Table 3, and Table 4 (for both indoor and outdoor enclosures) are based on a maximum outside temperature of +115° F (+46.1° C). These requirements comply with Section 10.2.1.3 of TA-NWT-001210. The Section requires HDSL equipment placed in outdoor cabinets to operate in a temperature, outside the housing, of -40°F (-40° C) with no solar load and +115° F (+46.1° C) with maximum solar load and maximum power dissipation. Full solar load is equal to the maximum sunlight exposure as defined in TR-TSY-000057.

The capacities listed for the indoor enclosures in Table 1 assume no solar load. The capacities listed for the outdoor enclosures in Table 2 and Table 3 assume a full solar load as described above. In order to reduce thermal stress, the "Recommended Slot Assignment for Maximum Capacity" column assigns slots according to the following two rules:

- 1 Always leave at least one empty slot between adjacent doublers.
- 2 Allow as much room as possible between doublers.

Slot assignments that differ from those recommended in the tables are allowed, so long as the above two rules are applied.

The doubler capacity numbers listed for each outdoor enclosure must be reduced by one for each additional +10° F (+5.5° C) rise (or any fraction thereof) in outside ambient temperature above +115° F (+46.1° C). The doubler capacity number for any application can be increased by one for those applications having no solar load to bear (not exposed to direct sunlight, as in manholes). However, any increase in capacity is still subject to the above rule (1) that requires at least one empty slot between adjacent doubler units in all applications.

For example, if the solar load is removed from the SPC 7430-8 T1 slot enclosure, whose capacity is two doubler units with solar load, capacity is increased to three doubler units. But this would necessitate placing two doublers side by side, with no empty slot between them. This violates the adjacency rule and thus forbids this shelf configuration.

The empty slot requirement can be waived by reducing the otherwise allowed capacity by one for every two doubler units that do not have an empty slot between them. For instance, if the application allows for seven doublers, but two are directly adjacent with no empty slot between them, then the total capacity must be reduced to six.

Standard T1 and DDS repeaters can be installed in the same apparatus case with the doubler unit. If this method is used, the maximum number of doubler units that can occupy the same case with the standard repeaters must be reduced by one for every four T1 repeaters (or fractions thereof) installed and by one for every single DDS/ISDN repeater installed.

For optimal performance, T1 and DDS repeaters located with doubler units in outdoor enclosures should be placed in slots that are not adjacent to the doubler units.

The 819 enclosure has two individual isolated chambers. Slots 1 through 14 are in one chamber. Slots 15 through 25, along with the PRES, ALT, CAP, and COIL slots are in the other chamber.



**Slot 7 of the 819 enclosure cannot be used for doubler units because of mechanical interference between the doubler unit cover and a mounting screw in the cavity adjacent to slot 7.**

There are 15 different models of the 819 enclosure. The HDU-219 is compatible only with the following four models:

- 819 A1
- 819 A2
- 819 B1
- 819 B2

**Table 2. Indoor Enclosure Capacities for the HDU-219 without Solar Load**

Vendor	Description	Model Number	HDU-219 Doubler Capacity	239 T1 Repeater Capacity	Recommended Slot Assignment for Maximum Capacity
Charles	Indoor wall mount	CiAC2300*	3	7	1, 3, 5
		CiAC2002*	1	2	1
SPC	Indoor rack/wall mount	4400-09	4	9	1, 3, 5, 7 or 2, 4, 6, 8

\* Requires removing the metal slot separator.

The HDU-219 is not compatible with the older 818 T1 repeater apparatus case because the 818 has a shallow cover, which cannot accommodate the HDU-219 length. However, the 818 case can be used if the shallow cover is replaced by the deeper cover of the 819 apparatus case.

The doubler unit capacity deployment rules can be summarized as follows:

- 1 Use Table 2 for indoor enclosures.
- 2 Use Table 3 and Table 4 for outdoor enclosures with Full Solar Load for ambient temperatures up to 115° F maximum.
- 3 Increase the Table 3 and Table 4 capacities by one for non-solar load (shaded or manhole) applications.
- 4 Increase the Table 3 and Table 4 capacities by one for each full 10° F reduction in ambient temperature below 115° F.
- 5 Decrease the Table 3 and Table 4 capacities by one for each 10° F increase, or fraction thereof, in ambient temperatures above 115° F.

**Table 3. Outdoor Enclosure Capacities for the HDU-219 with Full Solar Load**

<b>Vendor</b>	<b>Description</b>	<b>Model Number</b>	<b>HDU-219 Doubler Capacity</b>	<b>239 T1 Repeater Capacity</b>	<b>Recommended Slot Assignment for Maximum Capacity*</b>
AT&T	Outdoor dual chamber	819	4 per chamber/8 total	25	1, 5, 11, 14, 15, 18, 22, 25
AT&T	Outdoor 841 cabinet	27A, B, C or D shelf	8 per shelf/32 total	25 per shelf/100 total	1, 5, 11, 14, 15, 18, 22, 25
AT&T	Outdoor cabinet	809	5	12	1, 5, 8, 10, 12
Alcatel	Outdoor canister, pole/wall mount	621204	4	12	1, 4, 8, 11
		621205	5	25	1, 4, 8, 11, 15
		621206	7	50	1, 4, 14, 17, 27, 30, 36
Charles	Outdoor canister, pole/wall mount	CiAC4306 †	2	6	1 or 5
		CiAC3300	1	3	1 or 2
		CiAC5312	4	12	1, 3, 7, 9
		CiAC5325	5	25	4, 8, 12, 16, 18
		CiAC5350	7	50	4, 8, 12, 16, 18, 20, 27

(Continued on following page)

**Table 3. Outdoor Enclosure Capacities for the HDU-219 with Full Solar Load (continued)**

Vendor	Description	Model Number	HDU-439 Doubler Capacity	239 T1 Repeater Capacity	Recommended Slot Assignment for Maximum Capacity*
Sierra	Outdoor canister,	3011	2	6	3, 6
Sunrise	pole/wall mount	3021	1	5	3
SPC	Outdoor canister,	7130-08FP	2	8	4, 6
	pole/wall mount	7130-12FP	4	12	1, 4, 7, 10
		7130-25FP	6	25	1, 4, 7, 10, 18, 28

† Requires removing the metal slot separator.

\* Slot numbers refer to the slots into which a doubler unit may be inserted to access its four network cable pairs.

- 6** Decrease any outdoor capacity by one for every four T1 repeaters, or fraction thereof, that are installed with the doublers.
- 7** Decrease any outdoor capacity by one for every DDS or ISDN repeater that is installed with the doublers.
- 8** For all outdoor applications, decrease the capacity by one for every two adjacent doublers that are not separated by at least one empty slot.



**Always provide as many empty slots between doublers as possible.**

**Table 4. Outdoor Enclosure Capacities for the HDU-217 with Full Solar Load**

<b>Vendor</b>	<b>Description</b>	<b>Model Number</b>	<b>HDU-217 Doubler Capacity</b>	<b>DDS Repeater Capacity</b>	<b>Recommended Slot Assignment for Maximum Capacity</b>
SPC	Outdoor canister, pole/wall mount	7130-0656	2	6	1, 6 or 3, 4
		7130-0856	4	8	1, 4, 7, 16
		7130-1656	6	16	1, 4, 7, 10, 13, 16
Adtran	Outdoor canister, pole/wall mount	LRH30AV or LRH30FV	1	2	1 or 2
		LRH 11-30AD or LRH 11-30FD	2	4	1, 4 or 2, 3
Sierra	Outdoor canister, pole/wall mount	3011	2	3	3, 6
Sunrise		3021	2	2	4, 6



## Installing and Removing the Cut-Through Card

When the dual-slot HDU-219 is inserted into a T1 enclosure, it blocks access to the adjacent slot. In order to cut through the IN (CO side) pairs to the OUT (field side) pairs of the blocked repeater slot for downstream access, a HCC-239 (HiGain Cut-through Card) is included with all HDU-219 List 1 doubler units shipped with the Revision 02 practice. A block diagram of the HCC-239 is shown in Figure 3. A special insertion tool (Figure 4), the HCT-239 (PairGain part number 150-1595-01), that simplifies the HCC-239 installation may be purchased from PairGain.



**A package of 25 HCC-239 cut-through cards (PairGain part number 150-1550-01) is also available if this cut-through feature is needed in other doubler installations.**

To install the HCC-239 use the HCT-239 insertion tool (or long-nosed pliers):

- 1 Loosen the wing nut on the HCT-239 insertion tool.
- 2 Slide the non-connector edge of the card into the tapered edge of the insertion tool.

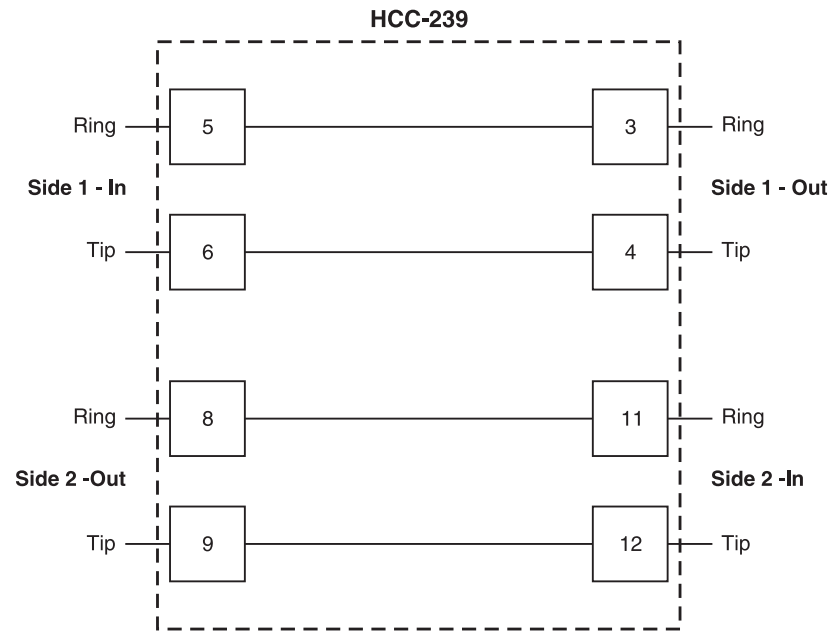


**The HCC-239 card is symmetric, so the orientation is irrelevant and the card cannot be plugged in backward.**

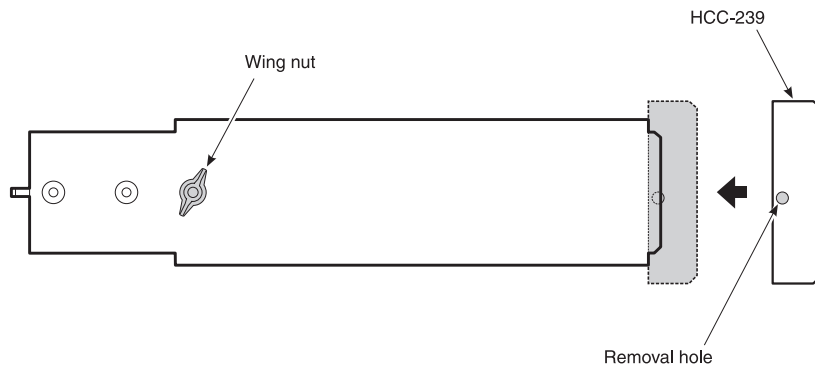
- 3 Tighten the wing nut to firmly grip the card.
- 4 Hold the tool near the end, and insert the card into the blocked slot cavity.
- 5 Carefully align the edge of the card with the slot edge connector.
- 6 Push the card into the connector until it is firmly seated.
- 7 Loosen the wing nut and remove the tool.

To remove the HCC-239 card from the slot, proceed as follows:

- 1 Grip the end of the tool and insert the tool into the slot cavity containing the HCC-239 card.
- 2 Carefully insert the tool hook into the removal hole in the card.
- 3 Align the hook along the open side of the card edge connector.
- 4 Apply steady outward pressure, and gently remove the HCC-239.



**Figure 3.** HCC-239 Card Block Diagram



**Figure 4.** HCT-239 Insertion Tool

## Locating Doubler Unit Enclosures

The physical location of the doubler units is determined by the following three deployment rules:

- 1** Place the enclosures at the electrical limits, 35 dB, of each span. This would place the first doubler at the 35 dB location and the second at 70 dB. This allows the maximum circuit range of 105 dB to be realized, if the third span to the most distant remote unit is also 35 dB.
- 2** If rule 1 is not applicable (no customers 105 dB away), then try to make all spans the same electrical length (same 196 kHz loss). This minimizes the maximum span loss and assures maximum operating margin, resulting in optimal transmission performance on the HDSL cable pairs. If specific application constraints preclude using rule 2, or, if two different circuit layout choices have the same maximum span loss, then use rule 3.
- 3** This rule minimizes the power consumption and dissipation of the HLU that provides the doubler power. Rule 3 requires Span 1 to be a minimum and Span 3 to be a maximum. This choice minimizes the  $I^2R$  loss in the cable pairs, and reduces the thermal stress on the HLU.

## **TESTING THE UNIT**

### **Using Alarms**

The HDU-217 and HDU-219 front panel contains one tri-color STATUS LED. The light color and whether it is steady or flashing provides you with the information listed in Table 5.

*Table 5. Front Panel Status Indicator*

<b>STATUS LED</b>	<b>Description</b>
Flashing green once per second	Synchronization is being attempted between the HDU and the upstream (network) module.
Flashing green more than once per second	Synchronization is being attempted between the HDU and the downstream (customer) module.
Solid green	HDSL frame synchronization has been achieved between the HDU and both the upstream and downstream modules.
Flashing red once per second	HDSL Cyclic Redundancy Check (CRC) error has occurred between the HDU and the upstream module. See the "Fault Isolation" section of this practice.
Flashing red more than once per second	An HDSL CRC error has occurred between the HDU and the downstream module. See the "Fault Isolation" section in this practice.
Flashing yellow once per second	A Network Doubler Unit (NDU) loopback is in effect in the HDU toward the network. This tests the integrity of the upstream span.
Flashing yellow more than once per second	A CDU (HDU to Customer) loopback is in effect in the HDU towards the customer. This tests the integrity of the downstream span.

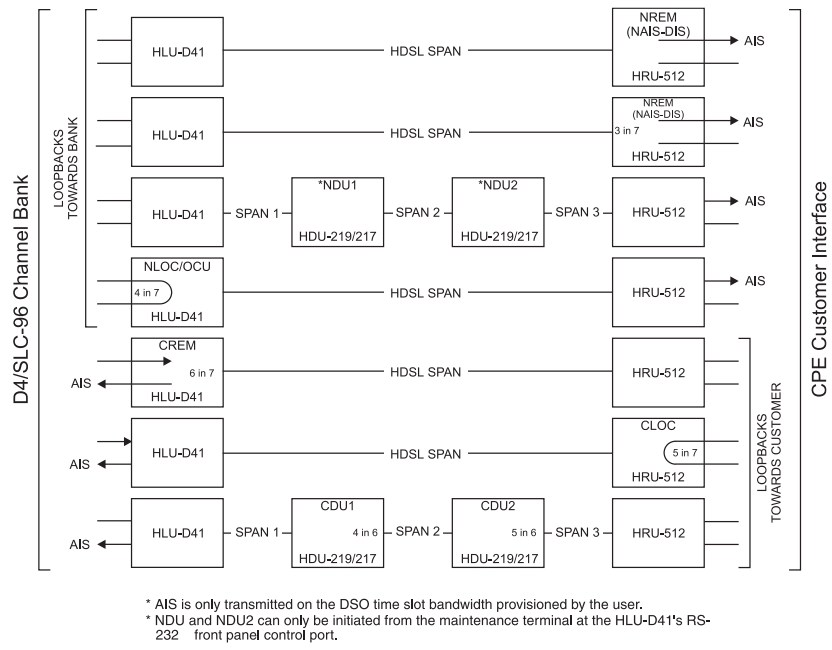
## Loopback Operation

The complete family of loopbacks that a HiGain system can execute is shown in Figure 5. Four of these loopbacks, NDU1, NDU2, CDU1, and CDU2, occur in the doubler. The loopbacks can be initiated from the HLU RS-232 Craft port, the HLU front-panel buttons, or from a family of Special Loopback (SPLP) in-band loopback commands.

The loopback command set is listed in Table 6. For more information about other doubler loopback commands, see the appropriate HLU practices.

*Table 6. Loopback Command Set*

<b>Command Set</b>	<b>Loopback</b>
110000 (2-in-6)	NDU1
111000 (3-in-6)	NDU2
111100 (4-in-6)	CDU1
111110 (5-in-6)	CDU2



**Figure 5. HiGain Loopbacks**

## **SYSTEM ADMINISTRATION**

### **Fault Isolation**

Solutions for common problems are listed in Table 7. For additional help, refer to Figure 5.

*Table 7. Fault Isolation Guide*

<b>Problem</b>	<b>Solution</b>
LED does not light	<ol style="list-style-type: none"> <li>1 Verify that the HLU is installed and operational in the central office (CO).</li> <li>2 Verify proper cabling between the doubler enclosure and the central office.</li> <li>3 Measure 100 V to 200 Vdc between pins 5 or 6 and 8 or 9. This voltage peaks every 15 seconds as the HLU powers up. If less than 130 Vdc is present, check the cabling or the HLU. Only the line units mentioned in this practice can be used to power doublers. Other HLU versions can seem to work but do not provide reliable operation and should not be used.</li> </ol>
HDSL LED continues to flash green once a second	Synchronization is being attempted with the upstream unit.
HDU-217 or HDU-219 loses power	The HLU at the CO is not present. Measure the resistance of the HDSL input loop. Resistance should be normal loop resistance plus the 25-Ohm signature of the HLU.

## Technical Support

Customer service provides after-sale support, including warranty administration, spare parts, repair parts, equipment repair and modification, technical service, engineering, and installation.

PairGain Technical Assistance is available 24 hours a day, 7 days a week by contacting PairGain's 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 fault isolation 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.

Return for Repair Procedure. Repair inquiries can be made by calling for a Return Material Authorization (RMA) number as specified in "Warranty," below.

When returning a defective item for repair, the following information is required:

- Your RMA number or requisition number
- Description and quantity of equipment being returned
- Your billing address
- Your shipping address



## **CERTIFICATION AND WARRANTY**

### **Certification**

The HDU-217 and the HDU-219 have been tested and comply with the limits for Class A digital devices pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, can cause harmful interference to radio communications.

### **Warranty**

PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of sixty (60) months from the date of original shipment, given proper 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 abuse or improper use or installation.

This unit should not be field repaired. 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 will void the warranty.

If a unit needs repair:

- 1 Call PairGain for a Return Material Authorization (RMA) number at 800.370.9670, 714.730.2800, or fax to 714.730.2961.
- 2 Return the defective unit, freight prepaid, along with a brief description of the problem, to:

PairGain Repair Center  
14352 Franklin Avenue  
Tustin, CA 92780-7031

PairGain will continue to repair or replace faulty modules beyond the warranty program at a nominal charge. Contact your PairGain sales representative for details and pricing.

## **Abbreviations**

<b>AWG</b>	American Wire Gauge
<b>CDU</b>	HDU to Customer loopback
<b>CRC</b>	Cyclic Redundancy Check
<b>CSA</b>	Carrier Serving Area/Customer Service Area
<b>DDS</b>	Dataphone Digital Service or Digital Data System
<b>HCC</b>	HiGain Cut-Through Card
<b>HCDS</b>	High Capacity Digital Service
<b>HDSL</b>	High bit-rate Digital Subscriber Line
<b>HDU</b>	HiGain Doubler Unit
<b>HLU</b>	HiGain Line Unit
<b>HRU</b>	HiGain Remote Unit
<b>ISDN</b>	Integrated Services Digital Network
<b>KBPS</b>	Kilo (thousand) Bits Per Second, sometimes written Kb/s
<b>MBPS</b>	Mega (million) Bits Per Second, sometimes written Mb/s
<b>NDU</b>	Network Doubler Unit
<b>NEBS</b>	Network Equipment Building System
<b>POTS</b>	Plain Old Telephone Service
<b>RMA</b>	Return Material Authorization
<b>SPLP</b>	Special Loopback
<b>WCN</b>	Warranty Control Number



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