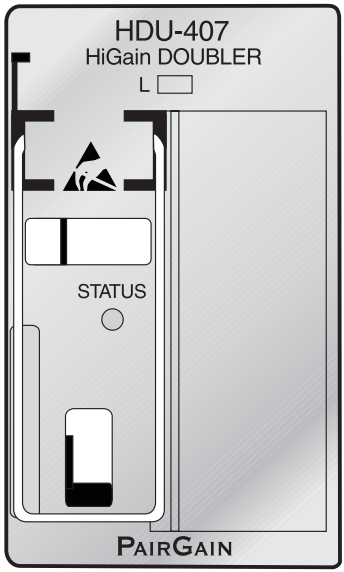
HiGain Micro Doubler Unit

Model	List Number	Part Number	CLEI Code
HDU-407	2	150-1576-02	T1R6AH0CAA



PairGain Technologies, Inc.
Engineering Services Technical Practice

Section 150-407-102-02

PairGain

Revision History of This Practice

Revision	Release Date	Revisions Made
01	June 24, 1998	Initial Release
02	January 5, 1999	Added front panel status LED to Table 4.

USING THIS TECHNICAL PRACTICE

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

Notes contain information about special circumstances.

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

UNPACK AND INSPECT YOUR SHIPMENT

Upon receipt of the equipment:

1 Unpack the container and visually inspect the product for signs of damage. If the equipment has been damaged in transit, immediately report the extent of the damage to the transportation company and to your sales representative.

2 Verify the contents using the packing list to ensure complete and accurate shipment.

If you must store the equipment for a prolonged period, store it in the original container.

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OVERVIEW

The PairGain® HiGain® HDU-407 List 2 is a low-power doubler unit that extends the range of a HiGain repeaterless T1 transmission system.

The doubler units are installed between any doubler-compatible HiGain Line Unit (HLU) and a HiGain Doubler Unit (HDU) or HiGain Remote Unit (HRU). They allow 1.544 Mbps transmission over twice the normal Carrier Serving Area (CSA) range.

The CSA encompasses approximately 24,000 feet (7.315 km) of American Wire Gauge (AWG) 24 wire or 18,000 feet (5.486 km) of AWG 26 wire loops.

Two doublers can increase the CSA range by one half of the original range. Each additional doubler increases the range by one half of the original CSA length (12,000 feet or 3.658 km).

The HDU-407 List 2 is compatible with PairGain's HiGain and PG-Flex product lines. Refer to the PG-Flex documentation for more information regarding the PG-Flex doubler applications.

FEATURES

- Occupies one standard Digital Data Service (DDS) or Integrated Services Digital Network (ISDN) mechanics slot
- Powered by any doubler-compatible HiGain or PG-Flex line unit
- Front-panel status display Light Emitting Diodes (LED)
- Lightning and power-cross protection on both sides of the High bit-rate Digital Subscriber Line (HDSL) interface
- Extremely low power dissipation
- Extremely low latency
- Compatible with a four-span, line-powered circuit or a five-span, locally-powered HiGain circuit

- Compatible with PG-Flex List 3x line units in configurations with up to three spans
- Complies with the applicable requirements of Network Equipment Building System (NEBS) Generic Equipment requirements of GR 1089 CORE and GR 63 CORE compliance
- Minimal wander and jitter

HiGain Applications

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

The HDU-407 has a range of up to 35 dB loss at 196 kHz on each of the four HDSL loops. A list of HDSL signal cable losses for various cable gauges at 196 kHz and 135 Ω is provided in Table 1. The table shows to the HDSL cable pairs between the HLU and the HDU-407 and between the HDU-407 and another HDU or HRU.

Table 1. *HDSL Signal Cable Loss*

Cable Gauge	Ohms per Thousand ft (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.

The HDU-407 can be used in two-span to five-span circuits, depending on the models of the HLU and HRU being used with the doubler units and the power option chosen for the HRU. The number of doublers is equal to one less than the number of spans as shown in Figure 4 on page 16.

Table 2 lists the maximum number of HDU-407 doubler units that can be deployed according to the HLU and HRUs that are used with it.

Table 2. *HDU-407 Circuit Ranges*

HLU Model	Maximum Number of HDU-407 Doublers Per Circuit[a]			
	Line Powered		Local Powered	
	I-CPE ON	I-CPE OFF	I-CPE ON	I-CPE OFF
HLU-231 Lists 6D, HLU-319 List 2D, HLU-231 List 7D, HLU-231 List 7B, HLU-388 List 2D, HLU-431 List 1D	1	2[b]	2	2
HLU-231 List 8x, HLU-319 List 5x, HLU-388 List 5x	2	3[c]	2	4[d]

(a) HRU-411 applications with Current-Customer Premises Equipment (I-CPE) on are limited to single HDU-407 doubler circuits. The HRU-412 is limited to applications with one and two doublers only.
(b) Only HLU-231 L7B, HLU-231 L7D and HLU-431 can line power two doublers with I-CPE off.
(c) Requires HRU-402 or HRU-411.
(d) Requires HRU-402.

Each span can take up to 30 seconds to acquire HDSL synchronization. The total time to acquire end-to-end synchronization increases with the number of spans.

The physical location of the doublers is driven by the following three deployment rules:

- **Rule 1.** Place the enclosures at the electrical limits, 35 dB, of each span. This places the first doubler at the 35 dB location and the second at 70 dB and so on. This allows the maximum circuit range to be realized.

Caution must be observed when pushing doubler spans to their 35 dB maximum range. Refer to PairGain's Technical Advisory #TA-015 on HiGain operating ranges and general deployment guidelines.

- **Rule 2.** If Rule 1 is not applicable, 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.
- **Rule 3.** This rule minimizes the power consumption and dissipation of the HLU that provides the doubler power. Rule 3 requires the spans closer to the HLU to be as short as possible and the spans farther from the HLU to be as long as possible. This choice minimizes the I^2R loss in the cable pairs, and reduces the thermal stress on the HLU.

Only those HRUs that have a local powering option can be used in local HRU-powered applications.

PRODUCT DESCRIPTION

The HDU-407 includes:

- open-framed cover
- front panel featuring:
  - status display
  - Common Language Equipment Identifier/Equipment Catalog Item (CLEI/ECI) bar code
  - configuration number
  - extraction handle

COVER

The open-framed cover reduces thermal stress and improves reliability by allowing air to freely circulate over all components.

FRONT PANEL

Figure 1 on page 6 shows the HDU-407 front panel and Table 3 on page 6 describes the doubler unit components.

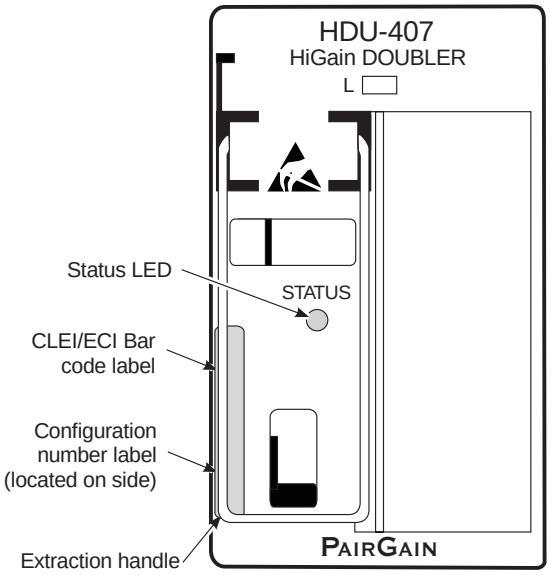


Figure 1. *HDU-407 Front Panel*

Table 3. *Front Panel Components and Labels*

Name	Function
Status LED	Indicates operational status of doubler.
CLEI/ECI Bar Code Label	Contains human-readable CLEI code number and ECI bar code number.
Configuration Number	Contains either a a stand-alone two or three-digit configuration number or a five or six-digit warranty configuration number as follows: Digit 1 - Last digit of shipment year Digits 2 and 3 - Shipment month Digits 4, 5, and 6 - Configuration number
Extraction Handle	For removing the HDU from the enclosure.

FUNCTIONAL DESCRIPTION

HiGain uses the PairGain Two-Binary, One-Quaternary (2B1Q) HDSL transceiver system to establish two full-duplex, 784 kbps data channels between the HLU and the HRU units. Each HDU-407 increases the maximum range by approximately 12,000 feet (3.66 km) of AWG 24 wire or 9,000 feet (2.74 km) of AWG 26 wire per doubler.

A block diagram of the HDU-407 with pinouts is shown in Figure 2. The doubler unit power supply uses the HDSL simplified line voltage to produce +5 Vdc and +3 Vdc required by the HDU-407 electronics. The power feed is passed on to the HDSL output pair to power a second doubler or a remote unit.

The maximum power dissipation of the doubler unit is 3.2 watts.

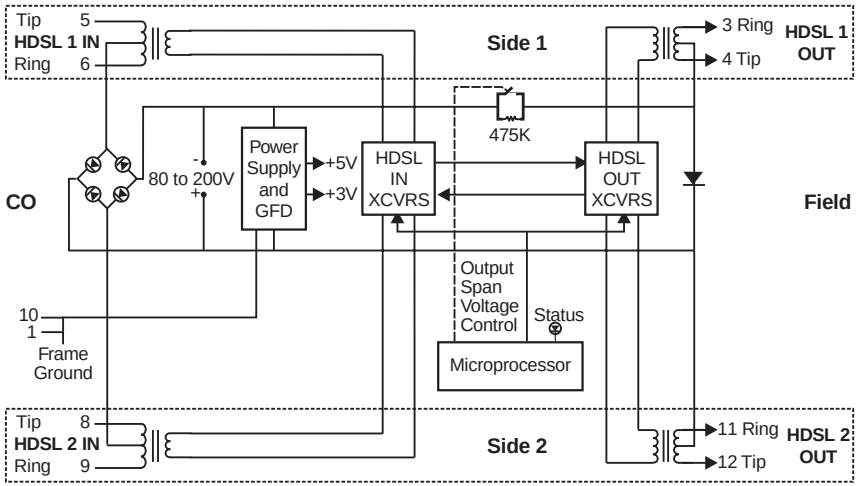


Figure 2. *Doubler Block Diagram*

DOUBLER CAPACITY WITH FULL SOLAR LOAD

The HDU-407 can be housed in a variety of outdoor enclosures manufactured by PairGain and a variety of other vendors. The number of doublers used in any of the enclosures depends on the maximum outside ambient temperature. The capacity of the doubler unit in several of these standard enclosures is listed in Table 4 on page 9. The capacities listed in Table 4 are based on a maximum outside temperature of +115° F (+46.1°C). Consult PairGain for the latest deployment rules when using the enclosures at ambient temperatures above 115° F or when using enclosures not listed.

These requirements comply with Bellcore standards, which require HDSL equipment placed in outdoor cabinets to operate in an outside ambient temperature, of -40°F (-40°C) with no solar load and +115°F (+46.1°C) with a maximum solar load and maximum power dissipation.

Full solar load is equal to maximum sunlight exposure as defined in Bellcore's Technical Advisory TR-TSY-000057.

The capacities listed for the outdoor enclosures in Table 4 assume a full solar load as described above. The "Recommended Slot Assignment for Maximum Capacity" column assigns slots according to the following thermal stress reduction rules:

- **Rule 1.** Always leave at least one empty slot between adjacent doublers. The adjacency rule only applies to the left and right hand sides of the doubler. The top of one unit can be adjacent to the bottom of another, however, the latter configuration should be avoided if possible.

Rule 1 does not apply to the PairGain HRE-458 enclosure since it has the required slot separations already built into its design.

- **Rule 2.** Allow as much room as possible between doublers on all four sides.

Slot assignments that do not follow the recommended configurations in Table 4 are permissible as long as the above two rules are applied. Otherwise, damage may occur to doubler units.

Table 4. *Outdoor Enclosure Capacities with Full Solar Load*

Vendor	Description	Model No.	HDU-407 Doubler capacity	239 T1 Repeater capacity	Recommended Slot Assignment for Maximum Capacity
Adtran	Outdoor canister	LRH30AV or LRH30FV	1	2	1 or 2
		LRH 1130AV or LRH 1130FD	2	4	1, 4 or 2, 3
SIERRA	Outdoor canister, pole/ wall mount	3011	2	3	3, 6
SUNRISE	Outdoor canister, pole/ wall mount	3021	2	2	4, 6
SPC	Outdoor canister, pole/ wall mount	7130-0656	3	6	1, 3, 5
		7130-0856	5	8	1, 3, 4, 6, 8
		7130-1656	7	16	1, 3, 6, 8, 9, 11, 16
PairGain	Outdoor canister, pole/ wall mount	HRE-819	8	10	1, 2, 4, 5, 7, 8, 9, 10

Some of the Table 4 capacities are conservative estimates. Ongoing tests at PairGain may result in increasing some of these estimates.

Thermal constraints must be observed to ensure reliable service for worst-case conditions.

DOUBLER CAPACITY WITHOUT FULL SOLAR LOAD

Doubler capacity can be increased by two for applications where the enclosures are underground or not exposed to direct sunlight. However, any increase in capacity is still subject to deployment rule 1. Rule states: Place the enclosures at the electrical limits (35 dB) of each span. This places the first doubler at the 35 dB location and the second at 70 dB and so on. This allows the maximum circuit range to be realized.

The doubler capacity listed for each outdoor enclosure must be reduced by one for every additional +5°F (+2.8°C) rise, or any fraction thereof, in outside ambient temperatures above +115°F (+46.1°C).

The capacities can be increased by one for every additional +5°F (+2.8°C) reduction in outside ambient temperatures above +115°F (+46.1°C).

Reduce doubler capacity by one for every two doublers that do not have an empty slot between them. If the application allows seven doublers, but two are directly adjacent to each other, then the total capacity must be reduced to six.

Standard T1 repeaters can be installed in the same enclosure with doubler units. If this method is used, the maximum number of doublers that can occupy the same case with the standard repeaters must be reduced by one for every four T1 repeaters (or fractions thereof) installed. T1 repeaters located with doublers in outdoor enclosures should be placed in slots that are not adjacent to the doublers.

Rule one in the section titled "Doubler Capacity with Full Solar Load" on page 8 above does not apply if the adjacent slot is occupied by a DDS or IDSN repeater.

MICRO DOUBLER CAPACITY DEPLOYMENT RULES

The deployment rules for micro doubler capacity are summarized below:

1 Use Table 4 on page 9 for outdoor enclosures with Full Solar Load for ambient temperatures up to 115° F maximum.

2 The capacities shown in Table 4 on page 9 can be increased by two for non-solar load (shaded or manhole applications).

3 Decrease capacities in Table 4 on page 9 by one for every 5° F increase, or fraction thereof, in ambient temperatures above 115° F.

4 Increase the capacities by one for every full +5°F reduction in ambient temperatures below 115°F.

5 Decrease any outdoor capacity by one for every two DDS or ISDN repeaters, or fraction thereof, that are installed with the doublers.

6 For all outdoor applications, decrease the capacity by one for every two adjacent doublers that are not separated by at least one empty slot.

INSTALLATION

This section describes the compatibility and installation of the HDU-407.

COMPATIBILITY

The HDU-407 List 2 is compatible with the following PairGain outdoor enclosures:

- HRE-500, single-slot unit
- HRE-458, 10-slot unit

INSTALLING THE HDU-407

To install the HDU-407 in an enclosure, perform the following steps and refer to the enclosure installation manual for information about cabling, proper connections, grounding, and line and local power.

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

To install the doubler unit, perform the following steps.

1 Slide the doubler into the card guides for the desired slot (see Figure 3 on page 13).

2 Push the unit into the enclosure until it is seated in the card-edge connector.

The unit should snap into place, indicating that it is properly seated.

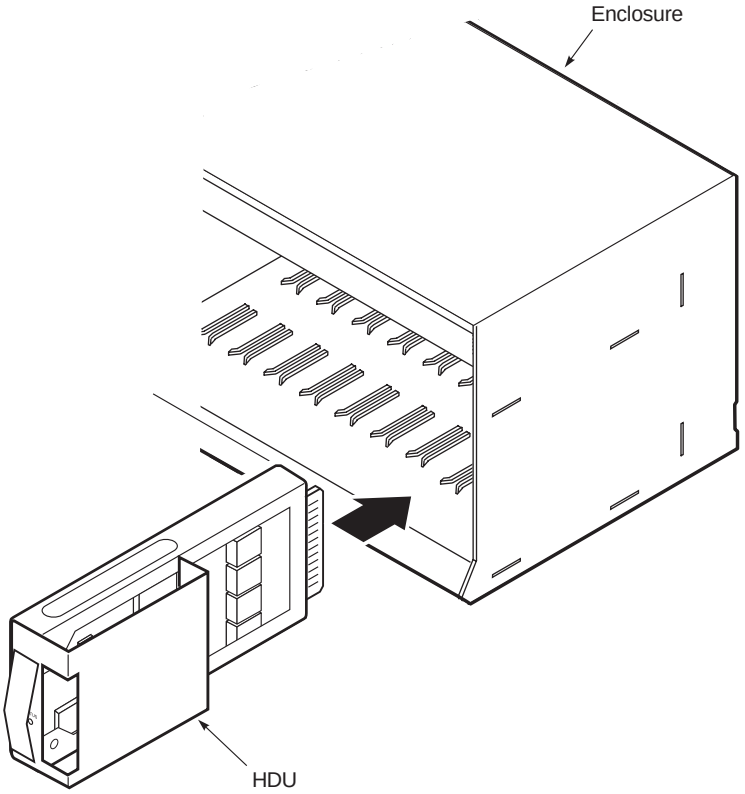


Figure 3. *Installing the HDU-407 in a Remote Enclosure*

Some enclosures may require you to adjust the retaining bar located on the front of the enclosure in order for the doubler unit to be installed. Refer to the appropriate PairGain technical practice.

Once the HDU-407 is installed in the enclosure, the front panel Status LED flashes green if power is applied from an upstream line unit. When the loops on both sides of the HDU synchronize, the LED constantly glows solid green. Refer to the section titled "Alarms" on page 14 for more details on LED operation.

ALARMS

The front panel of the HDU-407 contains a tri-color LED. The LED color and activity provides information on system functionality (see Table 5).

Table 5. *Front Panel Status LED*

LED	Description
Flashing green once per second	Indicates synchronization is being attempted between the HDU-407 and the upstream (network) module.
Flashing green more than twice per second	Indicates synchronization is being attempted between the HDU-407 and the downstream (customer) module.
Solid green	Indicates HDSL frame synchronization has been achieved between the HDU-407 and both the upstream and downstream modules.
Flashing red once per second	Indicates an HDSL Cyclic Redundancy Check (CRC) error has occurred between the HDU-407 and the upstream module. See "Appendix A - Specifications" on page 17.
Flashing red more than twice per second	Indicates an HDSL CRC error has occurred between the HDU-407 and the downstream module. See "Appendix A - Specifications" on page 17.
Flashing yellow once per second	Indicates a Network Doubler Unit (NDU) loopback exists in the HDU-407 towards the network. This tests the integrity of the upstream span.
Solid yellow	Indicates the HDSL margin is less than the margin threshold provisioned for the circuit.
Flashing yellow more than twice per second	Indicates a CDU (HDU-407 to Customer) loopback exists in the HDU-407 towards the customer. This tests the integrity of the downstream span.

LOOPBACK OPERATION IN HIGAIN SYSTEMS

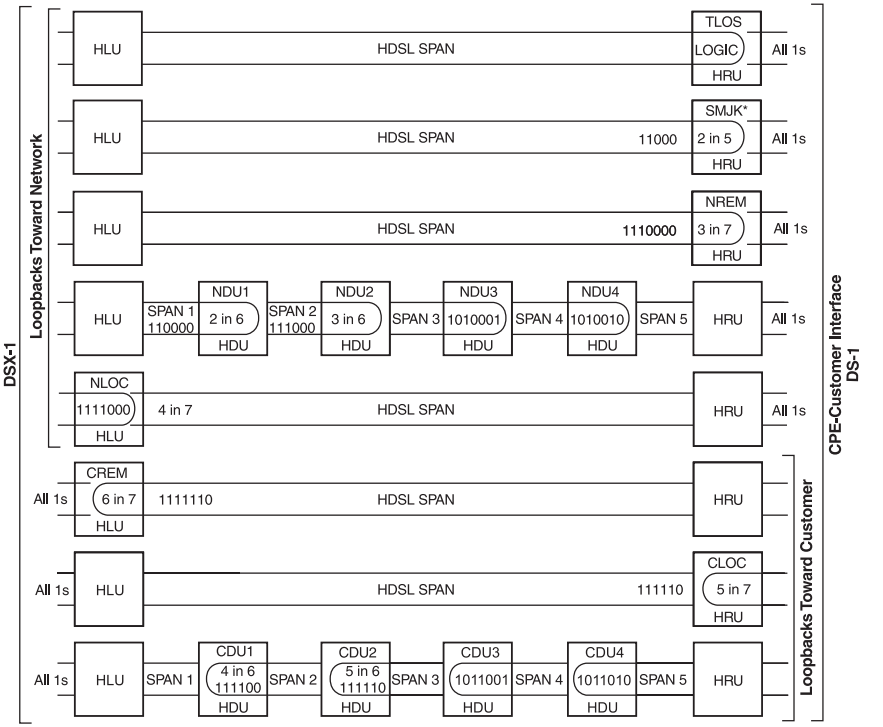
When equipped with the HDU-407 a HiGain system can execute the types of loopbacks listed in Table 6.

The loopbacks can be initiated from the HLU Craft Port, the HLU front-panel buttons, or from a family of Special Loopback (SPLB) in-band commands initiated at the T1 input port at either the HLU or HRU.

The commonly used SPLB Generic command set for four-doubler loopbacks is listed in Table 6. The commands are specific combinations of either 6 or 7 bits that continuously repeat. All NDU loopbacks are towards the network. All CDU loopbacks are towards the customer. Figure 4 on page 16 is a diagram of a HiGain loopback system.

Table 6. *SPLB Generic Loopback Command Set*

Command Set	Loopback Command
NDU1	1 1 0 0 0 0 (2-in-6)
NDU2	1 1 1 0 0 0 (3-in-6)
NDU3	1 0 1 0 0 0 1
NDU4	1 0 1 0 0 1 0
CDU1	1 1 1 1 0 0 (4-in-6)
CDU2	1 1 1 1 1 0 (5-in-6)
CDU3	1 0 1 1 0 0 1
CDU4	1 0 1 1 0 1 0



*Set the SAIS option to ENA to send the all ones pattern (AIS) to the CI during Smart-Jack loopback. Use the 3-in-5 code to loop down.

Figure 4. *HiGain Loopbacks*

For more information about other doubler loopback commands, see the practice for the HLU being used with the doubler.

APPENDIX A - SPECIFICATIONS

Appendix A lists the specifications for the HDU-407.

HDSL

Line Code	784 kbps, 2B1Q full duplex
Output	+13 dBm
Line Impedance	135Ω
Resistive Signature	
Input/Output	25Ω (maximum)
Line Output DC	25Ω (maximum)
Start-up Time (per span)	15 seconds (typical), 30 seconds (maximum)

Line Clock Rate

Internal Stratum 4 clock

Power Consumption

3.0W (nominal), 3.2W (maximum)

Maximum Provisioning Loss

35 dB @ 196 kHz, 135Ω

Wander and Jitter

Nominal - The absence of an HDSL framer from the HDU-407 reduces the Doubler Unit effect on a circuit's overall wander and jitter to second order insignificance when compared to the wander and jitter of other circuit modules.

Latency

80 microseconds (maximum either direction)

Mounting

Standard DDS or ISDN Mechanics slot

Electrical Protection

Secondary surge and power cross protection on all HDSL ports

Environmental

Operating Temperature	-40°F (-40° C) to +149°F (+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-407 (Standard DDS or ISDN Mechanics)

Height	2.6 inch (6.6 cm)
Width	1.45 inch (3.7 cm)
Depth	6.5 inch (16.5 cm)
Weight	0.8 lbs (1.76 kg)

APPENDIX B - GROUND FAULT

Appendix B describes ground fault detection and isolation.

GROUND FAULT DETECTION

The HDU-407 has Ground Fault Detection (GFD) circuits as described in R7-1, Section 7.2.1 of GR-1089 CORE, Issue 1, Revision 1, December, 1996.

When used with HiGain line units, ground faults occurring at any point along any span are immediately detected. Ground fault conditions shut the HiGain circuit down. The line unit periodically tries to apply power to the first span to determine whether the fault condition is still present. As long as the condition exists, the power cycling and ground fault protection continues. To discontinue the ground fault protection, locate and repair the fault in the cable.

Circuits containing both the HDU-407 and older doublers without a GFD circuit also support this new ground fault detecting feature, provided the doubler nearest the HLU is an HDU-407.

The operation of the ground fault circuit requires that the doubler enclosure ground plane is properly connected to earth ground.

GROUND FAULT ISOLATION

Solutions for common problems that may occur with the HDU-407 are listed in Table 7.

Table 7. *Fault Isolation Guide*

Problem	Solution
LED does not light	Verify that the HLU is installed and operational in the Central Office. Verify proper cabling between the doubler enclosure and the Central Office. Measure 100V to 200 Vdc between pins 5 or 6 and 8 or 9. This voltage peaks every 15 to 30 seconds as the HLU cycles between self test and line power. If less than 100 Vdc is present, check the cabling or the HLU. Only the line units mentioned in the Description and Features section can be used to power doublers. Other HLU models may not provide reliable operation and should not be used.
LED continues to flash green once a second	Synchronization is being attempted with the upstream unit.
HDU-407 loses power	The HLU at the Central Office (CO) is not present. Measure the resistance of the HDSL input loop. Resistance should be normal loop resistance plus the 25Ω signature of the HLU.
HDSL line power only appears in very short bursts	A grounded pair is being detected by either the HLU or HDU-407 in Span 1. This causes the unit's Ground Fault Detection (GFD) circuit to trigger which forces the HDSL line voltage off immediately after it cycles on. Remove the HLU and HDU-407 and check for cable ground faults in Span 1. The doubler's GFD circuit can easily be checked by grounding any of the loop connectors to the doubler. This forces the circuit down immediately. If the circuit stays up, either the GFD circuit is defective or the HDU-407 is not properly grounded.
HDU-407 shuts off after Span 1 comes up	A grounded pair is being detected by the HDU-407 in Span 2. Remove HDU-407 and check for ground fault in Span 2.

APPENDIX C - GLOSSARY

Appendix C contains information on abbreviations and definitions for your HDU-407.

2B1Q	Two-Binary, One-Quaternary. Line coding used for HDSL.
AIS	Alarm Indicator Signal
AWG	American Wire Gauge--the standard used to describe wire size. The diameter of the wire increases as the gauge decreases: 26 AWG is 0.0157 feet (4 mm) in diameter, 24 AWG is 0.0201 feet (51 mm), and so on.
Bridged Tap	A pair of wires connected in parallel across a single line to form a "T" configuration.
Cable Binder Group	A group of 25 pairs of wires.
CDU	HDU to Customer loopback
CLEI	Common Language Equipment Identifier
CO	Central Office
CRC	Cyclic Redundancy Check
CSA	Carrier Serving Area/Customer Service Area
DDS	Digital Data Service
ECI	Equipment Catalog Item
ENA	Enable
GFD	Ground Fault Detection
HDSL	High bit-rate Digital Subscriber Line
HDU	HiGain Doubler Unit
HLU	HiGain Line Unit
HRE	HiGain Remote Enclosure
HRU	HiGain Remote Unit

ISDN	Integrated Services Digital Network
KBPS	Kilo (thousand) Bits Per Second, sometimes written Kb/s
LED	Light Emitting Diode
Loop	A length of twisted-pair copper wire connecting the local unit of an HDSL circuit to the remote unit.
MBPS	Mega (million) Bits Per Second, sometimes written Mb/s
NDU	HDU to Network Loopback
NEBS	Network Equipment Building System
POTS	Plain Old Telephone Service
RMA	Return Material Authorization
SPLB	Special Loopback

APPENDIX D - PRODUCT SUPPORT

Appendix D contains product support, warranty, FCC compliance, and modification information.

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 through 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) 730-2800. Transmission speeds up to 28.8 kbps are supported with a character format of 8-N-1.

ORDERING PROCEDURE

Orders may be placed by telephone, by fax, or by mail.

Telephone:	(714) 832-9922
Fax:	(714) 832-9924
Mail:	PairGain Technologies, Inc. 14352 Franklin Avenue Tustin, CA 92680

When placing an order, please provide the following information:

- Customer purchase order number
- Ship-to and bill-to addresses
- Part numbers and quantity required
- Requested delivery date
- Preferred method of shipment

After receiving your order, PairGain will send an Order Acknowledgment to the bill-to and ship-to addresses (unless directed otherwise).

Return for Repair Procedure. Repair inquiries can be made by calling for a RMA number.

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

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 correct 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 incorrect 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 and 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 complies 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. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Refer to the installation section of the appropriate instruction manual for the unit you are installing to get information on:

- Cabling
- Correct connections
- Grounding

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 products 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

ISO 9001
DNV
DNV Certification, Inc.
Certificated Firm

PAIRGAIN