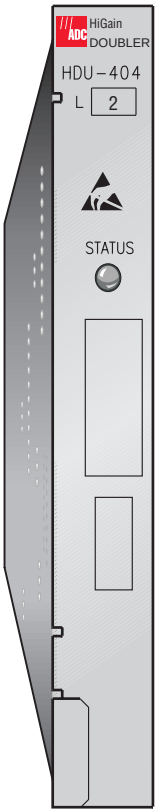
HiGain

QUICK INSTALLATION



HDU-404 LIST 2
DOUBLER UNIT

ADC

THE HDU-404 LIST 2

The HiGain® HDU-404 List 2 is a low-power micro 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). Each doubler allows 1.544 Mbps transmission over an additional Carrier Service Area (CSA) range. The HDU-404 is compatible with both the HiGain and PG-Flex product lines. The CSA includes loops up to 12,000 feet (3.657 km) of 24 AWG or 9,000 feet (2.743 km) of 26 AWG wire.

FEATURES

- Occupies one 200-mechanics slot
- Powered by any doubler-compatible HiGain or PG-Flex line unit
- Extremely low power dissipation
- Lightning and power cross-protection on both sides of the High-bit-rate Digital Subscriber Line (HDSL) interface
- Front-panel status display Light Emitting Diode (LED)
- Extremely low latency
- Compatible with PG-Flex List 3x line units in configurations with up to three spans
- Minimal wander and jitter
- Used in four-span line-powered circuits (three doublers and one remote) or five-span locally powered circuits (four line-powered doublers and one locally powered remote)

SPECIFICATIONS

Operating Temperature	-40 °F (-40 °C) to +149 °F (+65 °C)
Operating Humidity	5% to 95% non-condensing
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
Mounting	Standard 400 or SLIM™ (half the width of a 400)
HDSL Line Code	784 kbps, Two Binary, One Quaternary (2B1Q) full duplex
HDSL Output	+13.0 dBm, 135 Ω
Maximum Provisioning Loss	35 dB at 196 KHz, 135 Ω
Line Clock Rate	Internal Stratum 4 clock
Power Consumption	3.1 W (nominal)
Resistive Signature Input/Output	25 Ω (maximum)

1 BEFORE YOU BEGIN

1 Verify that you are installing the HDU-404 List 2 with the following compatible HiGain outdoor enclosures:

- HRE-450 List 5, single-slot
- HRE-423, 3-slot
- HRE-454, 4-slot

2 Verify that you are installing the HDU-404 List 2 with compatible line and remote circuit modules (see Table 1 inside)**.**

3 Determine the number of doublers the circuit can support based upon:

- the model of the HLU and HRU in the circuit (see Table 1)
- whether or not the HRU is locally powered or line powered (see Table 1)
- whether you are installing in a HiGain (see "HiGain Doubler Applications") or PG-Flex application (see "PG-Flex Doubler Applications").

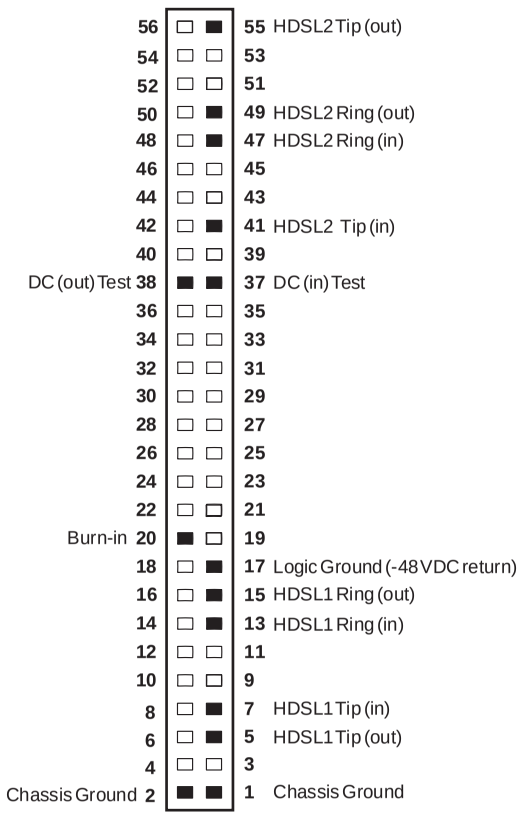
4 Observe the following rules for enclosure placement:

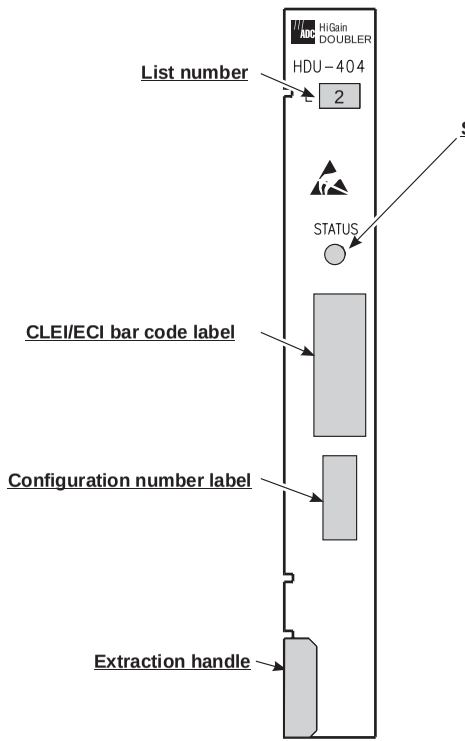
- Rule 1: Place the enclosures at the electrical limits (35 dB) of each span.
- Rule 2: Make all spans the same electrical length (same 196 kHz loss) to achieve optimum performance if Rule 1 is not applicable.
- Rule 3: Confirm that the spans closest to the HLU be as short as possible and the spans furthest from the HLU be as long as possible to minimize power consumption and dissipation of the HLU.

5 Determine the enclosure capacity based upon solar exposure and maximum ambient temperature factors as shown in Table 2, "Solar Load and Maximum Ambient Temperature for Slots 1 through 4".

Continued 

Card-edge connector





Status LED reports the following conditions that are shown in order of priority:

Flashing red (once per second)	Indicates HDSL Cyclic Redundancy Check (CRC) error has occured between the HDU-409 and the upstream module.
Flashing red (twice per second)	Indicates HDSL CRC error has occured between the HDU-409 and the downstream module.
Flashing yellow (once per second)	Indicates a loopback at the doubler towards the network. This loopback tests the integrity of the upstream span.
Flashing yellow (twice per second)	Indicates a loopback at the doubler towards the customer. This loopback tests the integrity of the downstream span.
Flashing green (once per second)	Indicates synchronization is being attempted between the HDU-409 and the upstream (network) module.
Flashing green (twice per second)	Indicates synchronization is being attempted between the HDU-409 and the downstream (customer) module.
Solid yellow	Indicates the HDSL margin is less than the margin threshold provisioned for the circuit.
Solid green	Indicates HDSL frame synchronization has been achieved between the HDU-409 and both the upstream and downstream modules.

HiGain Doubler Applications

The HDU-404 List 2 can be used in two- to five-span circuits, depending on the HLU model and the power option (line or local) of the compatible HRU. Table 1 lists the maximum number of doublers that can be deployed.

Table 1. *Maximum Number of HDU-404 List 2 Doublers per Circuit*

HLU Model	Maximum Number of HDU-404 Doublers Per Circuit [a]			
	Line-Powered Remote		Locally Powered Remote	
	I-CPE ON	I-CPE OFF	I-CPE ON	I-CPE OFF
HLU-388 List 2x, HLU-319 List 2x, HLU-231 List 3D, HLU-231 List 6D, HLU-232 List 1D, HLU-231 List 7x, HLU-431 List 1x	1	2	2	2
HLU-231 List 8D, HLU-319 List 5D, HLU-388 List 5D HLU-231 List 8/List 8E, HLU-319 List 5/List 5E, HLU-388 List 5/List 5E	2	3 [b]	2	4 [c]

(a) The HRU-412 is limited to applications with one and two doublers only.
(b) Requires HRU-402, all lists.
(c) Requires HRU-402 List 1 or List 3.

HiGain systems support doubler loopbacks when HiGain doublers are used with compatible HiGain circuit modules.

Consult your line unit documentation for details on how to execute generic, special, and doubler loopbacks.

PG-Flex Doubler Applications

Figure 1 shows a typical HDU-404 List 2 installation for the PG-Flex subscriber carrier system. For each doubler installed between the PG-Flex Central Office Terminal (COT) and Remote Terminal (RT), two auxiliary power pairs are required. A maximum of two doublers may be installed in a PG-Flex system. With two doublers, four sets of auxiliary power pairs must be installed between the COT and the RT. These auxiliary power pairs must be the same wire gauge (or larger) as the pairs used for HDSL.

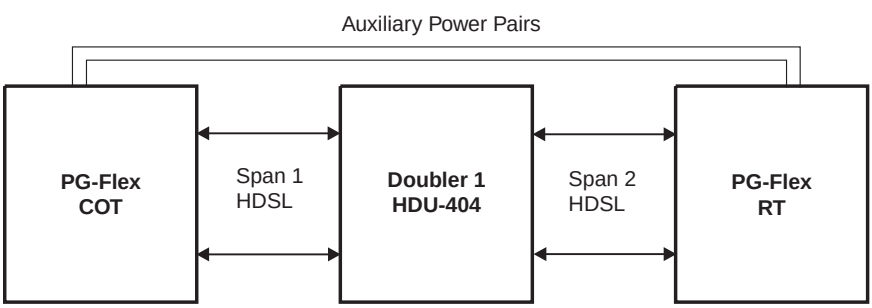


Figure 1. *Typical HDU Installation with PG-Flex*

PG-Flex systems do not support doubler loopbacks.

DOUBLER DEPLOYMENT

Sealed multislot outdoor enclosures restrict the rate of heat transfer to the outside air. This restriction may result in excessive heat buildup. Table 2 shows the number and location of occupied slots that can be reliably housed in either the HRE-423, HRE-450, or HRE-454 enclosure as a function of solar exposure and maximum ambient temperature.

Table 2. *Solar Load and Maximum Ambient Temperature for Slots 1 through 4* [a]

Slot Occupancy					
Slot 1	**Slot 2**	**Slot 3**	**Slot 4**	**Solar Load** [b]	**Maximum Ambient Temperature** [c]
HRE-423 (3-slot)					
x	x	x		Full	135 °F
x	x	x		None	140 °F
x	x			Full	145 °F
x	x			None	135 °F
	x			Full	155 °F
	x			None	160 °F
HRE-450 (1-slot)					
x				Full	150 °F
x				None	160 °F
HRE-454 (4-slot)					
x	x	x	x	Full	125 °F
x	x	x	x	None	130 °F
x	x		x	Full	135 °F
x	x		x	None	140 °F
	x		x	Full	145 °F
	x		x	None	150 °F
	x			Full	155 °F
	x			None	160 °F

(a) Doubler-occupied slots.
(b) Maximum sunlight exposure per TR-TSY-000057. None = Doublers are inside a remote enclosure, underground, or fully shaded.
(c) Outside air temperature.

2 INSTALLATION

1 Align the HDU-404 List 2 with the enclosure slot guides and slide the unit in.

2 Push the unit into the enclosure until it snaps into place, indicating that it is properly seated.

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

When used in a HiGain circuit, the HDU-404 List 2 immediately detects ground faults occurring at any point in any span and shuts down the HDSL power feed circuit until the ground fault is located and repaired. When using older doublers without a GFD circuit, the HDU-404 must be the doubler nearest the HLU to support GFD. The ground plane of the doubler enclosure must be securely connected to earth ground.

3 POWER-UP SEQUENCE

Once the HDU-404 is installed in the enclosure, the front panel Status LED flashes green when power is applied from an upstream line unit. Once the loops on both sides of the HDU synchronize, the LED turns a steady green.

FCC Class A Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference 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, may 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.

Limited Warranty

Product warranty is determined by your service agreement. Contact your sales representative or Customer Service for details.

Modifications

Any changes or modifications made to this device that are not expressly approved by ADC DSL Systems, Inc. voids the user's warranty.

All wiring external to the products should follow the provisions of the current edition of the National Electrical Code.

Standards Compliance

This equipment has been tested and verified to comply with the applicable sections of the following safety standards:

- GR 63-CORE - Network Equipment-Building System (NEBS) Requirements
- GR 1089-CORE - Electromagnetic Compatibility and Electrical Safety
- Binational standard, UL-1950/CSA-C22.2 No. 950-95: Safety of Information Technology Equipment

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