PAIRGAIN TECHNOLOGIES HIGAIN™ REMOTE ENCLOSURE MODEL HRE-423 Issue 1

List 1, PairGain #150-1118-01 CLEI: T1RHA2N4MA
List 2, PairGain #150-1118-02 CLEI: T1RHA2G4MA

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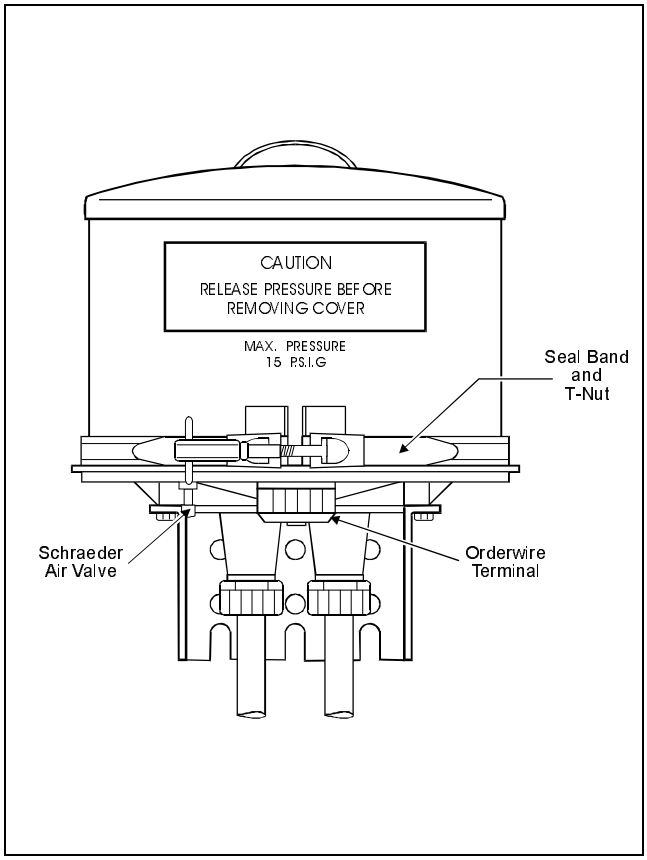

Figure 1. HRE-423, List 1 and 2 Remote Enclosure. The PairGain HRE-423 weatherproof enclosure houses up to three HRU-412 HiGain Remote Units or HDU-451 HiGain Doubler Units

A. PRODUCT OVERVIEW

1. DESCRIPTION AND FEATURES

1.01 This document describes the HiGain Weatherproof Enclosures HRE-423 List 1, (Gel-Filled), HRE-423 List 2, (Air-Filled) and the installation of these enclosures. These enclosures are a part of a HiGain system and are used to house the HiGain Remote Units or the HiGain Doubler Units. The List 1 and List 2 enclosures are identical except for a whisker valve in enclosures with air-filled stubs. The applicable codes for these enclosures are:

- HRE-423, List 1, Gel-Filled
  Part Number: 150-1118-01
  CLEI: T1RHA2N4MA
- HRE-423, List 2. Air-Filled
  Part Number: 150-1118-02
  CLEI: T1RHA2G4MA

1.02 Revision History of this practice.

Revision 04—April 10, 1996

a) Changed stubs from dual jacket to single jacket cables.

b) Numerous additions, deletions and clarifications to information (text and figures).

c) Changed the stubs binder group tracer colors.

d) Changed the order wire from the Black/Green to the White/Red pair.

1.03 HRE-423, List 1 and 2 features:

- Gel or air-filled stubs
- Underground or pole mount
- Primary surge protection
- Stainless steel cover

2. APPLICATIONS

2.01 The primary application of the HRE-423 Remote Enclosure is to house the HRU-412 or EDU 412 Remote Units or HDU-451 or EDU-451 Doubler Units of a HiGain repeaterless T1 transmission system. It can also house other HiGain plugs with 400 mechanics. The HiGain system provides a quick and cost-effective way of delivering High Capacity Digital Service (HCDS) to customers over metallic cable pairs. The HiGain system utilizes two-bit, one-quaternary (2B1Q) High-bit-rate Digital Subscriber Line (HDSL) transmission technology as recommended by Bellcore TA-TSY-001210.

3. SPECIFICATIONS

Operating Temperature and Humidity

-40 to 65° Celsius, 5 to 95% (non-condensing)

Altitude

To 14,000 ft (4,300 m)

Mounting

400 Mechanics

Dimensions

Height: 15.5 in. (39.4 cm)
Width: 13.3 in. (33.8 cm)
Depth (dome): 14.9 in. (37.9 cm)
Height (total): 19 in. (48.5 cm)

Volume

0.884 cu ft (0.025 m^3)

Weight

HRE-423, List 1 (GF): 84 lb. (38.1 kg)*
HRE-423, List 2 (AF): 74 lb. (33.57 kg)*
(*Shipping weights including stubs and packaging)

4. CERTIFICATION

4.01 FCC Certification does not apply to this product.

5. WARRANTY

5.01 PairGain Technologies warrants this product to be free of defects and to be fully functional for a period of 36 months from the date of original shipment, given proper installation. 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 improper use or installation.

5.02 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.
14402 Franklin Avenue
Tustin, CA 92680
ATTN: Repair and Return Dept.
(800) 638-0031

6. CUSTOMER SERVICE

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

6.02 **Technical Support.** For technical support, (8:00 AM to 5:00 PM Pacific Time) Monday through Friday, call 1-800-638-0031. After hours emergency support is available through the same number.

6.03 **Ordering Procedure.** Orders may be placed by telephone, by fax, or by mail.

Fax: **(714) 832-9924**

Telephone: **(714) 832-9922**

Mail: **PairGain Technologies, Inc.**
14402 Franklin Avenue
Tustin, CA 92780

6.04 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.

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

6.06 **Return for Repair Procedure.** Repair inquiries can be made by calling for a Material Return Authorization (RMA) number as specified in Paragraph 5.03.

6.07 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

B. FUNCTIONAL DESCRIPTION

7. COMPONENTS

7.01 The enclosure consists of a metal alloy card cage with space for up to three HiGain Remote units or HiGain Doubler plug-in units, a fiberglass composite baseplate, and a stainless steel cover which maintains weather-tight integrity. Figure 1 shows an HRE-423; Figure 2 shows an HRE-423 with the stainless steel cover removed.

7.02 **Stainless Steel Cover.** A stainless steel cover fits over the card cage and seals the inner assembly when clamped to the baseplate. The cover provides a durable corrosion-resistant, easily removed, protective cover. For highly corrosive environments, a special cover made of type 316 stainless steel is available. The stainless steel cover V-retainer, equipped with a T-bolt, tightens to seal the enclosure cover firmly against the O-ring on the baseplate. The O-ring compresses to effect a pressure-tight seal. A locking Z-bar with the T-handle prevents unauthorized access to the enclosure. The bracket accepts a padlock with a maximum shackle diameter of 0.3-inch. Cover V-retainers may be torqued to 25 to 30 inch-pounds, if required, or they may be manually tightened.

7.03 **Card Cage.** The card cage inside the enclosure has three mounting positions to hold up to three plug-in units. Above each slot is an RS-232 connector, which provides access to the terminals of the unit in that particular slot. A retainer bar across the bottom of the card cage extends the width of the card cage. The retainer bar prevents the plug-in units from disconnecting when the enclosure is subjected to severe vibrations. Personnel can remove or insert plug-in units by turning the retaining screw in the center of the bar until it releases and turning down the retaining bar.

The enclosure has a mechanism that enables the card cage to tilt approximately 45 degrees to provide easy access to the rear of the card cage. Two retainer screws at the base of the card cage (one on each side) lock the card cage in its normal level position and prevent it from tilting during severe vibrations. A lightning protection unit (LPU) on the rear side of the card cage, at the end of each slot, provides primary lightning protection for the HDSL loops as well as the circuit toward the customer interface.

7.04 Lightning Protection Unit (LPU). The Lightning Protection (LPU), shown in Figure 3, is a printed board assembly that attaches to the card cage at the rear of each plug-in unit slot, over the wire wrap connector pins. All HRE-423 versions have the LPU shipped as part of the basic enclosure. The LPU must be installed to provide proper grounding and protection. The unit contains four gas tubes, which provide the actual surge protection. The individual gas tubes are field replaceable components. For ease in replacing gas tubes, PairGain recommends that you use a gas tube extractor.

This LPU has two option screws for setting the HRU-412 List 1, 2, & 4 CDE current options on the T1 loop to the CI. The LPU also provides a 51 kilohm resistor which references frame ground (protection ground) to circuit ground. Note that when using the HRE-423 to house HRU-412, List 6 or List 7 units, the two current option screws must be disabled (see Paragraph 17.01).

Any time you remove the LPU from the card cage, there is no frame ground connection for the unit in that particular slot. When you must remove the LPU momentarily (i.e. during replacement), make sure you connect a temporary clip lead from the ground lug to pin 1 or pin 2 of the pin connector on the rear of the slot where the LPU was removed.

7.05 Cable Stubs and Pressurization. The screened cable stubs provided with the HRE-423 are 50 feet long. The stubs are available as gel-filled List 1 or air-filled List 2. Cable strain relief grips, which screw onto the end of the hollow conical openings extending through the baseplate, secure the two cable stubs to the enclosure baseplate. The cable pairs are splayed out and encapsulated in polyurethane poured into the conical openings. This provides a air-tight seal at the cable entry point.

For a cable-pressurized enclosure with air filled stubs, cable stub A connects inside the enclosure to a whisker valve via nylon pressure tubing. This connection enables dry air or dry nitrogen to flow from the main cable to the cable stub to the whisker valve. When the housing cover is in place, the whisker valve is open, which enables air or nitrogen to flow into the housing. Removing the stainless steel cover closes the valve to prevent pressure loss from the cable. The maximum pressure for an HRE-423 List 2 (AF) enclosure is 15 psi. Enclosures with gel filled stubs cannot be pressurized from the main cable, but can be statically (locally) pressurized to a maximum of 15 psi. Note that when gel filled enclosures are locally pressurized, the air tends to leak out between the small gap that exists between the copper conductors of all pairs and their insulation.

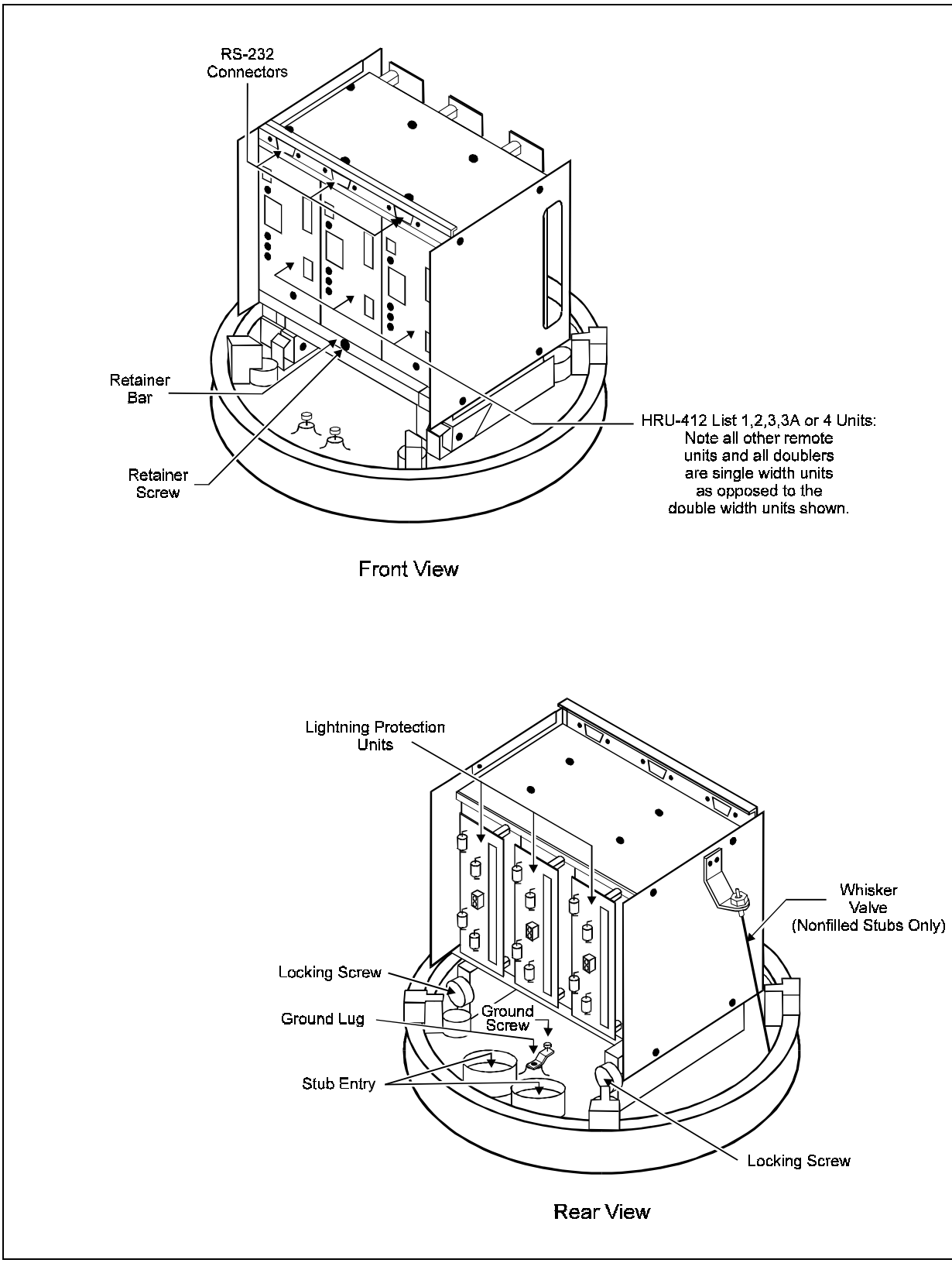

Figure 2. HRE-423 with Cover Removed. List 1 has dual 50-foot gel-filled screened cable stubs. List 2 has dual 50-foot air-filled screened stubs and a whisker valve to prevent pressure loss in the cable when the enclosure is open.

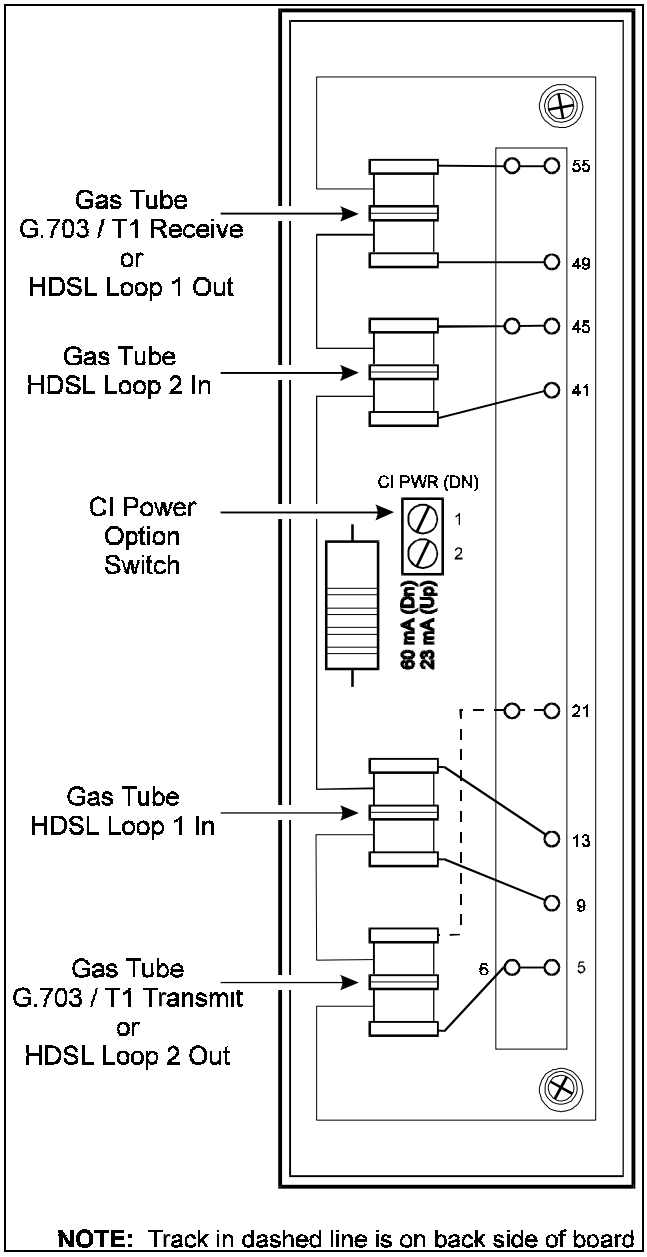

Figure 3. Lightning Protection Unit. The LPU provides primary lighting protection for the HDSL loops and customer T1 circuits.

An external Schraeder bleed valve (similar to a car tire valve) on the bottom side of the enclosure baseplate relieves internal pressure before the enclosure is opened. Always relieve the internal pressure before opening the enclosure. You can use this valve to statically pressurize the enclosure from a source other than the main cable (maximum pressure of 15 psi). The bleed valve also provides a point to attach a pressure gauge in order to check the internal pressure of the enclosure.

The HRE-423 List 1 with filled cable stubs can be statically pressurized through the external Schraeder valve if desired. Always relieve the pressure of a static-pressurized enclosure as considerable pressure can build up.

You can convert the HRE-423 with gel-filled cable stubs to a vented -to-atmosphere enclosure, if necessary, by installing a vent breather kit (600342-700-001) provided with the enclosure. The vent kit replaces the external Schraeder valve with a vent tube. The vent tube contains a stainless steel wool filter to prevent insects from entering.

7.06 Spare Connections. Several spare wire pairs are provided in all versions of the HRE-423. Should any pair become damaged, any spare pair may be used as a replacement. The preferred spare pair is in cable stub A, group 1, white/black.

7.07 Orderwire Connections. An orderwire pair is taken out of the incoming stub behind the card cage. The orderwire pair comes under the card cage to the conical connectors on the baseplate in front of the card cage. The conical connectors are shown in Figure 2.

A technician can gain access to the orderwire without opening the enclosure. Extending down from the baseplate, in front of the stubs, is the orderwire access. Unscrew the access cover and the technician may connect to the orderwire**.**

8. OPTIONAL EQUIPMENT AND REPLACEABLE PARTS

8.01 Optional Equipment for Highly Corrosive Environments. For highly corrosive environments, a special cover made of 316 stainless steel is available. An anti-corrosion kit also may be ordered. The anti-corrosion kit consists of a pair of galvanized steel sacrificial angle brackets and a ground strap connecting the base mounting bracket and sacrificial angles to the housing ground lug.

8.02 Replaceable parts. Table 1 lists field-replaceable parts for the HRE-423s.

TABLE 1. FIELD-REPLACEABLE PARTS

Description	*Part Number*
O-Ring	132-1001-01
Desiccant, 2 bags	132-1002-01
Stainless Steel Cover, Standard	132-1003-01
V-Retainer, Z-bar Assembly	132-1004-01
Anticorrosion Kit	132-1005-01
Air Vent Kit	132-1006-01
Bleeder Valve Kit	132-1007-01
Lightning Protection Unit* (NOTE 2)	132-1008-01
Gas Tube (3 element)	425-1002-01

*If you remove the LPU, you must connect a temporary clip lead from the ground lug to pin 1 or pin 2 of the pin connector where the LPU has been temporarily removed. This ensures a frame ground connection to the HRU-412 in the affected slot.

C. INSTALLATION

9. UNPACKING

9.01 Before installing a new HRE-423, unpack and visually inspect all components as follows to ensure that all of the components are present and that no physical damage occurred in shipping (see Figure 2):

1) Remove the HRE-423 from its shipping carton.
2) Perform an inventory to verify that all equipment listed on the packing list is present.
3) Inspect the enclosure for shipping damage.
4) Check the card cage for any sign of breakage.
5) Check the O-ring for any sign of damage.
6) Find and loosen the retaining screws at the rear base of the card cage.
7) Tilt the card cage on its hinge.
8) Lower the card cage to its level position and tighten the screws to lock it in position. PairGain recommends always keeping the card cage in a level, locked position.
9) Report any damage to the carrier immediately.

10. MOUNTING

10.01 Pole or Pedestal Mounting. Use the procedure in Table 2 to mount the enclosure on a pole or pedestal. Mounting dimensions for pole or pedestal mounted enclosures are shown in Figures 4 and 5. Have the following equipment ready before you begin this procedure:

- Two or four 3/8-inch lag screws, 4 inches long (minimum). If a pole or pedestal has a diameter of less than 7 inches, you will need two screws. Larger poles and pedestals require four screws and washers.
- One flat-blade screwdriver or wrench
- One drill with a 1/4-inch bit

10.02 Flat-Surface Mounting. Use the procedure in Table 3 to mount the enclosure on a flat surface in a manhole. You must allow for enough top clearance to remove the cover (see Figure 6). Have the following equipment ready before you begin this procedure:

- 4 3/8-inch, 16 NC anchor bolts, 2-1/2 inches long for wall mounting; or
- 4 3/8-inch through bolts for rack mounting.
- 1 Pair of pliers or wrench
- 1 Drill with a 1/4 inch bit

TABLE 2. POLE OR PEDESTAL MOUNTING PROCEDURE

Step	*Action*
	DANGER **While mounting the enclosure, hold the enclosure securely to prevent personal injury or damage to the enclosure.** **NOTE** **Because of the weight of the enclosure, you may want to detach the mounting bracket from the baseplate without breaking the pressure seal by removing four attaching bolts. The bolts are arranged symmetrically, so you can rotate the enclosure 90, 180, or 270 degrees with respect to the vertical orientation. In this case, you can decide on the orientation after completely securing the bracket to the pole or pedestal.**
	PROCEDURE FOR MOUNTING ON A POLE OR PEDESTAL WITH A DIAMETER OF LESS THAN 7 INCHES (see Figures 4 and 5)
1	Select a convenient mounting location on the pole or pedestal.
2	Position the mounting bracket against the pole or pedestal (stubs down) and mark the location of the center mounting slot and hole.
3	Remove the bracket and drill two holes, 1/4-inch diameter by 3 inches deep, at the locations marked in Step 2.
4	Start a lag screw in the bottom mounting hole and screw into the pole or pedestal approximately 2/3 or the screw length.
5	Rest the housing bracket on the lag screw, so the bottom center slot of the mounting bracket engages the screw.
6	Slide the lag screw in the center hole of the mounting bracket and start the screw in the top mounting hole.
7	Secure the enclosure bracket to the pole or pedestal by tightening the lag screws until snug.
8	If stubs connect to underground cable, dress the cable stubs down the pole or pedestal to the splice case. If stubs connect to aerial cable, form a drip loop in each stub and dress the stubs up the pole or pedestal to the splice case.
9	(Optional but recommended.) Install a customer-supplied metal guard over the stubs as added protection against vandalism.
	PROCEDURE FOR MOUNTING ON A POLE OR PEDESTAL WITH A DIAMETER LARGER THAN 7 INCHES (see Figures 4 and 5)
1	Select a convenient mounting location on the pole or pedestal.
2	Position the mounting bracket against the pole or pedestal (stubs down) and mark the location of the four outside mounting slots and holes.
3	Remove the bracket and drill four holes, 1/4-inch diameter by 3 inches deep, at the locations marked in Step 2.

Table continued on next page

TABLE 2. POLE OR PEDESTAL MOUNTING PROCEDURE (CONTINUED)

Step	*Action*
4	Start a lag screw in each bottom mounting hole and screw into the pole or pedestal approximately 2/3 of the screw length.
5	Rest the enclosure bracket on the lag screw, so the bottom outside slots of the mounting bracket engage the screws.
6	Slide the lag screws into the top outside holes of the mounting bracket and start screws in the top mounting holes.
7	Secure the enclosure bracket to the pole or pedestal by tightening the lag screws until snug.
8	If stubs connect to underground cable, dress the cable stubs down the pole or pedestal to the splice case. If stubs connect to aerial cable, form a drip loop in each stub and dress the stubs up the pole or pedestal to the splice case.
9	(Optional but recommended.) Install a customer-supplied metal guard over the stubs as added protection against vandalism.

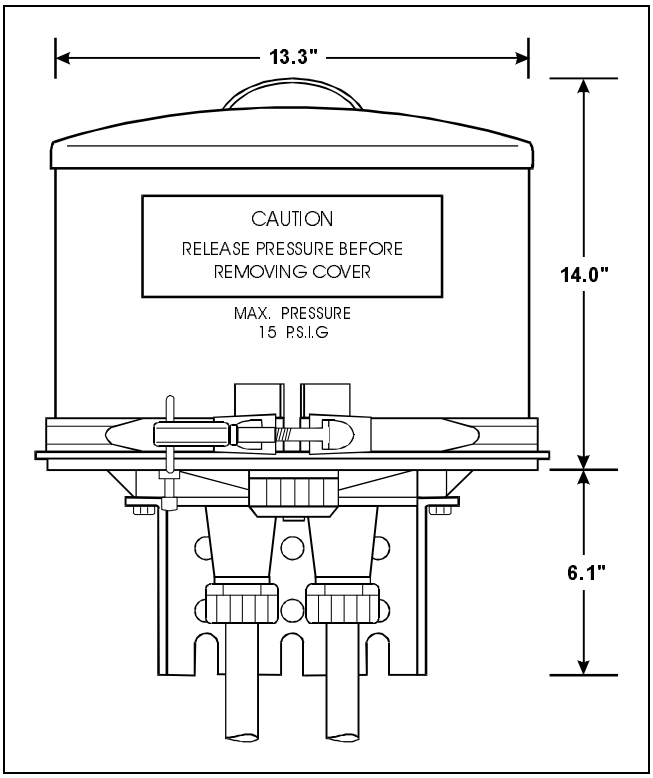

Figure 4. HRE-423 Enclosure Dimensions. The enclosure can be mounted on a pole, a dedestal, or on a wall in a manhole.

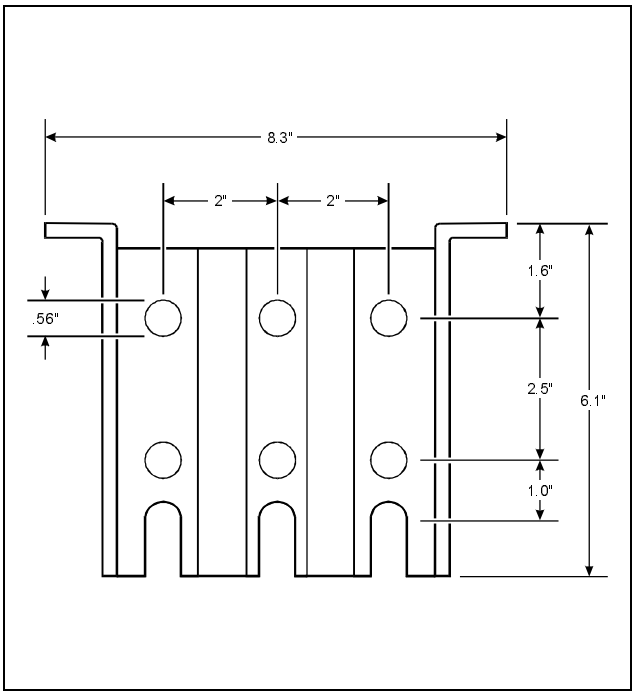

Figure 5. Mounting Bracket Dimensions. Four bolts hold the mounting bracket to the enclosure baseplate.

TABLE 3. FLAT-SURFACE-MOUNTING PROCEDURE

Step	*Action*
	DANGER **While mounting the enclosure, hold the enclosure securely to prevent personal injury or damage to the enclosure.**
	PROCEDURE FOR MOUNTING THE ENCLOSURE ON A WALL (see Figure 6)
1	Select a convenient mounting location on the wall. **CAUTION** **Do not mount the HRE-423 horizontally in a manhole.**
2	Position the enclosure bracket against the wall and mark the location of the two outside mounting slots and four holes.
3	Remove the bracket and drill four mounting holes of the appropriate size at locations marked in Step 2.
4	Position the enclosure so the outside slots and holes in the mounting bracket align with the mounting holes.
5	Slide the anchor bolts into the outside slots and holes of the mounting bracket and start the bolts in the mounting holes.
6	Secure the enclosure to the wall by tightening the bolts until snug.
	PROCEDURE FOR MOUNTING THE ENCLOSURE IN A RACK (see Figure 6)
1	Select a convenient location on the cable rack.
2	Position the enclosure so the outside slots and holes in the mounting bracket align with the mounting holes in the cable rack.
3	Slide bolts with nonmetallic washers through into the outside slots and holes of the mounting bracket and start the bolts in the mounting holes.
4	Secure the enclosure to rack by tightening the bolts until snug.

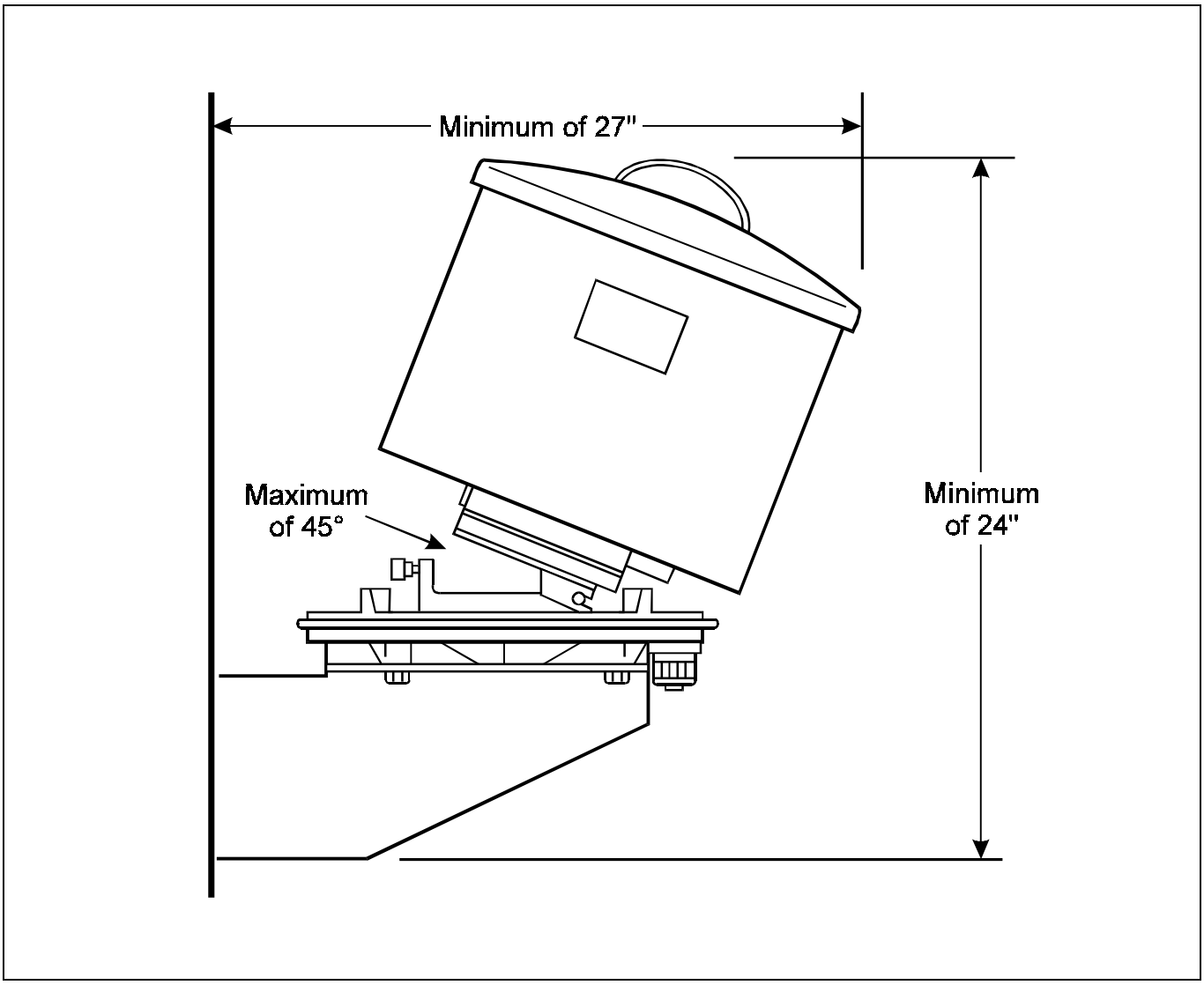

Figure 6. Flat-Surface Mounted Enclosure. This illustration shows the mounting dimensions for flat surface-mounted enclosures.

11. GROUNDING

11.01 Use the standard grounding procedure in Table 4 or use existing local grounding practices to ground the enclosure. The HRE-423 requires a resistance of 25 ohms or less to ground as measured with a megger-type ohmmeter.

11.02 Have the following equipment ready before you begin the procedure:

- One bullet bond
- One ground rod for pole or pedestal mounted enclosures (may require more than one rod).
- One Megger-type ohmmeter
- Cable, 6 AWG

TABLE 4. GROUNDING PROCEDURE

Step	*Action*
	DANGER **Make sure you ground the HRE-423 before splicing the cable stubs into the main cable. This grounding method (or an accepted local grounding method) must be in effect at all times to safeguard personnel.**
	CAUTION **Always maintain connection of protection ground wire which connects under the mounting screw of the lightning protection unit for proper operation of the lightning protection unit. Operating the HRU-412 or HDU-451 units within an HRE-423 without the lightning protection unit installed and grounded is not recommended by PairGain and may result in damage to the units.**
	PROCEDURE FOR GROUNDING A POLE- OR PEDESTAL-MOUNTED ENCLOSURE (see Figure 7)
1	Bond the main cable shield through the splice case using bullet bond.
2	Drive the ground rod into the ground near the enclosure location.
3	Using a megger-type ohmmeter, measure the resistance between enclosure ground and the ground rod. ***Requirement: The resistance must be 25 ohms or less.***
4	If the requirement is met, proceed to Step 5. If requirement is not met, follow local practice to lower the resistance to ground to meet the requirement before proceeding to Step 5.
5	Using 6 AWG cable, connect the grounding lug on the enclosure to the ground rod.
6	Using 6 AWG cable, connect the main cable shield to the ground rod. **CAUTION** **Do not connect the main cable shield to the enclosure stub cable shields, because the stub shields are internally grounded to the enclosure ground lug. Connecting the main cable shield to the stub cable shields may cause a ground loop.**
7	If commercial power ground exists, bond telephone ground to power ground as a safety measure.
8	Using a megger-type ohmmeter, measure the main cable shield resistance. ***Requirement: The resistance must be 5 ohms or less.***
9	If the requirement is not met, ground the main cable shield every 2,000 feet.

Table continued on next page

TABLE 4. GROUNDING PROCEDURE (CONTINUED)

PROCEDURE FOR GROUNDING A FLAT SURFACE-MOUNTED ENCLOSURE (see Figure 8)	
1	Bond the main cable shield through the splice case using bullet bond.
2	Using a megger-type Ohmmeter, measure the resistance between enclosure ground and the ground connection point in the manhole. ***Requirement: The resistance must be 25 ohms or less.***
3	If the requirement is met, proceed to Step 4. If the requirement is not met, follow local practices to lower the resistance to ground to meet the requirement in Step 2 before proceeding to Step 4.
4	Using 6 AWG cable, connect the ground lug on the HRE-423 to the ground connection in the manhole.
5	Using 6 AWG cable, connect the main cable shield to the ground connection in the manhole. **CAUTION** **Do not connect the main cable shield to the enclosure stub cable shields, because the stub shields are internally grounded to the enclosure ground lug. Connecting the main cable shield to the stub cable shields may cause a ground loop.**
6	Using a megger-type ohmmeter, measure the main cable shield resistance. ***Requirement: The resistance must be 5 ohms or less.***
7	If the requirement is not met, ground the main cable shield every 2,000 feet.

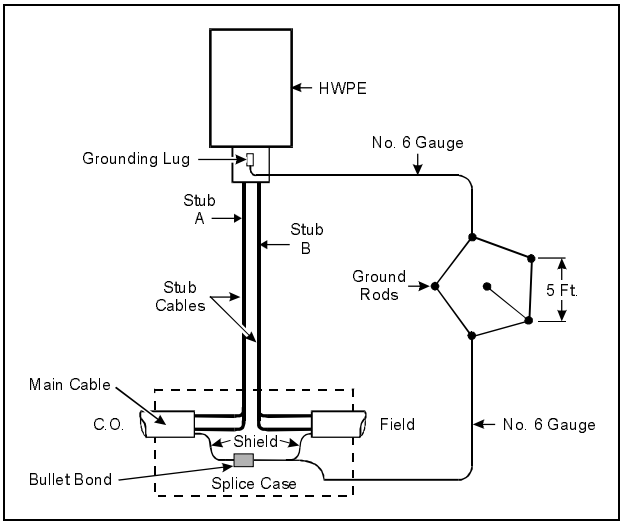

Figure 7. Pole-Mounted Grounding. This diagram shows a grounding circuit for a pole or pedestal mounted enclosures.

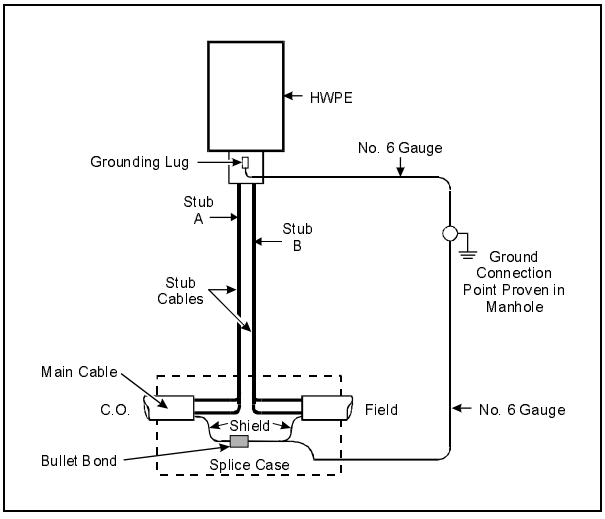

Figure 8. Flat Surface Grounding. This diagram shows a grounding circuit for a manhole-mounted enclosures.

D. WIRING

12. GENERAL

12.01 Two cable stubs, A & B shown in Figures 7 & 8, provide the wire access from the HRE-423 to the main cable. Each stub has 28 pairs. The WHT/RED pair in Group 1 of Stub A is the order wire pair. Each cable stub contains two groups of wires, each in its own screened section, (Group 1) with 14 pairs and (Group 2) with 14 pairs (See Figure 9). The colored pair assignments are the same in each group. Tracer threads define the two groups: Group 1 has the blue tracer threads and Group 2 the orange tracer threads.

12.02 The wiring from the cable stub entry to the card cage connectors and to the orderwire connector is factory-installed.

12.03 The HRE-423 can be used to house either remote units or doublers.

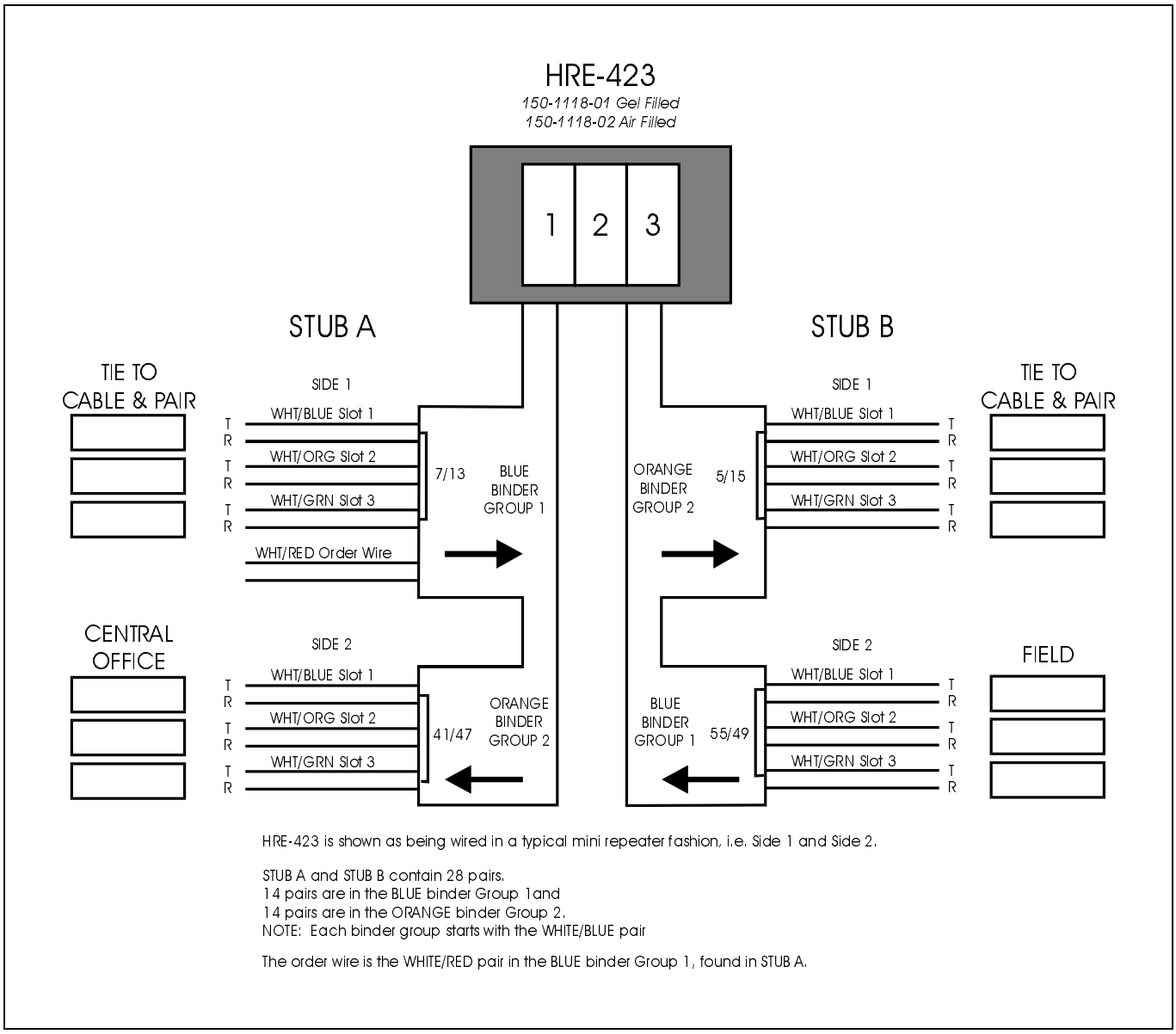

Figure 9. HRE-423 interface wiring diagram and cable assignment drawing. See Figure 6 for cable pair signal assignments.

13. REMOTE UNIT APPLICATIONS

13.01 The following lists the HiGain remote units that can be used in the HRE-423 and the appropriate pin assignment figure number.

Figure #	Unit	Description
10	HRU-412 List 1, 2, 3, 3A, & 4	Double wide module for 2 pair (HDSL) T1 (1.544 Mbps) service
11	HRU-412 List 6 & 7	Single wide module for 2 pair (HDSL), T1 (1.544 Mbps) service.
12	ERU-412 List 2	Single wide module for 2 pair (HDSL), E1 (2.048 Mbps) service, G.703, 120 ohm balanced.
13	HRU-512	Single wide module for 1 pair (HDSL), T1 fractional (128 to 786 Kbps) service.
14	HRU-612	Single wide module for 1 pair (HDSL), T1 (1.544 Mbps) service.

13.02 The CPE current pins shown in Figure 10 provide the HRU, List 1, 2, & 4 with the option to provide 60ma of current to power an external Network Interface Device (Smart Jack). See Section 17 for instructions regarding this option.

13.03 The wire list for the HRU-412 (all list numbers) connecting pairs in each stub is shown in Table 6. Connectors J1, J2, and J3 are the card edge connectors at the rear of each HRU-423 slot. The slots are numbered 1 through 3, from right to left, facing the front of the card cage.

13.04 To ensure compatibility of the HRE-423 with all versions of the HRU-412 Remote Units, each slot has three jumper wires. Table 5 lists the connections made by the white jumper wires on connectors J1, J2, and J3. These connections are listed for information purposes only. All jumper connections are made at the factory. You do not need to make any jumper connections during installation.

13.05 The wire list for ERU-412, List 2, 120 ohm applications is shown in Table 7. Use of the ERU-412, List 1, 75 ohm unit is not recommended since the HRE-423 does not provide the proper G.703 unbalanced interface for this unit.

13.06 Table 8 shows the wire list for the single HDSL pair HRU-512 and HRU-612 applicatons. Only the Group 1 pairs in Stubs A and B are used. Group 2 pairs are not used.

13.07 The HRE-423 is not wired to provide 48V power to any of its slots.

14. DOUBLER APPLICATIONS

14.01 The HRE-423 can be used to house the following two HiGain doublers:

- HDU-451 T1 (1.544 Mbps) unit
- EDU-451 E1 (2.048 Mbps) unit

Both of these units have identical pair assignments as shown in Figure 15. Their wire list is shown in Table 9. Figure 16 summarizes all of the HRE-423 interfaces.

TABLE 5. FACTORY-INSTALLED JUMPER CONNECTIONS

Signal	***Jumper Connection Between***	
HDSL 1 TIP	J1 PIN 9	J1 PIN 7
HDSL 2 RING	J1 PIN 45	J1 PIN 47
T1 TX RING	J1 PIN 21	J1 PIN 15
HDSL 1 TIP	J2 PIN 9	J2 PIN 7
HDSL 2 RING	J2 PIN 45	J2 PIN 47
T1 TX RING	J2 PIN 21	J2 PIN 15
HDSL 1 TIP	J3 PIN 9	J3 PIN 7
HDSL 2 RING	J3 PIN 45	J3 PIN 47
T1 TX RING	J3 PIN 21	J3 PIN 15

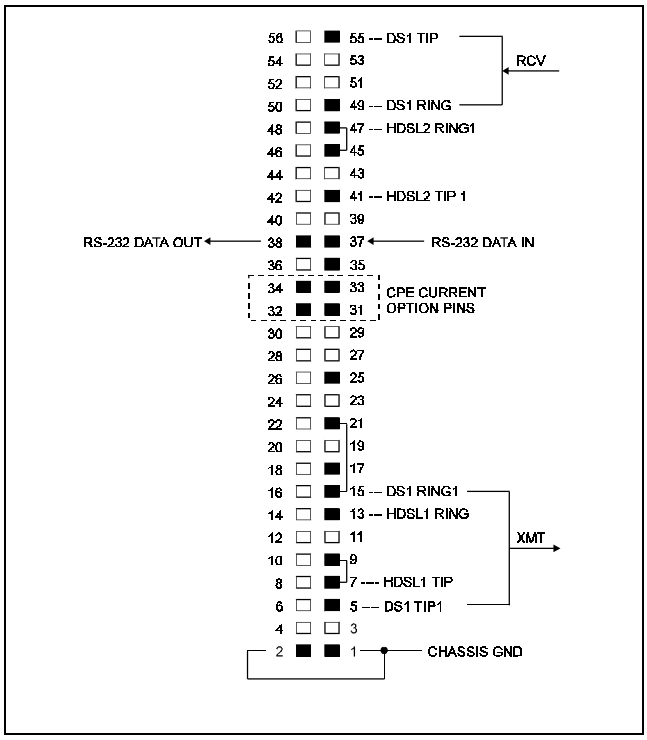

Figure 10. HRU-412, List 1, 2, 3, 3A, & 4 Pin Assignments. The active pins are highlighted in black in this illustration.

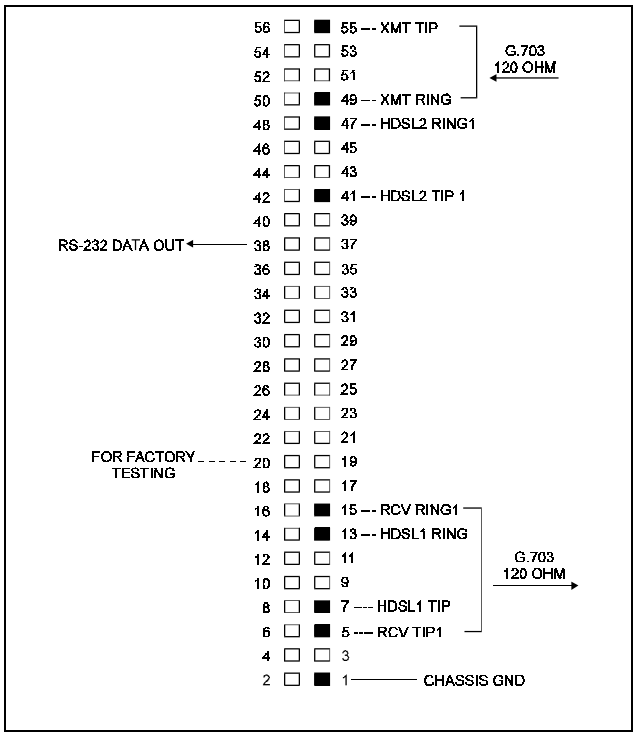

Figure 12. ERU-412, List 2 Pin Assignments. The active pins are highlighted in black in this illustration.

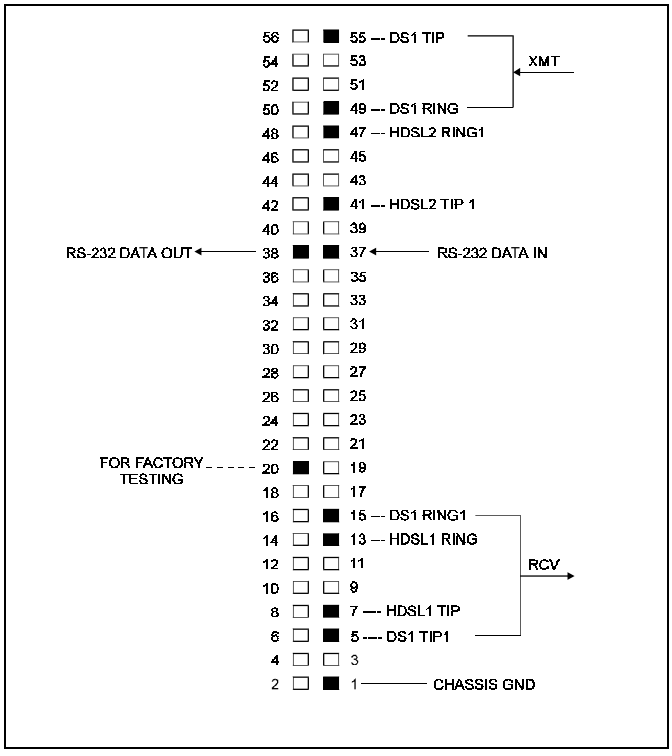

Figure 11. HRU-412, List 6 & 7 Pin Assignments. The active pins are highlighted in black in this illustration.

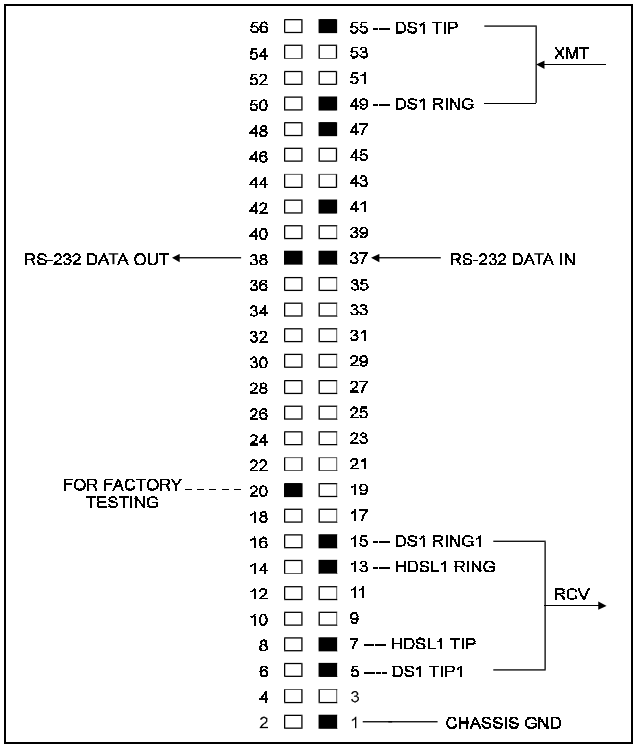

Figure 13. HRU-512 Pin Assignments. The active pins are highlighted in black in this illustration.

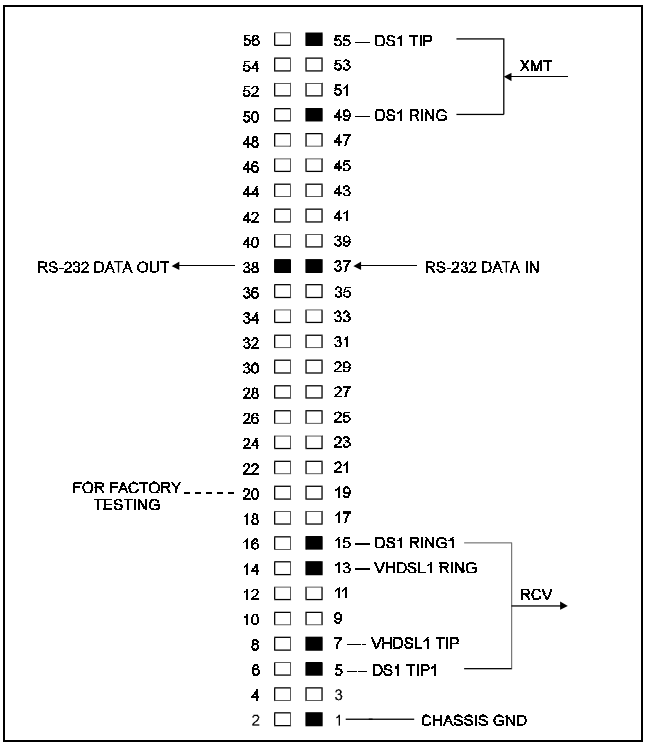

Figure 14. HRU-612, Pin Assignments. The active pins are highlighted in black in this illustration.

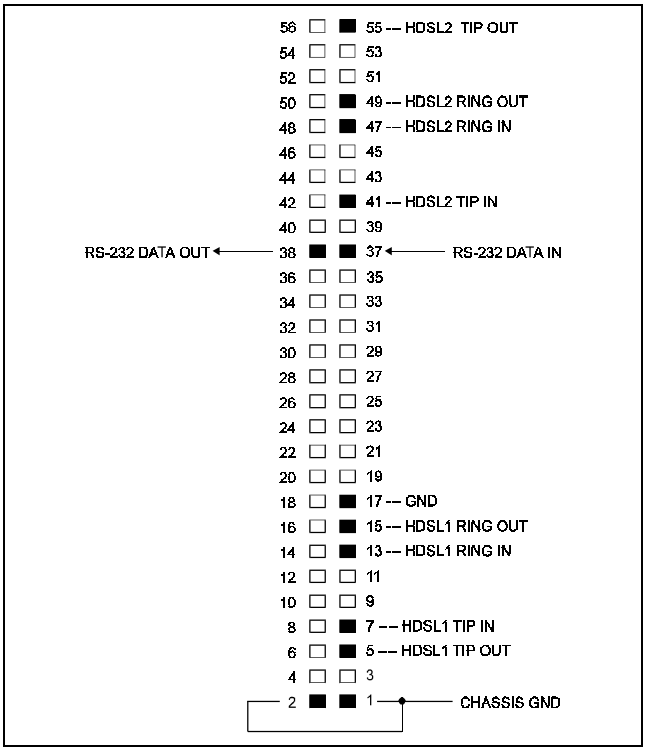

Figure 15. HDU-451 and EDU-451 Pin Assignments. The active pins are highlighted in black in this illustration.

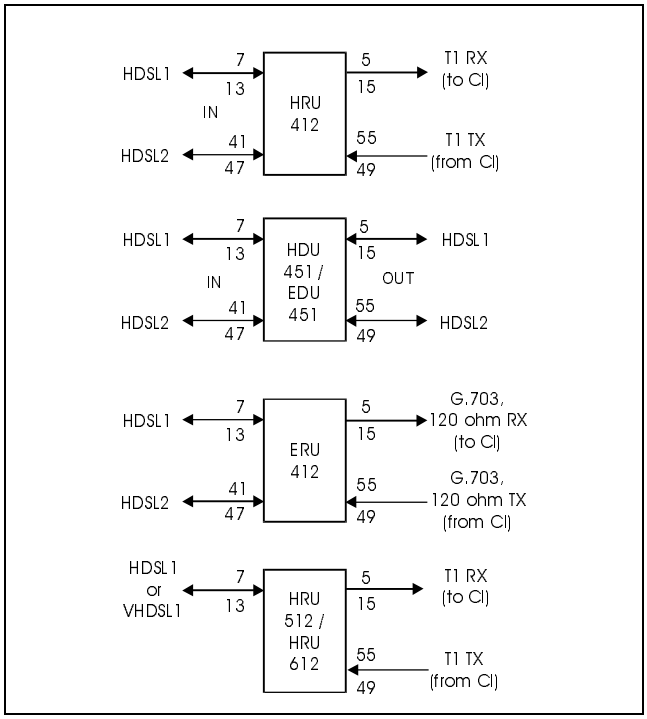

Figure 16. HRE-423 Wiring Interfaces.

TABLE 6. HRE-423 / HRU-412 WIRE LIST

HRU 423 Slot No.	***Signal***	***Cable***	***Group***	***Tip***	***Ring***	***Connector***
1	HDSL 1 Tip	A	1	Wht		J1 Pin 7
1	HDSL 1 Ring	A	1		Blu	J1 Pin 13
1	HDSL 2 Tip	A	2	Wht		J1 Pin 41
1	HDSL 2 Ring	A	2		Blu	J1 Pin 47
1	T1 RX Tip	B	1	Wht		J1 Pin 55
1	T1 RX Ring	B	1		Blu	J1 Pin 49
1	T1 TX Tip	B	2	Wht		J1 Pin 5
1	T1 TX Ring	B	2		Blu	J1 Pin 15
2	HDSL 1 Tip	A	1	Wht		J2 Pin 7
2	HDSL 1 Ring	A	1		Orn	J2 Pin 13
2	HDSL 2 Tip	A	2	Wht		J2 Pin 41
2	HDSL 2 Ring	A	2		Orn	J2 Pin 47
2	T1 RX Tip	B	1	Wht		J2 Pin 55
2	T1 RX Ring	B	1		Orn	J2 Pin 49
2	T1 TX Tip	B	2	Wht		J2 Pin 5
2	T1 TX Ring	B	2		Orn	J2 Pin 15
3	HDSL 1 Tip	A	1	Wht		J3 Pin 7
3	HDSL 1 Ring	A	1		Grn	J3 Pin 13
3	HDSL 2 Tip	A	2	Wht		J3 Pin 41
3	HDSL 2 Ring	A	2		Grn	J3 Pin 47
3	T1 RX Tip	B	1	Wht		J3 Pin 55
3	T1 RX Ring	B	1		Grn	J3 Pin 49
3	T1 TX Tip	B	2	Wht		J3 Pin 5
3	T1 TX Ring	B	2		Grn	J3 Pin 15
E3	Orderwire Tip	A	1	Wht		J1 Pin 5
E2	Orderwire Ring	A	1		Red	J1 Pin 21

Group 1 Binder is Blue; Group 2 Binder is Orange.

TABLE 7. HRE-423 / ERU-412, LIST 2 WIRE LIST

HRU 423 Slot No.	*Signal*	*Cable*	*Group*	*Tip*	*Ring*	*Connector*
1	HDSL 1 Tip	A	1	Wht		J1 Pin 7
1	HDSL 1 Ring	A	1		Blu	J1 Pin 13
1	HDSL 2 Tip	A	2	Wht		J1 Pin 41
1	HDSL 2 Ring	A	2		Blu	J1 Pin 47
1	G.703/120 ohm RX Tip	B	1	Wht		J1 Pin 55
1	G.703/120 ohm RX Ring	B	1		Blu	J1 Pin 49
1	G.703/120 ohm TX Tip	B	2	Wht		J1 Pin 5
1	G.703/120 ohm TX Ring	B	2		Blu	J1 Pin 15
2	HDSL 1 Tip	A	1	Wht		J2 Pin 7
2	HDSL 1 Ring	A	1		Orn	J2 Pin 13
2	HDSL 2 Tip	A	2	Wht		J2 Pin 41
2	HDSL 2 Ring	A	2		Orn	J2 Pin 47
2	G.703/120 ohm RX Tip	B	1	Wht		J2 Pin 55
2	G.703/120 ohm RX Ring	B	1		Orn	J2 Pin 49
2	G.703/120 ohm TX Tip	B	2	Wht		J2 Pin 5
2	G.703/120 ohm TX Ring	B	2		Orn	J2 Pin 15
3	HDSL 1 Tip	A	1	Wht		J3 Pin 7
3	HDSL 1 Ring	A	1		Grn	J3 Pin 13
3	HDSL 2 Tip	A	2	Wht		J3 Pin 41
3	HDSL 2 Ring	A	2		Grn	J3 Pin 47
3	G.703/120 ohm RX Tip	B	1	Wht		J3 Pin 55
3	G.703/120 ohm RX Ring	B	1		Grn	J3 Pin 49
3	G.703/120 ohm TX Tip	B	2	Wht		J3 Pin 5
3	G.703/120 ohm TX Ring	B	2		Grn	J3 Pin 15
E3	Orderwire Tip	A	1	Wht		J1 Pin 5
E2	Orderwire Ring	A	1		Red	J1 Pin 21

Group 1 Binder is Blue; Group 2 Binder is Orange.

TABLE 8. HRE-423 (HRU-512 / HRU-612) WIRE LIST

HRU 423 Slot No.	***Signal***	***Cable***	***Group***	***Tip***	***Ring***	***Connector***
1	HDSL 1 VHDSL1 Tip	A	1	Wht		J1 Pin 7
1	HDSL 1 VHDSL1 Ring	A	1		Blu	J1 Pin 13
1	Not Used	A	2	Wht		J1 Pin 41
1	Not Used	A	2		Blu	J1 Pin 47
1	T1 RX Tip	B	1	Wht		J1 Pin 55
1	T1 RX Ring	B	1		Blu	J1 Pin 49
1	T1 TX Tip	B	2	Wht		J1 Pin 5
1	T1 TX Ring	B	2		Blu	J1 Pin 15
2	HDSL 1 VHDSL1 Tip	A	1	Wht		J2 Pin 7
2	HDSL 1 VHDSL1 Ring	A	1		Orn	J2 Pin 13
2	Not Used	A	2	Wht		J2 Pin 41
2	Not Used	A	2		Orn	J2 Pin 47
2	T1 RX Tip	B	1	Wht		J2 Pin 55
2	T1 RX Ring	B	1		Orn	J2 Pin 49
2	T1 TX Tip	B	2	Wht		J2 Pin 5
2	T1 TX Ring	B	2		Orn	J2 Pin 15
3	HDSL 1 VHDSL1 Tip	A	1	Wht		J3 Pin 7
3	HDSL 1 VHDSL1 Ring	A	1		Grn	J3 Pin 13
3	Not Used	A	2	Wht		J3 Pin 41
3	Not Used	A	2		Grn	J3 Pin 47
3	T1 RX Tip	B	1	Wht		J3 Pin 55
3	T1 RX Ring	B	1		Grn	J3 Pin 49
3	T1 TX Tip	B	2	Wht		J3 Pin 5
3	T1 TX Ring	B	2		Grn	J3 Pin 15
E3	Orderwire Tip	A	1	Wht		J1 Pin 5
E2	Orderwire Ring	A	1		Red	J1 Pin 21

Group 1 Binder is Blue; Group 2 Binder is Orange.

TABLE 9. HRE-423 (HDU-451 / EDU-451) WIRE LIST

HRU 423 Slot No.	*Signal*	*Cable*	*Group*	*Tip*	*Ring*	*Connector*
1	HDSL 1 Tip IN	A	1	Wht		J1 Pin 7
1	HDSL 1 Ring IN	A	1		Blu	J1 Pin 13
1	HDSL 2 Tip IN	A	2	Wht		J1 Pin 41
1	HDSL 2 Ring IN	A	2		Blu	J1 Pin 47
1	HDSL2 TIP OUT	B	1	Wht		J1 Pin 55
1	HDSL2 Ring OUT	B	1		Blu	J1 Pin 49
1	HDSL1 Tip OUT	B	2	Wht		J1 Pin 5
1	HDSL1 Ring OUT	B	2		Blu	J1 Pin 15
2	HDSL 1 Tip IN	A	1	Wht		J2 Pin 7
2	HDSL 1 Ring IN	A	1		Orn	J2 Pin 13
2	HDSL 2 Tip IN	A	2	Wht		J2 Pin 41
2	HDSL 2 Ring IN	A	2		Orn	J2 Pin 47
2	HDSL2 TIP OUT	B	1	Wht		J2 Pin 55
2	HDSL2 Ring OUT	B	1		Orn	J2 Pin 49
2	HDSL1 Tip OUT	B	2	Wht		J2 Pin 5
2	HDSL1 Ring OUT	B	2		Orn	J2 Pin 15
3	HDSL 1 Tip IN	A	1	Wht		J3 Pin 7
3	HDSL 1 Ring IN	A	1		Grn	J3 Pin 13
3	HDSL 2 Tip IN	A	2	Wht		J3 Pin 41
3	HDSL 2 Ring IN	A	2		Grn	J3 Pin 47
3	HDSL2 TIP OUT	B	1	Wht		J3 Pin 55
3	HDSL2 Ring OUT	B	1		Grn	J3 Pin 49
3	HDSL1 Tip OUT	B	2	Wht		J3 Pin 5
3	HDSL1 Ring OUT	B	2		Grn	J3 Pin 15
E3	Orderwire Tip	A	1	Wht		J1 Pin 5
E2	Orderwire Ring	A	1		Red	J1 Pin 21

Group 1 Binder is Blue; Group 2 Binder is Orange.

E. MAINTENANCE

15. SPLICING

15.01 Splicing consists of connecting the wire pairs of the HRE-423 dual cable stubs (A and B) to the main cable within the splice case. Tables 10 through 12 contain step-by-step procedures for preparing the stubs for splicing into the main cable (pre-splice procedure), actually splicing the stubs into the main cable (splicing procedure), and dressing and taping the final splice in the splice case (post-splicing procedure).

15.02 In using the splicing procedure in Table 7, be sure to maintain Tip and Ring integrity when splicing stub pairs into the main cable. The T1 lines must have correct Tip/Ring connection, although the HDSL units will compensate if Tip and Ring are crossed but may give false indications when trouble occurs. Therefore, PairGain highly recommends that you maintain Tip and Ring integrity when splicing HRE-423 stubs A and B into the main cable. Follow local practices as required.

TABLE 10. CABLE STUB PRE-SPLICE PREPARATION PROCEDURE

Step	*Action*
	DANGER **Make sure you ground the HRE-423 enclosure before splicing the cable stubs into the main cable. The grounding method in Table 4 (or an accepted local grounding method) must be in effect at all times to safeguard personnel.**
	CAUTION **Do not strip the screen divider in the cable stub at this time.**
	NOTE **The HRE-423 comes with two screened cable stubs that are precut and capped: refer to Figure 10 for a cross-sectional view of the screened cable stub.**
1	Strip sufficient length of outer jacket, copper shield, and mylar sheath from the cable stub.
2	Strip the main cable as required by the cable manufacturer.
3	Install shield bonding connectors in accordance with standard practices.
4	To avoid split pairs, tie or band the ends of the group one and group two pairs. Cut off pair ends and the cable butt to aid in the removal of grease.
5	Separate pairs between the tied ends and the cable butt to aid in the removal of grease.
6	Remove grease by wiping with a clean cloth or paper towel. **NOTE** **When the ambient temperature is low, warm the cable pairs to aid in removing grease by cleaning the stub in a heated enclosure or by using a heat gun to apply warm air to the pairs. Avoid applying excessive heat, which could deform the insulation on the pairs.**
7	Keep cable pairs dry. If you are not completing splicing immediately, cover the cable stubs.

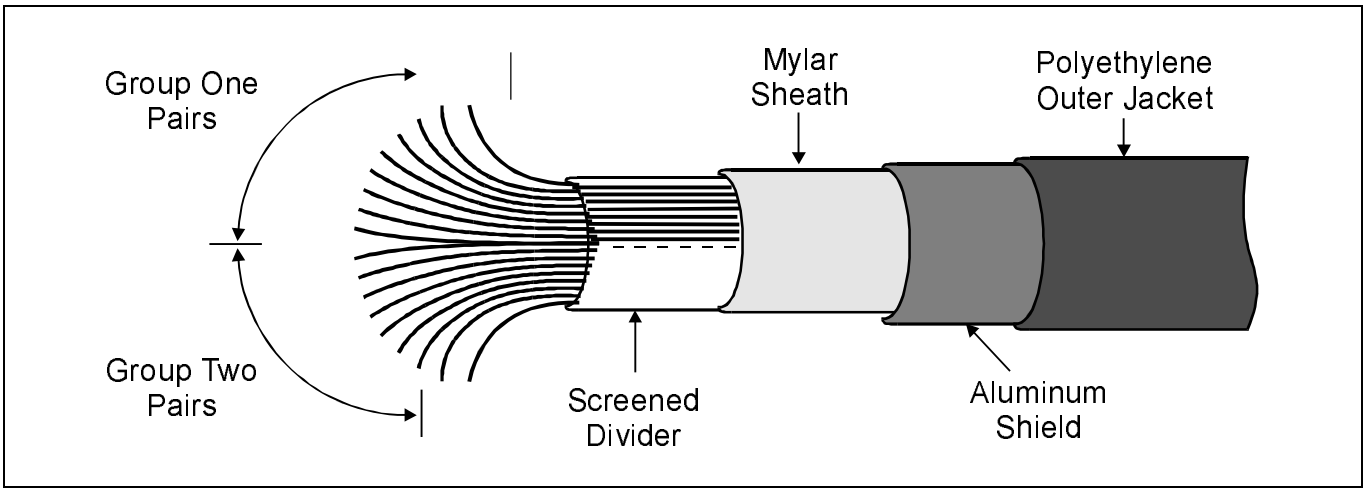

Figure 17. Cable Stub Cross-Section. The HRE-423 comes with two screened cable stubs that are precut and capped.

TABLE 11. SPLICING PROCEDURE FOR HRE-423 CABLES

Step	***Action***
	CAUTION **If you are using blocking capacitors, signaling and dialing capability on the orderwire pair will be directional. When splicing the orderwire pair, take care to maintain the direction of signaling your application requires.** **NOTE** **Maintain Tip and Ring integrity on the T1 side. PairGain also highly recommends that you maintain Tip and Ring integrity on the HDSL side.**
1	Splice the cable stubs to the main cable using the diagram in Figure 16 and the wire identification information in Tables 6, 7, 8, and 9.
2	Visually inspect each splice for split pairs, opens, and shorts.
3	**NOTE** **Maintenance personnel may sometimes cross-splice defective pairs between units in unit-type cable or colors in layer-type cable. These pairs are referred to as wandering pairs and may cause trouble.** Repair or correct defective or wandering pairs before closing the splice. Otherwise, the color code sequence of the cable stub in relation to the pair count (in Figure 16) or the main cable will be broken.
4	Perform any cable tests required by local practice.

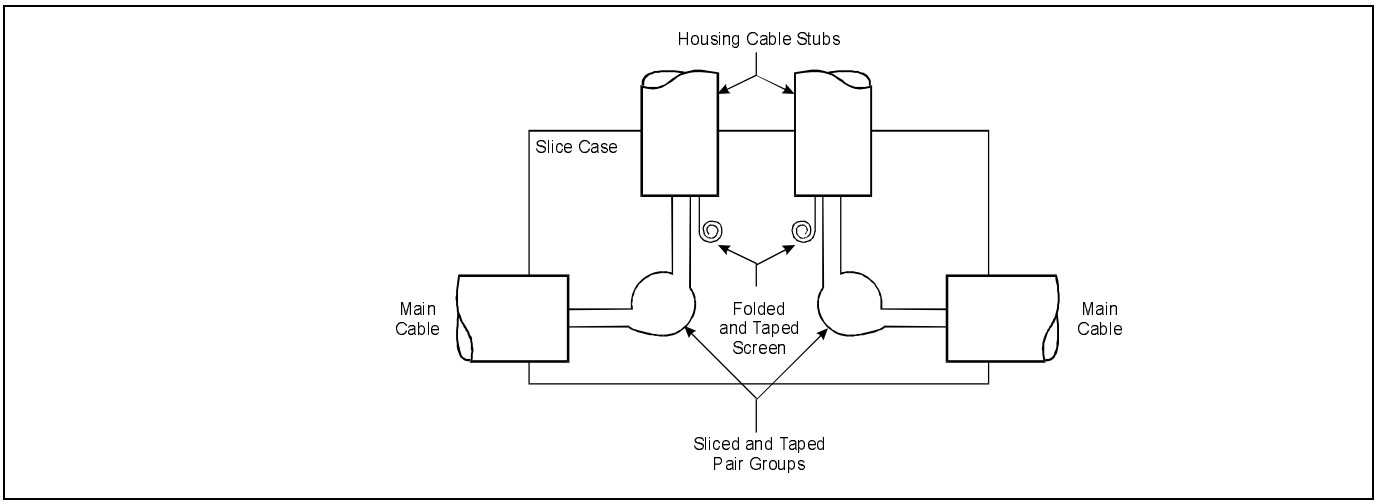

Figure 18. Dress Splice in Splice Case. This illustrations illustrates the screen divider and taped pair groups.

TABLE 12. POST-SPLICE PROCEDURE

Step	***Action***
1	See Figure 17. Starting at the cable stub butt, wrap the pairs on one side of the screen with 3/4-inch, self-bonding rubber tape. Overlap the tape by one-half its width.
2	Repeat Step 1, wrapping the pairs on the other side of the screen in the same way.
3	Starting at the cable stub butt, wrap the pairs on one side of the screen with 2-inch, pressure sensitive, aluminum tape. Overlay the tape by one-half its width and form the tape in place. Aluminum tape provides electrical isolation between the pairs on the opposite sides of the screen and should be formed to fit smoothly around pairs.
4	Repeat Step 3, wrapping the pairs on the other side of the screen in the same way.
5	Starting at the cable stub butt, wrap the pairs on one side of the screen with two layers of 3/4-inch vinyl tape. Overlap the tape by one-half its width.
6	Repeat Step 5, wrapping the pairs on the other side of the screen in the same way.
	CAUTION **The screen divider is an insulated floating divider between the input and output pairs in the cable stub. Do not ground the divider, because this may result in poor performance. If the main cable has a screen divider, you do not need to splice the screen between cables to provide electrical continuity. The aluminum tape you use to wrap the input and output pairs provides the necessary isolation.**
7	Cut the cable stub screen divider approximately 6 inches from the cable stub butt.
8	Fold each corner at a 45 degree angle to the center of the screen as shown in Figure 18.
9	Fold the screen divider back on itself several times and tape it to prevent it from unfolding.
10	Position the folded and taped screen divider between the spliced and taped input and output pairs as shown in Figure 17.
11	Seal and close the splice case according to the splice case instructions.

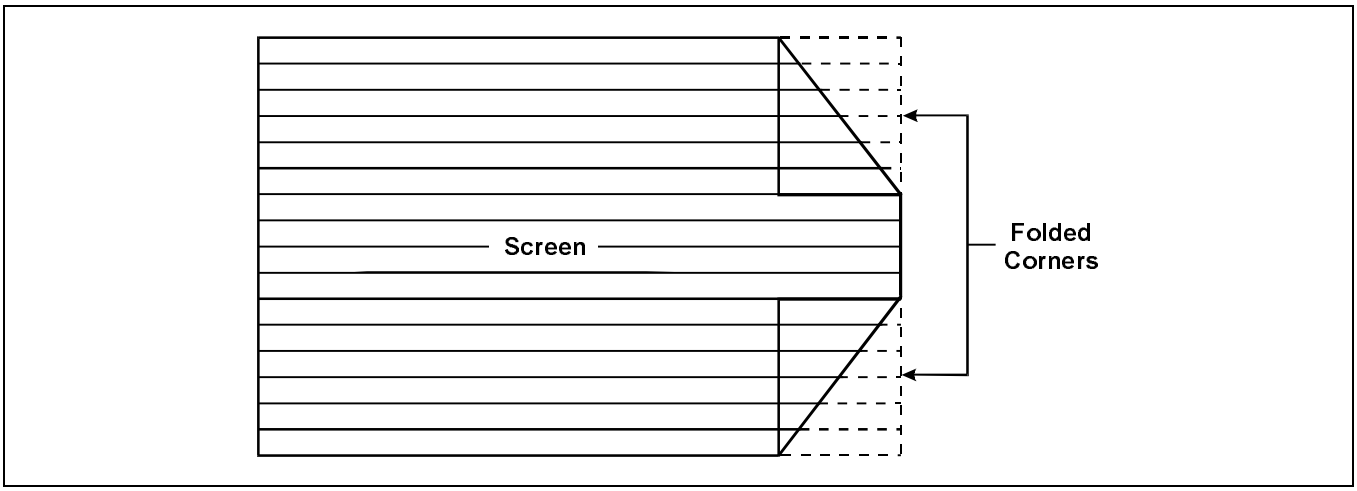

Figure 19. Screen Folding Diagram. The screen divider is an insulated floating divider between the input and output pairs in the cable stub

16. OPENING AND CLOSING THE ENCLOSURE

16.01 Opening the Enclosure. Although the HRE-423 enclosure may or may not be pressurized, you should always assume it is, and relieve the pressure before opening. Use the recommended procedure in Table 13 to open an HRE-423. No special equipment is required.

16.02 Closing the Enclosure. Use the procedure in Table 8 to close the HRE-423 enclosure. Have the following items ready before you begin the procedure.

- Desiccant, Davison Chemical Corp. PROTECK-SORB-121 or equivalent.
- Anti-seize compound, Dow Corning.

17. SETTING LPU HRU-412 POWER OPTIONS

17.01 When the HRU-412 List 1, 2, or 4 HiGain Remote Unit mounts in the HRE-423, three options to provide current to the CI (customer interface) are provided. The options are described in detail in Technical Practice 150-412-100. The lightning protection unit on the rear of each card cage slot enables you to set (make or break) these options by turning two screws up or down. These two screw switches, shown in Figure 3, are labeled: **CI PWR** (top screw #1) and **60 mA / 23 mA** (bottom screw #2). Note that the option settings on each of the three LPUs may be different. The circuits through the different HRE-412 slots are independent of each other, and the power option settings do not have to be the same. Set the options as follows:

CI Power Option	Switch Settings	
	CI PWR	60 mA / 23 mA
60 mA	Down	Down
No current feed	Up	Up or Down
23mA	Down	Up

Note that when the HRE-423 is used to house other than List 1, 2, or 4 units, the two LPU current screw options must be disabled (turned up). This prevents a conflict between the LPU out-board current setting screw options and HRU on-board switch options which replace the LPU out-board screw options. The ERU-412 does not have this CI current option feature.

TABLE 13. PROCEDURES FOR OPEN CLOSING THE HRE-423 ENCLOSURE

Step	Action
	PROCEDURE FOR OPENING THE ENCLOSURE
	DANGER **Always assume the enclosure is pressured. Failure to relieve pressure in an enclosure before removing its cover could result in serious personal injury.**
1	Relieve the enclosure pressure by pressing the valve core of the external bleed valve. The bleed valve is located on the bottom of the enclosure baseplate near the orderwire access terminals. **DANGER** **Make sure you have vented all pressure before proceeding to Step 2. If a time lapse occurs between performing Step 1 and performing Step 2, the enclosure may become pressurized by the main cable. If this occurs, relieve the enclosure pressure again to avoid serious injury.**
2	Unlock the enclosure.
3	Loosen the cover clamp and twist the cover slightly to break the seal.
4	Remove the cover clamp.
5	Remove the cover from the enclosure. If the enclosure is equipped with air core stubs, the whisker valve automatically closes when you remove the cover to prevent loss of pressure from the main cable. **WARNING** **Exercise care when removing and handling the enclosure cover. A damaged cover may not seal properly when replaced.**
	PROCEDURE FOR CLOSING THE HRE-423 ENCLOSURE (see Figures 1 and 2)
1	Inspect the enclosure cover for dirt, moisture, or mechanical damage, especially around the flange which mates with the baseplate and O-ring. Remove any accumulation of dirt or moisture from the cover.
2	Inspect the baseplate for dirt, moisture, or mechanical damage, especially around the baseplate flange. Remove any accumulation of dirt or moisture from baseplate.
3	Place two new units of desiccant in the enclosure and fasten the retainer bracket in place.
4	Slide the cover over the card cage and position it on the O-ring and baseplate.
5	Lubricate the threads of the cover clamp T-bolt with anti-seize compound.
6	Position the cover clamp around the base of the cover and the baseplate flange. Hand-tighten the T-bolt securely. **WARNING** **Do not use tools or the free-moving locking assembly as a hand-hold when tightening the T-bolt.**

Table continued on next page

TABLE 10. PROCEDURES FOR OPEN CLOSING THE HRE-423 ENCLOSURE (CONTINUED)

Step	Action
7	If you are pressurizing the enclosure from a portable pressure bottle, continue from Step 8. If you are pressurizing the enclosure from the main cable, continue from Step 10. If you are not pressurizing the enclosure, continue from Step 12.
8	For nonfilled (air core) stubs, block cable stub A in the splice case by placing an air dam in the stub according to local practice to prevent pressure leakage into the main cable. In lieu of blocking the cable stub, you can disable the whisker valve by cutting the nylon pressure tubing attached to the whisker valve and sealing the tubing with epoxy cement.
9	Use a portable pressure bottle and standard tire gauge at the external bleed valve to pressurize the enclosure to a maximum of 15 psi. Continue from Step 12.
10	Allow the enclosure to pressurize from the main cable through cable stub A.
11	Check the O-ring and enclosure for leaks by painting the enclosure with a pressure-testing solution, such as soap and water. If you detect a leak is, tighten the T-bolt and tap lightly around the cover clamp; repeat as necessary until the cover is sealed.
12	Secure the HRE-423 with padlock. (This step is not required for manhole-mounted enclosures. However, a locking assembly is provided if needed.)

18. GLOSSARY

AWG	American Wire Gauge	**HRE-423**	HiGain Remote Enclosure
Blu	blue	**LPU**	Lightning Protection Unit
Blk	black	**NF**	non-filled (air core)
Brn	brown	**Org**	orange
CI	Customer Interface	**PWR**	power
F	filled (gel core)	**psi**	pounds per square inch
fax	facsimile	**RX**	receive
Grn	green	**TX**	transmit
HDSL	High-bit-rate Digital Subscriber Line	**Wht**	white
HRU	HiGain Remote Unit		