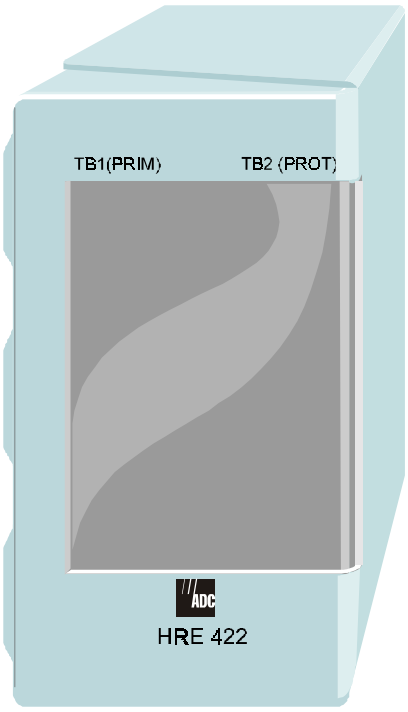
HiGain

USER MANUAL



HRE-422 Lists 1, 2, 3, and 4
HiGain Remote Indoor Enclosure
Product Catalog: 150-1147-01, 150-11147-02, 150-1147-03, 150-1147-04
CLEI: T1MFR004RA, T1MFS004RA

Revision History of This Manual

To order copies of this document, use document catalog number 100-422-100-04.

Issue	Release Date	Revisions Made
3	August 6, 1996	Added List 4
4	February 11, 2002	ADC rebranding of document - no technical changes

USING THIS MANUAL

Three types of messages, identified by icons, appear in text.

Notes contain information about special circumstances.

Cautions indicate the possibility of personal injury or equipment damage.

The Electrostatic Discharge (ESD) symbol indicates that a device or assembly is susceptible to damage from electrostatic discharge.

INSPECTING SHIPMENT

Upon receipt of the equipment:

- Unpack each container and inspect the contents for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC DSL Systems, Inc. Order replacement equipment, if necessary.
- Check the packing list to ensure complete and accurate shipment of each listed item. If the shipment is short or irregular, contact ADC DSL Systems, Inc. as described in Product Support on page 14. If you must store the equipment for a prolonged period, store the equipment in its original container.

QUICK INSTALLATION GUIDE FOR HIGAIN™ REMOTE INDOOR ENCLOSURE - MODEL HRE-422

List 1 ADC # 150-1147-01, CLEI: T1MFR004RA
List 2 ADC # 150-1147-02, CLEI: T1MFS004RA
List 3 ADC # 150-1147-03
List 4 ADC # 150-1147-04

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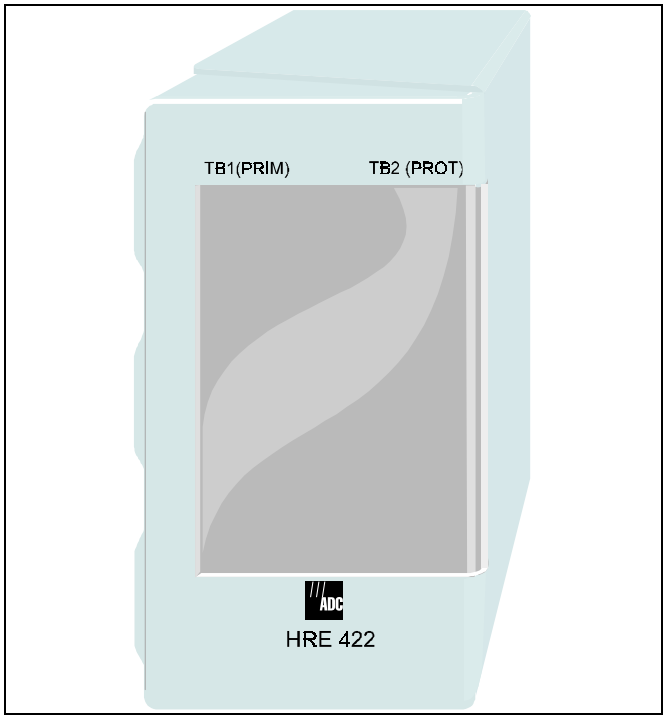

Figure 1. HRE-422 Enclosure (Front View). The HRE-422 accepts two single-width “400” mechanics plugs and supports automatic switching from the primary to the protection circuit.

A. PRODUCT OVERVIEW

1. DESCRIPTION AND FEATURES

1.01 ADC's HiGain Model HRE-422 Remote Indoor Enclosure (Figures 1 and 2) accepts two single width, "400" mechanics plugs. The List 1 and 2 units have RJ-48C and RJ-48X DS1 interface connectors, respectively. Their main applications are in the Regional Bell Operating Companies (RBOCs) and the independent telephone companies in the United States. The List 3 unit has two DB-15 and four BNC connectors that comply with the G.703, 120-ohm balanced and 75-ohm unbalanced, international ERU-412 applications, respectively. The List 4 unit has two DB-15 and two RJ-48C connectors which meet the DS1 Canadian interface requirements. The HRE-422 compatible remote plugs and their technical practices are as follows:

- HRU-412, List 6 #150-412-106
- HRU-412, List 7 #150-412-107
- HRU-412, List 8 #150-412-108
- HDU-451, List 1 & 2 #150-451-100
- HDU-451, List 3 #150-451-103
- HDU-451, List 4 #150-451-104
- EDU-451, List 1 #150-451-200
- EDU-451, List 2 #150-451-202
- ERU-412, List 1 & 2 #150-412-200
- HRU-612, List 1 #150-612-100
- HRU-612, List 2 #150-612-102
- HRU-512, List 1 #150-512-100

The HRE-422 is strictly an indoor enclosure that must be restricted to those "protected" environments that prevent exposure to outdoor hostile elements.

1.02 Revision History of this practice.

Revision 03—August 6, 1996

a) Added List 4.

1.03 HRE-422 Remote Enclosure List 1, 2, 3 and 4 features:

- Protection switch enables or disables automatic switching from the primary circuit to the protection circuit. This feature is only available in List 1, 2, and 3 units.
- Two "400" mechanics slots accept single-width plug-in units for individual or protection switching applications
- RJ-48 jacks (List 1 and 2) simplify DS1 customer interface connections
- BNC connectors (List 3) accommodate G.703 balanced 120-ohm or unbalanced 75-ohm applications
- DB-15 and RJ-48C connectors (List 4) accommodate DS1 Canadian standard interface connections

2. APPLICATIONS

2.01 The primary application of the HRE-422 Remote Enclosure is to house two HiGain Remote Units with 400 mechanics, to provide a quick and cost-effective way of delivering T1 or G.703 High Capacity Digital Service (HCDS) over metallic cable pairs. Note that because the HRE-422 uses standard 400 mechanics, it can accommodate any plug with 400 mechanics.

WARNING:

The HDU-451 and EDU-451 units are not UL listed and their use in the HRE-422 will void the UL certification of the HRE-422.

2.02 In addition to its use as an enclosure, the List 1, 2, and 3 HRE-422 units contain protection switching circuitry for operation in applications where automatic 1x1 switching, from a primary circuit to a protection circuit is needed. A toggle switch inside the HRE-422 enables customers to select this protector switch mode. The HRU-232 line unit is required at the CO end to provide the complete protection switch circuit. The List 4 unit does not support the protection switching features.

3. SPECIFICATIONS

Operating Temperature & Humidity

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

Dimensions

Height:	6.5 in. (16.51 cm)
Width:	3.5 in. (8.89 cm)
Depth:	10.5 in. (26.67 cm)
Weight	35 oz (1.09 kg)

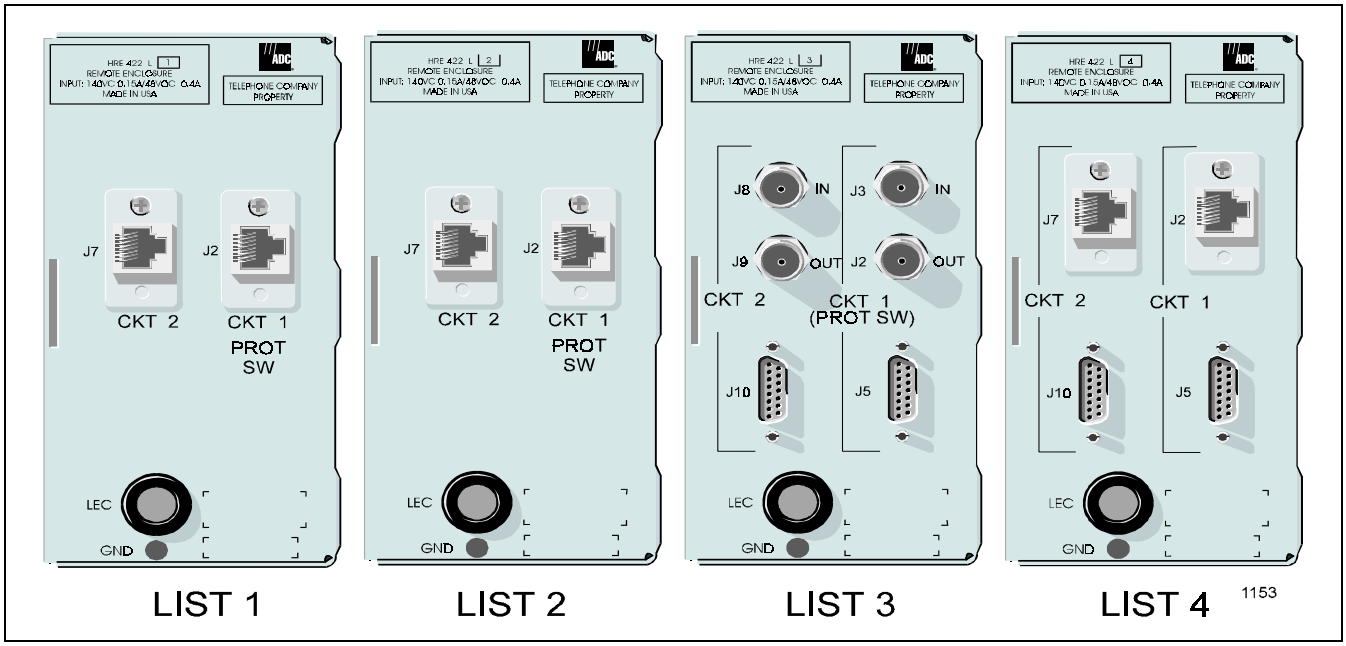

Figure 2. HRE-422 Enclosures (Rear View). The ADC HRE-422 is a 2-slot, wall-mountable enclosure, which accepts two HiGain Remote Units, or two HiGain Doubler Units. The List 1 and 2 units are for use in the United States; List 3 unit meets International applications and List 4 meets the Canadian standards.

4. CERTIFICATION

4.01 UL Listing: The HRE-422 is a UL Listed component.



WARNING:

Use of HDU-451, or EDU-451 doubler units in the HRE-422 will void the UL certification.

4.02 Use normal caution when installing or modifying telephone lines. Dangerous voltages may be present. It is also considered imprudent to install telephone wiring during a lightning storm.

4.03 Always disconnect all telephone lines and power connections before servicing or disassembling this equipment.

4.04 For performance and safety reasons, only power supplies listed for use with telephone equipment by a Nationally Recognized Testing Laboratory (NRTL) should be used with ADC equipment.

4.05 Refer to the installation section of the appropriate instruction manual for the unit you are installing for:

- Cabling information
- Proper connections
- Grounding information
- Line vs. local power

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

WARNING:

These units contain no user serviceable components. Only authorized ADC Service Personnel should service or repair these units. "Use only with Isolated Class 2 Power Source, Rated 48V dc 3.0A Maximum."

4.07 **CSA Certification.** The HRE-422 has been tested and found to comply with CSA Standard C22.2 -950 with telecommunication features.

5. WARRANTY

5.01 ADC Telecommunications, Inc. 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 and regular maintenance. ADC 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.

5.02 This module should not be field repaired. If it fails, replace it with another unit and return the faulty unit to ADC for repair. Any modifications of the unit by anyone other than an authorized ADC representative will void the warranty.

5.03 If a unit needs repair, call ADC for a Return Material Authorization (RMA) number and return the defective unit, freight prepaid, along with a brief description of the problem, to:

ADC Telecommunications, Inc.
14402 Franklin Avenue
Tustin, CA 92780
ATTN: Repair and Return Dept.
(714) 832-9922
(800) 638-0031

6. TECHNICAL ASSISTANCE

6.01 ADC Technical Assistance is available 24-hours-a-day, 7-days-a-week by contracting ADC's Customer Service Engineering group at one of the following numbers:

Telephone: **(800) 638-0031**
(714) 832-9922

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

6.02 During normal business hours (8:00 AM to 5:00 PM, Pacific Time, Monday - Friday, excluding holidays), technical assistance calls are 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 results in a callback within 30 minutes of initiating the request.

6.03 In addition, ADC maintains a computer bulletin board system for obtaining current information on ADC 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) 730-3299. Transmission speeds up to 28.8 kbps are supported with a character format of 8-N-1.

B. FUNCTIONAL DESCRIPTION

7. OPERATION

7.01 The HRE-422 enclosure consists of a wall-mountable base and a cover (Figure 3), which slides over and attaches to the mounting base with a screw. The base has two printed circuit boards mounted side by side, each containing:

- One card edge connector. Each connector accepts one standard 400 mechanics plug.
- RJ-48 connectors (J2 or J7) configured as non-shorting RJ-48C (List 1 and List 4) or one RJ-48 connector configured as shorting RJ-48X (List 2 only). These connectors connect DS1 circuits to the enclosure's HRU-412 Remote Units or HDSL loops to HDU-451 Doubler Units.
- DB-15 connectors (J5 or J10) (List 3 and List 4), connects G.703 balanced 120-ohm circuits to the enclosure's ERU-412 Remote Units or DS1 Canadian circuits to the enclosure HRU-412 Remote Units.
- Two BNC connectors (J3 and J4 or J8 and J9) (List 3 only), connect G.703 unbalanced 75-ohm circuits to the enclosure's ERU-412 Remote Units.

A 30-pin connector (P1) interconnects the circuit boards.

7.02 The main (outer) connection circuit board (see Figures 4, 6, and 8) has two 9-position terminal blocks (TB1 and TB2), which provide access to all interface signal connections (HDSL and DS1/G.703), plus battery and ground. Also located on this circuit board are a PROT'N (protection) LED indicator and switch (S1) that enables (ON) or disables (OFF) the protection switch mode. A rear panel punch-out labeled LEC (Local Exchange Carrier) provides cable access to TB1 and TB2.

7.03 The protection switching (inner) circuit board has two relays (K1 and K2), which switch between the primary (TB1) and protection (TB2) circuits in the event of a failure in the primary circuit. The inner circuit board of the List 3 unit also has four balanced longitudinal (simplex) chokers (L1 through L4), located in the Tip and Ring of the HDSL pairs for each circuit. They prevent excessive common mode AC voltages from entering the HRE-422 module, where they could cause transmission errors.

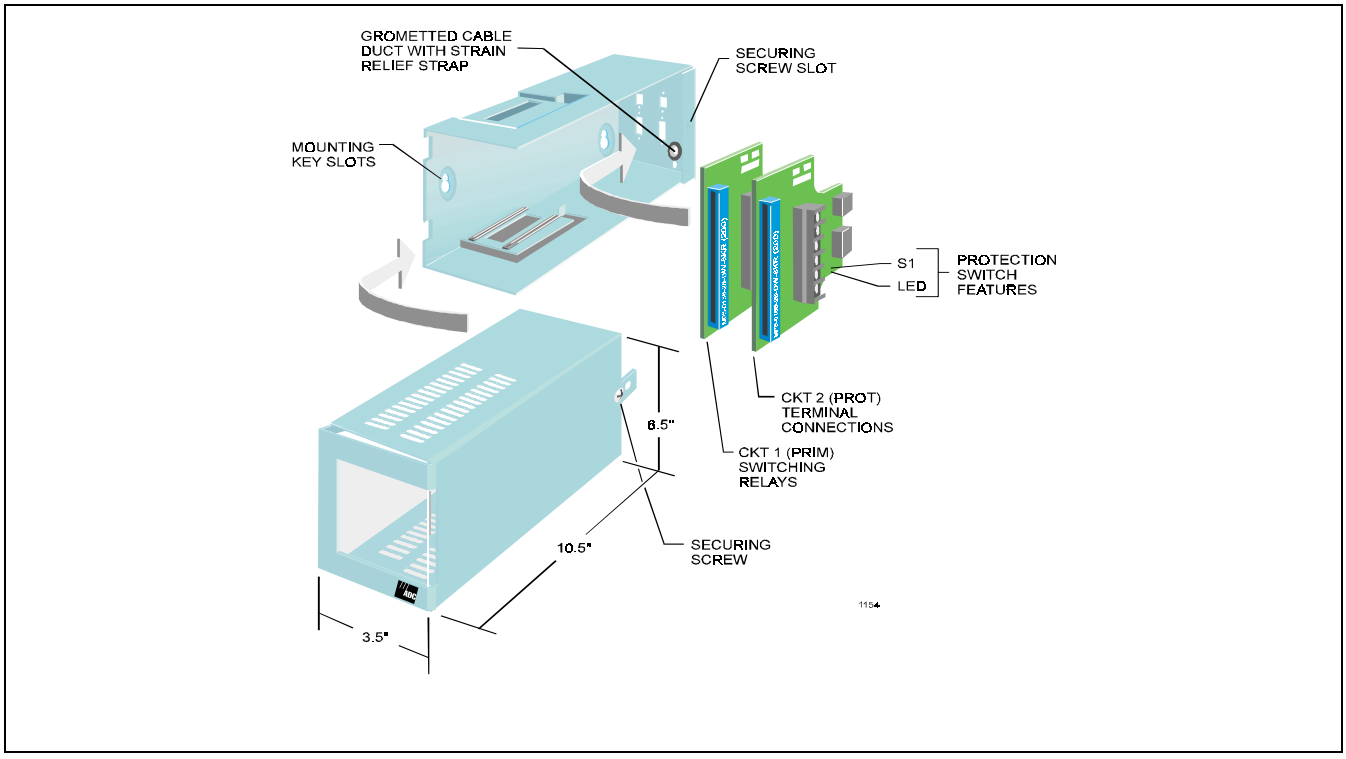

Figure 3. HRE-422 Enclosure Cover and Wall Mounting Section. The HRE-422 cover is equipped with a securing screw for added security. Three holes are located on the mounting base for securing the unit to a vertical surface.

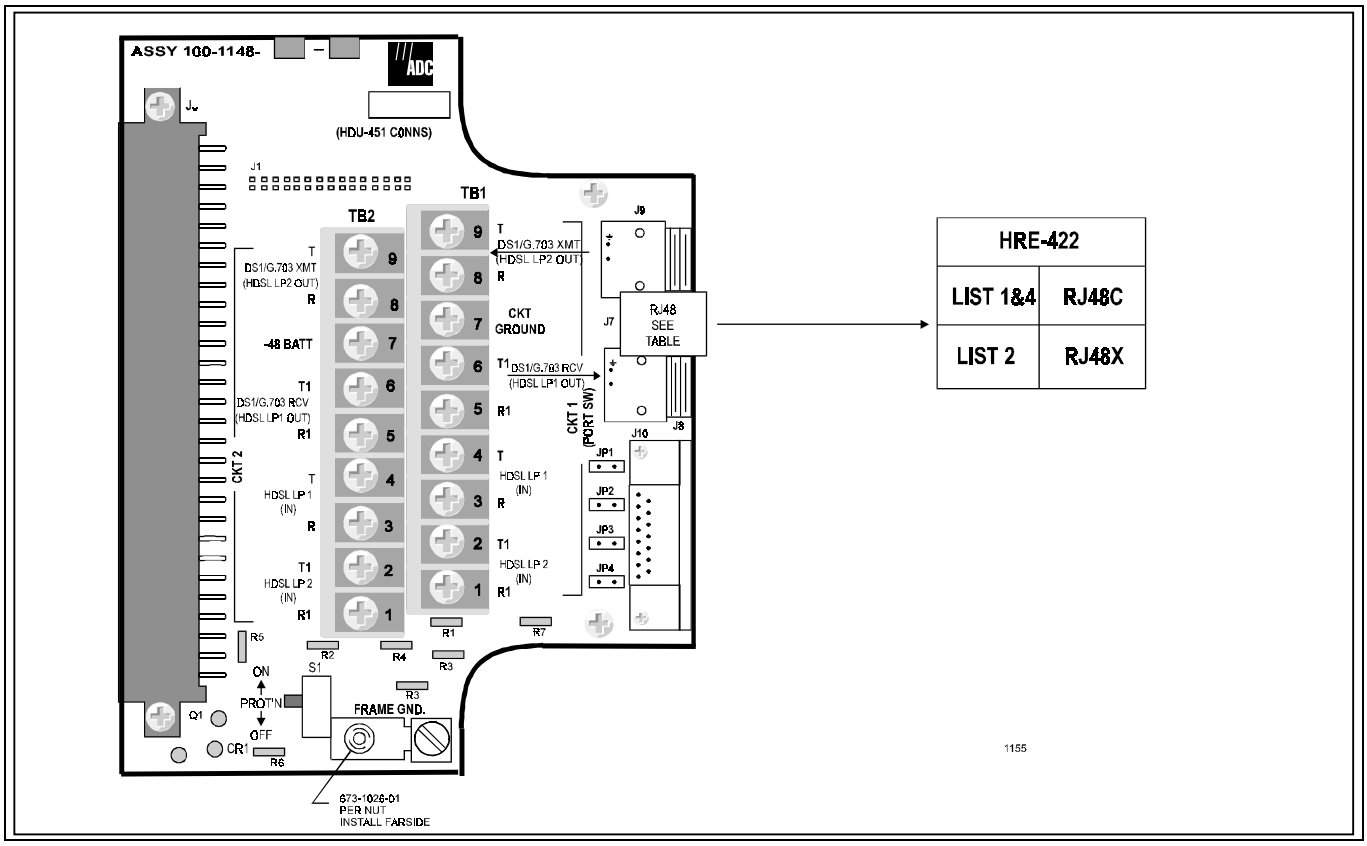

Figure 4. HRE-422, List 1 & 2 Printed Circuit Board and TB1/2 Pin Assignments. The diagram differentiates between the List 1, 2, and 4 units by the type of jack used. The List 1 and 4 units use an RJ-48C while the List 2 unit uses an RJ-48X.

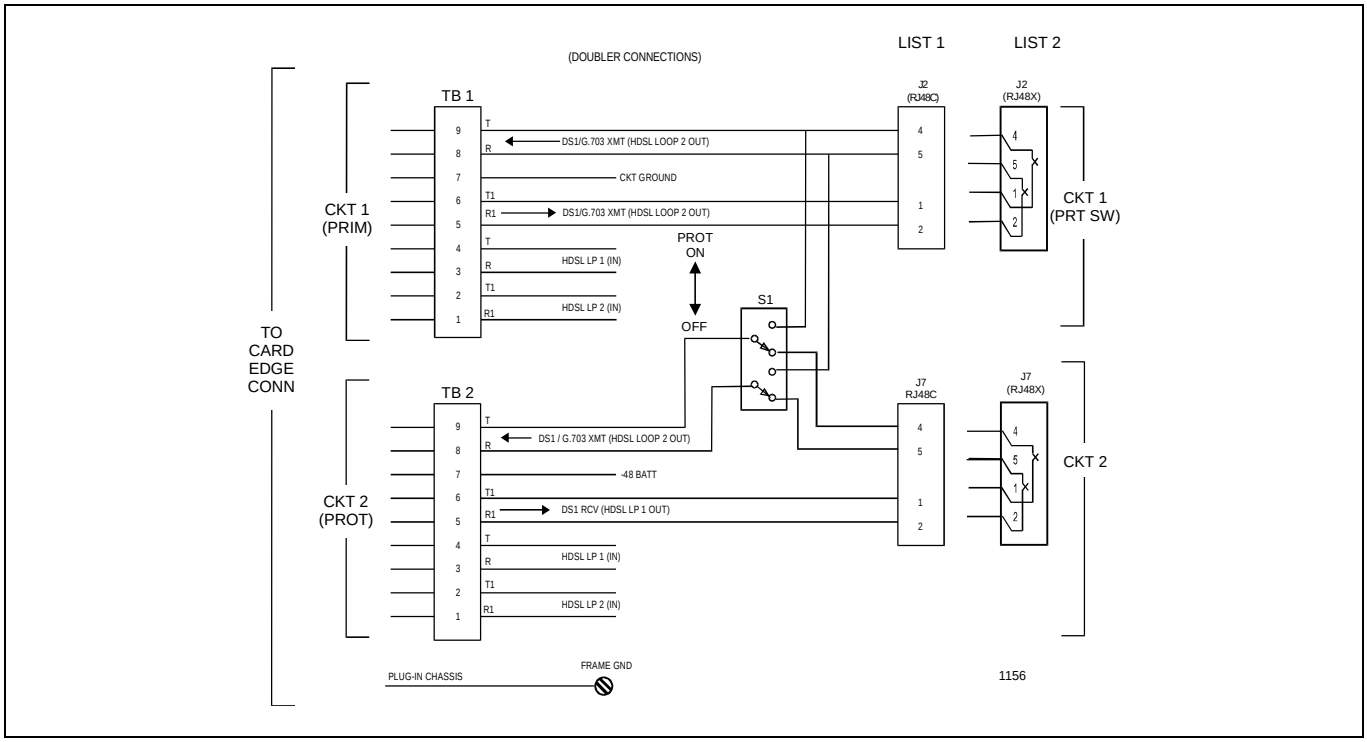

Figure 5. HRE-422, List 1 and 2 Block Diagram.

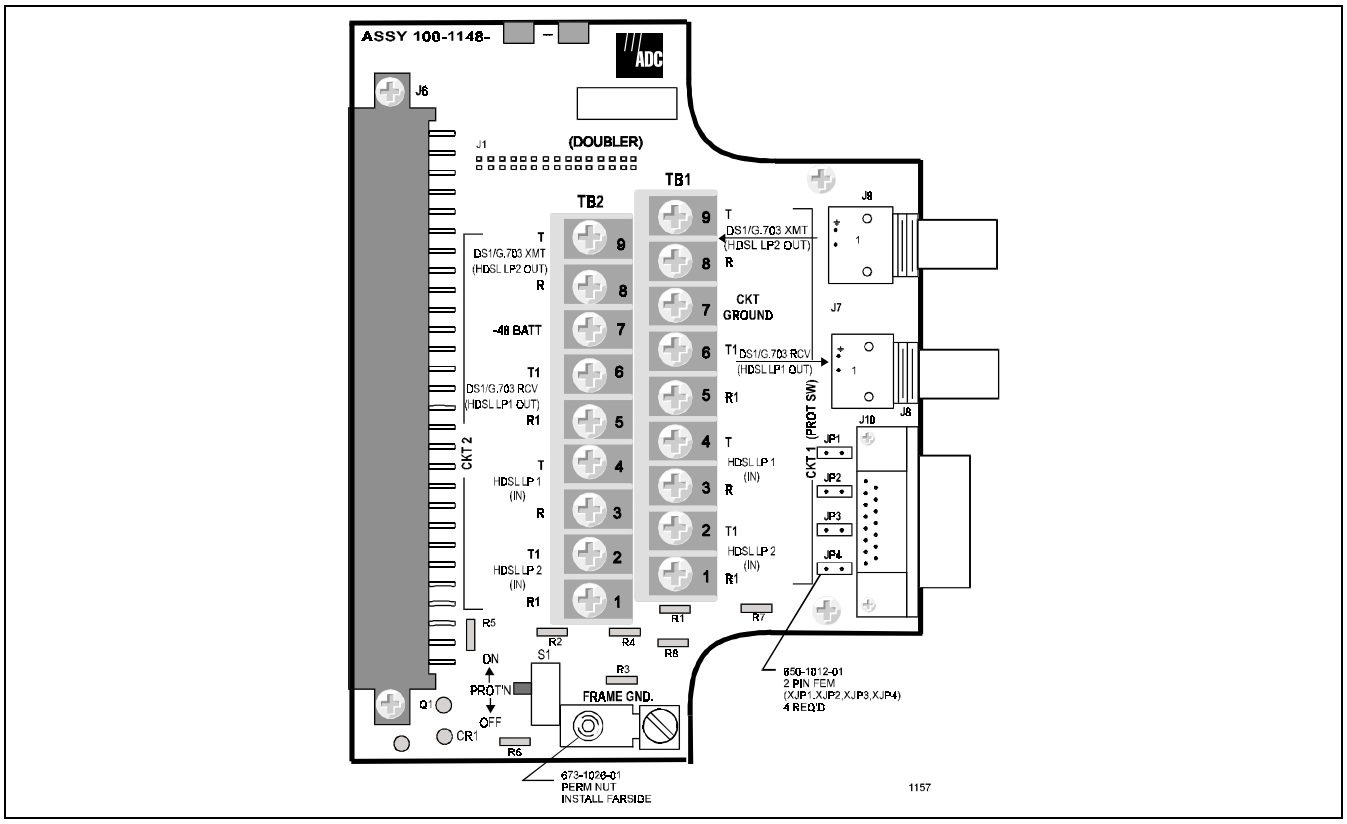

Figure 6. HRE-422, List 3 Printed Circuit Board and TB1/2 Pin Assignments. The diagram differentiates the List 3 unit by illustrating the two BNC connectors on the upper right hand side of the circuit board.

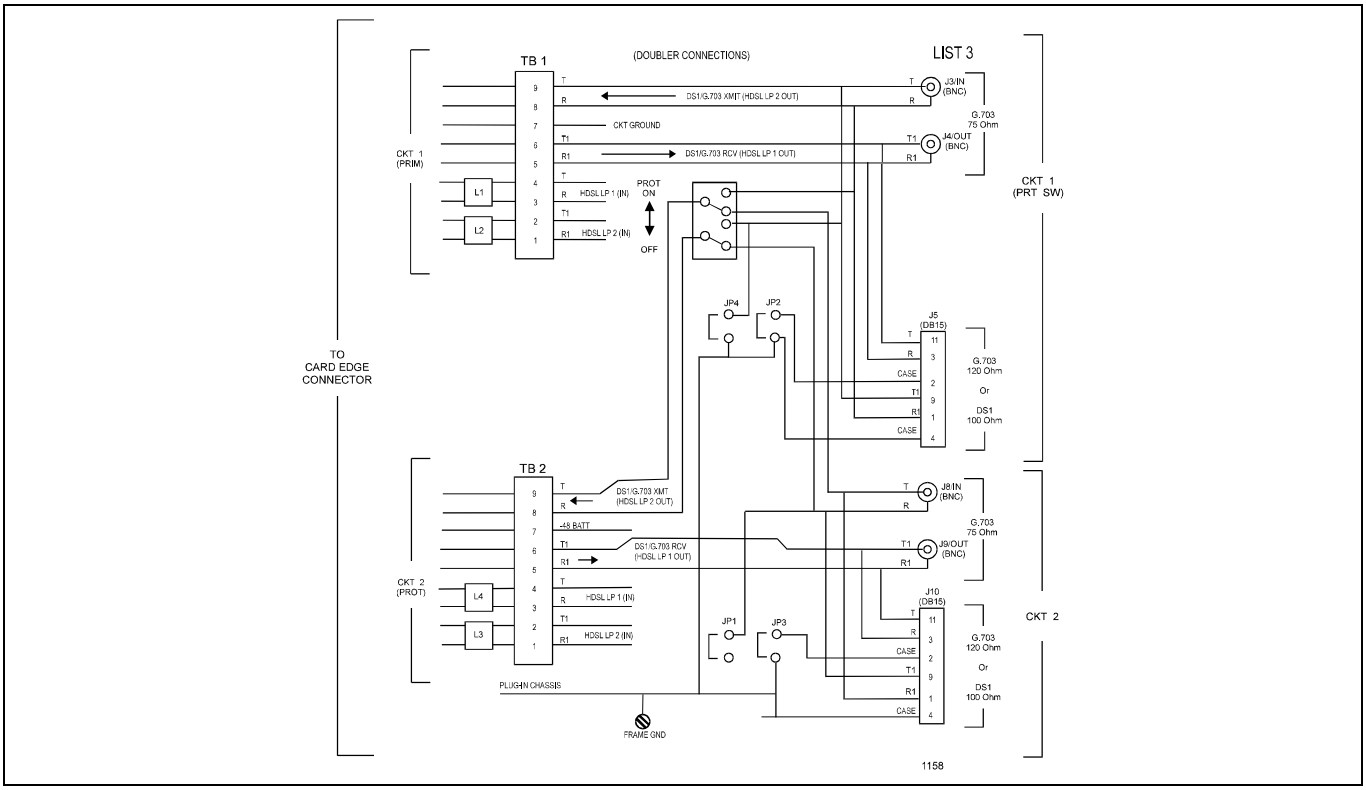

Figure 7. HRE-422, List 3 Block Diagram.

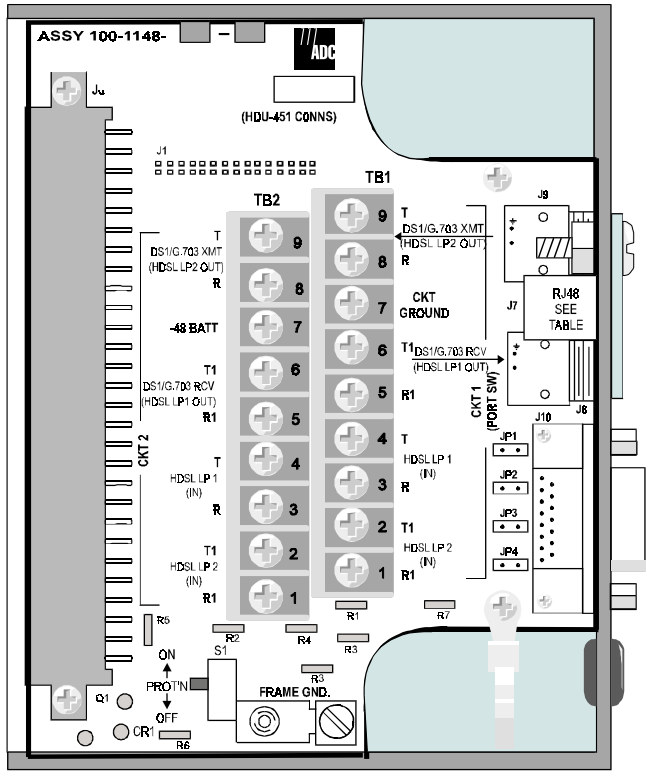

Figure 8. HRE-422, List 4 Printed Circuit Board and TB1/2 Pin Assignments.

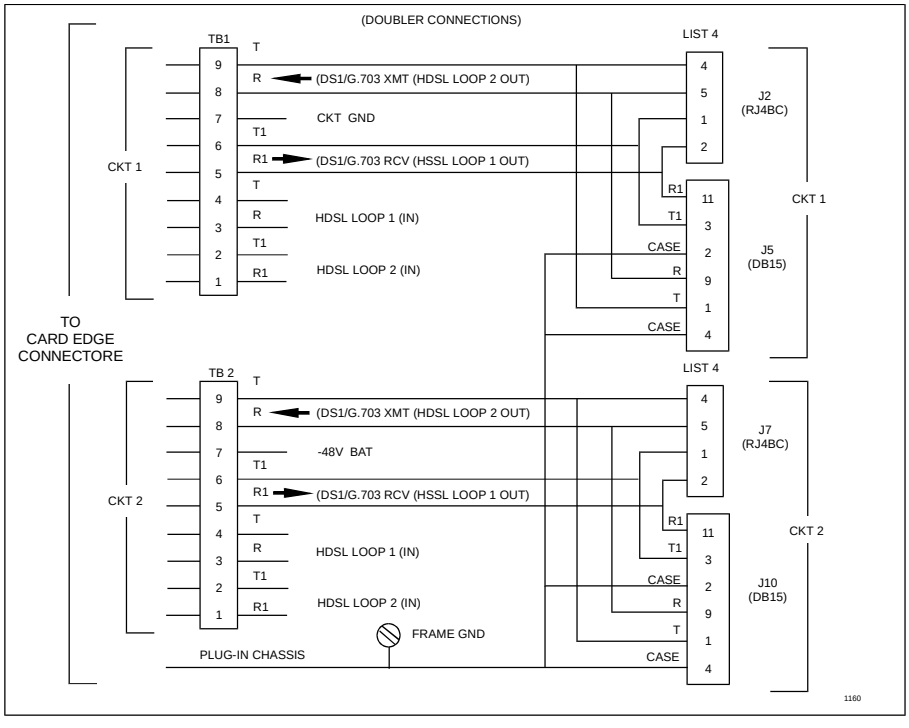

Figure 9. HRE-422, List 4 Block Diagram.

C. INSTALLATION OPTIONS AND WIRING

8. LIST OF MATERIAL

8.01 Upon receipt of the equipment, visually 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 ADC. The following material is included with each HRE-422.

DESCRIPTION	QTY.
HRE-422 Technical Data Sheet	1
#10 x 3/8 panhead sheetmetal screw(s)	3
10-32 x 3/8 button tamper-proof screw(s)	1
Circuit Assignment Label	1
Drilling Template	1

8.02 The tamper-proof screw can replace the factory-supplied blade "securing screw" shown in Figure 3. The tamper-proof screw requires an Allen key wrench, available on request, to install. It provides additional security in applications that require it. The gummed Circuit Assignment Label is for identifying circuit numbers. You can attach it to any convenient location on the enclosure. The RJ-48 jack comes with a small metal cover, which you can use to prevent access to the DS1 interface when the Customer Interface (CI) is external to the HRE-422 Remote Enclosure. This makes the HRE-422, List 1 and 2, compliant with the Minimum Point Of Entry (MPOE) requirements.

9. MOUNTING

9.01 Select a suitable wall location to mount the unit. The location should provide sufficient access to wiring connections on the right and to indicators, test jacks, etc., on the left. Slide the cover off the mounting base and use the drilling template provided in the shipping kit or the base as a template for drilling or locating mounting holes, see Figure 3 and Figure 10. The mounting surface should be 3/4" plywood or other material of equal or greater strength. Use three #10 wood screws or bolts for mounting.

10. POWER AND GROUND WIRING

10.01 See Figure 5 for List 1, 2 applications, Figure 7 for List 3 applications, and Figure 9 for List 4 applications. Attach earth ground to the FRAME GND lug if local practice dictates. If local power is required, connect -48V to the -48 BATT terminal of TB2 and power return to the CKT GROUND terminal of TB1. The List 3 coils, L1 through L2 in Figure 7, are balanced longitudinal (simplex) suppression chokers located in the Tip and Ring of the each HDSL pair. They prevent excessive common mode AC voltages from entering the HRE-422 module, where they could cause transmission errors.

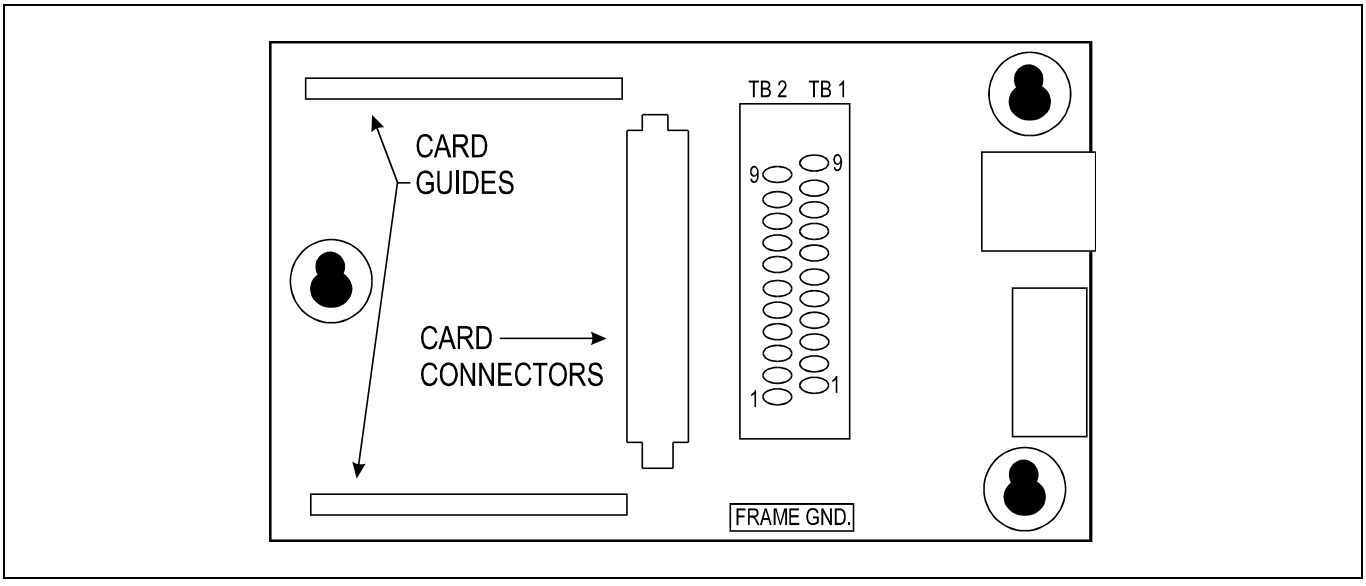

Figure 10. Wall Mounting Base. The wall mountable enclosure base has printed circuit boards that connect the card edge connectors to the TB1 and TB2 terminal blocks. The lug holes for this mounting base are typical for all HRE-422 enclosures.

11. DS1 AND HDSL INTERFACE WIRING FOR HRU-412 APPLICATIONS

Note: Jumpers JP1 and JP4 are only used for the G.703 applications described in Paragraph 13**. These four jumpers must be left open for all applications described in this section.**

11.01 DS1 CONNECTIONS TO CI (List 1, 4). The CPE DS1 circuits connect to the HRU-412 Remote Units either through the RJ-48C (see Figure 11) or the RJ-48X jacks (J2 and J7) (see Figure 12) located on the rear panel of the HRE-422, or directly to the TB1 and TB2 terminal blocks. If you use the terminal boards, connect the DS1 output from the CPE (XMT) to the T and R terminals of TB1 and TB2. Connect the DS1 input to the CPE (RCV) to the T1 and R1 terminals of TB1 and TB2.

Note: If you use the TB1 and TB2 terminal boards for CPE access when using the List 2 HRE-422, you must open the shorted pins in RJ-48X jacks J2 and J7 by inserting a dummy RJ-48 plug into J2 and J7.

11.02 DS1 CONNECTIONS TO CI (List 3, 4). The CPE DS1 circuits connect to the HRU-412 Remote Units either through the DB-15 jacks (J5 and J10, see Figure 13) located on the rear panel of the HRE-422, or directly to the TB1 and TB2 terminal blocks. If you use the terminal blocks, connect the DS1 circuits as described in paragraph 11.01.

11.03 HDSL LOOPS 1 and 2 (List 1, 2, 3 and 4). The two HDSL pairs coming to the HRE-422 Remote Units from the field connect to the HDSL LP 1 and 2 terminals of the TB1 and TB2 terminal blocks (see Figures 4 through 9).

11.04 Connect the HDSL Loop 1 pairs to the HDSL LP 1 (IN) terminals of the TB1 and TB2 terminal blocks. Connect the HDSL Loop 2 pairs to the HDSL LP 2 (IN) terminals of the TB1 and TB2 terminal blocks. Because the HDSL signals are bi-directional, they do not carry a ”transmit” or “receive” designation. With reference to T1 terminology, however, Loop 1 is called the “receive pair” and Loop 2 the “transmit pair”.

Note: If you reverse these leads, a “CHREV” message is displayed in the ALARMS display field when viewing the SPAN STATUS screen from a HiGain terminal interface port. This condition does not affect system operation but it should be corrected to avoid any confusion regarding the identities of the two HDSL loops.

12. HDSL INTERFACE WIRING FOR DOUBLER APPLICATIONS (LIST 1, 2, 3 and 4)

Note: Jumpers JP1 and JP4 are only used for the G.703 applications described in Paragraph 13**. These four jumpers must be left open for all applications described in this section.**

12.01 HDSL LOOPS 1 and 2 (IN). The HDSL Loop 1 and 2 pairs coming to the HRE-422 Doubler Units from the Line Units connect to the HDSL LP 1 and 2 (IN) terminals of the TB1 and TB2 terminal blocks. (See Figures 4 through 9).

12.02 Connect the HDSL Loop 1 pair to the HDSL LP 1 (IN) terminals of the TB1 and TB2 terminal blocks. Connect the HDSL Loop 2 pair to the HDSL LP 2 (IN) terminals of the TB1 and TB2 terminal blocks. Because the HDSL signals are bi-directional, they do not carry a ”transmit” or “receive” designation. With reference to T1 terminology, however, Loop 1 is called the “receive pair” and Loop 2 the “transmit pair”.

Note: If you reverse these leads, a “CHREV” message is displayed in the ALARMS display field when viewing the SPAN STATUS screen from a HiGain terminal interface port. This condition does not affect system operation but it should be corrected to avoid any confusion regarding the identities of the two HDSL loops.

12.03 HDSL Loops 1 and 2 (OUT). The HDSL Loop 1 and 2 field pairs connecting to the HRE-422 Doubler Units to the Remote Units connect to the HDSL LP 1 and 2 (OUT) terminals of the TB1 and TB2 terminal blocks, see Figures 4 through 9.

12.04 Connect the HDSL Loop 1 pair to the HDSL LP 1 (OUT) terminals of the TB1 and TB2 terminal blocks. Connect the HDSL Loop 2 pair to the HDSL LP 2 (OUT) terminals of the TB1 and TB2 terminal blocks. The doubler connections for this application are shown in parenthesis in the block diagrams, see Figures 5 and 9. This is done to highlight the fact that these same pins support different interfaces in other applications.

12.05 Note that the **HDSL LP 1 out** and **HDSL LP 2 out** pairs also connect to the DS1/G.703 connectors (J2 & J7 in List 1, 2 and 4), (J3, 4, 5, 8, 9 & 10 in List 3). Care should be taken to prevent inadvertent contact to these connectors for these doubler applications.

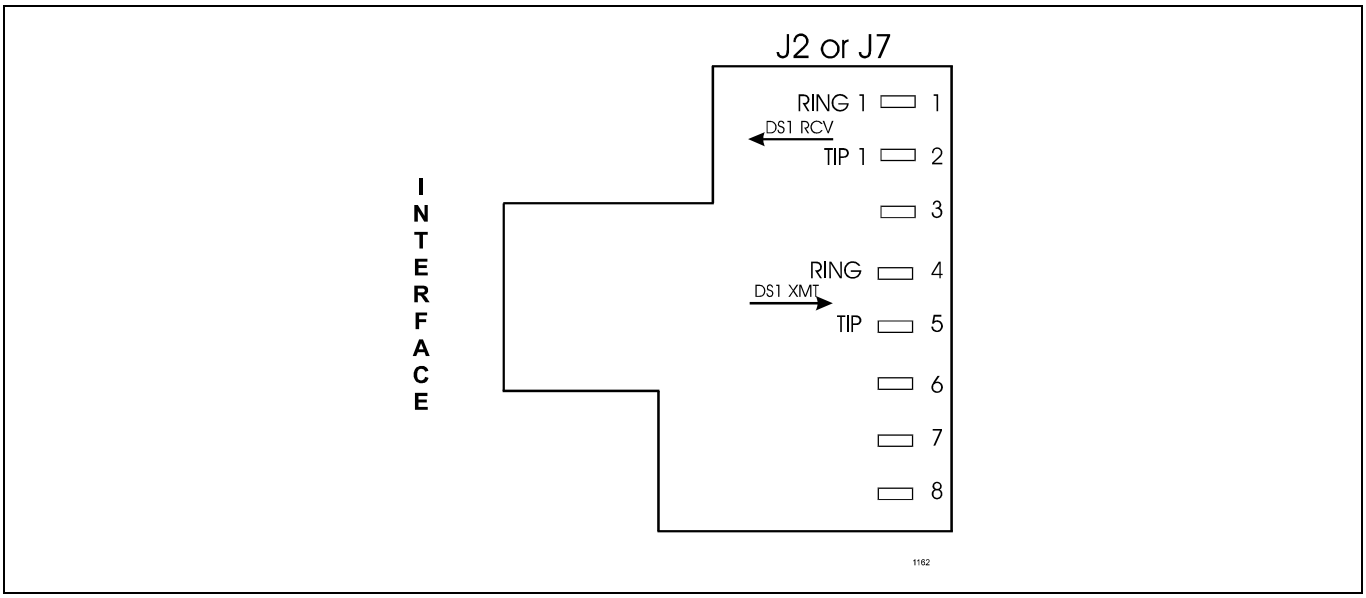

Figure 11. List 1, RJ-48C Pin Assignments.

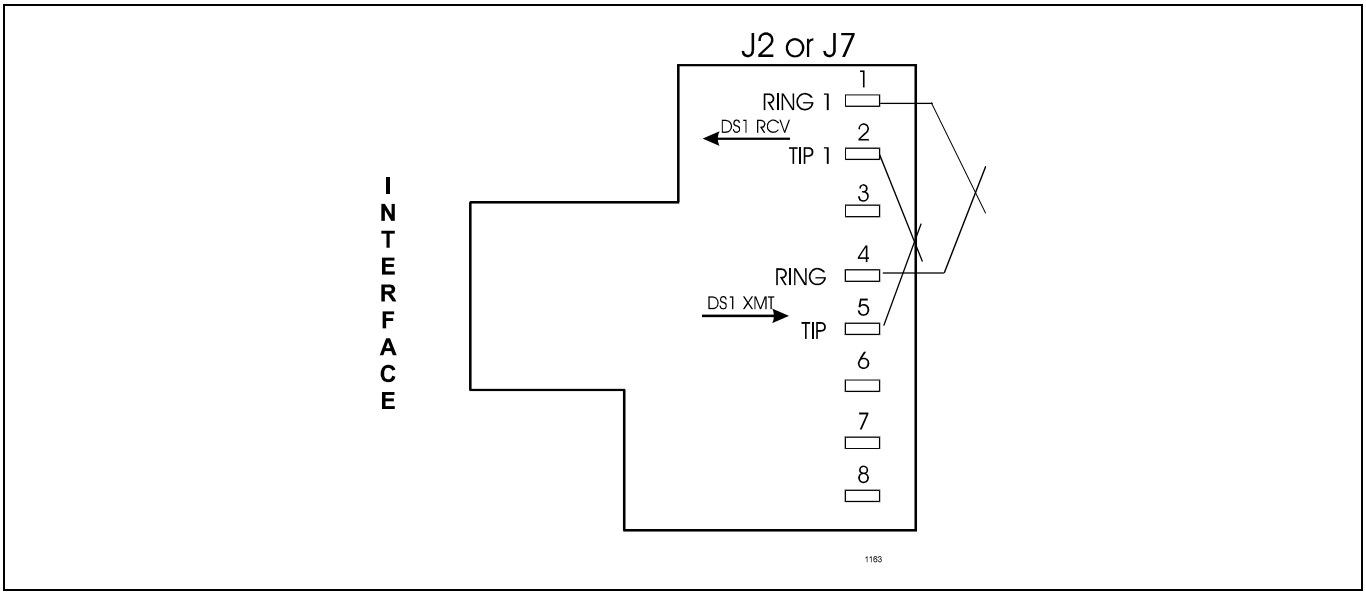

Figure 12. List 2, RJ-48X Pin Assignments.

13. G.703 INTERFACE WIRING FOR ERU-412 APPLICATIONS (LIST 3)

13.01 HDSL LOOP 1 and 2 (IN). The two HDSL pairs coming to the HRE-422 Remote Units from the field connect to the HDSL LP 1 and 2 terminals of the TB1 and TB2 terminal blocks, see Figures 5 and 9.

13.02 Connect the HDSL Loop 1 pairs to the HDSL LP 1 (IN) terminals of the TB1 and TB2 terminal blocks. Connect the HDSL Loop 2 pairs to the HDSL LP 2 (IN) terminals of the TB1 and TB2 terminal blocks. Because the HDSL signals are bi-directional, they do not carry a ”transmit” or “receive” designation. With reference to T1 terminology, however, Loop 1 is called the “receive pair” and Loop 2 the “transmit pair”.

Note: If you reverse these leads, a “CHREV” message is displayed in the ALARMS display field when viewing the SPAN STATUS screen from a HiGain terminal interface port. This condition does not affect system operation but it should be corrected to avoid any confusion regarding the identities of the two HDSL loops.

13.03 G.703 120-Ohm Connections to CI. The CPE G.703 120-ohm balanced interface circuits connect to the HRE-422 Remote Units either through the DB-15 jacks (J5 and J10) located on the rear panel of the HRE-422 (Figure 13), or directly to the TB1 and TB2 terminal blocks. If you use the terminal blocks, connect the G7.03 output from the CPE (XMT) to the T and R terminals of TB1 and TB2. Connect the G.703 input to the CPE (RCV) to the T1 and R1 terminals of TB1 and TB2.

Note: Jumpers JP2 and JP4 comply with the CCITT G.703 requirement to provide the option to connect the input’s outside connector to earth when they are closed. JP2 and JP4 provide this option for the 120-ohm connectors J5 and J10.

13.04 G.703 75-Ohm ERU Connections to CI. The CPE G.703 75-ohm unbalanced circuits connect to the HRE-422 Remote Units through the BNC connectors (J3, J4, J8, and J9) located on the rear panel.

Note: Jumpers JP1 and JP3 comply with the CCITT G.703 requirement to provide the option to connect the ring lead (outer conductor) of the input port to earth when they are closed. JP1 provides the option for 75-ohm connector J3. JP3 provides the option for 75-ohm connector J8.

14. TURN UP

14.01 Slide one HRU-412 or ERU-412 Remote Unit or one HDU-451 or EDU-451 Doubler Unit along each pair of card guides and into each edge connector, see Figure 3. Make sure each card is seated firmly in its connector. Refer to the appropriate ADC Technical Practices listed in Paragraph 1.01 for complete turn-up instructions.

14.02 If you are using the protection feature of the HRE-422, slide the PROT’N switch S1 on the outer circuit board to ON to enable the protection feature or to OFF to disable the feature. The LED, CR1, can be viewed from an opening in the rear of the curve. It is normally off but lights up RED whenever the primary system backup fails and the PROTECT system has been switched in to replace it. For all protection switch applications, the PRIMARY remote unit is connected to TB1 and the PROTECT unit is connected to TB2. See Figure 14 for a block diagram of the protection switch circuit. Refer to the HLU-232 Protection Line Unit practice #150-232-100 for more information on protection switching.

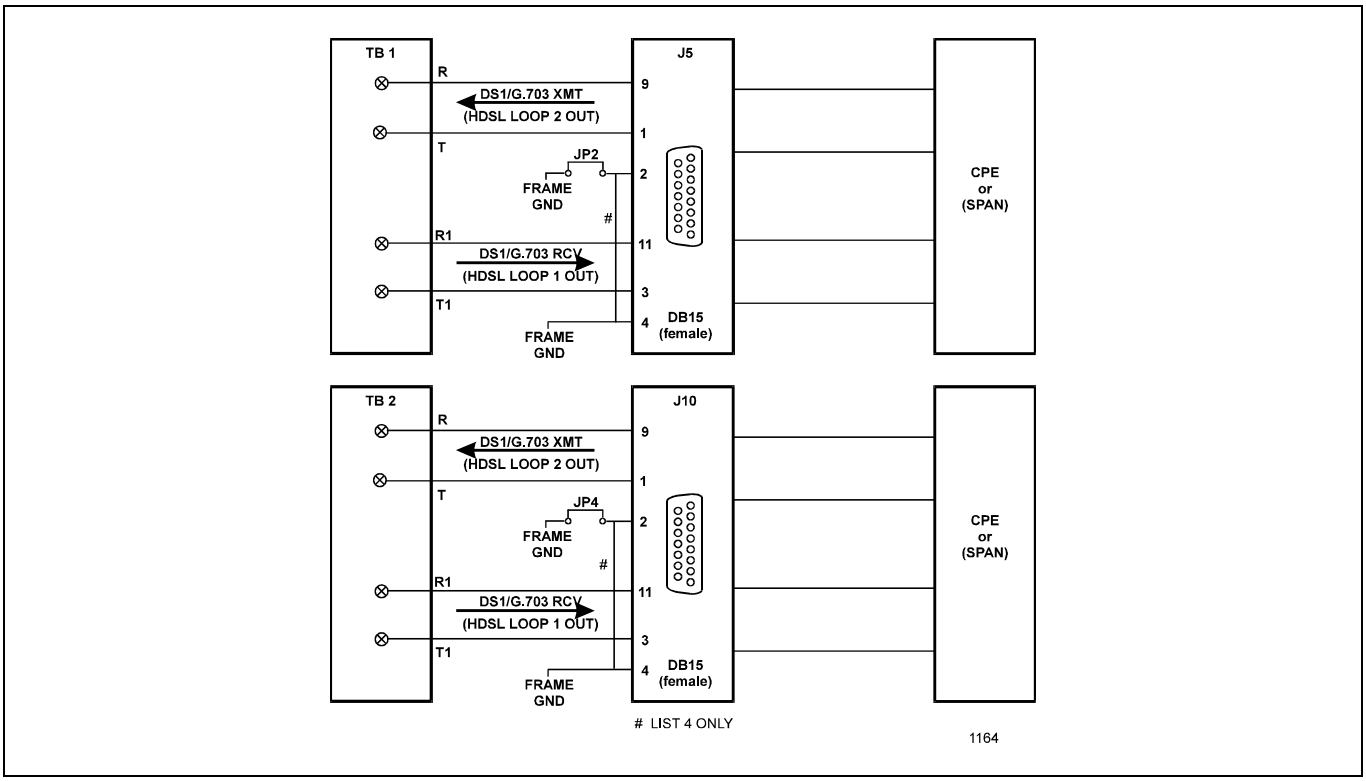

Figure 13. List 3 and List 4, DB-15 Pin Assignments.

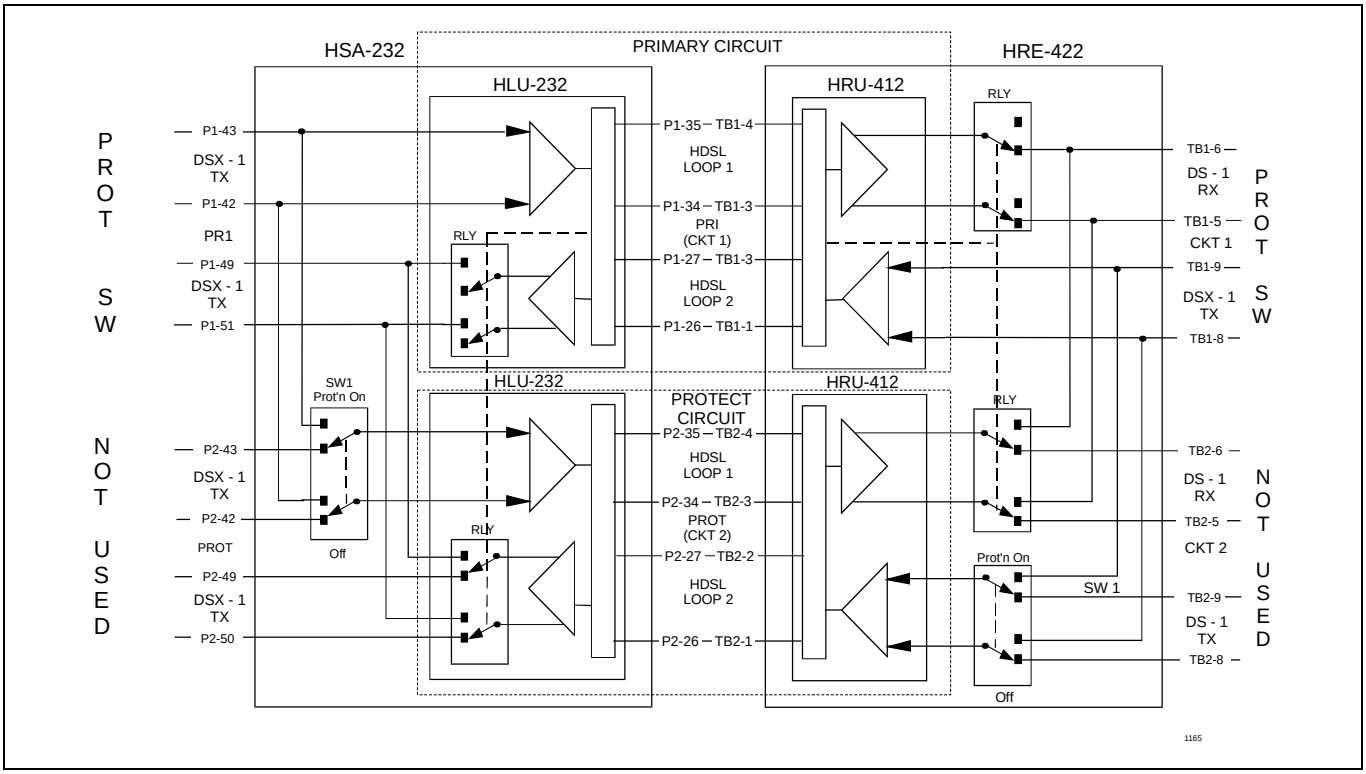

Figure 14. Protection Switch Block Diagram

PRODUCT SUPPORT

ADC Customer Service Group provides expert pre-sales and post-sales support and training for all its products.

Technical support is available 24 hours a day, 7 days a week by contacting the ADC Technical Assistance Center (TAC).

Sales Assistance 800.366.3891 extension 73000 (USA and Canada) 952.917.3000 Fax: 952.917.3237	• Quotation Proposals • Ordering and Delivery • General Product Information
Systems Integration 800.366.3891, extension 73000 (USA and Canada) 952.917.3000	• Complete Solutions (from concept to installation) • Network Design and Integration Testing • System Turn-Up and Testing • Network Monitoring (upstream or downstream) • Power Monitoring and Remote Surveillance • Service/Maintenance Agreements • Systems Operation
ADC Technical Assistance Center 800.366.3891, ext.73223 800.638.0031 714.730.3222 Fax: 714.730.2400 Email: wsd_support@a dc.com	• Technical Information • System/Network Configuration • Product Specification and Application • Training (product-specific) • Installation and Operation Assistance • Troubleshooting and Repair/Field Assistance
Online Technical Support	• www.adc.com/Knowledge_Base/index.jsp
Online Technical Publications	• www.adc.com/library1/
Product Return Department 800.366.3891 ext. 73748 or 952.917.3748 Fax: 952.917.3237 Email: repair&return@adc.com	• ADC Return Material Authorization (RMA) number and instructions must be obtained before returning products.

All 800 lines are toll-free in the USA and Canada.

LIMITED WARRANTY

ADC DSL Systems, Incorporated (“ADC”) warrants that, for a period of thirty-six (36) months from the date of shipment, the hardware portion of its products will be free of material defects and faulty workmanship under normal use. ADC's obligation, under this warranty, is limited to replacing or repairing, at ADC's option, any such hardware product which is returned during the 36-month warranty period per ADC's instructions and which product is confirmed by ADC not to comply with the foregoing warranty.

ADC warrants that, for a period of 90 days from the date of purchase, the software furnished with its products will operate substantially in accordance with the ADC published specifications and documentation for such software. ADC’s entire liability for software that does not comply with the foregoing warranty and is reported to ADC during the 90-day warranty period is, at ADC’s option, either (a) return of the price paid or (b) repair or replace of the software. ADC also warrants that, for a period of thirty (30) days from the date of purchase, the media on which software is stored will be free from material defects under normal use. ADC will replace defective media at no charge if it is returned to ADC during the 30-day warranty period along with proof of the date of shipment.

The transportation charges for shipment of returned products to ADC will be prepaid by the Buyer. ADC will pay transportation charges for shipment of replacement products to Buyer, unless no trouble is found (NTF), in which case the Buyer will pay transportation charges.

ADC may use reconditioned parts for such repair or replacement. This warranty ***does not*** apply to any product which has been repaired, worked upon, or altered by persons not authorized by ADC or in ADC's sole judgment has subjected to misuse, accident, fire or other casualty, or operation beyond its design range.

Repaired products have a 90-day warranty, or until the end of the original warranty period—whichever period is greater.

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