Teleline™

Single 8-card Shelf HVI Cabinet (751950/15CU6) and Backboard (751950/05CU6) with Two Integrated 4-slot NIU Shelves Description and Installation Guide

925W751047-01E

POSITRON

Positron Inc.

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Chapter 1

General Information

1.1 Publication Information

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Teleline Single 8-card Shelf HVI Cabinet (751950/15CU6)
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1.2 About this Guide

This guide introduces you to the Teleline Single 8-card Shelf HVI Cabinet (751950/15CU6) and Backboard (751950/05CU6) with Two Integrated 4-slot NIU Shelves, and describes how to install them. This guide was designed to be read from beginning to end.

1.2.1 Related Documentation

For any other technical document relating this system installation or applications cards and shelves, please refer to the Positron Web site: www.PositronPower.com.

1.2.2 Positron Products and Services

Positron engineers and manufactures high voltage isolation products to protect personnel and telecommunications circuits in high voltage areas that are susceptible to the effects of Ground Potential Rise (GPR).

Positron is the leader in isolation technology with its Teleline wireline products and TeleLite optical fiber wireline isolation/protection product families. Positron provides total flexibility in product configuration – from standalone units protecting a single circuit to high-capacity, multi-shelf HVI preconfigured systems.

Positron also provides a wide range of consulting, analysis and training services for communications companies and electrical utilities.

Full details and contact information are available at: www.PositronPower.com

1.3 Service and Support

1.3.1 Positron Contact Information

General information:	Positron Inc. 5101 Buchan Street, Suite 220 Montreal, Quebec, Canada H4P 2R9 US and Canada: 1-888-577-5254 International: 1-514-345-2220 Fax: 514-345-2271 E-mail: info@positronpower.com Website: www.positronpower.com
Customer Service and Repairs:	US and Canada: 1-888-577-5254 International: 1-514-345-2220 E-mail: customerservice@positronpower.com

1.3.2 Technical Customer Support

Positron is committed to providing excellent ongoing technical support to its customers. A team of specialists is always available for telephone consultations or for on-site visits to assist in the maintenance and troubleshooting of Positron equipment.

For pricing information or assistance in the planning, configuration and implementation of the installation of equipment, contact Technical Customer Service.

1.3.3 Customer Training

Full customer training courses on High Voltage Interface (HVI) are also available. For more information, contact Positron.

1.3.4 Repair Service

All warranty repairs are performed at no cost. Positron reserves the right to repair or replace any equipment that has been found to be defective.

For information about out-of-warranty repairs, contact Positron's Repair Department. Due to the varied nature of repairs, no specific turnaround can be guaranteed, but average turnaround time is 20 working days from date of receipt. In emergency situations, special arrangements can be made. All repaired items are warranted for a period of 90 days.

Before returning any items to Positron for repair, warranty repair or replacement, call the Repair department to obtain a Return Material Authorization (RMA) number. Parts returned without RMA numbers cannot be accepted. The RMA number must always be clearly marked on all boxes, crates, and shipping documents. Bulk repairs (more than five items) will require additional processing time, so please take this into consideration when requesting an RMA number.

To accelerate the repair process, whenever possible, include a report detailing the reason for return with the unit(s). Also, please include the name and phone number of a person who can be contacted should our Repair department need further information.

When packing items being returned for repair, please ensure they are properly packed to avoid further damage. Plug-in cards should never be shipped while installed in a shelf; this will cause damage that can extend the repair period.

1.4 Teleline Warranty

Subject to the provisions of this paragraph, Positron warrants that the equipment shall perform in accordance with Positron's specifications. The warranty remains valid for five (5) years from the date of shipment. The warranty fully covers workmanship, materials and labor. Positron shall, at its sole discretion, repair or replace the problem unit.

Freight costs to ship defective equipment to Positron are borne by the Customer, with return of replaced or repaired equipment to be at Positron's expense.

1.4.1 Limitation of Liability

Subject to anything to the contrary contained herein, Positron's sole obligation and liability and the customer's sole remedy for Positron's negligence, breach of warranty, breach of contract or for any other liability in any way connected with or arising out of, the equipment or any services performed by Positron shall be as follows:

- In all situations involving performance or non-performance of the equipment or any component thereof, the customer's sole remedy shall be, at Positron's option, the repair or replacement of the equipment or said component.
- For any other claim in any other way related to the subject matter of any order under, the customer shall be entitled to recover actual and direct damages; provided that Positron's liability for damages for any cause whatsoever, and regardless of the form of the action, whether in contract or in tort (including negligence), shall be limited to the value of the order.

Positron shall not be obligated to repair or replace any item of the equipment which has been repaired by others, abused or improperly handled, improperly stored, altered or used with third party material or equipment, which material, or equipment may be defective, of poor quality or incompatible with the equipment supplied by Positron, and Positron shall not be obligated to repair or replace any component of the equipment which has not been installed according to Positron specifications.

IN NO EVENT SHALL POSITRON BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL, PUNITIVE, EXEMPLARY OR SIMILAR OR ADDITIONAL DAMAGES INCURRED OR SUFFERED INCLUDING

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1.4.2 Cancellation and Rescheduling Charges

Should the customer cancel, prior to shipment, any part of an order, the customer agrees to pay to Positron cancellation charges, not as a penalty, which shall total all expenses, including labor expenses, incurred by Positron prior to said cancellation. Equipment that has been specially developed for the customer's specific applications shall not be subject to cancellation. Cancellation or rescheduling is not permissible after shipment of the System.

Chapter 2

Overview and Planing

2.1 Introduction

The Teleline Single 8-card Shelf HVI Backboard (751950/05CU6) and Cabinet (751950/15CU6) withTwo Integrated 4-slot NIU Shelves features:

- Teleline 8-card Shelf, model 751109/15
- Lightning arrestor
- 5 Pin Protector Block
- Isolation jacks
- Frame ground
- Circuit ground
- Ground bar
- Station cable terminating blocks
- Two NIU terminating shelves
- Cable entry holes

The Cabinet (751950/15CU6) provides a fan and heater.

2.1.1 8-card Shelf, model 751109/15

The 8-card Shelf, model 751109/15, accommodates Teleline plug-in cards. The shelf is molded from specially treated polyurethane, making it lightweight and flame retardant of high dielectric strength. The polyurethane body limits the possibility of many kinds of infiltration while providing reliable isolation from external ground potentials.

The shelf itself is compliant with CSA CAN/CSA-C22.2 No.60950-1 for US and Canada.

2.1.2 Single 8-card Shelf HVI Backboard (751950/05CU6) and

Cabinet (751950/15CU6) with Two Integrated 4-slot NIU Shelves

Both Single 8-card Shelf HVI Backboard (751950/05CU6) and Cabinet (751950/15CU6) with Two Integrated 4-slot NIU Shelves assemblies have the same functionalities and require the same connections and power input. The difference between them being that the HVI Cabinet (751950/15CU6) assembly has temperature controls and can be installed outdoors as well as indoors while the Backboard (751950/05CU06) can only be installed indoors.

2.1.3 HVI Placement

2.1.4 Placement Selection

The location selected for the HVI unit must take into account:

- Room for the HVI and related equipment.
- Location where the CO or dedicated cable enters building.
- Location and length of the grid ground connection.
- Elimination of all telephone equipment on the entrance cable.

This then ensures that the CO or dedicated cable enters onto or within the HVI assembly straight from the entrance conduit.

The placement of related equipment and wiring must be located so as to prevent an arcing condition from the CO cable.

The CO or dedicated cable must be installed to maintain a 15 cm (6 inch) air gap from the cable jacket to any grounded component or structure surface or member.

The CO cable can not cross or come within 15 cm (6”) of any equipment on the low voltage side of the HVI.

The station side or low voltage side equipment can not cross or come within 15 cm (6”) of the CO or dedicated cable, the top of the lightning arrestor, any other equipment that is attached to the CO cable shield, cable pairs, or the CO side of the Teleline Shelf or the CO side of any related equipment.

2.2 HVI Equipment Layout - Concept

All equipment that is subject to the effects of the remote ground aspect of the site is grouped and located the High Voltage Side and the Low Voltage side of the HVI unit. With the equipment laid out in this manner it is easy to determine what potential is possible on all equipment at any time.

The CO cable cannot cross or come within 15 cm (6”) of any equipment on the low voltage side of the HVI. The station side or low voltage side equipment cannot cross or come within 15 cm (6”) of the CO Cable, the top of the lightning arrestor, any other equipment that is attached to the CO cable shield, cable pairs, or the CO side of the Teleline Shelf or the CO side of any related equipment.

2.2.1 High Voltage Side

The High Voltage side of the HVI contains equipment and wiring that is at remote ground potential. Therefore, if the installation is complete with the connection to the feeding cable that originates beyond the substation, it is not at a safe potential to touch, unless using rubber gloves and standing on a rubber safety mat. In other words, if a fault event occurs, this equipment and or wiring will be at a potential that is stable and not subject to the Ground Potential Rise effects of the substation grid. Therefore, if the individual is standing on the grid, the effects of the fault will make this equipment energized to an unsafe voltage level.

The equipment normally found on this side contains but may not be limited to, the CO cable, the cable attachment to the surge or lightning arrestor, the connection at the top of the surge or lightning arrestor, Isolation jacks if they are installed, and the CO side of the Teleline equipment.

The Teleline equipment is designed to isolate the personnel and equipment from the effects of the high and the low voltage condition of this site.

2.2.2 Low Voltage Side

The low voltage side of the HVI contains equipment and wiring that is essentially at substation ground potential. Therefore it is at a safe potential to touch. It is important to note that the circuit wires may be at an elevated potential in relation to the earthing or ground potential of the building or concrete floor that is being

stood upon. Therefore care should be taken when handling circuit equipment and or wiring.

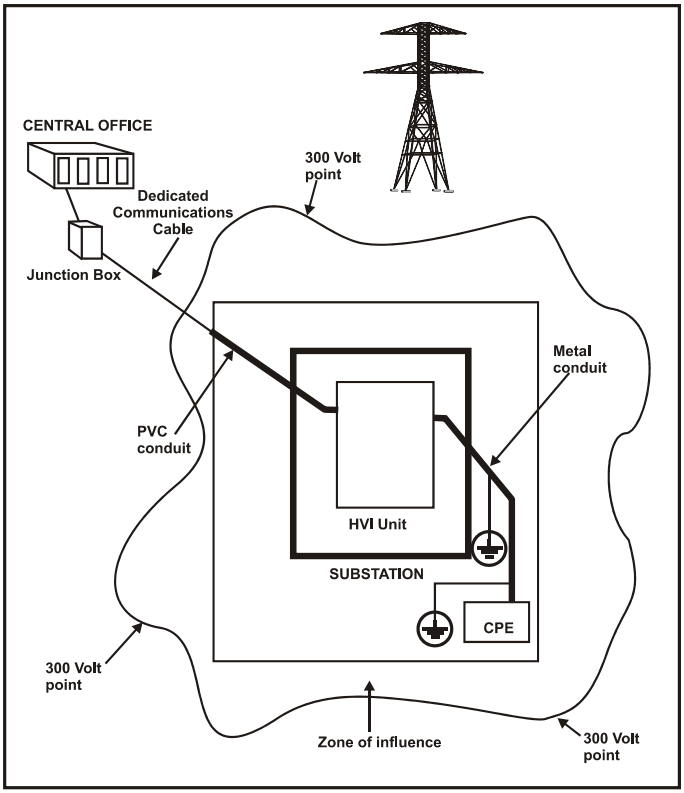
The Teleline equipment is designed to isolate the personnel and equipment from the effects of the high and the low voltage condition of this site.

2.3 300 Volt Point Location

2.3.1 Cable Shields

The 300 V point for an installation is defined by the electrical parameters of the substation. This is the point where the Ground Potential Rise of the site is reduced to 300 V or less. This is usually a new or existing cable closure.

Figure 1: 300V Point



There will be a minimum of two cables in the closure at this point. The cable that originates at the CO will be called the general use cable. The cable that originates

in this closure and routes into the substation switch room will be called the dedicated cable. Any other cables located in this closure will be referred to as other cable(s).

Splicing of the general use cable pairs to the dedicated cable pairs in this closure must follow the following rules:

- All pairs spliced from the general use cable to the dedicated cable must not be spliced using modular connectors. These pairs must be spliced using single conductor splice connectors. This is an electrical dielectric strength item.
- All pairs spliced from the general use cable to other cable(s) can be spliced using any normal splicing method.
- All cable shields should be bonded together at this point.

➤ **Grounding the 300 V point closure**

Grounding of the 300 V point closure can be accomplished utilizing a ground rod driven within a 1.8m (6’) radius of the closure.

1. Attach a #6 AWG bare copper wire to this ground rod and route it to this same cable closure.
2. Attach this ground wire to the cable closure bond bar.
3. All cables within this closure are to be bonded to this cable bond bar, thereby effectively grounding them to a local ground.

NOTE

- Do not install a bond wire to any power system multi grounded neutral conductor or other power system apparatus at this closure.

2.3.2 Cable Routing CO Side Non-Metallic Conduit

As shown in Figure 1 on page 20, the CO Cable should be routed to the HVI utilizing a nonmetallic conduit. This increases the insulation of the cable shield from earth ground contact via the dielectric material of the conduit. This conduit should originate on the HVI backboard and extend to a distance of at least 3 m (10 feet) beyond the grounded perimeter fence. In addition the cable after it leaves the

nonmetallic conduit should not cross or come in contact with any grounded conductive surface.

2.3.3 Cable Routing Station Side Metallic Conduit

The station cable(s) that terminate on the HVI backboard should be routed to this backboard utilizing a metallic conduit. If the distance between origination point and the termination point of the HVI backboard is substantial, greater than 30 m (100 feet), then a #2 copper bonding conductor should be run with the station cables either exposed or in a metallic conduit of its own. This bonding conductor is then tied to ground at both ends and the equipment connected to the cable pairs is also bonded to this same ground point. This effectively puts both ends of the station cable(s) and the serving equipment at the same earthing potential.

2.3.4 Crossing Cables and Ground Wires

The CO cable, or any cable that the shield is at remote ground potential should not cross or come in contact with any ground wire or conductive surface within the Zone of Influence of the substation.

The station cables are at local or substation potential. Therefore, they can be run adjacent to or may cross local ground wires or grounded conductive surfaces.

2.3.5 Sealing Current

Sealing current will be simplexed back to the Central Office source by the circuit cards when utilized. No provision is made for sealing current to work beyond this card. Therefore it is anticipated that the NCTE equipment will be operated close to the HVI backboard.

2.4 Electrical Power

2.4.1 Power Supply Configurations

This shelf also has the capability of utilizing the following power supply modules with the respective input power and a resulting output power as identified below:

Table 1: Power supply configurations:

Model #	Input Voltage	Output Voltage
751313MC	120 Vac or 129 Vdc	-24 Vdc output to the shelf
751318MC	120 Vac or 129 Vdc	-48 Vdc output to the shelf
751316	48 Vdc	-24 Vdc output to the shelf
751319MC	48 Vdc	-48 Vdc output to the shelf

2.4.2 Power Supply Combinations

This shelf can use the following power supply combinations:

Table 2: Power supply combinations:

Input Voltage	Model(s)	Output Voltage	Supply Current
120 Vac or 129 Vdc	Single 751313MC or Dual 751313MC	-24 Vdc	2 A 4 A
120 Vac or 129 Vdc	Single 751318MC or Dual 751318MC	-48 Vdc	1 A 2 A
Mixed Configuration: 120 Vac or 129 Vdc	Single 751313MC and Single 751318MC	-24 Vdc & -48 Vdc	2 A 1 A
These two output voltages will appear simultaneously on the shelf backplane.			
48 Vdc	Single 751316 or Dual 751316	-24 Vdc	2 A 4 A
48 Vdc	Single 751319MC or Dual 751319MC	-48Vdc	1 A 2 A
48 Vdc	Single 751316 or Single 751319MC	-24 Vdc & -48Vdc	2 A 1 A
These two output voltages will appear simultaneously on the shelf backplane.			

Table 3: Cable Pair Output Voltages

Cable Pair #	Function
18 (Yellow/Green)	Ground. (+)
20 (Yellow/Slate)	-24 Vdc output
22 (Violet/Orange)	-48 Vdc output

Either or both of these output voltage(s) can be utilized to power external equipment to the shelf. However, calculations as to power consumption should be done to ensure that the various supply output is not exceeded. This of course assumes that the respective power supply is in and working in the shelf power supply area and they have been energized by the respective input voltage source(s).

2.4.3 Environmental and Temperature Considerations

2.4.4 HVI Cabinet

The HVI Cabinet designs comply with Standard I.E.E.E. 487 recommendations. Compliance with this standard will insure a safe working environment for all personnel, while protecting the telecommunications network from hazardous voltages and currents.

The shelf enclosure is made of an insulating material, which under normal operating conditions (i.e., shelf closed) results in a higher temperature internally than externally (ambient room temperature). Therefore, special care must be taken to ensure that the internal temperature never exceeds the operating temperature of each card.

This section provides a procedure for the calculation of the temperature inside the shelf.

For a list of the thermal specifications for all Teleline cards designed for use within shelves, see Table 4 on page 25.

Table 4: Positron Plug-in Card Thermal Specifications

Note	Model	Power Consumption	Power Dissipation	Operating Temperature Range	
1	7501-16B	8.4 W from -24 Vdc	8.5 W	**0° to 50° C**	**32° to 122°F**
1	7501-16C	6 W from -48 Vdc	6 W	**0° to 50° C**	**32° to 122°F**
	7501-24	N/A	N/A	-20° to 65° C	-4° to 149°F
	7501-72	N/A	< 200 mW if loop current is < 80 mA	-20° to 65° C	-4° to 149°F
		N/A	< 5 W if loop current is > 80 mA	-20° to 65° C	-4° to 149°F
1	751312	270 mA (charging)	N/A	**0° to 50° C**	**32° to 122°F**
2	751313MC	N/A	**25% of output power**	-20° to 65° C	-4° to 149°F
2	751318MC	N/A	**25% of output power**	-20° to 65° C	-4° to 149°F
2	751316	N/A	**25% of output power**	-20° to 65° C	-4° to 149°F
2	751319MC	N/A	**25% of output power**	-20° to 65° C	-4° to 149°F
	751322	1.8 W avg at -24 Vdc	1 W at (-24 Vdc)	-20° to 65° C	-4° to 149°F
		2.4 W avg at -48 Vdc	2 W at (-48 Vdc)	-20° to 65° C	-4° to 149°F
	751322 &	2.6 W at -24 Vdc	2 W at (-24 Vdc)	-20° to 65° C	-4° to 149°F
	751322/1	3.6 W at -48 Vdc	3.5 W at (-48 Vdc)	-20° to 65° C	-4° to 149°F
	751322/2	2.6 W at -24 Vdc	2 W at (-24 Vdc)	-20° to 65° C	-4° to 149°F
		3.6 W at -48 Vdc	3.5 W at (-48 Vdc)	-20° to 65° C	-4° to 149°F
	751323	1.7 W avg at -24 Vdc	1 W at (-24 Vdc)	-20° to 65° C	-4° to 149°F
		2.4 W avg at -48 Vdc	2 W at (-48 Vdc)	-20° to 65° C	-4° to 149°F
	751325	1.8 W at -24 Vdc	1 W (-24 Vdc)	-20° to 65° C	-4° to 149°F
		2.4 W at -48 Vdc	2 W (-48 Vdc)	-20° to 65° C	-4° to 149°F
	751329R2	N/A	0.75W	-20° to 65° C	-4° to 149°F
	751329SP	3 W at -48 Vdc	2.5W	-20° to 65° C	-4° to 149°F
	751333A	10.6 W at -24 Vdc	3 W (-24 Vdc)	-20° to 65° C	-4° to 149°F
		11 W at -48 Vdc	3.5 W (-48 Vdc)	-20° to 65° C	-4° to 149°F
	751339R2	N/A	4W	-20° to 65° C	-4° to 149°F
	751339SP	10 W at -48 Vdc	5W	-20° to 65° C	-4° to 149°F
	751340R2	N/A	2W	-20° to 65° C	-4° to 149°F
	751340SP	7 W at -48 Vdc	3W	-20° to 65° C	-4° to 149°F
Note: 1	**These cards are designed for indoor applications due to their temperature range**				
Note: 2	**Power Supply Card**				

2.5 Thermal Calculations

2.5.1 Calculating the temperature inside the HVI Cabinet

To simplify the calculation, we have estimated that the maximum temperature rise inside the HVI will not exceed 5ºC, (9ºF). This is taking into account the solar load and the proper operation of the fan.

➤ Calculating the temperature inside the Teleline shelf

1. Add the power consumption of all cards powered by -24 Vdc as shown in Table 4 on page 25. This value represents the “Total Power Consumption” at -24 Vdc. This value is required for the calculation of the power dissipation of the internal power supply.

NOTE

- If an external power supply is being used, omit the following step.

2. Add the power consumption of all cards powered by -48 Vdc as shown in Table 4 on page 25. This value represents the “Total Power Consumption” at -48 Vdc. This value is required for the calculation of the power dissipation of the internal power supply.

NOTE

- If an external power supply is being used, omit the following step.

3. Add the power dissipation of all cards as shown in Table 4 on page 25. This value represents the “Total Power Dissipation.”
4. The “Maximum Operating Temperature” of a card represents the highest temperature at which a card is guaranteed to operate within specifications. At the bottom of the maximum operating temperature column, enter the lowest of the maximum operating temperatures. This temperature is referred to as the “Highest Allowable Temperature.”
5. The temperature inside the shelf is calculated using the following equation.
6. Temperature inside the shelf = (Total Power Dissipation x Shelf Thermal Resistance) + Room Temperature* (see Note1 below)

7. Shelf Thermal Resistance = 0.31° C/W (0.56°F/W)
8. Compare the “Calculated temperature inside the shelf” with the “Highest Allowable Temperature.” The “Temperature inside the shelf” should not exceed the “Highest Allowable Temperature.”

If the calculated temperature is higher than the highest allowable temperature, the following can be done:

➤ **To lower the temperature inside the cabinet:**

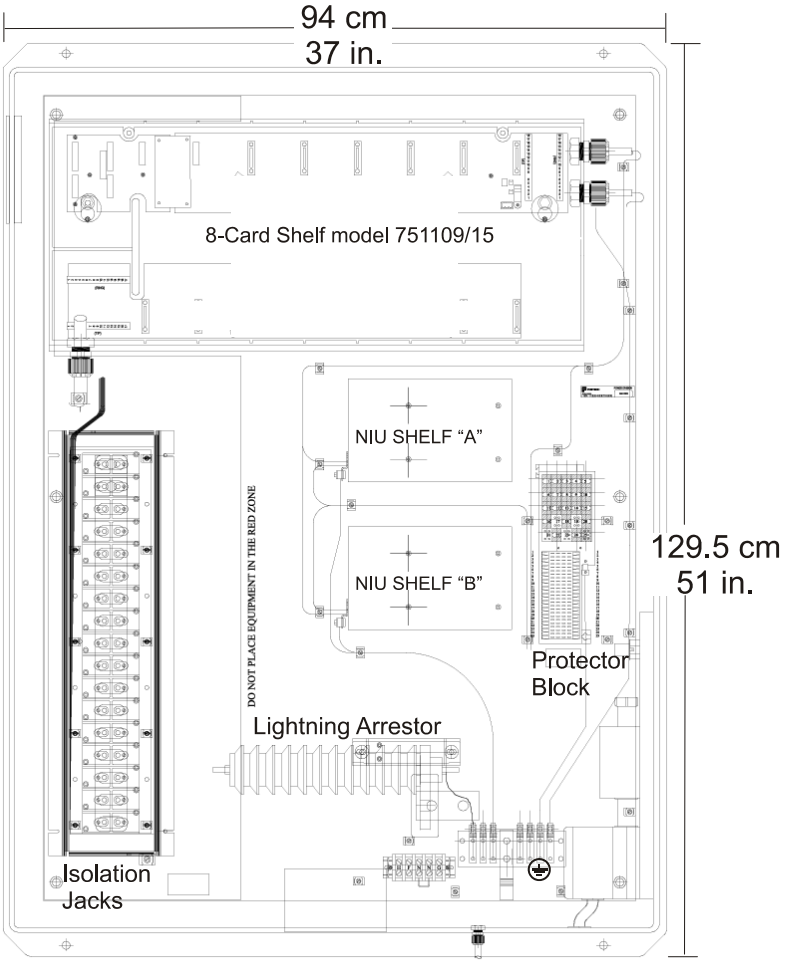
1. Reduce the number of cards in the shelf by distributing the cards among other available shelves.
2. Move the cards between shelves to replace a card that dissipates heat with one that does not, for example, model 7501-24.
3. Lower the temperature of the room where the equipment is installed.
4. Use an external power supply to power the shelf. This will reduce the internal power dissipation.

*** Note1:**
If installed inside use 50°C (122°F).

If installed outside, use the maximum outside temperature in the shade of 46°C (115°F) plus the HVI temperarure rise of 5°C (9°F).

2.6 HVI Cabinet Unit model (751950/15CU6)

Figure 2: HVI Cabinet Unit model (751950/15CU6)



2.7 HVI Cabinet Specifications

The HVI Cabinet design complies with Standard I.E.E.E. 487 recommendations.

Compliance with these standards will insure a safe working environment for all personnel, while protecting the telecommunications network from hazardous voltages and currents.

Table 5: Physical Specifications: 8-card HVI Cabinet model (751960/15CU6)

Parameter	Specification
Height	129.5 cm (51”)
Width	94 cm (37”)
Depth	35.6 cm (14”)
Weight	56.5 kg (124.5 lbs.)

Table 6: Operating Temperatures (When using 65°C (149°F) Rated Cards)

Parameter	Specification
Inside installation	-20°C to 55°C (-4°F to 130°F)
Outside installation (with solar load)	-20°C to 46°C (-4°F to 115°F)

NOTE

- See Table 4 on page 25 for temperature ratings of Teleline plug-in cards.

2.8 HVI Backboard model (751950/05CU6) Specifications

Figure 3: HVI Backboard Unit model (751950/05CU6)

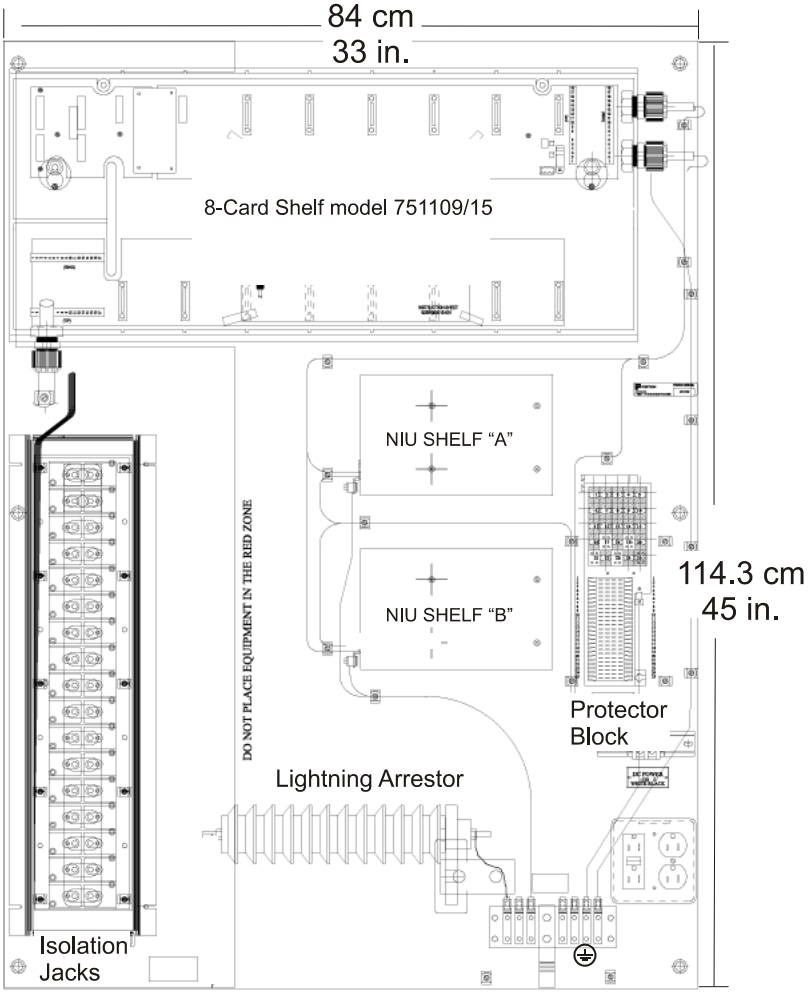


Table 7: Backboard model (751960/05CU6) Physical Specifications:

Parameter	Specification
Height	114.3 cm (45”)
Width	84 cm (35”)
Depth	27.9 cm (11”)
Weight	34 kg (75 lbs)

Table 8: HVI Backboard model (751960/05CU6) Operating Temperatures
(When using 65°C (149°F) Rated Cards)

Parameter	Specification
Inside installation	-20°C to 55°C (-4°F to 130°F)
Outside installation (with solar load)	-20°C to 46°C (-4°F to 115°F)

NOTE

- See Table 4 on page 25 for temperature ratings of Teleline plug-in cards.

2.9 Power Connections

2.9.1 129 Vdc Wiring to HVI Units

This HVI units have provisions for 129 VDC power. Wiring to the HVI unit should be done via a 3/4” conduit. There are two conductors needed to power the equipment.

Table 9: 129 Vdc Conductors

Conductor	Color
-129 Vdc	White Wire
0 Vdc	Black Wire

The circuit feeding this backboard should be sized for a maximum load of 5A.

Actual connection to the serving power circuit is done on the backboard in the lower right hand area. There is a name tag identifying the connection point on the terminal strip.

2.9.2 120 Vac Cabinet Wiring

This cabinet has 120 Vac environmental controls. Wiring to the unit should be done via one of the two 2" conduits to the cabinet. Provisions for cable attachment have been made at the base of the double duplex outlet box. Three conductors are needed for this process:

Table 10: Wiring Power to the Cabinet

Conductor	Wire Color
Phase Wire	BLACK or RED
Neutral Wire	WHITE
Ground Wire	GREEN

The circuit feeding this unit should be sized for a maximum of 15 A.

Actual connection to the serving power circuit is done in the back of the double duplex electrical box. Three conductor pig-tails with wire nuts for the connection to the power source are located inside this box.

Chapter 3

Installation

3.1 HVI Installation

3.1.1 Preparation for Installation

Review the plan view drawing for the equipment to be installed. Any problems associated with the placement of this equipment must be addressed before work is commenced.

Confirm that:

- The supporting structure is adequate to support the cabinet.
- The installation space is adequate for the cabinet exterior size.
- The entrance cable location is as designed.
- The power source is the same as that identified on the drawing and in this document.
- The Substation Ground Grid connection is available and within 1.8m (6’) of the cabinet.
- The safety considerations as outlined in “Safety Precautions” on page 37 have been taken.

3.1.2 Safety Precautions

CAUTION

When working on the equipment, the following safety issues should be noted:

- A rubber safety mat and rubber safety gloves must be available for use at the job site at all times. These gloves and mat should be tested for a 10,000 V exposure safe level.
- There is an extreme hazard in working on or coming in contact with the lightning arrestor during inclement weather. The lightning arrestor is connected to the cable shield so a lighting strike may at any time energize it.
- Direct contact with conductors and equipment while standing on a moist surface is hazardous. Ensure that the rubber safety mat does not allow water or any conducting material to come in contact with personnel.
- Precautions should be taken to ensure that moisture is prevented from entering or splashing on the unit.
- AC and DC power used to power communications and environmental equipment may be present at all times. Normal working procedures for powered circuits and devices should be followed.
- Communication pairs that leave the cabinet can be energized at any moment. Rubber gloves and mats should be utilized at any time when there is a potential for contact with an energized conductor.
- Do not install or work on these circuits or cables during a lightning storm. Power substations and their transmission systems attract lightning due to their designed aerial ground wires above the substation grid and support structure.

3.1.3 Additional Safety Precautions for Exterior Locations

CAUTION

Additional Safety Precautions for Exterior Locations:

- When necessary to work on the cabinet for long periods of time during wet weather conditions, a rainproof umbrella or tent should be used to keep the work area dry.
- If the craftsman standing area is wet or saturated, a raised platform for the mat may be required.

3.2 HVI Cabinet model (751950/15CU6) Installation

3.2.1 Additional Hardware Required

Table 11: Additional Hardware Required

Quantity	Description	Use
4	3/8” diameter studs or lag bolts	For mounting to the supporting surface
4	3/8” washers	For use with the mounting fasteners
1	Connector	For the Grid Ground wire to the #6 cabinet ground wire connection

➤ Unpacking the HVI Cabinet

1. Cut the packing straps holding the cabinet box to the pallet.
2. Open the cabinet and remove any packing material.
3. Remove any other loose items and set aside for later use.

➤ Mounting the Unit to the Supporting Structure

CAUTION

- The cabinet weight is substantial. Mounting should be accomplished by two or more persons.

1. Orient the brackets as needed to fit the installation surface on the supporting structure. The orientation shown in Figure 4 on page 40 is the preferred one.
2. Utilizing the dimensions as shown in Figure 4 on page 40, locate and drill the top two holes to mount the cabinet to the support surface. Refer to the plan view drawing of the cabinet.
3. Bolt the cabinet to the supporting structure using two studs or lag bolts and washers.
4. Drill and install the studs or lag bolts and washers for the bottom two mounting holes. Tighten the mounting hardware assemblies to secure the cabinet to the supporting structure.

Figure 4: HVI Cabinet (715950/15CU6) Mounting Holes

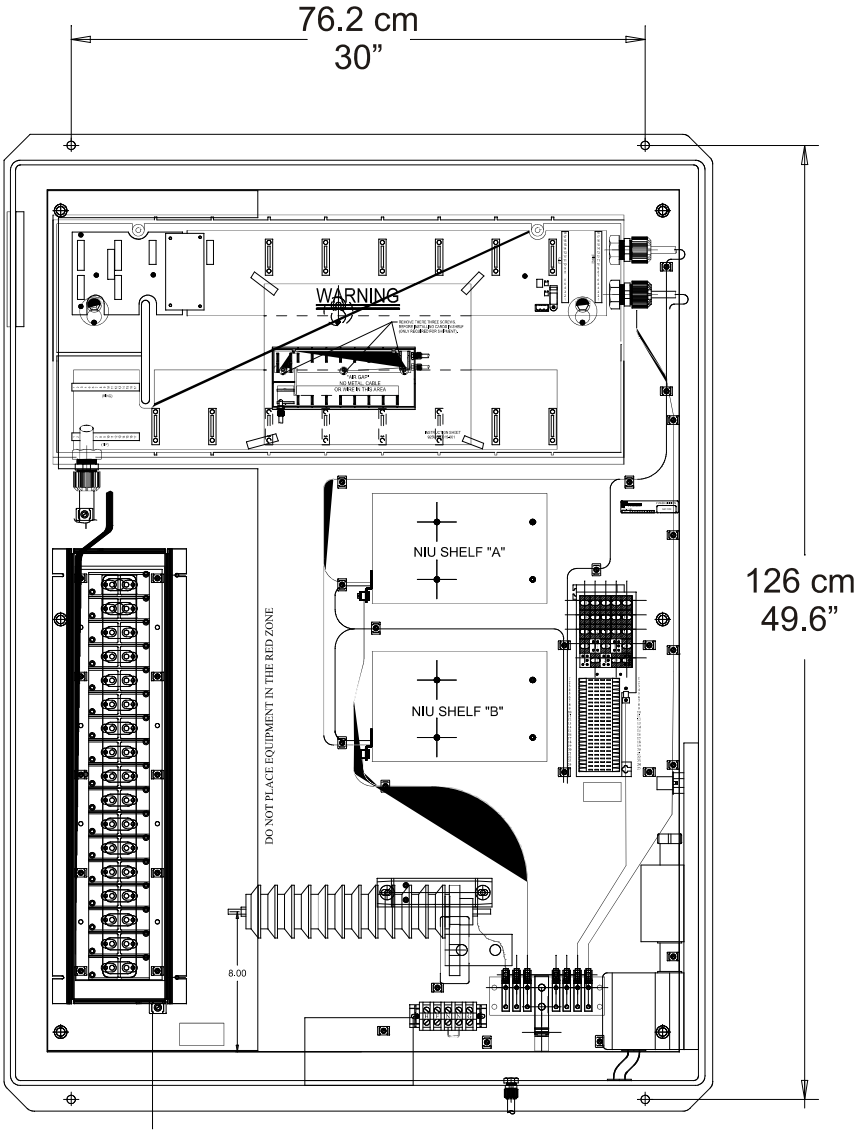
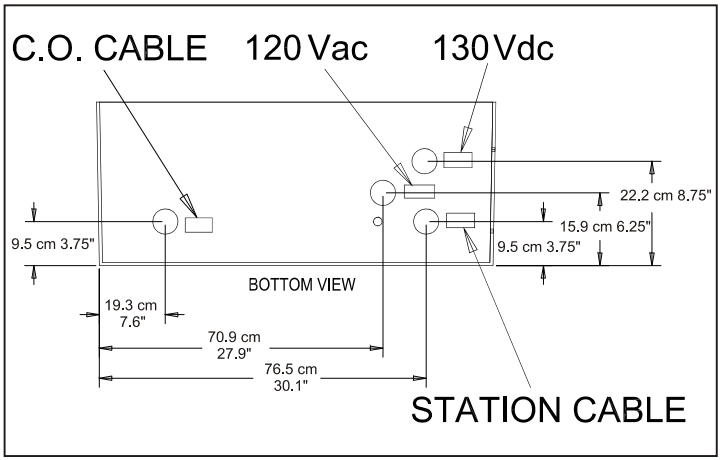


Figure 5: Cable Entry Holes for HVI Cabinet (715950/15CU6)



3.2.2 Installing The Power Service

1. The incoming power cables should be routed into the cabinet using a 2" conduit.
2. Route the incoming 130 Vdc and/or 120 Vac power cables through the cabinet holes marked "130 Vdc" and "120 Vac".
3. If using only one of the power sources, the unused power entrance should be blocked.
4. Inside the cabinet, route the power cables to the electrical panel on the right of the backboard. Attach the cables to the backboard and panel using cable platforms and cable ties.
5. Attach the 130 Vdc conductors, if used, onto the power terminal strip marked for 130 Vdc on the electrical panel.
6. Connect the 120 Vac conductors, if used, to the electrical panel wiring through the base of the double duplex box using the pre-installed wire connectors.
7. The 8-Card Shelf is pre-wired to the 120 Vac using an AC power cord. If 130 Vdc is to be used to power the shelf, then replace the AC power cord with the DC power cord provided with the HVI kit. Connect it to the shelf using Table

12 below and connect the other end to the 130 Vdc terminal block on the electrical panel.

8. Insert the Power Supply Card model 751318MC into the far right in the uper left hand corner area of the 8-Card Shelf.

For any powering issues, please refer to the documentation provided for the 8-Card Shelf, model 751109/15, or the 751318MC power supply.

Documentation is available on the Positron Power website: www.positronpower.com

Table 12: Power Cable Connections for 130 Vdc or 48 Vdc

Description	Connector Position	Wire Color
130 Vdc or 48 Vdc	TB3-1	White
Ground	TB3-2	Green
0 Vdc	TB3-3	Black

3.2.3 120 Vac (UPS Backed-up) Communication Equipment

This HVI cabinet can be modified to use UPS battery backed-up power for 120 Vac power.

➤ **To modify the HVI cabinet to permit UPS backed-up power**

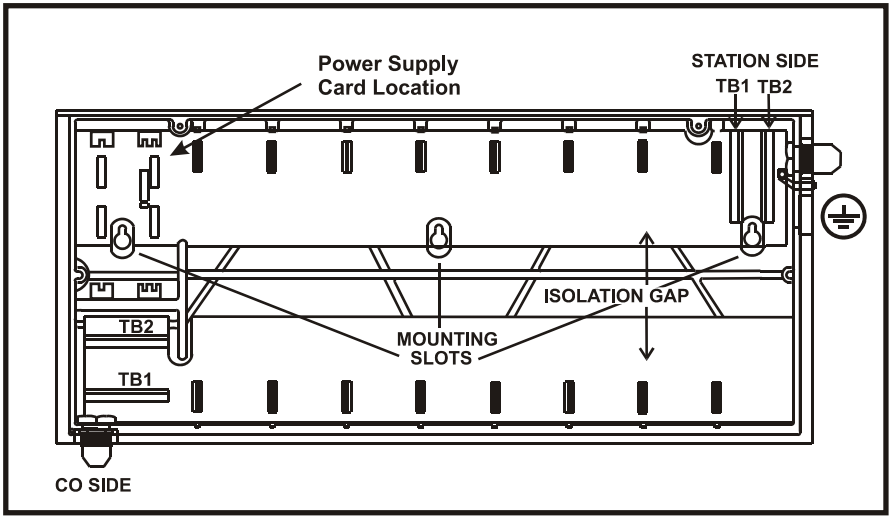
1. Connect the UPS conductors to the base of the double duplex box on the electrical panel.
2. Label the duplex box to indicate that it is a UPS source.
3. The HVI cabinet should now be powered by a UPS backed-up system. This will prevent local substation power loss from impacting the circuits.

There are three conductors needed to power the equipment:

Table 13: Equipment Power Conductors

Conductor	Wire Color	Label
120 Vac	Black Wire	“For UPS Use Only”
Neutral Vac	White Wire	“For UPS Use Only”
Ground	Green wire with yellow stripes	“For UPS Use Only”

Figure 6: 8-card Shelf, model 751109/15



3.2.4 48 Vdc Source for the NIU Mountings

An internal Power Supply Card Model #751318MC for the shelf will also be used to power each of the NIU mountings. Power connections from this supply to each of the NIU mountings have been accomplished on the following terminal position on each NIU mounting.

Table 14: Terminal Positions on Each NIU Mounting

NIU Terminal	Marked	
TB9	+PWR	0 Vdc
TB9	-PWR	-48 Vdc

3.2.5 Power Supply Alarm

This shelf offers the means of monitoring the output of Model 751313MC and Model 751318MC plug-in power supplies using dry alarm contacts. The wires Violet/Slate and Slate/Violet of the Station cable provide Normally Open (NO) contacts during normal operation. If the output of an internal plug-in power supply disappears, either through an AC or DC primary source power outage, an input fuse failure, a power supply failure or a power short-circuit in the load (internal or external), the alarm contacts will close to enable a current, AC or DC, to circulate in the alarm circuit.

If the shelf contains two redundant power supplies, one unit would generate an alarm closure to signify loss of output, while the redundant power supply takes over the powering of the shelf. This enables a service call without a service outage.

The alarm contacts are rated for voltages of up to 125 Vac or 30 Vdc and currents up to 150 mA (AC or DC).

There are many applications for use of dry alarm contacts, such as:

- Closing a circuit to turn on a 12 Vdc light indicator
- Using the contact closure to drive a higher current relay that could turn ON a light bulb or horn alarm
- Closing a circuit to drive a piezo alarm sounder
- Provide a contact closure for an input of alarm monitoring/reporting unit

This feature is especially useful for installations with critical circuits that cannot tolerate a service outage or where downtime must be minimized.

3.2.6 Testing Environmental Equipment

The HVI cabinet including all environmental equipment was tested and verified prior to shipment. A functional test of the fan and heater can be done by changing the operating setting on the thermostats.

➤ To test the environmental equipment

1. Record the current temperature setting levels as that is the optimum levels for proper control of the cabinet temperature.
   - The heater should be set at: 10ºC ± 3ºC (50ºF ± 5ºF).
   - The fan should be set at: 35ºC ± 3ºC (95ºF ± 5ºF).
2. Functional tests on the circuit modules should be done as described in the documentation provided.

3.3 HVI Backboard (751950/05CU6) Installation Instructions

The HVI backboard should be located on the grid of the site. This installation location should also be located so as to provide easy access for maintenance. The equipment utilized in this manual is designed to isolate energies, that is, it does not shunt or route damaging energy to a grounding field.

3.3.1 Additional Hardware Required

The following customer-supplied hardware will be required to install the unit

Table 15: Additional hardware required:

Quantity	Article	Application
4	3/8” diameter studs or lag bolts	mounting to the supporting surface
4	3/8” washers	use with the above mounting fasteners
1	connector	connect Grid Ground wire to the #6 backboard ground wire connection

3.3.2 Safety Precautions

CAUTION

When working on the equipment, the following safety issues should be noted:

- A rubber safety mat and rubber safety gloves must be available for use at the job site at all times. These gloves and mat should be tested for a 10,000 V exposure safe level.
- There is an extreme hazard in working on or coming in contact with the lightning arrestor during inclement weather. The lightning arrestor is connected to the cable shield so a lighting strike may at any time energize it.
- Direct contact with conductors and equipment while standing on a moist surface is hazardous. Ensure that the rubber safety mat does not allow water or any conducting material to come in contact with personnel.
- Precautions should be taken to ensure that moisture is prevented from entering or splashing on the unit.
- AC and DC power used to power communications and environmental equipment may be present at all times. Normal working procedures for powered circuits and devices should be followed.
- Communication pairs that leave the cabinet can be energized at any moment. Rubber gloves and mats should be utilized at any time when there is a potential for contact with an energized conductor.
- Do not install or work on these circuits or cables during a lightning storm. Power substations and their transmission systems attract lightning due to their designed aerial ground wires above the substation grid and support structure.

➤ To unpack the HVI backboard unit

1. Cut any packing straps holding the backboard box to the pallet.
2. Open the box and remove the lag bolts holding the backboard to the pallet.
3. Examine the backboard and remove any packing material.
4. Remove any other loose items and set aside for later use.

3.3.3 Mounting to the Supporting Structure

CAUTION

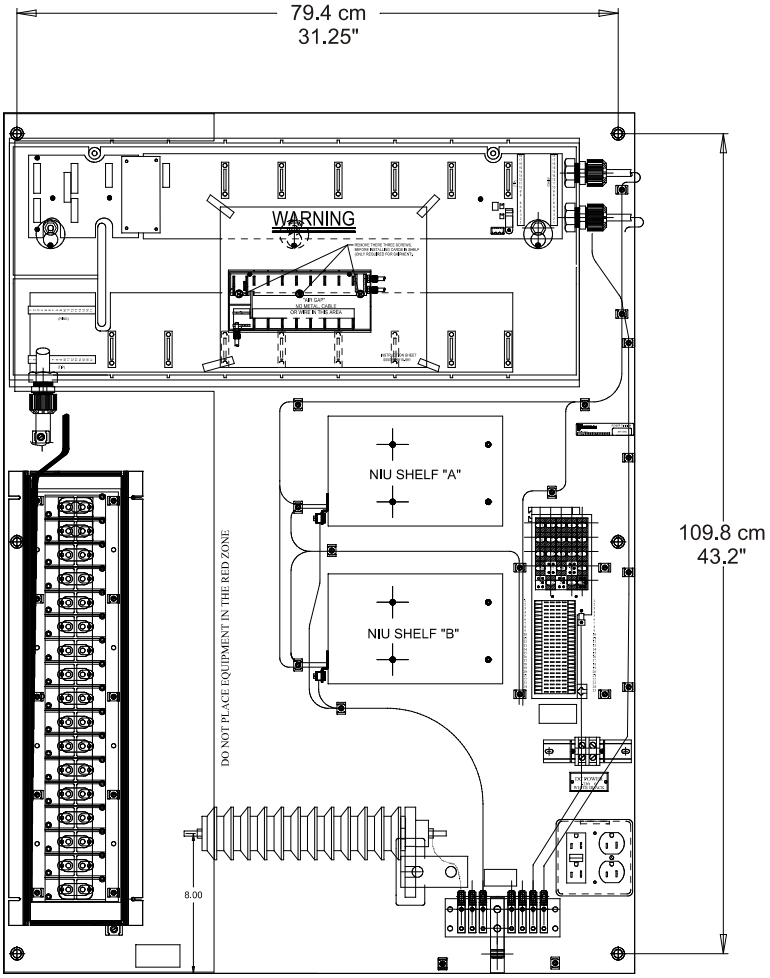
- The backboard weight is substantial. Mounting should be accomplished by two or more persons.

➤ To mount the backboard

1. Orient the backboard as needed to fit the installation surface on the supporting structure. The orientation shown in Figure 7 on page 49 is the only one allowed.
2. Locate and drill the top two holes to mount the backboard to the support surface as indicated in Figure 7 on page 49.
3. Use two studs or lag bolts and washers to bolt the backboard to the supporting structure.
4. After the backboard is supported by the top fasteners, drill and install the studs or lag bolts and washers for the bottom two holes.
5. Secure the backboard to the supporting structure by tightening the mounting hardware assemblies.

The backboard is now ready for connection to the external wiring sources.

Figure 7: Mounting Holes for HVI Backboard (715950/05CU6)



3.3.4 Installing the Power Service

1. Route the incoming 130 Vdc and/or 120 Vac power cables to the bottom right hand side of the backboard.
2. Attach the 130 Vdc conductors, if used, onto the power terminal strip marked for 130 Vdc.
3. Connect the 120 Vac conductors, if used, through the double duplex box using the pre-installed wire connectors inside the box.
4. The 8-Card Shelf is pre-wired to the 120 Vac using an AC power cord. If 130 Vdc is to be used to power the shelf, then replace the AC power cord with the DC power cord provided with the HVI kit. Connect it to the shelf using Table 12 on page 42 and connect the other end to the 130 Vdc terminal block on the backboard.
5. Insert the Power Supply Card model 751318MC into the far right in the upper left hand corner area of the 8-Card Shelf.

For any powering issues, please refer to the documentation provided for the 8-Card Shelf, model 751109/15, or the 751318MC power supply.

Documentation is available on the Positron Power website:
www.positronpower.com

3.3.5 120 Vac (UPS Backed-Up) Communication Equipment

This HVI backboard can be modified to use UPS battery backed-up power for 120 Vac power.

➤ To modify the HVI backboard to permit UPS backed-up power

1. Connect the UPS conductors to the duplex outlet.
2. Label the duplex box to indicate that it is a UPS source.
3. Plug the shelf-installed 120 Vac power cord into this UPS duplex outlet.

The Teleline shelf should now be powered by a UPS backed-up system. This will prevent local substation power loss from impacting the circuits.

There are three conductors needed to power the equipment:

Table 16: Equipment Power Conductors

Conductor	Wire Color	Label
120 Vac	Black Wire	“For UPS Use Only”
Neutral Vac	White Wire	“For UPS Use Only”
Ground	Green wire with yellow stripes	“For UPS Use Only”

3.4 Station Side Connections

3.4.1 Ground Wire

This cabinet must be connected to the substation grid ground. Provisions have been made for connecting the cabinet to ground via the provided ground bar located in the lower right hand area of the cabinet. See Figure 2 on page 28. The lightning Arrestor, 8-card Shelf, model 751109/15, and the secondary protector block are connected to this same ground bar.

➤ **To ground the cabinet**

1. Connect the bar to the grid with a minimum gauge #6 ground wire. The ground wire should be 2m (6') or less external to the cabinet.
2. Cut off all excess ground wire after the connection to the grid conductor is made.
3. Install a grounding clamp sized for the grid conductor and the cabinet grounding conductor. The use of a non oxidation compound is recommended. Exothermic welding of this connection would be acceptable.

3.4.2 Ground Connections for the NIU Mountings:

Each of the NIU mountings have a ground terminal position that must be connected to ground. This is a Frame Ground. These connections have been accomplished with the NIU on the following terminal position. This completes any grounding requirements for the NIU shelf.

Table 17: NIU Ground Terminal Position

NIU Terminal	Marked		HVI Ground Bar
Ground Lug	GND Symbol	Outside the shelf, a ground lug is installed	Term #2 &3

3.4.3 Terminated Shelf Pairs on 5 Pin Protector 66 Block

The shelf output cable pairs have been terminated either directly to the left-hand side of the 5-pin protector block or thru the NIUs.

- The first 8 pairs (slot 1-4) are connected to NIU(A), then to the protector block pairs 1-8.
- The pairs 9-16 (slot 5-8) are connected to NIU(B), then to the protector block pairs 9-16.
- The pairs 17-25 are connected directly to the protector block pairs 17-25.

For 8-Card Shelf Station Cable Connections, refer to Table 18 on page 54.

Table 18: 8-Card Shelf Station Cable Connections

Shelf Station Cable			Shelf Slot #	NIU A FAC	NIU B FAC	Protector Block Pair # (left side)
Ring	Tip	Pair #				
Blue/White	White/Blue	1	1	TB5-R/T		
Orange/White	White/Orange	2	1	TB5-R1/T1		
Green/White	White/Green	3	2	TB6-R/T		
Brown/White	White/Brown	4	2	TB6-R1/T1		
Slate/White	White/Slate	5	3	TB7-R/T		
Blue/Red	Red/Blue	6	3	TB7-R1/T1		
Orange/Red	Red/Orange	7	4	TB8-R/T		
Green/Red	Red/Green	8	4	TB8-R1/T1		
Brown/Red	Red/Brown	9	5		TB5-R/T	
Slate/Red	Red/Slate	10	5		TB5-R1/T1	
Blue/Black	Black/Blue	11	6		TB6-R/T	
Orange/Black	Black/Orange	12	6		TB6-R1/T1	
Green/Black	Black/Green	13	7		TB7-R/T	
Brown/Black	Black/Brown	14	7		TB7-R1/T1	
Slate/Black	Black/Slate	15	8		TB8-R/T	
Blue/Yellow	Yellow/Blue	16	8		TB8-R1/T1	
Orange/Yellow	Yellow/Orange	17	NA			17
Green/Yellow	Yellow/Green	18	GND			18
Brown/Yellow	Yellow/Brown	19	NA			19
Slate/Yellow	Yellow/Slate	20	-24 Vdc			20
Blue/Violet	Violet/Blue	21	NA			21
Orange/Violet	Violet/Orange	22	-48 Vdc			22
Green/Violet	Violet/Green	23	NA			23
Brown/Violet	Violet/Brown	24	Aux Pwr			24
Slate/Violet	Violet/Slate	25	Pwr ALRM			25

3.4.4 5-Pin Protector Block Connections

The 5-pin protector block provides the access point for all the equipment to be connected to the HVI Cabinet 751950/15CU6 or HVI Backboard 751950/05CU6.

- The first eight pairs provide access to the four slots of the NIU(A) isolated by the first four slots of the Positron shelf.
- The pairs 9-16 provide access to the four slots of the NIU(B) isolated by slots 5-8 of Positron shelf.
- The pairs 18 and 22 provide power for both NIUs.
- The remainder of the pairs provide access to various power and signals from the Positron shelf.

For 5-Pin Protector Block Left Side Connections, refer to Table 19 on page 56.

Table 19: 5-Pin Protector Block Left Side Connections

Protector Block			Positron Station Cable	NIU A	NIU B
Ring	Tip	Pair #		CPE	CPE
Blue/White	White/Blue	1		TB1-R1/T1	
Orange/White	White/Orange	2		TB1-R/T	
Green/White	White/Green	3		TB2-R1/T1	
Brown/White	White/Brown	4		TB2-R/T	
Slate/White	White/Slate	5		TB3-R1/T1	
Blue/Red	Red/Blue	6		TB3-R/T	
Orange/Red	Red/Orange	7		TB4-R1/T1	
Green/Red	Red/Green	8		TB4-R/T	
Brown/Red	Red/Brown	9			TB1-R1/T1
Slate/Red	Red/Slate	10			TB1-R/T
Blue/Black	Black/Blue	11			TB2-R1/T1
Orange/Black	Black/Orange	12			TB2-R/T
Green/Black	Black/Green	13			TB3-R1/T1
Brown/Black	Black/Brown	14			TB3-R/T
Slate/Black	Black/Slate	15			TB4-R1/T1
Blue/Yellow	Yellow/Blue	16			TB4-R/T
Orange/Yellow	Yellow/Orange	17	NA		
Green/Yellow	Yellow/Green	18	GND		
Brown/Yellow	Yellow/Brown	19	NA		
Slate/Yellow	Yellow/Slate	20	-24 Vdc		
Blue/Violet	Violet/Blue	21	NA		
Orange/Violet	Violet/Orange	22	-48 Vdc		
Green/Violet	Violet/Green	23	NA		
Brown/Violet	Violet/Brown	24	Aux Pwr		
Slate/Violet	Violet/Slate	25	Pwr ALRM		

3.4.5 Secondary Protector Modules

The station cable terminating block is a terminating block for the Teleline module output pairs and the station service cable pairs. It also acts as a secondary protector block. The protector modules inserted into the 5 pin receptacle are balanced solid state Positive Temperature Coefficient (PTC) equipped modules. These modules must be plugged into the protector block field for the circuit to function through the interface block. These modules are installed to prevent damage to the Teleline module in the event that an unbalance voltage condition appears across the tip and ring conductors of a station cable pair.

In the event one of the protector modules fails, it will fail shorted to ground and should be replaced.

3.4.6 Terminated 'Teleline' and NIU shelf pairs on 5 pin protector block

The design of this HVI incorporates two NIU terminating mountings. Wiring to these mountings has been accomplished from the 'Teleline' shelf to each of the NIU units. The first 'listing of connections' provides the details of that wiring. The second 'listing of connections' table shows the wiring details of the connections from the NIU units and the subsequent connections on the protector block. The third 'listing of connections' table shows for the wiring for the station cable routing from the 'Teleline' shelf direct to the protector block. These connections have been terminated on the left hand side of the 5 PIN protector block. There are three separate cables used: one cable from the 'Teleline' shelf, one from the NIU unit #1 and one from the NIU unit #2 to connect the shelf and the NIU units to the protector block.

3.4.7 Site Originating Station Circuit Cables

➤ To Install the Station Circuit Cables

1. Route the station cable(s) through the strain relief on the bottom of the cabinet.
2. Continue routing the cables up to the interface block located in the upper right-hand area of the cabinet.
3. Prepare the cable by exposing the conductors
4. Place the conductors on the right hand side of the terminating block and press them into place on the block.
5. Press the conductors home on the block using a punch-down tool and cut off the excess with the cutter blade on the tool.
6. Observe that a cable pair is oriented on the block in a left to right manner on a single row of connectors. Match the Tip to Ring configuration to equal that of the left side of the block (cable pairs from the shelf & modules). The cable pair count is vertical with the top pair being pair #1 and is associated with row #1 on the 66 protection block terminals.
7. Secure the cable(s) or conductors to the backboard.

3.5 CO Side Connections

3.5.1 Terminating Dedicated CO Cable Pairs on Isolation Jacks

The dedicated cable pairs are to be terminated onto screw terminals or wire-wrap isolation jacks. The tip of the jack is the 'Tip' conductor and the shorter or higher pin on the jack is the 'Ring' conductor location. The jacks are numbered from top to bottom, with the top jack being number 1.

NOTE

- Do not bond or ground the cable shield.

Table 20: Attachment sequence: Dedicated Cable Pairs

Dedicated Cable			
Ring	**Tip**	**Cable Pair #**	**Jack Position**
Blue/White	White/Blue	1	1
Orange/White	White/Orange	2	2
Green/White	White/Green	3	3
Brown/White	White/Brown	4	4
Slate/White	White/Slate	5	5
Blue/Red	Red/Blue	6	6
Orange/Red	Red/Orange	7	7
Green/Red	Red/Green	8	8
Brown/Red	Red/Brown	9	9
Slate/Red	Red/Slate	10	10
Blue/Black	Black/Blue	11	11
Orange/Black	Black/Orange	12	12
Green/Black	Black/Green	13	13
Brown/Black	Black/Brown	14	14
Slate/Black	Black/Slate	15	15
Blue/Yellow	Yellow/Blue	16	16
Violet/Slate	Slate/Violet	25	17

3.5.2 Dedicated CO Cable Pairs to Shelf Stub Color Code Assignments

The 8-card Shelf, model 751109/15 CO Cable Pairs are already connected within the shelf. The connection to the CO Cable must be done inside the cabinet utilizing the isolation jacks.

This splicing sequence will then marry sheath cable odd # pairs (1 to 15) to slots 1 through 8 for a two wire circuit(s). It will also marry sheath cable even # pairs (2 to 16) to slots 1 through 8 for the second half of a four wire circuit(s). This then results in the following cable pair assignment for a series of four wire circuits.

See section 3.5.4 on page 62.

NOTE

- Do not bond or ground the cable shield.

The attachment sequence for the dedicated cable pairs is shown in Table 21 on page 61.

Table 21: Dedicated (CO) Cable Pairs to Shelf Stub Color Code Assignments

Dedicated Cable			Shelf CO Cable Stub		
Pair #	Ring	Tip	Pair #	Ring	Tip
1	Blue/White	White/Blue	1	Blue/White	White/Blue
2	Orange/White	White/Orange	2	Orange/White	White/Orange
3	Green/White	White/Green	3	Green/White	White/Green
4	Brown/White	White/Brown	4	Brown/White	White/Brown
5	Slate/White	White/Slate	5	Slate/White	White/Slate
6	Blue/Red	Red/Blue	6	Blue/Red	Red/Blue
7	Orange/Red	Red/Orange	7	Orange/Red	Red/Orange
8	Green/Red	Red/Green	8	Green/Red	Red/Green
9	Brown/Red	Red/Brown	9	Brown/Red	Red/Brown
10	Slate/Red	Red/Slate	10	Slate/Red	Red/Slate
11	Blue/Black	Black/Blue	11	Blue/Black	Black/Blue
12	Orange/Black	Black/Orange	12	Orange/Black	Black/Orange
13	Green/Black	Black/Green	13	Green/Black	Black/Green
14	Brown/Black	Black/Brown	14	Brown/Black	Black/Brown
15	Slate/Black	Black/Slate	15	Slate/Black	Black/Slate
16	Blue/Yellow	Yellow/Blue	16	Blue/Yellow	Yellow/Blue
25	Violet/Slate	Slate/Violet	25	Violet/Slate	Slate/Violet

3.5.3 Attachment sequence: Dedicated Cable Pairs

This splicing sequence will then marry sheath cable pairs 1 & 2 through 15 & 16 to slots 1 through 8 for a 4-wire circuit.

Table 22: Cable pair assignment for a series of 4-wire circuits

CO Side Cable Pair List	Shelf Slot Position List
1 & 2	1
3 & 4	2
5 & 6	3
7 & 8	4
9 & 10	5
11 & 12	6
13 & 14	7
15 & 16	8

3.5.4 Terminated Shelf Stub Cable Pairs on Isolation Jacks

The cable pairs are terminated onto the isolation jacks. The red conductor is the ring conductor and the white conductor is the tip conductor. This will insure that the circuits will appear in the shelf as expected, designed, and listed in the Circuit Assignment List. The jacks are numbered from top to bottom, with the top jack being number 1.

NOTE

- Do not bond or ground the cable shield.

Table 23: Attachment sequence: 8-card Shelf, model 751109/15 cable stub to the Isolation jack

Shelf Stub			
Ring	**Tip**	**Cable Pair**	**Jack Position**
Blue/White	White/Blue	1	1
Orange/White	White/Orange	2	2
Green/White	White/Green	3	3
Brown/White	White/Brown	4	4
Slate/White	White/Slate	5	5
Blue/Red	Red/Blue	6	6
Orange/Red	Red/Orange	7	7
Green/Red	Red/Green	8	8
Brown/Red	Red/Brown	9	9
Slate/Red	Red/Slate	10	10
Blue/Black	Black/Blue	11	11
Orange/Black	Black/Orange	12	12
Green/Black	Black/Green	13	13
Brown/Black	Black/Brown	14	14
Slate/Black	Black/Slate	15	15
Blue/Yellow	Yellow/Blue	16	16
Violet/Slate	Slate/Violet	25	17

3.5.5 Remote Ground Shelf Pair

The remote ground pair of the shelf appears on CO Pair #25 (Violet/Slate). This cable pair should be used only if a remote ground connection is required. This is usually done with a 751323 series card or for use with a ground start PBX trunk or a coin phone circuit.

3.5.6 Teleline #751125 Lightning Arrestor

This unit has been installed and correctly wired to the ground bar as designed. The cabinet #6 ground wire must be connected to the grid ground connection as instructed in the item titled GROUND WIRE. The connection to the CO cable must be done as instructed in order for the unit to dissipate energy from the cable as

designed. See the instructions in the section for the CO cable installation for correct connection procedures.

Additional information may be found in the documentation found in the envelope marked #751125 for this unit.

➤ Attaching the Lightning Arrestor to the Cable Shield

NOTE

- Please see Figure 8 on page 66.

1. The insulation around the cable sheath should be stripped only in an area of 10 cm (4 inches) where it is to be clamped to the lightning arrestor. Caution should be taken not to strip the insulation or cut the cable in any other area.
2. Using a sheath knife, make a 5 - 6 cm (2" to 2 1/2”) long slit longitudinally in the shield along the length of the cable. Be careful not to damage the inner poly wrap if the cable is so equipped.
3. Using a sheath knife, make a 4 cm (1-1/2”) long slit circumferential in the shield, perpendicular to the slit in step 1. DO NOT cut all the way around the cable. This cut would be approximately 2 cm (3/4”) long on each side of the longitudinal slit created in step 1.
4. Repeat at the opposite end of the slit. Be careful not to damage any inner poly wrap.
5. Carefully fold these created shield flaps back, sufficiently far to allow for the base of the cable bond clamp to be placed in the created void.
6. Place the cable clamp base into the created void. If there is no inner poly wrap on the cable in use, use two layers of vinyl tape to create an insulating blanket under the clamp.
7. Carefully bend the shield flaps back into place and on top of the bond clamp. This action captures the base of the bond clamp between the inner poly insulation and the shield material.
8. Place the outer bond clamp pressure plate and one nut on the stud of the bond clamp then tighten securely.
9. Apply four layers of vinyl tape over the exposed shield and bond clamp, working the tape layers from one end of the made sheath opening to the

other. This will create a good physical bond to the material and an efficient coverage of a dielectric insulating wrap.

NOTE

- Do not tape over the nut on the stud.

10. Place a #6 bond strap or equivalent flex braid on the stud. Use the second nut to secure.
11. Route the other end of the bond strap to the indicated lightning arrestor attach point. See Figure 1 on page 17 for an overview.

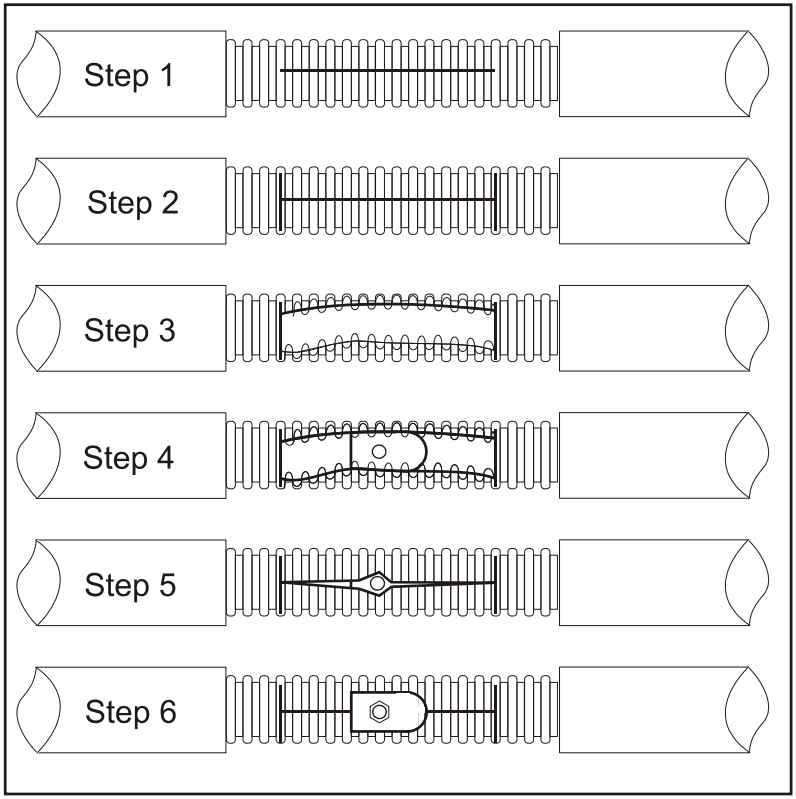
These actions have now resulted in a connection of the cable shield to the cable side of the lightning arrestor.

The ground side of the lightning arrestor has been secured to the cabinet ground wire and was identified in a previous section.

NOTE

- This ground connection must be a substation grid or equivalent connection to ensure proper arrestor operation and adequate energy dissipation.

Figure 8: Grounding the Cable Shield



3.6 Card Insertion and Removal

For information relevant to any of the cards, refer to their respective documentation.

➤ **Inserting plug-in cards:**

1. Push up on the yellow retaining clip slightly with one hand
2. Insert the cards with the other hand.
3. Close and secure the cover by fastening the wing nuts. To close the cover properly, you must first secure the bottom of the cover before joining the holes with their respective screws. This procedure is very important in order to prevent damage to the cover.

NOTE

- The yellow retaining clips prevent the dislodging of cards due to vibration when the shelf is mounted near mechanical equipment
- Two spare yellow retaining clips have been included with the installation kit to be used in the event that a clip becomes unusable.

DANGER

- The cover must be kept closed and secured at all times in order to protect personnel from potentially hazardous voltages, and to prevent damage to the cover.
- To prevent minor injury to your fingers when removing a card from the shelf, use your right hand only. Push up on the yellow retaining clip with your right thumb and then pull the card out.

3.6.1 Installing Plug-in Circuit Cards

CAUTION

- Make sure that the rubber mat is in place and rubber gloves are being utilized before starting work in this step.

➤ To install and test circuit cards

1. Place the circuit cards into the slots in the shelf.
2. Turn the circuits up for service. Make sure that no raw 120 Vac power is used to power any NCTE circuit component
3. Test each circuit to verify that the circuits are working through the equipment as expected. Sealing current will be simplexed back to the Central Office source by the circuit cards when utilized. No provision is made for sealing current to work beyond this card. Therefore it is anticipated that the NCTE equipment will be operated close to the HVI backboard.

3.7 Circuit Testing

➤ To test CO Side of pairs

CAUTION

Fault Exposure Hazard

- All work performed after this work sequence requires the use of a rubber mat and rubber safety gloves when working on or touching any cable pair on the CO side of the shelf.
- Use of the mat and gloves is also required when using the Test Card since this card brings contact with the cable pairs out to the edge of the card on the CO Pairs terminal pins.
- In the event of inclement weather obey the precautions listed in section 3.1.2 on page 37.

1. Insert the test card Model 751366 into a slot in the shelf.
2. Test the cable pairs from the shelf slot to the CO Main Distributing Frame or any other available test point that is at or beyond the 300 Volt point closure using appropriate test equipment.
3. Test all pairs for shorts, grounds and opens. This test is being done to insure that all connections are complete between the CO side of the shelf to the Central Office, thereby proving the reliability of the circuit.
4. If there are any problems with the pairs, open the Isolation jack plug and access the cable pair directly on the CO side of the jack field.
5. Repeat this test for all shelf slot positions.

➤ To test substation side of pairs

CAUTION

- Make sure that the rubber mat is in place and rubber gloves are being utilized before starting work in this step.

This test will confirm the presence of power in the shelf.

1. Insert the test card Model # 751366 into a slot in the shelf.
2. Repeat this test for all shelf slot positions.

3.7.1 Test Substation Side of Pairs with Test Card

CAUTION

- Use the rubber mat and rubber safety gloves when using the Test Card since this card presents the full fault-created voltage potential across the CO and Station cable pair pins on the test card.
- In the event of inclement weather, obey the precautions listed in section 3.1.2 on page 37.

1. Insert the test card Model # 751366 into a slot in the shelf.
2. Test the cable pairs from the substation side of the shelf to the 66 protection block on the protector block on the backboard using appropriate test equipment.
3. Repeat this test for all cable pairs in all shelf slot positions.

Appendix A

Acronyms

Acronyms

AC	Alternating Current
CO	Central Office
CPE	Customer Premises Equipment
DC	Direct Current
FAC	Facility-Side
GND	Ground
GPR	Ground Potential Rise
HVI	High Voltage Interface
MD	Manufacture Discontinued
PWR	Power
NIU	Network Interface Unit
NCTE	Network Channel Terminating Equipment