

Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit, 751233/1A and 751233/2A

Description and Installation



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1. The Standalone Basic Rate ISDN Unit

The Standalone Basic Rate Integrated Services Digital Network (ISDN) Unit provides high voltage isolation between an ISDN line and the network termination (NT) equipment at the customer's location. It also provides isolation for an Adtran Total Reach ISDN or Total Reach DDS circuit.

The unit consists of an isolator card mounted inside a small compact enclosure. The enclosure is molded from fiberglass, making it a lightweight, flame retardant product of high dielectric strength. Its fiberglass body limits the possibility of many kinds of infiltration while providing reliable isolation from external ground potentials.

The unit is shipped with a 12-conductor cable, for connection to the Central Office (CO) incoming cable, a power cable, and mounting hardware.

Its features include the following:

- The unit meets ANSI T1.601-1992, RC9042A, FCC part 15, subpart B.
- When set to feed battery, the unit provides -50 V dc, -65 V dc, -100 V dc or -130 V dc on the line to the equipment on the Station side of the card, depending on the jumper settings. The Tip is always positive and the Ring is negative.
- The CO side circuit components are powered from the CO battery feed.
- The unit can operate without battery feed if selected through jumper settings.
- The enclosure resists the infiltration of dust, mist, and water from sprinklers.

The Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit is available in two options:

- Model 751233/1A provides for grounded -24 V dc, -48 V dc or floating 130 V dc input.
- Model 751233/2A provides the same power input plus 120 V ac with battery backup.

Model variations 1 and 2 are visually similar externally. For a view of the Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit cover closed, refer to Figure 1.

Major components vary according to models. For a view of the major components of the 751233/1A, refer to Figure 2. For a view of the major components of the 751233/2A, refer to Figure 3.

Figure 1 Model 751233/1A and 751233/2A Cover Closed

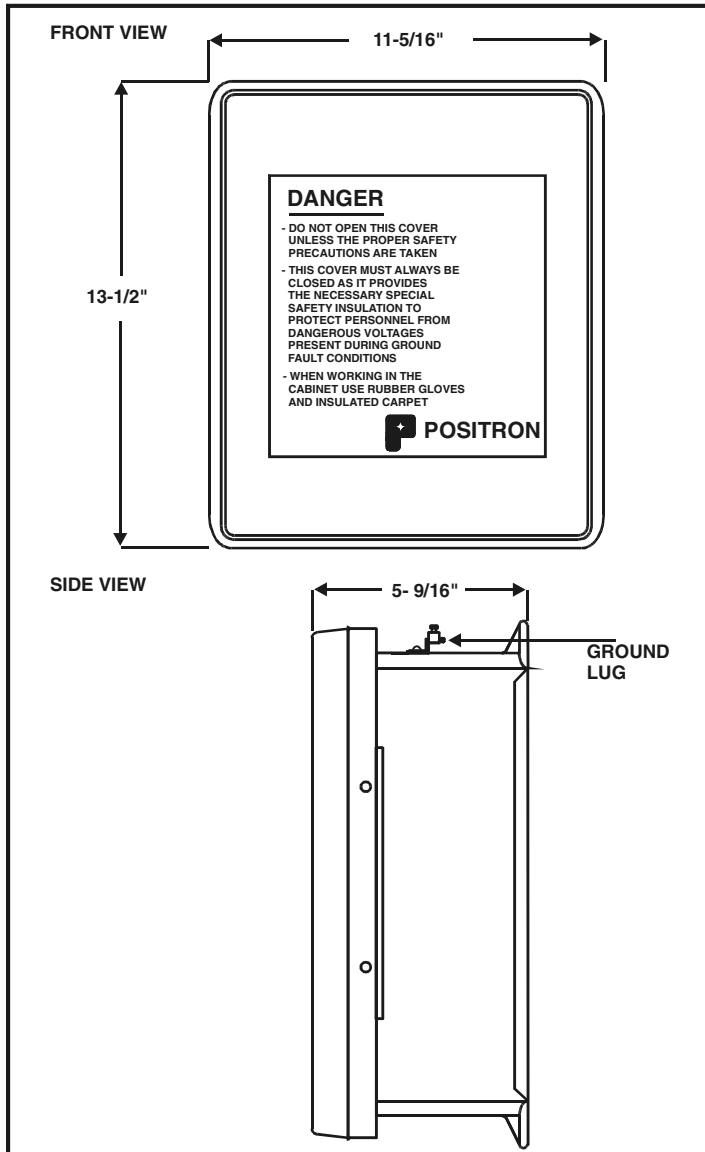
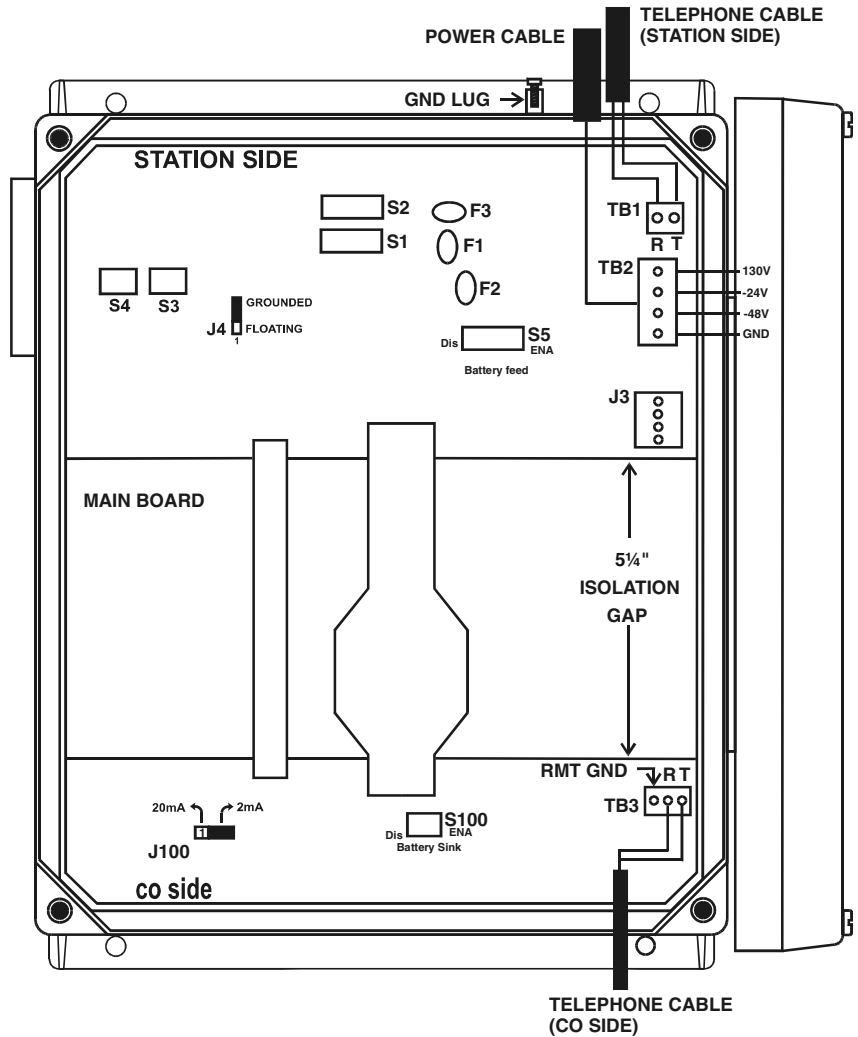
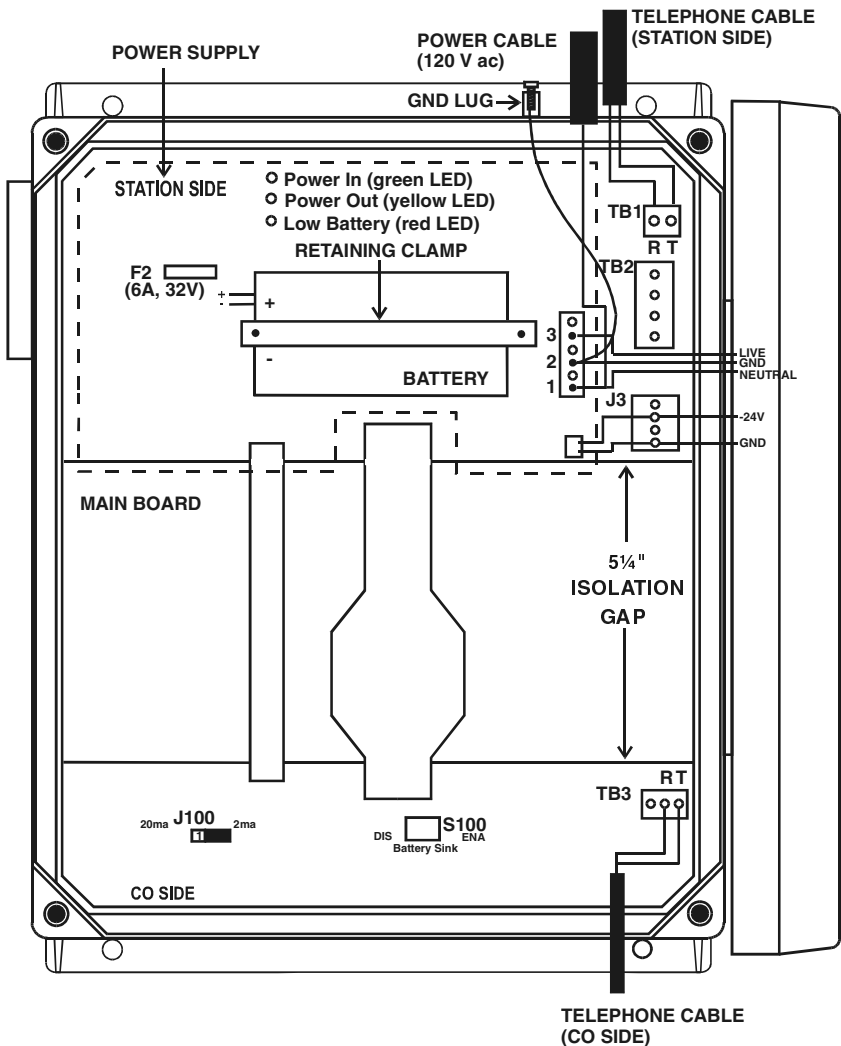


Figure 2 Model 751233/1A Cover Open (Only Major Components Shown)



NOTE: POWER INPUT CONNECTIONS ARE FROM -24, -48, OR 130 V dc SOURCE

Figure 3 Model 751233/2A Cover Open (Only Major Components Shown)



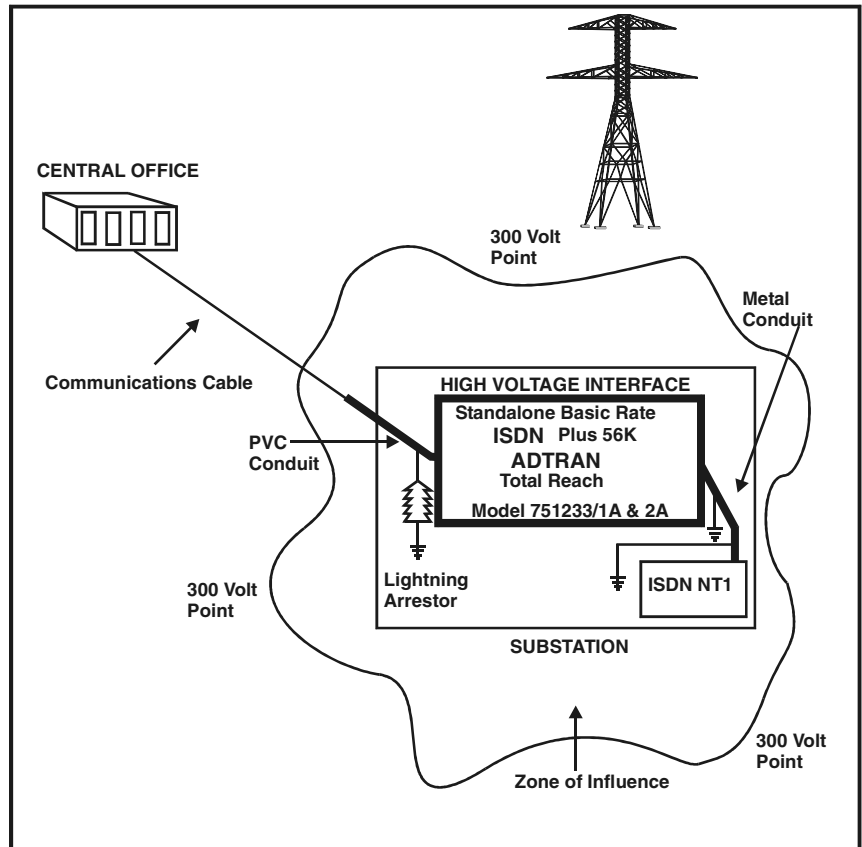
NOTE: POWER INPUT CONNECTIONS ARE FROM -24, -48, 130 V dc SOURCE OR 117 V ac

2. Applications

The Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit is used to isolate ISDN Basic Rate (144kb) NT equipment.

For an illustration of the unit's application, refer to Figure 4.

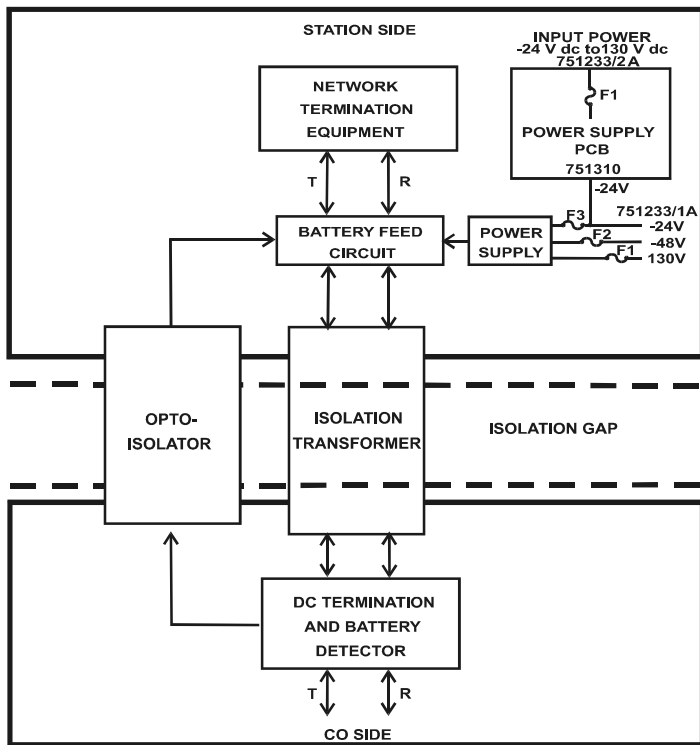
Figure 4 High Voltage Interface Application



3. Hardware Description

The Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit contains the Basic Rate ISDN Plus 56K ADTRAN Total Reach card. The card is comprised of two sides. The Station side is located on the upper portion of the card and the CO side is located on the lower portion of the card. The Station side is separated from the CO side by an isolation transformer and an opto-isolator which create a 5¼ inch isolation gap. For the unit's block diagram, refer to Figure 5.

Figure 5 Block Diagram



Battery Feed Circuit

The Battery Feed Circuit supplies the line with a voltage of 0, -50, -65, -100 or -130 V dc depending on the selected switch settings of the card. The Battery Feed Circuit will duplicate the absence or presence of a battery on the CO side at the Station side.

Power Supply

The Power Supply is switch mode configured. It receives an input of either -24 V dc, -48 V dc or 130 V dc, which must be set via the card's input switches (for model 751233/2A the switches are factory-set to -24 V dc) and generates the required voltages used by the card itself. In addition, the power supply generates line voltages of either 50 V dc, 65 V dc, 100 V dc or 130 V dc. Model 751233/2A also receives an input of 120 V ac and has battery backup.

Note

When the unit's S5 is set for "no battery", the power supply is turned off and the unit draws very little current.

Isolation Transformer

The Isolation Transformer is a high voltage, low-loss, full duplex component that permits the transmission of data through the isolation gap while maintaining an isolation on the CO and Station sides of the card.

Opto-Isolator

The Opto-Isolator consists of a light emitting diode (LED) and a phototransistor pair that transmits the absence or presence of battery on the CO side to the battery feed circuit on the Station side.

DC Termination and Battery Detector

The DC Termination and Battery Detector circuit presents a low DC impedance to the CO and detects CO battery.

Fuse F1 and F2 of Power Supply

Fuse F1 protects the input of the power supply on model 751233/2A from overvoltage. Fuse F2 protects the power supply in case of a bad connection of the battery when replaced.

Fuse F1, F2 and F3 of ISDN board

The fast-blow Fuses F1(1A), F2 and F3(2-1/2A) provide overcurrent protection in case of unit malfunction or input overvoltage.

4. Technical Specifications

For a listing of model 751233/1A and 751233/2A electrical specifications, refer to Table 1. For a listing of the power supply's physical specifications (model 751233/2A only), refer to Table 2. For a listing of model 751233/1A and 751233/2A physical specifications, refer to Table 3.

Table 1 Electrical Specifications (measured at 77°F or 25°C, 50% R.H.)

Parameter	Specifications
	Models 751233/1A & 751233/2A
ISOLATION DATA:	
Isolation resistance	≥100 000 MΩ
Metallic surge	3 kVrms
Insulation voltage	50 kVrms (70 kV peak)
NOISE	
THD (1 kHz @ -3 dBm)	Better than -68 dB
Impulse noise (both sides)	Less than 1 count in 30 minutes above 48 dBmC
Phase jitter	< 0.5°, 300 to 3400 Hz
Noise (2 Hz to 100 Hz)	-60 dBm
Circuit noise (quiet termination, 50 kHz flat filter)	<10 dBm
S/N ratio (50 kHz flat filter)	45 dB with 1 kHz sine @ 2.5 V pk
Crosstalk (with adjacent card)	TBD
SIGNAL	
Return loss (@ 2.5 V pk, either side, opposite side terminated with 135Ω)	≥ 0 dB @ 1 kHz; increases 20 dB/dec, 1 kHz to 10 kHz; ≥ 20 dB, 10 kHz to 25 kHz; decreases 20 dB/dec, 25 kHz to 250 kHz; 0 dB @ 250 kHz

Parameter	Specifications
Insertion loss (@ 2.5 V pk, with CO and Station side circuits ON or OFF; connected directly)	≤ 0.5 dB @ 40 kHz; ≤ 0.5 dB @ 3 kHz
Insertion loss (@ 2.5 V pk, with CO and Station side circuits ON or OFF; 5 miles of 22 gauge on CO side)	≤ 2 dB @ 40 kHz; ≤ 2 dB @ 3 kHz
Longitudinal balance (CO side)	≥ 24 dB @ 5 Hz; increases 20 dB/dec to ≥ 55 dB @ 281.2; ≥ 55 dB, 281.2 Hz to 40 kHz; decreases 20 dB/dec above 40 kHz
Bandwidth (-3 dB)	200 Hz to 120 kHz
DC CHARACTERISTICS	
Maximum CO side voltage	200 V
Current limiting on CO side	2 mA \pm 1 mA or 20 mA \pm 4 mA
Minimum operating current on CO side	≤ 1.5 mA
Line voltage on Station side	50 V dc, 65 V dc, 100 V dc, 130 V dc
Current limit on Station side	50 mA to 60 mA
DC voltage drop (when on)	<30 V
DC termination when dropped (off)	10 μ F \pm 10%; R ≥ 2 M Ω
When DC dropped on CO side, DC Station side has to drop	Within ≤ 100 ms
DC resistance Tip-Ground or Ring-Ground	> 5 M Ω for V ≤ 100 V dc
Max. input current -24 V dc -48 V dc 130 V dc * When S5 set without battery feed	≤ 620 mA ≤ 270 mA ≤ 110 mA ≤ 5 mA

Table 2 Power Supply Specifications

Parameter	Specifications
POWER SUPPLY	Model 751233/2A only
Input Voltage	120 V ac or -24 to 130 V dc (not polarity sensitive)
Max. Input Current with Max. Load at: -24 V dc -48 V dc 130 V dc 120 V ac * When S5 set without battery feed	≤ 825 mA ≤ 360 mA ≤ 150 mA ≤ 175 mA rms ≤ 50 mA
With battery feed Without battery feed * * Card does not require power, it functions even when the battery is discharged.	1.6 hours minimum 36 hours minimum
BATTERY TIME AVAILABLE (with new, fully charged battery)	
With battery feed Without battery feed	1.6 hours minimum 4.0 hours minimum
BATTERY SERVICE LIFE	4 years (minimum)
BATTERY REPLACEMENT	12V/1.2 Ah Sonnenschein A212/1.2S

Table 3 Physical Specifications

Parameter	Specifications
Operating temperature range with battery (model 751233/2A only)	+32°F to +122°F (0°C to + 50°C)
Operating temperature range (model 751233/1A or model 751233/2A without battery)	-4°F to +149°F (-20°C to + 65°C)
Height	13-1/2" (34.29 cm)
Width	11-5/16" (28.734 cm)
Depth	5-9/16" (14.129 cm)
Weight Model 751233/1A Model 751233/2A	8.4 lbs (3.8 kg) 8.7 lbs (3.95 kg)

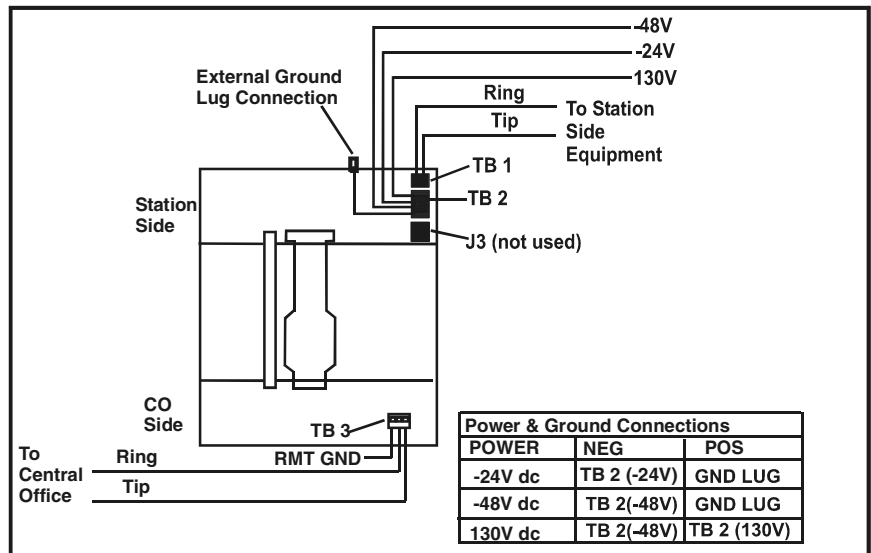
5. Installation

The Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit is used when the number of lines to be isolated does not justify the installation of a shelf. It will isolate one basic rate ISDN line (two wires, 144 kbits/s) and is powered from an AC or DC source.

To view the ISDN, model 751233/1A, refer to Figure 6.

To view the ISDN, model 751233/2A, refer to Figure 7.

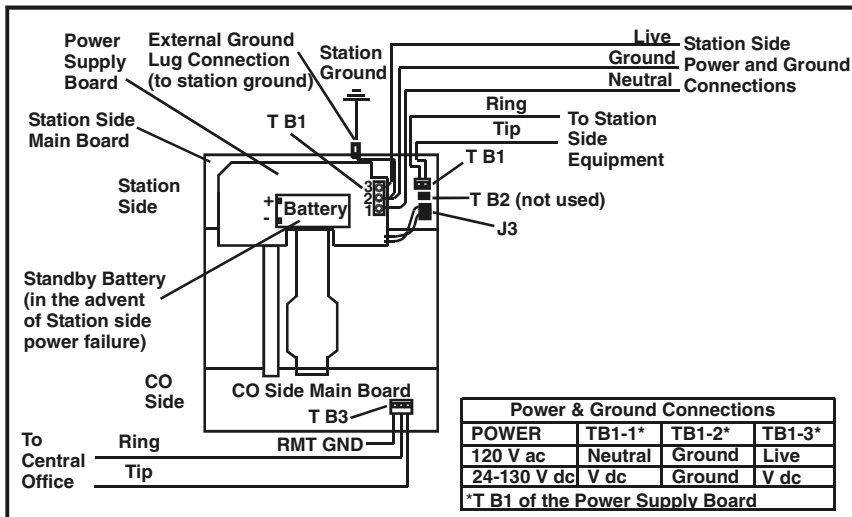
Figure 6 Model 751233/1A



Note

1. The 751233/1A can be powered from -24V, -48V or 130V. It has no battery back-up.
2. Using the external ground lug connection is the preferred way of grounding the unit.
3. When operating from a floating 130 V dc source, the unit should still be grounded using the ground lug.

Figure 7 Model 751233/2A

**Note**

1. The 751233/2A can be powered from 120 V ac or 24 to 130 V dc via the piggyback power supply.
2. The external ground lug connection is the preferred way of grounding the unit.
3. When using the ground lug, do not connect TB1-2. (TB1-2 of the power supply board).

Caution

- Stand on a thick rubber mat and wear rubber gloves during the installation procedure. It is preferable to perform these procedures on a clear dry day when a Ground Potential Rise (GPR) or transients are less likely to occur.
- This unit utilizes CMOS circuitry that can be damaged by static electricity. Observe normal CMOS handling procedures to avoid static discharge. Manipulate the card exclusively by the faceplate to prevent any damage to the card and to limit the possibility of electric shock. When moving the card, carry it in an ESD safe container or the antistatic bag, provided with the card. Failure to follow ESD precautions may void the warranty. For further information concerning ESD precautions, contact Positron's Customer Support department.
- Power should only be applied after all wiring is completed. The station and CO cables should be kept at least six inches apart upon wiring in order to prevent an electric arc between the two in the event of damage to, or degradation of, their insulation.

-
1. Verify that you have the following customer provided tools and hardware which are required to install the unit:
 - Station cable
 - Center punch
 - Electric drill with a 5/32" diameter bit
 - 7/16" hex wrench
 - 1/8" and 1/4" common blade screw drivers
 - 1" thick plywood backboard with appropriate mounting hardware
 - Digital voltmeter
 - Cable clamps and mounting hardware for routing cables exterior to the unit (quantity determined by the cable lengths involved).
 2. Unpack the Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit and its installation hardware from its protective box.

3. Check the contents of your Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit kit.

For a listing of model 751233/1A kit components, refer to Table 4. For a listing of model 751233/2A kit components, refer to Table 5.

Table 4 Model 751233/1A Kit Contents

Items Included	Qty	Part Numbers
Standalone Basic Rate ISDN Unit	1	244-751233-401
Description and Installation document	1	925-751342-001
One-card Shelf accessory kit	1	7501-22-02
6' power cable (3-conductor)	1	207-990000-020
10' insulated cable (12-conductor)	1	207-990000-138
Connector cord grip (1/2" hub)	1	230-990400-036
Connector cord grip (1/2" hub)	1	230-990400-037
Connector cord grip (1/2" hub)	1	230-990400-038
Instruction sheet, strain relief	1	241-010016-001
Fuse (2 A, 250 V)	1	248-990000-008
Terminal block (0.2")	1	666-990000-071
Terminal block (0.2")	1	666-990000-086
Nylon cable fastener (3/4" diameter)	5	706-990000-010
Hex nut 1/2-14NPT	3	714-990000-005
Screw, pan (6-32 X 3/8)	2	724-020001-015
Hex screw with washer (#14A)	4	724-990000-011
Screw, pan (6-32 X 3/8)	2	724-990000-073
Washer (#6)	2	738-990010-003
Instruction sheet, One-card Shelf	1	7501-18-113

Table 5 Model 751233/2A Kit Contents

Items Included	Qty	Part Numbers
Standalone Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit	1	244-751233-402
Description and Installation document	1	925-751342-001
One-card Shelf accessory kit	1	7501-22-02
6' power cable (3-conductor)	1	207-990000-020
10' insulated cable (12-conductor)	1	207-990000-138
Connector cord grip (1/2" hub)	1	230-990400-036
Connector cord grip (1/2" hub)	1	230-990400-037
Connector cord grip (1/2" hub)	1	230-990400-038
Instruction sheet, strain relief	1	241-010016-001
Fuse (2 A, 250 V)	1	248-990000-008
Terminal block (0.2")	1	666-990000-071
Terminal block (0.2")	1	666-990000-086
Nylon cable fastener (3/4" diameter)	5	706-990000-010
Hex nut 1/2-14NPT	3	714-990000-005
Screw, pan (6-32 X 3/8)	2	724-020001-015
Hex screw with washer (#14A)	4	724-990000-011
Screw, pan (6-32 X 3/8)	2	724-990000-073
Washer (#6)	2	738-990010-003
Instruction sheet, One-card Shelf	1	7501-18-113

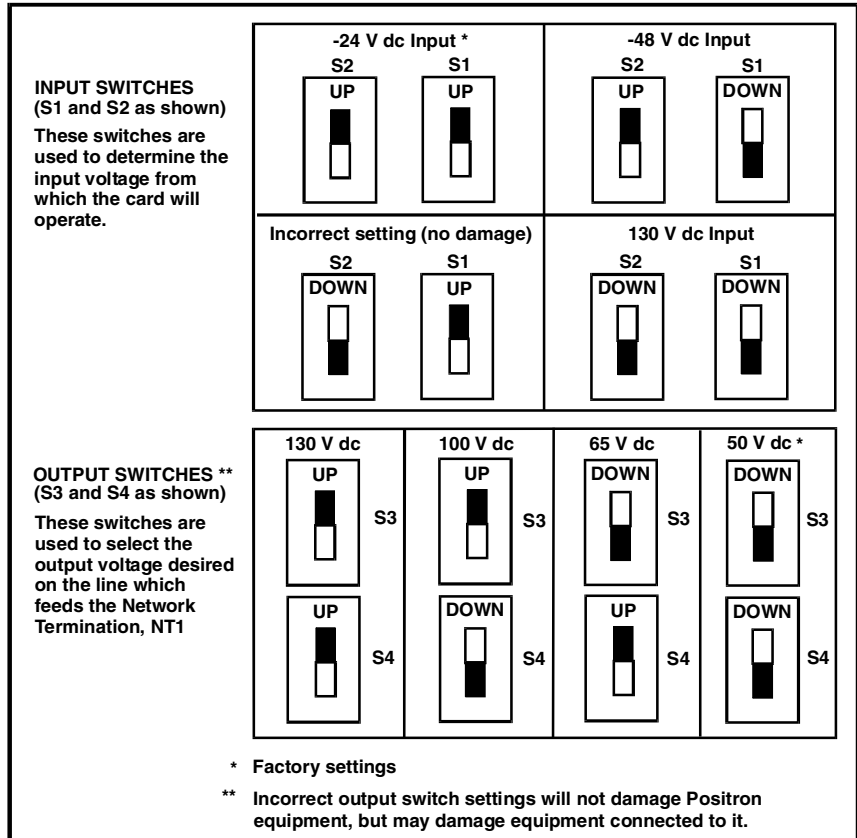
4. Remove the cover of the unit by unfastening the four screws located at each corner.
5. Confirm that the isolation unit is a Standalone Card Basic Rate ISDN Plus 56K ADTRAN Total Reach Unit by identifying the name located inside the cover and the model number on a metallic label on the top of the right-hand portion of the unit.
6. If the unit is model 751233/2A, the power supply board is not fastened to the main isolation card prior to shipment, and therefore requires installation first. Unfasten the cover of the unit and proceed as follows:
 - ▶ Remove the screws from the top of the spacers mounted on the Station side circuit board.
 - ▶ Position the power supply board onto the spacers and align the board holes with the spacers.
 - ▶ Secure using the four screws with the nylon screw going on the spacer in the isolation gap.
7. Fasten the 1" thick plywood backboard to the wall.
 - ▶ Mount the enclosure onto it using the four screws supplied.

Note

The Station (subscriber) side of the enclosure may be identified by two access holes, one for the telephone cable and the other for the power cable. The CO (remote) side has only one hole for the telephone cable entry. The orientation of the unit does not matter.

8. Verify that the input switches, output switches, and the jumpers are set properly and are compatible with the equipment to be protected. The unit is factory-set for -24 V dc input, -50 V dc on the line and 2 mA current sink on the CO side. For an illustration of the Station side power supply options, refer to Figure 8. For a listing of the Station side and CO side battery options, refer to Figure 9, Table 6 and Table 7.

Figure 8 Station Side Power Supply Options

**Note**

For all switch settings:

UP, meaning toward the terminal blocks (TB1 and TB2).

DOWN, meaning away from the terminal blocks.

Figure 9 Station and CO Side Battery Switches

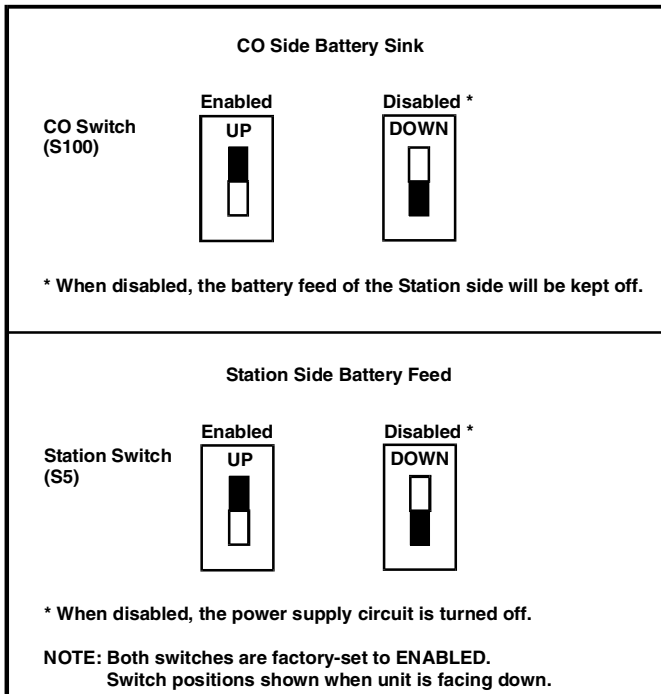


Table 6 J100 Settings

Jumper	Description	Jumper Position
J100	20 mA current sink	1 - 2
J100	2 mA current sink	2 - 3 *
* factory setting		

Table 7 J4 Settings

Jumper	Description	Jumper Position
J4	Floating	1 - 2
J4	Grounded	2 - 3 *
* factory setting		
NOTE: When set to grounded, the Tip side of the line is grounded. If the battery is enabled, the Ring is then negative.		

Note

Incorrect settings will not damage the card, but may damage the equipment connected to the line.

9. Make the power connections of the unit according to the diagrams inside the cover of the unit.
10. The strain reliefs supplied each have a cable entry diameter appropriate to one of the three cables employed in this installation. The CO cable strain relief is the largest, accommodating a cable diameter from 0.375" to 0.570". The power cable strain relief accommodates a cable diameter from 0.250" to 0.570", and the station cable strain relief accepts a cable diameter from 0.125" to 0.275". All measurements are the outside cable diameters.
 - ▶ Slide the strain reliefs supplied onto the CO, station, and power cables and affix them to the unit.
 - ▶ Route the power cable and the two telephone cables, allowing a length of five inches per cable for the internal connections to the terminal blocks. Cut the excess wire once the exact internal length is established, and tighten the strain reliefs.
 - ▶ Connect the ground lug to station ground by using a #6 AWG stranded wire.
 - ▶ Strip back the outer jacket of each cable one inch. Strip the inner insulating jacket of each conductor 1/8". Connect these stripped conductors to the designated terminal locations. For a listing of the unit's terminal block connections, refer to Table 8.

Table 8 Terminal Block Connections

Cable	Signal	Color Coding	Connector Position
Station	Tip Ring	Customer determined Customer determined	TB2-T TB2-R
CO	Tip Ring	Any of the available 12 conductors	TB1-T (CO Side) TB1-R (CO Side)
Power	-24 V dc Ground	Customer determined Customer determined	TB2-2 (751233/1A) TB2-4 (751233/1A)
	-48 V dc Ground	Customer determined Customer determined	TB2-3 (751233/1A) TB2-4 (751233/1A)
	130 V dc Return	Customer determined Customer determined	TB2-3 (751233/1A) TB2-1 (751233/1A)
	120 V ac 120 V ac 120 V ac	Line Neutral Ground ¹	3 (Power supply terminal block) (751233/2A) 1 (Power supply terminal block) (751233/2A) 2 (Power supply terminal block) (751233/2A)
<p>¹ The ground lug is the preferred way of grounding the unit. Use ground of power cable only if no local ground is available. If ground lug is used, cut the green wire of the power cable.</p>			

Note

When using the AC version, the ground of the power supply is internally connected to the external ground lug.

- ▶ Bundle the cable conductors using the tie wraps supplied.

-
11. Model 751233/2A is shipped with both leads of the battery disconnected to prevent discharge.
 - ▶ Reconnect these leads to their respective battery terminals: red to “+”, black to “-”.
 - ▶ If fuse F2 blows, correct the wiring error and replace the fuse.

Fuse F2 protects the power supply card against improper connection of the battery leads. To locate F2, refer to Figure 3.
 - ▶ Apply power to the unit, and use a digital voltmeter to measure the voltage across the terminals of TB1 on the power supply card. The voltage should correspond to the source voltage to within 1%.
 - ▶ Measure the voltage across the terminals of J3 on the main PCB of the unit. The voltmeter should register 23 to 25 V dc.
 - ▶ Allow the batteries to fully recharge for at least three hours, and then switch off the external power to the unit. Confirm that the battery backup is able to maintain communications. For information concerning the battery times available under varying conditions, refer to Table 1.
 12. Ensure that there are no excess wires dangling into the isolation gap between the Station and CO side circuits. Then close and secure the shelf cover with the captive screws.
 13. Verify that the Standalone Basic Rate ISDN Unit is functioning as it should by checking that an applied signal is correctly received.

6. Battery Replacement Procedure

Replacement of the battery for model 751233/2A will be necessary after its rated service life has expired. Its rated service life is at least four years. It is to be replaced by a Sonnenschein 12V/1.2 Ah A212/1.2S unit or equivalent.

1. Remove the retaining clamp holding the battery in place.
For the location of the retaining clamp, refer to Figure 3.
2. Disconnect the battery and dispose of it in a government approved waste site.

Caution

The batteries contain toxic lead and corrosive acid, and as they are user-replaceable, should only be disposed of in government approved waste sites.

3. Position a new battery in place and refasten the retaining clamp. Reconnect the leads (red to "+", black to "-").
4. Close and secure the cover.

7. Service and Support

Technical Customer Support

Positron is committed to providing excellent ongoing technical support to its customers. A team of specialists is always available at our Technical Support Center in Montreal for either telephone consultations or on-site visits, to assist Field Technical personnel in the maintenance and troubleshooting of Positron equipment. During normal business hours, (8:30 a.m to 5:00 p.m. EST), any one of our Technical Customer Support (TCS) staff may be reached by dialing 1-888-577-5254 from anywhere in the continental United States or from Canada. Customers outside North America should dial 1-514-345-2200. Staff may also be contacted via fax at 514-345-2271 or e-mail at powerdivision@positron.qc.ca.

Positron TCS staff are available to provide technical assistance and/or to supervise the installation of Positron equipment. Assistance in the planning, configuration, and implementation of the installation will be provided as requested. Arrangements and pricing information regarding field assistance may be obtained by contacting the Technical Customer Support department. Please contact Positron for scheduling at least four weeks prior to the actual requested visit date.

Customer Training

Positron offers full customer training courses, as requested. Seminars are also available on High Voltage Interface (HVI). For more information, contact a customer representative by dialing 1-888-577-5254 or use our e-mail address, powerdivision@positron.qc.ca.

Warranty

Positron warrants that all equipment shall perform in accordance with Positron's specifications. The warranty remains valid for five (5) years from the date of shipment. The warranty will be honored provided that the equipment has not been abused and provided that the equipment has been installed and used in accordance with Positron's installation instructions and specifications. The warranty fully covers workmanship, materials and labor.

This warranty is in lieu of all other warranties, whether expressed or implied, including warranties of merchantability and fitness for a particular purpose. Positron guarantees that all equipment shall perform in accordance with Positron's specifications. Positron disclaims any warranty that Positron

equipment will meet customer requirements beyond the product specification. Positron disclaims any warranty that operations will be uninterrupted or error free.

Repair Service

Positron Inc. offers repair services by which customers can count on timely and quality repairs, regardless of customer location.

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

For information about out-of-warranty repairs, contact Positron's Repair department at 1-800-661-4911 (from anywhere in the continental United States or from Canada) or dial 514-345-2228. Due to the varied nature of repairs, no one time frame for turnaround can be guaranteed. However, average turnaround time is two weeks from date of receipt. In emergency situations, special arrangements can be made by contacting our Repair department. All repaired items are warranted for a period of 90 days. Bulk repairs (more than five items) will require additional processing time, therefore, please take this into consideration when requesting a Return Material Authorization (RMA) number.

Before returning any items to Positron for repair, warranty repair or replacement, call the Repair department to obtain an RMA number. Parts returned without RMA numbers cannot be accepted. The RMA number must always be clearly marked on all boxes and crates and on all shipping documents.

Items under warranty are to be shipped prepaid to Positron and will be returned prepaid to the customer. Items that are not under warranty are to be shipped prepaid to Positron and will be returned prepaid with freight charges included on the invoice. Positron cannot accept items shipped collect. A purchase order number is required for all repairs.

To accelerate the repair process, whenever possible, customers should include a report detailing the reason for return with the unit(s) being returned. 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 that the item(s) is properly packed to avoid further damage. Teleline Isolator cards should never be shipped while installed in a shelf; this will cause damage and will almost invariably extend the repair period.

Ordering Information

Positron's Teleline equipment can be ordered by telephone, facsimile, or by mail. All orders should be directed to the Positron Inside Sales department. Ordering by telephone, or facsimile will eliminate any delays arising from postal services. However, a hard copy purchase order is required as a confirmation. In addition to the model numbers of the items being ordered, the following information is required:

- Company name, contact name and telephone number
- Purchase order number
- "Ship To" address
- "Bill To" address
- Date required on site

All orders must be followed by a confirming order. Equipment will not be shipped until such confirmation is received.

For a list of our contact information, refer to Table 9.

Table 9 Positron Contact Information

Address	Positron Inc.
	5101 Buchan St.
	Montreal, Quebec, Canada
	H4P 2R9
Main telephone number	514-345-2200
Customer Service department telephone number	514-345-2200, 1-888-577-5254
General e-mail address	powerdivision@positron.qc.ca
Customer Service department fax number	514-345-2271
TCS department toll-free number	1-888-577-5254
TCS department fax number	514-345-2271
TCS department e-mail address	scarbonaro@positron.qc.ca
Repair department telephone numbers	514-345-2228 or 1-800-661-4911
Customer representative e-mail address	customerservicepower@positron.qc.ca

