TRI-R/ENCASED W/METAL ENCLOSURE TOTAL REACH ISDN REMOTE ENCASED UNIT INSTALLATION/MAINTENANCE

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FIGURES

TABLES

1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN Low Voltage Total Reach ISDN Remote Encased mounted in a protective metal enclosure (TRI-R/Encased w/Metal Enclosure). Figure 1 is an illustration of the TRI-R/Encased w/ Metal Enclosure.

Revision History

This Installation and Maintenance Practice has been reissued to include the following information and changes:

- Changes to Figure 1. TRI-R/Encased w/Metal Enclosure, illustrating the location of the frame ground

Features

Identical in fit, form, and function, two part numbers have been assigned to allow for account and service code variances of the local exchange carriers. The features for the 4212083CASE and 4212083CASE#A include:

- Meets all Layer 1 requirements for the ISDN 2B1Q U-interface as specified in ANSI T1.601-1992
- Provides 30.5 kft nominal range on mixed gauge wire via the Total Reach ISDN (TRI) interface
- Provides 18 kft nominal range on mixed gauge wire via the U-interface
- Monitors performance of the Layer 1 facility as specified in TR-NWT-000397 and TR-TSY000829
- Records 8 hours of performance history, as specified by TR-NWT-000829
- Responds to eight ISDN BRA National Standard *eoc* messages including B1, B2, and 2B+D loopbacks
- Protects against lightning and power cross in compliance with GR-1089-CORE
- Span powered by the Total Reach ISDN-Central Office unit
- Compatible with –130 and –190 VDC Central Office units

General Description

The TRI-R/Encased w/Metal Enclosure is a sealed module mounted in a metal enclosure allowing deployment at any above ground location such as on a customer's premises, mounted on a pole or inside a remote terminal cabinet, or in a telco wiring closet. The interconnect to the network and customer's NT1 is made using the 18 in. long interconnect cable. The cable is made up of 22 AWG solid conductor, and provides spade terminals for wiring to terminal blocks or station protectors.

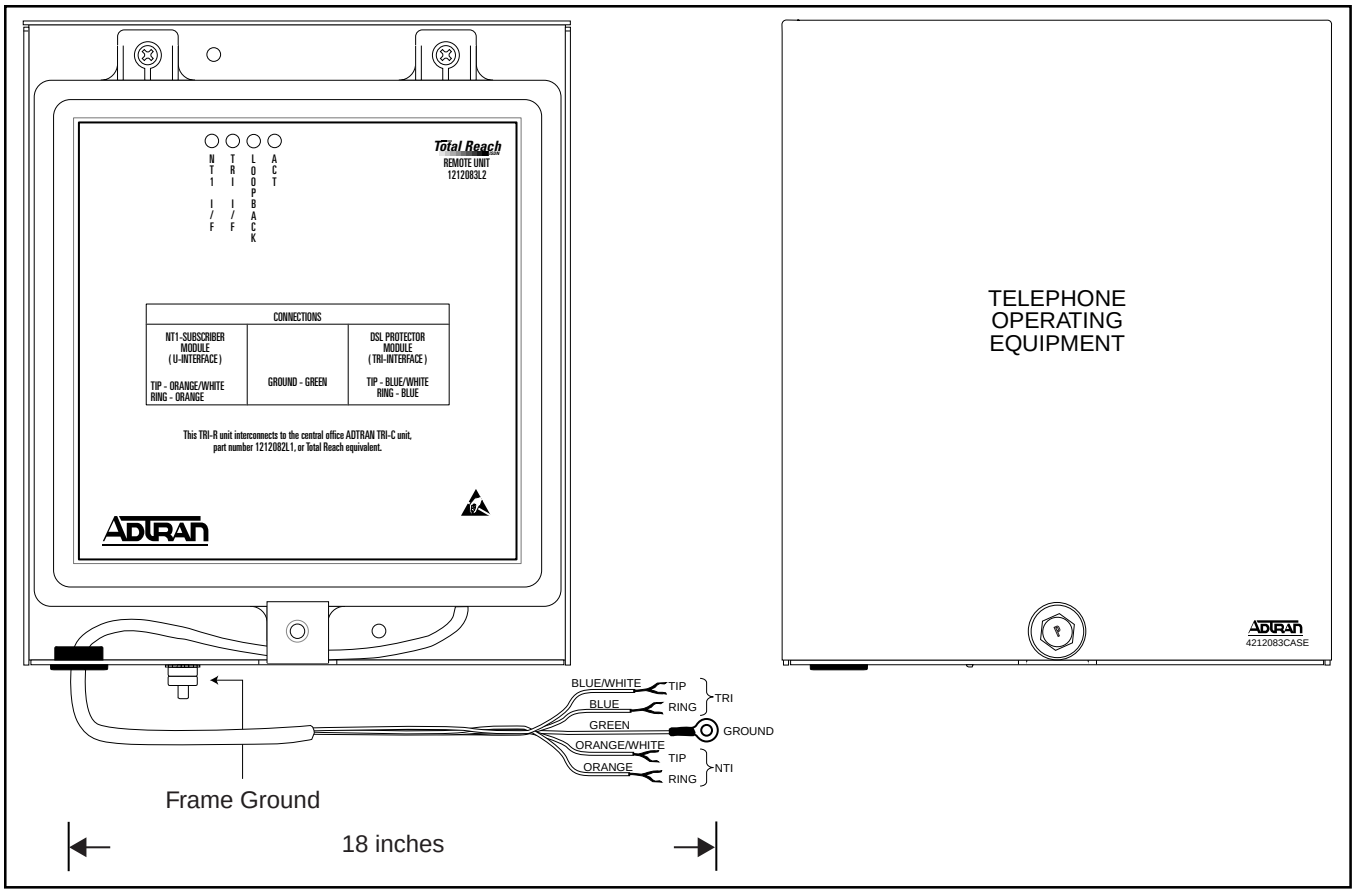

Figure 1. TRI-R/Encased w/Metal Enclosure

The TRI-R/Encased, in conjunction with the Central Office card (TRI-C), allows the transparent transport of Basic Rate ISDN (BRI) service to the customer premises at distances up to 30.5 kft over a single twisted pair of mixed gauge wire.

The TRI-R/Encased restores the 2B+D data and Layer 1 embedded operations channel (eoc) information from the Total Reach ISDN interface, converting it to the 2B1Q standard U-interface line code for transport to the customer's NT1/TA.

The TRI-R/Encased makes use of ADTRAN's Simple Coded Pulse Amplitude Modulation (SC PAM) line coding technology to extend the service range of ISDN without requiring the use of current mid-span U-Repeater technology. SC PAM is a full-duplex, multilevel encoding scheme that uses bandwidth reduction and improved adaptive equalization to transparently extend the ISDN Digital Subscriber Line (DSL) well beyond the current serving range of ISDN.

The Total Reach ISDN system extends the DSL serving range up to 52 dB when measured at 20 kHz at 135 ohms termination. This is based on –44.2 dBm of 2B1Q Near End Crosstalk (NEXT) as defined in ANSI TI.601 (typically referred to as 0 dB margin). Refer to *Deployment Guidelines* for additional information.

The Low Power T400 TRI-R is span powered by –130 VDC maximum from the multiple Low Power TRI-C products, or by –190 VDC maximum from the T400 TRI-C, P/N 1210082LI, CLEI DDRPLKCIAA (see Figure 2). This allows the TRI-R to be located near or at the customer's premises. The TRI-R converts the span-powered input to provide operation voltages for the TRI-R and provide sealing current for the customer's NT1/TA.

2. INSTALLATION

CAUTION

This equipment contains static sensitive components. Be sure proper electrostatic discharge procedures are followed before handling/installing the equipment.

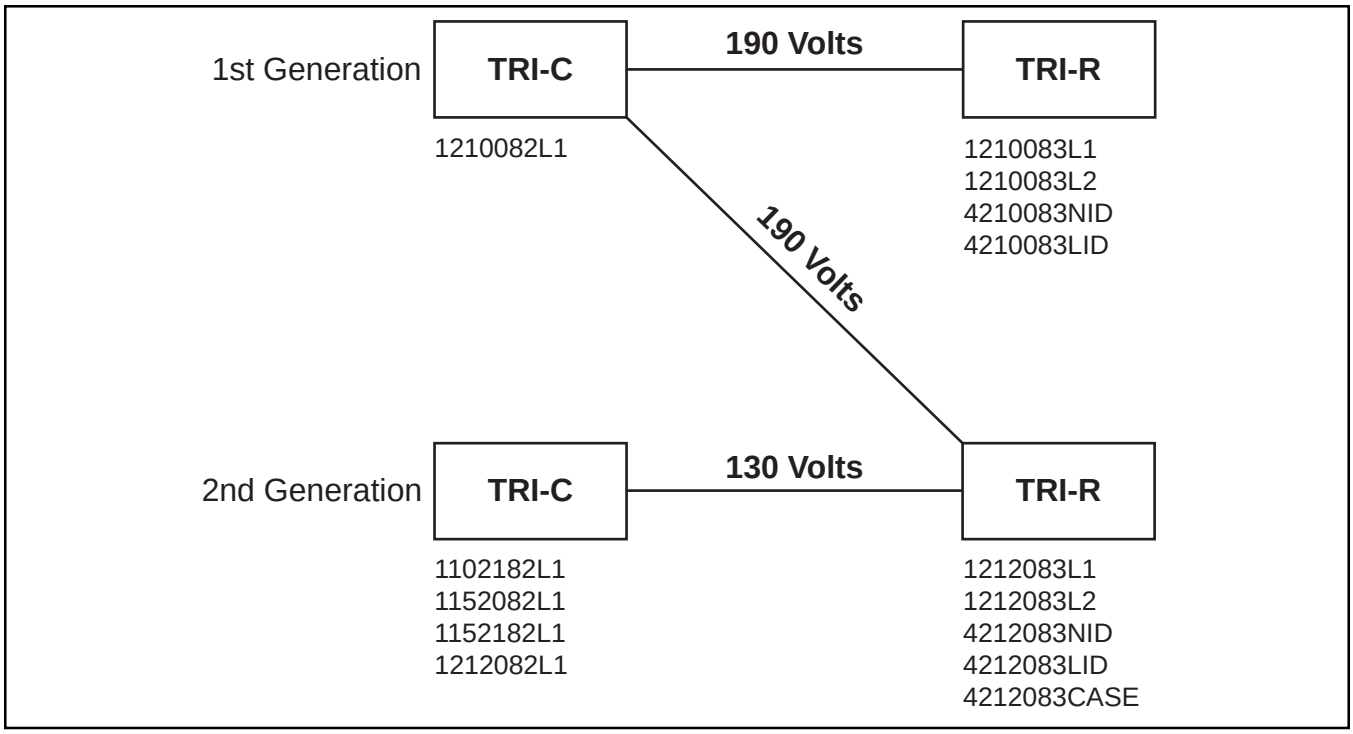

Figure 2. 1st Generation to 2nd Generation Interoperability

After unpacking the unit, immediately inspect it for possible shipping damage. If damage is discovered, file a claim immediately with the carrier; then contact ADTRAN Customer Service (see *Warranty and Customer Service*).

Mounting

Loosen the 7/16 security bolt and remove the front cover. Insert two screws (recommend 48 x 1.5-inch) through the two mounting holes located on the base of the metal enclosure and attach to the customer's residence, pole, or wire closet (see Figure 1).

CAUTION

Up to –190 VDC maximum may be present on the OSP Cable Pair.

For applications on customer's residence, the metal enclosure should be within 12 inches from the Network Interface Device (NID) to allow for proper routing of the interconnect cable. Thread the interconnect cable through the grommet of the metal enclosure (see Figure 1) and connect the ground wire (Green) to an approved ground. Connect the TRI Interface (Blue and Blue/White) to the station protector module that will be used for the network. These connections are not sensitive to Tip/Ring reversal.

Connect the NT1 Interface (Orange and Orange/White). These connections are not sensitive to Tip/Ring reversal. If a customer wiring bridge module will be used, the module must be an electronic free module (no 1/2 ringer or RFI). Connection to the customer module can be made using one of the following methods:

- Use a separate station protector module using the wiring post to make the electrical connection
- Use interconnect devices such as Scotchlok™ in the telco compartment of the NID

For applications that require a pole or cabinet mount, connections to the drop (TRI-Interface) and station side (NT1-Interface) should be made using approved methods (either Scotchlok or a suitable splice enclosure). For applications in a wiring closet, connections to the drop (TRI-Interface) and station side (NT1-Interface) can be made using standard punch-down blocks, or any other suitable method.

After installation, the TRI-R/Encased will initiate the training sequences to the TRI-C. Once synchronization is achieved on the Total Reach interface, the TRI-R/Encased will then initiate the training sequences to the customer's terminal equipment. The TRI I/F and NT1 I/F LEDs should go out when synchronization has been achieved on the TRI-interface and U-interface respectively.

After synchronization, if either the TRI I/F or NT1 I/F LED flashes at a rate of once per second, this indicates the receipt of Near End Block Errors (NEBES) on the associated interface. Both LEDs may illuminate immediately following synchronization of each interface, but should go OUT within 1 second. An LED that remains ON, or flashes intermittently, indicates a possible error condition on the associated interface, and should be checked before concluding circuit turn-up.

Once synchronization is complete and all connections are made, the interface indicates activation using the ACT LED. The ACT LED will light after successful exchange of the Activation bit between the customer's terminal equipment and the ISDN Switch.

The ACT LED will flash if the activation bit is received on the U-interface (when NT1 or the customer's terminal equipment is providing the Activation bit), but is not received from the ISDN Switch on the TRI-interface.

During normal operation, the ACT LED will be ON, and all other LEDs will be OFF. See Table 1 for additional LED information and Figure 3 for LED location.

Upon completion of circuit turn-up, replace the front cover and tighten the 7/16 security bolt to 20 to 30 in-lbs. DO NOT OVERTIGHTEN.

Deployment Guidelines

The Total Reach ISDN system is designed to provide range extension on single twisted-pair, non-loaded loops that exceed the typical ISDN deployment range. The general guidelines require the loop have an insertion loss of less than 52 dB at 20 kHz, or less than 61 dB at 40 kHz with 135 ohms driving and terminating impedances (see Table 2). Table 3 provides recommended guidelines for the Total Reach ISDN interface. Adherence to these guidelines will allow general deployment of Total Reach ISDN without further qualification. If any of the stated guidelines are exceeded, additional circuit testing will be required to ensure loop loss and noise levels are not exceeded.

CAUTION

All load coils must be removed from the circuit pairs being deployed. Loading coils, which are used to enhance voice quality on analog circuits, are designed to pass frequencies in the lower bandwidth range. Technologies operating in higher bandwidth ranges such as DDS, HDSL, or, in this case, ISDN, will not operate properly if all loading coils are not removed from the pair.

Specific loss constants and DC loop resistance for various wire gauges are provided in Table 4. Loop loss constants (in dB/kft) are provided for 20 and 40 kHz and can be used to determine the Estimated Measured Loss (EML) for any local loop. Examples of maximum loop lengths are provided for each wire gauge, and are based on 70°F PIC cable, with –44.2 dBm ANSI NEXT. These constants were derived using the method for determining the insertion loss with 135 Ohm driving and termination impedances as

Table 1. Front Panel Indicators

Indicator	Color	Description
NT1 I/F	Red	ON solid indicates a loss of signal or synchronization with the 2B1Q BRI interface toward customer's NT1. Flashing once per second indicates receipt of a NEBE from the 2B1Q BRI interface.
TRI I/F	Red	ON solid indicates a loss of signal or synchronization with the TRI-C unit. Flashing once per second indicates receipt of a NEBE from the TRI-C unit.
LOOPBACK	Yellow	Indicates the TRI-R unit is in a network-commanded test: 1 flash per second for B1 loopback, 2 flashes per second for a B2 loopback, and solid for 2B+D loopback.
ACT	Green	ON solid indicates that the terminal equipment has exchanged ACT bits with the ISDN switch. Flashing once per second indicates that the ACT bit is being sent from only the terminal equipment.

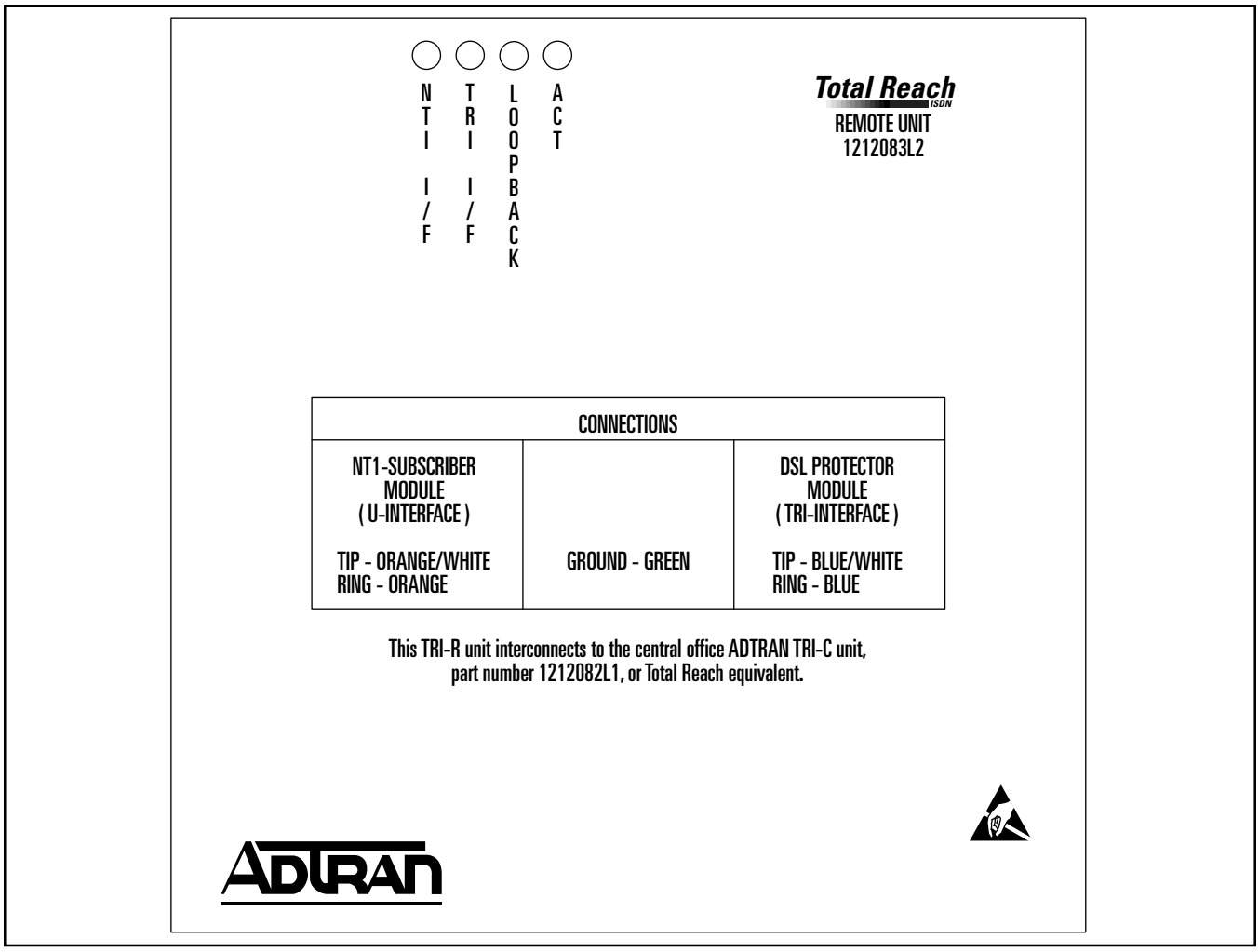

Figure 3. TRI-R/Encased Label

described in Bell Lab Transmission System for Communications, 1982. The total length of multigauge cable must yield a loop loss less than or equal to 52 dB @ 20 kHz or 61 dB @ 40 kHz.

For EML, multiply each section's loop length in kilofeet by the appropriate cable loss constant in Table 4 to determine the insertion loss of each section. To determine the insertion loss for each bridged tap in the feeder, multiply the length of the bridged tap by 1.32 dB (2.09 for 40 kHz). The maximum loss of each bridged tap is 4.2 dB, (4.7 dB for 40 kHz), regardless of length. Assume 250 ft. for Central Office wiring. For total insertion loss for the loop, add each section's insertion loss, the loss due to bridged taps, and loss of Central Office wiring.

Some Loop Deployment Programs provide automatic loop insertion loss predictions based on 40 kHz for ISDN 2B1Q. Table 2 provides a conversion estimate in decibels between insertion loss at 40 kHz for 2B1Q ISDN and the recommended 20 kHz for Total Reach ISDN. To use, determine the loss in decibels at 40 kHz using current methods and the largest component cable size (24 or 22 AWG). If the 22 and 24 AWG components are approximately the same, use the values associated with 22 AWG. This table should only be used to provide a rough estimate of the insertion loss at 20 kHz. A more accurate estimate can be obtained by determining the exact cable makeup of a loop and applying the cable loss constants in Table 4.

The U-Interface follows local deployment guidelines for standard ISDN as specified in ANSI Tl.601 and shown in Table 5.

Table 2. 20 kHz vs 40 kHz Loop Loss Conversion

20 kHz (dB)	40 kHz w /majority 22 AWG (dB)	40 kHz w/majority 24 AWG (dB)
1	1	1
5	6	6
10	12	12
15	18	18
20	23	24
25	29	30
30	35	36
31	36	38
32	37	39
33	39	40
34	40	41
35	41	42
36	42	44
37	43	45
38	44	46
39	46	47
40	47	48
41	48	50
42	49	51
43	50	52
44	51	53
45	53	55
46	54	56
47	55	57
48	56	58
49	57	59
50	58	61
51	60	62
52	61	63

Table 3. TRI-Interface Deployment Guidelines

Description	Value
Maximum Loop Loss @ – 44.2 dBm ANSI NEXT	52 dB @ 20 kHz or 61 dB @ 40 kHz
Maximum DC resistance	2000 Ω
Maximum single bridged taps	2 kft
Maximum total bridged taps	6 kft
Maximum number bridged taps	3

Table 4. Cable Loss Constants (PIC @ 70°F)

Cable Gauge (mm)	Maximum Loop Length*	Loss @ 20 kHz per kft	Loss @ 40 kHz per kft	Ohms per kft
26/0.40	24 kft	2.159 dB	2.721 dB	83
24/0.51	33 kft	1.586 dB	1.921 dB	52
22/0.61	46 kft	1.134 dB	1.325 dB	32
19/0.91	80 kft	0.655 dB	0.770 dB	16
Bridged Tap	6 kft	1.32 dB	2.09 dB	N/A
* Based on –44.2 dBm ANSI NEXT				

Table 5. U-Interface Deployment Guidelines

Description	Value
Maximum Loop Loss @ – 38.2 dBm ANSI NEXT	42 dB @ 40 kHz
Maximum DC resistance	1300 Ω
Maximum single bridged taps	3 kft
Maximum total bridged taps	6 kft
Maximum number bridged taps	3
Max Noise	– 57 dBm (135 Ω termination, 50 kb filter)

3. TESTING

The TRI-R/Encased responds to *eoc* loopbacks, including B 1, B2, and 2B+D. Loopbacks can be initiated from the ISDN switch, or from any other upstream network device that affords test access. The TRI-R/Encased also supports performance monitoring as described in TR 829 for fault isolation.

4. SPECIFICATIONS

Refer to Table 6 for unit specifications.

5. MAINTENANCE

The TRI-R/Encased requires no routine maintenance to operate properly.

ADTRAN recommends that repairs not be performed in the field. Repair services can be obtained by returning the defective unit to ADTRAN's Customer and Product Service Department (CAPS).

6. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within 10 years from the date of shipment if it does not meet its published specifications or fails while in service (see *ADTRAN Telco Network Equipment Warranty, Repair, and Return Policy and Procedure* document 60000087-IOA).

Contact CAPS prior to returning equipment to ADTRAN.

For service, CAPS requests, or further information, contact one of the following numbers:

ADTRAN Technical Support
(800) 726-8663
Standard hours: Monday-Friday, 7am-7pm CST
Emergency hours: 7 days/week, 24 hours/day

ADTRAN Sales
(800) 827-0807

ADTRAN Repair/CAPS
(256) 963-8722

Repair and Return Address
ADTRAN, Inc.
Customer & Product Service (CAPS) Department
901 Explorer Boulevard
Huntsville, Alabama 35806-2807

Table 6. Specifications

Two-wire (Customer) Loop Interface	
Line	Two-wire
Operating Mode	Full-duplex
Data Rate	160 kbps total; 144 kbps available to customer
Signal Format	2B1Q
Transmit Power (rms)	13 dBm to 14 dBm nominal
Tx/Rx Impendance	135 Ω nominal
Receiver Sensitivity	42 dB @ 40 kHz with –38.2 dBm of ANSI NEXT
Sealing Current	4 to 10 mA depending on loop loss
Total Reach ISDN Interface	
Line	Two-wire
Operating Mode	Full-duplex
Signal Format	Simple Coded Pulse Amplitude Modulation (SC PAM)
Transmit Power (rms)	13 dBm nominal
Tx/Rx Impendance	135 Ω nominal
Input Power	1.4 W nominal (–95 to –130 VDC, dependent on loop loss)
Receiver Sensitivity	52 dB @ 20 kHz with –44.2 dBm of ANSI NEXT
Size	
Replacement Module	6 1/4" H x 6 1/4" W x 2"L
Metal Enclosure	7 1/4" H x 6 1/2" W x 1 3/4" L
Weight	
Replacement Module	13 oz
Metal Enclosure	3.1 lb
Temperature	
Operating	–40 to 70° C (–40 to 158° F)
Storage	–40 to 85° C (–40 to 185° F)
Relative Humidity	
Up to 95% non-condensing	