PRACTICES

CAUTION!
SUBJECT TO ELECTROSTATIC DAMAGE OR DECREASE IN RELIABILITY.
HANDLING PRECAUTIONS REQUIRED.

Section 61212.083L2-5
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TRI-R/ENCASED
TOTAL REACH ISDN REMOTE ENCASED UNIT
INSTALLATION AND MAINTENANCE

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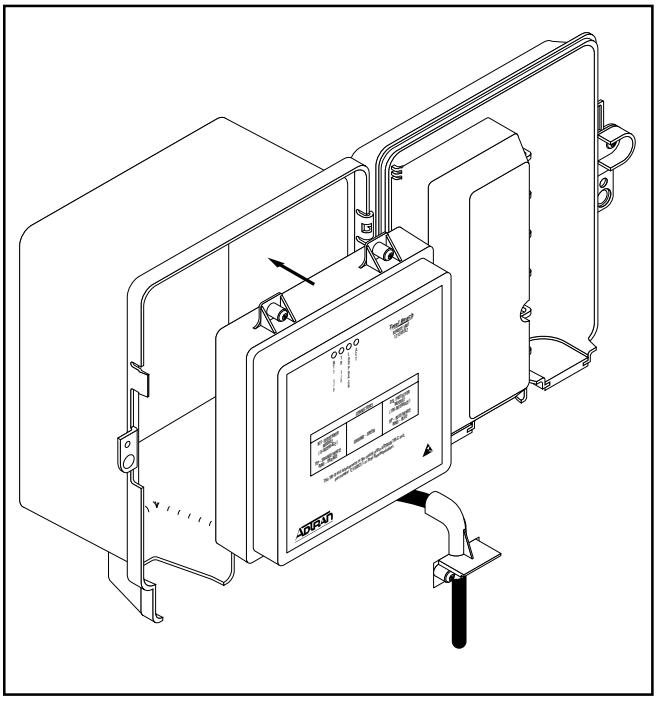

Figure 1. TRI-R/Encased

Revision History

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

- Addition of Figure 2. 1st Generation to 2nd Generation Compatibility
- Clarification of the LOOPBACK LED in Table 2. Front Panel Indicators
- Minor format change to Tables 4 and 6
- Added note to Table 5. Cable Loss Constants (PIC @ 70°F)
- Clarification of the Deployment Guidelines section

1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN Low Voltage Total Reach ISDN Remote Encased (TRI-R/Encased). The TRI-R/Encased is designed for mounting in a lid designed for ADTRAN by Siecor®. This ADTRAN lid can be mounted on a Siecor CAC® 7600 or 7700 Telephone Network Interface. Figure 1 is an illustration of the TRI-R/Encased.

Features

The TRI-R/Encased, part number 1212083L2, features 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 (TR) 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 loopback
- Protects against lightning and power cross in compliance with GR-1089-CORE
- Span powered by the Total Reach ISDN-Central Office unit
- Designed for use with a Siecor 7600/7700 Telephone Network Interface
- Compatible with –130 and –190 VDC Central Office units

General Description

The TRI-R/Encased is a sealed module used as a point of demarcation at the customer premise. The TRI-R/Encased is designed for mounting in the lid of a Siecor 7600 or 7700 Telephone Network Interface, and is available from ADTRAN in two different configurations:

- 4212083NID - TRI-R/Encased module, mounted and pre-wired on a Siecor CAC 7600 base assembly
- 4212083LID - TRI-R/Encased module mounted in a LID, installed onto existing Siecor CAC 7600/7700

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 standard U-interface line code 2B1Q for transport to the customer's NT1/TA.

TRI-R 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 T1.601 (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 1210082L1, CLEI DDRPLKC1AA (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

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

The TRI-R/Encased is designed for mounting in the ADTRAN lid of a Siecor 7600 or 7700 Telephone Network Interface. If the TRI-R/Encased is pre-assembled on the Siecor 7600, refer to the *Siecor CAC 7600 Telephone Network Interface Installation* for detailed mounting information.

If the TRI-R/Encased will be installed as a pre-assembled LID onto an existing Siecor CAC 7600 or 7700, remove the old lid from the Siecor housing. Snap the ADTRAN lid with the TRI-R/Encased onto

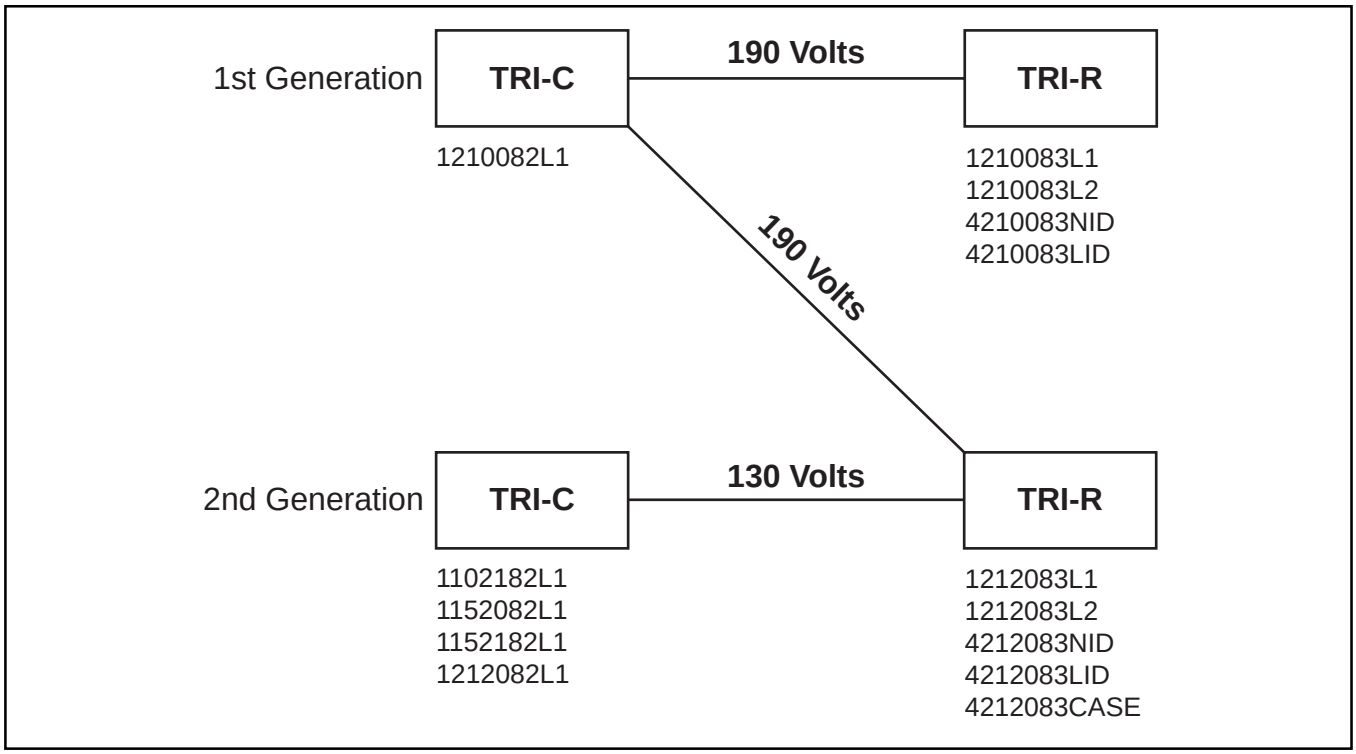

Figure 2. 1st Generation to 2nd Generation Compatibility

the existing base. Thread the wiring from the TRI-R/Encased through the hole in the left-hand grommet, and connect the blue and blue/white pair to a Station Protector, and the green wire to the ground. The orange and orange/white wires from the TRI-R/Encased will connect to the subscriber module. If possible, make the connection to the back side of the subscriber module, to keep from interfering with customer premises wiring.

The TRI-R/Encased may be wall mounted in a telco wiring closet. Determine a suitable location on the wall and secure the TRI-R/Encased unit with three wood screws (recommend #6 x 2-inch) through the three mounting holes. Route the interconnect cable to a punchdown block or use another suitable splice method.

The TRI-R/Encased incorporates 24 AWG solid twisted pair cable for the interconnection between the electronics and the station protector/customer interface. When wiring the unit for service, note the change in wire colors used for connection. The wire colors used for connecting the unit are different from the wire colors used to connect the –190 VDC unit (P/N 1210083L2). Table 1 depicts the wire color changes between the two units.

The TRI-R/Encased module fits into the ADTRAN LID. To install, place the module into the ADTRAN LID with the label side facing up. Secure it with three subscriber access screws.

Table 1. Interface Cable Wire Color

Connections	– 190 VDC TRI-R/OP (P/N 1210083L2)	Low Voltage TRI-R/Encased (P/N 1212083L2)
NT1 - Subcriber Module (U-interface)	Green (T) Red (R)	Orange/White (T) Orange (R)
DSL Protector Module (TRI interface)	Blue (T) White (R)	Blue/White (T) Blue (R)
Ground	Black	Green

CAUTION *Make sure that once the wires are correctly placed, the nuts are securely tightened. Failure to properly tighten the nuts will result in faulty connections. Also make sure that the wires are contained within the area of the protective compartment. Wires that are caught in the closed lid will not function properly.*

CAUTION *–130 VDC maximum is present on the low-voltage TRI-C tip and ring. –190 VDC maximum is present on the TRI-C tip and ring of the 1210082L1.*

Following power-up, some of the TRI-R/Encased LED indicators will initially illuminate, and then stabilize with the NT1 I/F and TRI I/F LEDs remaining ON. Figure 3 illustrates the location of the LED indicators, and Table 2 describes the four front panel status LEDs.

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 2 for additional LED information.

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 52 dB at 20 kHz, or less the 61 dB at 40 kHz with 135 ohms driving and terminating impedances (see Table 3). Table 4 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 constant values and DC loop resistance for various wire gauges are provided in Table 5. 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 *Bell Lab Transmission System for Communications, 1982*, and the method for determining the insertion loss with 135 ohms driving and termination impedances. The total length of multi-gauge 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 5 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.

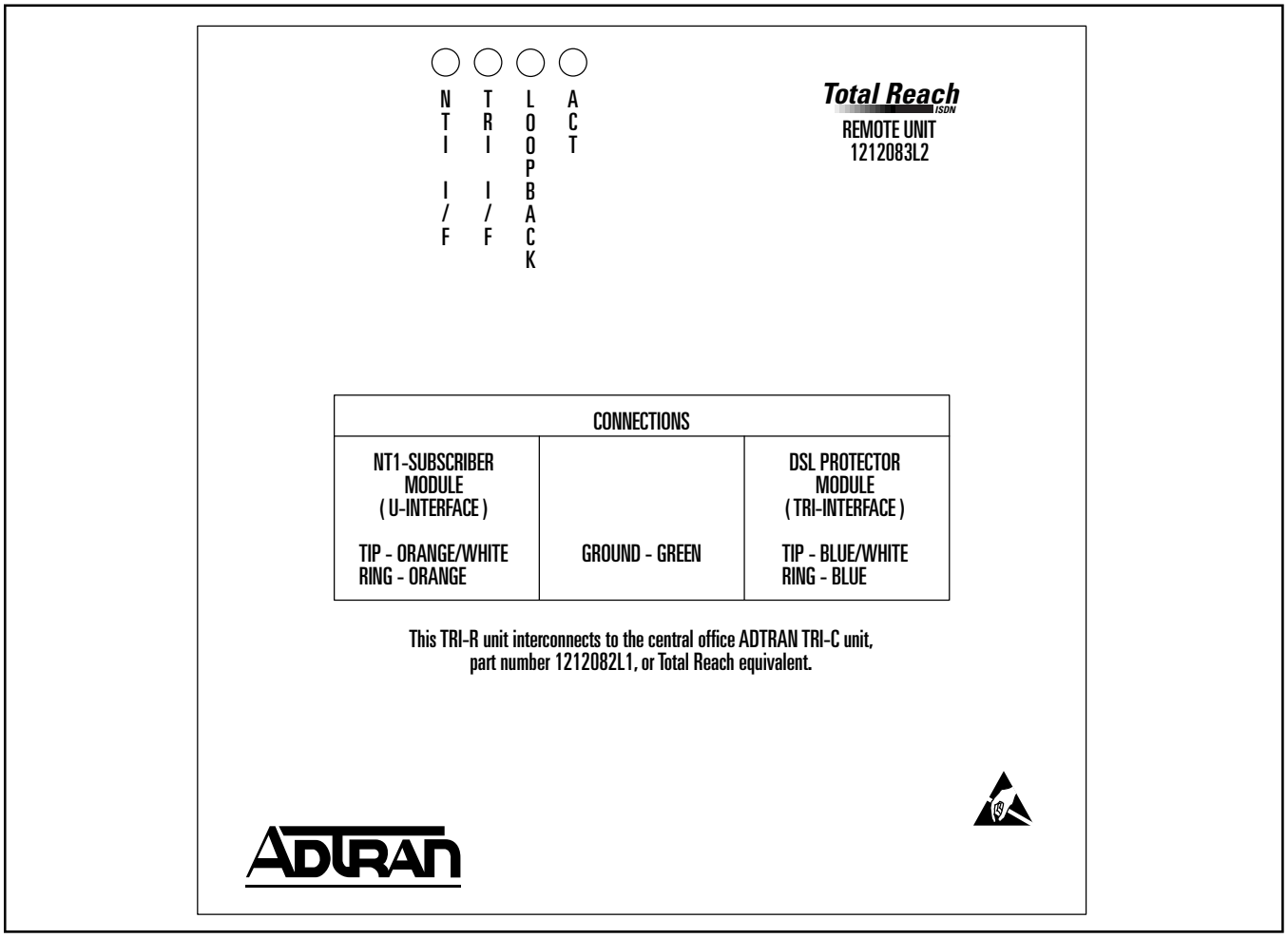

Figure 3. TRI-R/Encased Label

Table 2. 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.

Table 3. 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 4. 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 5. 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				

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 3 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 5.

The U-Interface follows local deployment guidelines for standard ISDN as specified in ANSI T1.601 and shown in Table 6.

Table 6. 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 B1, 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 8 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 60000087-10A).

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 7. 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
Siecor Housing	10" H x 8 1/2" W x 4 1/2" L
Weight	
Replacement Module	13 oz
Siecor Housing	2.8 lb
Mounting	
Designed for LID that Fits Siecor 7600/7700 CAC NID product family	
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	