

## BR1/10 TRI-C DP TOTAL REACH ISDN CENTRAL OFFICE CARD INSTALLATION & MAINTENANCE

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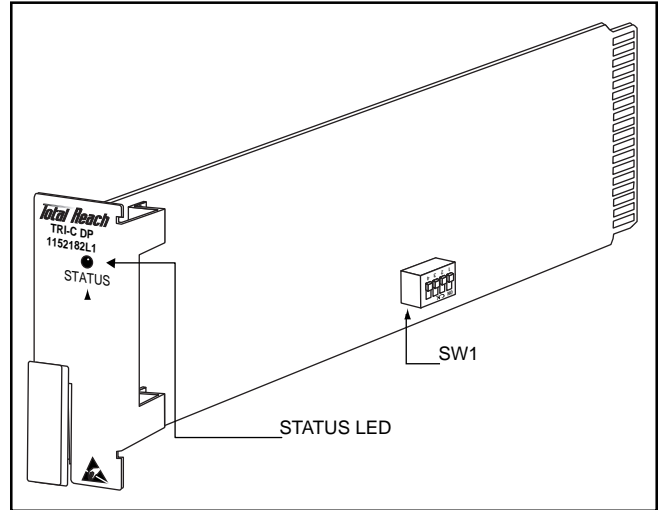
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**Figure 1. BR1/10 TRI-C DP**

## 1. GENERAL

This practice provides installation and maintenance information for the ADTRAN BR1/10 TRI-C DP. **Figure 1** is an illustration of the BR1/10 TRI-C DP.

### Revisions

Revision B added a PAU paragraph and note, the ESD logo, and upgraded portions of the document for readability.

### Features

BR1/10 TRI-C DP, part number 1152182L1, features include:

- Total Reach (TR) interface provides 30.5 kft nominal range on mixed wire gauge.

- Provides span powering for the Total Reach ISDN Remote unit.
- Operates in 3-DS0 format according to TR-NWT-000397.
- Supports ADTRAN 4:1 Time Division Multiplexer (TDM) format.
- Features performance monitoring of the Layer 1 facilities as specified in TR-NWT-000397 and TR-TSY-000829.
- Eight hours of performance history, as specified by TR-NWT-000829.
- Eight ISDN BRA National Standard eoc messages responded to, including B1, B2, 2B+D loopbacks.
- Lightning and power cross protection in compliance with GR-1089-CORE.
- Span powering is compliant with GR-1089-CORE Class A2 powering requirements.
- Operates with BR1/10 LIU and BCU to provide local test access for each channel unit.

**General Description**

The BR 1/10 TRI-C DP is a line card that plugs into a single channel slot of an ADTRAN BR1/10 compatible Central Office/Remote Terminal shelf. It provides the interface between the T1 carrier facility and the Digital Subscriber Line (DSL) towards the customer premises. The TRI-C DP is intended to be deployed in a Logical Unit Line Termination (LULT) configuration, typically referred to as Adjacent-to-Customer.

For monitoring and test purposes the BR1/10 TRI-C DP is supported by the channel bank's LIU and BCU common cards. The TRI-C receives power from a PAU card also in the common card section of the channel bank.

**NOTE**

**The PAU must be fuse protected with a 2A GMT type fuse.**

The TRI-C DP can be deployed along with other BR1/10 line cards, such as the BR1/10 U-BR1TE.

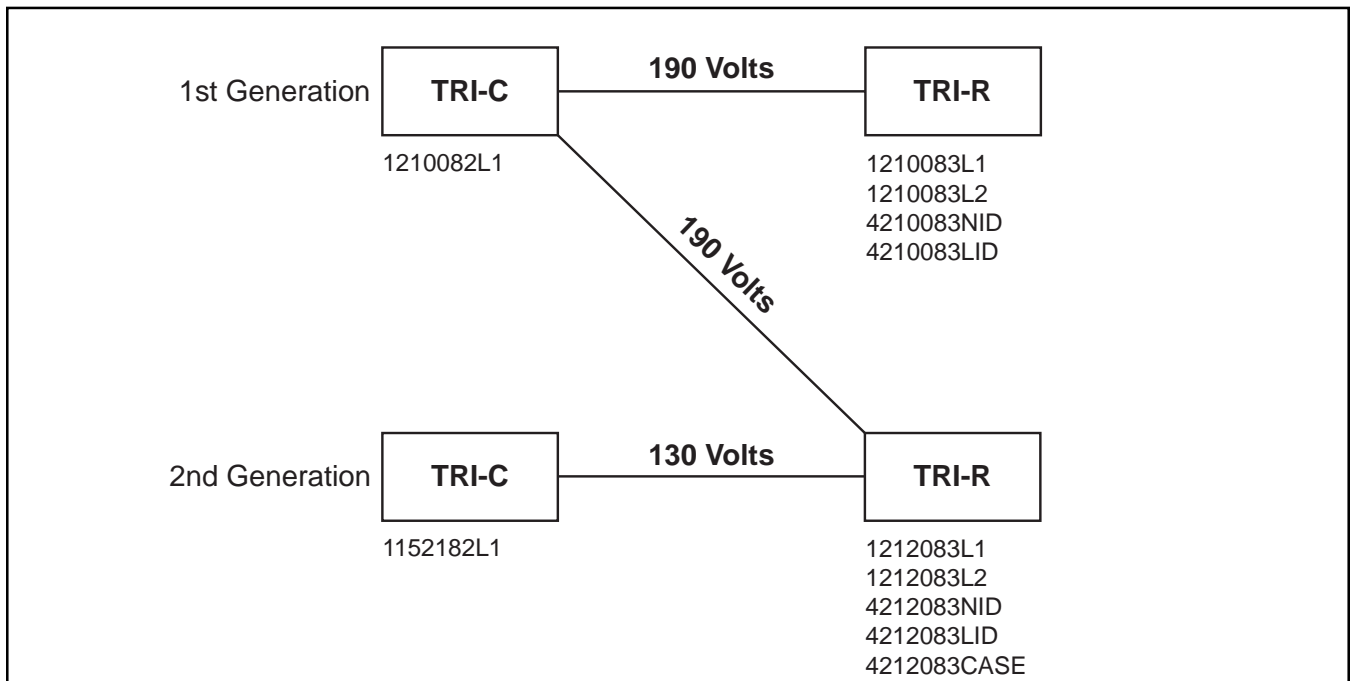
**NOTE**

**For proper operation of the TRI-C DP, the CLEI Code of the BR1/10 BCU must be D4CIS7Z2AA or D4CIK7Z2AA.**

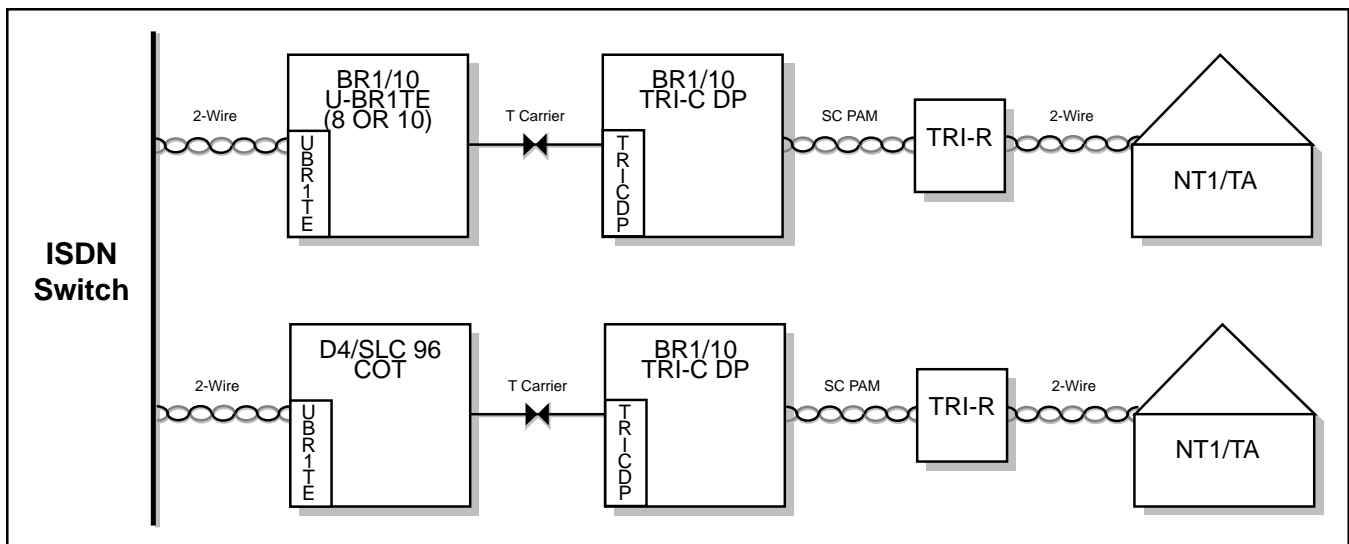
The BR1/10 TRI-C DP works in conjunction with a number of ADTRAN 2nd Generation Total Reach ISDN Remote units such as those listed in **Figure 2**. The TRI system allows for transmission of Basic Rate ISDN (BRI) service to the customer premise at distances up to 30.5 kft over a single twisted pair of mixed gauge wire. The TRI-C DP can be deployed in either a Central Office or Remote Terminal location that terminates a T1 carrier facility from an ISDN serving Central Office or Tandem Office configuration, as seen in **Figure 3**.

The TRI-C DP converts the 2B+D data and Layer 1 embedded operations channel (eoc) information from the T1 data stream to the TRI-interface for transport to the TRI-R. The TRI-C DP provides -130 VDC normal tip-to-ring on the DSL for span powering of the TRI-R. The TRI-R terminates the DSL and restores the 2B+D data and Layer 1 eoc information to an ANSI T1.601 compatible U-interface for delivery to the customer's NT1/TA.

The TRI-C DP makes use of ADTRAN's Simple Coded Pulse Amplitude Modulation (SC PAM) line coding technology to extend the service range of ISDN without 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.



**Figure 2. 1st Generation to 2nd Generation Compatibility**



**Figure 3. Position Settings at Network Locations**

The Total Reach ISDN system extends the DSL serving range up to 52 dB when measured at 20 kHz. This is based on -44.2 dB of 2B1Q Near End Crosstalk (NEXT) as defined in ANSI T1.601 (typically referred to as 0 dB margin). Refer to Deployment Guidelines subsection for additional information.

The BR1/10 Channel Banks and the TRI-C DP have been designed to provide a maximum concentration for 2B+D service. When deployed across carrier from another ADTRAN BR1/10 channel bank, the 10 DSL mode can be used. This mode makes use of ADTRAN's proprietary D-Channel 4:1 TDM, allowing the deployment of up to ten TRI-C DP or U-BR1TEs. This optimizes the utilization of the T1 carrier facilities. The TRI-C DP will also operate in the 8 DSL mode, which will terminate a TR-NWT-000397 3-DS0 U-BR1TE product, such as a D4/SLC-96 U-BR1TE. In either mode, the TRI-C DP must be terminated across carrier with a U-BR1TE configured as a Logical Unit Termination (LUNT) when deploying 2B+D, 1B+D or D-channel services.

Options for the functions specific to the BR1/10 TRI-C DP are selected with the four-position Dual In-line Package (DIP) switch on the TRI-C DP. The STATUS LED provides status synchronization information for the local craft persons.

## 2. INSTALLATION

### CAUTION

**Devices and components described in this document may be subject to ESD damage. Follow all static control measures when working with this equipment.**

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

### NOTE

**For proper operation of the TRI-C DP, the CLEI Code of the BR1/10 BCU must be D4CIS7Z2AA or D4CIK7Z2AA.**

The BR1/10 TRI-C DP plugs directly into any of the BR1/10 chassis channel positions labeled 1 through 10. To install the TRI-C DP, grasp the unit by the faceplate and insert it into the backplane connector until firmly seated. At this point, the STATUS LED on the unit should illuminate RED. A RED STATUS LED indicates that synchronization has not been achieved for either the TRI-interface or the T1 interface. Once synchronization is achieved on both interfaces, the STATUS LED will change to GREEN. If the STATUS LED remains RED, check the BCU indicators to determine the error type. A summary of BCU LED information is provided in **Table 1**. For

**Table 1. BR1/10 BCU Indicators**

LED	Color	Condition	Description
LP SYNC	Red	ON OFF	TRI Interface not synchronized TRI Interface is synchronized
CR-SYNC	Red	ON OFF	T1 Interface not synchronized T1 Interface is synchronized
LP-CRC	Red	ON or Flashing OFF	Near End Block Error (NEBE) received from TRI Interface No NEBEs received from TRI Interface
CR-CRC	Red	ON or Flashing OFF	NEBE received from T1 Interface No NEBEs received from T1 Interface
ACT	Green	ON OFF	Terminal equipment has exchanged ACT bit with ISDN switch ACT bit has not been exchanged
DS0-LB	Yellow	Flash 1/sec Flash 2/sec ON Solid OFF	B1 loopback active B2 loopback active 2B+D loopback is active or locally initiated test is active No loopback active

more information, see the BCU Installation and Maintenance Practice number 61150.080L1-5B.

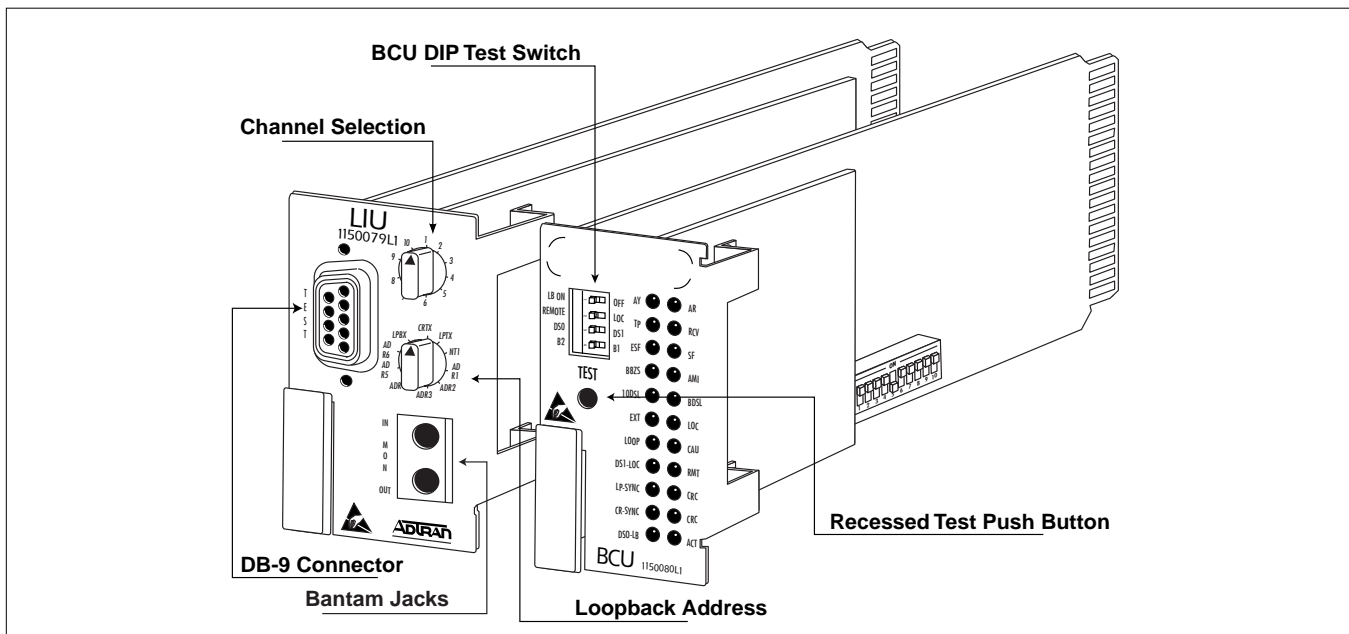
The BR1/10 BCU provides additional status information regarding the individual TRI-C DPs. To access this information, select an individual TRI-C DP unit using the channel selection switch labeled 1-10 on the LIU. The LIU and BCU are illustrated in **Figure 4**.

Once an individual TRI-C DP is selected, the status can be checked using the indicators on the BCU.

Following power-up, the LP and CR SYNC LEDs on the BR1/10 BCU will be ON (RED) until synchronization is achieved across the ISDN interface and the T1 facility respectively. Upon synchronization with the carrier and loop interface, the LEDs turn OFF and remain off.

**Configuration**

SW1 provides the option settings for the BR1/10 TRI-C DP. **Figure 1** shows the location of SW1. Switch functions are explained in **Table 2**.



**Figure 4. BR1/10 LIU and BCU**

**Table 2. Switch Functions**

Switch	Function	Description																																
SW1-1 SW1-2 SW1-3	Service Level Selection	Selects the service level to be provided. The BR1/10 TRI-C DP is optioned for 2B+D service, but may provide other levels as needed.																																
		<table border="1"> <thead> <tr> <th>Service Option</th> <th>SW1-1 B1</th> <th>SW1-2 B2</th> <th>SW1-3 D</th> </tr> </thead> <tbody> <tr> <td>2B+D</td> <td>ON</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>2B</td> <td>ON</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>B1+D</td> <td>ON</td> <td>OFF</td> <td>ON</td> </tr> <tr> <td>B2+D</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>B1</td> <td>ON</td> <td>OFF</td> <td>OFF</td> </tr> <tr> <td>B2</td> <td>OFF</td> <td>ON</td> <td>OFF</td> </tr> <tr> <td>D</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> </tbody> </table>	Service Option	SW1-1 B1	SW1-2 B2	SW1-3 D	2B+D	ON	ON	ON	2B	ON	ON	OFF	B1+D	ON	OFF	ON	B2+D	OFF	ON	ON	B1	ON	OFF	OFF	B2	OFF	ON	OFF	D	OFF	OFF	ON
Service Option	SW1-1 B1	SW1-2 B2	SW1-3 D																															
2B+D	ON	ON	ON																															
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B1+D	ON	OFF	ON																															
B2+D	OFF	ON	ON																															
B1	ON	OFF	OFF																															
B2	OFF	ON	OFF																															
D	OFF	OFF	ON																															
SW1-4 ON OFF	Zero Byte Substitution Enables ZBS Disables ZBS	The ZBS option of the TRI-C DP must be set the same as the U-BR1TE terminating the T1 carrier facility. SW1-4 should be ON for AMI-provisioned circuits. The switch setting is optional for B8ZS-provisioned circuits. Consult local provisioning guidelines.																																

**Connections**

**Table 3** shows the wiring interconnects for the two-wire TR-interface. All other input and output to the BR1/10 TRI-C DP are made through the backplane.

**Table 3. BR1/10 TRI-C DP Connector Interface**

Channel Position	Pin	Lead
1	27	R
	2	T
2	29	R
	4	T
3	31	R
	6	T
4	33	R
	8	T
5	35	R
	10	T
6	37	R
	12	T
7	39	R
	14	T
8	41	R
	16	T
9	43	R
	18	T
10	45	R
	20	T

**Faceplate Features**

The BR1/10 TRI-C DP provides a faceplate STATUS LED as illustrated in **Figure 1**. Status LED indication is as follows:

- Off - No power.
- Red Steady - No synchronization.
- Green Steady - Synchronized.
- Red/Green Flashing - Unit establishing communication with BCU.

The Red and Green flashing lasts for 3 seconds. It indicates to the user the selection of that channel unit on the BR1/10 LIU channel selection rotary switch. After the 3 seconds the LED returns to the current synchronization status.

**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 than 61 dB at 40 kHz, with 135 ohms driving and terminating impedances as seen in **Table 4**. **Table 5** 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.

**Table 4. 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 5. 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

**CAUTION**

**ADTRAN does not recommend that the Low Power TRI-C DP be installed on existing circuits terminated with P/N 1210083L1, 1210083L2, 4210083NID, and 4210083LID. No damage will result from inadvertent deployment of the Low Voltage -130 VDC TRI-C DP with a -190 VDC TRI-R.**

**NOTE**

**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 loop loss constant values and DC loop resistance for various wire gauges are provided in **Table 6**. 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 insertion loss with 135 ohms driving and termination impedances from Bell Lab Transmission System for Communications, 1982. 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.

**Table 6. 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 EML, multiply each section’s loop length in kilofeet by the appropriate cable loss constant in **Table 6** 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 4.2dB, (4.7 dB for 40 kHz) regardless of length. Assume 250 feet 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 4** provides a conversion estimate in dB between insertion loss at 40 kHz for 2B1Q ISDN and the recommended 20 kHz for Total Reach ISDN. To use, determine the dB loss 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 using the cable loss constants in **Table 6**.

### 3. TESTING

The BR1/10 TRI-C DP responds to standard multi-point embedded operations channel (mp-eoc) testing, including B1, B2 and 2B+D loopbacks. These eoc commands are sent from an upstream device, such as the ISDN switch, U-BR1TE, or an ISDN test set.

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#### NOTE

**For proper operation of the TRI-C DP, the CLEI Code of the BR1/10 BCU must be D4CIS7Z2AA or D4CIK7Z2AA.**

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### DS0 TESTING

DS0 Local Test access allows local craft persons to assist in circuit turn-up or determine a point of trouble/equipment malfunction when remote testing capabilities are not available or convenient.

The BR1/10 BCU and LIU provide network access for testing downstream ISDN devices, inserting a test pattern to either the carrier or loop interface, performing a local bilateral loopback, and conducting a local performance monitoring of the ISDN circuit.

When DS0 is selected on the BR1/10 BCU, local test access is afforded to each of the installed BR1/10 TRI-C DP channel units in both the downstream and upstream directions. Bantam jacks provide for the following:

- DS0 logic access
- 8 kHz and 64 kHz clock reference
- Channel unit selection, 1 - 10
- Test selection by the BR1/10 LIU

When the 10 position rotary switch is used to select a TRI-C DP channel unit, the STATUS LED on the TRI-C DP channel unit will flash RED and GREEN for approximately 3 seconds before returning to the current status display.

### Loopback Test (ADR1-ADR6, NT1)

Loopbacks in the network-to-customer direction can be initiated from either the ISDN switch or the BR1/10 LIU. The downstream direction is automatically selected based on the card position in the network. To initiate a loopback, perform the following:

1. Insert the TX and RX Bantam plugs of the DS0 digital test set into the Bantam jack of the LIU. Connect the clock input to the DS0 digital test set DB-9 connector on the LIU. Configure the test set for Near Logic and 64 kbps.
2. Select the desired TRI-C DP channel unit using the DSL rotary switch on the LIU. The selected TRI-C DP channel card STATUS LED will flash GREEN and RED for approximately 3 seconds when selected.
3. Select the desired loopback address on the LIU (ADR1-ADR6, or NT1).
4. Select the desired bearer channel using B1/B2 DIP switch on the BCU.
5. Depress the BCU’s recessed TEST push-button to initiate the loopback test. The DS0-LB status

LED will light YELLOW when the loopback is established to the selected address. If the selected address does not respond, the DS0-LB LED will remain off. Observe the DS0 digital set for bit errors.

6. Tests to the other B channel or additional network ISDN devices may be performed by changing to another test (steps 3 and 4). It is not necessary to exit the test mode to select a new test. If a new TRI-C DP channel unit is selected, all DS0 tests will be terminated.
7. To terminate the loopback, depress the TEST push-button, or remove the transmit Bantam plug. Upon deactivation of the test, the DS0-LB LED will turn off.

### **Point-to-Point Test, (CRTX, LPTX)**

A point-to-point (straightaway) test can be performed to either the TRI-interface (LPTX) or the T1 carrier interface (CRTX).

To initiate a point-to-point test using a DS0 digital test set, perform the following:

1. Insert the TX and RX Bantam plugs of the DS0 digital test set into the Bantam jack on the LIU. Connect the clock input to the DS0 digital test set DB-9 connector on the LIU. Configure the test set for Near Logic and 64 kbps.
2. Select the desired TRI-C DP channel unit using the DSL rotary switch on the LIU. The selected TRI-C DP channel card STATUS LED will flash GREEN and RED for approximately 3 seconds when selected.
3. Select the desired test direction, LPTX or CRTX, on the LIU.
4. Select the desired bearer channel using B1/B2 DIP switch on the BCU.
5. Depress the recessed TEST push-button on the BCU to initiate the test.
6. If a BR1/10 U-BR1TE channel unit is across the T1 carrier, perform Steps 1 through 4, choosing the same faceplate switch setting. Ensure both test sets are configured for the same test pattern (511, 2047).
7. Observe the DS0 digital test set for bit errors.
8. To deactivate the loopback, depress the TEST push-button, or remove the transmit Bantam plug. Upon deactivation of the test, the DS0-LB LED will turn off.

### **Local Loopback (LPBK)**

A bilateral loopback can be initiated for any of the BR1/10 TRI-C DP channel units for either bearer channel. Since a local test pattern source is not required for this test, it can be performed without additional test equipment. To initiate a local loopback, perform the following:

1. Select the desired TRI-C DP channel unit using the DSL rotary switch on the LIU. The selected TRI-C DP channel card STATUS LED will flash GREEN and RED for approximately 3 seconds when selected.
2. Select the LPBK using the ten-position rotary switch.
3. Select the desired bearer channel using B1/B2 DIP switch on the BCU.
4. Depress the recessed TEST push-button to initiate the test. The DS0-LB LED will flash once per second for a B1 loopback; twice per second for a B2 loopback.
5. To deactivate the loopback, depress the TEST push-button. Upon deactivation of the test, the DS0-LB LED will go out.

### **Local Performance Monitoring**

Performance monitoring of the local T1 carrier system and the Total Reach interface of the ISDN data can be performed from the front panel without interruption of service to the customer. For this test, bearer channel selection is not applicable and a test pattern source is not required. To initiate local performance monitoring, perform the following:

1. Ensure a Bantam plug is NOT installed in the faceplate TX Bantam jack on the BR1/10 LIU.
2. Select the desired TRI-C DP channel unit using the DSL rotary switch on the LIU. The selected TRI-C DP channel card STATUS LED will flash GREEN and RED for approximately 3 seconds when selected.
3. Select ADR1 on the LIU.
4. Depress the recessed TEST push-button to initiate the test.
5. The total number of crc errors are simultaneously displayed by the LP and CR CRC status LEDs. The LEDs will flash upon the receipt of 6 to 19 crc errors, and will illuminate solid when >20 crc errors are received.
6. To deactivate Local Performance monitoring, depress the TEST push-button.



#### **4. SPECIFICATIONS**

The specifications for the BR1/10 TRI-C DP are listed in **Table 7**.

#### **5. MAINTENANCE**

The BR1/10 TRI-C DP does not require programmed maintenance for normal operation.

ADTRAN does not recommend that repairs be performed in the field. Repair services are obtained by returning the defective unit to ADTRAN's Customer Service.

#### **6. WARRANTY AND CUSTOMER SERVICE**

ADTRAN will replace or repair this product within ten 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 Customer And Product Service (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, 7 am-7 pm 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 BR1/10 TRI-C DP Specifications**

<b>Total Reach ISDN Interface</b>		
Line:	2 wire	
Operating Mode:	Full duplex	
Signal Format:	SC-PAM (Simple Coded Pulse Amplitude Modulation)	
Output Power:	13 dB nominal @ 0 to 80 kHz	
Tx/Rx Source Impedance:	135 ohm AC impedance	
Receiver Sensitivity:	52 dB @ 20 kHz with – 44.2 dB ANSI NEXT	
Output Power:	– 140 VDC nominal 2 Watts nominal	
<b>DS1 Facility Interface</b>		
BR1/10 Compatible Equipment		
<b>Network Compatibility</b>		
Interface:	ISDN and other digital service, according to TR-NWT-000397. 3 DS0 method. ADTRAN 4:1 TDM delivery of 2B+D Basic Rate ISDN.	
<b>Faceplate Indicator</b>		
Status:	Indicates Loop and Carrier status.	
<b>Mechanical</b>		
Size:	2 1/2" High, 9 3/8" Deep, 5/8" Wide	
Weight:	10 oz	
Mounting:	Mounts in ADTRAN BR1/10 Channel Banks	
<b>Power</b>		
-48V	3.2W	On-Card Dissipation 1W
5V	0.7W	Normal operating mode
<b>Environmental</b>		
Temperature:	Operating: – 40° C to 70° C (– 40° F to 122° F) Storage: – 40° C to 85° C (– 40° F to 185° F)	
Relative Humidity	Up to 95%, non condensing	