# TRDDB
# Total Reach® Digital Data Bank Channel Unit
# Installation and Maintenance

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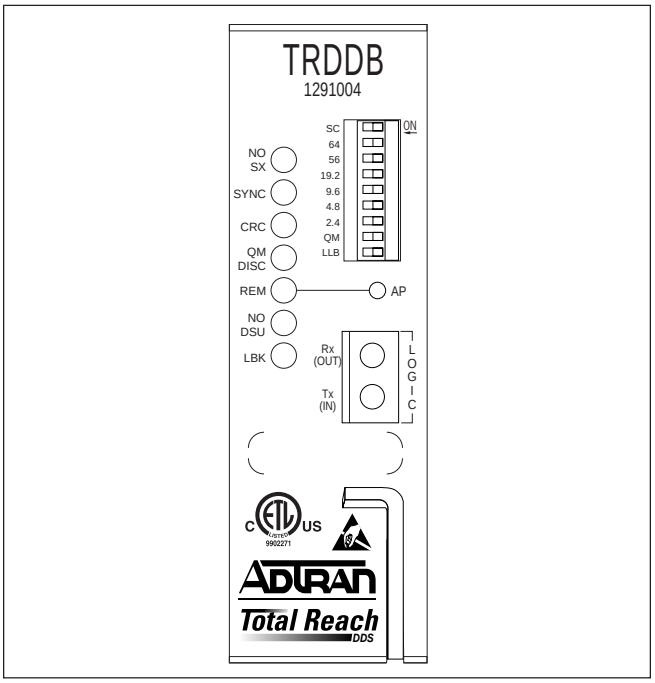


**Figure 1. Total Reach DDB**

## 1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN D4 Total Reach® Digital Data Bank (TRDDB) channel unit. **Figure 1** is an illustration of the ADTRAN TRDDB (P/N 1291004L2).

### Revision History

Issue 2 of this document includes an edge connector pinout illustration.

### Features

- 2-wire deployment
- Repeaterless operation
- Bridged tap tolerant
- Span power for remote Total Reach OCU-R (TROCU-R) termination unit
- Embedded Digital System 6 capabilities for remote provisioning, configuration, and performance monitoring

- Protected Loopback prevents false latching loopback at 64 kbps
- Alternating Mux-Out-of-Sync/Abnormal Station trouble code during loss of loop synchronization
- Utilization in D4 channel bank and SLC-96 remote terminal applications
- NEAR and FAR logic level Bantam test access
- Loop Quality Monitor and latching loopback

## Description

The ADTRAN D4 TRDDB is a 2-wire Total Reach DDS functional replacement for the following ADTRAN 4-wire OCU part numbers:

- 1104004L3 D4OCBRD2AA
- 1104004L4 D4OCBRE2AA
- 1105004L1 D4OCBSD2AA
- 1105004L2 D4OCBSE2AA
- 1105018L1 D4OCBTD2AA

The TRDDB delivers data at rates up to 64 kbps using a single copper pair. Used in combination with the TROCU-R termination unit, the TRDDB can accommodate extended loop lengths, eliminating the need for DDS repeaters. The TRDDB span powers the remote TROCU-R located at the customer premises. The TROCU-R converts the 2-wire signal to the traditional 4-wire Alternate Mark Inversion (AMI) signal for presentation to the customer.

The ADTRAN TRDDB occupies a single channel position in the WECO® compatible D4 channel bank, GPC shelf, or AT&T® SLC-96 terminal. It provides the interface between a DS0 signal and the 2-wire metallic loop extending to the customer premises. The TRDDB will interoperate with another TRDDB, OCU DDB, DS0 DP, MJU, or 1/0 DCS and can be located in an end office, hub office, or intermediate office.

## Application

In a typical application the TRDDB can be used to provide test access at the DS0 level for DDS circuits served from a single CO (**Figure 2**). By using TRDDB channel units in this configuration instead of other dataport channel units, valuable port space on 1/0 DCS devices can be saved.

TRDDB channel units can be used to deliver multipoint DDS circuits connected to MJUs in ADTRAN GPC shelves or D4/SLC-96 channel banks (**Figure 3**). The TRDDB can also be used in applications where an IXC T1 is back-hauled to a metallic SMAS point in a local DDS serving CO (**Figure 4**).

**NOTE**

The TRDDB must be used with an appropriate TROCU-R unit.

## 2. INSTALLATION

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

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

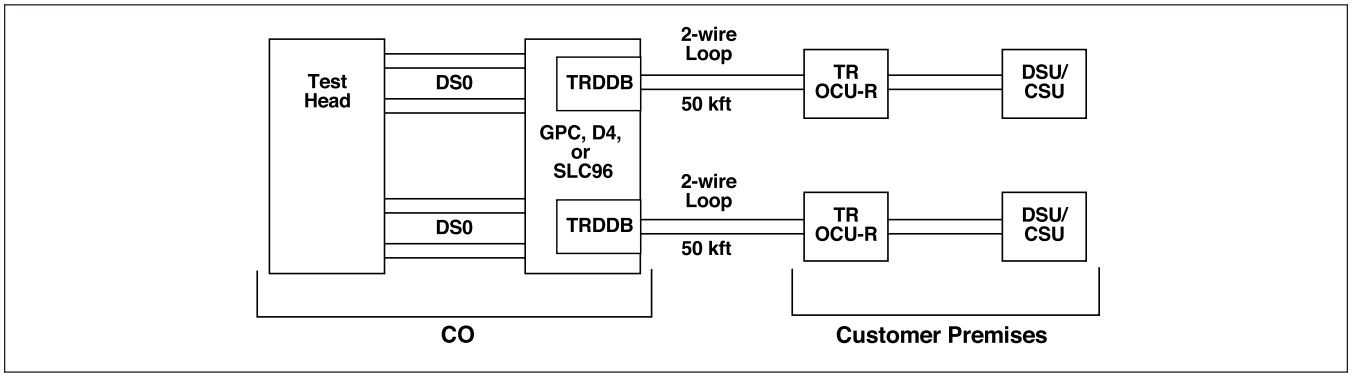


**Figure 2. DS0 Level Test Access for DDS Customers with Two End Points Served from Same CO.**

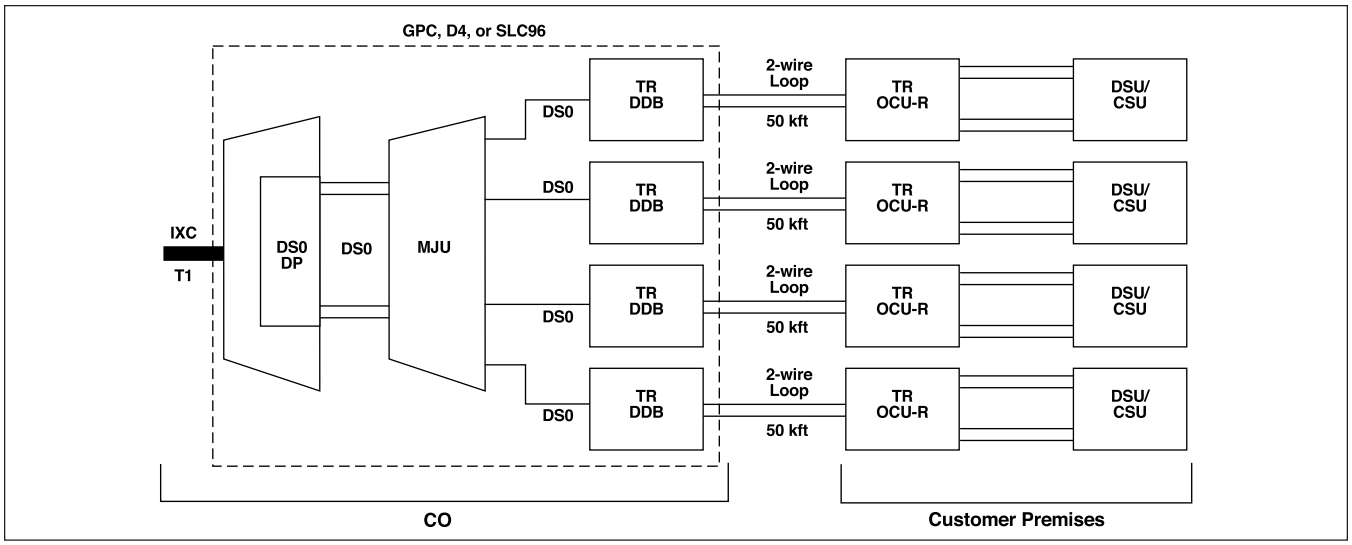


**Figure 3. Multipoint DDS Deployment**

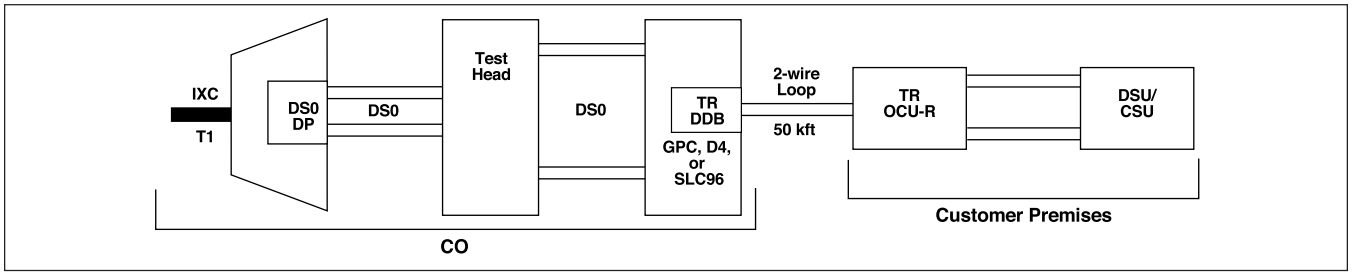


**Figure 4. Back-Hauled IXC T1 to DDS**

## Compliance Codes

This product is intended for installation in a restricted access location in a Type B or E enclosure only. In normal operation, loop current will not exceed 22 mA @ -130 Vdc with a maximum power requirement of 100 mA from -48 Vdc. See **Table 1** for codes.

**Table 1. Compliance Codes**

| Code | Input | Output |
|---|---|---|
| Power Code (PC) | F | C |
| Telecommunication Code (TC) | – | X |
| Installation Code (IC) | A | – |

## Signal Pinout

The ADTRAN TRDDB plugs directly into a WECO or equivalent D4 channel bank or the ADTRAN ACT 1900/2300 channel bank. No special wiring is required. The 2-wire loop is connected using the Tip (pin 24) and the Ring (pin 51) on the D4 backplane. The 4-wire DS0 signal uses MA (pin 46) and MB (pin 48) as the DS0 input pair and EA (pin 45) and EB (pin 19) as the DS0 output pair. Refer to **Figure 5** for pinout assignments.

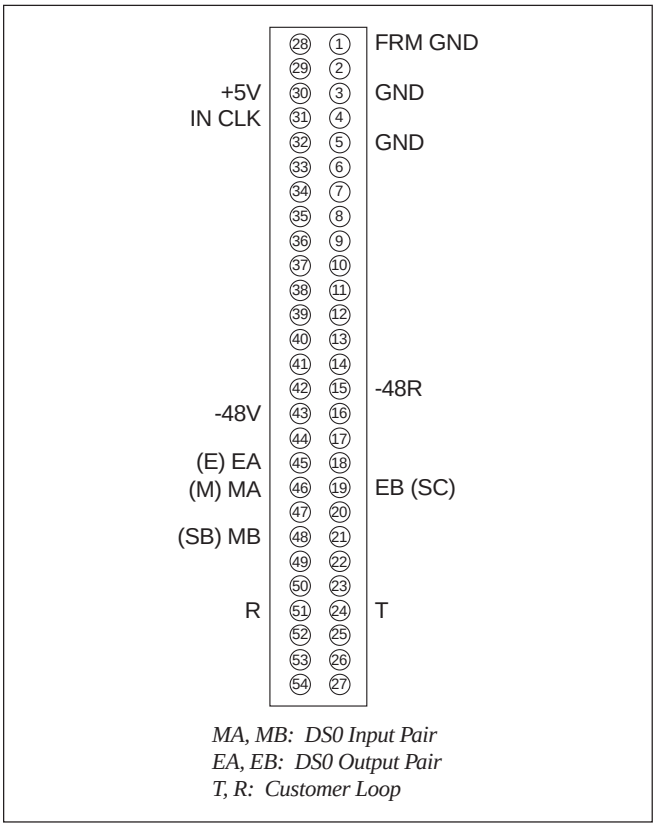


**Figure 5. Connector Pin Assignments**

### Span Power

Span-powering is accomplished using -130 Vdc, measured from Tip to Ring. Voltage measured from Ring to GND should indicate 0 V. Voltage measured from Tip to GND should indicate about -130 Vdc or less depending on voltmeter impedance.

### Synchronization and LED Indication

The TRDDB and TROCU-R typically require 30 to 90 seconds to achieve synchronization. Once synchronized, the SYNC indicator LED will turn Green. If synchronization cannot be achieved, check the T/R pair for open- or short-circuit conditions or load coils. Refer to **Table 2** for LED indication.

**Table 2. LED Indicators**

| LED | Description |
|---|---|
| NO SX | ON indicates that there is no sealing current present on the 2-wire Total Reach loop; check for continuity to a TROCU-R.<br>Flashing if a short circuit is present on the 2-wire loop. |
| SYNC | Green indicates sync, Red indicates that there is no sync between the TRDDB and the remote TROCU-R; check for continuity, load coils, and other abnormal line conditions. |
| CRC | ON indicates that there are errors on the 2-wire data stream; check for abnormal line conditions. |
| QM DISC | ON indicates that Quality Monitor Disconnect has occurred. |
| REM | ON indicates that the unit has been remotely provisioned; Flashing indicates that the remote control link is active. Push the AP button to toggle between manual and remote provisioning. |
| NO DSU | ON indicates the absence of the customer DSU/CSU as determined by the TROCU-R. |
| LBK | ON indicates DS0, OCU, or CSU loopback activation.<br>Flashing indicates loopback at the TRDDB towards the customer initiated by the TROCU-R. |

### Options

Select the appropriate OPTIONS and RATE using SW1 front panel switch as illustrated in **Figure 6**.

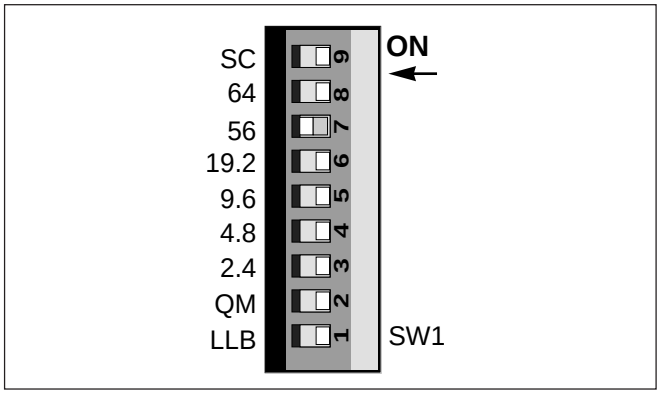


**Figure 6. Rate Selection and Option Switch**

### False Loopback Immunity

ADTRAN's Protected Loopback family of channel units include an algorithm compatible with SARTS, Hekimian, TPI, and other test systems that virtually eliminates false latching loopback occurrences. This algorithm is always enabled at 64 kbps. In addition, ADTRAN's Protected Loopback family features a Protected Loopback mode for further false latching loopback protection.

### Latching Loopback (SW1-1)

During operation up to 56 kbps with LLB enabled (SW1-1 ON), the TRDDB will respond to the legacy DS0 latching loopback sequences and translates OCU and CSU latching loopback sequences to the OCU-R per TR62310 and ANSI T1.417. With LLB OFF, the TRDDB will not respond to latching loopback.

At 64 kbps the function of the LLB switch is altered. When 64 kbps is enabled, placing LLB to ON will permit the TRDDB to respond to the legacy latching loopback sequence per TR62310 and ANSI T1.417. At 64 kbps, with LLB OFF, the TRDDB will enable ADTRAN's Protected Loopback mode.

#### Protected Loopback

ADTRAN's Protected Loopback supports the DDS latching loopback standard in T1E1.2/99-007R1. When enabled, the TRDDB will respond to latching loopback when the idle code preamble is sent prior to the latching loopback sequence specified in TR62310 and ANSI T1.417. See **Table 3** for the latching loopback sequence requirement when Protected Loopback is enabled.

**Table 3. Protected Loopback Mode Requirement T1E1.2/99-007R1 (Latching Loopback)**

| Sequence Function | Byte Code | # of Received Bytes |
|---|---|---|
| Exit Data Protocol | Idle - 11111110 | Minimum of 35 Idle bytes |
| Clear existing loopbacks | Transition in progress (TIP) X0111010 | Minimum of 35 TIP bytes |
| Identify device to be looped | Loopback select code (LSC)<br>X0000101 - DS0<br>X1010101 - OCU<br>X0110001 - CSU<br>X1000001 - NIE | Minimum of 35 LSC bytes |
| Prepare to loop; send MAP code after 30 bytes | Loopback enabled (LBE) X1010110 | Minimum of 100 LBE bytes |
| Activate loopback | Far-End voice (FEV) X1011010 | Minimum of 32 FEV bytes |
| Minimum of 35 TIP bytes required to disable established latching loopback.<br>X = Don't Care bit | | |

### Quality Monitor (SW 1-2)

When QUALITY MONITOR (SW1-2) is ON, the TRDDB monitors the 2-wire loop and 4-wire customer interface data for errors. Excessive errors cause a trouble code to be sent to the network: ASC (4-wire errors) or alternating MOS and ASC (2-wire errors). Customer data transmission is automatically restored when the trouble condition is cleared.

### Rate Selection

Only one rate should be selected plus secondary channel if applicable . Do not select SC if 64 kbps is selected.

## 3. TESTING

Testing for the TRDDB is accomplished using the same test procedures for 4-wire DS0 DP units.

Cable loss data based on wire type and temperature for the Total Reach DDS Nyquist frequency of 13.3 kHz is listed in **Table 4**.

The ADTRAN TRDDB front panel is equipped with logic level bantam test access jacks that permit testing in both directions using a portable test set. Latching DS0 DP loopback sequences are supported. Choose NEAR to test toward the customer loop; choose FAR to test toward the DS0 drop.

In the FAR direction, a DS0 loopback sequence will loop the DS0 DP directly across the drop. In the NEAR direction, a DS0 loopback sequence will loop the unit directly connected to the portable test set.

**Table 4. Cable Type and Temperature Loss Data @ 13.3 kHz**

| Plastic Cable | dB Loss/kft | Paper Cable | dB Loss/kft |
|---|---|---|---|
| 19 Gauge PIC (0F) | 0.5302 | 19 Gauge PULP (0F) | 0.5616 |
| 19 Gauge PIC (70F) | 0.6083 | 19 Gauge PULP (70F) | 0.6415 |
| 19 Gauge PIC (120F) | 0.6610 | 19 Gauge PULP (120F) | 0.6955 |
| 22 Gauge PIC (0F) | 0.912 | 22 Gauge PULP (0F) | 0.9454 |
| 22 Gauge PIC (70F) | 1.0258 | 22 Gauge PULP (70F) | 1.0606 |
| 22 Gauge PIC (120F) | 1.1015 | 22 Gauge PULP (120F) | 1.1370 |
| 24 Gauge PIC (0F) | 1.2571 | 24 Gauge PULP (0F) | 1.2900 |
| 24 Gauge PIC (70F) | 1.3982 | 24 Gauge PULP (70F) | 1.4324 |
| 24 Gauge PIC (120F) | 1.4917 | 24 Gauge PULP (120F) | 1.5268 |
| 26 Gauge PIC (0F) | 1.6751 | 26 Gauge PULP (0F) | 1.6823 |
| 26 Gauge PIC (70F) | 1.8469 | 26 Gauge PULP (70F) | 1.8568 |
| 26 Gauge PIC (120F) | 1.9608 | 26 Gauge PULP (120F) | 1.9718 |

### TRDDB Bidirectional Loopback Support

The TRDDB will execute a bidirectional loopback when performing a DS0 loopback at the TRDDB (**Figure 7**). If the TROCU-R detects a bidirectional loopback during power up synchronization, the TROCU-R allows data to pass on the 4-wire interface by entering pass-thru mode (Figure 7). This allows a standard portable DDS test set, connected to the 4-wire customer interface of the TROCU-R, to verify the integrity of the 2-wire loop by transmitting a test pattern and examining the returning data for synchronization and errors. The TRDDB LBK indicator will illuminate during a TRDDB bidirectional loopback in pass-thru mode. The latching and alternating loopback sequences are defined in **Table 5** and **Table 6.**

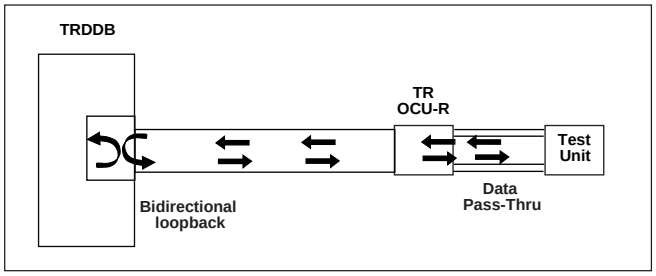


**Figure 7. TRDDB Bidirectional Loopback Pass-Thru Mode**

**Table 5. Latching Loopback Activation Sequence**

| Sequence Function | Byte Code | Number of Received Bytes |
|---|---|---|
| Clear existing loopbacks | Transition in progress (TIP)<br>X0111010 | Minimum of 35 TIP bytes |
| Identify device to be looped | Loopback select code (LSC)<br>X1010101 - OCU<br>X0110001 - CSU<br>X1000001 - NEI<br>X0000101 - DS0 | Minimum of 35 LSC bytes |
| Prepare to loop; send MAP code after 30 bytes | Loopback enabled (LBE)<br>X1010110 | Minimum of 100 LBE bytes |
| Activate loopback | Far-End voice (FEV)<br>X1011010 | Minimum of 32 FEV bytes |
| Minimum of 35 TIP bytes required to disable established latching loopback.<br>X = Don't Care bit | | |

**Table 6. Alternating Loopback Activation Sequence**

| Sequence Function | Received Bytes |
|---|---|
| Active loopback | Four consecutive bytes of specified loopback code<br>X0101010 - OCU<br>X0101000 - CSU<br>X0101100 - DSU |
| Maintain loopback and test for bit errors | Data byte alternating with loopback code<br>example:<br>XDDDDDD1/X0101010 |
| Clear loopback | Four consecutive data bytes without CSU loopback code |
| X = Don't care bit | |

If a DS0 loopback is invoked after the TROCU-R achieves synchronization, some TROCU-R units will not pass or receive data from the CPE or DDS test set. These OCU-Rs will send a MUX-Out-Of-Sync code downstream on the 4-wire customer loop. This is consistent with current DDS testing methods and is referred to as the bidirectional loopback normal mode (**Figure 8**). For testing purposes, the installer may choose to initiate the TROCU-R pass-thru mode. Once the bidirectional loopback is executed in normal mode, unseat and reseat the TROCU-R and allow the unit to train. Once trained, the unit will revert to pass-thru mode for further testing.

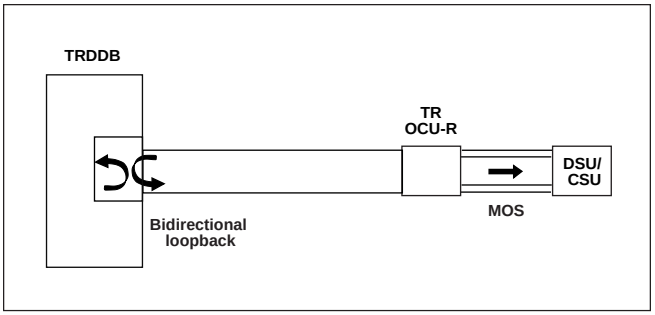


**Figure 8. TRDDB Bidirectional Loopback Normal Mode**

### Remote End Initiated LBK Tests

The TRDDB supports loopbacks generated from the TROCU-R which allow testing to be performed without coordination with the CO or test center. These loopbacks, initiated by the TROCU-R front panel LBK pushbutton aid in system turn-up testing or troubleshooting from the remote end.

The TRDDB responds to a loopback command initiated at the TROCU-R as follows:

Pressing the LBK pushbutton once will initiate a loopback at the TRDDB towards the customer. See **Figure 9**. This allows data to be sent from the remote end to test the local loop and the TROCU-R.

Pressing the LBK pushbutton a second time initiates a loopback at the TROCU-R towards the 4-wire DDS (CPE) interface. See **Figure 10**. Pressing the LBK pushbutton a third time disables all current latching loopbacks initiated by the LBK pushbutton.

If errors exist the loopbacks can help determine the source; either the local loop or the TROCU-R. During a remote end initiated loopback the Total Reach system transmits ASC 9Eh towards the network indicating an out-of-service condition generated by the remote end as seen in Figure 9 and Figure 10.

All Total Reach system latching loopbacks, whether initiated by the craft interface, LBK pushbutton, or via the Test Center or CO, may be disabled by sending 35 TIP bytes <X0111010> where X is a “don’t care”. All existing latching loopbacks may also be disabled by pressing the LBK pushbutton on the CO or remote units.

## 4. REMOTE PROVISIONING AND DIAGNOSTICS

### Control Protocol

Remote access to provisioning and status information is accomplished using ADTRAN Digital System 6 Message protocol, defined in Control and Diagnostic Procedures Practice, Section 6032991-6. Digital System 6 is supported by the TPI 108/109 and 105 portable test set and is supported by Hekimian React 2001 Release 1.900 remote test system. The Total Reach DDS network elements comply with ANSI T1.107-1995, “ Digital Hierarchy Format Specifications Annex G ” which allows remote provisioning, querying, and performance monitoring via in-band control of network elements.

**NOTE**

The REACT 2001 GUI software Release supports ANSI T1.107-1995.

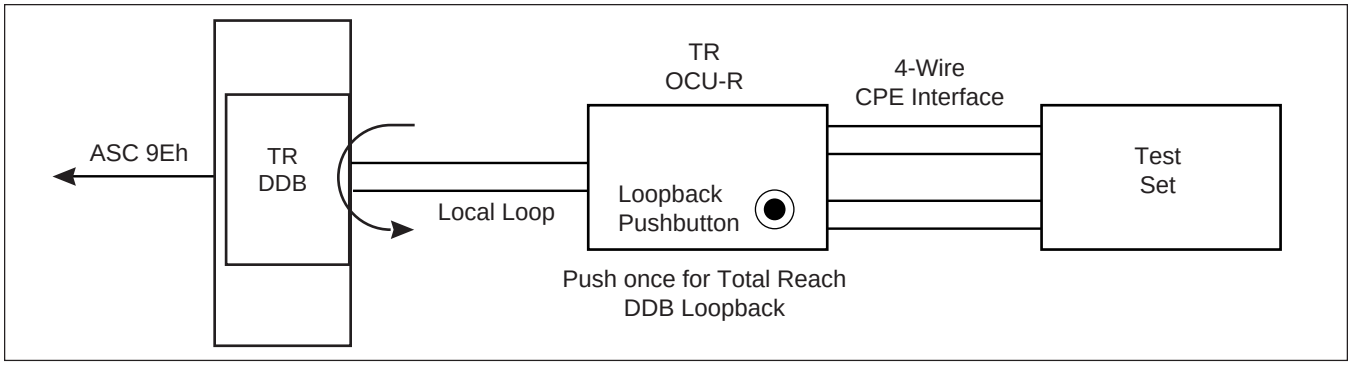


**Figure 9. TROCU-R Remote End Initiated Loopback, Local Loop**

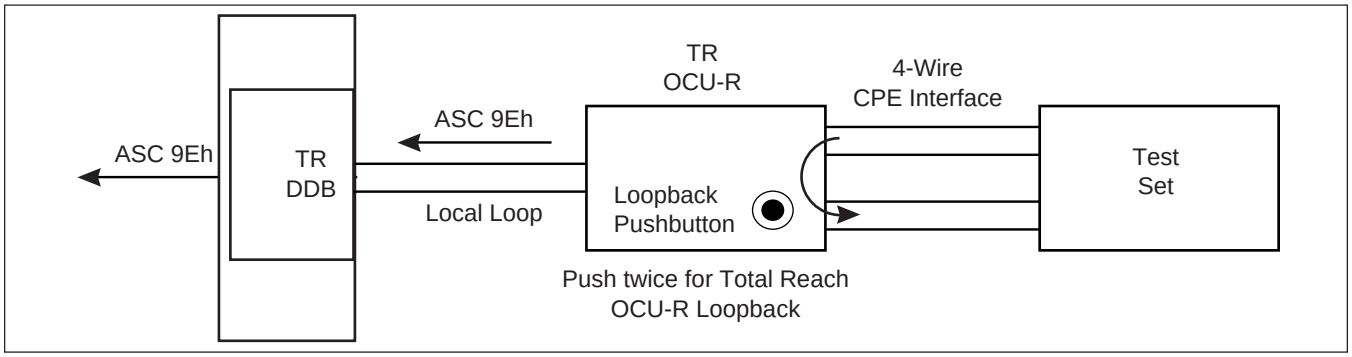


**Figure 10. TROCU-R Remote End Initiated Loopback, Customer Loop**

Remote access is accomplished using a defined set of in-band DS0 byte sequences similar to the latching loopback sequence. Commands issued through the test system are recognized by the individual channel unit, which responds with the appropriate byte sequences. These in-band commands may be used to verify options via dialogs with REACT 2001 and TPI 108/109 test sets. Unit CLEI, serial number, provisioning, and performance information can be retrieved remotely using the Digital System 6 protocol.

### Provisioning and Status

All configuration options can be remotely viewed or provisioned. The front panel Remote (REM) LED indicator *flashes* during control link establishment and remains ON after the channel unit has been remotely provisioned.

If the channel unit has been remotely provisioned, the operator can alternate remote configuration and manual switch settings by pressing the momentary Alternate Provisioning (AP) switch located on the front panel. If the channel unit is removed from the system, the unit retains previous provisioning information in nonvolatile RAM.

The REM indicator remains ON when the channel unit is operating based on Remote Provisioning, and is OFF when operating on manual switches. If the channel unit has never been remotely provisioned, the AP switch has no effect and the REM indicator remains OFF. See Table 1 for LED indicators.

### Out-of-Band Diagnostics

In addition to in-band access to TRDDB performance diagnostics and provisioning via Digital System 6, access is also available out-of-band (non-intrusively) via the craft interface located on the TROCU-R. The TROCU-R displays provisioning information, Total Reach system status, performance monitoring information stored in 15 minute and 24 hour registers for both the TRDDB and TROCU-R, and an event log which time stamps system performance anomalies and threshold violations. Physical access to the terminal interface on the TROCU-R is made by a serial interface connection to a dumb terminal or dumb terminal emulation. Provisioning of the TRDDB can be viewed and changed from the terminal interface on the TROCU-R. Further information about the TROCU-R terminal interface and performance monitoring is found in the TROCU-R practice, P/N 61291023L3-5A.

## 5. DEPLOYMENT GUIDELINES

The TRDDB and TROCU-R use technology intended to eliminate the need for repeaters and concerns over impairments caused by typical noise and bridged taps. Listed below are the loop design guidelines for Total Reach DDS (see Table 3 and **Table 7** for more information):

- All loops must be nonloaded.
- Actual Measured Loss (AML) should not exceed 50 dB at 13.3 kHz (135 Ω termination), the Nyquist frequency of Total Reach DDS.

**NOTE**

The 50 dB AML limit includes 6 dB of signal margin to account for potential near-end cross talk (NEXT) from other digital services that may be provisioned in the same binder group. Loop length should not exceed 50 kft.

- Bridged tap length should not exceed 12 kft.
- Background noise level should not exceed 34 dBrn.
- Impulse noise should not exceed -40 dBm, (+50 dBrn).

**NOTE**

Measure noise with 50 kbit weighting characteristic approximating a filter with a passband of 40 Hz to 30 kHz. Background noise level or impulse noise level is referenced from 56/64 kbps data rate in TR62310.

**Table 7. Total Reach DDS Insertion Loss Measurements**

| **Total Reach DDS** 13.3 kHz compared to 28 kHz for traditional DDS service | | |
|---|---|---|
| **Line Configuration** | **@ 13.3 kHz** | **@ 28 kHz** |
| 27 kft 26 AWG | 50.12 dB | 65.35 dB |
| 36.25 kft 24 AWG | 50.00 dB | 62.50 dB |
| 50 kft 22 AWG | 50.24 dB | 59.33 dB |

## 6. MAINTENANCE

The TRDDB does not require routine maintenance for normal operation.

## 7. 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 Carrier Networks 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 Sales

Pricing/Availability

(800) 827-0807

### ADTRAN Technical Support

Presales Applications/Postsales Technical Assistance
(888) 726-8663

Standard hours: Monday-Friday, 7 a.m. - 7 p.m. CST
Emergency hours: 7 days/week, 24 hours/day

### ADTRAN Repair/CAPS

Return for Repair/Upgrade
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