Model TROCU DP Preferred Option
Total Reach® All-Rate DDS Dataport
Installation and Maintenance

CONTENTS

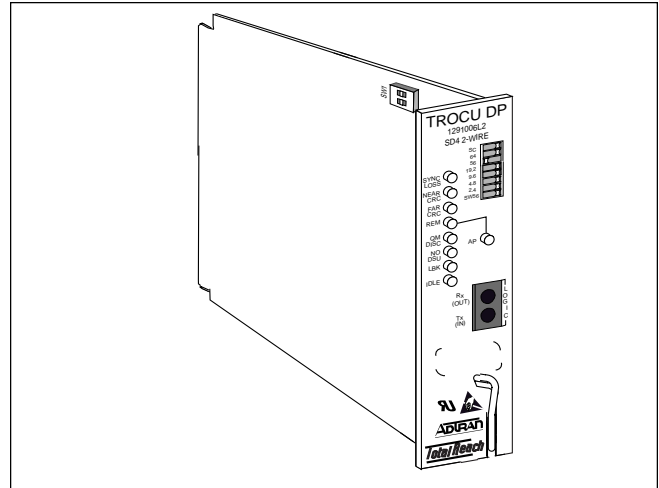## FIGURES

TABLES

1. GENERAL

This practice provides installation and maintenance procedures for the ADTRAN D4 Total Reach Office Channel Unit Dataport (TROCU DP) Preferred Option. The unit is illustrated in **Figure 1**.

Document Revision History

Issue 2 of this document revises the Deployment Guidelines subsection.

Description

ADTRAN D4 TROCU DP Preferred Option is a functional replacement for the D4 OCU DP, delivering data at rates up to 64 kbps on a single copper pair. Used in combination with the Total Reach Digital Data Service Remote termination unit (TRDDS-R), the TROCU DP can accommodate extended loop lengths eliminating the need for DDS repeaters. The TROCU DP span powers the remote TRDDS-R located at the customer premise. The TRDDS-R converts the two-wire signal to the


Figure 1. TROCU DP Preferred Option

traditional four-wire Alternate Mark Inversion (AMI) signal for presentation to the customer.

The TROCU DP occupies a single channel position in the WECO® compatible D4 channel bank or the AT&T® SLC-96 Mode I and III terminal. It provides the interface between a DS0 timeslot of the T-carrier data stream, and the two-wire metallic loop extending to the customer premises.

The TROCU DP may interoperate over the carrier system with another TROCU DP, an OCU DP, a DS0 DP, a 1/0 DCS, or the central office switch. The unit can be located in an end office, hub office, intermediate office, or remote terminal digital carrier system (see **Figure 2**). The two-wire loop is connected using the tip (pin 24) and ring (pin 51) on the D4 backplane.
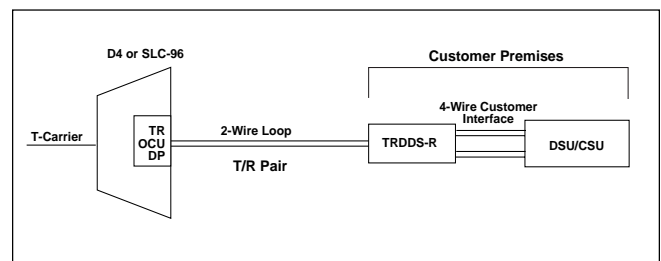
Figure 2. Total Reach DDS Circuit Diagram

> **NOTE**
> **The TROCU DP must be used with an appropriate TRDDS-R unit.**

Features

In addition to operation over extended ranges the TROCU DP incorporates or supports the following:

- Two-wire deployment.
- Repeaterless operation.
- Bridged tap tolerant
- Span power for remote TRDDS-R termination unit.
- Utilization in all D4 channel bank and SLC-96 Mode I or III remote terminal applications.
- NEAR and FAR logic level bantam test access.
- Loop Quality Monitor and A/B signaling options.
- Embedded Digital System 6 capabilities for remote provisioning, configuration, and performance monitoring.

Line Code

The ADTRAN TRDDS incorporates Simple Coded-Pulse Amplitude Modulation (SC PAM), a line code that reduces the bandwidth needed to transport signals over copper loops. The Power Spectrum Density (PSD) of SC PAM complies with Basic Rate Interface (BRI) PSD mask as specified in ANSI T1.601 and is below allowable 2B1Q PSD levels. SC PAM increases the deployment ranges and allowable bridged tap lengths when compared to AMI and 2B1Q. Additionally, SC PAM has an improved spectral compatibility when compared to AMI and 2B1Q.

Sealing Current

The TROCU DP provides a constant 10 mA sealing current to the TRDDS-R. With 10 mA sealing current and span power of -130 Vdc, ADTRAN's TRDDS system is in the A3 Class as specified in Bellcore TR-NWT-001089, Standard for Electrical Safety for Network Telecommunications Equipment.

2. OPTIONS

Select the appropriate OPTIONS and RATE using SW1 and faceplate switches as illustrated in **Figure 3** and **Figure 4**.

> **CAUTION**
> **Select only one option rate. Rate is selected on faceplate switch SW2 by pushing one or two switches to the right toward the inscribed rates. If either SW56 or 64 is selected, the secondary channel (SC) switch may not be selected.**

A/B Signaling

When A/B Signaling (SW1-1) is OFF, the unit derives signaling from the incoming data stream. When A/B signaling is ON, the unit determines the state of the A and B signaling bits using signals present on the backplane of the channel bank. This method assumes that proper signaling has been maintained throughout network tandems and cross connect systems.

> **NOTE**
> **A/B option is only applicable when SW56 is selected; otherwise the option is a "don't care."**

Quality Monitor

When Quality Monitor (SW1-2) is ON, the unit monitors the incoming two-wire loop and four-wire customer interface data for errors. If excessive errors are detected, the unit blocks customer data transmission and sends Abnormal Station Code to the network. Customer data transmission is automatically restored when the trouble condition is cleared. The Quality Monitor feature is recommended for use on multipoint circuits.
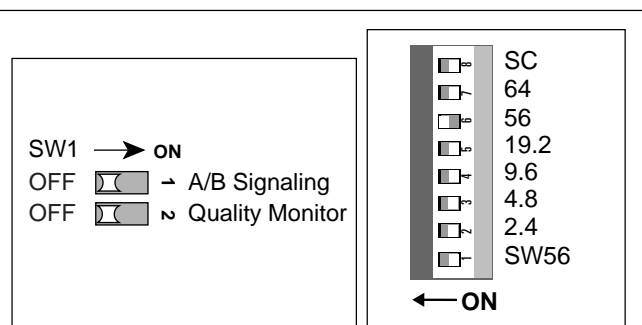
Figure 3. Option Switch

Figure 4. Rate Selection

In lieu of option switches, the TROCU DP Preferred Option has been preprovisioned with feature settings as indicated in **Table 1**.

Table 1. Preprovisioning

Feature	Setting
Latching Loopback	ON
Zero Code Suppression	ON (Unless 56 kbps, SC, and 64 kbps = OFF)
Error Correction	OFF

3. INSTALLATION

C A U T I O N !
SUBJECT TO ELECTROSTATIC DAMAGE
OR DECREASE IN RELIABILITY.
HANDLING PRECAUTIONS REQUIRED.

The TROCU DP plugs directly into a WECO or equivalent D4 channel bank or the ADTRAN ACT 1900/2300 channel bank. No special wiring is required. The two-wire loop uses the T/R (Tip and Ring) pair, pins 24 and 51 of the D4 backplane.

Span-powering is accomplished using -130 V, measured from Tip to Ring. Voltage measured from Tip to GND should indicate approximately -130 V; voltage from Ring to GND should indicate approximately 0.0 V.

When inserted into a powered up backplane the TROCU DP and TRDDS-R will synchronize within 30 to 90 seconds. When synchronized, the SYNC LOSS indicator LED will turn Off. If synchronization cannot be achieved, check the T/R pair for an open circuit or short circuit condition, or load coils (see LED Indicators).

4. TESTING

Testing for the TROCU DP is accomplished using the same test procedures for four-wire OCU and OCU DP units. **Table 2** describes cable loss for the TRDDS Nyquist frequency of 13.3 kHz.

The TROCU DP is equipped with logic level bantam test access jacks that permit testing in both directions using a portable test set. Latching and alternating OCU and CSU loopback sequences are supported. Alternating loopbacks do not operate when the 64 kbps data rate is selected. Choose NEAR to test toward the customer loop; choose FAR to test toward the T-carrier.

In the FAR direction, an OCU loopback sequence will loop the unit directly across the T-carrier system. In the NEAR direction, an OCU loopback sequence will loop the unit directly connected to the portable test set.

NOTE
If 64 kbps is selected, the unit will only respond to latching loopback sequences. Alternating sequences are not valid at this rate.


Table 2. Cable Type 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)	1.6823	26 Gauge PULP (0F)	1.6751
26 Gauge PIC (70F)	1.8568	26 Gauge PULP (70F)	1.8469
26 Gauge PIC (120F)	1.9718	26 Gauge PULP (120F)	1.9608

As an enhancement to automated testing capability, TRDDS eliminates false error indication when invoking NIE, CSU, or DSU loopbacks immediately following release of OCU loopback.

TROCU DP Bidirectional Loopback Support

The TROCU DP will execute a bidirectional loopback when performing an OCU loopback at the TROCU DP as shown in **Figure 5**. If the TRDDS-R detects a bidirectional loopback during power-up synchronization, the TRDDS-R allows data to pass on the four-wire interface by entering into the pass-thru mode. This allows a standard portable DDS test set, connected to the four-wire customer interface of the TRDDS-R, to verify the integrity of the two-wire loop by transmitting a test pattern and examining the returning data for synchronization and errors. The TROCU DP LBK LED will illuminate solid during an OCU loopback. Refer to **Figure 6** for an illustration of the bidirectional loopback pass-thru mode.
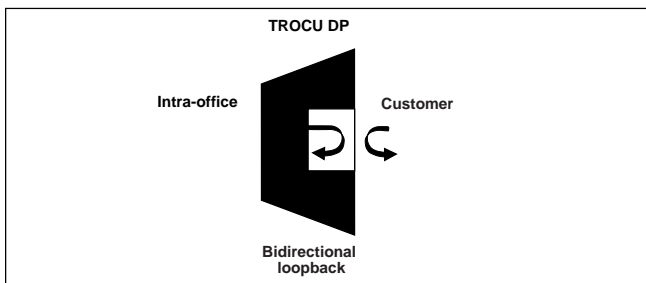
Figure 5. OCU Loopback at the TROCU DP
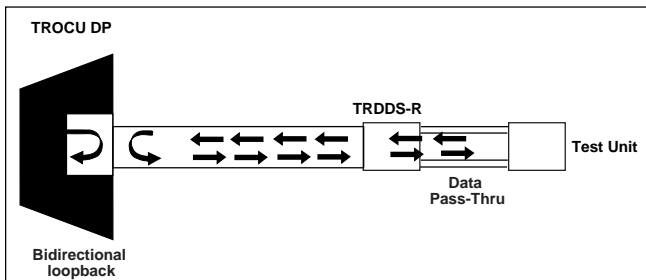
Figure 6. TROCU DP Bidirectional Loopback Pass-Thru Mode

If the TROCU DP bidirectional loopback is invoked after the TRDDS-R achieves synchronization, the TRDDS-R will not pass or receive data from the CPE or DDS test set. This is consistent with current DDS testing methods and is referred to as the TROCU DP bidirectional loopback normal mode. For testing purposes, the installer may choose to initiate the TRDDS-R to pass-thru mode. Once the bidirectional loopback is executed in normal mode, unseat and reseat the TRDDS-R and allow the unit to train-up. Once trained, the TRDDS-R will revert to pass-thru mode for further testing. Refer to **Figure 7** for TRDDS operation during bidirectional loopback in normal mode.
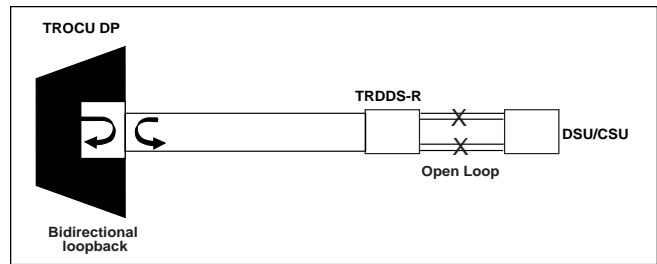
Figure 7. TROCU DP Bidirectional Loopback Normal Mode

5. 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 TRDDS network elements comply with ANSI T1.107-1995, "Digital Hierarchy Format Specifications Annex G" which allows remote provisioning, querying, and performance monitoring via inband control of network elements.

NOTE

The REACT 2001 GUI software Release 1.900 supports ANSI T1.107-1995.

Remote access is accomplished using a defined set of inband 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 inband 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 will Flash 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 between 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 Random Access Memory (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 3** for LED Indicators.

Table 3. LED Indicators

INDICATOR	DESCRIPTION
SYNC LOSS	ON indicates that there is no sync between the TROCU DP and the remote TRDDS-R; check for continuity, load coils, and other abnormal line conditions.
NEAR CRC	ON indicates that there are errors on the incoming data stream; check for the abnormal line conditions closer to the TROCU DP.
FAR CRC	ON indicates that there are errors occurring towards the remote TRDDS-R; check for the abnormal line conditions closer to the TRDDS-R.
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.
QM DISC	ON indicates that the Quality Monitor Disconnect has occurred.
NO DSU	ON indicates the absence of the customer DSU/CSU as determined by the TRDDS-R.
LBK	ON indicates the OCU or CSU loopback activation.
IDLE	ON indicates the presence of the Control Mode Idle toward the network.

6. DEPLOYMENT GUIDELINES

The TROCU DP and TRDDS-R use technology designed to eliminate the need for repeaters and concerns over impairments caused by typical noise and bridge tap. Table 2 describes cable loss for the TRDDS Nyquist frequency of 13.3 kHz. Listed below are the loop design guidelines for TRDDS (See Tables 2 and 4 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 TRDDS.

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 level 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 4. TRDDS Insertion Loss Measurements

TRDDS 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

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).

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