

TROCU DP Preferred Option All-Rate OCU Data Port Installation and Maintenance

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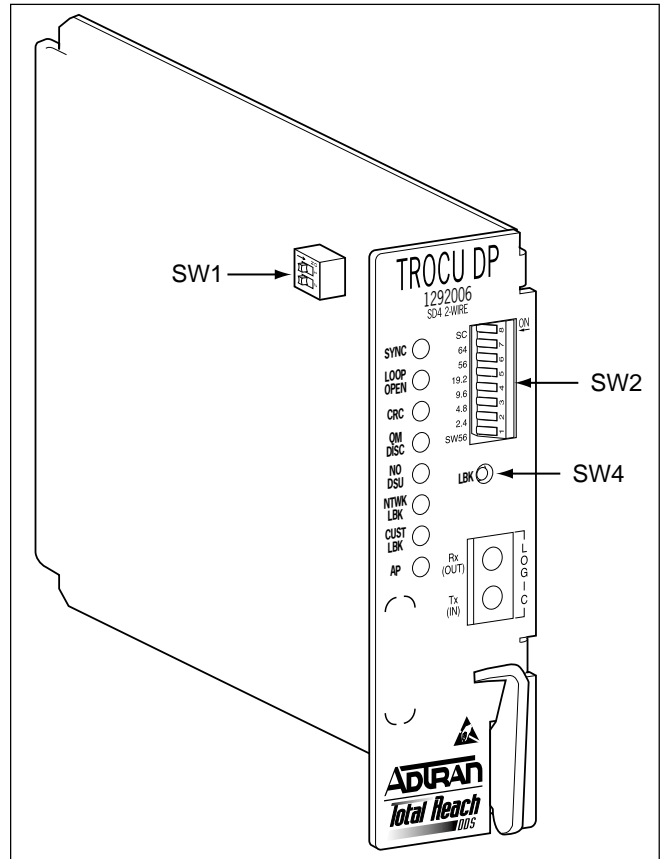


Figure 1. Total Reach OCU DP Preferred Option

1. GENERAL

This practice provides installation and maintenance procedures for the D4 Total Reach® OCU DP Preferred Option All-Rate DDS Data Port.

Figure 1 is an illustration of the TROCU DP (P/N 1292006L2).

Revision History

This revision removed the protected loopback option.

Features

- 2-wire deployment
- Repeaterless operation
- Bridged tap tolerant
- Span power for remote TR DDS-R termination unit
- False loopback immunity
- Utilization in all D4 channel banks
- 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

Description

The D4 Total Reach OCU DP (TROCU DP) is a functional replacement for the D4 OCU DP, delivering data at rates up to 64 kbps over a single copper pair. Used in combination with the TR DDS-R termination unit, the TROCU DP can accommodate extended loop lengths, eliminating the need for DDS repeaters. The TROCU DP span powers the remote TR DDS-R located at the customer premises. The TR DDS-R converts the 2-wire signal to the traditional 4-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. It provides the interface between a DS0 timeslot of the T-carrier data stream and the 2-wire metallic loop extending to the customer premises. The TROCU DP may interoperate over the carrier system with another TROCU DP, Total Reach DDS-DP, DS0 DP, 1/0 DCS, or switch and can be located in an end office, hub office, or intermediate office (see **Figure 2**).

NOTE

The TROCUDP must be used with an appropriate TR DDS-R unit.

2. INSTALLATION



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*).

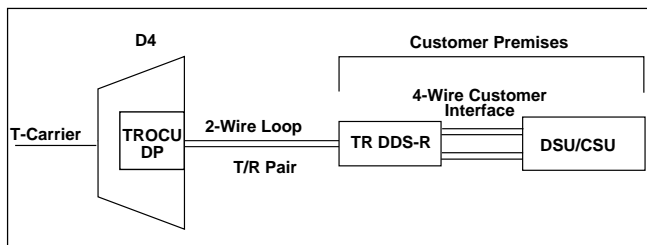


Figure 2. Total Reach DDS Circuit Diagram

Compliance Codes

The TROCU DP is intended for installation in a restricted access location in an enclosure with an Installation Code of “B” or “E.”

- Max input current @ max load = 100 mA @ -48 Vdc.

Table 1 shows the compliance codes for the TROCU DP.

Table 1. Compliance Codes

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

Signal Pair

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 2-wire loop uses the T/R (Tip and Ring) pair, pins 24 and 51 of the D4 backplane. The Total Reach DDS system is not polarity sensitive.

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 -130 Vdc or less depending on voltmeter impedance.

Synchronization and LED Indication

The TROCU DP and TR DDS-R typically require 30 to 90 seconds to reach synchronization. Once synchronized, the SYNC indicator LED will turn GREEN. If the units cannot synchronize, check the T/R pair for open- or short-circuit conditions or load coils.

Refer to **Table 2** for synchronization and operational status LED indication.

Table 2. LED Indicators

LED	Description
SYNC	Red indicates that there is no sync between the TROCU DP and the remote TR DDS-R; check for continuity, load coils, and other abnormal line conditions. Green indicates loop synchronization.
LOOP OPEN	ON indicates no sealing current present on the local loop; check for continuity and proper Total Reach DDS termination at remote end (TR DDS-R).
CRC	ON indicates that there are errors on the 2-wire loop; check for abnormal loop conditions.
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 TR DDS-R.
NTWK LBK	ON indicates an OCU loopback towards the network exists at the TROCU DP. Flashing indicates a loopback towards the network exists at the TR DDS-R or a channel loopback at the CSU.
CUST LBK	ON indicates a loopback towards the customer exists at the TROCU DP.
AP	ON indicates that the unit has been remotely provisioned; Flashing indicates that the remote control link is active. Push and hold the LBK button for 5 seconds to toggle between manual and remote provisioning.

3. OPTIONS

Select the appropriate Options and Rate using circuit board DIP Switch (SW1) and the front panel Dip Switch (SW2) as illustrated in **Figure 3** and **Figure 4**. SW1 must be provisioned prior to circuit board installation.

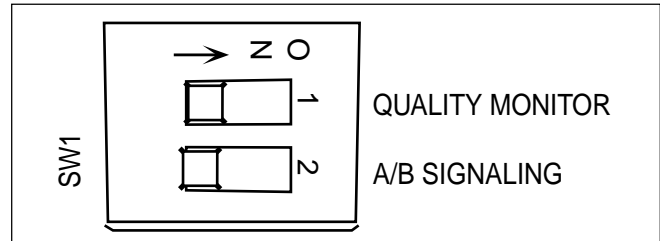


Figure 3. Option Switch

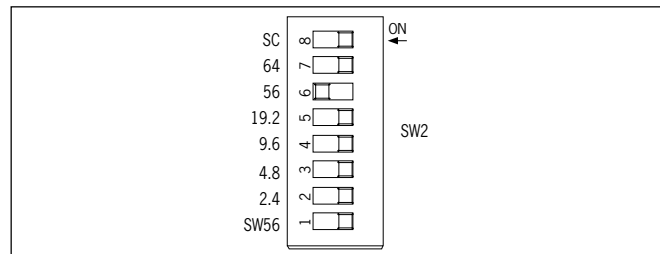


Figure 4. Rate Selection

Error Correction

Error Correction is not an option on this unit. It is always disabled.

Zero Code Suppression

Zero Code Suppression is not an option on this unit. It is always enabled for all rates except 64 kbps and 56 kbps with Secondary Channel. The unit ensures pulse density in the T-carrier data stream.

Latching Loopbacks

Latching Loopbacks are always enabled. The TROCU DP will respond to the legacy latching loopback sequence as described in TR62310 and ANSI T1.417.

False Loopback Immunity

ADTRAN's Protected Loopback family of channel units includes an algorithm compatible with SARTS, Hekimian, TPI, and other test systems that virtually eliminates false latching loopbacks. Immunity is automatically enabled at 64 kbps.

Quality Monitor

When Quality Monitor (SW1-2) is ON, the TROCU DP monitors the incoming 2-wire loop and 4-wire customer interface data for errors. If excessive errors are detected, the unit blocks the customer's data transmission and sends an abnormal station code (ASC) to the network. Customer data transmission is automatically restored when the trouble condition is cleared.

A/B Signaling

When A/B Signaling (SW1-3) 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 on the channel bank. This method assumes that proper signaling has been maintained throughout the network tandems and cross connect systems.

NOTE

A/B signaling option is only applicable when SW56 is selected; otherwise it is a "don't care."

Data Rate

Rate is selected on the front panel by pushing the desired switch to the left toward the enumerated rates.

4. TESTING

Testing for the TROCU DP is accomplished using the same test procedures for 4-wire OCU DP units.

Table 3 describes cable loss for the Total Reach DDS 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 OCU DP loopback sequences are supported. Choose NEAR to test toward the customer loop; choose FAR to test toward the T-carrier. In the FAR direction, an OCU DP loopback sequence will loop the unit directly across the T-carrier system. In the NEAR direction, an OCU DP loopback sequence will loop the unit directly connected to the 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.

NOTE

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

Table 3. Cable Type and Temperature Loss Data @ 13.3 kHz

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

Dual Function LBK Button

The TROCU DP front panel loopback pushbutton (LBK) allows loopbacks to be activated without test equipment or centralized test coordination. Press the LBK button once to loop the TR DDS-R toward the network. Pressing the LBK button during an active loopback releases any loopbacks in the Total Reach system. Press and hold the LBK button for 5 seconds to toggle between local and alternate (remotely provisioned) option settings.

Loopback LED Operation

TROCU DP system loopback status is indicated via the front panel NTKW LBK and CUST LBK LEDs. An active loopback occurring at the unit being viewed is indicated by a solid loopback LED. A flashing loopback LED indicates a loopback condition at the remote unit. When a loopback towards the network is initiated, the NTKW LBK LED is illuminated. A loopback generated towards the customer illuminates the CUST LBK LED.

TROCU DP Bidirectional Loopback Support

The TROCU DP will execute a bidirectional loopback when performing an OCU DP loopback at the TROCU DP. This allows a standard portable DDS test set, connected to the 4-wire customer interface of the TR DDS-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 TROCU DP's NTKW LBK and CUST LBK indicators will illuminate during a TROCU DP bidirectional loopback.

Refer to **Figure 5** for an illustration of the bidirectional loopback. The latching and alternating loopback sequences are defined in **Table 4** and **Table 5**.

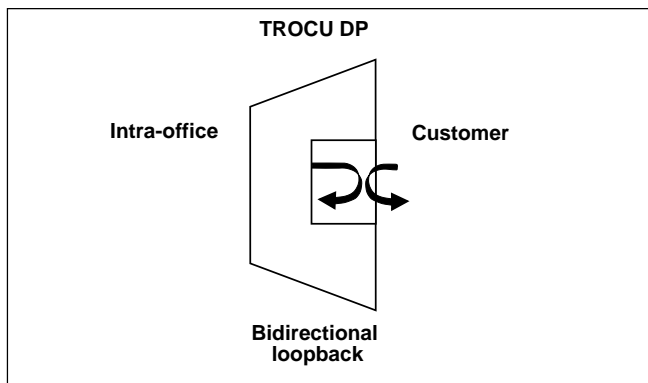


Figure 5. OCU DP Bidirectional Loopback

Remote End Initiated LBK Tests

The TROCU DP supports loopbacks generated from the TR DDS-R which allow testing to be performed without coordination with the CO or test center.

Table 4. Latching Loopback Activation Sequence

Sequence Function	Byte Code	Number of Received Bytes
Clear existing loopbacks	Transition in progress (TIP) X0111010	Minimum of 35 TIP bytes
Identify device to be looped	Loopback select code (LSC) X1010101 - OCU X0110001 - CSU X1000001 - NEI	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. X = Don't Care bit		

Table 5. Alternating Loopback Activation Sequence

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

Loopbacks initiated by the TR DDS-R front panel LBK pushbutton aid in system turn-up testing or troubleshooting from the remote end. The TROCU DP will respond to a loopback command initiated at the TR DDS-R as follows:

- Pressing the TR DDS-R LBK pushbutton once will initiate a loopback at the TROCU DP towards the customer. See **Figure 6**. This allows data to be sent from the remote end to test the local loop and the TR DDS-R. This loopback is indicated by a flashing CUST LED on the TR DDS-R and a solid CUST LED on the TROCU DP.
- Pressing the LBK pushbutton a second time initiates a loopback at the TR DDS-R towards the 4-wire DDS (CPE) interface. See **Figure 7**. A solid CUST LBK LED on the TR DDS-R indicates a loopback at the TR DDS-R towards the customer equipment.
- Pressing the TR DDS-R LBK pushbutton a third time disables all current latching loopbacks initiated by the TR DDS-R LBK pushbutton.

If errors exist, the loopbacks can help determine the source, either the local loop or the TR DDS-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 shown in Figures 6 and 7.

All Total Reach system latching loopbacks, whether initiated by a LBK pushbutton, CO, or from a remote Test Center, can be released by sending 35 DDS loop down TIP bytes <X0111010> (where X is a “don’t care” bit). All existing latching loopbacks can also be disabled by pressing the LBK pushbutton on the CO or remote unit.

Latching Loopback Timeout

Latching loopbacks created by either the pushbutton on the TROCU DP or the TR DDS-R will automatically be released after 120 minutes, returning the system to normal operation.

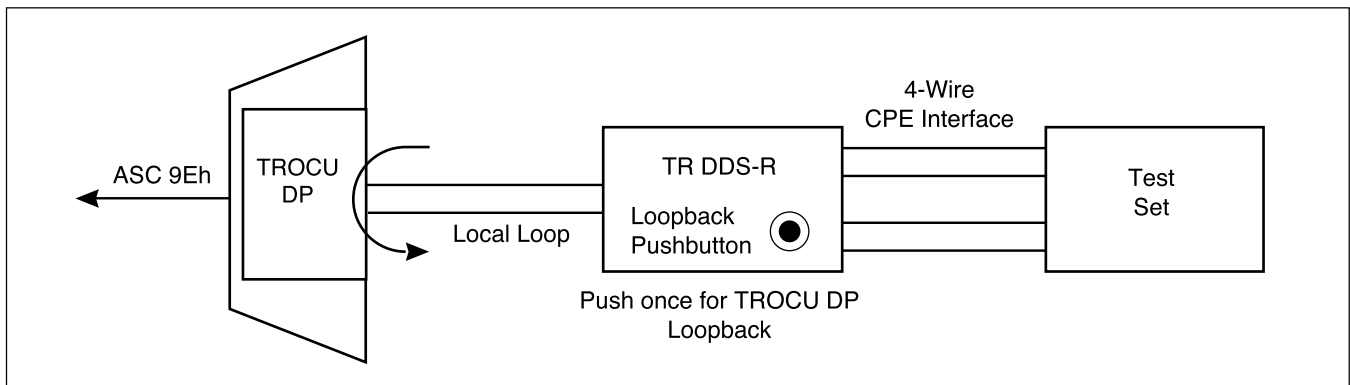


Figure 6. Total Reach DDS-R Remote End Initiated Loopback, Local Loop

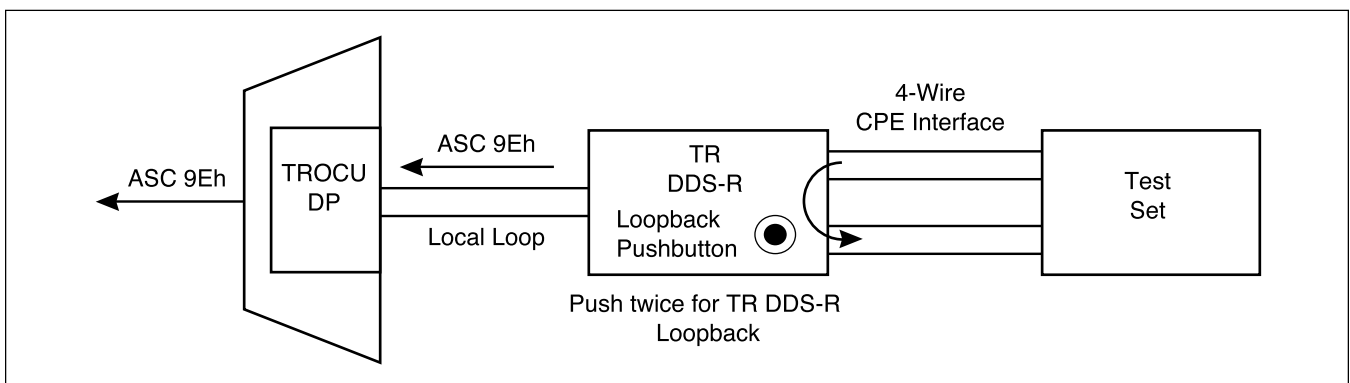


Figure 7. Total Reach DDS-R Remote End Initiated Loopback, Customer Loop

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 sets 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 1.900 supports ANSI T1.107-1995. 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 can be used to verify options via dialogs with REACT 2001, TPI 105 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 AP LED flashes during control link establishment and remains ON after the TROCU DP has been remotely provisioned. If the TROCU DP has been remotely provisioned, the operator can alternate between remote configuration and manual switch settings by depressing the front panel LBK pushbutton for 5 seconds. If the TROCU DP is removed from the system, the unit retains previous provisioning information in nonvolatile RAM. The AP indicator remains ON when the TROCU DP is operating based on remote provisioning, and is OFF when operating on manual switch settings. See Table 2 for LED indicators.

6. DEPLOYMENT GUIDELINES

The TROCU DP and TR DDS-R use technology intended to eliminate the need for repeaters and

concerns over impairments caused by typical noise and bridged tap. Listed below are the loop design guidelines for Total Reach DDS (see Table 3 and **Table 6** 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.

Table 6. 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

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 dBm.
- Impulse noise should not exceed -40 dBm, (+50 dBm).

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 TR6210.

7. MAINTENANCE

The TROCU DP does not require routine maintenance for normal operation.

8. WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within ten (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 60000087-10).

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 and availability
(800) 827-0807

ADTRAN Technical Support

Pre-sales Applications/Post-sales Technical Assistance
(800) 726-8663

Standard support hours:

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

ADTRAN Repair/CAPS

Return for repair/upgrade
(256) 963-8722

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