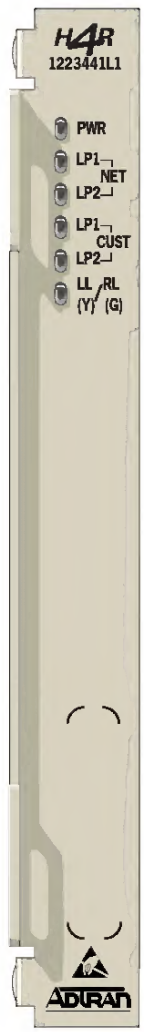
# T200 T1 HDSL4 Repeater (H4R)
# Installation and Maintenance Practice

**Part Number - 61223441L1-5C**




CLEI: T1R6T86D_ _
October 2004

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## Revision History

| Revision | Date | Description of Changes |
|---|---|---|
| C | October 2004 | Updated to add Bad Splice Detect and Fast Retrain feature descriptions |

## Conventions

The following typographical conventions are used in this document:

This font indicates a cross-reference link. First-time references to tables and figures are shown in **this font**.

This font indicates screen menus, fields, and parameters.

THIS FONT indicates keyboard keys (ENTER, ESC, ALT). Keys that are to be pressed simultaneously are shown with a plus sign (ALT+X indicates that the ALT key and X key should be pressed at the same time).

*This font* indicates references to other documentation and is also used for emphasis.

`This font` indicates on-screen messages and prompts.

**`This font`** indicates text to be typed exactly as shown.

**This font** indicates silkscreen labels or other system label items.

**This font** is used for strong emphasis

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**NOTE**

Notes inform the user of additional but essential information or features.

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**CAUTION**

Cautions inform the user of potential damage, malfunction, or disruption to equipment, software, or environment.

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**WARNING**

Warnings inform the user of potential bodily pain, injury, or death.

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## Training

ADTRAN offers training courses on our products. These courses include overviews on product features and functions while covering applications of ADTRAN's product lines. ADTRAN provides a variety of training options, including customized training and course taught at our facilities or at customer sites. For more information about training, please contact us.

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# T200 T1 HDSL4 Repeater

## 1. GENERAL

This practice is an installation and maintenance guide for the ADTRAN® T200 T1 HDSL4 Repeater (T200 H4R). **Figure 1** illustrates the front panel of the T200 H4R (P/N 1223441L1).


**Figure 1. T200 T1 HDSL4 Repeater**

# 2. DESCRIPTION

HDSL4 provides extended range T1 (DS1) transport on the telecommunications network. HDSL4 features spectral compatibility with ADSL and other transport technologies.

The T200 H4R performs signal regeneration to extend the range of the HDSL4 circuit.

The H4TU-C (Central Office Transceiver) unit receives DSX-1 input signals from the network through the chassis, transports them across the HDSL4 circuit, and terminates them through an H4TU-R remote unit which provides a traditional DS1 signal to customer equipment. The H4TU-C provides testing, provisioning, and performance monitoring capabilities that address circuit status.

An ADTRAN HDSL4 loop may consist of an H4TU-C, an H4TU-R, and up to three H4Rs.

## Features

The basic features of the T200 H4R, include the following:

- TC PAM line coding
- Lightning protection
- In-band loopback control
- Standard Type 200 or Type 400 form factor repeater apparatus case design
- Remote provisioning and pass-through performance monitoring
- Bad Splice Detection
- Fast Retrain

### Bad Splice Detection Feature

The T200 H4R supports the Runtime TScan 2.0™ bad splice detection feature, an ADTRAN proprietary non-intrusive algorithm for detection of anomalies (bad splices) in the copper pair.

Data transmission transceivers (especially echo-cancelled technologies) are subject to performance degradations and errors in the presence of bad splices. A splice may be benign for a period of time, allowing a circuit to behave appropriately for portions of the day. However, over time the splice will oxidize and incur small, rapid changes in impedance. This inconsistency in behavior makes the problem difficult to locate. Additionally, an impedance change that is large enough to cause the transceiver trouble may still be small enough to be undetected by test equipment utilized on the copper pairs. Therefore a non-intrusive method of identifying these bad splices has been developed to aid the customer in troubleshooting their distribution plant.

**NOTE**

The Splice Detection Feature is included with this product as an aid to troubleshooting. Due to inconsistency in environmental conditions and their effect on telecommunications plant, ADTRAN cannot guarantee the accuracy of the measurements. Comparison to existing engineering drawings should provide exact locations of suspect splices indicated by ADTRAN algorithms.

Splices that are varying in impedance will cause the HDSL data pump to see a reduced and/or fluctuating signal quality (margin). The HDSL data pump will attempt to track these changes. When the changes become too severe, errors or loss of synchronization result.

### View Splice Results Screen

The Bad Splice Detection feature is accessed from the Troubleshooting screen via the craft access terminal of the H4TU-C or H4TU-R. Selecting the View Splice Results option from the Troubleshooting screen menu displays the screen illustrated in **Figure 2**. Results will be reported in the Splice Detection Results column for each transceiver:

- NTF - Reported if the unit is active and no problems have been detected or the number of anomalies detected have not yet reached the detection count threshold, which facilitates the reporting of the result to this screen. (Eight is the present threshold.)
- LOS - Reported if the remote unit has not been detected.
- Number - Reported if an anomaly has been detected a number of times that exceeds the detection count threshold of eight. The number shown in this column represents the number of feet from the transceiver (Reference Point) to that anomaly. This number will also reflect the highest anomaly count seen, as it is possible to have more than one bad splice per circuit. This screen will report the worst (most frequently detected) anomaly.

In this example, a detection has occurred approximately 650 feet from an H4TU-C module on Loop 2 of the HDSL4 circuit.

```
Circuit ID:HTSVALHDSL4                                        06/17/04 07:32:04
                     Press ESC to return to previous menu

* Note: Chronic Circuit Results are only valid after all other circuit    *
* qualification tests have been performed and failed to show a trouble !! *

Splice Detector Version 1 Result Definitions:
---------------------------------------------
NTF    - No Trouble Found yet.
LOS    - Unit not in sync.
Number - Distance from Reference point (in ft.) of suspect splice.

 Reference    Splice Detection Results        Version          Result Shown
   Point        Loop 1        Loop 2          Number             for date
 ---------    ----------    ----------        -------            MM/DD/YY
   H4TUC          NTF           650              01              --------
   H4TUR          NTF           NTF              01              06/17/04
   H4RU1 NET      NTF           NTF              01
   H4RU1 CST      NTF           NTF              01            (B)Back
```

**Figure 2. Splice Results Screen**

### Fast Retrain Feature

Fast Retrain is an ADTRAN proprietary feature whose intent is to minimize downtime when an intermittent non power-related impairment (bad splice, noise burst, etc.) affects the HDSL loop and cannot be bridged.

HDSL2 and HDSL4 transceivers normally train in approximately 25 to 30 seconds. For an initial circuit turn-up, this is not a big issue. However, once service has been established on the circuit, any large down-time will interrupt communications on the circuit. A loss of synchronization on the HDSL loop can cause excessive down times due not only to the 30-second HDSL retrain time, but also further delays due to the higher level protocols in the network going through re-synchronization. On the older generation HDSL2 and HDSL4 units, a 1-second loss of HDSL frame synchronization would cause the data pumps to retrain. This retrain would take approximately 25 seconds during which AIS would be sent to the terminating equipment. The reception of AIS by the terminating equipment then might trigger higher level protocol re-synchronizations.

In an effort to minimize this down time, the Fast Retrain feature has been implemented. If an impairment (bad splice, for example) causes the HDSL data pump to lose frame synchronization for 500 msec or longer, instead of retraining, a fast retrain will be attempted. This abbreviated train can achieve data mode in 5 to 7 seconds. A successful fast retrain should be evident by watching the Span Status screen and by reduced unavailable seconds (UAS) in the PM data for each LOS alarm recorded.

**NOTE**

Fast-Retrain capable units must be installed on both ends of the HDSL4 circuit for this feature to function properly. Also, if there is a failure of a fast retrain attempt, for any reason, then the traditional (25-30 second) retrain will be initiated.

## Compatibility

The T200 H4R is used in conjunction with any T1.418 compliant span powering H4TU-C and an H4TU-R. Compatible ADTRAN HDSL4 transceiver units are listed in **Table 1**.

**Table 1. ADTRAN Unit Compatibility**

| Part Number | Unit Name |
|---|---|
| 118141*x*L*y* | Total Access 3000 H4TU-C |
| 122*x*401L*y* | 220 H4TU-C |
| 122*x*403L*y* | DDM+ H4TU-C |
| 122*x*404L*y* | 3192 H4TU-C |
| 122*x*407L*y* | Soneplex H4TU-C |
| 122*x*424L*y* | T200 H4TU-R, Local Power |
| 122*x*426L*y* | T200 H4TU-R, Span Power |

x = any generic number; y = any list number

Due to span power limits, the number of H4Rs permitted in the circuit depends upon the type of H4TU-C utilized. An ADTRAN T200 H4R provides DS1 transport on all revised resistance design (RRD) 26 AWG and/or 24 AWG loops. Three ADTRAN T200 H4R repeaters may be added to extend the range of a loop.

Repeater placement is determined by the following criteria:

- On single H4R loops, only on the attenuation properties of the loop segment must be considered.
- For a circuit requiring two H4Rs, both segment attenuation as well as segment DC resistance requirements be satisfied.
- For a circuit requiring three H4Rs, H4TU-C and H4TU-R hardware requirements, segment attenuation, and segment DC resistance requirements must all be satisfied.

Refer to the "HDSL4 Deployment Guidelines" section of this practice and the deployed H4TU-C.

## Compliance

Table 2 shows the compliance codes for the T200 H4R. The T200 H4R is NRTL listed to the applicable UL standards. The T200 H4R is to be installed in a restricted access location and in a Type "B" or "E" enclosure only.

**Table 2. Compliance Codes**

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

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by ADTRAN could void the user's authority to operate this equipment.

# 3. INSTALLATION


After unpacking the T200 H4R, inspect it for damage. If damage has occurred, file a claim with the carrier, then contact ADTRAN Customer Service. Refer to "Appendix A, Warranty" for further information. If possible, keep the original shipping container for returning the T200 H4R for repair or for verification of shipping damage.

There are no manual option settings for the H4R.

## Shipping Contents

The contents include the following items:

- T200 TI HDSL4 Repeater
- T200 TI HDSL4 Repeater Job Aid

**CAUTION**

Electronic modules can be damaged by ESD. When handling modules, wear an antistatic discharge wrist strap to prevent damage to electronic components. Place modules in antistatic packing material when transporting or storing. When working on modules, always place them on an approved antistatic mat that is electrically grounded.

## Installation Instructions

To install the T200 H4R, perform the following steps:

1. If present, remove the Access Module Blank from the appropriate slot of the enclosure.
2. Hold the T200 H4R by the front panel while supporting the bottom edge of the module.
3. Align the module edges to fit in the lower and upper guide grooves for the module slot.
4. Slide the module into the slot. Simultaneous thumb pressure at the top and at the bottom of the module will ensure that the module is firmly seated against the backplane of the enclosure.

When the unit first powers up it runs the a series of self-tests. Once the power up self-test is complete the status LEDs will reflect the true state of the hardware.

H4R power is derived from an H4TU-C, independent of line impedance or wire gauge. The operating power from the H4TU-C may also be used to span power the H4TU-R.

The T200 H4R is designed for deployment in any Type 200 form factor enclosure.

When installing the ADTRAN T200 H4R refer to the Installation and Maintenance Practice for the housing being used.

# 4. CONNECTIONS

All connections are made through card edge connectors. **Table 3** provides the card edge pin assignments.

**CAUTION**

The H4R dissipates a maximum of 5.4 watts.

**NOTE**

Ensure that the chassis ground is securely connected to the apparatus case. Ground pin designations are defined in Table 3.

**Table 3. H4R Card Edge Pin Assignments**

| Pin | Description |
|---|---|
| 1 | Ground |
| 5 | HDSL4 Loop 1 Tip (Customer) |
| 7 | HDSL4 Loop 1 Tip (Network) |
| 11 | Ground |
| 13 | HDSL4 Loop 1 Ring (Network) |
| 15 | HDSL4 Loop 1 Ring (Customer) |
| 17 | –48 VDC Return (ground) |
| 27 | Ground |
| 41 | HDSL4 Loop 2 Tip (Network |
| 47 | HDSL4 Loop 2 Ring (Network) |
| 49 | HDSL4 Loop 2 Ring (Customer) |
| 55 | HDSL4 Loop 2 Tip (Customer) |

# 5. HDSL4 DEPLOYMENT GUIDELINES

Refer to the H4TU-C Installation and Maintenance Practice, HDSL4 Deployment Guidelines section, for loop parameters including attenuation and loop resistance considerations.

**NOTE**

The H4TU-C with part numbers 1221401L6, 1221403L6, and 1221404L6 support only one H4R in the HDSL4 circuit.

Refer to the Detailed Status Screen by accessing the menus on the H4TU-C craft terminal interface for current Signal-to-Noise Ratio Margin and Attenuation status indications for the circuit.

# 6. FRONT PANEL LEDS

The ADTRAN T200 H4R provides front panel LEDs to display status information. See **Table 4** for a listing of the front panel LEDs and their indications.

**Table 4. Front Panel LEDs**

| Unit | LED | Indication | Description |
|---|---|---|---|
|  | **PWR** | ○ Off<br>● On | No span power is present<br>Span power is present |
| | **LP1/LP2 NET** | ○ Off<br>● Solid Green<br>✹ Fast Flashing Green<br>✹ Slow Flashing Green<br>● Solid Yellow<br>✹ Flashing Yellow<br>● Solid Red<br>✹ Flashing Red | No span power is present<br>Synchronized with an Signal to Noise Ratio (SNR) margin greater than the recommended SNR Margin Alarm Threshold<br>(Flashing 3 times per second) Attempting to synchronize with the H4TU-C<br>(Flashing once per second) Synchronized with a SNR margin greater than the SNR Margin Alarm Threshold, and the attenuation is greater than the Loop Attenuation Alarm Threshold<br>Synchronized with a SNR margin greater than 0 dB but less than the SNR Margin Alarm Threshold<br>Synchronized with a SNR margin greater than 0 dB but less than the SNR Margin Alarm Threshold, and the attenuation is greater than the Loop Attenuation Alarm Threshold<br>Synchronized with a SNR margin of 0 dB<br>(Flashing once per second) Synchronized with a SNR margin of 0 dB, and the attenuation is greater than the Loop Attenuation Alarm Threshold |
| | **LP1/LP2 CUST** | ○ Off<br>● Solid Green<br>✹ Fast Flashing Green<br>✹ Slow Flashing Green<br>● Solid Yellow<br>✹ Flashing Yellow<br>● Solid Red<br>✹ Flashing Red | No span power is present<br>Synchronized with an Signal to Noise Ratio (SNR) margin greater than the SNR Margin Alarm Threshold<br>(Flashing 3 times per second) Attempting to synchronize with the H4TU-R<br>(Flashing once per second) Synchronized with a SNR margin greater than the SNR Margin Alarm Threshold, and the attenuation is greater than the Loop Attenuation Alarm Threshold<br>Synchronized with a SNR margin greater than 0 dB but less than the SNR Margin Alarm Threshold<br>Synchronized with a SNR margin greater than 0 dB but less than the SNR Margin Alarm Threshold, and the attenuation is greater than the Loop Attenuation Alarm Threshold<br>Synchronized with a SNR margin of 0 dB<br>(Flashing once per second) Synchronized with a SNR margin of 0 dB, and the attenuation is greater than the Loop Attenuation Alarm Threshold |
| | **LL/RL** | ● Solid Yellow<br>✹ Flashing Yellow<br>● Solid Green | Indicates that a loopback is active at the H4R towards the H4TU-C<br>H4R is armed but not in loopback<br>Indicates that a loopback is active at the H4R towards the H4TU-R |

# 7. H4R CAPACITY GUIDELINES

The ADTRAN T200 H4R is designed for installation in a prewired Type 200 or Type 400 enclosure. Capacity guidelines for deployment are provided in **Table 5**.

**Table 5. T200 H4R Enclosure Capacity**

| Part Number | Unit Description | Capacity |
|---|---|---|
| 115004311 | 4-Slot, Air filled | 4 |
| 1150043L2 | 4-Slot, Gel filled | 4 |
| 1150087L1 | T200 single slot (above ground only) | 1 |
| 1150090Lx | 24-Slot, T400 high capacity cabinet (Pad or Pole Mounted | 24 |

# 8. MAINTENANCE

The ADTRAN T200 H4R requires no routine maintenance for normal operation. In case of equipment malfunction, perform an in-band loopback from the Central Office. If a malfunction is confirmed, replace the unit.

The ADTRAN T200 H4R has looping capability through the channel allowing digital loopback in fault isolation. The loopback is activated remotely. The type of loopbacks the H4R supports will be dependent upon the loopback capabilities of the transceiver units utilized on the circuit. Refer to the Installation and Maintenance Practice of the specific H4TU-C or H4TU-R for a list of loopback codes.

Performance monitoring, diagnostics, and loopbacks are also available from the craft interface at the H4TU-C or H4TU-R.

ADTRAN does not recommend that repairs be attempted in the field. Repair services may be obtained by returning the defective unit to ADTRAN. Refer to "Appendix A, Warranty" for further information.

# 9. SPECIFICATIONS

Soecifications for the T200 T1 HDSL4 Repeater are detailed in **Table 6**.

**Table 6. T200 T1 HDSL4 Repeater Specifications**

| Specification | Description |
|---|---|
| **Loop Interface** | |
| Modulation Type: | 16 TC PAM |
| Mode: | Full Duplex, Partially overlapped echo canceling |
| Number of Pairs: | 2 |
| Line Rate: | 1.552 Mbps |
| Baud Rate: | 261.333 k baud |
| Loop Loss: | Refer to "HDSL4 Deployment Guidelines" on page 7. |
| Bridged Taps: | Single Taps < 2000 ft., Total Taps < 2500 ft. |
| Performance: | Compliant with T1.418-2000 (HDSL4 Standard, Issue 2) |
| H4TU-C Transmit Power (Data) Level: | 14.1 ±0.5 dBm (0 to 400 kHz) |
| H4TU-C Transmit Power (Activation) Level: | 14.1 ±0.5 dBm (0 to 307 kHz) |
| Input Impedance: | 135 obms |
| Maximum Loop Resistance: | Refer to "HDSL4 Deployment Guidelines" on page 7. |
| Return Loss: | 12 dB (50 kHz to 200 kHz) |
| **Power**<br>*Tested with the ADTRAN H4TU-R (P/N 1223426L1) and H4R (P/N 1223445L1)* | |
| H4R Input Power: | 5.0 watts (span powered by H4TU-C) |
| **Clock** | |
| Clock Sources:<br>Internal Clock Accuracy: | DSX-1 Derived (with HDSL4 frame bit stuffing)<br>±25 ppm (Exceeds Stratum 4), Meets T1.101 Timing Requirements |
| **Tests** | |
| Diagnostics: | Loopback initiated with in-band codes or from H4TU-C or H4TU-R craft interface |
| **Physical** | |
| T200 Office Repeater Shelf-Mounted, Weight | < 1lb. |
| **Environment** | |
| Standard Operating Temperature:<br>Storage Temperature: | –40°C to +70°C<br>–40°C to +85°C |
| **Compliance** | |
| UL 60950<br>NEBS Level 3<br>FCC 47CFR Part 15, Class A | |
| **Part Number** | |
| T200 T1 HDSL4 Repeater: | 1223441L1 |

# Appendix A
# Warranty

## WARRANTY AND CUSTOMER SERVICE

ADTRAN will replace or repair this product within the warranty period if it does not meet its published specifications or fails while in service. Warranty information can be found at www.adtran.com/warranty.

Refer to the following subsections for sales, support, Customer and Product Service (CAPS) requests, or further information.

## ADTRAN Sales

Pricing/Availability:

800-827-0807

## ADTRAN Technical Support

Pre-Sales Applications/Post-Sales Technical Assistance:

800-726-8663

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:

(256) 963-8722

## Repair and Return Address

Contact CAPS prior to returning equipment to ADTRAN.

ADTRAN, Inc.
CAPS Department
901 Explorer Boulevard
Huntsville, Alabama 35806-2807