# TSU 610

# User Manual

**Part Numbers**

**1200610L2** **1200615L2**
**1200610L2#DC** **1200615L2#DC**

July 1999
61200610L2-1A

**Trademarks**:

Windows is a registered trademark of Microsoft Corp.
T-Watch is a trademark of ADTRAN, Inc.
SLC96 is a registered trademark of AT&T

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P.O. Box 140000
Huntsville, AL 35814-4000
Phone: (256) 963-8000

## ADTRAN Year 2000 (Y2K) Readiness Disclosure

ADTRAN has established a Year 2000 program to ensure that our products will function correctly in the new millennium. ADTRAN warrants that all products meet Y2K specifications regardless of model or revision.

Information about ADTRAN's Y2K compliance program is available at the following locations:

| | |
|---|---|
| ADTRAN Web Site | www.adtran.com |
| Product Matrix | www.adtran.com/y2kfax.html |
| Faxback Document Line | (256) 963-8200 |
| | *Y2K plans and product certifications are listed in the matrix.* |
| Y2K Project Line | (256) 963-2200 |
| E-mail | year2000@adtran.com |

**FCC Regulations require that the following information be provided to the customer in this manual:**

1. This equipment complies with Part 68 of the FCC rules. The required label is attached to the bottom of the chassis.
2. An FCC compliant telephone cord with modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.
3. If your product causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. If advance notice is not practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.
4. Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.
5. If you experience trouble with the equipment product, please contact ADTRAN at (256) 963-8000 for repair / warranty information. The telephone company may ask you to disconnect this equipment from the network until the problem has been corrected, or until you are sure the equipment is not malfunctioning.
6. This unit contains no user serviceable parts.
7. The following information may be required when applying to your local telephone company for leased line facilities.

| **Service Type** | **REN/SOC** | **FIC** | **USOC** |
|---|---|---|---|
| 1.544 Mbps -SF | 6.0N | 04DU9-BN | RJ-48C |
| 1.544 Mbps - SF and B8ZS | 6.0N | 04DU9-DN | RJ-48C |
| 1.544 Mbps - ESF | 6.0N | 04DU9-1KN | RJ-48C |
| 1.544 Mbps - ESF and B8ZS | 6.0N | 04DU9-1SN | RJ-48C |

## FEDERAL COMMUNICATIONS COMMISSION RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio frequencies. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded cables must be used with this unit to ensure compliance with Class A FCC limits.


*Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

## CANADIAN EMISSIONS REQUIREMENTS

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled “Digital Apparatus,” ICES-003 of the Department of Communications.

Cet appareil nuerique respecte les limites de bruits radioelectriques applicables aux appareils numeriques de Class A prescrites dans la norme sur le materiel brouilleur: “Appareils Numeriques,” NMB-003 edictee par le ministre des Communications.

## CANADIAN EQUIPMENT LIMITATIONS


*The Industry Canada Certification label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.*

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic waterpipe system, if present, are connected together. This precaution may be particularly important in rural areas.


*Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or an electrician, as appropriate.*

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the equipment that the total of the LNs of all devices does not exceed 100.

The ringer equivalence number (REN) assigned to each terminal adapter is used to determine the total number of devices that may be connected to each circuit. The sum of the RENs from all devices in the circuit should not exceed a total of 5.0.

## AFFIDAVIT REQUIREMENTS FOR CONNECTION TO DIGITAL SERVICES

- An affidavit is required to be given to the telephone company whenever digital terminal equipment without encoded analog content and billing protection is used to transmit digital signals containing encoded analog content which are intended for eventual conversion into voiceband analog signals and transmitted on the network.

- The affidavit shall affirm that either no encoded analog content or billing information is being transmitted or that the output of the device meets Part 68 encoded analog content or billing protection specifications.

- End user / customer will be responsible to file an affidavit with the local exchange carrier when connecting unprotected CPE to a 1.544 Mbps or subrate digital services.

- Until such time as subrate digital terminal equipment is registered for voice applications, the affidavit requirement for subrate services is waived.

## AFFIDAVIT FOR CONNECTION OF CUSTOMER PREMISES EQUIPMENT TO 1.544 MBPS AND/OR SUBRATE DIGITAL SERVICES

For the work to be performed in the certified territory of _____(telco name)

State of _____

County of _____

I, _____ (name),

(business address), _____ (telephone number) being duly sworn, state:

I have responsibility for the operation and maintenance of the terminal equipment to be connected to 1.544 Mbps and / or _____ subrate digital services. The terminal equipment to be connected complies with Part 68 of the FCC rules except for the encoded analog content and billing protection specifications. With respect to encoded analog content and billing protection:

( ) I attest that all operations associated with the establishment, maintenance, and adjustment of the digital CPE with respect to analog content and encoded billing protection information continuously complies with Part 68 of the FCC Rules and Regulations.

( ) The digital CPE does not transmit digital signals containing encoded analog content or billing information which is intended to be decoded within the telecommunications network.

( ) The encoded analog content and billing protection is factory set and is not under the control of the customer.

I attest that the operator(s) / maintainer(s) of the digital CPE responsible for the establishment, maintenance, and adjustment of the encoded analog content and billing information has (have) been trained to perform these functions by successfully having completed one of the following (check appropriate blocks):

( ) A. A training course provided by the manufacturer / grantee of the equipment used to encode analog signals; or

( ) B. A training course provided by the customer or authorized representative, using training materials and instructions provided by the manufacturer / grantee of the equipment used to encode analog signals; or

( ) C. An independent training course (e.g., trade school or technical institution) recognized by the manufacturer / grantee of the equipment used to encode analog signals; or

( ) D. In lieu of the preceding training requirements, the operator(s) / maintainer(s) is (are) under the control of a supervisor trained in accordance with _____ (circle one) above.

I agree to provide _____ (telco's name) with proper documentation to demonstrate compliance with the information as provided in the preceding paragraph, if so requested.

_____Signature

_____Title

_____ Date

Transcribed and sworn to before me

This _____ day of _____, 199___

_____

Notary Public

My commission expires:

_____

## IMPORTANT SAFETY INSTRUCTIONS

When using your telephone equipment, please follow these basic safety precautions to reduce the risk of fire, electrical shock, or personal injury:

1 Do not use this product near water, such as near a bath tub, wash bowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.

2 Avoid using a telephone (other than a cordless-type) during an electrical storm. There is a remote risk of shock from lightning.

3 Do not use the telephone to report a gas leak in the vicinity of the leak.

4 Use only the power cord, power supply, and/or batteries indicated in the manual. Do not dispose of batteries in a fire. They may explode. Check with local codes for special disposal instructions.

## SAVE THESE INSTRUCTIONS

## Warranty and Customer Service

ADTRAN will replace or repair this product within five years from the date of shipment if the product does not meet its published specifications or if it fails while in service. For detailed warranty, repair, and return information refer to the ADTRAN Equipment Warranty and Repair and Return Policy Procedure.

Return Material Authorization (RMA) is required prior to returning equipment to ADTRAN.

For Service, RMA requests, or more information, contact ADTRAN Customer Service listed on the inside back cover of this manual.

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# Chapter 1 Introduction

## TSU 610 OVERVIEW

This manual covers the use of the following products:

- TSU 610
- TSU 610 with DC power
- TSU 610 HDSL
- TSU 610 HDSL with DC Power

Unless otherwise stated, the TSU 610 refers to all four products.

## Product Description

The TSU 610 is a T1/FT1 multiplexer with six option slots, an interchangable network interface, and embedded SNMP management. The TSU 610's six option slots accept one of many available option modules for voice and data applications. Each module offers up to four ports for a total of 24 possible voice or data ports.

The TSU 610 serves as the link between the following user data sources:

- local area network (LAN) bridges
- routers
- computers
- CAD systems
- teleconferencing equipment
- PBXs.

By using multiple data ports, the TSU 610 can simultaneously connect one or more of these devices to a T1 circuit. The amount of bandwidth allocated to each port is custom-programmable. You can manually allocate bandwidth or set the bandwidth to change automatically at predetermined times to use the available bandwidth most advantageously.

Changes in the configuration do not disrupt data flow in channels that are not being reconfigured. The unique architecture and the availability of option modules provide a path for growth to accommodate future requirements.

An interchangable network interface allows the network to be T1 or HDSL. Future modules will be forth-coming to interface other XDSLs.

The TSU 610 offers several network management options. You can manage via SNMP through the chain-in ports. If you are using T-Watch Pro, a Microsoft Windows® program, you can manage the TSU 610 via the same chain-in ports. An enhanced VT-100 terminal interface is also provided.

## Standard Features in the TSU 610

The standard features of the TSU 610 are listed below:

- A single T1 or HDSL interface
- Six slots to house option modules with up to four additional data ports, including voice
- Architecture that allows mix of port types to meet the data interface requirements
- Easy configuration capabilities using simplistic menus displayed on a terminal connected to either the chain-in or craft ports
- SNMP, Telnet, and T-Watch Pro management via SLIP
- Ability to proxy for “agentless” units
- Enhanced terminal mode

- Two programmable configuration maps that define the bandwidth allocation between data ports
- Data drop and insert, as well as full drop and insert
- Flash memory for software updates
- Timing selectable from the network, from the slot 1 data port, internally, or from a secondary interface
- QRSS; 511 test patterns (when using Nx option card), All Ones, All Zeros
- Fractional T1 loopbacks as defined in annex B of ANSI T1.403-1995
- Extensive self-testing and monitoring to ensure proper operation.

## TSU Option Modules

| Module | Description |
|---|---|
| **T1** | The T1 Network Interface module allows the TSU 610 to terminate a T1 line. Each DS0 of the T1 frame may be mapped independently to any option card installed. |
| **HDSL** | The HDSL Network Interface module allows the TSU 610 to terminate an ADTRAN HDSL line. Each DS0 of the HDSL frame may be mapped independently to any option card installed. |
| **DSX1** | Short haul T1 interface for operation with a PBX (Terminal Interface). |
| **Full Drop and Insert** | Permits the dropping of data and insertion of new data into the same DS0 time slot. This module includes a long haul DS1 interface. It can also be used as a second DS1 interface to provide up to 3 MB aggregate throughput. |
| **Nx56/64 Serial Interface** | Provides a V.35 serial interface in either single or dual versions. |
| **NxIQ** | Frame-relay aware device that provides detailed information regarding the health and performance of the frame relay circuit. |
| **Voice Interface** | 2/4 channel FXS/FX0/E&M. |
| **OCU DP** | Interfaces to DDS or 4-wire Switched-56. |

| Module | Description |
|---|---|
| **DSU DP** | Provides two sync or async ports (232 or V.35). |
| **Dial Backup** | Allows for backup of data upon network T1 failure. |
| **U-BR1TE** | Allows ISDN lines to be extended over a T1 line. |

## Option Module Architecture

The TSU 610 features a unique architecture that allows the addition of six option modules and plug-on boards, providing an opportunity for growth to accommodate many applications. See *Figure 1-1*. This unique approach allows you to mix interface types to meet any application.

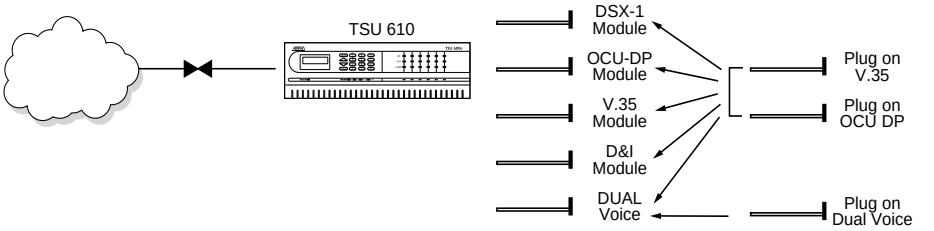



**Figure 1-1. TSU 610 Option Modules**

# TSU 610 Configuration Applications

The following examples illustrate possible configurations of TSU 610 applications.

## Router, PBX, Video Conferencing Application

In this application, an Nx54/64 module provides a V.35 interface to a router. The PBX is interfaced to the TSU 610 with the DSX-1 module. An OCU DP module and OCU DP plug-on board provide two switched 56 circuits for video conferencing. The SLIP port allows SNMP network management over the LAN. See *Figure 1-2*.

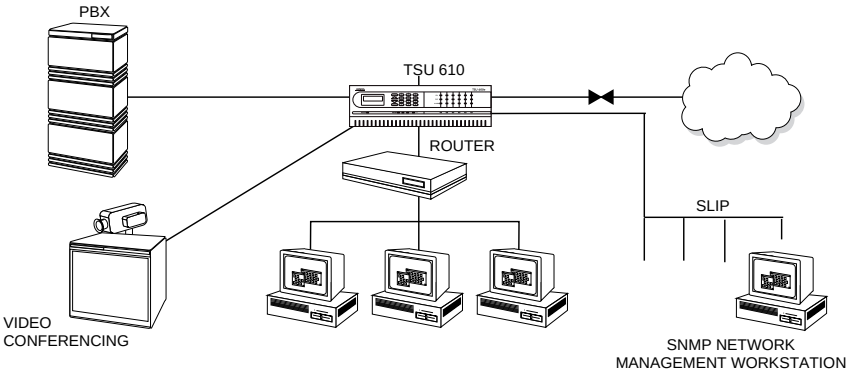



**Figure 1-2. Router, PBX, Video Conferencing Application Set Up**

## Drop and Insert, Voice, and Router Application

The TSU 610 provides a router interface with an Nx56/64 module. A drop and insert module provides a second T1 interface to a remote TSU. T-WATCH PRO (which runs on a PC) easily manages the network. FXO modules are used to provide PBX extensions to remote sites. See *Figure 1-3*.

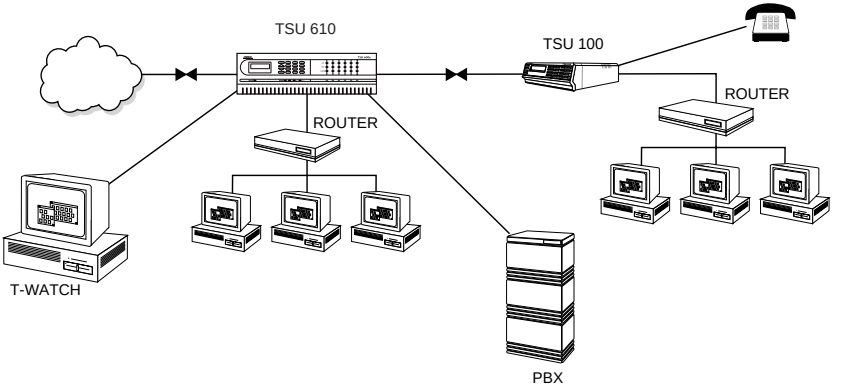



**Figure 1-3. Drop and Insert, Voice, and Router Application Set Up**

# Chapter 2 Installation

## UNPACK, INSPECT, POWER UP

## Receipt Inspection

Carefully inspect the TSU 610 for shipping damages. If you suspect damage, file a claim immediately with the carrier and then contact ADTRAN Customer Service (see the inside last page of this manual). If possible, keep the original shipping container for use in shipping the TSU 610 back for repair or for verification of damage during shipment.

## ADTRAN Shipments Include

- The TSU 610 with installed network module
- A line interface cable: an 8-position modular to 8-position modular (15 ft.)
- A DB-25 to modular adapter
- An 8-position, 6-foot modular cable for the Chain-In port connection
- The User Manual
- Rackmount Brackets
- Rackmount Data Sheet

# Customer Provides

- Cables for any expansion modules to be used with the TSU 610
- 23-inch rack mount brackets, if needed (1200271L1)

# Power Connection

### AC-Powered Unit

The AC- powered TSU 610 is equipped with a captive, 8-foot power cord, terminated by a 3-prong plug which connects to a grounded power receptacle.


*Power to the TSU 610 must be from a grounded 90-120 VAC, 50/ 60 Hz source*

### DC-Powered Unit

The DC-powered TSU 610 is equipped with a terminal strip on the rear of the unit. The power source should be connected to the terminal strip according to the polarity markings on the unit.

**For Example**:

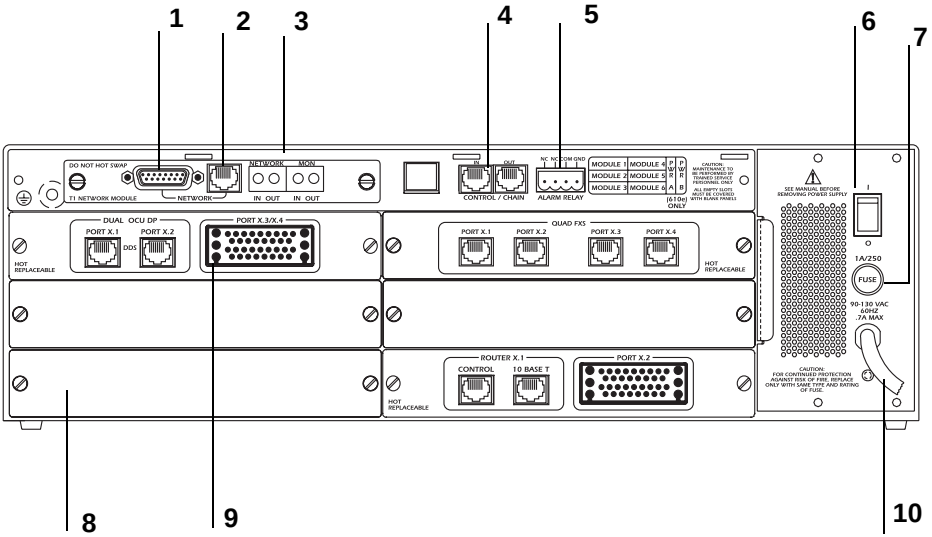
A -48 V source would be connected with the -48 V return attached to the (+) terminal and the -48 VDC attached to the (-) terminal. Power must be from a DC source in the range of 21 to 26 VDC or in the range of 40 to 56 VDC.

The protective cover should be reinstalled over the terminal strip once the power source is connected.

The DC-powered TSU 610 is to be installed only in restricted areas (dedicated equipment rooms, equipment closets, etc.) in accordance with Articles 110-16 and 110-18 of the National Electric Code, ANSI/NFPA 70.

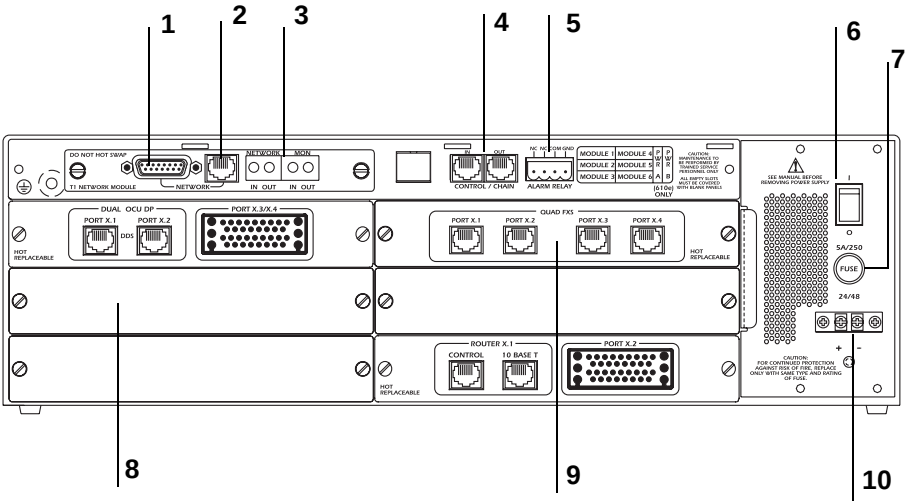
# IDENTIFICATION OF REAR PANEL LAYOUTS

Figure 2-1, Figure 2-2, Figure 2-3, and Figure 2-4 show the configuration for the rear panels of the TSU 610, TSU 610 with DC Power, TSU 610 HDSL, and TSU 610 HDSL with DC power.



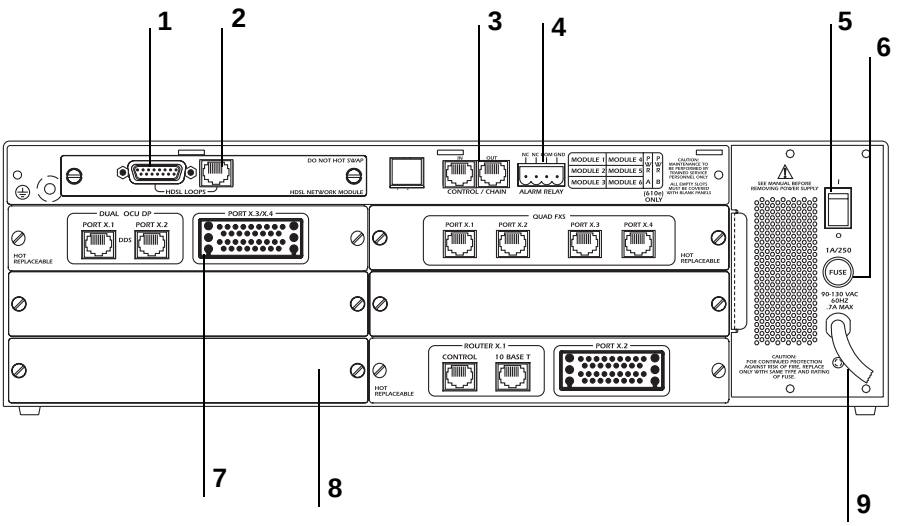

| | |
|---|---|
| 1 | T1 Network Connection (DA-15 Connector) |
| 2 | T1 Network Connection (RJ-48C) |
| 3 | T1 Monitor / Test Jacks |
| 4 | Control In / Out Connection |
| 5 | Alarm Relay Connection |
| 6 | Power Switch |
| 7 | 1A / 250V Fuse |
| 8 | Blank panel covering an unused option slot |
| 9 | Example of option modules installed |
| 10 | Power Cord |

**Figure 2-1. TSU 610 Rear Panel**



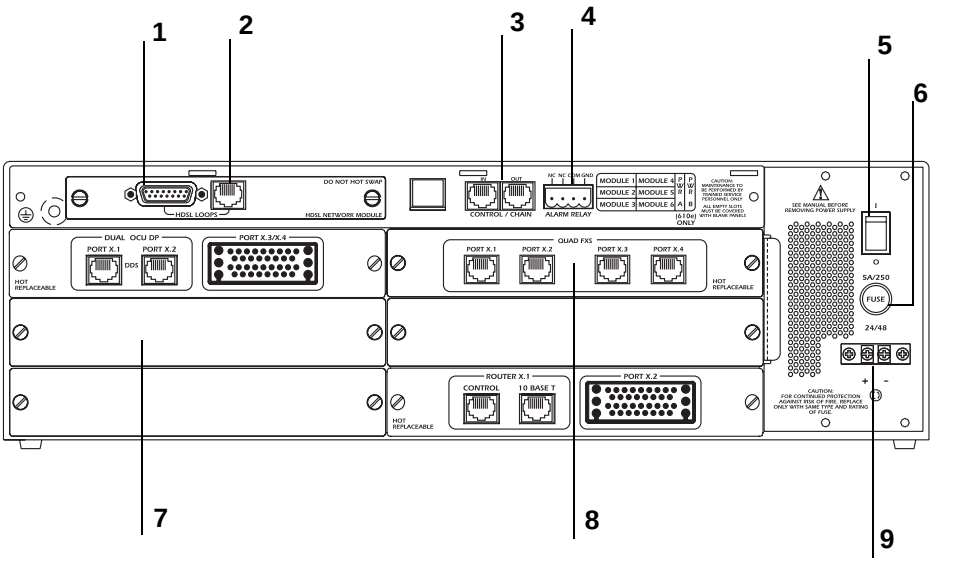

| | |
|---|---|
| 1 | T1 Network Connection (DA-15 Connector) |
| 2 | T1 Network Connection (RJ-48C) |
| 3 | T1 Monitor / Test Jacks |
| 4 | Control In / Out Connection |
| 5 | Alarm Relay Connection |
| 6 | Power Switch |
| 7 | 5A / 250V Fuse |
| 8 | Blank panel covering an unused option slot |
| 9 | Example of option modules installed |
| 10 | Power Input Terminals |

**Figure 2-2. TSU 610 with DC Power Rear Panel**




| | |
|---|---|
| 1 | HDSL Network Connection (DA15) Connector) |
| 2 | HDSL Network Connection (8-pin modular connector) |
| 3 | Control In / Out Connection |
| 4 | Alarm Relay Connector |
| 5 | Power Switch |
| 6 | 1 A / 250 V Fuse |
| 7 | Example of option modules installed |
| 8 | Blank panel covering an unused option slot |
| 9 | Power Cord |

**Figure 2-3. TSU 610 HDSL Rear Panel**




| | |
|---|---|
| 1 | D-15 HDSL Connection |
| 2 | 8-Pin Modular HDSL Connection |
| 3 | Control In / Out Connection |
| 4 | Alarm Relay Connection |
| 5 | Power Switch |
| 6 | 5A / 250V Fuse |
| 7 | Blank panel covering an unused option slot |
| 8 | Example of option modules installed |
| 9 | Power Input Terminals |

**Figure 2-4. TSU 610 HDSL with DC Power Rear Panel**

# TSU 610 Interfaces

The TSU 610 is equipped with six option slots, management interfaces, and a network interface, in the rear panel. See Figure 2-5.

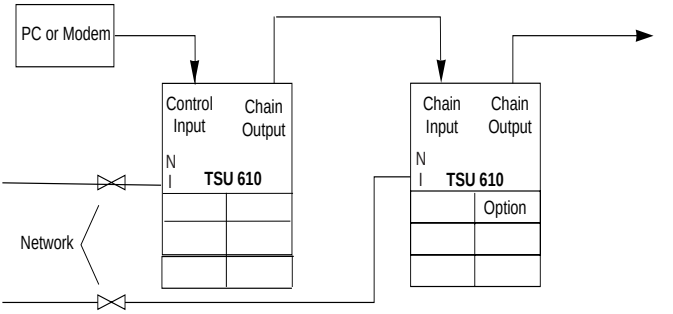



**Figure 2-5. TSU 610 Interfaces**

## Network Interface

The network interface (NI) is a plug-in module that allows different types of interfaces to be used. Currently a T1 Interface and an HDSL (High-bit-rate Digital Subscriber Line) are available.

The T1 interface complies with the applicable ANSI and ATt&T standards.

The HDSL interface complies with Bellcore TA-NWT-1210 and ANSI Technical Report T1E1.4/92-002RZ. See Appendix F for loop insertion loss requirements for deployment of T1 HDSL on PIC cable.

### T1 Network Test Interface

The **IN** and **OUT** test jacks for the T1 network interface provide intrusive test capability for the incoming T1. By connecting to these jacks with test equipment, the T1 connection will be broken, and the test equipment will terminate the incoming T1. The **T1 MON** test jack provides a

bridged access jack for non-intrusive monitoring of the incoming T1. When connected to this jack, the test equipment should be configured for a bridged termination.

### Control Port Input

The control port input provides an EIA-232 input from a PC or a modem for control of the TSU 610. You can also use it as a chain input from another TSU 610 or other TSU Family products.

### Chain Port Output

The chain port output provides an EIA-232 output to chain control to other TSUs.

### Option Slot Arrangement

As viewed from the rear of the TSU 610, the slots are numbered as shown in Figure 2-6. All slots are functionally identical except slots one, two, and six. These slots offer additional functions.

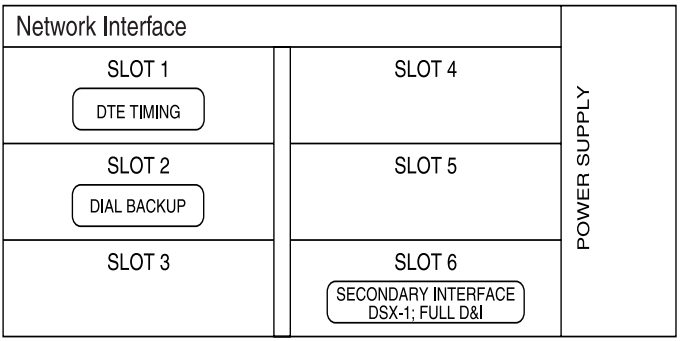



**Figure 2-6. TSU 610 Slot Designation (Rear View)**

### Slot 1

Slot 1 is used as the source of DTE timing when the DTE timing mode is selected or as the source of UBR1TE timing when the UBR1TE timing mode is selected. If DTE timing is desired, the DTE interface port sourcing the timing must be connected to Slot 1. This slot will accept all other interface types except Secondary Network interface option modules, including DSX-1 (PBX), the Full Drop and Insert (D&I) network interface, or the multiport Dial Backup (DBU).

### Slot 2

Slot 2 is used for the multiport Dial Backup module if it is installed. This slot accepts all other interface types except Secondary Network interface option modules, including DSX-1 (PBX) and the Full Drop and Insert (D&I) network interface.

### Slots 3-5

Slots 3-5 will accept any interface type except secondary interface, the interface for DTE timing, or the multiport DBU. If other interfaces have any restriction on their location, this will be specified in the individual option card manual (provided with the option cards).

### Slot 6

Slot 6 services any option module type including secondary network interface ports (DSX-1 (PBX) and Full D&I), but not the DTE timing source. If a secondary network interface port is to be used, it must be installed in slot 6.


*You can use NxDBU modules in any slot.*

# Power-up Testing

When shipped from the factory, the TSU 610 is set to factory default conditions. At the first application of power, the unit automatically executes a memory self-test. A full self-test can be run from the terminal; a passcode and unit ID may be set using the UTIL menu.

## Self-Test

Upon a power-up, the Test LEDs are illuminated and the following occurs:

| When . . . | Then . . . |
|---|---|
| the self-test is complete with no failures detected | the **OK LED** lights up. |
| a failure is detected | a list of failures is displayed on the terminal. |

The full self-test procedure (invoked from a terminal or T-Watch Pro) consists of the following tests:

### Board level tests

Each of the TSU 610 boards contains an on-board processor which executes a series of tests checking the circuitry on the board.

- RAM and EPROM tests
- Verify on-board circuitry

### Unit level tests

- Front panel LED verification
- Board-to-board interface test

A test pattern is sent from the controller through a loopback on all other boards and checked on the controller. This verifies the data path, clocks, and control signals for the entire chassis.

## Initialization

### Set User Passcode

The TSU 610 is designed to operate with or without the use of a passcode. The default condition is without a passcode.


*If the unit is to be remotely accessed using T-Watch Pro, you must enter a passcode. When managing a number of units, the passcode can be the same for all the units.*

The passcode should be a number easily remembered. Once entered, the passcode is required to access any operation other than viewing. See *Set Passcode* on page 4-22.

### Set Unit Identification

The Unit ID sets the unit to respond to remote control (controlled by a device other than the front panel or terminal). If no Unit ID is recorded it is not possible to operate from any remote control device, including the local PC for T-Watch Pro or SNMP. See *Unit ID* on page 4-23 for details.

### Set Control Port

The TSU 610 can be configured from the control port when T-Watch Pro, SNMP, or the terminal interface is being used.

If the control port is to be used, the control port baud rate must also be selected.

### Chain-In (PC)

The unit can be controlled from an external PC connected directly or via modem to the Chain-In port. When using Chain-In, the selection of the control port baud rate from 9600 (factory default), 1200, 2400, or 4800, 19200, or 38400 must be made using the Unit Configuration menu. Unless locked out externally, the front panel can also control the unit.

### Chain In/Chain Out

TSU 610 units and other TSUs can be linked together to form a chain. Figure 2-7 provides an example of a chain-in arrangement with a PC or a modem. The first TSU 610 in the chain receives controlling input from the PC or modem.

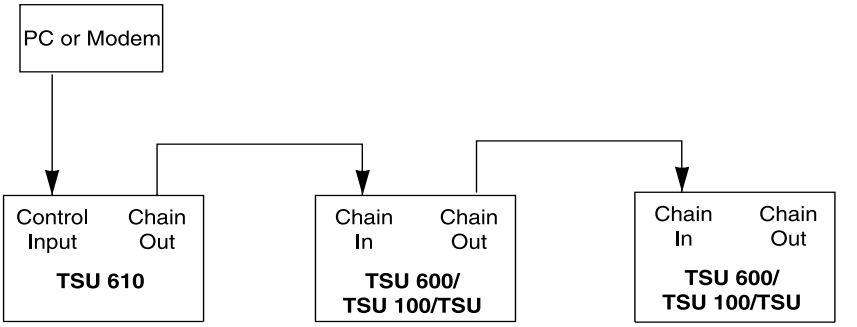



**Figure 2-7. Example of Chain In**

Subsequent TSUs in the chain are in a position to intake information from another TSU. This in-taking of information from another TSU in the chain is identified as Chain-In. The baud rate for the chained units must match that of the first unit.

At this point, the Unit Initialization procedure is concluded. If the unit is to be configured remotely, there are no additional steps necessary before executing remote configuration.

The Passcode, the Unit ID, and the Control Port settings are stored in a nonvolatile memory. This ensures that they are operable for subsequent power-up sequences.

## Normal Power-Up Procedure

After the unit has been put into operation with the initial power-up and initialization, subsequent power-up procedure includes only the Power-Up Self-Test followed by the request for a passcode (password) if this option was selected during initialization. Use the number keys to key in the previously recorded passcode and press **Enter**.

# GROUNDING INSTRUCTIONS

The grounding instruction information is from the Underwriters' *Laboratory UL 1950, 3rd Edition*.

An equipment grounding conductor that is not smaller in size than the ungrounded branch-circuit supply conductors is to be installed as part of the circuit that supplies the product or system.

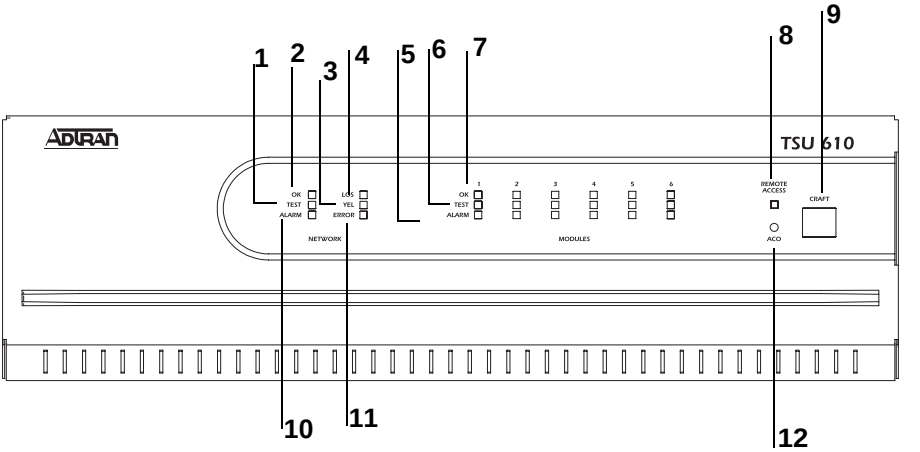
- Bare, covered, or insulated grounding conductors are acceptable.
- Individually covered or insulated equipment grounding conductors shall have a continuous outer finish that is either green, or green with one or more yellow stripes.
- The equipment grounding conductor is to be connected to ground at the service equipment.
- The attachment-plug receptacles in the vicinity of the product or system are all to be of a grounding type.
- The equipment grounding conductors serving these receptacles are to be connected to earth ground at the service equipment.
- A supplementary equipment grounding conductor shall be installed between the product or system and ground that is in addition to the equipment grounding conductor in the power-supply cord.
- The supplementary equipment grounding conductor shall not be smaller in size than the ungrounded branch-circuit supply conductors.
- The supplementary equipment grounding conductor shall be connected to the product at the terminal provided, and shall be connected to ground in a manner that will retain the ground connection when the product is unplugged from the receptacle.
- The connection to ground of the supplementary equipment grounding conductor shall be in compliance with the rules for terminating bonding jumpers at Part K or Article 250 of the National Electrical Code, ANSI / NFPA 70.

- Termination of the supplementary equipment grounding conductor is permitted to be made to building steel, to a metal electrical raceway system, or to any grounded item that is permanently and reliably connected to the electrical service equipment ground.
- The supplemental grounding conductor shall be connected to the equipment using a number 8 ring terminal.
- The terminal should be fastened to the grounding lug provided on the rear panel of the equipment.
- The ring terminal should be installed using the appropriate crimping tool (AMP P/N 59250T-EAD Crimping Tool or equivalent).

# Chapter 3 Operation

## FRONT PANEL

The TSU 610 front panel monitors operation and controls the configuration of the unit. The TSU 610 front panel is shown in Figure 3-1 on page 3- 2. For detailed descriptions of each part of the front panel, see *CSU Status LEDs* on page 3-3.




| | | |
|---|---|---|
| 1 | Test - (Network Status) | Active when the network interface is in test mode. |
| 2 | OK (Network Status) | Operation is in normal mode with no detected errors |
| 3 | YEL (Network Status) | Active when the Network Port receives a yellow alarm |
| 4 | LOS (Network Status) | Active when the Network has lost signal |
| 5 | Alarm (Module Status) | Active when an alarm condition has been detected |
| 6 | Test (Module Status) | Active when the module is in test mode |
| 7 | OK (Module Status) | Operation is in normal mode with no detected errors |
| 8 | Remote Access | Active when unit is being accessed by a remote terminal or T-Watch |
| 9 | Craft Port | Used to access unit from a remote terminal |
| 10 | Alarm (Network Status) | Active when an alarm condition has been detected on the network interface |
| 11 | Error (Network Status) | Indicates errors such as BPV, FER, and CRC |
| 12 | ACO Switch | Used to deactivate the alarm relay |

**Figure 3-1. Front Panel**

# CSU Status LEDs

**Table 3-1. Network Status LED Descriptions**

| LED | Color | Description |
|---|---|---|
| **OK** | **Green** | Indicates the operation is in the normal mode. No alarms have been detected. |
| **Test** | | Indicates that the network interface is operating in a test mode. This includes a self-test or loopback tests. When illuminated, this LED also indicates that normal data flow is not occurring on the Network Interface. |
| **Alarm** | **Red** | Red when an alarm (**RED, BLUE, YELLOW**) is active on the Network Interface. Otherwise, it is Off.<br><br>To view an alarm condition, select the **ACTIVE ALARM** menu item or select **ALARM** by pressing **SHIFT+8** on the terminal.<br><br>If the alarm conditions have been corrected, the alarm which caused the activation of the **ALARM** LED can be viewed under the **UNIT HISTORY** menu. |
| **LOS** | **Red** | Red when there is loss of signal on the Network. Otherwise, it is Off. |
| **YEL** | **Red** | Red when a yellow alarm is present. Otherwise, it is Off. |
| **ERROR** | **Red** | Flashes RED when CRC, XS0, BPV, or FER errors are detected on the Network Interface. |

**Table 3-2. Module Status LED Descriptions**

| LED | Color | Description |
|---|---|---|
| **OK** | **Green** | The module status LEDs display the operational condition of ports installed in the option slots.<br>Green when no alarm is active on the module. |
| **Test** | **Yellow** | Yellow when module is in test mode. Otherwise, it is Off. |
| **Alarm** | **Red** | Red when module is in alarm. Otherwise, it is Off.<br>To view an alarm condition, select the **ACTIVE ALARM** menu item or select **ALARM** by pressing **SHIFT+8** on the terminal.<br><br>If the alarm conditions have been corrected, the alarm which caused the activation of the **ALARM** LED can be viewed under the **UNIT HISTORY** menu |
| **Remote Access** | | On when unit is being accessed from a remote terminal. |


*Module LED's summarize the condition of all ports in that slot.*

# GENERAL MENU OPERATION

The TSU 610 uses a multilevel menu structure containing both menu items and data fields. All menu operations and data are accessed via a VT-100 equivalent terminal, a computer running terminal software, or a computer running T-Watch.

To access the TSU 610 menus in terminal mode, connect a VT-100 terminal or a computer running a terminal program to either the Chain-In port on the rear of the unit or the Craft jack on the front panel. Set the terminal to 9600 baud 1.5 Stop-8-No Parity. (Factory Default). Press **Control+PTT**. The Unit will respond with:

```
ADTRAN - TSU 610

Password:
```

Enter: **ADTRAN**. The unit will respond with:

```
Main Menu

        1) Status
        2) Config
        3) Util
        4) Test
        5) Remote Menu Access
        6) Management Config
        7) Flash Download
        8) Quit Session
Command
```

### Selecting and Activating a Menu Item

Choose a menu item by entering the desired menu item number on the **Command:** line and pressing **Enter**.

For example, to activate the **ALARM LIST** option from the Status menu, do the following:

| Step | Action |
|---|---|
| **1** | Activate the Status Menu by entering 1 at the **Command:** line. |
| **2** | Press **Enter**. |
| **3** | Select Active Alarms by entering 3 at the **Command:** line. |
| **4** | Press **Enter**.<br><br>*The **ALARM LIST** will appear, terminated by the phrase **End of List**.* |

### Editing a Data Field

| Step | Action |
|---|---|
| **1** | Select the Data to change by entering its number at the **Command:** line |
| **2** | Press **Enter**. |
| **3** | Select a value using the Space Bar. |
| **4** | Press **Enter**. |

### Exit Any Menu Field Operation or Display

Press **ESC** on the keyboard as many times as required to return to the desired menu.

# Data Port Identification

When configuring the unit, menu selections will include options from data port submenus. Selecting data ports is necessary because the TSU 610 uses a Slot-Port method to identify which data port the menu item is referencing. If a module containing a **PBX DSX-1 OPTION CARD** with an **Nx56/64 plug-on interface** is installed in option slot 6, it would be designated as:

DSX-1 Passthru=6.1

Where slot=6 and port =1.

The DSX-1 is located in option slot 6 and is the first port in that slot.

Nx56/64=6.2

Where slot=6 and port=2.

The Nx is located in Slot 6 and is the second port in that slot.

Viewed from the rear of the TSU 610, the module slots are arranged as shown in Figure 3-2.

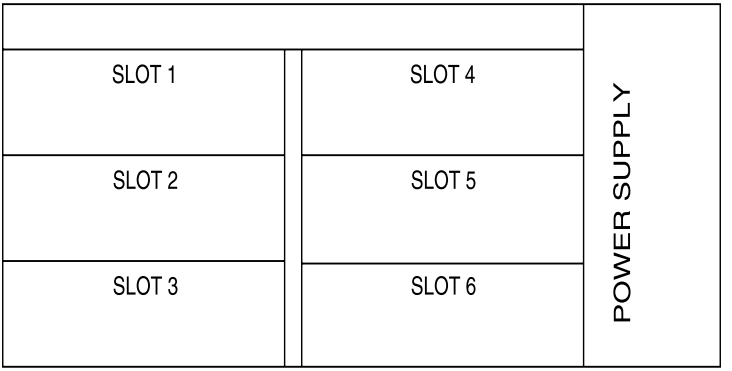



**Figure 3-2. Module Slots, TSU 610**

# Terminal Mode Connection

The TSU 610 provides the front panel menus to a VT-100 type terminal. This mode is used to configure and monitor the unit. Initiate this mode by typing **<ctrl> PTT** on the terminal once it is connected to the Chain-In port.

## Telnet Connection

You can connect to the TSU 610 via telnet. Before attempting to connect via Telnet, first define the IP address.


*The default gateway and subnet mask are not used in SLIP mode.*


*Only one Telnet session can be active at one time.*

# Menu Structure

The TSU 610 uses a multilevel menu structure containing both menu items and data fields. All menu operations and data display on the terminal screen.

The opening menu is the access point to all other operations. Each **MAIN** menu item has several functions and submenus to identify and access specific parameters.

## Menu Options

The **MAIN** menu contains the following:

**Status**
Displays all relevant information for the network and DTE interfaces.

**Config**
**(Configuration)**
Displays and sets the TSU 610 operational configuration, including all network interface parameters, the allocation of the DS0s, and the port parameters.

**Util (Utilities)**
Displays and sets system parameters.

**Test**
Initiates different types of unit tests and displays test results.

# Alternate Methods of Control

## T-Watch Pro (ADTRAN PC Program)

T-Watch Pro is the ADTRAN PC control program. It provides complete control over the configuration of the TSU 610 using a graphical interface and displays the same status and performance data as the Terminal Menu. This data is displayed in the form of tables and graphs.

The T-Watch Pro program has the following capabilities:

- Interfaces with a modem which permits dialing into a remote TSU 610 location to configure the unit or read the status or performance of the unit.
- Receives traps from any TSU product.
- Records and creates display performance data over a 30 day period.
- Accesses units via the local area network.

### T-Watch Pro/LAN Connection

To set up the TSU 610 to work with T-Watch Pro over the LAN, follow these steps:

| Step | Action |
|---|---|
| **1** | Set the **UNIT ID** using the terminal mode.<br><br>See *Unit ID* on page 4-23 for more information. |
| **2** | Set **CONTROL PORT** to **SLIP.** |
| **3** | Follow the installation instructions for T-Watch Pro to start the program and connect to the unit. |

### T-Watch Pro/EIA-232 Connection

To set up the TSU 610 to work with T-Watch Pro over a direct EIA-232 connection, the following steps are required:

| Step | Action |
|---|---|
| 1 | Set the **UNIT ID** and the **PASSCODE** using the terminal mode.<br><br>See *Unit ID on page 4-23 and Change/Set a Passcode on page 4-22* for more details. |
| 2 | Set the **CONTROL PORT RATE** to the same setting as the PC Com port. |
| 3 | Connect the **PC COM PORT** to the **CHAIN-IN PORT** on the TSU 610 using the DB25 to modular adapter and 6-foot modular cable. |
| 4 | Follow the installation instructions for T-Watch Pro to start the program and connect to the unit. |

## SNMP

The ADTRAN TSU 610 supports the Simple Network Management Protocol (SNMP) through the chain-in (SLIP) interface. See *Appendix B, Understanding SNMP* for detailed information.

To use SNMP with the TSU 610, do the following:

| Step | Action |
|---|---|
| 1 | Set **CONTROL PORT** to **SLIP** for Chain-In Port. |
| 2 | Load the appropriate MIB browser into the Network Management Station.<br><br>This is available on the ADTRAN webpage at **http://www.adtran.com)**.<br><br>The MIB browser issues SNMP gets/sets to the TSU 610. |

# Chapter 4 T1 Network Interface

## MAIN MENU FOR T1 NETWORK INTERFACE

The Telnet / Terminal main menu is the first menu displayed after the Telnet / Terminal session is established, as shown in *Figure 4-1*. The default Telnet / Terminal password is **ADTRAN**.

> **NOTE** *Only one Telnet/Terminal session may be active at a time.*

```
ADTRAN  TSU 610
Password: XXXXXXXX
Main Menu
1) Status
2) Config
3) Util
4) Test
5) Remote Menu Access
6) Management Config
7) Flash Download
8) Quit Session
```

**Figure 4-1. Telnet/Terminal Main Menu**

Menu flow is normally depicted from left to right. At every level of the menu, pressing **Cancel** returns the system to the previous menu level. Press **Cancel** repeatedly to return the system to the main menu.

# T1 Status Menu

The Status menu branch allows you to view the status of the TSU 610 operation. See *Figure 4-2.*

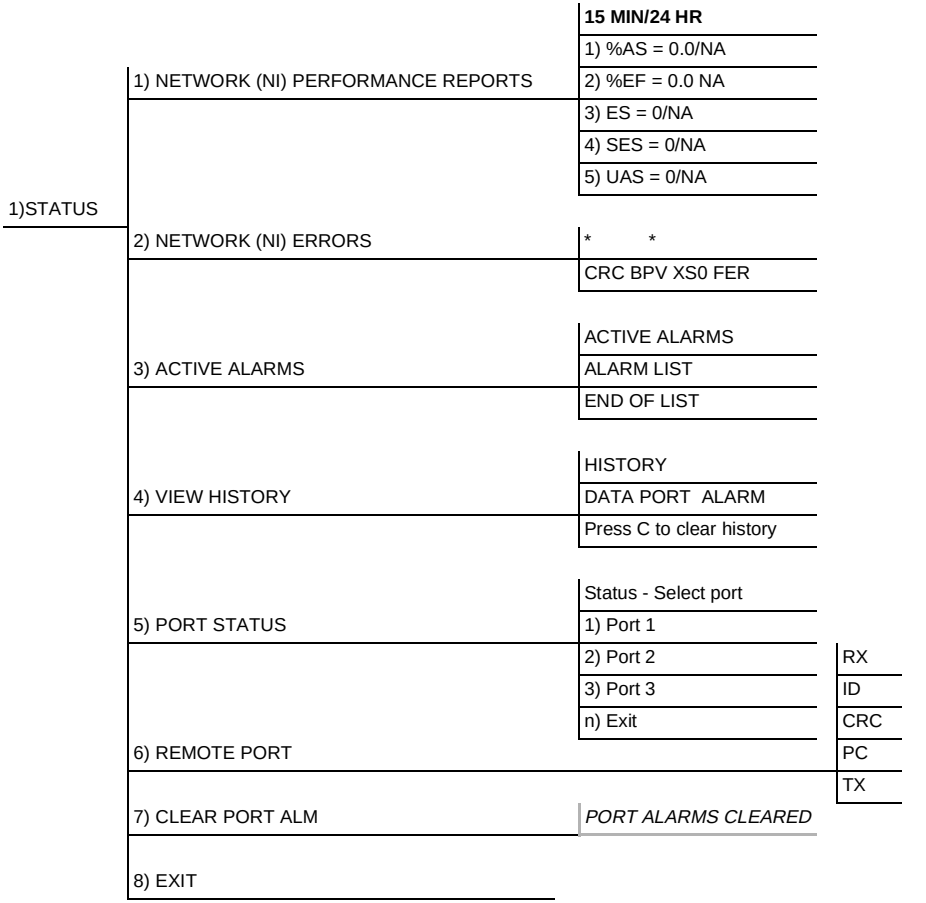



**Figure 4-2. TSU 610 T1 Status Menu**

## Network (NI) Performance Reports

The Network Interface Performance Reports display the user copy of the performance data. See *Figure 4-2 on page 4-2*. The TSU 610 maintains this performance data on the network in compliance with ANSI T1.403 and AT&T document TR54016. The data displayed is data accumulated over the last 15 minutes and over the last 24 hours.

**%AS**
% of available seconds

**%EF**
% of error free seconds

**ES**
Number of errored seconds (1 or more errors / second

**SES**
Number of severely errored seconds (more than 320 errors / second)

**UAS**
Number of unavailable seconds (10 or more consecutive seconds)

If insufficient time has passed to collect data, **NA** displays. Continue with standard operating procedures to exit the display.

When this menu is active, performance data can be cleared by pressing **Clear (Shift+9)** on the keypad. Only the user copy of the performance data is cleared.

Since only the user's copy of performance data is cleared by the TSU 610, the data displayed here might be different from the data sent to the network as PRM data.

## Network (NI) Errors

The NI Errors submenu displays the types of errors the Network Interface (NI) detects. A blinking **CSU ERROR** LED indicates that network errors are detected.

The asterisk (*) above an item indicates the type of errors detected. The error types described below:

**CRC**
CRC-6 bit errors based on the FDL. This is valid only in ESF mode.

**BPV**
Bipolar violations.

**XS0**
Excess zeros.

**FER**
Framing errors.

### Active Alarms

This menu item displays a list of current alarms reported by either the base controller or any of the ports. If no alarms are current, the menu item displays **End of List**.

This display includes two lines of text. The top line is the alarm source. The bottom line is the alarm message. A list of alarm messages is found in *Appendix D, System Messages* on page D-1.

### View History

This menu item displays and clears the accumulated status changes of the unit.

View History displays a history of the first 20 status changes in the unit, including the date, time, and type of change. The unit also records for viewing the date and time an alarm became active and inactive, as well as the date and time of test activation and deactivation.

To clear the **VIEW HISTORY** display, press **C** with the **VIEW HISTORY** menu active.

### Port Status

Port Status displays the signals monitored on the data ports. For example, an Nx56/64 interface monitors the RTS, CTS, TD, and RD, along with other signal lines. When a port is selected, the LCD indicates whether the signal is present.

### Remote Port

Remote Port displays the status of activity on the Chain-In remote port. This is useful for troubleshooting communication sessions, as well as verifying cabling.

**RX**
Characters received at remote port.

**ID**
Unit ID received at remote port.

**CRC**
Correct CRC received.

**PC**
Correct passcode received.

**TX**
Characters transmitted from the remote port.

### Clear Port Alarm

Clears the **LINK FAILED ALARMS** on option modules that have been removed from the TSU 610 chassis.

# T1 Configuration Menu

The Configuration menu sets the TSU 610 operational configuration, including all network interface parameters, the allocation of the DS0s, and the port parameters. See *Figure 4-3*.

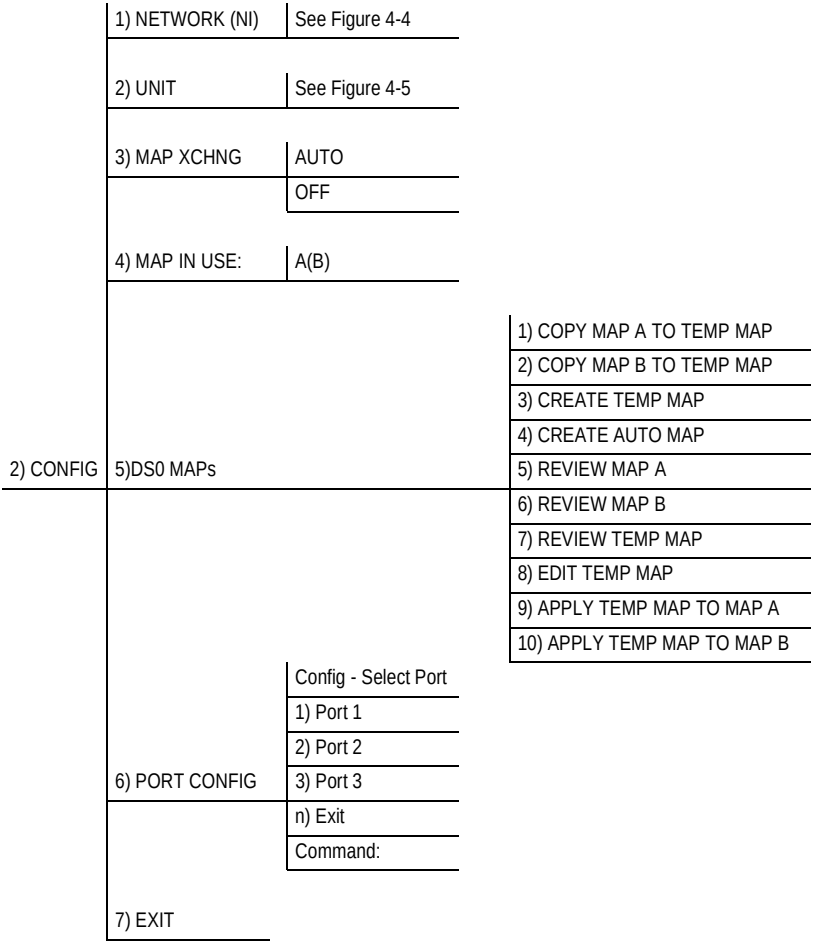



**Figure 4-3. TSU 610 Configuration Menu**

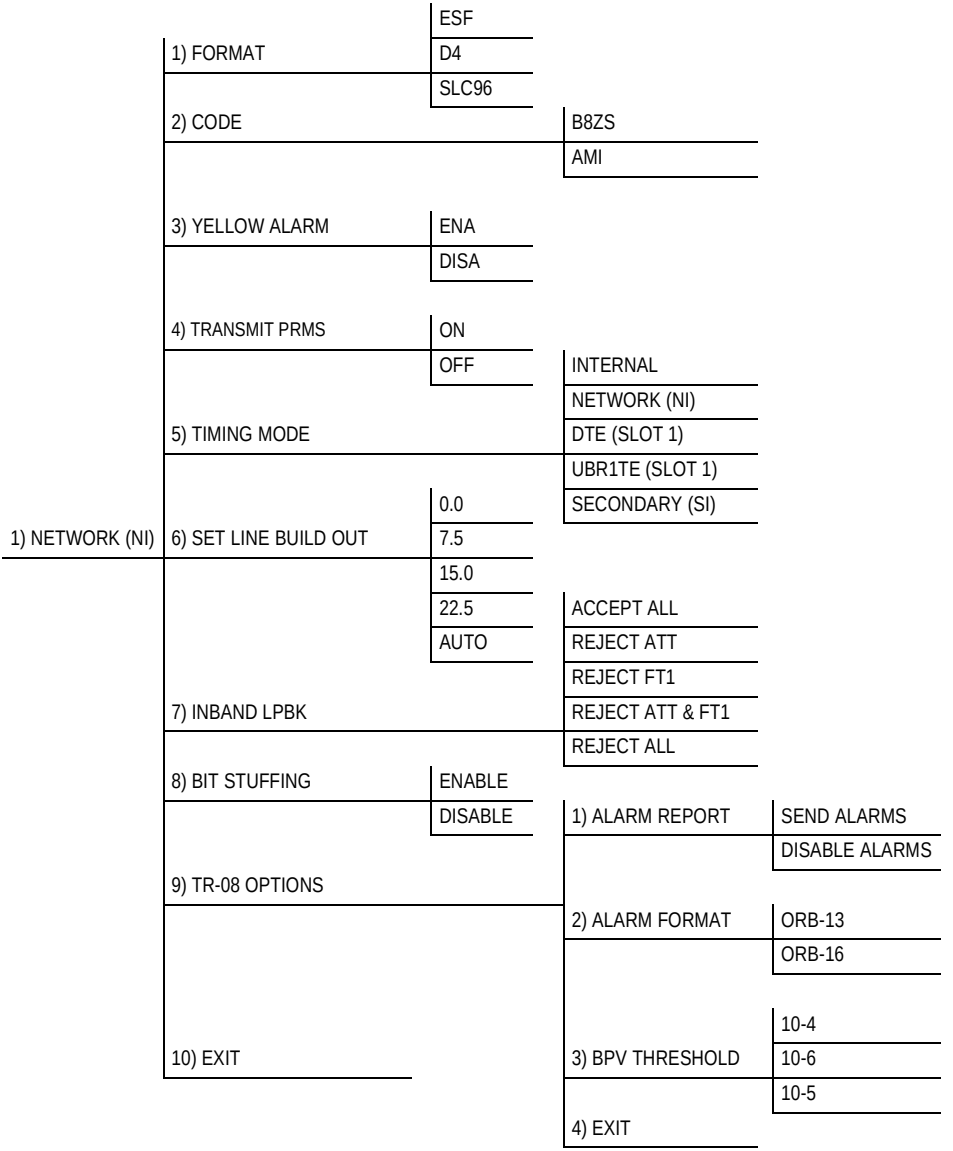



**Figure 4-4. TSU 610 T1 Network (NI) Menu**

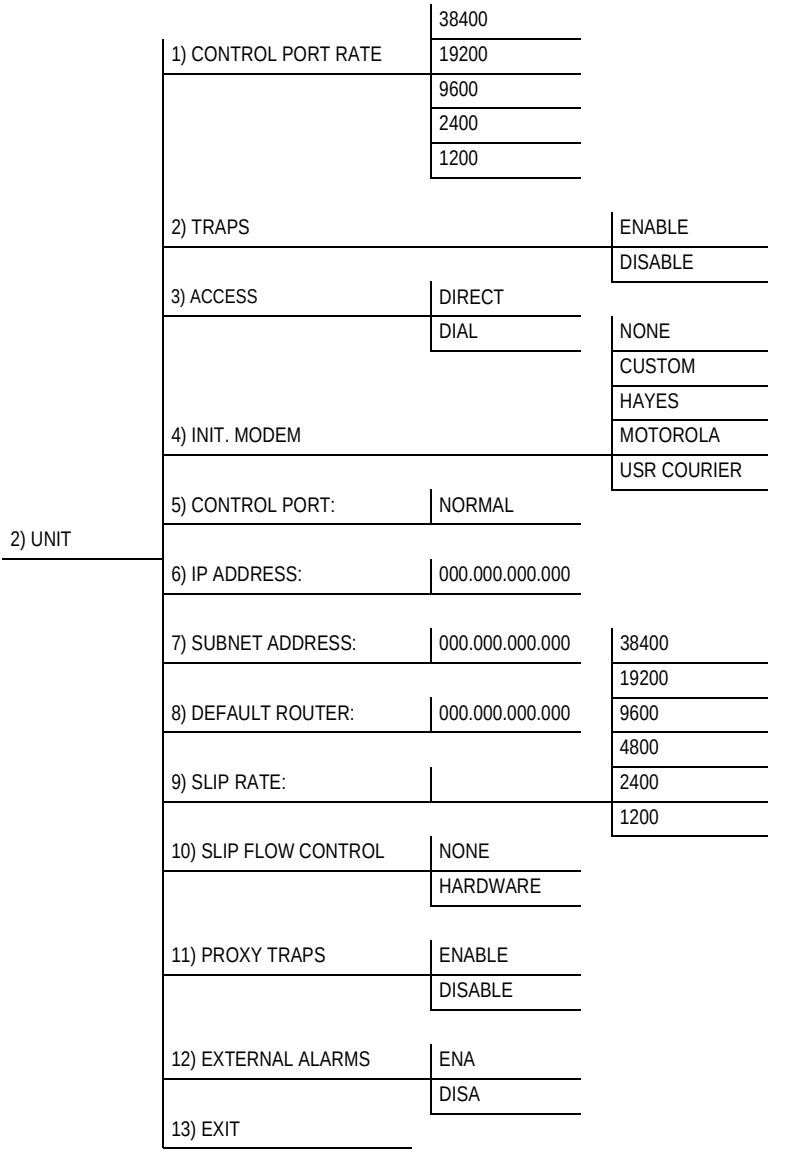



**Figure 4-5. TSU 610 T1 Unit Menu**

## Network (NI)

This menu item accesses the configuration of parameters associated with the network interface in the base unit. There are nine submenu items that include setting the format, the **Line Build Out** (LBO), and the timing mode. Submenu items do not include setting the parameters which may be necessary for a secondary interface (DSX-1 Passthru, etc.).

The **NETWORK** menu items and their descriptions follow.

### Format
Sets the frame format for the NI.
Choices: D4, ESF, SLC96


*D4 is equivalent to superframe format (SF).*

### Code
Sets the line code for the NI.
Choices: AMI, B8ZS.

### YEL Alarm
Enables and disables the transmitting of yellow alarms.
Choices: ENA, DISA

### XMIT PRM
Enables and disables the sending of PRM data on the facility data link (FDL). The PRM data continues to be collected even if XMIT PRM is disabled (possible only with ESF Format).
Choices: Off, On.

### Timing Mode
Selects the clock source for transmission toward the network from the NI. See *TSU 610 Clock Sources* on page 4-11 for more information.
Choices: Network, DTE (Slot 1), Normal (CSU), U-BR1TE (Slot 1), Internal, and Secondary (SI).

### SET LBO

Selects the line build out for the network interface. In AUTO mode, the TSU 610 sets the LBO based on the strength of the receive signal and displays the selected value.
Choices: 0.0 dB, 7.5 dB, 15 dB, 22 dB, and Auto


*To activate the -36 dB receiver sensitivity, set the LBO to* ***AUTO****. This feature is useful in a point-to-point application where no network elements are involved. If a network element such as a Smart Jack is installed on the circuit, the LBO should be set to* ***0 dB****.*

### INBAND LPBCK

Sets unit to accept or reject the network interface loop-up and loop-down codes as defined in ANSI T1.403.
Choices: Accept, Reject

### BIT STUFFING

When enabled, bit stuffing causes the TSU 610 to monitor for ones (1s) density violations and insert a one (1) when needed to maintain ones at 12.5%.
Choices: Enable, Disable

### TR-08

The TR-08 submenu configures the unit for TR-08 applications. The submenu items and their descriptions follow.

#### *Alarm Report*

Enables and disables the transmitting of alarm reports.
Choices: Send Alarms, Disable Alarms

#### *Alarm Format*

Sets the alarm frame format to 13 frames or 16 frames.
Choices: ORB-13, ORB-16

#### *BPV Threshold*

Sets the threshold for BPVs to trigger an alarm.
Choices: 10-4, 10-5, 10-6

## TSU 610 Clock Sources

The TSU 610 is operable from various clock sources, permitting it to perform properly in many different applications. The network interface timing mode is set by using the Network (NI) Configuration menu options. The following options are available:

- Network Timing
- DTE Timing
- UBR1TE
- Internal Timing
- Secondary Timing

The selected clock option always designates the clock source for transmission. Clocking necessary for receiving data is always recovered from incoming data.

### Network Timing

The network is the source of timing. The received data clocking is looped back to the network, where it is used to determine the transmission timing. This option is also referred to as loop-timed as the transmission clock is derived from the received clock. See *Figure 4-6*.

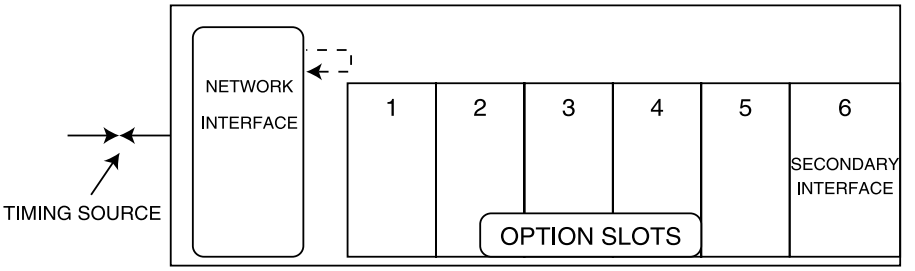



**Figure 4-6. Network Timed Clock Source**

### DTE Timing

The DTE is the source of timing. The TSU 610 uses the incoming DTE clock to determine the transmission timing. This is typically used in applications where it is necessary to have the DTE as the primary clock source (such as limited distance line drivers). See *Figure 4-7*.

The DTE source timing is restricted from use when a secondary interface is used at the same time.

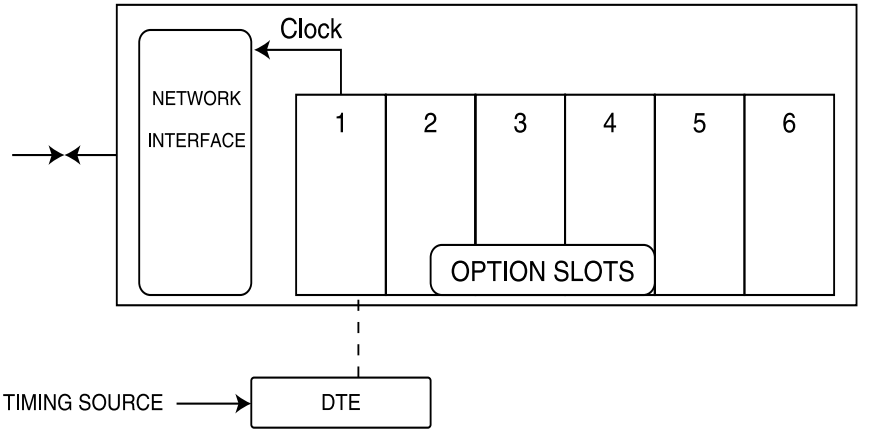



**Figure 4-7. DTE Timed Clock Source**

### U-BR1TE (Slot 1)

The timing mode selection U-BR1TE (Slot 1) works much like DTE timing except that the clock is derived from the U interface.

### Internal Timing

The TSU 610 is the source of timing. The TSU 610 is configured to use its own internal oscillator as the source of timing. Applications include private line driver circuits where one end is set to network and the other to internal. See *Figure 4-8*.

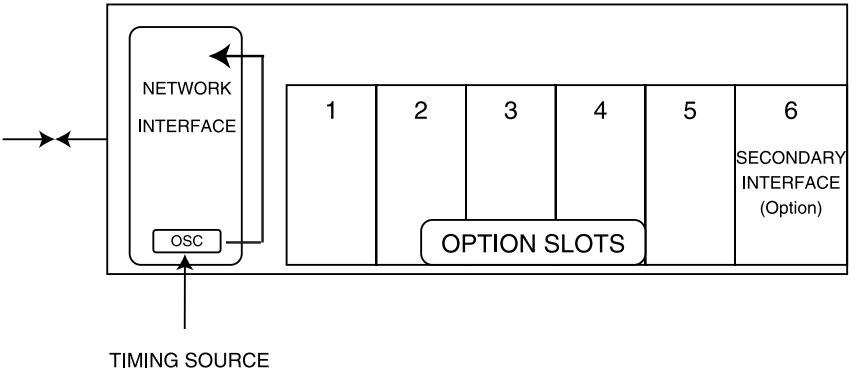



**Figure 4-8. Internal Clock Source**

### Secondary Timing

The secondary interface is the source of timing. The TSU 610 uses the clock derived by the secondary interface for transmission timing. See *Figure 4-9*.

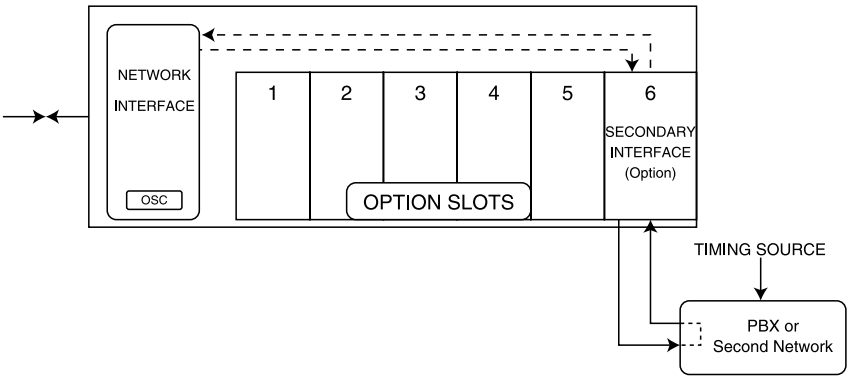



**Figure 4-9. Secondary Clock Source**

## Unit Menu

The Unit menu changes the baud rate of the Chain-In port and the setup of the Chain-Out port. The menu items are:

### Ctl Port Rate
Sets the baud rate for communication with the PC or modem.
Choices: 1200, 2400, 9600, 19200 and 38400 kbps

### Traps
Enables or disables the transmission of trap messages.
Choices: Enable, Disable

### Access
Sets the method of connection from the TSU 610 to T-Watch Pro / SNMP.
Choices:
Direct - Used if connected directly to the PC
Dial - Used when connection is through a modem. The dial string is entered from T-Watch Pro / SNMP.

### Init Modem
Allows you to choose an industry standard or a custom initialization string for a modem connected to the control port.

### Control Port
Selects the TCP / IP physical interface.
Choices: SLIP using the EIA-232 serial port.


*If this option is set to SLIP, the Chain-In port **may not** be used as a terminal interface.*

### IP Address
Uniquely identifies the TSU 610 on a TCP / IP network. This address is composed of four decimal numbers, each in the range of 0 to 255, separated by periods.

### Subnet Mask
This value is set to 0.0.0.0.

### Default Router
This value is set to 0.0.0.0.

### SLIP Rate

Sets the baud rate for the Chain-In port when used as the SLIP connection for SNMP management.
Choices: 1200, 2400, 4800, 9600, 19200, 38400

### SLIP Flow CTL

Used to activate flow control on the Chain-In port when used as the SLIP interface. Hardware mode uses RTS and CTS.
Choices: None, Hardware

### Proxy Traps

Enables or disables the transmission of trap messages from units being "proxied" for.
Choices: Enable, Disable

### External Alarms.

Allows the external alarm relay to be enabled or disabled. If enabled and an alarm occurs, it may be disabled to deactivate the alarm relay.

## Map Exchange (Map Xchng) Menu

The Map Exchange menu enables and sets the automatic time-of- day map switch. The unit provides selection of the hour, minute, and seconds for the map switching to take place.

The menu items are:

### OFF

Indicates the map in use does not change (disabled).

**Off** disables the Automatic Map Change feature.

Press **Enter** to activate the selection.

**AUTO**
Indicates that the map in use will change at a user-selected time of day.

**Auto** enables the Automatic Map Change feature.

Press **Enter** to activate the selection

When **Auto** is selected, the unit displays the screens to set times for switching. After editing Map A, press **Enter** to record the Map A settings and activate the selection fields for Map B. Use the same operation to edit switching time for Map B.

When ESF is used with an FDL channel between units, the units automatically coordinate the automatic map switch by sending a map switch command from end-to-end over the FDL. Only one end needs to be set to **Auto** for this to work.

### MAP In Use: A(B) Menu

This menu item controls the DS0 map the TSU 610 uses and displays the map in current use.

## DS0 Maps Configuration Menu

The Telnet / Terminal version of the DS0 maps configuration menu takes advantage of the 24-line VT 100 display. Upon entering this menu, the current Temp Map, shown in *Figure 4-10*, displays and is followed by 10 selections to use for configuring and reviewing map information.

**TEMP MAP**

| DS0# | PORT | DS0# | PORT |
|---|---|---|---|
| 1 | IDLE | 13 | IDLE |
| 2 | IDLE | 14 | IDLE |
| 3 | IDLE | 15 | IDLE |
| 4 | IDLE | 16 | IDLE |
| 5 | IDLE | 17 | IDLE |
| 6 | IDLE | 18 | IDLE |
| 7 | IDLE | 19 | IDLE |
| 8 | IDLE | 20 | IDLE |
| 9 | IDLE | 21 | IDLE |
| 10 | IDLE | 22 | IDLE |
| 11 | IDLE | 23 | IDLE |
| 12 | IDLE | 24 | IDLE |

1) COPY MAP A TO TEMP MAP
2) COPY MAP B TO TEMP MAP
3) CREATE TEMP MAP
4) CREATE AUTO MAP
5) REVIEW MAP A
6) REVEIW MAP B
7) REVIEW TEMP MAP
8) EDIT TEMP MAP
9) APPLY TEMP MAP TO MAP A
10) APPLY TEMP MAP TO MAP B

**Figure 4-10. DS0 Temp Map**

- Use the **UP** and **DOWN ARROWS** or **NUMBER KEYS** to move the cursor from one selection to another.
- Use the **Enter** key to perform the action displayed to the right of the cursor.

Normally, map configuration involves these steps.

| Step | Action |
|---|---|
| 1 | Initializes the Temp Map to one of three configurations (current Map A, current Map B, or all IDLEs). This step is optional. |
| 2 | Edits the Temp Map so that it reflects the desired map configuration. |
| 3 | Replaces the current DS0 map A or B configuration with the Temp Map configuration. |

### Initializing the Temp Map

Upon entering the DS0 maps configuration menu, the Temp Map reflects its last configured state. You can then use the following selections.

| Use selections... | To initialize... |
|---|---|
| 1, 2, 3 | the displayed Temp Map to one of three configurations. |
| 1, 2 | the Temp Map from its current configuration to one which reflects the currently stored Map A or B configurations, respectively. |
| 3 | the Temp Map to an all IDLE state. |

### Editing the Temp Map

If further changes to the Temp Map are needed, do the following:

| Step | Action | Explanation |
|---|---|---|
| **1** | Use **selection 8** to enter the Temp Map edit mode. | Upon entering this mode, the cursor location moves to DS0 number one in the DS0 field of the Temp Map.<br><br>The cursor may be moved from one DS0 to another by using the up and down arrows until the cursor is located at the DS0 number whose assigned port needs to be changed. |
| **2** | Press the **Enter** key to cause the cursor to move into the **PORT** field. | The up and down arrows are then used to scroll through the possible port selections. |
| **3** | Press the **ESC** key | This restores the previous port assignment and returns to the DS0 field. |
| **4** | Press the **Enter** key | This saves the current selected port and returns to the DS0 field.<br><br>Once the cursor is again located in the **Temp Map DS0** field, press the **ESC** key a second time to return to **selection 1** below the Temp Map display. |

### Applying the Temp Map

Once the Temp Map reflects the desired configuration, use **selections 9** or **10** to apply this configuration to Map A or B, respectively.

### Reviewing Maps

**Selections 5** through **7** give a summary of the number of ports assigned to Map A, Map B, and the Temp Map, respectively.

## Port Configuration (Port Config)

Port Configuration selects and configures the parameters associated with any data port in the unit. For example, parameters for the DSX-1 (PBX) interface are set through this menu. The items that can be set depend on which option module is installed. The list of option ports will vary with the configuration.

The TSU 610 is designed so that future ports will contain the appropriate menu selections to provide access by use of this menu item.

The Config menus for options ports are described in separate sections of the manual supplied with the option card.

### Remote Menu Access

Displays Telnet menus for a remote device (may be another TSU / TDU or any other ADTRAN product that supports Telnet via its EIA-232 chain port). After selecting this option, you may choose to connect to a device entered in the Unit Access Table or enter a Unit ID for a unit not in the Unit Access Table. **CTRL + X** terminates the session and returns to the TSU 610 Main Menu.

# Utility Menu

The Utility menu tree displays and sets system parameters. See *Figure 4-11*. This includes setting the time and date, resetting all parameters to factory values, or re-initiating the unit. This menu also displays the unit software revision and the Unit ID setting.

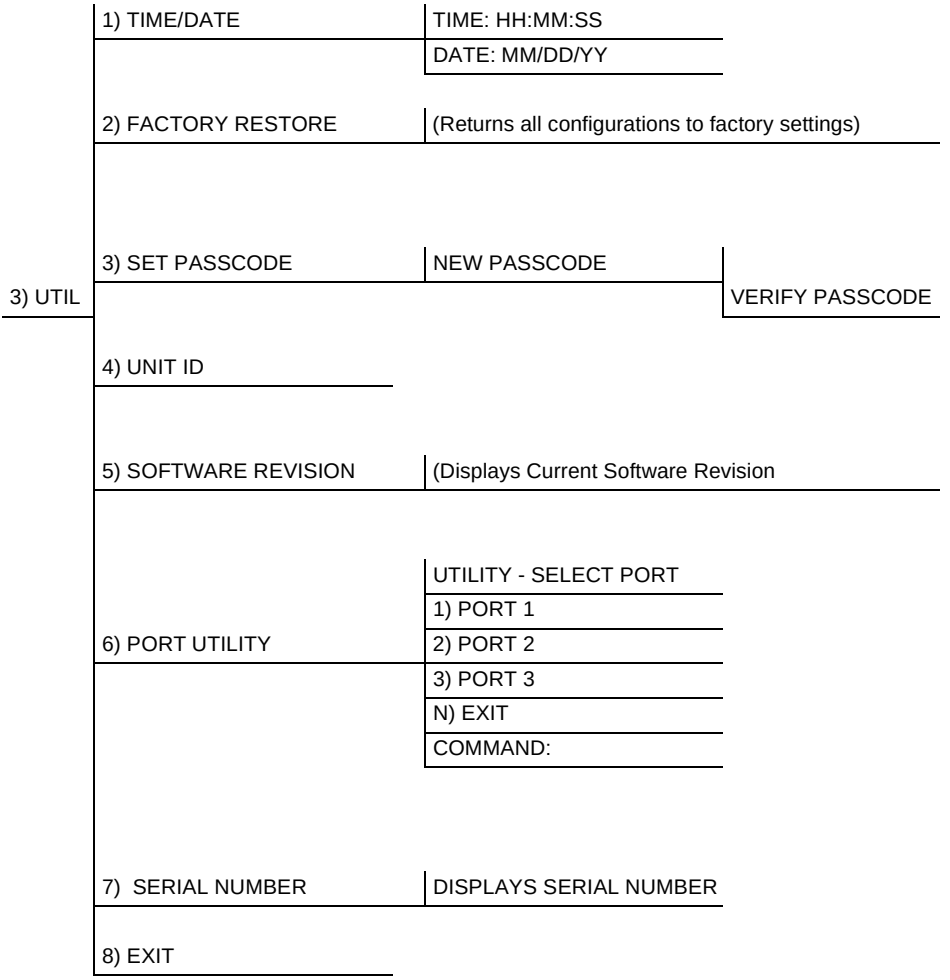



**Figure 4-11. Utility Menu Tree**

### Time/Date

This menu option displays or edits the current time and date. The TSU 610 maintains the time and date during power-off conditions.

| If you want to... | Do this... |
|---|---|
| Record the entry and move to the next editing position | Press **ENTER** after any numeric change |
| Move to a different field to edit | Press **ENTER** at the editing position without making any changes, or use the **UP** and **DOWN ARROW KEYS** |
| End the editing process | Press **CANCEL** |

### Factory Restore

This menu item restores the factory default settings for all unit parameters, including configured DS0 maps.

### Set Passcode

#### Enter Passcode from Other Menus

The **Passcode** prompt may make an unexpected appearance from other menu operations. This happens only when the unit is operating in the limited access mode, i.e., without an active passcode. The limited access mode may become active even if a passcode was entered, as it does when there is no activity for ten minutes. If the unit is to be remotely accessed using T-Watch Pro, a passcode must be entered. When managing a number of units, the passcode can be the same for all.

The unexpected appearance of the **Passcode** prompt occurs, for example, while operating in a limited access mode and attempting to change the data rate, **CONFIG, UNIT, CTL PORT RATE**. Use the number keys to enter the correct passcode, and press **Enter**. The unit displays **Access Granted**.

Pressing any key after entering a passcode causes the unit to return to the previous active menu. In this case it returns to

**CONFIG, UNIT, CTL PORT RATE** to permit changing the data rate.

### Change/Set a Passcode

The passcode can be changed or set at any time or eliminated altogether through the **UTILITY** menu item **SET PASSCODE**. This procedure requires the current passcode (if one is established) for operation.

The passcode can only be entered by using numbers. After entering the desired passcode, press **Enter.**

Set a null passcode at the **SET PASSCODE** menu by pressing **Enter** without any numbers. This sets a null passcode and grants unlimited access.

### Automatic Time-out Feature

For added security protection, the unit is equipped with an automatic time-out for operation with the password. After ten minutes of inactivity, the unit reverts to limited access operation. To make changes in the configuration, the passcode can be reentered. See *Set Passcode* on page 4-22 for further information concerning passcode use and both limited and editing access.

If the passcode number is lost, contact ADTRAN Customer and Product Service for assistance.

### No Passcode Desired

At the **New Passcode** prompt (in the Set Passcode menu), press **Enter** without any numerical entry. The system nullifies the need to enter a password for subsequent use and proceeds to the Unit ID prompt.

## Unit ID

This menu is used to access the current Unit ID setting. Viewing is available in limited access mode. Editing or changing the Unit ID requires the use of a password as in editing mode. Unit Identification numbers must be between 2 and 999. If an out-of-range number is entered, the unit assumes the upper limit number of 999.

### Setting the Unit Identification

In the Unit ID menu (item 4) under the Util menu, enter any value between 2 and 999. The number 1 is reserved for the PC.

Pressing **Enter** records the Unit ID number and establishes its availability for operation by remote control. The unit proceeds to the **Set Control Port** prompt.

### No Unit ID Desired

Without entering any numbers at the Unit ID prompt, press **Enter**. Pressing **Enter** with no Unit ID recorded establishes the unit as unable to be operated by remote control.

## Software Revision (Software Rev)

This menu provides access to the display of the current software revision level loaded into the base unit controller. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

Use **Cancel** to exit.

## Port Utility

This menu provides access to the display of the current software information for each port installed in the unit. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

# Test Menu

The Test menu initiates different types of unit tests and displays test results in the LCD window. The Test menu contains four items. See *Figure 4-12*.

Executing tests will disrupt some of the normal operation. See individual menu items concerning tests before executing.

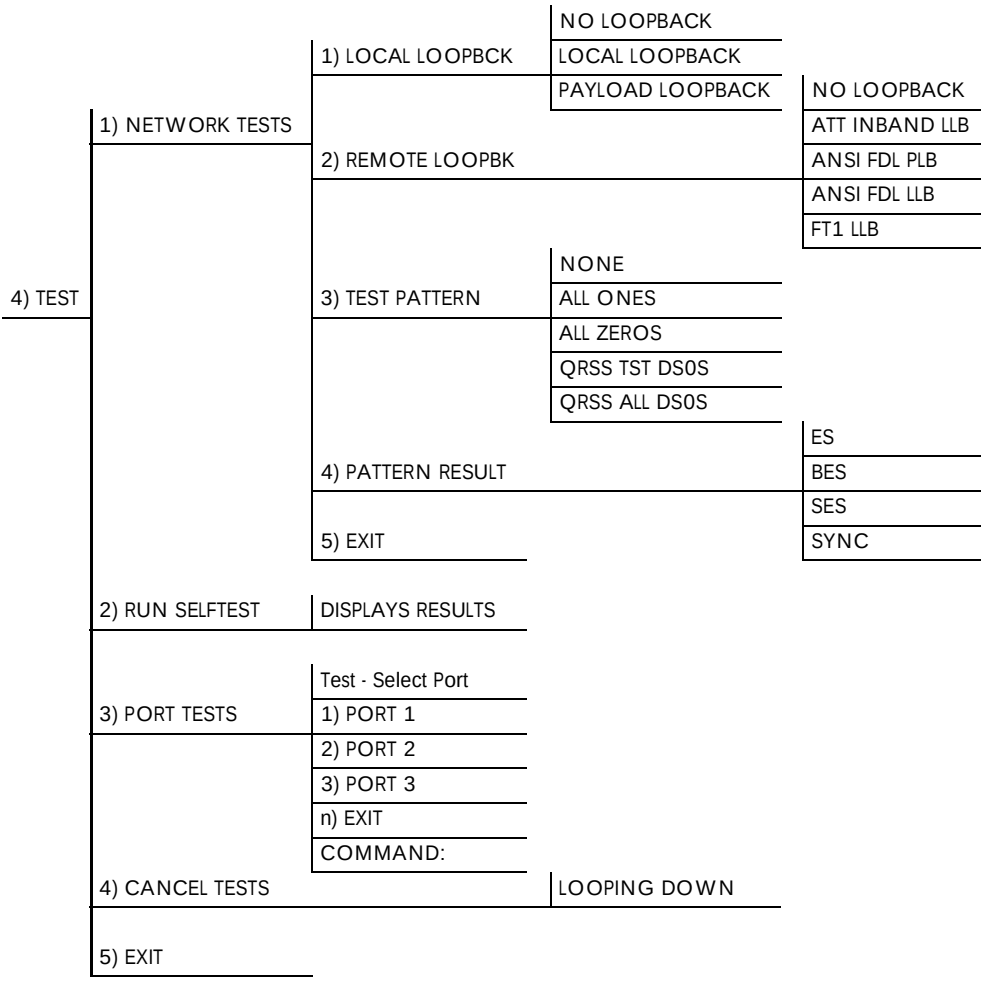



**Figure 4-12. TSU 610 T1 Test Menu**

## Network Tests

Network Tests control the activation of loopbacks and the initiation of data test patterns.

Network Tests are run on the Network Interface (NI). You can select three different test configurations to determine the type of loopback and the pattern to run. Test results are displayed on the terminal screen.

Executing Network Tests will disrupt normal data flow unless only **TST DS0s** are selected for testing.

### Loopback Tests

A number of different loopbacks can be invoked locally from the front panel, by T-Watch Pro commands, or remotely by using special in-band codes (AT&T D4 network loop up and loop down codes). Additionally, the loopbacks can be remotely controlled by means of out-of-band commands by the T1 ESF FDL or from T-Watch Pro by a modem connection. See *Figure 4-13 on page 4-27*.

### Network Interface Loopbacks

Network interface loopbacks affect the entire T1 data stream. There are two types of network loopbacks: line loopback and payload loopback.

Line loopback loops all of the received data back toward the network. The transmitted data is the identical line code that was received, including any bipolar violations or framing errors.

Payload loopback is similar to line loopback, except that the framing is extracted from the received data and then regenerated for the transmitted data.

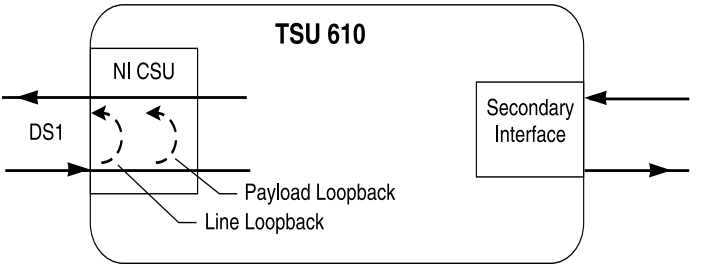



**Figure 4-13. Network Loopback Tests**

### Local Loopback

There are two available choices for setting the local loopback:

#### *No Loopback*

Deactivates the loopback.
Scroll to select a setting and record it by pressing **Enter**. The unit returns to the previous menu level.

#### *Payload Loopback*

Activates the payload loopback.

### Remote Loopback

This activates the same loopbacks as Local Loopback but at the far end. It uses either the inband loopup code as specified by ANSI T1.403 for line loopback (ATT In-Band LLB), or the FDL as specified in ANSI T1.403 for payload and line loopback codes. The following options are available:

#### *No Loopback*

Deactivates the loopback.

#### *ATT Inband LLB*

Activates the line loopback using inband code.

#### *ANSI FDL PLB*

Initiates the transmission of an FDL payload loopup code toward the far end.

***ANSI FDL LLB***
Initiates the transmission of an FDL line loopup code toward the far end.

***ANSI FT1 LLB***
Initiates the transmission of a FT1 loopback using the inband code described in T1.403.


***REMOTE LOOPBACK*** *can only be used with Fractional T1 if the ANSI FT1 LLB is selected.*

After a **REMOTE LOOPBACK** option is selected, the TSU 610 verifies that the far end is actually in a loopback by checking for the receipt of a code looped back from the far end. Once the **REMOTE LOOPBACK** type is selected, the LCD displays the loopback progress by displaying **LOOPING** until loopback is verified.

### Test Patterns

***None***
Terminates pattern generation.

***All Ones***
Sends an all ones pattern to the network.

***All Zeros***
Sends an all zeros pattern to the network.

***QRSS TST DS0s***
Inserts a QRSS pattern in those DS0s mapped as TST in the currently active map (A or B).

***QRSS All DS0s***
Generates a QRSS test pattern and inserts the pattern into all DS0s.

***QRSS Pattern***
The QRSS pattern is commonly used to simulate real data in T1 interfaces. This pattern can be assigned to appear in all DS0s or only in **TST DS0s**. When QRSS is set in all DS0s and one of the network loopbacks previously described is activated at the far end, a total end-to-end integrity check can

be run without the need for any external test equipment. When QRSS is assigned to **TST DS0s**, an integrity check of the link can be run along with normal data flow. The **TST DS0s** are user assigned as part of the DS0 Map.

This sets the pattern for the test and initiates the transmission of the pattern. The test is terminated by selecting **None**. The following patterns are available:

For example:

1. Use the up and down key to select **QRSS ALL DS0s**.
2. Press **Enter** to record the selection. The TSU 610 starts to generate a QRSS test pattern and inserts the pattern into all DS0s.
3. Select **None** to end the test.


*QRSS always runs at 64K/DS0.*

### Pattern Result

Displays the results of the test currently active. Leaving and returning to this menu item does not interrupt the test.

Pressing **2** injects errors into the test pattern. These errors are detected by the device performing the pattern check.

***ES***

The number of seconds with at least 1 bit error.

***BES***

The number of seconds with more than 1 bit error and less than 320.

***SES***

The number of seconds with more than 320 bit errors.

***SYNC***

Indicates if pattern sync is (yes) or is not (no) valid. An asterisk (*) indicates whether pattern sync has been lost since the start of testing.

Clear results by pressing **Shift+9**. The results are accumulated until the test pattern is set to **None** or **Cleared**.

Using **TST DS0s** for testing can be very useful, particularly in Fractional T1 applications. You can run an end-to-end test on the Fractional DS0s by:

1. Setting for Map B the **TST** in the same DS0 as used by Map A to receive data from an Nx56/64 port, and
2. Looping the far end using a V.54 loopback code on the Nx56/64 port. In addition, a single DS0 can be used for continuous testing while other DS0s are passing normal data.

This will also provide an end-to-end check on the entire link. Set each end to send QRSS in **TST DS0s** (using 1 DS0) and occasionally view the results on the Pattern Result Menu selection.

## Run Self-Test

The self-test checks the integrity of the internal operation of the electronic components by performing memory tests and by sending and verifying data test patterns through all internal interfaces. Although actual user data cannot be passed during these tests, the self-test can be run with the network and DTE interfaces in place and will not disturb any external interface.

The memory portion of the self-test automatically executes upon power-up. A full self-test can be commanded from a front panel menu or from T-Watch Pro.

In addition to the specified self-tests, background tests are run on various parts of the internal electronics. These run during normal operation to confirm continued correct functioning.

This menu selection is used to execute a full internal self-test. The results of the self-tests are displayed on the terminal screen. When you invoke the command, the **TEST** LEDs are illuminated. Test failures are displayed on the terminal screen. The self-test consists of the following tests:

### Board level tests

Each of the TSU 610 boards contain an on-board processor which executes a series of tests checking the circuitry on the board.

- RAM tests; EPROM checksum
- DS0 map tests
- On-board data path; sending a known test pattern through an on- board loop

### Unit level tests

- Front panel LED verification
- Phase Lock Loop verify
- Board-to-board interface test

A test pattern is sent from the controller through a loopback on all other boards and is checked on the controller. This verifies the data path, clocks, and control signals.

If a failure is detected, note the failure number and contact ADTRAN Technical Support.

The execution of self-test will disrupt normal data flow and prevent remote communication until the self-test is completed.

## Port Tests

The Port Tests menu is used to activate testing of specific data ports. It controls the activation of loopbacks and the initiation of data test patterns. Test results are displayed in the LCD window.

The execution of PortTests will disrupt normal data flow in the port being tested.

## Cancel Tests

Use this menu selection to deactivate all active tests, including tests on option modules.

# Remote Menu Access

Displays Telnet menus for a remote device (may be another TSU / TDU or any other ADTRAN product that supports Telnet via its EIA-232 chain port). After selecting this option, you may choose to connect to a device entered in the Unit Access Table or enter a Unit ID for a unit not in the Unit Access Table. **CTRL + X** terminates the session and returns to the TSU 610 main menu.

# Management Configuration

This menu sets management information, such as SNMP community names and trap destination addresses. See *Figure 4-14*.

### Unit Access Table

This menu edits and creates the Unit Access Table. This table stores the Unit ID, Passcode, and Unit Type for units connected via chain ports or connected remotely to the TSU / TDU (see *Table 4-1 on page 4-34*). An entry in the table is only required to support proxy SNMP MIB access or polling. For MIB access, an entry is required only if the unit's passcode is not the same as the Default Unit Passcode or the unit is a single port TSU Stand-alone.


*It is not necessary to have an entry in this table for a remote unit in order to Telnet to it or forward SNMP traps from it. In the Telnet case, the Remote Menu Access menu is selected from the Main menu and a Unit ID is entered which may or may not be in the Unit Access Table.*

| | | | |
|---|---|---|---|
| 6) MANAGEMENT CONFIG | 1) UNIT ACCESS TABLE | 1) ADD NEW UNIT<br>2) MODIFY UNIT<br>3) DELETE UNIT<br>4) DELETE UNIT PASSCODE<br>5) OK<br>Command | |
| | 2) SNMP READ COMMUNITY | | PUBLIC |
| | 3) SNMP READ/WRITE COMMUNITY | PRIVATE | |
| | 4) SNMP TRAP COMMUNITY | PUBLIC | |
| | 5) HOST 1 TRAP IP ADDRESS | 000.000.000.000 | |
| | 6) HOST 2 TRAP IP ADDRESS | 000.000.000.000 | |
| | 7) HOST 3 TRAP IP ADDRESS | 000.000.000.000 | |
| | 8) HOST 4 TRAP IP ADDRESS | 000.000.000.000 | |
| | 9) SYSTEM NAME | ADTRAN TSU 610 | |
| | 10) SYSTEM CONTACT | ADTRAN Customer Support: 1-888-423-8726 | |
| | 11) SYSTEM LOCATION | ADTRAN Customer Support: 1-888-423-8726 | |
| | 12) AUTH. FAIL TRAPS SENT | DISABLED | |
| | 13) POLL LINK STATUS TRAPS SENT | ENABLES | DISABLED<br>ENABLES |
| | 14) PING IP HOST | Enter IP Address to Ping | |
| | 15) TELNET TIMEOUT | 5 MINUTES | |
| | 16) TELNET PASSWORD | XXXXX | |
| | 17) EXIT | | |

**Figure 4-14. TSU 610 Management Config Menu**

Units accessed via T-Watch Pro over TCP/IP use the Unit ID and Passcode set by T-Watch Pro running on the PC.

**Table 4-1. Unit Access Table (for T1)**

Unit Access Table

| Unit ID | Passcode | Type | Polled | PollStatus |
|---|---|---|---|---|
| 20 | DEFAULT | Standard | No | |
| 3 | 0033 | Standard | Yes | UP |
| 6 | 0095 | TSU Stand Alone | No | |
| 8 | 0022 | Standard | Yes | UP |

1) Add New Unit
2) Modify Unit
3) Delete Unit
4) Default Unit Passcode 0022
5) OK

### Add New Unit

This adds a new device to the table. You must enter a device Unit ID, Passcode, Unit Type, and Polled Flag. The unit type can be Standard (which supports any TSU/TDU Multiplexer and the ISU 512) or TSU Standalone (a single port TSU with no option card slot). You can select a passcode of **0** to **9999** for each device or **DEFAULT**, in which the default passcode will be used.

Traps are normally sent from the unit in alarm to the TSU 610. For units in the Unit Access Table that are not chained directly to the TSU 610 but are managed over Inband or the FDL, traps are not automatically forwarded. Polling must be enabled on the TSU 610 for these units in order to receive traps on the NMS. The TSU 610 can be configured to poll selected units for traps by enabling the polled option when adding or modifying a unit entry.

### Modify Unit

Allows Unit ID, Passcode, Device Type, and Polled Flag to be changed for an existing entry in the table.

### Delete Unit
Deletes an entry in the table.

### Default Unit Passcode
Sets the default passcode for all devices in the table that have passcodes set to **DEFAULT**, or for any unit not listed in the table.

### OK
Returns to the Configure Agent menu.

## SNMP Read Community

SNMP Read Community Name defaults to public. NMSs using this community name have Read Access for all supported MIB objects but do not have the ability to change MIB objects. This value must be set to the same value on both the TSU 610 and the NMS (OpenView®, etc.) in order for the NMS to have Read Access to MIBs supported by the TSU 610. This value must be a text string of 16 characters or less.

## SNMP Read/Write Community

SNMP NMS using this community name have full Read / Write Access to all supported MIB objects (defaults to private). This setting must be the same value on both the TSU 610 and the NMS in order for the NMS to have Read / Write Access to MIBS supported by the TSU 610. This value must be a text string that is 16 characters or less.


*To access units external to the TSU 610 (proxied units) using an SNMP MIB browser, append a period and the Unit ID of the external device to the Read Only and Read/Write community name used in the MIB Browser, for example, public.4. See Appendix A, Understanding SNMP on page A-1, for more information.*

### SNMP Trap Community

This community name is used for all SNMP traps forwarded by the TSU 610. Traps received from daisy-chained units have a period and the Unit ID appended to the trap community name.

#### SNMP Trap Destination Address

The SNMP Trap Destination addresses are listed below:

#### *Host 1 Trap IP Address*

This is the first of four entries for SNMP trap destination addresses.

The TSU 610 forwards all SNMP traps to the IP address specified in this entry. If the address is set to the default value of 0.0.0.0, no traps are forwarded for this particular value.

#### *Host 2 Trap IP Address*

Defaults to 0.0.0.0. Second destination address for SNMP traps.

#### *Host 3 Trap IP Address*

Defaults to 0.0.0.0. Third destination address for SNMP traps.

#### *Host 4 Trap IP Address*

Defaults to 0.0.0.0. Fourth destination address for SNMP traps.

#### System Name

A text string that can uniquely identify an SNMP-managed node.

#### System Contact

A text string containing the name, phone number, etc. of the individual responsible for maintaining an SNMP-managed node.

#### System Location

A text string describing the physical location of an SNMP-managed node (for example, SECOND FLOOR PBX ROOM).

**Auto. Fail Traps Sent**
(DISABLED, ENABLED: defaults to DISABLED)
When enabled, the TSU 610 issues an SNMP trap when any SNMP request is received with an invalid community name. Can be used for security purposes.

**Poll Link Status Traps Sent**
(DISABLED, ENABLED, defaults to DISABLED). When enabled, the TSU 610 sends an SNMP trap whenever a device configured to be polled fails to respond. When the device begins responding to polls, a poll link-up trap is sent. The formats of the traps are defined in the agent MIB.

**Ping IP Host**
Allows the user to ping a specific IP address.

**Telnet/Terminal Time-out**
The TSU 610 terminates a Telnet or terminal session if no activity is detected for this length of time. Only one Telnet or terminal session may be active at one time. This time-out prevents an unattended session from blocking interactive access to the agent. The default value is five minutes.

**Telnet/Terminal Password**
This option allows modification of the password required for entry into a Telnet or terminal session. The default value is ADTRAN.

**Exit**
Returns to the TSU 610 Main menu.

## Flash Download

The TSU 610 uses flash memory that allows software updates via the chain-in port. This menu selection allows you to perform a flash download manually using **XMODEM**. T-Flash is also available to automate this process.

## Quit Session

Terminates the Telnet / Terminal session.

# Chapter 5 HDSL Network Interface

## MAIN MENU FOR HDSL NETWORK INTERFACE

The Telnet/Terminal main menu is the first menu displayed after the Telnet/Terminal session is established. See *Figure 5-1*. The default Telnet/Terminal password is **ADTRAN**.

| | |
|---|---|
| NOTE | *Only one Telnet/Terminal session may be active at a time.* |

```
ADTRAN  TSU 610
Password: XXXXXXXX
Main Menu
1) Status
2) Config
3) Util
4) Test
5) Remote Menu Access
6) Management Config
7) Flash Download
8) Quit Session
```

**Figure 5-1. Telnet/Terminal Main Menu**

# HDSL Status Menu

The Status menu branch allows you to view the status of the TSU 610 operation. See *Figure 5-2.*

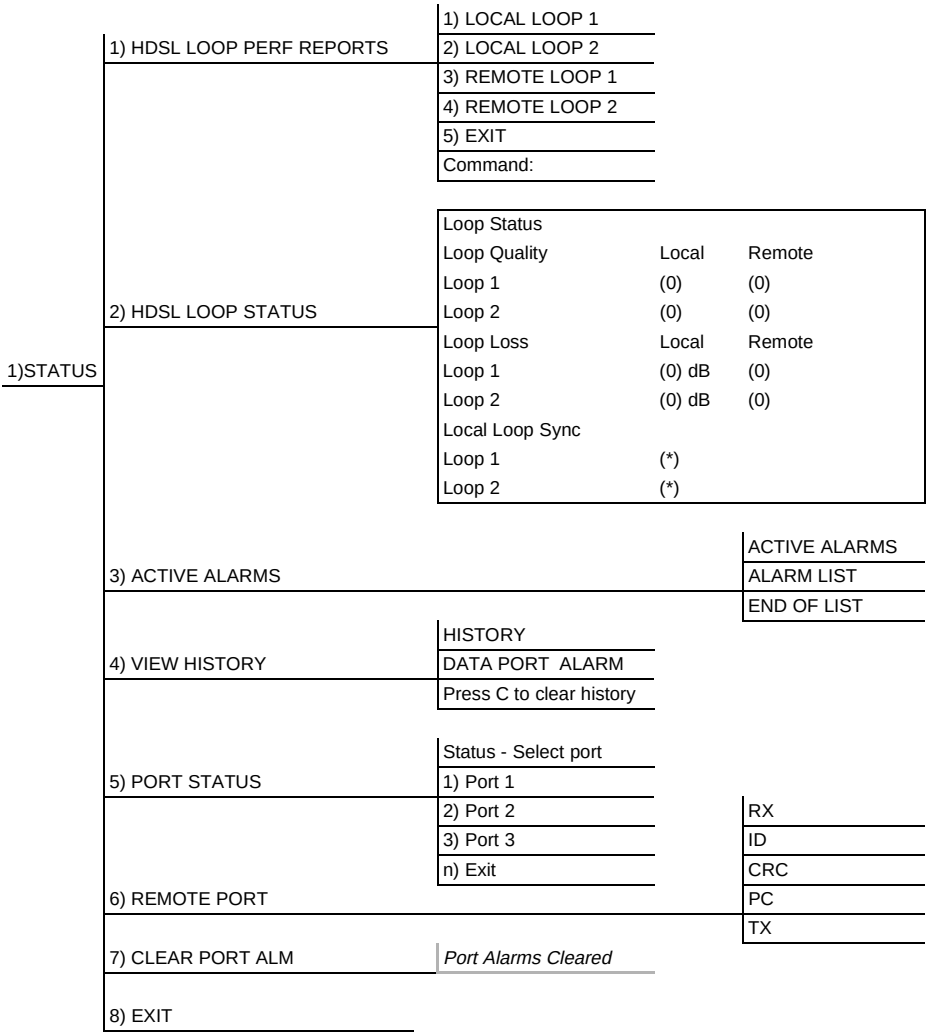



**Figure 5-2. Complete Status Menu**

## HDSL Performance Reports

The HDSL Interface Performance Reports display the user copy of the performance data. See *Figure 5-2 on page 5-2*. The TSU 610 maintains this performance data on the network in compliance with ANSI T1.403 and AT&T document TR54016. The data displayed is data accumulated over the last 15 minutes and over the last 24 hours.

**ES**
Number of errored seconds (1 or more errors / second)

**SES**
Number of severely errored seconds (more than 320 errors / second)

**UAS**
Number of unavailable seconds (10 or more consecutive seconds)

If insufficient time has passed to collect data, **NA** displays. Continue with standard operating procedures to exit the display.

When this menu is active, performance data can be cleared by pressing **C** on the keyboard. Only the user copy of the performance data is cleared.

Since only the user's copy of performance data is cleared by the TSU 610, the data displayed here might be different from the data sent to the network as PRM data.

## HDSL Loop Status

### Loop Quality

Displays Loop Quality on a scale of 0 (poor signal quality) to 9 (excellent signal quality) for both the Local Unit and the Remote Unit. A guildeline for interpreting the indicators are given below:

| | |
|---|---|
| 0 | Noise margin is $\leq 0$db ( $\approx 10^{-7}$BER) (poor loop quality). |
| 1-8 | Margin measurement above $10^{-7}$ BER in dB. |
| 9 | Margin is $\geq$9 dB (excellent quality) above $10^{-7}$ BER. |

ADTRAN has defined the following as guidelines that correspond to the operation of the TSU 610 HDSL:

| | |
|---|---|
| 0 | Poor Loop Quality |
| $\geq 0, \leq 2$ | Marginal Loop Quality |
| $\geq 2$ | Good Loop Quality |

### Loop Loss

Displays the Loop Loss in dB for both the Local unit and Remote unit. A loss of less than 31 dB is necessary for sync.

### Local Loop Sync

Displays an asterisk [*] when the Loop is in sync.

## Active Alarms

This menu item displays a list of current alarms reported by either the base controller or any of the ports. If no alarms are current, the menu item displays **End of List**. See *Figure 4-3*.

This display includes two lines of text. The top line is the alarm source. The bottom line is the alarm message. A list of alarm messages is found in *Appendix C, System Messages*, on page C-1.

## View History

This menu item displays and clears the accumulated status changes of the unit.

View History displays a history of the first 20 status changes in the unit, including the date, time, and type of change. The unit also records for viewing the date and time an alarm became active and inactive, as well as the date and time of test activation and deactivation.

To clear the View History display, press **C** with the **VIEW HISTORY** menu active.

### Port Status

Port Status displays the signals monitored on the data ports. For example, an Nx56/64 interface monitors the RTS, CTS, TD, and RD, along with other signal lines. When a port is selected, the LCD indicates whether the signal is present.

### Remote Port

Remote Port displays the status of activity on the Chain-In remote port. This is useful for troubleshooting communication sessions, as well as verifying cabling.

**RX**
Characters received at remote port.

**ID**
Unit ID received at remote port.

**CRC**
Correct CRC received.

**PC**
Correct passcode received.

**TX**
Characters transmitted from the remote port.

### Clear Port Alarm

Clears the **LINK FAILED ALARMS** on option modules that have been removed from the TSU 610 chassis.

# HDSL Configuration Menu

The Configuration menu sets the TSU 610 operational configuration, including all network interface parameters, the allocation of the DS0s, and the port parameters. See *Figure 5-3*.

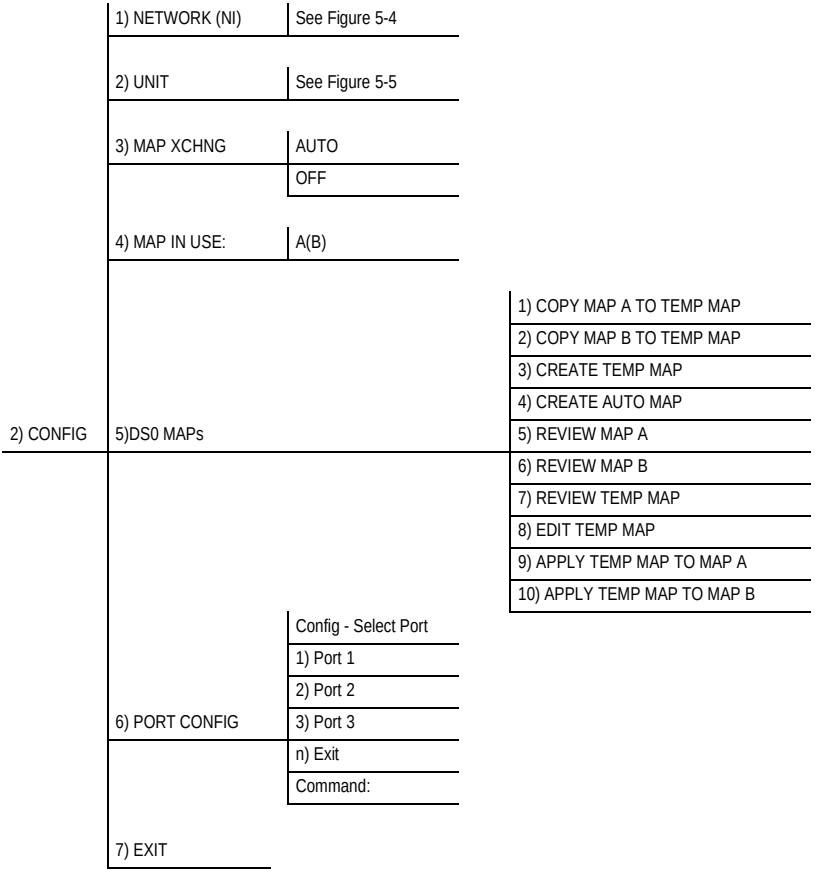



**Figure 5-3. TSU 610 HDSL Configuration Menu**

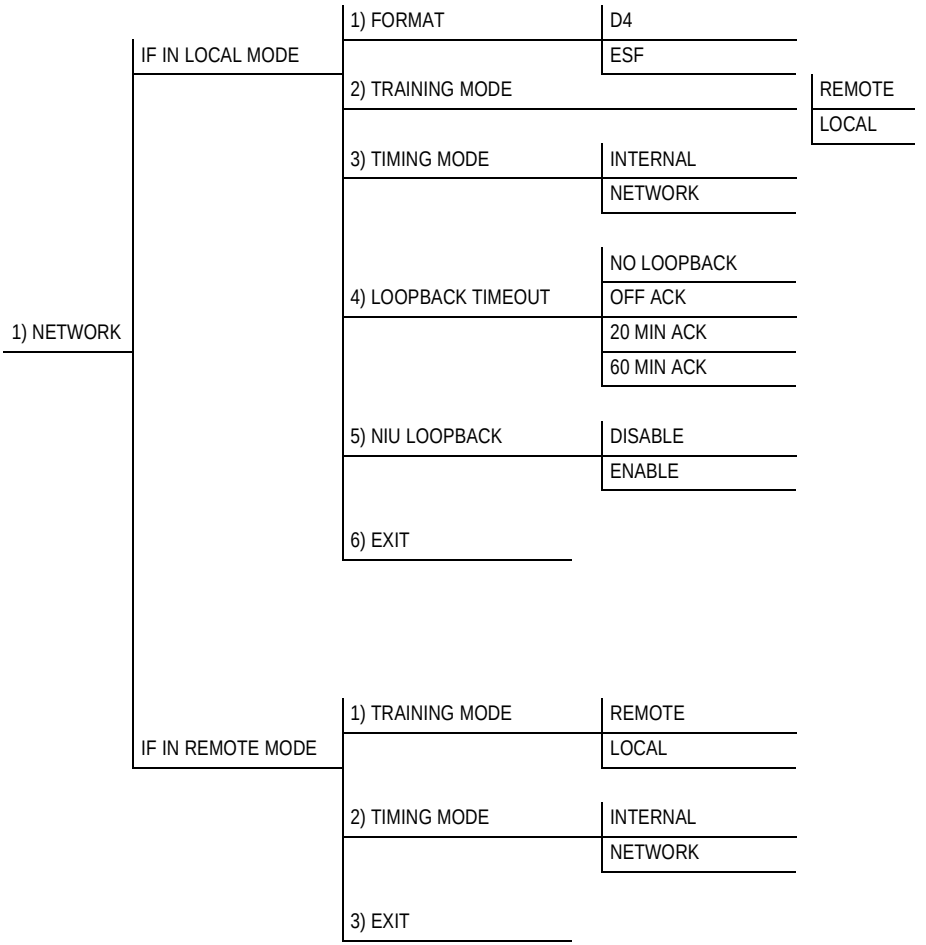



**Figure 5-4. TSU 610 HDSL Network (NI) Menu**

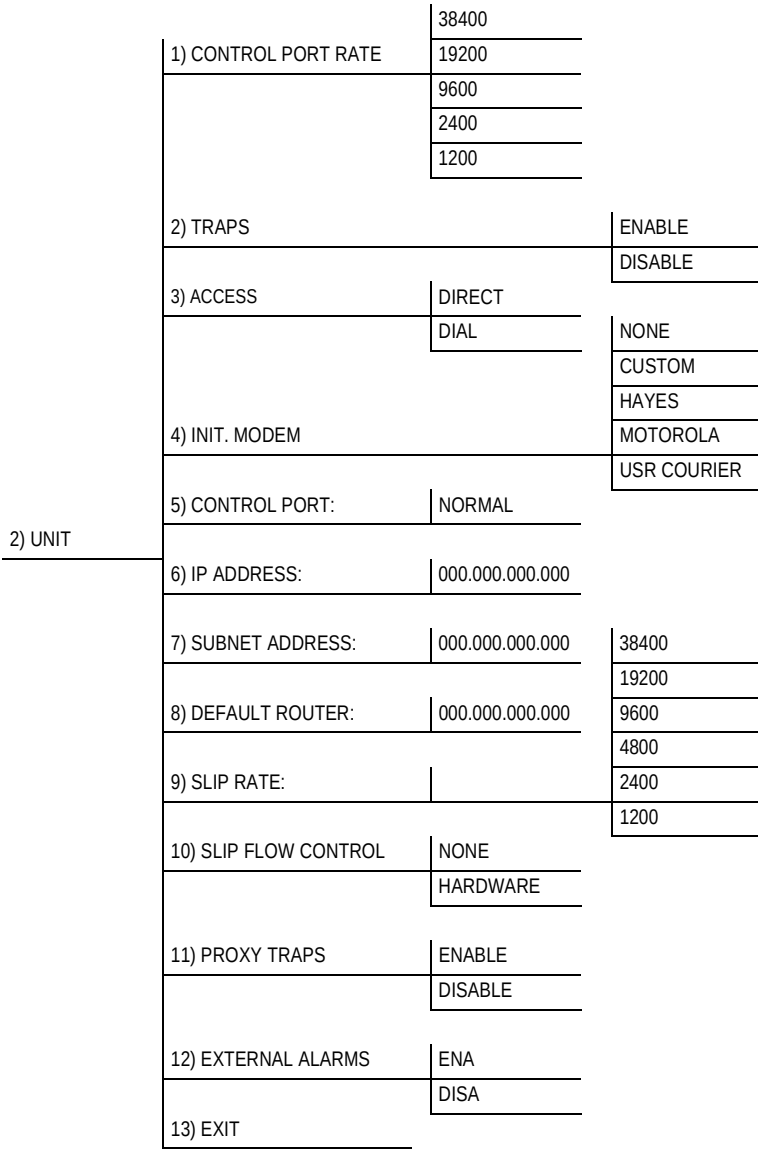



**Figure 5-5. TSU 610 HDSL Unit Menu**

## Network (NI)

### Format
(Local Mode Only)
The format command is used to configure a remote HTUR's T1 frame format.
Choices: D4, ESF

### Training Mode
This menu item is used to set the training mode of the HDSL interface. Local causes the interface to emulate an HTUC while Remote causes the interface to emulate an HTUR.

### Timing Mode
Selects the clock source for transmission toward the HDSL network.
Choices: Internal, Network, Secondary, DTE (Slot 1), UBR1TE (Slot 1), Secondary (SI) (Slot 6), Normal (DSU)

### Loopback Timeout
(Local Mode Only)
This menu item sets the length of time a loopback will run before it is automatically reset.
Choices: No Loopback, Off Acknowledge, 20 minute ackknowledge, 60 minute acknowledge, 120 minute acknowledge.

### NIU Loopback
(Local Mode Only)
This menu item selects the status of the NIU Loopback.
Choices: Disable, Enable.

### Exit
This menu item returns to the Config menu when selected.

## TSU 610 Clock Sources

The TSU 610 is operable from various clock sources, permitting it to perform properly in many different applications. The network interface timing mode is set by using the Network (NI) Configuration menu options. The following options are available:

- Network Timing
- DTE Timing
- UBR1TE
- Internal Timing
- Secondary Timing

The selected clock option always designates the clock source for transmission. Clocking necessary for receiving data is always recovered from incoming data.

### Network Timing

The network is the source of timing. The received data clocking is looped back to the network, where it is used to determine the transmission timing. This option is also referred to as loop-timed as the transmission clock is derived from the received clock. See *Figure 5-6*.

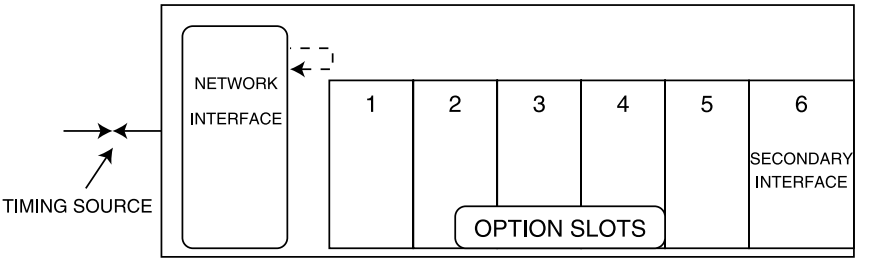



**Figure 5-6. Network Timed Clock Source**

### DTE Timing

The DTE is the source of timing. The TSU 610 uses the incoming DTE clock to determine the transmission timing. This is typically used in applications where it is necessary to have the DTE as the primary clock source (such as limited distance line drivers). See *Figure 5-7*.

The DTE source timing is restricted from use when a secondary interface is used at the same time.

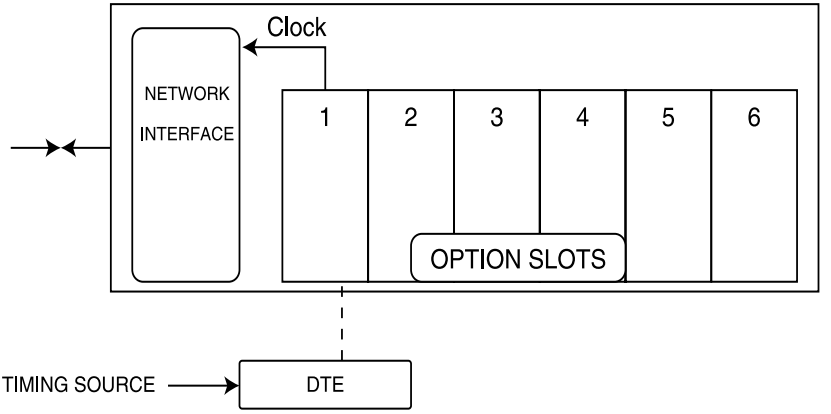



**Figure 5-7. DTE Timed Clock Source**

### U-BR1TE (Slot 1)

The timing mode selection U-BR1TE (Slot 1) works much like DTE timing except that the clock is derived from the U interface.

### Internal Timing

The TSU 610 is the source of timing. The TSU 610 is configured to use its own internal oscillator as the source of timing. Applications include private line driver circuits where one end is set to network and the other to internal. See *Figure 5-8*.

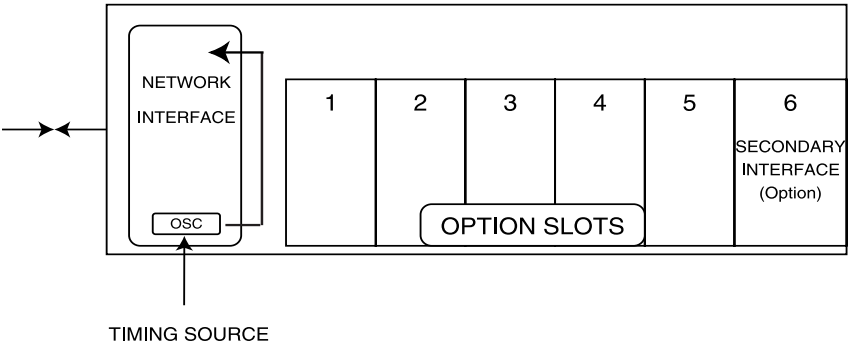



**Figure 5-8. Internal Clock Source**

### Secondary Timing

The secondary interface is the source of timing. The TSU 610 uses the clock derived by the secondary interface for transmission timing. See *Figure 5-9*.

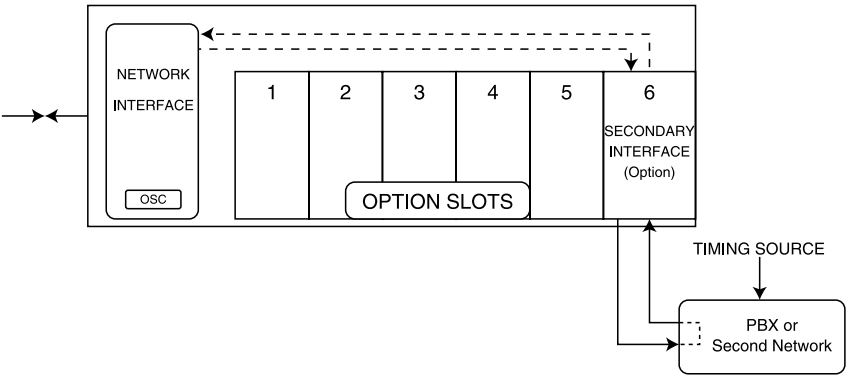



**Figure 5-9. Secondary Clock Source**

## Unit Menu

The Unit menu changes the baud rate of the Chain-In port and the setup of the Chain-Out port. The menu items are:

### Ctl Port Rate
Sets the baud rate for communication with the PC or modem.
Choices: 1200, 2400, 9600, 19200 and 38400 kbps

### Traps
Enables or disables the transmission of trap messages.
Choices: Enable, Disable

### Access
Sets the method of connection from the TSU 610 to T-Watch Pro / SNMP.
Choices:
Direct - Used if connected directly to the PC
Dial - Used when connection is through a modem. The dial string is entered from T-Watch Pro / SNMP.

### Init Modem
Allows you to choose an industry standard or a custom initialization string for a modem connected to the control port.

### Control Port
Selects the TCP / IP physical interface.
Choices: SLIP using the EIA-232 serial port.


If this option is set to SLIP, the Chain-In port **may not** be used as a Terminal interface.

### IP Address
Uniquely identifies the TSU 610 on a TCP / IP network. This address is composed of four decimal numbers, each in the range of 0 to 255, separated by periods.

### Subnet Mask
This value is set to 0.0.0.0.

### Default Router
This value is set to 0.0.0.0.

**SLIP Rate**
Sets the baud rate for the Chain-In port when used as the SLIP connection for SNMP management.
Choices: 1200, 2400, 4800, 9600, 19200, 38400

**SLIP Flow CTL**
Used to activate flow control on the Chain-In port when used as the SLIP interface. Hardware mode uses RTS and CTS.
Choices: None, Hardware

**Proxy Traps**
Enables or disables the transmission of trap messages from units being "proxied" for.
Choices: Enable, Disable

**External Alarms**
Allows the external alarm relay to be enabled or disabled. If enabled and an alarm occurs, may be disabled to deactivate the alarm relay.

## Map Exchange (Map Xchng) Menu

The Map Exchange menu enables and sets the automatic time-of-day map switch. The unit provides selection of the hour, minute, and seconds for the map switching to take place.

The menu items are:

**OFF**
Indicates the map in use does not change (disabled).

**Off** disables the Automatic Map Change feature.

Press **Enter** to activate the selection.

**AUTO**
Indicates that the map in use will change at a user-selected time of day.

**Auto** enables the Automatic Map Change feature.

Press **Enter** to activate the selection

When **Auto** is selected, the unit displays the screens to set times for switching. After editing Map A, press **Enter** to record the Map A settings and activate the selection fields for Map B. Use the same operation to edit switching time for Map B.

When ESF is used with an FDL channel between units, the units automatically coordinate the automatic map switch by sending a map switch command from end-to-end over the FDL. Only one end needs to be set to **Auto** for this to work.

### MAP In Use: A(B) Menu

This menu item controls the DS0 map the TSU 610 uses and displays the map in current use.

## DS0 Maps Configuration Menu

The Telnet / Terminal version of the DS0 maps configuration menu takes advantage of the 24-line VT 100 display. Upon entering this menu, the current Temp Map displays followed by 10 selections to use for configuring and reviewing map information. See *Figure 5-10*.

```
                              TEMP MAP

DS0#        PORT                          DS0#        PORT
1           IDLE                          13          IDLE
2           IDLE                          14          IDLE
3           IDLE                          15          IDLE
4           IDLE                          16          IDLE
5           IDLE                          17          IDLE
6           IDLE                          18          IDLE
7           IDLE                          19          IDLE
8           IDLE                          20          IDLE
9           IDLE                          21          IDLE
10          IDLE                          22          IDLE
11          IDLE                          23          IDLE
12          IDLE                          24          IDLE

1) COPY MAP A TO TEMP MAP
2) COPY MAP B TO TEMP MAP
3) CREATE TEMP MAP
4) CREATE AUTO MAP
5) REVIEW MAP A
6) REVEIW MAP B
7) REVIEW TEMP MAP
8) EDIT TEMP MAP
9) APPLY TEMP MAP TO MAP A
10) APPLY TEMP MAP TO MAP B
```

**Figure 5-10. DS0 Temp Map**

- Use the **UP** and **DOWN ARROWS** or **NUMBER KEYS** to move the cursor from one selection to another.
- Use the **Enter** key to perform the action displayed to the right of the cursor.

Normally, map configuration involves these steps.

| Step | Action |
|---|---|
| **1** | Initializes the Temp Map to one of three configurations (current Map A, current Map B, or all IDLEs). This step is optional. |
| **2** | Edits the Temp Map so that it reflects the desired map configuration. |
| **3** | Replaces the current DS0 map A or B configuration with the Temp Map configuration. |

### Initializing the Temp Map

Upon entering the DS0 maps configuration menu, the Temp Map reflects its last configured state. You can then use the following selections.

| Use selections... | To initialize... |
|---|---|
| **1, 2, 3** | the displayed Temp Map to one of three configurations. |
| **1, 2** | the Temp Map from its current configuration to one which reflects the currently stored Map A or B configurations, respectively. |
| **3** | the Temp Map to an all IDLE state. |

### Editing the Temp Map

If further changes to the Temp Map are needed, do the following:

| Step | Action | Explanation |
|---|---|---|
| 1 | Use **selection 8** to enter the Temp Map edit mode. | Upon entering this mode, the cursor location moves to DS0 number one in the DS0 field of the Temp Map.<br><br>The cursor may be moved from one DS0 to another by using the up and down arrows until the cursor is located at the DS0 number whose assigned port needs to be changed. |
| 2 | Press the **Enter** key to cause the cursor to move into the **PORT** field. | The up and down arrows are then used to scroll through the possible port selections. |
| 3 | Press the **ESC** key | This restores the previous port assignment and returns to the DS0 field. |
| 4 | Press the **Enter** key | This saves the current selected port and returns to the DS0 field.<br><br>Once the cursor is again located in the **Temp Map DS0** field, press the **ESC** key a second time to return to **selection 1** below the Temp Map display. |

### Applying the Temp Map

Once the Temp Map reflects the desired configuration, use **selections 9** or **10** to apply this configuration to Map A or B, respectively.

### Reviewing Maps

**Selections 5** through **7** give a summary of the number of ports assigned to Map A, Map B, and the Temp Map, respectively.

## Port Configuration (Port Config)

Port Configuration selects and configures the parameters associated with any data port in the unit. For example, parameters for the DSX-1 (PBX) interface are set through this menu. The items that can be set depend on which option module is installed. The list of option ports will vary with the configuration.

The TSU 610 is designed so that future ports developed will contain the appropriate menu selections to provide access by use of this menu item.

The Config menus for options ports are described in separate sections of the manual supplied with the option card.

### Remote Menu Access

Displays Telnet menus for a remote device (may be another TSU/TDU or any other ADTRAN product that supports Telnet via its EIA-232 chain port). After selecting this option, you may choose to connect to a device entered in the Unit Access Table or enter a Unit ID for a unit not in the Unit Access Table. **CTRL + X** terminates the session and returns to the TSU 610 Main Menu.

# Utility Menu

The Utility menu tree displays and sets system parameters. See *Figure 5-11*. This includes setting the time and date, resetting all parameters to factory values, or re-initiating the unit. This menu also displays the unit software revision and the Unit ID setting.

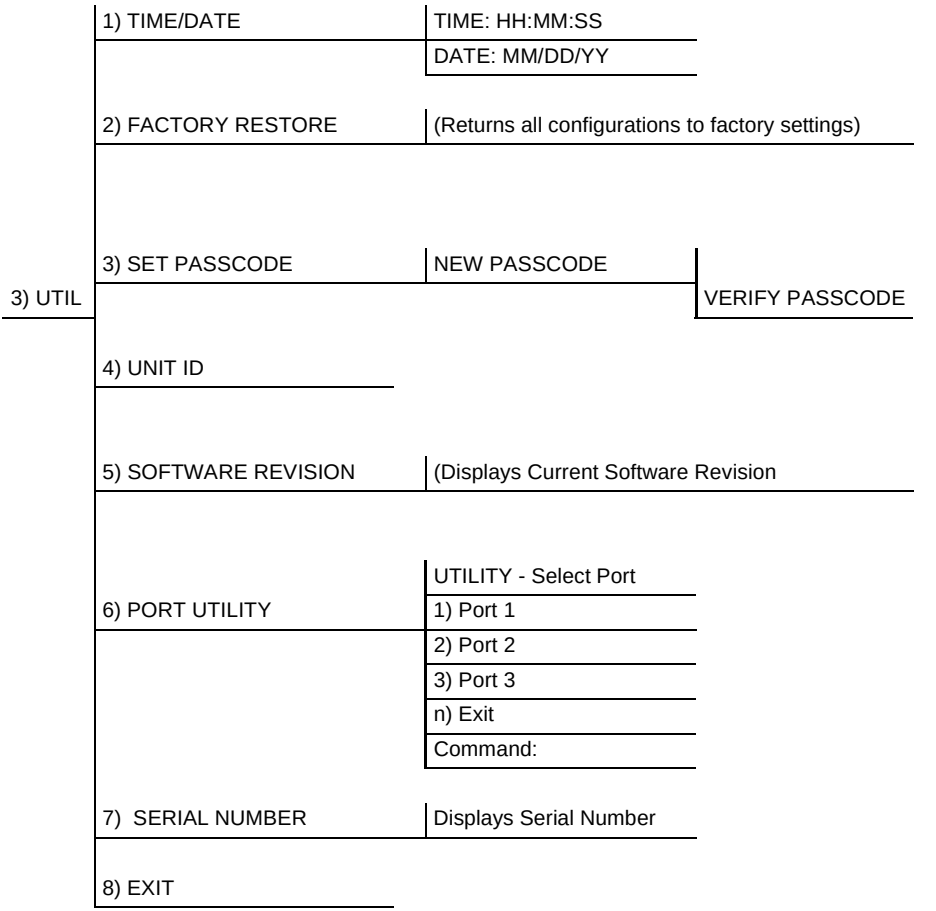



**Figure 5-11. Utility Menu Tree**

### Time/Date

This menu option displays or edits the current time and date. The TSU 610 maintains the time and date during power-off conditions.

| If you want to... | Do this... |
|---|---|
| Record the entry and move to the next editing position | Press **Enter** after any numeric change |
| Move to a different field to edit | Press **Enter** at the editing position without making any changes, or use the **UP** and **DOWN** arrow keys |
| End the editing process | Press **Cancel** |

### Factory Restore

This menu item restores the factory default settings for all unit parameters, including configured DS0 maps.

### Set Passcode

#### Enter Passcode from Other Menus

The **Passcode** prompt may make an unexpected appearance from other menu operations. This happens only when the unit is operating in the limited access mode, i.e., without an active passcode. The limited access mode may become active even if a passcode was entered, as it does when there is no activity for ten minutes. If the unit is to be remotely accessed using T-Watch Pro, a passcode must be entered. When managing a number of units, the passcode can be the same for all.

The unexpected appearance of the **Passcode** prompt occurs, for example, while operating in a limited access mode and attempting to change the data rate, **CONFIG, UNIT, CTL PORT RATE**. Use the number keys to enter the correct passcode and press **Enter**. The unit displays **Access Granted**.

Pressing any key after entering a passcode causes the unit to return to the previous active menu. In this case it returns to **CONFIG, UNIT, CTL PORT RATE** to permit changing the data rate.

### Change/Set a Passcode

The passcode can be changed or set at any time or eliminated altogether through the Utility menu item **Set Passcode**. This procedure requires the current passcode (if one is established) for operation.

The passcode can only be entered by using numbers. After entering the desired passcode, press **Enter.**

Set a null passcode at the **Set Passcode** menu by pressing **Enter** without any numbers. This sets a null passcode and grants unlimited access.

### Automatic Time-out Feature

For added security protection, the unit is equipped with an automatic time-out for operation with the password. After ten minutes of inactivity, the unit reverts to limited access operation. To make changes in the configuration, the passcode can be reentered. See *Set Passcode on page 5-21* for further information concerning passcode use, and both limited and editing access.

If the passcode number is lost, contact ADTRAN Customer and Product Service for assistance.

### No Passcode Desired

At the **New Passcode** prompt (in the Set Passcode menu), press **Enter** without any numerical entry. The system nullifies the need to enter a password for subsequent use and proceeds to the Unit ID prompt.

## Unit ID

This menu is used to access the current Unit ID setting. Viewing is available in limited access mode. Editing or changing the Unit ID requires the use of a password as in editing mode. Unit Identification numbers must be between 2 and 999. If an out-of-range number is entered, the unit assumes the upper limit number of 999.

### Setting the Unit Identification

In the Unit ID menu (item 4) under the Util menu, enter any value between 2 and 999. The number 1 is reserved for the PC.

Pressing **Enter** records the Unit ID number and establishes its availability for operation by remote control. The unit proceeds to the **Set Control Port** prompt.

### No Unit ID Desired

Without entering any numbers at the Unit ID prompt, press **Enter**. Pressing **Enter** with no Unit ID recorded establishes the unit as unable to be operated by remote control.

## Software Revision (Software Rev)

This menu provides access to the display of the current software revision level loaded into the base unit controller. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

Use **Cancel** to exit.

## Port Utility

This menu provides access to the display of the current software information for each port installed in the unit. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

# Test Menu

The Test menu initiates different types of unit tests and displays test results on the Terminal screen. The Test menu contains four items. See *Figure 5-12*.

Executing tests will disrupt some of the normal operation. See individual menu items concerning tests before executing.

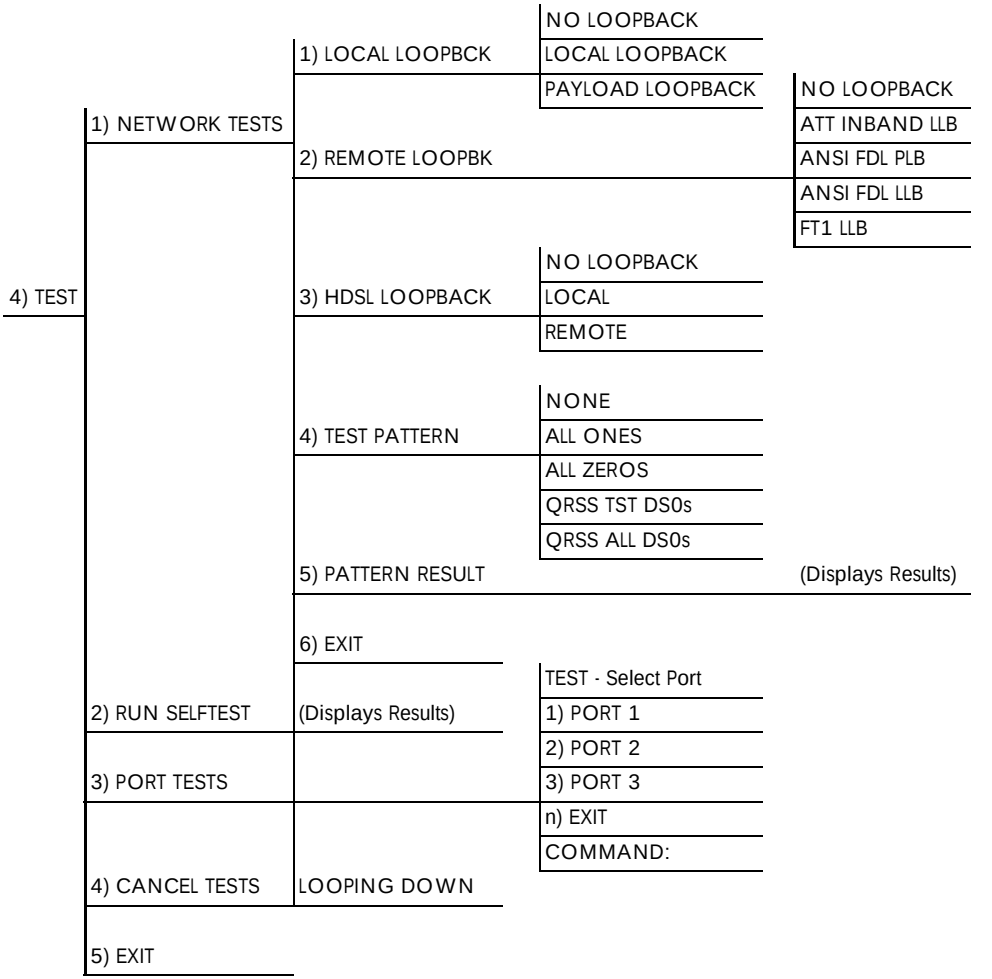



**Figure 5-12. Test Menu**

Menu flow is normally depicted from left to right. At every level of the menu, pressing **Cancel** returns the system to the previous menu level. Pressing **Cancel** repeatedly returns the system to the Main menu.

## Network Tests

Network tests control the activation of loopbacks and the initiation of data test patterns.

Network tests are run on the Network Interface (NI). You can select three different test configurations to determine the type of loopback and the pattern to run. Test results are displayed on the Terminal screen.

Executing **NETWORK TESTS** will disrupt normal data flow unless only **TST DS0s** are selected for testing.

### Loopback Tests

A number of different loopbacks can be invoked locally from the front panel, by T-Watch Pro commands, or remotely by using special in-band codes (AT&T D4 network loop up and loop down codes). Additionally, the loopbacks can be remotely controlled by means of out-of-band commands by the HDSL ESF FDL or from T-Watch Pro by a modem connection. See *Figure 5-13 on page 5-26*.

### Network Interface Loopbacks

Network interface loopbacks affect the entire HDSL data stream. There are two types of network loopbacks: line loopback and payload loopback.

Line loopback loops all of the received data back toward the network. The transmitted data is the identical line code that was received, including any bipolar violations or framing errors.

Payload loopback is similar to line loopback, except that the framing is extracted from the received data and then regenerated for the transmitted data.

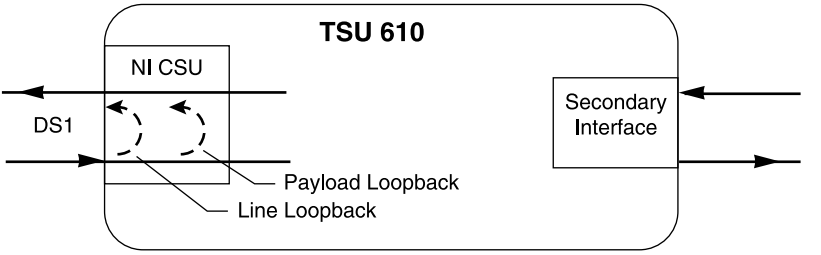



**Figure 5-13. Network Loopback Tests**

### Local Loopback

There are two available choices for setting the local loopback:

#### *No Loopback*

Deactivates the loopback.
Scroll to select a setting and record it by pressing **Enter**. The unit returns to the previous menu level.

#### *Payload Loopback*

Activates the payload loopback.

### Remote Loopback

This activates the same loopbacks as Local Loopback but at the far end. It uses either the inband loopup code as specified by ANSI T1.403 for line loopback (ATT In-Band LLB), or the FDL as specified in ANSI T1.403 for payload and line loopback codes. The following options are available:

#### *No Loopback*

Deactivates the loopback.

#### *ATT Inband LLB*

Activates the line loopback using inband code.

#### *ANSI FDL PLB*

Initiates the transmission of an FDL payload loopup code toward the far end.

***ANSI FDL LLB***
Initiates the transmission of an FDL line loopup code toward the far end.

***ANSI FT1 LLB***
Initiates the transmission of a FT1 loopback using the inband code described in T1.403.


***REMOTE LOOPBACK*** *can only be used with Fractional T1 if the ANSI FT1 LLB is selected.*

After a **REMOTE LOOPBACK** option is selected, the TSU 610 verifies that the far end is actually in a loopback by checking for the receipt of a code looped back from the far end. Once the **REMOTE LOOPBACK** type is selected, the LCD displays the loopback progress by displaying **LOOPING** until loopback is verified.

### HDSL Loopback

***No Loopback***
Deactivates any loopbacks.

***Local***
Loopbacks the HDSL interface at the local unit.

***Remote***
Loopbacks the HDSL interface at the remote unit.

### Test Pattern

***None***
Terminates pattern generation.

***All Ones***
Sends an all ones pattern to the network.

***All Zeros***
Sends an all zeros pattern to the network.

***QRSS TST DS0s***
Inserts a QRSS pattern in those DS0s mapped as TST in the currently active map (A or B).

### *QRSS All DS0s*

Generates a QRSS test pattern and inserts the pattern into all DS0s.

### *QRSS Pattern*

The QRSS pattern is commonly used to simulate real data in HDSL interfaces. This pattern can be assigned to appear in all DS0s or only in **TST DS0s**. When QRSS is set in all DS0s and one of the network loopbacks previously described is activated at the far end, a total end-to-end integrity check can be run without the need for any external test equipment. When QRSS is assigned to **TST DS0s**, an integrity check of the link can be run along with normal data flow. The **TST DS0s** are user assigned as part of the DS0 Map.

This sets the pattern for the test and initiates the transmission of the pattern. The test is terminated by selecting **None**. The following patterns are available:

For example:

1. Use the **Up** and **Down** key to select **QRSS ALL DS0s**.
2. Press **Enter** to record the selection. The TSU 610 starts to generate a QRSS test pattern and inserts the pattern into all DS0s.
3. Select **None** to end the test.


QRSS always runs at 64K / DS0.

### Pattern Result

Displays the results of the test currently active. Leaving and returning to this menu item does not interrupt the test.

Pressing **2** injects errors into the test pattern. These errors are detected by the device performing the pattern check.

### *ES*

The number of seconds with at least 1 bit error.

***BES***
The number of seconds with more than 1 bit error and less than 320.

***SES***
The number of seconds with more than 320 bit errors.

***SYNC***
Indicates if pattern sync is (yes) or is not (no) valid. An asterisk (*) indicates whether or not pattern sync has been lost since the start of testing.

Clear results by pressing **Shift+9**. The results are accumulated until the test pattern is set to **None** or **Cleared**.

Using **TST DS0s** for testing can be very useful, particularly in Fractional HDSL applications. You can run an end-to-end test on the Fractional DS0s by:

1. Setting for Map B the **TST** in the same DS0 as used by Map A to receive data from an Nx56/64 port, and
2. Looping the far end using a V.54 loopback code on the Nx56/64 port. In addition, a single DS0 can be used for continuous testing while other DS0s are passing normal data.

This will also provide an end-to-end check on the entire link. Set each end to send QRSS in **TST DS0s** (using 1 DS0) and occasionally view the results on the Pattern Result Menu selection.

## Run Self-Test

The self-test checks the integrity of the internal operation of the electronic components by performing memory tests and by sending and verifying data test patterns through all internal interfaces. Although actual user data cannot be passed during these tests, the self-test can be run with the network and DTE interfaces in place and will not disturb any external interface.

The memory portion of the self-test automatically executes upon power-up. A full self-test can be commanded from a front panel menu or from T-Watch Pro.

In addition to the specified self-tests, background tests are run on various parts of the internal electronics. These run during normal operation to confirm continued correct functioning.

This menu selection is used to execute a full internal self-test. The results of the self-tests are displayed on the Terminal screen. When you invoke the command, the **TEST** LEDs are illuminated. Test failures are displayed on the Terminal screen. The self-test consists of the following tests:

### Board level tests

Each of the TSU 610 boards contain an on-board processor which executes a series of tests checking the circuitry on the board.

- RAM tests; EPROM checksum
- DS0 map tests
- On-board data path; sending a known test pattern through an on- board loop

### Unit level tests

- Front panel LED verification
- Phase Lock Loop verify
- Board-to-board interface test

A test pattern is sent from the controller through a loopback on all other boards and is checked on the controller. This verifies the data path, clocks, and control signals.

If a failure is detected, note the failure number and contact ADTRAN Technical Support.

The execution of self-test will disrupt normal data flow and prevent remote communication until the self-test is completed.

### Port Tests

The Port Tests menu is used to activate testing of specific data ports. It controls the activation of loopbacks and the initiation of data test patterns. Test results are displayed in the LCD window.

The execution of PortTests will disrupt normal data flow in the port being tested.

### Cancel Tests

Use this menu selection to deactivate all active tests, including tests on option modules.

## Remote Menu Access

Displays Telnet menus for a remote device (may be another TSU/TDU or any other ADTRAN product that supports Telnet via its EIA-232 chain port). Aftger selecting this option, you may choose to connect to a device entered in the Unit Access Table or enter a Unit ID for a unit not in the Unit Access Table. **CTRL +X** terminates the session and returns to the TSU 610 main menu. See *Figure 5-14*.

| 5) REMOTE MENU ACCESS | Enter Remote Unit ID |
|---|---|

**Figure 5-14. Remote Menu Access**

# Management Configuration

This menu sets management information, such as SNMP community names and trap destination addresses.

## Unit Access Table

This menu edits and creates the Unit Access Table. See *Figure 5-15 on page 5-33.* This table stores the Unit ID, Passcode, and Unit Type for units connected via chain ports or connected remotely to the TSU / TDU (see *Table 5-1 on page 5-34*). An entry in the table is only required to support proxy SNMP MIB access or polling. For MIB access, an entry is required only if the unit's passcode is not the same as the Default Unit Passcode, or the unit is a single port TSU stand-alone.


*It is not necessary to have an entry in this table for a remote unit in order to Telnet to it or forward SNMP traps from it. In the Telnet case, the Remote Menu Access menu is selected from the Main menu. A Unit ID is entered which may or may not be in the Unit Access Table.*

| | | | |
|---|---|---|---|
| 6) Management Config | 1) UNIT ACCESS TABLE | 1) ADD NEW UNIT<br>2) MODIFY UNIT<br>3) DELETE UNIT<br>4) DELETE UNIT PASSCODE<br>5) OK<br>Command | |
| | 2) SNMP READ COMMUNITY | | PUBLIC |
| | 3) SNMP READ/WRITE COMMUNITY | PRIVATE | |
| | 4) SNMP TRAP COMMUNITY | PUBLIC | |
| | 5) HOST 1 TRAP IP ADDRESS | 000.000.000.000 | |
| | 6) HOST 2 TRAP IP ADDRESS | 000.000.000.000 | |
| | 7) HOST 3 TRAP IP ADDRESS | 000.000.000.000 | |
| | 8) HOST 4 TRAP IP ADDRESS | 000.000.000.000 | |
| | 9) SYSTEM NAME | ADTRAN TSU 610 | |
| | 10) SYSTEM CONTACT | ADTRAN Customer Support: 1-888-423-8726 | |
| | 11) SYSTEM LOCATION | ADTRAN Customer Support: 1-888-423-8726 | |
| | 12) AUTH. FAIL TRAPS SENT | DISABLED | |
| | 13) POLL LINK STATUS TRAPS SENT | ENABLES | DISABLED<br>ENABLES |
| | 14) PING IP HOST | Enter IP Address to Ping | |
| | 15) TELNET TIMEOUT | 5 MINUTES | |
| | 16) TELNET PASSWORD | XXXXX | |
| | 17) EXIT | | |

**Figure 5-15. TSU 610 HDSL Management Config Menu**

Units accessed via T-Watch Pro over TCP/IP use the Unit ID and Passcode set by T-Watch Pro running on the PC.

**Table 5-1. Unit Access Table (for HDSL)**

Unit Access Table

| Unit ID | Passcode | Type | Polled | PollStatus |
|---|---|---|---|---|
| 20 | DEFAULT | Standard | No | |
| 3 | 0033 | Standard | Yes | UP |
| 6 | 0095 | TSU Stand Alone | No | |
| 8 | 0022 | Standard | Yes | UP |

1) Add New Unit
2) Modify Unit
3) Delete Unit
4) Default Unit Passcode 0022
5) OK

### Add New Unit

This adds a new device to the table. You must enter a device Unit ID, Passcode, Unit Type, and Polled Flag. The unit type can be Standard (which supports any TSU/TDU Multiplexer and the ISU 512) or TSU Standalone (a single port TSU with no option card slot). You can select a passcode of **0** to **9999** for each device or **DEFAULT**, in which the default passcode will be used.

Traps are normally sent from the unit in alarm to the TSU 610. For units in the Unit Access Table that are not chained directly to the TSU 610 but are managed over Inband or the FDL, traps are not automatically forwarded. Polling must be enabled on the TSU 610 for these units in order to receive traps on the NMS. The TSU 610 can be configured to poll selected units for traps by enabling the polled option when adding or modifying a unit entry.

### Modify Unit

Allows Unit ID, Passcode, Device Type, and Polled Flag to be changed for an existing entry in the table.

**Delete Unit**
Deletes an entry in the table.

**Default Unit Passcode**
Sets the default passcode for all devices in the table that have passcodes set to **DEFAULT**, or for any unit not listed in the table.

**OK**
Returns to the Configure Agent menu.

### SNMP Read Community

SNMP Read Community Name defaults to public. NMSs using this community name have Read Access for all supported MIB objects but do not have the ability to change MIB objects. This value must be set to the same value on both the TSU 610 and the NMS (OpenView®, etc.) in order for the NMS to have Read Access to MIBs supported by the TSU 610. This value must be a text string of 16 characters or less.

### SNMP Read/Write Community

SNMP NMS using this community name have full read/write access to all supported MIB objects (defaults to private). This setting must be the same value on both the TSU 610 and the NMS in order for the NMS to have read/write access to MIBS supported by the TSU 610. This value must be a text string that is 16 characters or less.


*To access units external to the TSU 610 (proxied units) using an SNMP MIB browser, append a period and the Unit ID of the external device to the Read Only and Read/Write community name used in the MIB Browser, for example, public.4. See Appendix A, Understanding SNMP on page A-1, for more information.*

### SNMP Trap Community

This community name is used for all SNMP traps forwarded by the TSU 610. Traps received from daisy-chained units have a period and the Unit ID appended to the trap community name.

**SNMP Trap Destination Address**
The SNMP Trap Destination addresses are listed below:

***Host 1 Trap IP Address***
This is the first of four entries for SNMP trap destination addresses.

The TSU 610 forwards all SNMP traps to the IP address specified in this entry. If the address is set to the default value of 0.0.0.0, no traps are forwarded for this particular value.

***Host 2 Trap IP Address***
Defaults to 0.0.0.0. Second destination address for SNMP traps.

***Host 3 Trap IP Address***
Defaults to 0.0.0.0. Third destination address for SNMP traps.

***Host 4 Trap IP Address***
Defaults to 0.0.0.0. Fourth destination address for SNMP traps.

**System Name**
A text string that can uniquely identify an SNMP-managed node.

**System Contact**
A text string containing the name, phone number, etc. of the individual responsible for maintaining an SNMP-managed node.

**System Location**
A text string describing the physical location of an SNMP-managed node (for example, SECOND FLOOR PBX ROOM).

**Auto. Fail Traps Sent**
(DISABLED, ENABLED: defaults to DISABLED)
When enabled, the TSU 610 issues an SNMP trap when any SNMP request is received with an invalid community name. Can be used for security purposes.

### Poll Link Status Traps Sent

(DISABLED, ENABLED, defaults to DISABLED). When enabled, the TSU 610 sends an SNMP trap whenever a device configured to be polled fails to respond. When the device begins responding to polls, a poll link-up trap is sent. The formats of the traps are defined in the agent MIB.

### Ping IP Host

Allows the user to ping a specific IP address.

### Telnet/Terminal Time-out

The TSU 610 terminates a Telnet or Terminal session if no activity is detected for this length of time. Only one Telnet or Terminal session may be active at one time. This time-out prevents an unattended session from blocking interactive access to the agent. The default value is five minutes.

### Telnet/Terminal Password

This option allows modification of the password required for entry into a Telnet or Terminal session. The default value is ADTRAN.

### Exit

Returns to the TSU 610 Main menu.

# Flash Download

The TSU 610 uses flash memory that allows software updates via the chain-in port. This menu selection allows you to perform a flash download manually using XMODEM. T-Flash is also available to automate this process. See *Figure 5-16*.

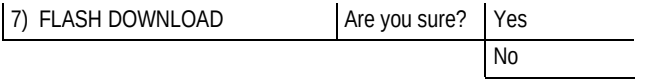



**Figure 5-16. Flash Download**

# Quit Session

Terminates the Telnet / Terminal session.

# Appendix A Understanding SNMP

As local area network (LAN) environments became standardized over the past ten years, multi-vendor equipment grew with competition. It became necessary to manage the various vendor equipment from a single control console. Thus, the SNMP emerged as the standard for managing commercial TCP / IP networks.

The term *SNMP* broadly refers to the message protocols used to exchange information between the network and the managed devices, as well as to the structure of network management databases.

## BASIC COMPONENTS

SNMP has three basic components: **Network Manager**, **Agent**, and **MIB**.

### Network Manager

This is a control program that collects, controls, and presents data pertinent to the operation of the network devices. It resides on a network management station.

### Agent

This is a control program that responds to queries and commands from the network manager and returns requested information or invokes configuration changes initiated by the manager. It resides in each network device.

## MIB

This is an index to the organized data within a network device. It defines the operating parameters that can be controlled or monitored. When requesting the network manager to retrieve or modify a particular piece of information about a network device, the network manager transmits the request to that network device. The agent in that device interprets the incoming request, performs the requested task, and sends its response to the network manager. The network manager collects all the data from the various network devices and presents it in a consistent form.

## COMMANDS

Using SNMP Version 1, the network manager can issue three types of commands: **GetRequest**, **GetNextRequest**, and **SetRequest**.

## GetRequest

This command retrieves a single item or the first in a series from a network device.

## GetNextRequest

This command retrieves the next item in a series from a network device.

## SetRequest

This command writes information to a network device.

# MESSAGE

The network device issues two types of messages: **GetResponse** and **Trap**.

## GetResponse

This message is the response to a network manager GetRequest or GetNextRequest command.

## Trap

This is an unsolicited message issued by a network device to report an operational anomaly or an alarm condition to the network manager. These messages are typically encased within informational packets and transported over the LAN or WAN (wide area network).

# TSU 610 SNMP ACCESS

By default, SNMP MIB Browser access to the TSU 610 IP address with the configured community names, accesses the host. The TSU 610 can also act as an SNMP proxy agent for external units. To access MIB variables on externally chained devices, append a period and the Unit ID of the device to the **Read** and **Read/Write** community names.

**Example:**

If the **Read** community name configured in the TSU 610 is **public**, specifying **public.3** as the community name in the SNMP MIB Browser allows reading SNMP MIB variables from externally chained unit 3.

If the external unit's passcode is not the default, an entry must be added to the Unit Access Table for SNMP MIB access. For a description of this operation, see *Table 4-1 on page 4-34* for the T1 Unit AccessTable and *Table 5-1 on page 5-34* for the HDSL Unit Access Table. However, SNMP traps for the unit can be forwarded without the entry.

# SNMP Trap Configuration

Traps received by the TSU 610 from external units and the host unit are converted into SNMP traps and forwarded to the configured NMS. The source of the trap is uniquely identified at the NMS by a combination of the IP address of the TSU 610, and the Unit ID of the sending device.

The Unit ID is present in the trap packet appended to the end of the trap community packet name, for example **public.4**. It is also included as an Octet String variable (adProdPhysAddress) in the trap packet as defined in the individual product MIBs. The latest versions of the product MIBs by default display the appended trap community name in their descriptions.

Typical steps required for Management Station trap configuration are loading the device specific MIBs and loading or creating device specific Trap Definition Files. The current product MIBs contain keywords embedded in comments that can be used by some network management platforms to automatically generate Trap Definitions. Otherwise, the descriptions may be used as a template for Trap Definitions.

If individual option card port identification and slot identification are required, they are present in the four byte **adProdPhysAddress** field of the trap packet. The first two bytes are the Unit ID of the base controller (least significant byte first). The next two bytes are port and slot number. This field is the second object identifier in all traps sent from TSU/TDU products.

For traps from the ISU 512, the Unit ID is the first object identifier. See the product MIBs for more information.

Definitions for Poll Link Up/Down traps are included in the TSU 610 MIB file: 600.MIB.

# SNMP MIB Browser Configuration

The steps required to configure Network Manager MIB variable access through the TSU 610 are as follows:

1. Load the desired product MIBs on the network management station. If, for example, the administrator is managing TSU 610 and ISU 512 devices, load TSU 610e.MIB, ISU512.MIB, and RFC1406.MIB.
2. Create device entries in the NMS database for all units that are to be managed through the TSU 610. The host unit should be configured as the Proxy agent for the external units. The IP address or host name used for the proxy designation is that of the TSU 610.
3. Set community names in the device's entries for external units to the TSU 610 community name with the device Unit ID appended as defined in the previous section, *TSU 610 SNMP ACCESS* on page A-3.
4. Set the device timeout for all device entries in the NMS device database to five seconds, including the host unit.

# SNMP MIB Files

The TSU 610 supports several standard MIBs including:

- MIB-II (RFC-1213)
- DS1 T1/E1 MIB (RFC-1406)

It also supports several ADTRAN enterprise specific MIBs including:

- ADTRAN Product MIB (ADTRAN.MIB)
- ADTRAN DS1 extensions MIB (ADS1.MIB)

The standard MIB files are usually included with most SNMP network management software.

The latest versions of the ADTRAN enterprise-specific MIBs are available in the following locations:

- ADTRAN anonymous ftp site (ftp.adtran.com)
- By dial-up from the BBS (256-963-8169)
- ADTRAN web site at http://www.adtran.com

# Appendix B Understanding TR-08

The TSU 610 chassis functions as a remote terminal in Digital Loop Carrier and in Integrated Digital Loop Carrier Systems as described in TR-TSY 000008. The TSU 610 supports SLC96 framing, Mode I operation, ORB-13 and ORB-16 alarm formats, alarm reporting, and user-definable BPV threshold detection rate.

A basic familiarity with DLC systems, IDLC systems, and TR-TSY-000008 is assumed, but the following information will be useful:

- All received TR-TSY-000008 specific alarms are reported locally within the history feature of the TSU 610.
- When the DISABLE ALARMS option is selected, no alarms will be sent on the DLF, but received alarms will be reported locally in the history.
- Other alarms normally reported by the TSU 610 will also be placed in history.
- Each TSU 610 needs to be configured as the A SHELF, as it is provisioned as a separate entity.
- All alarms will refer to A SHELF when received from TSU 610.

Table B-1 explains conditions that trigger alarms and how they are processed when received by the TSU 610.

**Table B-1. Alarm Conditions**

| Name | Explanation |
|---|---|
| **FELP** | When the TSU 610 receives a FELP alarm, it will loop the incoming data directly to the outgoing data. LINE ON is placed in history. The alarms and loop-back are cleared when FELP is no longer received. |
| **Loss of Data** | The TSU 610 will send **Minor Alarm** and the **A Shelf Alarm** for 2.5s when it quits receiving the data link on the T-Span. It will also report TR-08 DL Down in the history. After 2.5s, **Major Alarm**, and **A Shelf Alarm** are sent across the **Data Link**. |
| **OOF** | The TSU will send **Minor Alarm** and **A Shelf Alarm** upon receiving an out-of-frame condition. TR-08 DL Down and **Red Alarm** are declared in history for severe framing errors. After 2.5s, **Major Alarm** and **A Shelf Alarm** are sent across the **Data Link**. |
| **Loss of Signal** | The TSU 610 will send **Minor Alarm** and the **A Shelf Alarm** for 2.5s when it stops receiving a signal from the far end. It will also report TR-08 DL Down and LOS in the history. After 2.5s, **Major Alarm** and **A Shelf Alarm** are sent across the **Data Link**, and **Red Alarm** is declared in history. |
| **BPVs** | BPVs that are received at a rate greater than the threshold set under TR-08 options, will cause **Minor Alarm** and **A Shelf Alarm** to be sent on the DL. If the BPVs remain above the threshold for 2.5s, the TSU 610 will send **Major Alarm** on the DL. No events are placed in history. |
| **Protection Line Switch** | The TSU will not respond to this alarm. |

# TR-08 DS0 Conversion Table

The following table contains the mapping conversions needed to map voice ports to the TR-08 network.

**Table B-2. TR-08 DS0 Conversion Table**

| DS0 | TR-08 Channel Number | Port |
|---|---|---|
| 1 | 1 | 1.1 |
| 3 | 2 | 1.2 |
| 5 | 3 | 1.3 |
| 7 | 4 | 1.4 |
| 9 | 5 | 2.1 |
| 11 | 6 | 2.2 |
| 13 | 7 | 2.3 |
| 15 | 8 | 2.4 |
| 17 | 9 | 3.1 |
| 19 | 10 | 3.2 |
| 21 | 11 | 3.3 |
| 23 | 12 | 3.4 |
| 2 | 13 | 4.1 |
| 4 | 14 | 4.2 |
| 6 | 15 | 4.3 |
| 8 | 16 | 4.4 |
| 10 | 17 | 5.1 |
| 12 | 18 | 5.2 |
| 14 | 19 | 5.3 |
| 16 | 20 | 5.4 |
| 18 | 21 | 6.1 |
| 20 | 22 | 6.2 |
| 22 | 23 | 6.3 |
| 24 | 24 | 6.4 |

# Appendix C Network Pinouts

## T1 NETWORK MODULE

There are four jacks on the rear panel of the T1 Network Module:

- Two dual test jacks
- an 8-pin modular connector
- a 15-pin male D-connector

The latter two connectors are connected in parallel and are used for connecting to the network. See *Table C-1* and *Table C-2* for the pinouts of the network interfaces.

## Network Connections

The network connections are as follows:

| | |
|---|---|
| Connector Type | (USOC) RJ-48C |
| Part Number | AMP# 555164-1 |

**Table C-1. RJ-48C Pinouts**

| Pin | Name | Description |
|---|---|---|
| 1 | RXDATA-RING | Receive data from the network |
| 2 | RXDATA-TIP | Receive data from the network |
| 3 | UNUSED | |
| 4 | TXDATA-RING | Transmit data toward the network |
| 5 | TXDATA-TIP | Transmit data toward the network |
| 6,7,8 | UNUSED | |

Connector Type 15-Pin Male D-Connector
Part Number AMP# 747841-2

**Table C-2. 15-Pin D-Connector Pinouts**

| Pin | Name | | Description |
|---|---|---|---|
| 1 | T | TXDATA-TIP | Transmit data toward the network |
| 2 | | UNUSED | |
| 3 | T1 | RXDATA-TIP | Receive data from the network |
| 4, 5,6,7 | | UNUSED | |
| 8 | FG | FRAME GROUND | Grounded to Chassis |
| 9 | R | TXDATA-RING | Transmit data toward the network |
| 10 | | UNUSED | |
| 11 | R1 | RXDATA-RING | Receive data from the network |
| 12,13,14 | | UNUSED | |
| 15 | FG | FRAME GROUND | Grounded to Chassis |

# HDSL NETWORK MODULE

On the rear panel of the HDSL Network Module are two jacks:

- An 8-pin modular connector
- a 15-Pin male D-Connector

These two connectors are connected in parallel and are used for connecting to the network. See *Table C-3* and *Table C-4* for the pinouts of the network interfaces.

## Network Connections

The network connections are as follows:

| | |
|---|---|
| Connector Type | 8-Pin Modular |
| Part Number | AMP# 555164-1 |

**Table C-3. HDSL Pin Modular Pinouts**

| Pin | Name | Description |
|---|---|---|
| 1 | LOOP 1 - RING | Loop 1 data |
| 2 | LOOP 1 - TIP | Loop 1 data |
| 3 | UNUSED | |
| 4 | LOOP 2 - RING | Loop 2 data |
| 5 | LOOP 2 - TIP | Loop 2 data |
| 6,7,8 | UNUSED | |

Connector Type 15-Pin Modular
Part Number AMP# 747841-2

**Table C-4. HDSL 15-Pin D-Connector Pinouts**

| Pin | Name | | Description |
|---|---|---|---|
| 1 | T | LOOP 2 - TIP | Loop 2data |
| 2 | | UNUSED | |
| 3 | | LOOP 1 - TIP | Loop 1 data |
| 4,5,6,7 | | UNUSED | |
| 8 | FG | Frame Ground | Grounded to Chassis |
| 9 | R | LOOP 2 - RING | Loop 2 data |
| 10 | | UNUSED | |
| 11 | R1 | LOOP 1 - RING | Loop 1 data |
| 12,13,14 | | | |
| 15 | FG | Frame Ground | Grounded to Chassis |

# CONTROL IN/CHAIN IN

This is used as an EIA-232 port for connection to a computer or modem (Control-in) or to another TSU 610 or TSU 100 (chain-in). See *Table C-5,* for this pinout.

## Chain-in Connections

The chain-in connections are as follows:

| | |
|---|---|
| Connector Type | 8-Pin Modular |
| Part Number | AMP# 555164-1 |

**Table C-5. Control-In/Chain-In Pinout**

| Pin | Name | Description |
|---|---|---|
| 1 | GND | Ground-connected to unit chassis |
| 2 | RTS | Request to send-flow control |
| 3 | RXDATA | Data received by the TSU 610 |
| 4 | UNUSED | |
| 5 | TXDATA | Data transmitted by the TSU 610 |
| 6,7 | UNUSED | |
| 8 | CTS | Clear to send -- flow control |

# Chain-Out

This is used to connect to another *TSU 610* chain-in connector. See *Table C-6*.

## Chain-Out Connections

The Chain-Out connections are:

| | |
|---|---|
| Connector Type | 8-Pin Modular |
| Part Number | AMP# 555164-1 |

**Table C-6. Chain Out Pinout**

| Pin | Name | Description |
|---|---|---|
| 1 | GND | Ground-connected to unit chassis. Connected to GND of next unit (pin 10). |
| 2 | UNUSED | |
| 3 | TX DATA | Data transmitted to chained units by the TSU 610. Connect to RX DATA of the next unit (chain-in pin 3). |
| 4 | UNUSED | |
| 5 | RX DATA | Data received from chained unit by the TSU 610. Connect to TX DATA of the next unit (chain-in pin 5). |
| 6,7,8 | UNUSED | |

# CRAFT PORT

This is used as an EIA-232 port for connection to a computer or modem (Control-in) or to another TSU/TDU family multiplexer or TSU 100 (Chain-in). See *Table C-7* for this pinout.

**Table C-7. Craft Port**

| Pin | Name | Description |
|---|---|---|
| 1 | GND | Ground-connected to unit chassis. |
| 2 | RTS | Request to snd-flow control |
| 3 | RXDATA | Data received by the TSU 610 |
| 4 | UNUSED | |
| 5 | TXDATA | Data transmitted by the TSU 610 |
| 6,7 | UNUSED | |
| 8 | CTS | Clear to send-flow control |

# ALARM

This is used to connect the TSU 610 to an external alarm device. See *Table C-8*.

Connector Type 4-Pin, Eurostyle connector

**Table C-8. External Alarm Device Connector**

| Pin | Name | Description |
|---|---|---|
| 1 | NC | Normally Closed |
| 2 | NO | Normally Open |
| 3 | COM | Common |
| 4 | GND | Connected to Unit Chassis |

# Appendix D System Messages

This appendix lists and defines the alarm and status messages that appear on the TSU 610 screen.

## ALARM MESSAGES: NETWORK INTERFACE (NI)

| Alarm | Description |
|---|---|
| Red | NI unable to frame align with incoming signal |
| Yellow | Remote alarm indication (RAI) being received from far end |
| Blue | Unframed all ones (1s) (AIS) being received at NI |
| Loss of Signal | No signal detected at NI |

# STATUS MESSAGES: NETWORK INTERFACE (NI)

| Message | Description |
|---|---|
| Payload On | Payload loopback activated |
| Line On | Loopback off |
| Loopback Off | All loopbacks deactivated |
| Factory Restore | Factory setting restored |
| Power On | Unit powered on |
| Self-Test | Internal self-test performed |
| TR-08 DL Down* | TR-08 data link is down |
| TR-08 DL Up* | TR-08 data link is up |
| Minor Alarm* | Loss of sync, carrier loss, BPV threshold exceeded, or data link failure. |
| Major Alarm* | Conditions for a minor alarm have continued for greater than 2.5 seconds. |


**TR-08 alarm messages appearing in the alarm or history log have been received from the far end. If the NI detects one of the above conditions, it will send the appropriate alarm (if enabled) to the far end but no message will appear in the alarm or history log.*

# Appendix E Specifications

## ELECTRICAL SPECIFICATIONS

## T1/FT1 Interface

| | |
|---|---|
| T1 Line Rate | 1.544 Mbits/s ± 75 bps |
| Line Code | Bipolar, RZ; AMI or B8ZS |
| Framing | D4(SF), ESF, or SLC96 |
| FT1 Line Rate | DS0 Channelized (multiple of 64 kbps) |
| Transmit Timing | Network, DTE, U-BR1TE Secondary NI,or Internal |
| Input Signal | 0 to -36 dB (DS-1) |
| Line Build-out | 0, 7.5, 15, 22.5 dB, AUTO |
| Connector | RJ-48C |
| Test Jacks | Bantam jacks: TX and RX (to Network) and TX and RX MON |

# Compatibility

| | |
|---|---|
| T1 Interface | Pub 62411 |
| ESF Format Interface | TR. 194 |
| ESF Performance Monitoring | TR. 54016 and T1.403 |
| Approvals: | FCC Part 15<br>FCC Part 68<br>UL 1950<br>NEBS Level 1 |

# Management Interfaces

### Chain-In/Chain-Out Ports

| | |
|---|---|
| Interface Devices | PC Serial Port, Modem or SLIP connection to router |
| Interface Type | EIA-232 |
| Data Rates | 1200, 2400, 4800, 9600, 19200, 38400 |
| Data Format | EIA-232 N81 |
| Protocols | TWATCH/ADLP, ATEL/ADLP, SLIP, TCP/IP |
| Connector | 8-Pin Modular |

# Option Slot Interface

### Slots 1-6

| | |
|---|---|
| Interface | ADTRAN proprietary, accepts standard TSU Option Modules. |

# CHASSIS SPECIFICATION

| | |
|---|---|
| Height | Less than 5.25-inch (will fit in a 3U rack mount opening) |
| Width | Will fit within a 19-inch rack |

# ENVIRONMENTAL SPECIFICATIONS

| | |
|---|---|
| Input Power | AC-powered units:<br>90 - 130 VAC 60 HZ<br><br>DC powered units:<br>21 - 26 VDC or 40 - 56 VDC |
| Fuse | AC powered units:<br>1A, 250V<br><br>DC powered units:<br>5A, 250V |
| Operating Temperature | 0 to 70 degrees C |
| Max Power Consumption | 55 W |
| Max Current | AC powered units: 0.7A<br>DC powered units: 3A |

# Appendix F HDSL Deployment Guidelines

## HDSL TECHNOLOGY OVERVIEW

Typically, T1 circuits are deployed from a telephone company office using a device known as an office repeater. See *Figure F-1 on page F-3*. If the circuit termination point is farther than 3,000 feet from the serving office, a T1 loop repeater is generally installed to recover and regenerate the signal before the loop attenuation encountered renders the signal unusable. Subsequent spacing of loop repeaters is approximately 6,000 feet.

The T1 line is then terminated on the customer premises with a T1 Channel Service Unit (CSU). In some places, such as a dense metropolitan area, providing an acceptable location for a loop repeater can become expensive. As a consequence of deploying loop repeaters, a portion of telephone company equipment is no longer located in the Central Office (CO) and therefore requires additional expense in servicing and maintaining the circuit. The HDSL concept is to enhance the transmission scheme for T1 signals such that a complete Carrier Service Area (CSA) can be addressed without the need for a loop repeater or conditioned local loops.

A CSA varies depending on wire gauge, but extends roughly 9,000 to 12,000 feet from a serving office. Also, total bridged tap lengths of up to 2,500 feet are permissible with single bridged tap lengths not exceeding 2,000 feet.

The existing T1 transmission scheme is Alternate Mark Inversion (AMI) resulting in a power spectrum centered around 7772 kHz. Attentuation (loss), crosstalk, and other undesirable effects of transmitting information over twisted pair cables increase as the frequency of the power spectrum increases.

One benefit of HDSL, then, is to lower the power spectrum in frequency by modifying the transmission scheme. The HDSL modulation technique employs echo cancelling technology to transmit and receive (full duplex) on a single pair of wires. In a 4-wire system (such as T1), this technique could be applied to both pair of wires effectively reducing by half, the frequency range of the associated power spectrum. In addition to using echo cancellation techniques, a scheme for encoding multiple bits of information into symbols is also used. Modulation techniques such as those employed in ISDN U-interface products referenced to as 2B1Q make more efficient use of the available bandwidth. In this case it serves to lower the transmission symbol rate and therefore the frequency range of the power spectrum while maintaining the same data rate by encoding several bits of information into a single symbol. By lowering the frequency content of the HDSL signal, the effects such as attenuation and crosstalk can be reduced to tolerable levels, thereby allowing transmission over longer distances.

# HDSL Deployment Guidelines

The ADTRAN HDSL system is designed to provide DS1 based services over loops which comply with the following CSA deployment guidelines:

- All loops are nonloaded only.
- For loops with 26 AWG cable, the maximum loop length including bridged tap lengths is 9 kFt.
- For loops with 24 AWG cable, the maximum loop length including bridged tap lengths is 12 kFt.
- Any single bridged tap is limited to 2 kFt.
- Total bridges tap length is limited to 2.5 kFt.
- The total length of multi-gauge cable containing 26 AWG cable must not exceed the following:

  $12 - \{(3*L^{26})/9] - L^{BTAP}$ (in kFt)

  $L^{26}$ = Total length of 26 AWG cable excluding Bridged Taps

  $L^{BTAP}$ = Total length of all Bridged Taps

These deployment criteria are summarized in the chart shown in Figure F-1.

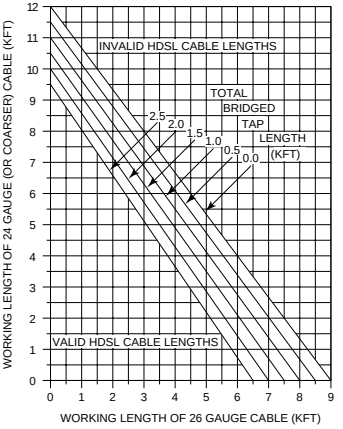



**Figure F-1. HDSL Deployment Guidelines**

## Loop Loss

Recommended maximum local loop loss information for PIC Cable at 70 $^{o}$F, 135Ω, resistive termination is provided in Figure F-2.

An approximation for the maximum amount of wide-band noise on an HDSL local loop as measured by a 50 kbps filter is:

≤31 dBm*

An approximation for the maximum level of impulse noise as measured using a 50 kbps filter on an HDSL loop is:

≤50 dBm*

| Frequency (Hz) | Maximum Loss (dB) |
|---|---|
| 3000 | 12.0 |
| 10,000 | 15.0 |
| 50,000 | 25.5 |
| 100,000 | 30.0 |
| 150,00 | 32.75 |
| 200,000 | 35.25 |

**Figure F-2. Loop Insertion Loss Data***


*[*] These approximations are to be used as guidelines only and may vary slightly on different loops. Adhering to the guidelines should produce performance in excess of $10^{-7}$ BER.*

# Index

## D



## E



## F



## G



## H

## I



## L



## M



## N

## O



## P



## Q



## R



## S

## T

## U



## V



## W



## X



## Y

# Product Support Information

## Presales Inquiries and Applications Support

Please contact your local distributor, ADTRAN Applications Engineering, or ADTRAN Sales:

| | |
|---|---|
| Applications Engineering | (800) 615-1176 |
| Sales | (800) 827-0807 |

## Post-Sale Support

Please contact your local distributor first. If your local distributor cannot help, please contact ADTRAN Technical Support and have the unit serial number available.

| | |
|---|---|
| Technical Support | (888) 4ADTRAN |

## Repair and Return

If ADTRAN Technical Support determines that a repair is needed, Technical Support will coordinate with the Customer and Product Service (CAPS) department to issue an RMA number. For information regarding equipment currently in house or possible fees associated with repair, contact CAPS directly at the following number:

| | |
|---|---|
| CAPS Department | (256) 963-8722 |

Identify the RMA number clearly on the package (below address), and return to the following address:

ADTRAN, Inc.
CaPS Department
6767 Old Madison Pike
Progress Center
Building #6, Suite 690
Huntsville, AL 35807

RMA # _____