



TSU LT

User Manual

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ADTRAN Year 2000 (Y2K) Readiness Disclosure

ADTRAN has established a Year 2000 program to ensure that our products will correctly function 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
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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. If your TSU LT 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.
3. 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.
4. If you experience trouble with the TSU LT equipment, please contact ADTRAN at (205) 963-8000 for repair/ warranty information. The telephone company may ask you to disconnect the equipment from the network until the problem has been corrected, or until you are sure the equipment is not malfunctioning.
5. This unit contains no user-serviceable parts.
6. An FCC compliant telephone cord and 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.
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	6.0F	04DU9-BN	RJ48C
1.544 Mbps - SF and B8ZS	6.0F	04DU9-DN	RJ48C
1.544 Mbps - ESF	6.0F	04DU9-1KN	RJ48C
1.544 Mbps - ESF	6.0F	04DU9-1SN	RJ48C

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 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.

IMPORTANT SAFETY INSTRUCTIONS

WARNING

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, see 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 one of the numbers found at the inside back page of this manual.

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T1/FT1 OVERVIEW

T1 digital communication links have been used by the telephone companies (telcos) for voice transmission since the early sixties. The D4 channel bank is an example of a T1 digital carrier system that was introduced in the mid-seventies and is still widely used by the telcos.

Communication demands of businesses continued to grow to the point that the telcos began offering T1 service directly to the public. D4 channel banks began to be used for T1 in corporate network topographies for voice. The technological advances in computer development also created a demand for T1 data communication which now is a large part of the T1 traffic.

T1 Service Offerings

T1 is a digital service that is delivered to the user over two pairs of wires from the service provider. The signal operates at 1.544 mega bits per second (Mbps) and is usually extended by repeaters that are installed about every mile after the first 6000 feet. The T1 signal is divided into 24 time slots or digital signal level zeros (DS0s) which operate at 64 kilo bits per seconds (kbps). Each time slot is occupied by digitized voice or by data.

The T1 signal originally used a type of framing known as D4 Superframe which identifies how the T1 is multiplexed. Extended Superframe (ESF) is an enhancement of that framing format. ESF provides a non-disruptive means of full time monitoring on the digital facility. It was originally used by the service provider to monitor the performance of their service offering. Since the introduction of ESF, equipment that is installed in private networks can also provide the same performance information to the user.

Fractional T1

Fractional T1 (FT1) allows the buyer to purchase less than a full T1 circuit between two points. Most carriers offer fractional T1 in increments of 56 or 64 kbps. Connection is made to the same network elements. The network allows multiple users to share the same interoffice T1 bandwidth.

FT1 remains almost exclusively an inter-exchange carrier (IXC) service. Local exchange carriers (LECs) typically do not offer FT1, so the user's proximity to the IXC's point-of-presence (POP) is key in the savings that fractional T1 offers.

FT1 local access is available in two forms:

- **56 kbps** - In 56 kbps the required number of digital data service (DDS) lines is extended from the IXC POP and the bandwidth is combined at the office on an outbound T1 circuit. The user pays for the individual 56K lines and the amount of the interoffice T1 utilized
- **Full T1 line** - In T1 access, the user pays for a full T1 to the IXC POP and then only for the bandwidth utilized.

TSU LT Overview

This section provides a functional description of the TSU LT, describes its features, and illustrates its four interfaces.

Functional Description

The ADTRAN TSU LT is one of several T1 multiplexers that offer complete flexibility for connection of various data sources to T1 or FT1 facilities. This family of TSU multiplexers includes the following:

- **TSU and TSU LT** - T1 CSU/DSUs with a single Nx56K/64K serial port.
- **TSU 100** - Same as the TSU with the added feature of a slot in the rear panel to house an option module. Each module offers up to four additional data ports.
- **TSU 600** - Same as the TSU with the added feature of six slots in the rear panel to house up to six option modules. Each module offers up to four additional data ports for a total of 24 possible data ports.

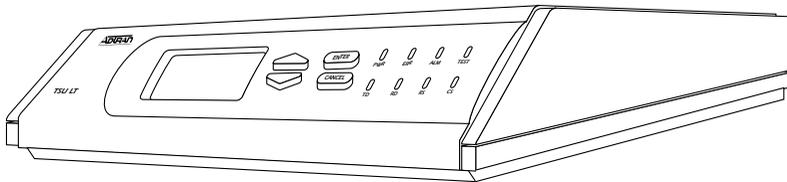


Figure 1-1. TSU LT Unit - Front View

The TSU LT serves as the link between user data sources such as local area network (LAN) bridges and routers, computers, CAD systems, and teleconferencing equipment. The amount of bandwidth allocated to the port is custom programmable. The data terminal equipment (DTE) data can occupy contiguous or alternate channels in the T1 stream, and the channels may start at any position.

TSU LT Rear Panel

Number Identification for TSU LT Rear Panel

No.	Item	Function
1	Network	T1-FT1 network interface
2	In	Bantam test jack
3	Out	Bantam test jack
4	MON (Monitor)	Bantam test jack
5	Chain-In	Interface of chain-in
6	Chain-Out	Connects to chain-in of another TSU LT
7	V.35 Nx56/64	DTE port
8	Power Switch	Used to turn power on or off
9	Power Cord	Captive 3-prong power cord

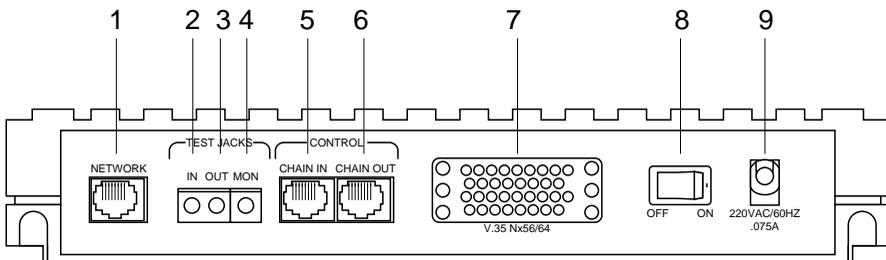


Figure 1-2. TSU LT Rear Panel

TSU LT Features

- A DS1 interface and an Nx56/64 DTE serial interface port.
- Easy configuration capabilities using simplistic menus displayed in a liquid crystal display (LCD) window operated by a front panel keypad.
- Timing is selectable from the network, from the Nx56/64 DTE port, or internally.
- All ones, all zeros, 511, and 1:8 test patterns.
- Extensive self-testing and monitoring ensures proper operation.
- Flexible channel allocation (any starting channel and alternate or contiguous).

TSU LT Interfaces

The TSU LT is equipped with four interfaces:

- Network DS1 interface per AT&T 62411
- Nx56/64 serial V.35 high speed interface
- Control input (EIA-232)/Chain port input
- Chain port output

See Figure 1-3 and the following descriptions in this section.

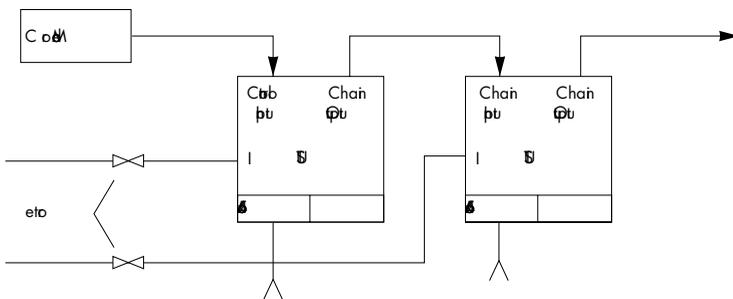


Figure 1-3. TSU LT Interfaces

Network Interface (NI)

The Network Interface (NI) port complies with the applicable ANSI and AT&T standards:

- Alternate mark inversion (AMI) or binary 8 zero suppression (B8ZS) coding
- Automatic or manual line build-out
- Auto detect or manual settings for D4 or ESF framing
- Network performance monitoring and reporting
- Local and remote test loopbacks
- Extensive self-testing

Nx56/64 Serial Interface

Features of the Nx56/64 serial interface include:

- Data rates: N*56K or N*64K, where N=1 to 24 (DS0s)
- Inverted data (inverted high-level data link control (HDLC))
- A V.35 interface
- Standard V.35 connectors
- Test loopbacks with 511 pattern generation and check
- Extensive self-testing

Control Port Input

Features of the control port input include:

- EIA-232 input from a personal computer (PC) or a modem for control of the TSU LT
- Chain input from another TSU LT
- Up to 9600 baud operation
- Input for PC proxy agent control or for a chained connection

Chain Port Output

Features of the chain port output include:

- EIA-232 output to chain control to other TSU LTs
- Up to 9600 baud operation
- Automatic setup; no user input required

Software Management

Front Panel

The front panel provides complete and easy control of all items that can be configured through menu-guided options. The front panel LCD also displays the status of operation and performance reports for the unit. A complete discussion of the operation of the front panel is found in *Chapter 3, Operation* on page 3-1. The menu options are found in *Chapters 4 through 7*.

T-Watch Pro Management Software Program

T-Watch Pro is the ADTRAN management software program that allows the user to control the TSU LT from a PC. It provides complete control over the configuration of the TSU LT using a graphic interface. The T-Watch Pro program displays the same status and performance data as the front panel LCD. This data is displayed as tables and graphs.

The T-Watch Pro program has the following capabilities:

- Interfaces with a modem which permits dialing into a remote TSU LT location to configure the unit or read the unit's status or performance.
- The performance data read from the units can be exported in a file which is compatible with common spread sheet programs.

TSU LT Testing

The TSU LT offers three forms of testing:

- Self-test
- Loopback tests
- Pattern generation and check

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 run with the network and DTE interfaces in place and without disturbing any external interface.

The self-test automatically executes upon power up. It can also be commanded from a front panel menu or from the control port.

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

- Monitoring the phase-locked loop for lock.
- Standard background network performance monitoring, as required by ANSI T1.403 and AT&T 54016 for which the results are stored.

Loopback Tests

A number of different loopbacks can be invoked locally from the front panel, by T-Watch commands, or remotely by using special inband codes. These include AT&T D4 network loop up/loop down codes and V.54 loop up/loop down codes for the Nx56K/64K serial interface. Additionally the loopbacks can be remotely controlled by out-of-band commands via the T1 ESF facility data link (FDL), or from T-Watch via a modem

connection. Network and DTE interface loopbacks are discussed in this section.

Network Loopbacks

There are three types of network loopbacks. See Figure 1-4.

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

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

Data Loopback

Loops back all active DS0s and inserts idle code into unoccupied DS0s.

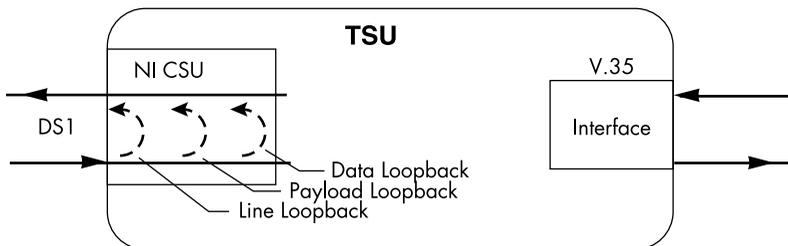


Figure 1-4. Network Loopback Tests

DTE Interface Loopbacks

The Nx56K/64K serial interface offers a DTE loopback. See Figure 1-5 on page 1- 10.

DTE Loopback

Loops all data from the DTE back towards the DTE. This loopback may be initiated by the DTE asserting the local loopback (LL) input on the connector or by using the front panel or T-Watch commands. The DTE (or the external test equipment) must provide a test pattern to check the DTE interface.

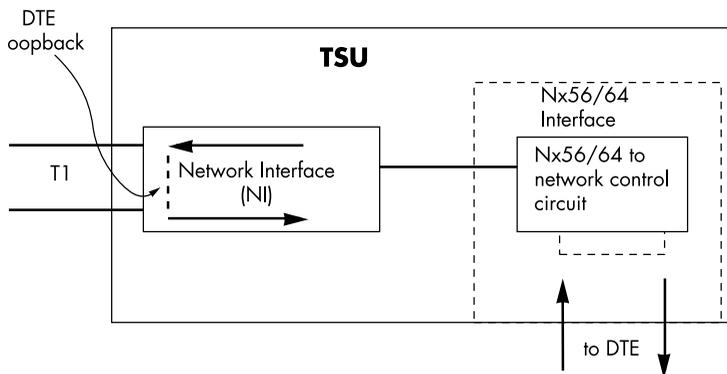


Figure 1-5. DTE Interface Loopback

Pattern Generation

The TSU LT offers four available test patterns: 511, 1:8, All Ones, and All Zeros.

511	The 511 pattern is generated and checked by the Nx56K/64K serial interface. It only appears in the DS0s assigned to the Nx56K/64K port. When used in conjunction with the payload loopback at the far end, an end-to-end integrity check can be made on the DTE ports
1:8	The 1:8 is a stress pattern which places the maximum number of 0s in the transmitted data. This is always done over all DS0s. This pattern is used in conjunction with external test equipment to determine if the T1 line is performing acceptably under a stress condition. Each channel of the T1 has only one bit set.
All Zeros	Generates an all zeros pattern in every channel.
All Ones	Generates an all ones pattern in every channel.

Bridge/Router Application

A bridge or router can be interfaced to the network by using the V.35 DTE interface. The bandwidth used is programmable at Nx56 or Nx64 data rates for T1 or FT1 service. The bandwidth can be selected as contiguous or alternate. Figure 1-6 shows a simple bridge application.

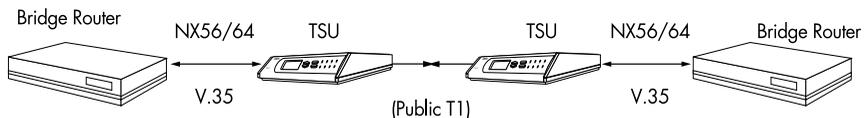


Figure 1-6. Simple Bridge Application on a T1 or FT1 Circuit

INSPECTING FOR DAMAGES

Carefully inspect the TSU LT for any shipping damage. If damage is suspected, file a claim immediately with the carrier and then contact ADTRAN Customer Service. If possible, keep the original shipping container for use in shipping the TSU LT back for repair or for verification of damage during shipment.

Items Shipped by ADTRAN

The following items are included in the ADTRAN shipment:

- TSU LT unit
- Line interface cable: an 8-position modular to 8-position modular
- TSU LT User Manual
- Loopback plug

Items Provided by Customer

- DTE cable(s)
- Cable for supervisory port, if used

Power Connection

Each TSU LT unit is provided with a captive eight-foot power cord, terminated by a three-prong plug which connects to a grounded power receptacle.



Power to the TSU LT must be from a grounded 220-230 VAC, 60 Hz power source.

Power Up Testing and Initialization

When shipped from the factory, the TSU LT is set to factory default conditions. At the first application of power, the unit automatically executes self-tests followed by an initialization sequence which sets up the unit.

Self-Test

When	Then
A power-up or commanded self-test occurs	The LCD displays ADTRAN TSU INITIALIZING and the LEDs illuminate sequentially.
The self-test is completed with no failures detected	The LCD momentarily displays ALL TESTS PASSED .
a failure is detected	It is displayed in the LCD window. The automatic self-test consists of the following tests: Board level tests Random access memory (RAM) tests; erasable programmable read only memory (EPROM) checksum. 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.

OPERATION

The TSU LT can be configured and controlled from either the local front panel or from a PC using the T-Watch Management Software Program.

General Menu Operation

The TSU LT uses a multilevel menu structure containing both menu items and data fields. All menu operations and data are displayed in the LCD window. The menu items are numbered and can be viewed by using the **Up** and **Down arrows**.

MAIN MENU	1) STATUS		1) NI PERF REPORTS	
			2) CURR ERR/ALM	
			3) ERR/ALM HIST	
	2) CONFIG	1) NETWORK (NI)		
		2) UNIT		
		3) PORT		
	3) UTIL		1) TIME/DAY	
			2) SOFTWARE REV	
			3) REINIT UNIT	
	4) TEST	1) NETWORK TESTS	4) ADDRESS	
		2) RUN SELFTEST	5) SET PASSCODE	
		3) PORT TESTS	6) FACT RESTORE	

Figure 3-1. TSU LT Main Menus

Menu flow is normally depicted from left to right. Arrows on the lower right of the screen indicate the direction of additional menu items. 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.

The opening menu is the access point to all other operations. There are four main menu items, **1)STATUS, 2)CONFIGURE, 3)UTILITY, 4)TEST**. Each Main Menu item has several functions and submenus to identify and access specific parameters. Each main item menu contains a complete menu diagram to identify the location of each operation.

Menu Structure

The TSU LT uses hierarchical menus to access its many features. The main menu level (Figure 3-2) leads to submenus (see Figure 3-1 on page 3- 1). All menu operations are displayed in the LCD window. The complete TSU LT menu diagram is shown in *TSU LT Menu Tree* on page A-1.

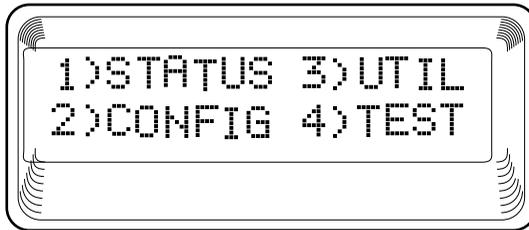


Figure 3-2. TSU LT Main Menu Screen



*This menu structure diagram is a limited overview. A brief description of each menu item, presented in menu order, immediately follows. A complete menu diagram is shown in *TSU LT Menu Tree* on page A-1.*

Four Opening Menu Functions

STATUS

The **STATUS MENU** provides the ability to view the status of the TSU LT operation. This menu includes the following items:

NI PERF REPORTS

Used to view the user set of data on the Network Interface Performance Reports in compliance with ANSI T1.403 and AT&T document TR54016.

CURR ERR/ALM

Used to view current errors/alarms which are being reported by the TSU LT.

ERR/ALM HIST

Used to view and clear history errors and alarms.

CONFIG

The **CONFIGURATION MENU** is used to set the TSU LT operational configuration. This menu includes the following sub-items.

NETWORK (NI)

Used to set all of the parameters associated with the network interface.

UNIT

Used to control TSU LT control port baud rate and to set up the dial out function.

PORT

Used to configure the parameters associated with the V.35 port.

UTIL

The **UTILITY MENU** is used to view and to set system parameters. This menu includes the following sub-items:

TIME/DATE

Accesses the display and allows the setting of the current time and date.

SOFTWARE REV

Displays the version number of the current software revision level. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

REINIT UNIT

Used to reinitialize the unit. This menu item is *not* used to restore the factory default settings for all parameters.

ADDRESS

Used to view and change the current **Unit Address** used for control port access.

SET PASSCODE

Allows a passcode to be set.

FACT RESTORE

Restores factory default settings for all unit parameters.

TEST

The **TEST MENU** is used to initiate different types of tests of the unit and to view test results. Test results are displayed in the LCD window. The menu contains three sub-items.



Test execution disrupts some normal operations. See individual menu items concerning tests before executing.

NETWORK TESTS

Used to control the activation of loopbacks and the initiation of data test patterns.

RUN SELF TEST

Used to execute an internal self-test.

PORT TESTS

Used for the testing of the DTE port.

Menu Features

Data Field

A menu item followed by a **colon (:)** identifies an editable data field.

Display Field

A menu field followed by **alarm** or **error** information.

Arrows

Menus that display small **Up** or **Down Arrows** in the lower right corner indicate there are more menu items than are viewable on a two-line LCD. The additional menu items are accessed with the **Up** or **Down Arrows**. (Undisplayed menu items are also available by using the appropriate menu number.)

Example Menu Operations

To select a menu item...

Step	Action
1	Use the Up and Down arrows to place the cursor on the desired menu item (in this example CONFIG). See Figure 3-3
2	Place the cursor on the number 2 and press Enter . <i>The unit responds by displaying the first two available sub-menu fields. The cursor is on the first field. If there are more than two menu fields, a Down arrow is visible on the lower right corner. See Figure 3-4</i>

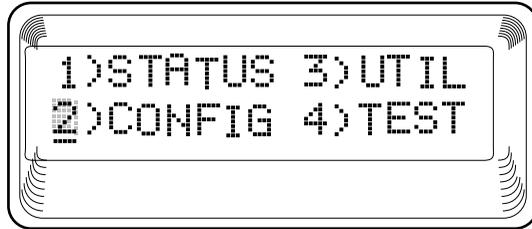


Figure 3-3. Cursor on Menu Item.

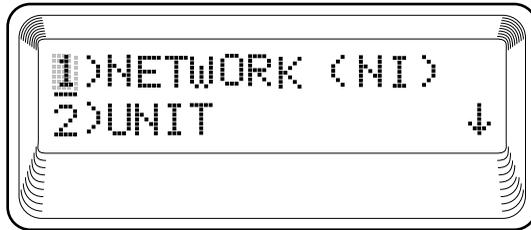


Figure 3-4. Submenu Fields

To select a submenu item

Step	Action
1	Use the same operation used to select an opening menu item.
2	Use the Up and Down Arrows to place the cursor on the desired menu item. In this example NETWORK (NI) . <i>The unit responds by displaying the first two available data field items. The cursor is on the number of the first item. When there are more than two data field items for the selected submenu, a Down Arrow is visible on the lower right corner.</i>

To Set the Data Field

Data fields that are available for editing are preceded by a colon (:).

Step	Action
1	<p>Press Enter while the cursor is located on the submenu item number . The cursor moves to the data field, (to the right of the submenu item name).</p> <p><i>You can use the Up and Down Arrows to scan the available value settings which display in the data field position one at a time.</i></p>
2	<p>When the desired value is in the data field position, press Enter to set the value.</p> <p><i>The unit is set for the value shown in the data field and the cursor moves back to the submenu item position indicating the operation is complete. You can select another submenu field or press Cancel to return to the submenu.</i></p>



Cancel is available any time during the operation. If used prior to pressing **Enter** after making a data change, the original data value is restored and the cursor returns to the submenu field.

To View Display-Only Data Fields

An example of a **DISPLAY ONLY** data field is found by selecting the following menu choices:

Step	Action
1	Select STATUS from the MAIN MENU .
2	<p>Select submenu CURR ERR/ALM.</p> <p>LOSS OF SIGNAL INACTIVE/ACTIVE is displayed giving the current state of the alarm.</p>

To Exit Any Menu Field Operation or Display

Press **Cancel** as many times as required to return to the desired menu level.

Front Panel

The TSU LT front panel is shown in Figure 3-5. Unit features are identified by call-outs.

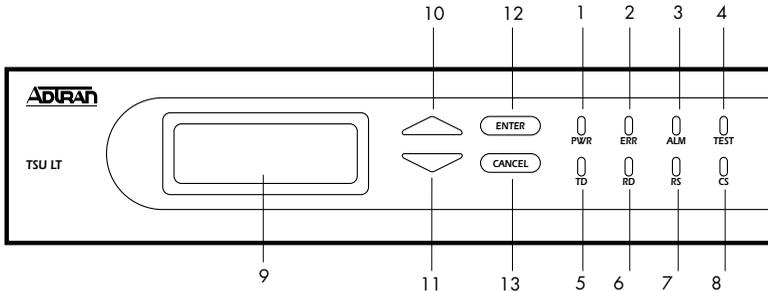


Figure 3-5. Front Panel Layout

Item	Displays	Function
1	PWR	LED ON when power is received by TSU LT.
2	ERR	LED ON when errored events have happened in the last second.
3.	ALM	LED ON when an alarm condition exists.
4	TEST	LED ON when unit is in test mode.
5	TD	LED ON when DTE data is being received.
6	RD	LED ON when DTE data is being received.
7	RS	LED ON when request to send (RTS) active from DTE.
8	CS	LED ON when TSU LT has clear to send (CTS) active toward DTE.
9	LCD	A 2X16 LCD window that displays menu items used in configuration and displays information useful in monitoring the unit.
Operation Keys:		
10	Up/Down	Keyboard arrows used to travel up/down menu trees. Arrows increase/decrease numeric values and scroll through selections.
11	Enter	Used to choose paths and make selections.
12	Cancel	Used to exit selections or menu tree branches.

STATUS

The **STATUS MENU** branch provides the ability to view the status of the TSU LT operation. See Figure 4-1.

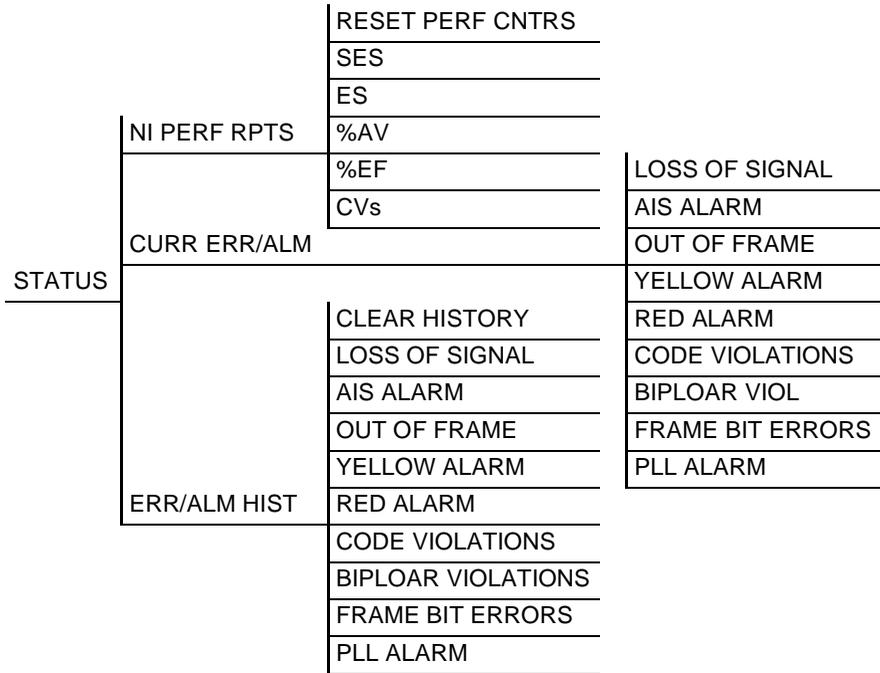


Figure 4-1. Status Menu

NI PERF RPTS

The Network Interface Performance Reports displays the user copy of the performance data. The TSU LT 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.

These fields cannot be edited, only cleared as previously discussed. Only the user copy of performance data is cleared. See Figure 4-2. Continue with standard operating procedures to exit the display.

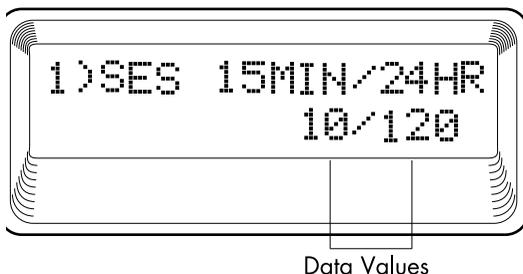


Figure 4-2. Severely Errored Seconds Screen

SES

Number of severely errored seconds

ES

Number of errored seconds

%AV

Percentage of available seconds

%EF

Percentage of error free seconds

CVs

Number of code violations



Since only the user's copy of performance data is cleared by the TSU LT, the data displayed here might be different from the data being sent to the network as performance report message (PRM) data.

CURR ERR/ALM

The **CURRENT ERROR/ALARM MENU** is used for viewing currently Active/Inactive errors and alarms (see Figure 4-3).

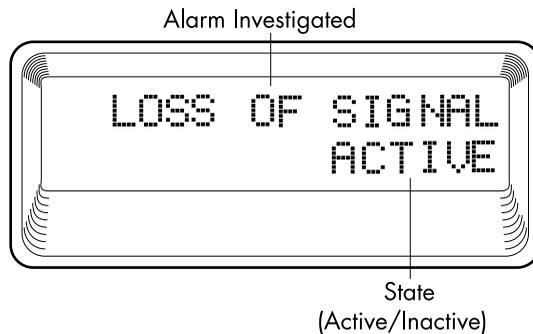


Figure 4-3. Loss of Signal (Current Errors/Alarms) Screens

The **Up** and **Down Arrows** are used to access the complete display of the errors/alarms that are currently active.

Alarms and Errors

The following are alarms and errors which can be seen.

Loss of Signal

No pulses received at NI

AIS Alarm

Unframed All-Ones received at NI

Out of Frame

No framing pattern sync at NI

Yellow Alarm

Receiving yellow alarm pattern from NI

Red Alarm

Loss of signal/out of frame (LOS/OOF) causing red alarm at NI

Code Violations

Cyclic redundancy check (CRC) errors in ESF, or bipolar violations (BPVs) in Superframe Format (SF) were received at NI

Bipolar Violations

BPVs in SF or ESF

Bipolar Violations

BPV's in SF or ESF

Bit Errors

Frame Bits received incorrectly at NI.

PLL Alarm

Unable to sync up to selected clock

ERR/ALM Hist

The **ERROR/ALARM HISTORY** menu is used for viewing history of errors and alarms. If an alarm has occurred since the last **CLEAR HISTORY** selection, the menu is *active*. If the condition has not occurred then the menu is *inactive* (see Figure 4-4).

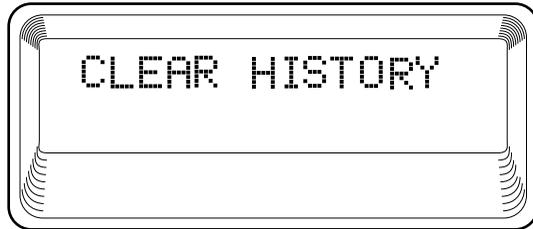


Figure 4-4. Clear History Screen

These conditions are the same as for the **CURR ERR/ALM** submenu except that these are *history* Alarm/Errors instead of *current* Alarm/Errors.

CONFIG

The **CONFIGURATION MENU** is used to set the TSU LT operational configuration, including all of the network interface parameters, and the allocation of the DS0s and the port parameters. See Figure 5-1.

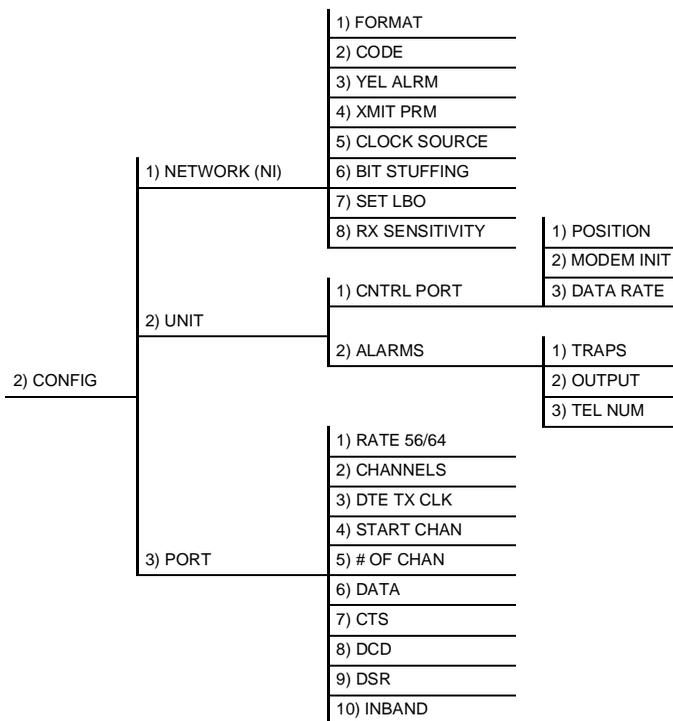


Figure 5-1. Configuration Menu

Network (NI)

This menu is used to access the configuration of parameters associated with the network interface in the TSU LT. There are eight submenu items that include setting the format, the line build-out (LBO), and the clock source. See Figure 5-2.

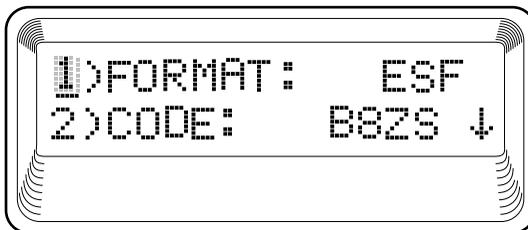


Figure 5-2. Network Submenu

The fields and parameters available are:

FORMAT

Sets the frame format for the NI.
Choices: D4, ESF, AUTO



D4 is equivalent to Superframe Format (SF).

CODE

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

YEL ALRM

Enables and disables the transmitting of yellow alarms.
Choices: ENA (enable), DISA (disable)

XMIT ALRM

Enables and disables the transmitting of performance report messages (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: ENA, DISA

CLOCK SOURCE

Selects the clock source for transmission toward the network from the NI.

Choices: NETWORK, DTE, INTERNAL

TSU LT Clock Sources

The TSU LT is operable from various clock sources permitting it to perform properly in many different applications. The network interface clocking options are set by using the Network Configuration menu options. Three clock source options are available:

- Network timing
- DTE timing
- Internal timing



The clocking option selected 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 **looped timed** as the transmission clock is derived from the received clock. See Figure 5-3.

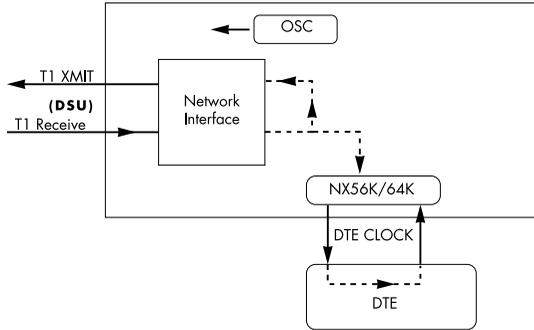


Figure 5-3. Network Timed Clock Source

DTE Timing

The DTE is the source of timing. The TSU LT uses the incoming DTE clock to determine the transmission timing. This is typically used in applications such as limited distance line drivers, where it is necessary to have the DTE as the primary clock source. See Figure 5-4.

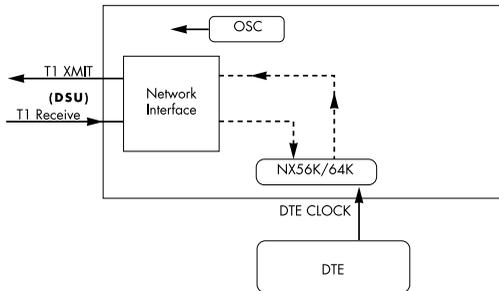


Figure 5-4. DTE Clock Source

Internal Timing

The TSU LT is the source of timing. The TSU LT 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 5-5.

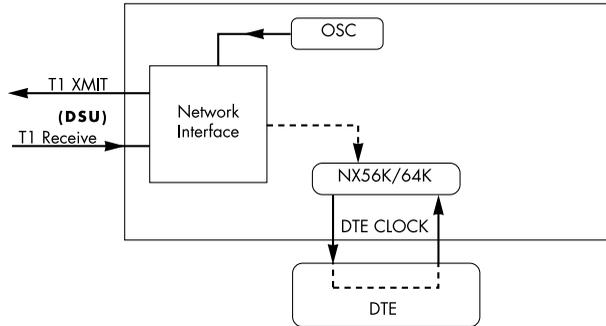


Figure 5-5. Internal Clock Source

BIT STUFFING

When enabled, Bit Stuffing causes the TSU LT to monitor for ones (1s) density violations and insert a one (1) when needed to maintain ones at 12.5 percent. This option should be disabled if B8ZS is enabled, if Nx56 is selected, or if alternate channels are being used. All of these other options already ensure pulse density requirements.

Choices: ENA, DISA

SET LBO

Selects the line build-out for the network interface. In **AUTO** mode, the TSU LT will set the LBO based on the strength of the receive signal.

Choices: 0dB, AUTO, -22.5dB, -7.5dB, -15dB

RX SENSITIVITY

Selects the desired receiver sensitivity setting. The factory default is **NORMAL** which is adequate for most applications. The extended setting should be used only in applications where the **NORMAL** setting will not suffice.

Unit

The **UNIT SUBMENU** is used to change control port and alarm options.

Follow standard operating procedure to access the **UNIT MENU** items. See Figure 5-6.

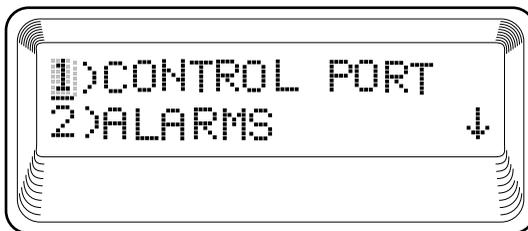


Figure 5-6. Configuration Submenu

CNTRL PORT

Used to set the unit up as the master or slave on a chain of units, and to initialize a modem and the control port data rate.

POSITION of TSU LT

Determines if this TSU LT is at the head of a chain of units (directly connected to the modem or PC). The head of the chain is referred to as the master unit. Units down the chain are referred to as slaves or a slave unit. The setting of the **Position Selection** is necessary only when using a modem, in which case the head unit should be **MASTER**. For all other cases, select **SLAVE**. (The master is in charge of control of the modem.)

Choices: MASTER, SLAVE

MODEM INIT

The TSU LT is capable of initializing a modem. This menu selection is used to perform this initialization and should be selected only when the TSU LT is serving as the **MASTER** unit. Prior to modem initialization it should be physically connected to the TSU LT and the power turned on. At this point, an industry-standard AT command string is used to initialize the modem. The string is also used following future power-up sequences.

Choices: ENA, DISA

DATA RATE

Selects the data rate for the control port. This should be consistent with all units on a chain and with the modem and/or PC/Proxy Agent serial port.

Choices: 1200, 2400, 9600

ALARMS

Used to initialize the method by which the control port handles alarm conditions.

TRAPS

Determines if alarm conditions should automatically send alarm messages (traps) to the controlling PC/Proxy Agent. The setting is for this unit, or for slaves if this unit is a master.

Choices: ENA, DISA

For applications where the **AUTO INBAND SELECTION** is not acceptable, Traps should only be enabled with the Inband selection set to **On** or **Off**.

OUTPUT

Selects whether the alarm traps (if enabled) are sent directly, or if the telephone number stored in the TSU LT should be dialed first (industry-standard AT dial command sent to modem).

Choices: DIRECT, DIAL

TEL NUM

This is the telephone number which is dialed to obtain alarm traps. The string can be up to 20 characters in length and is terminated with a semicolon (;) as the last character. A colon (:) character is used to represent a pause in the dial string.

For example, for number 9:5551212; dial 9, pause momentarily and then dial 5551212. This pause could be necessary to access an outside line, such as a PBX.

When editing a specific character, the arrows are used to scroll from 0 to 9, then colon (:) and semicolon (;). The new telephone number is entered into the TSU LT only upon pressing **Enter** after typing the semicolon.
Choices: 20 digits (0-9, :, and ;)



NOTE

*The typed digits are accepted only after pressing **Enter**.*

Port

The menu item **PORT** is used to select and then to configure the parameters associated with the V.35.

RATE 56/64

This sets the base rate of the interface. The actual data rate depends on the number of DS0s assigned to the Nx port. The DTE data rate vs. the number of DS0s appears in the appendix *DTE Data Rate Chart*.
Choices: 56K, 64K

CHANNELS

This sets the unit to use **ALTERNATE** or **CONTIGUOUS** channels in the T1 data stream. If more than 12 channels are used, then **CONTIGUOUS** must be used. If not, then **ALTERNATE** channels may be used to meet pulse density requirements (only necessary for Nx 64 without B8ZS). If other than a private

network, the carrier must be notified of this choice.
Choices: ALT (alternate), CONT (contiguous)

DTE TX CLK

Controls the clock used by the TSU LT to accept the transmit (TX) data from the DTE. Most applications will allow for this to be set to **INTERNAL**. If the interface cable is long (causing a phase shift in the data) the clock can be selected as **INT/INV** (Internal/Inverted). This switches the phase of the clock which should compensate for a long cable. The factory default setting for this option is **AUTO**. The **AUTO DTE TX CLK** setting will allow the TSU LT to automatically detect the delay from the DTE device to the TSU LT and set the proper phase of the clock. This feature will automatically select between the **INTERNAL** and **INT-INV** settings. If the DTE provides a clock with TX data, the clock selection is set to **EXTERNAL**. The TSU LT will depend on an externally supplied clock to accept the TX data.

Choices: INTERNAL, INT-INV, EXTERNAL, AUTO

START CHAN

Used to select the channel in which the T1 stream will start. The setting must be consistent with carrier if using a public network.

Choices: 01 through 24

OF CHAN

Used to select the number of DS0s (channels) that are to be used. The corresponding DTE rate will be this number times 56K or 64K, depending on Port Option number 1.

Choices: 01 through 24

DATA

Used to control the inverting of the DTE data. This inversion can be useful when operating with an HDLC protocol. Often used as a means to ensure ones (1s) density. TSU LTs on both ends must have identical option settings.

Choices: NORMAL, INVERT

CTS

Used to control characteristics of CTS.

Choices: NORMAL (see Table 5-1), FORCE ON

DCD

Data Carrier Detect - Indicates to the DTE when a valid signal is being received at the Network Interface.

Choices: NORMAL (see Table 5-1), FORCE ON

DSR

Data Set Ready - This signal indicates to the DTE when the DCE is turned **ON** and ready for operations.

Choices: NORMAL (see Table 5-1) or FORCE ON

Table 5-1. Normal Mode Operation

NORMAL MODE OPERATION							
Conditions which cause the Port Control Signals to be deactivated							
SIGNAL	RTS	V.54 LOOP BK	511 TST ON	SELF-TEST ACTIVE	NETWK TEST ACTIVE	NO DS0 MAPPED	NETWORK ALARM
CTS	Follows	OFF	OFF	OFF	OFF	OFF	OFF
DCD	—	—	—	OFF	—	OFF	OFF
DSR	—	OFF	OFF	OFF	OFF	OFF	—

Where " — " = don't care

INBAND

Inband Configuration Channel - Used to enable/disable an 8 kbps remote configuration channel. See Figure 5-7 on page 5- 11). When this option is set to **ON**, the first DS0 occupied operates in 56K mode and the DTE clock rate is reduced by 8 kbps. The TSU LT uses this 8 kbps channel to send and receive configuration data across a T1 span. As shown in Figure 5-7 on page 5- 11, this allows the PC connected to the chain-in port on TSU LT A to monitor/configure both TSU LT A and B. This feature is useful when FDL connectivity is not available across the T1 span.

The 8 kbps channel is only taken out of the first DS0. If two 64K DS0s are mapped, the DTE rate would be 120 kbps instead of 128 kbps. This menu option can also be set to **AUTO** which activates the Inband Channel only when commands are sent from T-Watch to the remote unit (TSU LT B in Figure 5-7). If no T-Watch activity is detected for 10 minutes, the Inband Channel is deactivated.

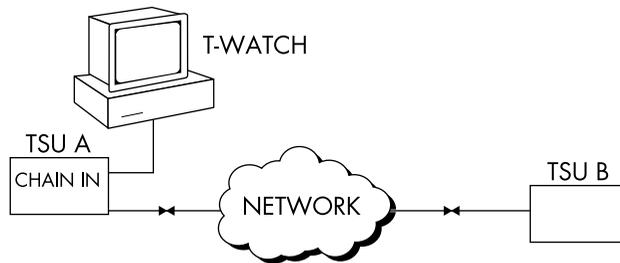


Figure 5-7. Inband Remote Configuration

UTIL

The **UTILITY MENU** is used to view and to set system parameters. See Figure 6-1. This includes setting the time and date and resetting all parameters to factory values or to re-initialize the unit. This menu is also used to view the unit's software revision and the unit ID setting.

UTIL	1) TIME/DATE	TIME: HH:MM:SS
		DATE: MM/DD/YY
	2) SOFTWARE REV	Displays current software revision
	3) REINIT UNIT	
	4) ADDRESS	
	5) SET PASSCODE	
6) FACT RESTORE	(Returns all configurations to factory settings)	

Figure 6-1. Utility Menu

Time/Date

Time/Date is used to view or to edit the current time and date. The time and date are maintained during power off conditions (see Figure 6-2).

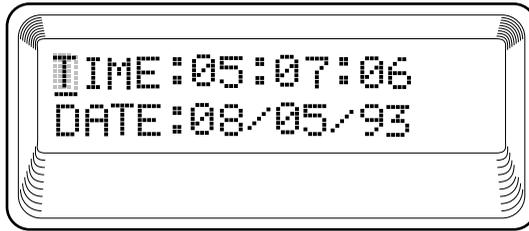


Figure 6-2. Time/Date Screen

Table 6-1. Editing the Time/Date

To	Do this ...
Record the entry and move to the next editing position.	Press Enter (after any numeric change)
Move to the next editing position or field	Press Enter without making any changes at the cursor. Press the up and down arrow keys
End the editing process	Press Cancel

Software Rev

Use the **SOFTWARE REVISION** submenu to access the display of the current software revision level. This information is required when requesting assistance from ADTRAN Customer Service or when updates are needed.

Reinit Unit

REINIT UNIT submenu is used to reinitialize the unit. This menu item *is not* used to restore the factory default settings for all parameters.

Address

ADDRESS is used to access the current **UNIT ADDRESS** setting. Unit identification numbers must be between 000 and 256. See Figure 6-3.

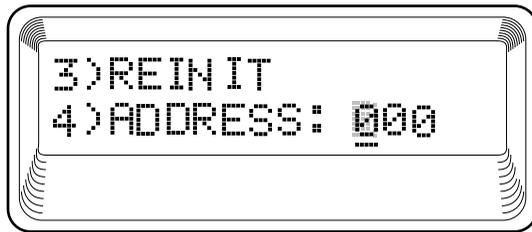


Figure 6-3. Address Screen

Set Passcode

Set Passcode allows a passcode to be added, changed, or deleted.

Fact Restore

The **FACTORY RESTORE** submenu is used to restore the factory default setting for all unit parameters. This restores all parameters to the factory settings.

Network Tests

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

The network tests are run on the network interface (NI). Three different test configurations can be selected to determine the type of loopback and the pattern to run. Test results are displayed in the LCD window. See Figure 7-2.

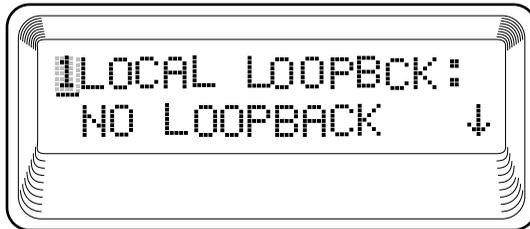


Figure 7-2. Local Loopback Screen

LOCAL LOOPBCK

There are three available choices for setting the local loopback:

No Loopback

Deactivates the loopback.

Line On

Activates the line loopback.

Payload On

Activates the payload loopback.

REMOTE LOOPBCK

Activates the same loopbacks as the **LOCAL** but at the far end. This uses either the inband loopup code as specified by AT&T 62411 for line loopback (ATT In-Band LLB), or the FDL as specified in ANSI T1.403 for payload and line loopback codes. An FDL (formerly TABS) maintenance message corresponding to AT&T TR54016 can be used for payload loopback as well.

No Loopback

Deactivates the loopback.

V.54 Inband PLB

Indicates inband transmission of V.54 loopup pattern in channels occupied by DTE data only. This choice should be used for public fractional network.

AT&T Inband LLB

Activates the line loopback using inband code.

AT&T Inband LLB

Activates the line loopback using inband code.

ANSI FDL LLB

Initiates the transmission of an FDL line loop-up code toward the far end.

AT&T PLB

Indicates the transmission of the PLB maintenance on the FDL.



NOTE

Only V.54 loopbacks can be used with fractional T1 since the full T1 stream including the FDL is not transported to the far end (unless it is a private network).

TEST PATTERN

Sets the pattern for the test and initiates the transmission of the pattern. There are four patterns available. The test is terminated by selecting **NO PATTERN**.

1:8 ALL DS0s

Generates a 1 in 8 pattern in all DS0s.

511 Active DS0s

Generates a 511 test pattern and inserts the pattern into currently active channels.

All Zeros

Generates an all zero's pattern in every channel.

All Ones

Generates an all one's pattern in every channel.

CLR ERRORS

CLR ERRORS has two functions.

1. It clears out the 511 error total when you press **Enter**.
2. It displays a total of the 511 errors. If 511 errors are being received, the display is updated accordingly. See Figure 7-3.

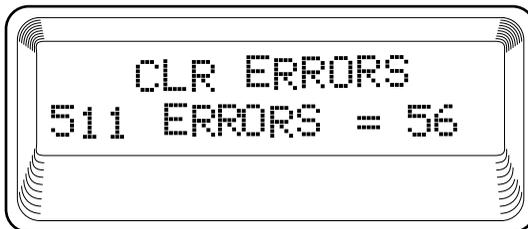


Figure 7-3. Clear Errors Screen

This menu function is very useful for testing end-to-end integrity of the network. First loop up the far end TSU LT. Then send a 511 pattern from the local TSU LT. The **CLR ERRORS** screen can then be used to determine if the link is

functioning properly by verifying that no errors are being counted.

INSERT 511 ERRORS

When running a 511 pattern test, press the **Enter** key to insert an error into the 511 pattern.

Run Self-test

This menu selection is used to execute an internal self-test. This is the same self-test that is performed automatically at power up. The results of the self-tests are displayed in the LCD. Upon invoking the command the LCD displays **INITIALIZING** and test failures are displayed in the LCD window (see Figure 7-4). To initialize a self test, proceed with the following steps:

Step	Action
1	RAM tests; EPROM checksum
2	On board data path; sending a known test pattern through an on-board loop
3	Front panel LED verification
4	Phase lock loop verify <i>If a failure is detected, note the failure number and contact ADTRAN Technical Support.</i>



Executing self-test disrupts normal data flow and prevents remote communication until the self-test is completed (approximately five seconds)

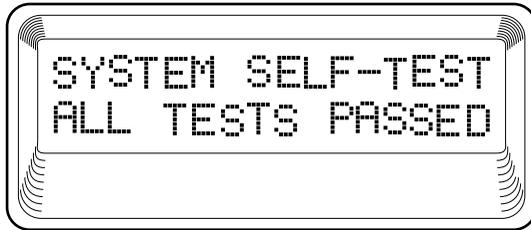


Figure 7-4. Self Test Results Screen

Port Tests

Port Tests are used to control the activation of a DTE loopback. This test loops data received at the V.35 interface back towards the DTE. See Figure 7-5).

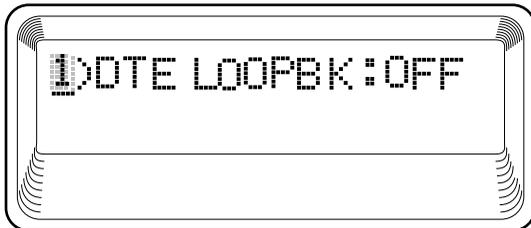


Figure 7-5. Loopback Setting Screen

TESTING EXAMPLES

Before using the TSU LT to pass data, it is recommended to run tests on the circuit. Testing consists of sending a test pattern from end-to-end and checking for errors in the pattern. There are two types of tests used to accomplish this:

- Send the pattern from one end and loop back the far end.
- Send the pattern from both ends and check at both ends.

Far End Looped Back Test

Two types of tests can be executed with the far end looped. The first is a check of the network and the network interfaces at both ends (511). The second is a check of the DTE port.

Network Interface Test

The Network Interface Test can be run with any channel setup because the 511 pattern is always sent in the occupied channels.

Step	Action
1	Select TEST from the MAIN MENU . See Figure 8-1.
2	Use the Up and Down arrows to place the cursor on TEST .
3	Press Enter to select <i>Result: The first two TEST submenu items display. See Figure 8-2.</i>

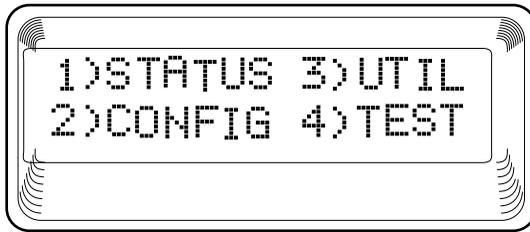


Figure 8-1. Main Menu with TEST Selected

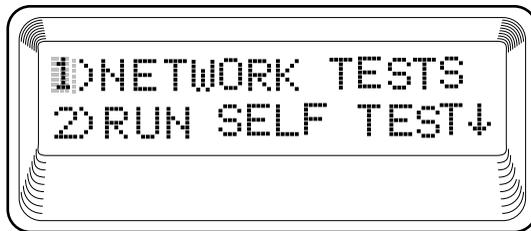


Figure 8-2. Test Menu with NETWORK TESTS Selected

Step	Action
1	Use the Up and Down arrows to place the cursor on NETWORK TESTS .
2	Press Enter to select.
3	Press Enter again to enter the NETWORK TEST menu. <i>Result: Beginning display of the submenu items. Each menu item can be selected with the Up and Down arrows</i>

The **LOCAL LOOPBACK TEST MENU** is shown in Figure 8-3.

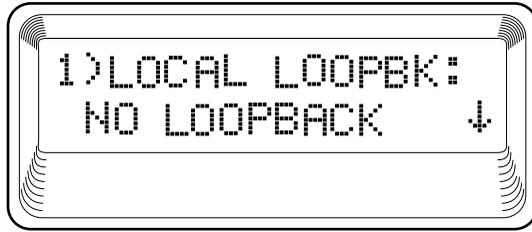


Figure 8-3. Local Loopback Test Menu

The menu offers the following options:

- Line On
- Payload On
- No Loopback

The menu options for the **REMOTE LOOPBACK TEST MENU** are shown in Figure 8-4 on page 8- 3.

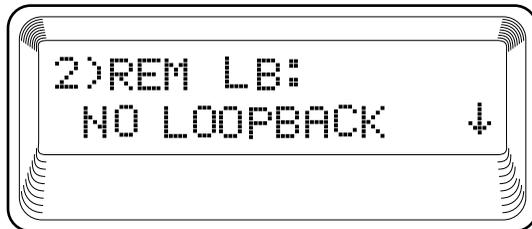


Figure 8-4. Remote Loopback Test Menu

The menu options for the **REMOTE LOOPBACK** are:

- No Loopback
- V.54 Inband PLB
- ANSI FDL LLB
- AT&T Inband LLB
- ANSI FDL PLB
- AT&T FDL PLB

The Test Pattern screen is shown in Figure 8-5.

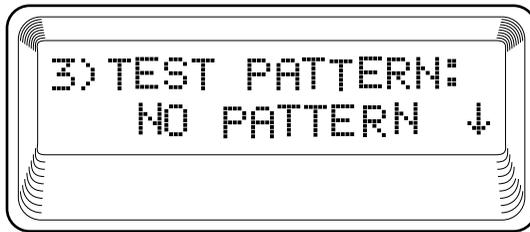


Figure 8-5. Test Pattern Screen

The menu options available for the **TEST PATTERN SCREEN** are:

- No Pattern
- 1:8 all DS0s
- 511 Active DS0s
- All Zeros
- All Ones

Step	Action
1	Use the Up and Down arrows to place the cursor on REMOTE LOOPBK
2	Press Enter to select
3	Use the Up and Down arrows to set PAYLOAD in the data field. (Must use V.54 Inband PLB for Fractional T1 on Public Networks.)
4	Press Enter to activate a Remote Payload Loopback . <i>Results: This initiates the transmission of a loopup code toward the far end.</i>

When completed, do the following:

Step	Action
1	Use the Up and Down arrows or the number 3 to select TEST PATTERN .
2	Press Enter to activate the TEST PATTERN sub-menu
3	Use the Up and Down arrows to select 511 ACT. DS0s
4	Press Enter to activate the selection. <i>Results: The TSU LT always checks for 511 errors. The results of this check are shown under submenu item 4 (see Figure 8-6).</i>

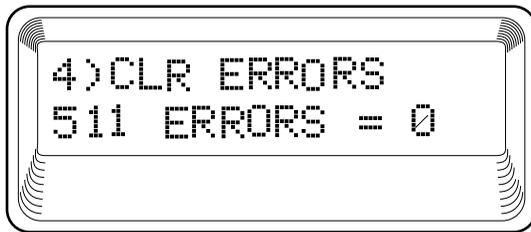


Figure 8-6. Clear Errors Screen

When through viewing the results, do the following:

Step	Action
1	Press Cancel to return to submenu item TEST PATTERN .
2	Select NO PATTERN to terminate the test and the 511 pattern generation. <i>Result: The far end remains in loopback until the network REMOTE LOOPBK is set to NO LOOPBACK under submenu item REMOTE LOOPBK.</i>

TSU LT Menu Tree

The complete menu tree for the TSU LT is shown in Figures A-1 and A-2.

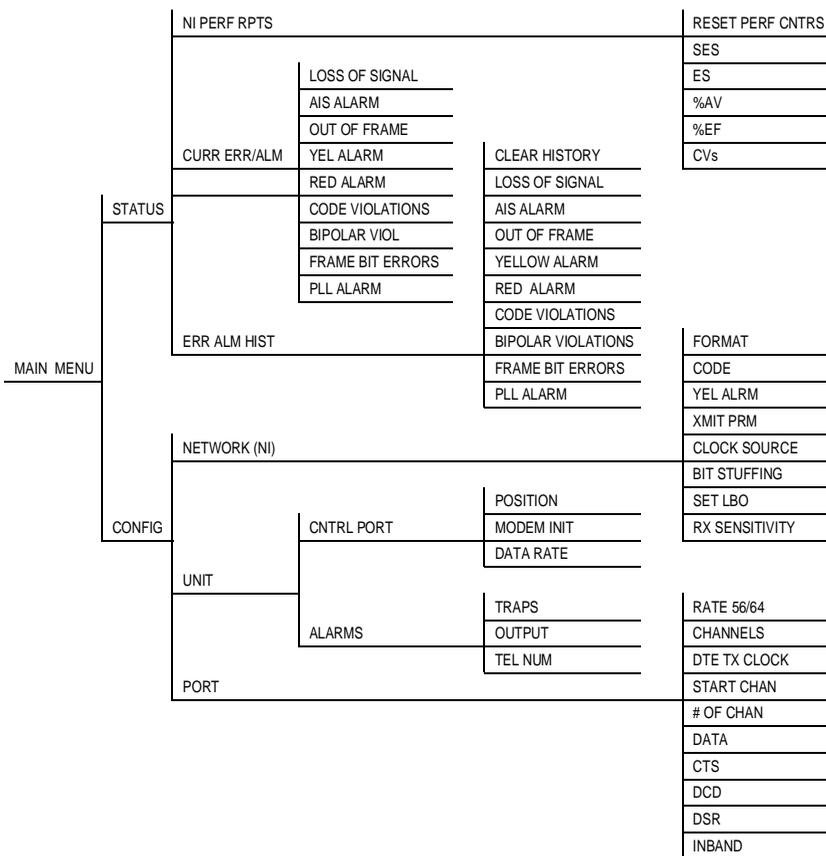


Figure A-1. TSU LT Menu Tree (Status and Config)

DTE Data Rate Chart

The DTE data rate chart is shown in Table B-1.

Table B-1. DTE Data Rate vs. DS0s

# OF DS0s (N)	DTE RATE=56K	DTE RATE=64K
N=1	56K	64K
N=2	112K	128K
N=3	168K	192K
N=4	224K	256K
N=5	280K	320K
N=6	336K	384K
N=7	392K	448K
N=8	448K	512K
N=9	504K	576K
N=10	560K	640K
N=11	616K	704K
N=12	672K	768K
N=13	728K	832K
N=14	784K	896K
N=15	840K	960K
N=16	896K	1024K
N=17	952K	1088K
N=18	1008K	1152K
N=19	1064K	1216K
N=20	1120K	1280K
N=21	1176K	1344K
N=22	1232K	1408K
N=23	1288K	1472K
N=24	1344K	1536K

WIRING

Network

On the rear panel, the TSU LT has an eight-position modular jack labeled **NETWORK**. This connector is used for connecting to the network. See Table C-1 for the network connector pin assignments.

Connector Type (USOC) RJ-48C
Product Number AMP# 555164-2

Table C-1. Network Pin Assignments

Pin	Name	Description
1	R1 RXDATA-RING	Receive data from the network
2	T1 RXDATA-TIP	—
3	UNUSED	—
4	R TXDATA-RING	Send data towards the network
5	T TDCDATA-TIP	—
6, 7, 8	UNUSED	—

Control-In/Chain-In

Use this as an EIA-232 port for connection to a computer or modem (chain-in) or another TSU (chain-out). See Table C-2 for the pin assignment for this connector.

Connector Type RJ-48
Product Number AMP# 555164-2

Table C-2. Control-In/Chain-In Pin Assignments

Pin	Name	Description
1	GND	Ground connected to unit chassis
2	UNUSED	—
3	RXDATA	Data received by the TSU
4	UNUSED	—
5	TXDATA	Data transmitted by the TSU
6	UNUSED	—
7	RI	Ring indicate from modem
8	UNUSED	—

Chain-Out

Use this to connect to another TSU ACE chain-in connector. The pinout for this connector is shown in Table C-3.

Connector Type RJ-48
Product Number AMP# 555164-2

Table C-3. Chain-Out Pin Assignments

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

Nx56K/64K DTE (V.35)

The pinout for this connector is shown in Table C-4.

Connector Type V.35
Product Number AMP# 92-4883-3-1

Table C-4. Primary V.35 Pin Assignment

Pin	CCITT	Description
A	101	Protective ground (PG)
B	102	Signal ground (SG)
C	105	Request to send (RTS) from DTE
D	106	Clear to send (CTS) to DTE
E	107	Data set ready (DSR) to DTE
F	109	Received line signal detector (DCD) to DTE
H	—	Data terminal ready (DTR) from DTE
J	—	Ring indicator (RI)
L	—	Local loopback (LL)
N	—	Remote loopback (RL)
R	104	Received data (RD-A) to DTE
T	104	Received data (RD-B) to DTE
V	115	RX clock (RC-A) to DTE
X	115	RX clock (RC-B) to DTE
P	103	Transmitted data (TD-A) from DTE
S	103	Transmitted data (TD-B) from DTE
Y	114	TX clock (TC-A)
AA	114	TX clock (TC-B)
U	113	External TX clock (ETC-A) from DTE
W	113	External TX clock (ETC-B) from DTE
NN&K	—	Test mode (TM) to DTE

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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 (205) 963-8722

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

ADTRAN Customer and Product Service
6767 Old Madison Pike
Progress Center
Building #6, Suite 690
Huntsville, AL 35807
RMA # _____

