TSU T1 SERVICE UNIT
User Manual

1200060L2 **TSU T1 Service Unit with Embedded SNMP**

61200060L2-1B
September 2002

Trademarks

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To the Holder of the Manual

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

Notes provide additional useful information.

Cautions signify information that could prevent service interruption.

WARNING *Warnings provide information that could prevent damage to the equipment or endangerment to human life.*

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 a bathtub, 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 Important Safety Instructions

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 for filing an affidavit with the local exchange carrier when connecting unprotected customer premise equipment (CPE) to 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 _____, _____

_____
Notary Public

My commission expires:

_____

FCC regulations require that the following information be provided in this manual:

1. This equipment complies with Part 68 of FCC rules. On the back of the equipment housing is a label showing the FCC registration number and ringer equivalence number (REN). If requested, provide this information to the telephone company.
2. If this equipment causes harm to the telephone network, the telephone company may temporarily discontinue service. If possible, advance notification is given; otherwise, notification is given as soon as possible. The telephone company will advise the customer of the right to file a complaint with the FCC.
3. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of this equipment. Advance notification and the opportunity to maintain uninterrupted service are given.
4. If experiencing difficulty with this equipment, please contact ADTRAN for repair and warranty information. The telephone company may require this equipment to be disconnected from the network until the problem is corrected or it is certain the equipment is not malfunctioning.
5. This unit contains no user-serviceable parts.
6. An FCC compliant telephone cord with a modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using an FCC compatible modular jack, which is Part 68 compliant.
7. The following information may be required when applying to the local telephone company for a dial-up line for the V.34 modem:

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

8. The REN is useful in determining the quantity of devices you may connect to your telephone line and still have all of those devices ring when your number is called. In most areas, the sum of the RENs of all devices should not exceed five. To be certain of the number of devices you may connect to your line as determined by the REN, call your telephone company to determine the maximum REN for your calling area.
9. This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs. Contact your state public utility commission or corporation commission for information.

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.

WARNING

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.

Industry Canada Compliance Information

Notice: The Industry Canada label applied to the product (identified by the Industry Canada logo or the "IC:" in front of the certification/registration number) signifies that the Industry Canada technical specifications were met.

Notice: The Ringer Equivalence Number (REN) for this terminal equipment is supplied in the documentation or on the product labeling/markings. The REN assigned to each terminal device indicates the maximum number of terminals that can be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the RENs of all the devices should not exceed five (5).

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 numérique respecte les limites de bruits radioelectriques applicables aux appareils numériques de Class A prescrites dans la norme sur le materiel brouilleur: "Appareils Numériques," NMB-003 edictee par le ministre des Communications.

Warranty and Customer Service

ADTRAN will repair and return this product within 5 years from the date of shipment if it does not meet its published specifications or 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 further information, contact one of the numbers listed at the end of this section.

LIMITED PRODUCT WARRANTY

ADTRAN warrants that for 5 years from the date of shipment to Customer, all products manufactured by ADTRAN will be free from defects in materials and workmanship. ADTRAN also warrants that products will conform to the applicable specifications and drawings for such products, as contained in the Product Manual or in ADTRAN's internal specifications and drawings for such products (which may or may not be reflected in the Product Manual). This warranty only applies if Customer gives ADTRAN written notice of defects during the warranty period. Upon such notice, ADTRAN will, at its option, either repair or replace the defective item. If ADTRAN is unable, in a reasonable time, to repair or replace any equipment to a condition as warranted, Customer is entitled to a full refund of the purchase price upon return of the equipment to ADTRAN. This warranty applies only to the original purchaser and is not transferable without ADTRAN's express written permission. This warranty becomes null and void if Customer modifies or alters the equipment in any way, other than as specifically authorized by ADTRAN.

EXCEPT FOR THE LIMITED WARRANTY DESCRIBED ABOVE, THE FOREGOING CONSTITUTES THE SOLE AND EXCLUSIVE REMEDY OF THE CUSTOMER AND THE EXCLUSIVE LIABILITY OF ADTRAN AND IS IN LIEU OF ANY AND ALL OTHER WARRANTIES (EXPRESSED OR IMPLIED). ADTRAN SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING (WITHOUT LIMITATION), ALL WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SOME STATES DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES, SO THIS EXCLUSION MAY NOT APPLY TO CUSTOMER.

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Customer Service, Product Support Information, and Training

ADTRAN will repair and return this product if within 5 years from the date of shipment the product does not meet its published specification or the product fails while in service.

A return material authorization (RMA) is required prior to returning equipment to ADTRAN. For service, RMA requests, training, or more information, use the contact information given below.

Repair and Return

If you determine that a repair is needed, please contact our Customer and Product Service (CAPS) department to have an RMA number issued. CAPS should also be contacted to obtain information regarding equipment currently in house or possible fees associated with repair.

CAPS Department (256) 963-8722

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

ADTRAN Customer and Product Service
901 Explorer Blvd. (East Tower)
Huntsville, Alabama 35806

RMA # _____

Pre-Sales Inquiries and Applications Support

Your reseller should serve as the first point of contact for support. If additional pre-sales support is needed, the ADTRAN Support web site provides a variety of support services such as a searchable knowledge base, latest product documentation, application briefs, case studies, and a link to submit a question to an Applications Engineer. All of this, and more, is available at:

http://support.adtran.com

When needed, further pre-sales assistance is available by calling our Applications Engineering Department.

Applications Engineering (800) 615-1176

Post-Sale Support

Your reseller should serve as the first point of contact for support. If additional support is needed, the ADTRAN Support web site provides a variety of support services such as a searchable knowledge base, updated firmware releases, latest product documentation, service request ticket generation and trouble-shooting tools. All of this, and more, is available at:

http://support.adtran.com

When needed, further post-sales assistance is available by calling our Technical Support Center. Please have your unit serial number available when you call.

Technical Support (888) 4ADTRAN

Installation and Maintenance Support

The ADTRAN Custom Extended Services (ACES) program offers multiple types and levels of installation and maintenance services which allow you to choose the kind of assistance you need. This support is available at:

http://www.adtran.com/aces

For questions, call the ACES Help Desk.

ACES Help Desk	(888) 874-ACES (2237)

Training

The Enterprise Network (EN) Technical Training Department offers training on our most popular products. These courses include overviews on product features and functions while covering applications of ADTRAN's product lines. ADTRAN provides a variety of training options, including customized training and courses taught at our facilities or at your site. For more information about training, please contact your Territory Manager or the Enterprise Training Coordinator.

Training Phone	(800) 615-1176, ext. 7500
Training Fax	(256) 963-6700
Training Email	training@adtran.com

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Chapter 1 Introduction

T1/FT1 OVERVIEW

T1 digital communication links have been used by the telephone companies (telcos) for voice transmission since the early 1960s. The D4 channel bank is an example of a T1 digital carrier system that was introduced in the mid-1970s 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 installed in private networks can provide the same performance information to the user.

Fractional T1

Fractional T1 (FT1) lets the buyer 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, or a full T1 line. 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 used. In T1

access, the user pays for a full T1 to the IXC POP and then only for the bandwidth used.

TSU OVERVIEW

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

Functional Description

The ADTRAN TSU (See Figure 1-1 below and Figure 1-2 on page 25) 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 but 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.

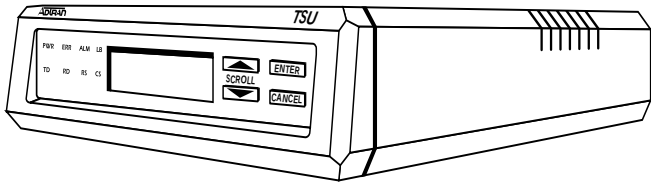

Figure 1-1. TSU Unit - Front View

The TSU 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.

Number Identification	
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
7. V.35 NX56/64	DTE port
8. Power Switch	Used to turn power on or off
9. Power Cord	Captive three-prong power cord

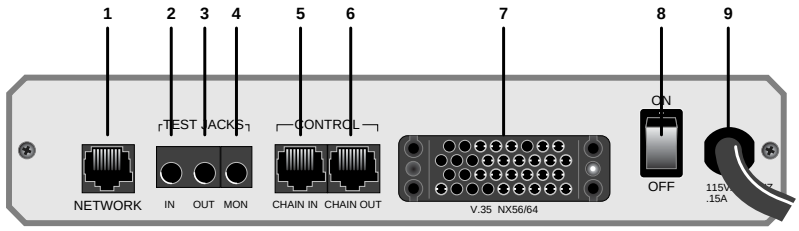

Figure 1-2. TSU Rear Panel

Features

The TSU has the following 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 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, ensuring proper operation.
- Flexible channel allocation (any starting channel and alternate or contiguous).

Interfaces

The TSU is equipped with four interfaces as shown in Figure 1-3:

- 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

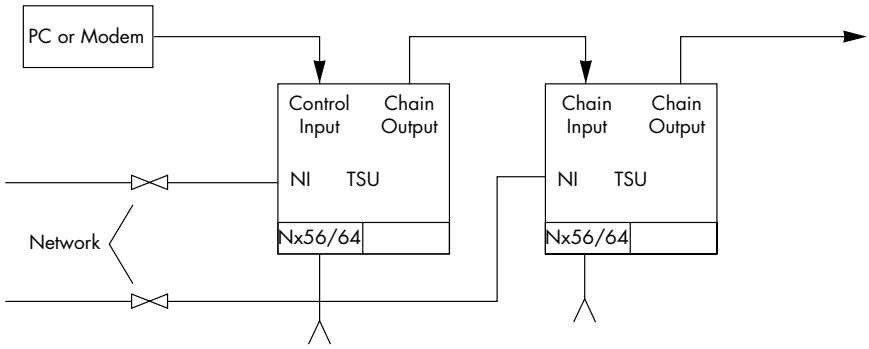

Figure 1-3. TSU Interfaces

TSU INTERFACES

Network Interface (NI)

The Network Interface (NI) port complies with the following 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: Nx56K or Nx64K, 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
- Chain input from another TSU
- Up to 9600 baud operation
- Acts as input for PC proxy agent control or as input for a chained connection

Chain Port Output

Features of the chain port output include:

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

Two Methods Of Control

Front Panel

The front panel provides complete, 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 and all the menu options is found in *Chapter 3: Operation* on page 37.

T-Watch PRO Management Software Program

T-Watch PRO is the ADTRAN management software program that allows the user to control the TSU from a PC. It provides complete control over the configuration of the TSU 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 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 CLOCK SOURCES

The TSU is operable from various clock sources which permits 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

> **NOTE** *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 1-4.

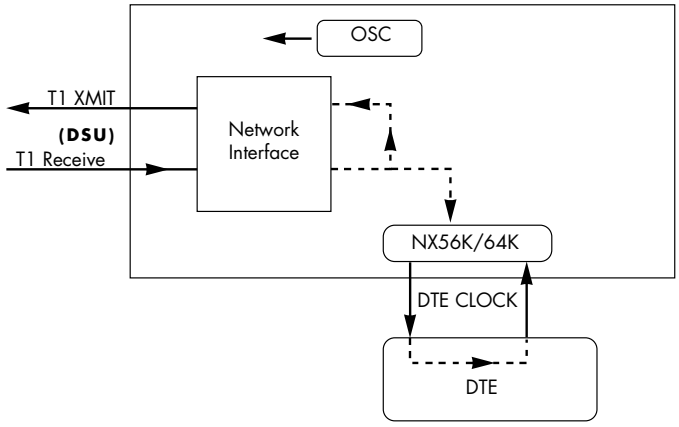

Figure 1-4. Network Timed Clock Source

DTE Timing

The DTE is the source of timing. The TSU 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 1-5 on page 29.

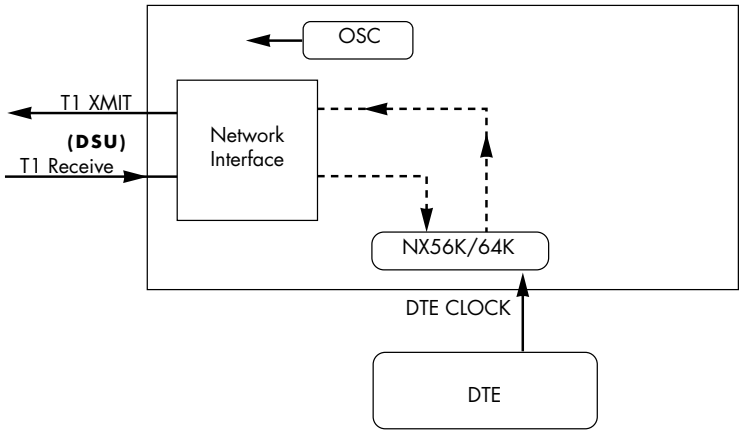

Figure 1-5. DTE Clock Source

Internal Timing

The TSU is the source of timing. The TSU 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 1-6.

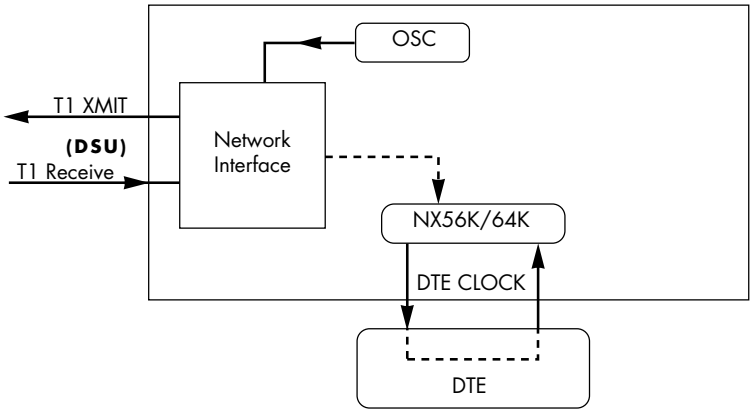

Figure 1-6. Internal Clock Source

TSU TESTING

The TSU 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 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 PRO commands, or remotely by using special inband codes (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 PRO via a modem connection. Network and DTE interface loopbacks are discussed in this section.

Network Loopbacks

There are three types of network loopbacks, as shown in Figure 1-7 on page 31.

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.

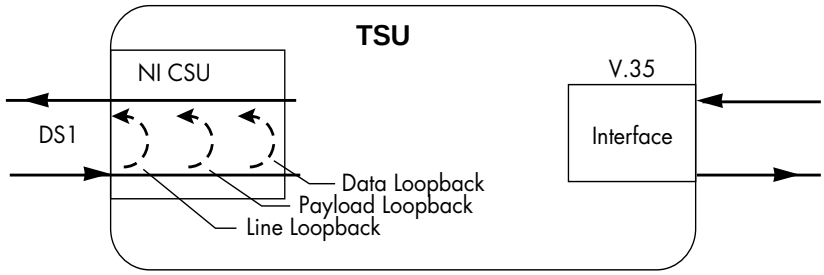

Figure 1-7. Network Loopback Tests

DTE Interface Loopbacks

The Nx56K/64K serial interface offers a DTE loopback as shown in Figure 1-8.

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 front panel or T-Watch PRO commands. The DTE (or the external test equipment) must provide any test pattern in order to check the DTE interface.

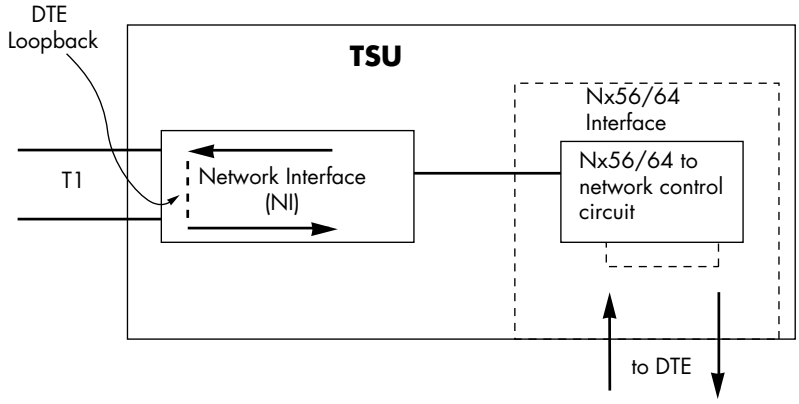

Figure 1-8. DTE Interface Loopback

Pattern Generation

The TSU offers four available test patterns: 511, 1:8, All ONES, andAll 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 as previously described, 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 0's 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 Ones

Generates an All ONES pattern in every channel.

All Zeros

Generates an All ZEROS pattern in every channel.

APPLICATION

Using the V.35 DTE interface, a bridge or router can be interfaced to the network. 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 1-9 shows a simple bridge application.

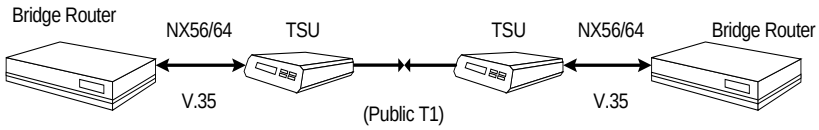

Figure 1-9. Bridge Application on a T1 or FT1 Circuit

Chapter 2 Installation

UNPACK, INSPECT

Carefully inspect the TSU 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 back for repair or for verification of damage during shipment.

Shipped by ADTRAN

The following items are included in the ADTRAN shipment:

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

Provided by Customer

The following items must be supplied by the customer:

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

POWER CONNECTION

Each TSU 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 must be from a grounded 115 VAC, 60 Hz power source.

WIRING

Network

On the rear panel, the TSU has an eight-position modular jack labeled **NETWORK**. This connector is used for connecting to the network. Table 2-1 shows the network connector pin assignments.

Connector Type (USOC) RJ-48C

Table 2-1. 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 TDXDATA-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**). Table 2-2 shows the pin assignments for this connector.

Connector Type RJ-48

Table 2-2. 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 chain-in connector. The pinout for this connector is shown in Table 2-3.

Connector Type RJ-48

Table 2-3. 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 2-4.

Connector Type V.35

Table 2-4. Primary V.35 Pin Assignments

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

Table 2-4. Primary V.35 Pin Assignments (Continued)

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

POWER UP TESTING AND INITIALIZATION

When shipped from the factory, the TSU 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

Upon a power-up or commanded self-tests, the LCD displays **ADTRAN TSU INITIALIZING** and the LEDs illuminate sequentially. When the self-test is completed with no failures detected, the LCD momentarily displays **ALL TESTS PASSED**. If a failure is detected, it is displayed in the LCD window. The automatic self-test procedure consists of the following tests.

1. 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.

2. Unit level tests

   Front panel LED verification.

   Phase lock loop verify.

Chapter 3 Operation

OPERATION

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

Front Panel

The TSU front panel is shown in Figure 3-1; features are identified by call-outs.

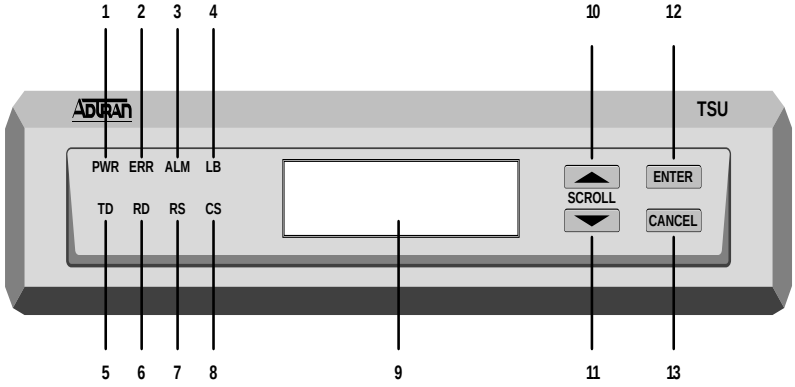

Figure 3-1. Front Panel Layout

Identification Of Numbers

Item	Displays	Function
1	**PWR**	LED ON when power is applied to the TSU.
2	**ERR**	LED ON when errored events have occurred in the previous second.
3	**ALM**	LED ON when an alarm condition exists.
4	**LB**	LED ON when unit is in loopback.
5	**TD**	LED ON when DTE data is being transmitted.
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 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	**SCROLL** (Up Arrow)	Arrow used to travel up menu trees. Arrow increases numeric values and scrolls through selections.
11	**SCROLL** (Down Arrow)	Arrow used to travel down menu trees; decreases numeric values and scrolls through selections.
12	**ENTER**	Used to choose paths and make selections.
13	**CANCEL**	Used to exit selections or menu tree branches.

GENERAL MENU OPERATION

The TSU 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 **SCROLL (**Up**)** and **SCROLL (**Down**)** arrows.

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 that 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 Operation

To select a menu item:

1. Use the Up and Down arrows to place the cursor on the desired menu item, in this case, **2) CONFIG**. See Figure 3-2.

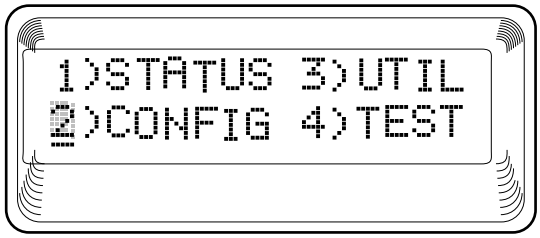

Figure 3-2. Cursor on Menu Item

2. With the cursor on the number 2, press **ENTER.**

Results: The unit responds by displaying the first two available submenu 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 as shown in Figure 3-3 on page 39.

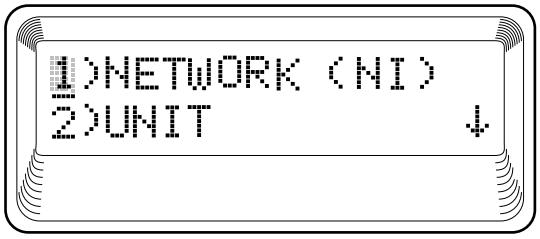

Figure 3-3. Sub-Menu Fields

3. To select the desired submenu item, perform the same operation used to select an opening menu item.
4. Use the Up and Down keys to place the cursor on the desired menu item (in this example, **1) NETWORK(NI)**.

Results: 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.

To Set the Data Field

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

1. Press **ENTER** while the cursor is located on the submenu item number

Results: The cursor moves to the data field (to the right of the submenu item name)

2. Use the Up and Down arrows to scan the available value settings, which display in the data field position one at a time
3. When the desired value is in the data field position, press **ENTER** to set the value.

Results:

a. The unit is set for the value shown in the data field.
b. The cursor moves back to the submenu item position indicating the operation is complete, or another submenu field may be selected.
c. **Select CANCEL** to return to the submenu.

> NOTE
>
> ***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:

1. Select from the Main menu **1)STATUS**.
2. Select submenu **2)CURR ERR/ALM**.
3. **LOSS OF SIGNAL INACTIVE/ACTIVE** is displayed, giving the current state of the alarm.

To Exit Any Menu Field Operation or Display

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

Menu Structure

The TSU uses hierarchical menus to access its many features. The Main menu level shown in Figure 3-4 leads to submenus (see Figure 3-5 on page 41). All menu operations are displayed in the LCD window. The complete TSU menu diagram is shown in *Appendix A, TSU Menu Tree,* on page 63.

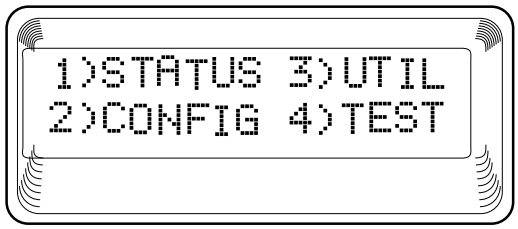

Figure 3-4. TSU Main Menu Screen

This menu structure diagram is a limited overview. A detailed description of each menu item, presented in menu order, immediately follows. A complete menu diagram is shown in Appendix A, TSU Menu Tree, on page 63.

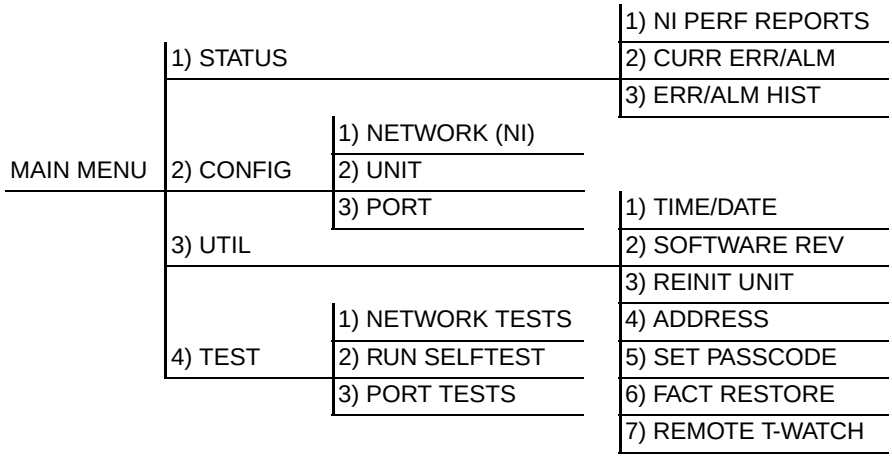

Figure 3-5. TSU Main Menus

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**, and **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.

Overview: Four Opening Menu Functions

1)STATUS

The Status menu allows you to view the status of the TSU 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.

2)CURR ERR/ALM
Used to view current errors/alarms which are being reported by the TSU.

3)ERR/ALM HIST
Used to view and clear history errors and alarms.

2)CONFIG

Use the Configuration menu to set the TSU operational configuration. This menu includes the following items.

1)NETWORK (NI)
Used to set all of the parameters associated with the network interface.

2)UNIT
Used to control TSU control port baud rate and to set up the dial out function.

3)PORT
Used to configure the parameters associated with the V.35 port.

3)UTIL

Use the Utility menu to view and set system parameters. This menu includes the following items:

1)TIME/DATE
Accesses the display and allows the setting of the current time and date.

2)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.

3)REINIT UNIT
Used to re-initialize the unit. This menu item is *not* used to restore the factory default settings for all parameters.

4)ADDRESS
Used to view and change the current Unit Address used for control port access.

5)SET PASSCODE
Allows a passcode to be set.

6)FACT RESTORE
Restores factory default settings for all unit parameters.

7) REMOTE T-WATCH
Used to control or configure a remote unit via the facility data link (FDL) or the inband channel.

4)TEST

Use the Test menu 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 items.

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

1)NETWORK TESTS
Used to control the activation of loopbacks and the initiation of data test patterns.

2)RUN SELF-TEST
Used to execute an internal self-test.

3)PORT TESTS
Used for the testing of the DTE port.

Each of the four Main menu items is discussed in detail in the following pages.

1)STATUS

The Status menu branch shown in Figure 3-6 shows the status of the TSU operation.

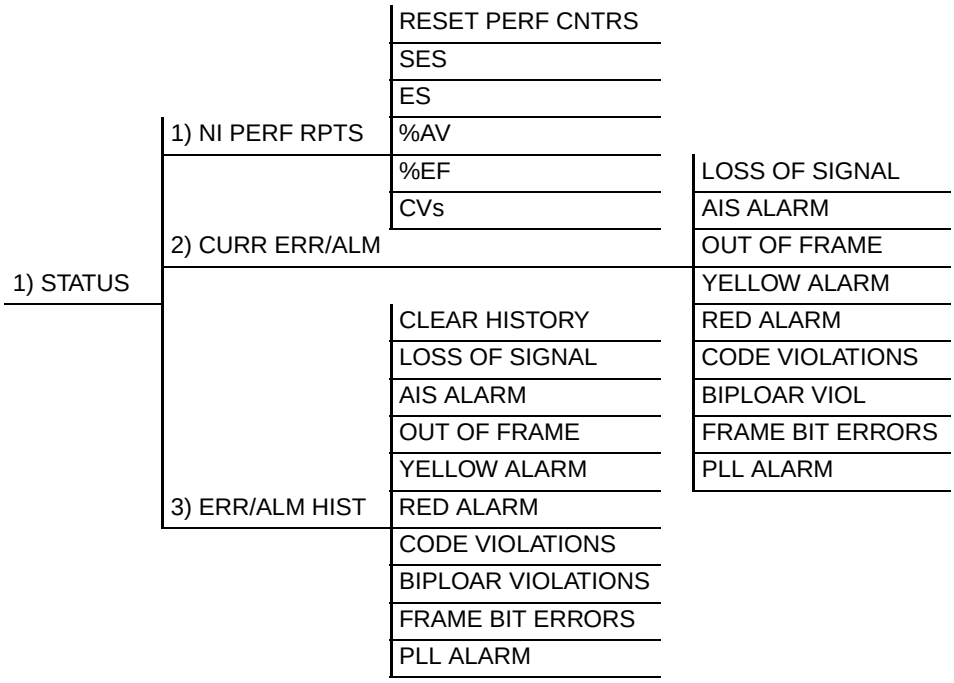

Figure 3-6. Status Menu

1)NI PERF RPTS, Submenu of 1)Status

The Network Interface Performance Reports display the user copy of the performance data. The TSU 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 previous 15 minutes and over the previous 24 hours.

These fields can be cleared, but not edited. Only the user copy of performance data is cleared. See Figure 3-7.

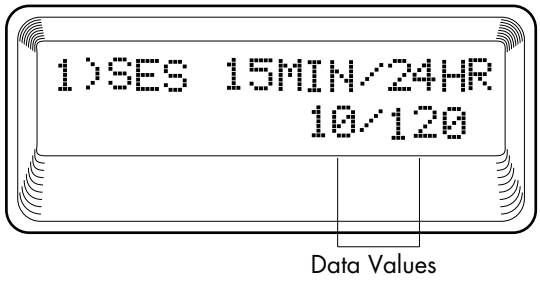

Figure 3-7. Severely Errored Seconds Screen

SES	Number of severely errored seconds
ES	Number of errored seconds
%AV	% of available seconds
%EF	% of error free seconds
CVs	Number of code violations

Continue with standard operating procedures to exit the display.

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

2)CURR ERR/ALM, Submenu of 1)Status

Use the Current Error/Alarm menu to view currently Active/Inactive errors and alarms (see Figure 3-8).

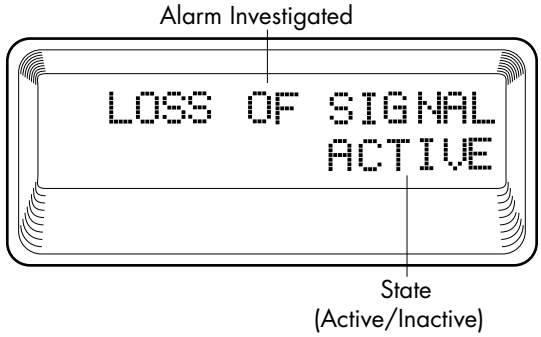

Figure 3-8. Loss of Signal (Current Errors/Alarm) Screens

The Up and Down arrows are used to access the complete display of the errors/alarms that are currently active. The following list shows the 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
BIT ERRORS	Frame Bits received incorrectly at NI
PLL ALARM	Unable to sync up to selected clock

3)ERR/ALM Hist, Submenu of 1)Status

Use the Error/Alarm History menu to view 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 3-9).

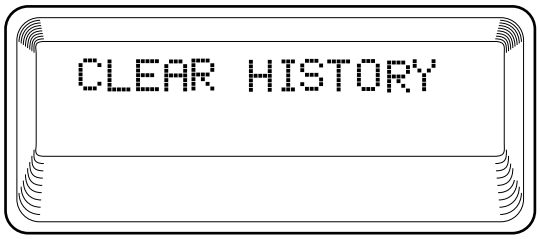

Figure 3-9. Clear History Screen

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

2)CONFIG

Use the Configuration menu, shown in Figure 3-10, to set the TSU operational configuration, including all of the network interface parameters, and the allocation of the DS0s and the port parameters.

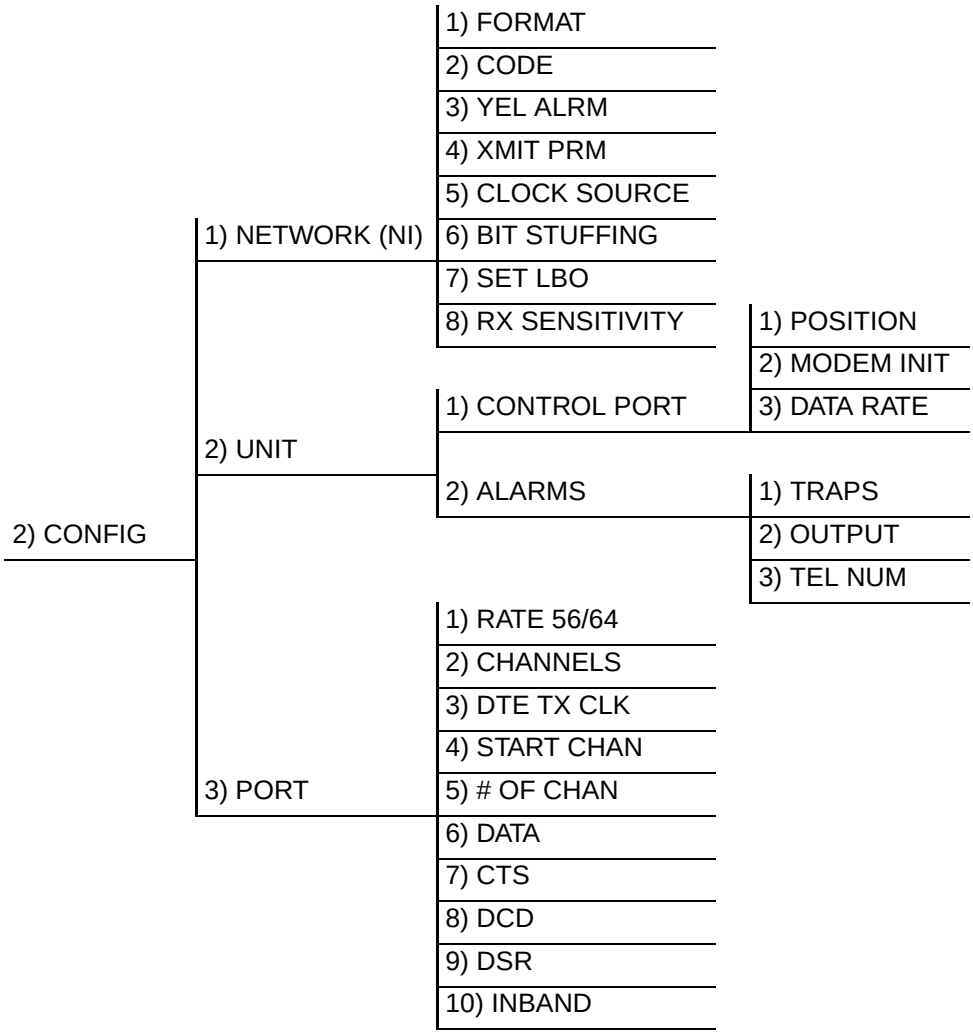

Figure 3-10. Configuration Menu

1)Network (NI), Submenu of 2)Config

Use the Network submenu, shown in Figure 3-11, to access the configuration of parameters associated with the network interface in the TSU. There are eight submenu items that include setting the format, the line build-out (LBO), and the clock source.

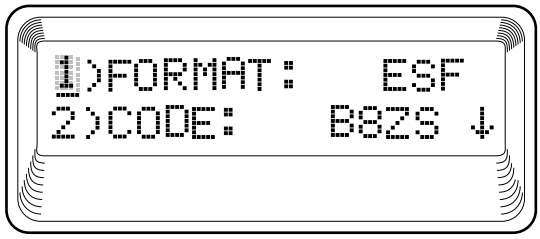

Figure 3-11. Network Submenu

The fields and parameters available are:

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

> NOTE *D4 is equivalent to Superframe Format (SF).*

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

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

4)XMIT PRM
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: ON, OFF

5)CLOCK SOURCE
Selects the clock source for transmission toward the network from the NI.
Choices: NETWORK, DTE, INTERNAL

6)BIT STUFFING
When enabled, Bit Stuffing causes the TSU to monitor for ONES (1s) density violations and to insert a **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

7)SET LBO

Selects the line build out for the network interface. In **AUTO** mode, the TSU will set the LBO based on the strength of the receive signal.
Choices: 0dB, AUTO, -22.5dB, -7.5dB, -15dB

8) 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.

2)Unit, Submenu of 2)Config

Use the Unit submenu to change control port and alarm options.

Operation

Follow standard operating procedure to access the Unit menu items (see Figure 3-12).

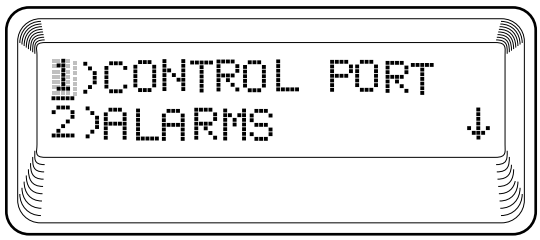

Figure 3-12. Unit Submenu Screen

1)CONTROL PORT

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

1)POSITION - Determines if this TSU is at the head of a chain of units and is 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 *slave units*.

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 for control of the modem.)
Choices: MASTER or SLAVE

2)MODEM INIT - The TSU is capable of initializing a modem. Use this menu selection to perform this initialization and should be selected only when the TSU is serving as the master unit. Prior to modem initialization, it should be physically connected to the TSU 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

3) DATA RATE - Selects the data rate for the control port. This should be consistent with all units on a chain and with the modem, the PC/Proxy Agent serial port, or both.
Choices: 1200, 2400, 9600

2)ALARMS

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

1)TRAPS - This setting 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.**

2)OUTPUT - Selects whether the alarm traps (if enabled) are sent directly or the telephone number stored in the TSU should be dialed first (industry-standard AT dial command sent to modem).
Choices: DIRECT or DIAL

3)TEL NUM - This is the telephone number 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 (:) represents a pause in the dial string.

Example: Number 9:5551212; would dial 9, pause momentarily and then send 5551212. This pause could be necessary to access an outside line from a PBX, for example.

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 by pressing **ENTER** after typing the semicolon.
Choices: 20 digits (0-9), (:), and (;)

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

3)Port, Submenu of 2)Config

Use the menu item **PORT** to select and configure the parameters associated with the V.35.

1)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 versus the number of DS0s appears in Appendix B, *DTE Data Rate Chart,* on page 65.
Choices: 56K, 64K

2)CHANNELS

This sets the unit to use alternate or contiguous channels in the T1 data stream. If more than 12 channels are used, a contiguous channel must be used. If not, alternate channels may be used to meet pulse density requirements (only necessary for Nx 64 without B8ZS). If other than a private network is used, the carrier must be notified of this choice.
Choices: ALT (alternate), CONT (continue)

3)DTE TX CLK

Controls the clock used by the TSU 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 to detect automatically the delay from the DTE device to the TSU 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 will depend on an externally supplied clock to accept the TX data.
Choices: INTERNAL, INT-INV, EXTERNAL, or AUTO

4)START CHAN

Used to select the channel in which the T1 stream will start. The setting must be consistent with the carrier if using a public network.
Choices: 01 through 24

5)# OF CHAN

Used to select the number of DS0s (channels) 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

6)DATA

Used to control the inverting of the DTE data. This inversion can be useful when operating with an HDLC protocol and is often used to ensure ***1s*** density. TSUs on both ends must have identical option settings.
Choices: NORMAL or INVERT

7)CTS (Clear to Send)

Used to control characteristics of CTS.
Choices: NORMAL (see Table 3-1 on page 51) or FORCE ON

8)DCD (Data Carrier Detect)

Indicates to the DTE that a valid signal is being received at the networkin interface.
Choices: NORMAL (see Table 3-1) or FORCE ON

9)DSR (Data Set Ready)

This signal indicates to the DTE that the DCE is turned on and ready for operations.
Choices: NORMAL (see Table 3-1) or FORCE ON

Table 3-1. 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							

10)INBAND (Inband Configuration Channel)

Used to enable/disable an 8 kbps remote configuration channel. 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 uses this 8 kbps channel to send and receive configuration data across a T1 span. As shown in Figure 3-13, this allows the PC connected to the chain-in port on TSU A to monitor/configure both TSU 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 B in Figure 3-13). If no T-Watch PRO activity is detected for 10 minutes, the Inband Channel is deactivated.

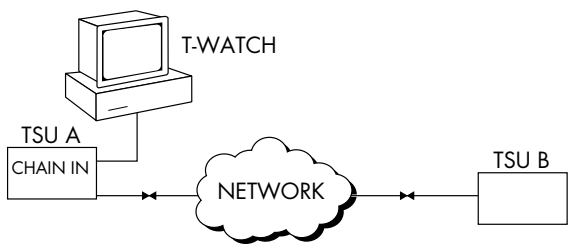

Figure 3-13. Inband Remote Configuration

3)UTIL

Use the Utility menu to view and set system parameters, as shown in Figure 3-14. This includes setting the time and date, resetting all parameters to factory values, or reinitializing the unit. This menu is also used to view the unit's software revision and the unit ID setting.

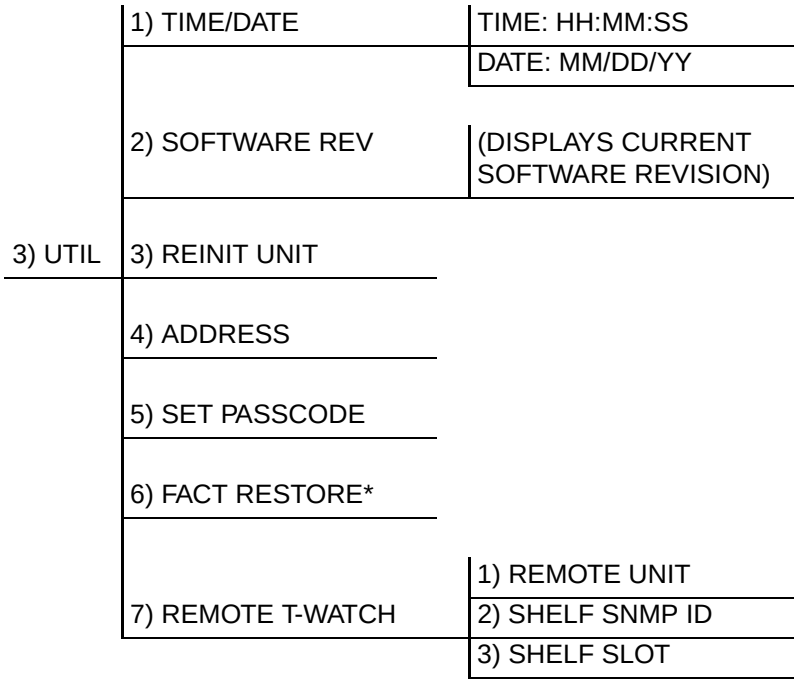

Figure 3-14. Utility Menu

*Returns all configurations to factory settings.

1)Time/Date, Submenu of 3)Util

Use the Time/Date screen, shown in Figure 3-15, to view or edit the current time and date. The time and date are maintained during power-off conditions.

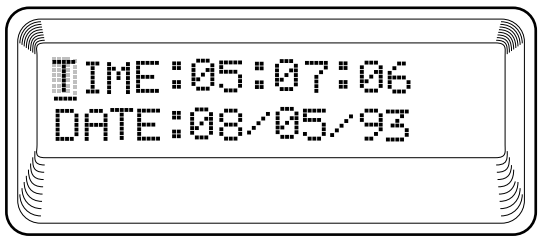

Figure 3-15. Time/Date Screen

Keystroke Summary for Editing Time/Date

Pressing **ENTER** after any numeric change always records the entry and moves to the next editing position. If **ENTER** is pressed at the editing position without making any changes, the cursor moves to the next editing position. The Up and Down arrows will also move the cursor to different fields to edit. Pressing **CANCEL** at any time will end the editing process.

2)Software Rev, Submenu of 3)Util

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.

3)Reinit Unit, Submenu of 3)Util

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

4)Address, Submenu of 3)Util

Use the submenu, shown in Figure 3-16, to access the current Unit Address setting. Unit identification numbers must be between **000** and **256**.

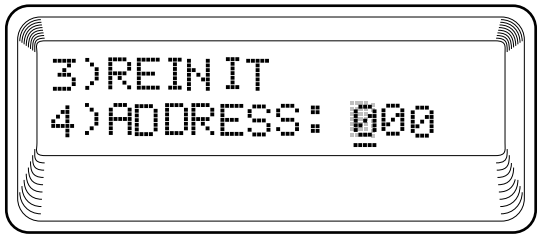

Figure 3-16. Address Screen

5)Set Passcode, Submenu of 3)Util

Allows a passcode to be added, changed, or deleted.

6)Fact Restore, Submenu of 3)Util

Use the Factory Restore submenu to restore the factory default setting for all unit parameters. This restores all parameters to the factory settings.

7)Remote T-Watch, Submenu of 3) Util

To communicate with a far-end unit via the FDL (such as, from a proxy like T-Watch), identify the remote unit as a stand-alone or rackmount. Use this option to select the remote unit type, ID, and slot number.

The ID and slot number are only applicable if the selected remote unit is a rackmount, so these may be left blank if the remote unit is a stand-alone.

REMOTE UNIT:

STANDALONE: The far-end unit is stand-alone

RACKMOUNT: The far-end is a rackmount

SHELF SNMP ID:
Enter the SNMP ID of the far-end rackmount unit (0-255)

SHELF SLOT:
Enter the slot number of the far-end rackmount unit (1-16).

This type of communication may not be available with all T1 products.

4)TEST

Purpose

Use the Test menu to initiate different types of tests of the unit and view test results (see Figure 3-17 on page 55). Test results are displayed in the LCD window. The menu contains three items: **NETWORK TESTS**, **RUN SELF-TEST**, and **PORT TESTS.**

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

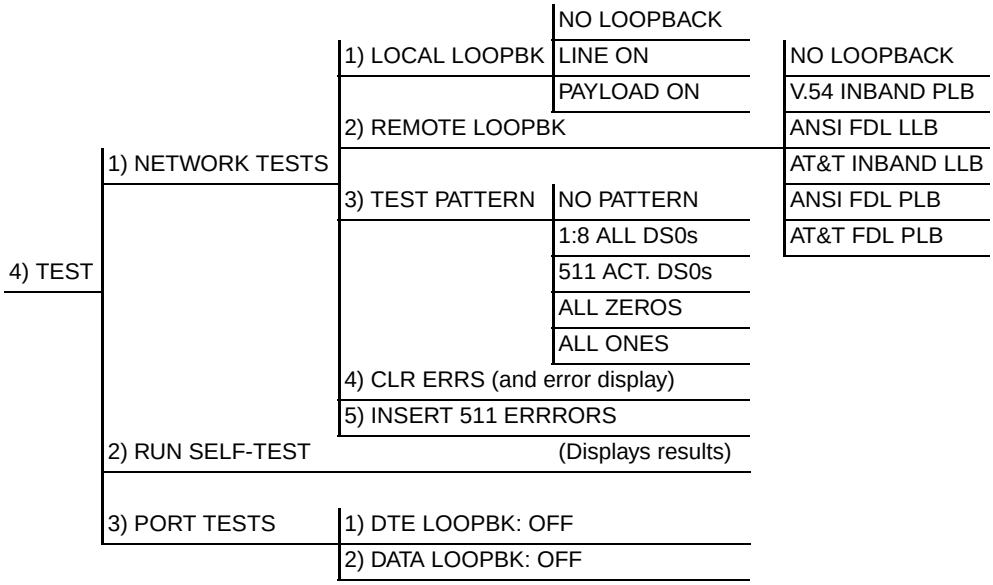

Figure 3-17. Complete Test Menu

1)Network Tests, Submenu of 4)Test

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, as shown in Figure 3-18.

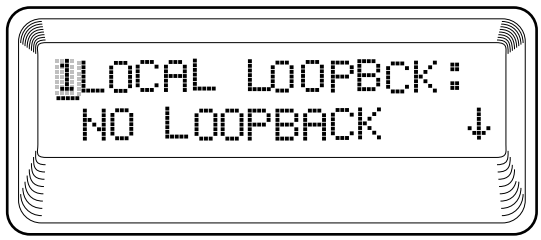

Figure 3-18. Local Loopback Screen

1)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

2)REMOTE LOOPBK

Activates the same loopbacks as the **LOCAL LOOPBCK**, but at the far end. This uses either the inband loop-up code as specified by AT&T 62411 for line loopbacks (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 loop-up 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 an inband code.

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

AT&T FDL PLB
Initiates the transmission of the PLB maintenance message on the FDL.

ANSI FDL PLB
Initiates the transmission of an FDL payload loop-up code toward the far end.

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).

3)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 Zeros pattern in every channel

All ONES
Generates an All Ones pattern in every channel

4)CLR ERRORS

Accomplishes two functions. First, it clears out the 511 error total when **ENTER** is pressed. Second, it displays a total of the 511 errors. If 511 errors are being received, the display is updated accordingly, as shown in Figure 3-19.

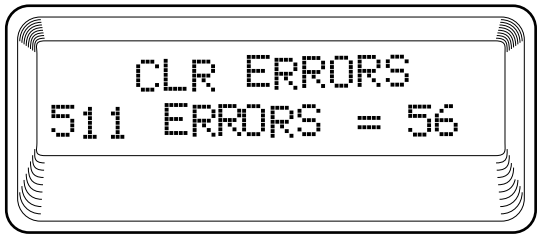

Figure 3-19. Clear Errors Screen

This menu function is very useful for testing end-to-end integrity of the network. First, loop up the far end TSU; then send a 511 pattern from the local TSU. The **CLR ERRORS** screen can then be used to determine if the link is functioning properly by verifying that no errors are being counted.

5)INSERT 511 ERRORS

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

2)Run Self-Test, Submenu of 4)Test

Use the menu selection 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, as shown in Figure 3-20 on page 58. To initialize a self-test, proceed with the following tests:

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

The execution of Self-Test disrupts normal data flow and prevents remote communication until the self-test is completed (approximately five seconds).

If a failure is detected, note the failure number prior to contacting ADTRAN Technical Support.

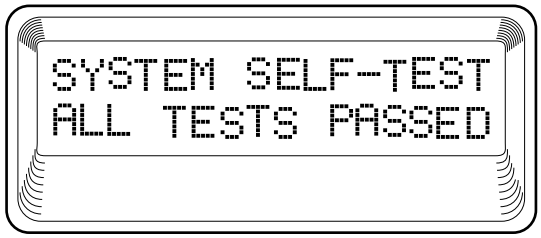

Figure 3-20. Self-Test Results Screen

3)Port Tests, Submenu of 4)Test

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, as shown in Figure 3-21.

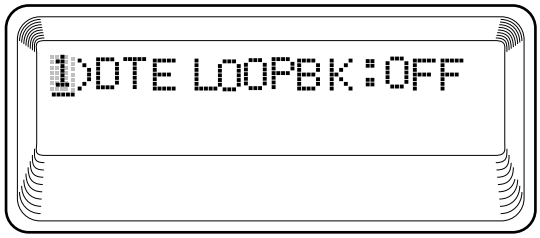

Figure 3-21. Loopback Setting Screen

Chapter 4 Example Operations

TESTING EXAMPLE

Prior to actually using the TSU 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. Using the two types of tests, you can send the pattern from one end and looped back to the far end or send the pattern from both ends and check at both ends.

The two types of tests are discussed in the following sections, *Far End Looped Back Test* and *Network Interface Test*.

Far End Looped Back Test

Two types of tests can be executed with the far end looped. The first one checks the network and the network interfaces at both ends (511). The second checks 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. Select **TEST** from the Main menu, as shown in Figure 4-1.

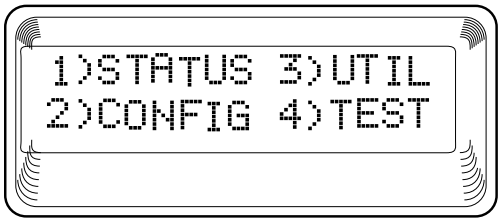

Figure 4-1. Main Menu Screen with 4)TEST Selected

1. Use the arrows to place the cursor on **4)TEST**
2. Press **ENTER** to select.

Results: The first two test submenu items display as shown in Figure 4-2.

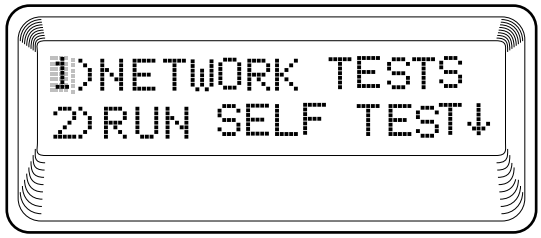

Figure 4-2. Test Menu Screen with NETWORK TESTS Selected

1. Use the arrows to place the cursor on **1)NETWORK TESTS**
2. Press E**NTER** to select.
3. Press **ENTER** again to enter the Network Test menu

Results: Beginning display of the submenu items.; each menu item can be selected with the Up and Down arrows

The Local Loopback test menu is shown in Figure 4-3.

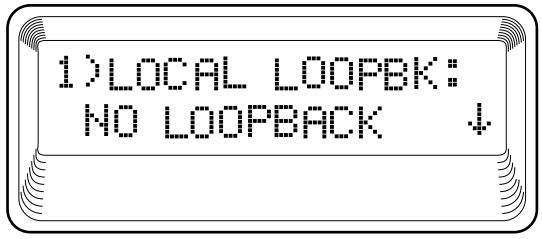

Figure 4-3. Local Loopback Test Menu Screen

The options this menu offers are:

- LINE ON
- PAYLOAD ON
- NO LOOPBACK

The Remote Loopback test menu is shown in Figure 4-4.

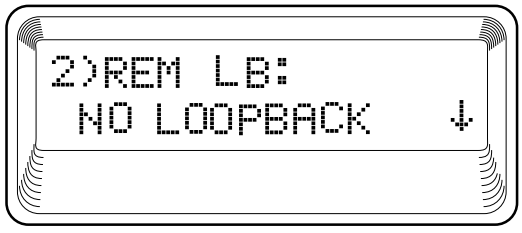

Figure 4-4. Remote Loopback Test Menu Screen

The options the Remote Loopback menu offers 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 4-5.

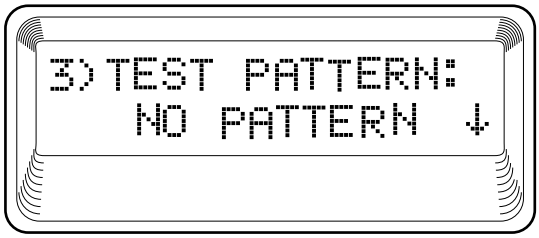

Figure 4-5. Test Pattern Screen

The options available for the Test Pattern Screen are:

- NO PATTERN
- 1:8 ALL DS0S
- **511 ACTIVE DS0S**
- ALL ZEROS
- ALL ONES

1. Use the arrows to place the cursor on **2)REMOTE LOOPBK**
2. Press: **ENTER** to select
3. Use the Up and Down arrows to set **PAYLOAD** in data the field. (Must use V.54 Inband PLB for Fractional T1 on Public Networks.)
4. Press **ENTER** to activate a Remote Payload Loopback

Results:This initiates the transmission of a loopup code toward the far end.

5. When completed, use the arrows or the **number 3** to select **3)TEST PATTERN**
6. Press **ENTER** to activate the **TEST PATTERN** submenu.
7. Use the arrows to select 511 ACT. DS0s
8. Press **ENTER** to activate the selection

Results: The TSU always checks for 511 errors. The results of this check are shown under submenu item 4 (see Figure 4-6 on page 62).

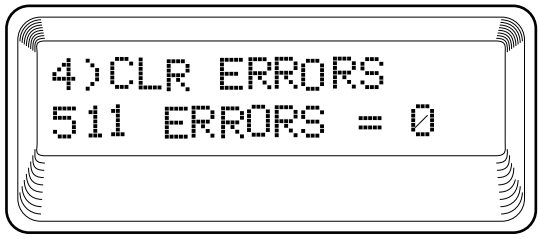

Figure 4-6. Clear Errors Screen

1. When you are through viewing the results, press **CANCEL** to return to submenu item **3)TEST PATTERN** and select **NO PATTERN** to terminate the test and the 511 pattern generation.
2. The far end remains in loopback until the network **REMOTE LOOPBK** is set to **NO LOOPBACK** under submenu item **2)REMOTE LOOPBK**.

Appendix A TSU Menu Tree

The complete menu tree for the TSU is provided in Figure A-1.

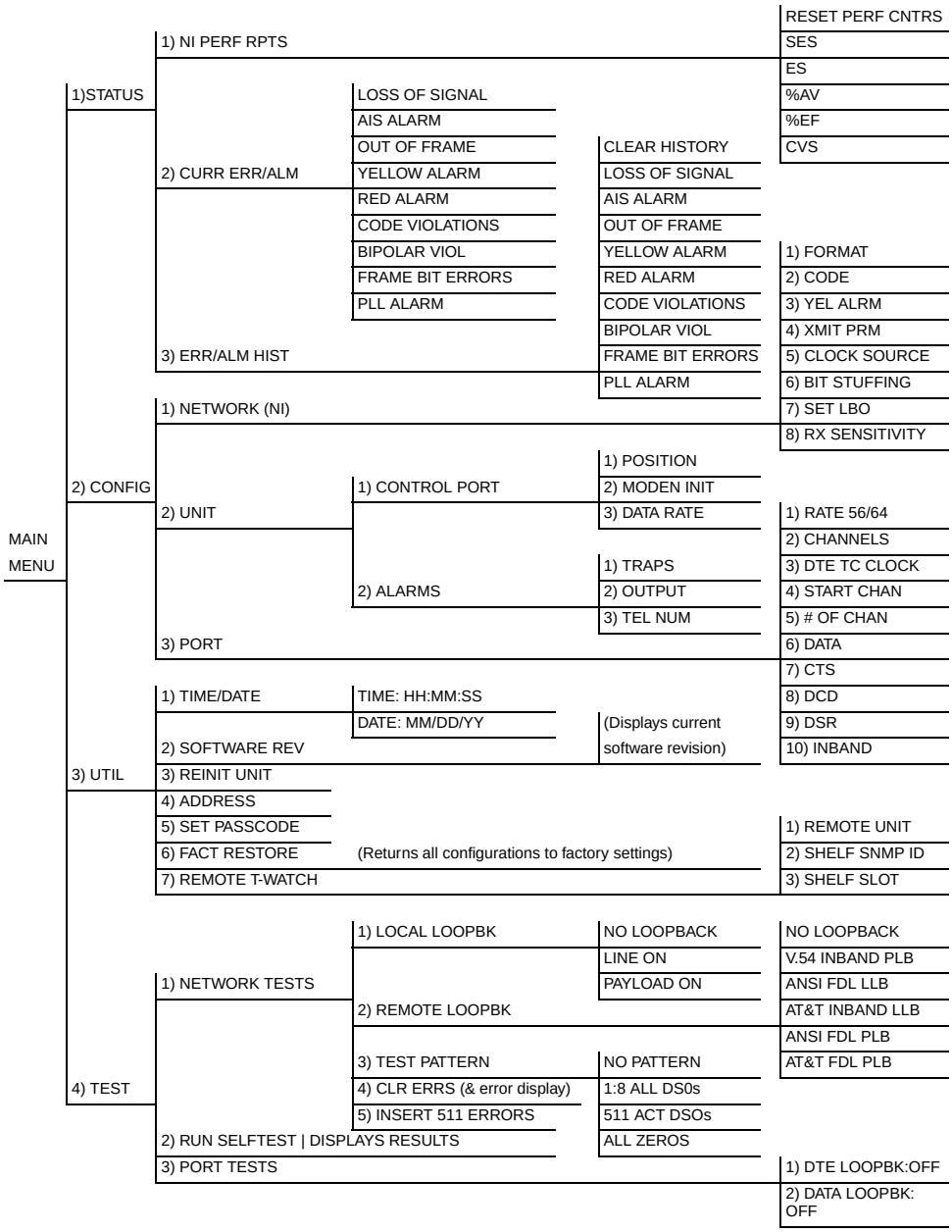

Figure A-1. TSU Menu Tree

Appendix B

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

Appendix C Acronyms

AIS	Alarm Indication Signal
ALM	Alarm
AMI	Alternate Mark Inversion
ANSI	American National Standards Institute
AV	Available Seconds
B8ZS	Bipolar 8 Zero Suppression
BPV	Bipolar Violation
CHAN	Channel
CLK	Clock
CLR	Clear
CNTRL	Control
CONFIG	Configuration
CRC	Cyclic Redundancy Check
CS (CTS)	Clear to Send
CSU/DSU	Channel Service Unit/Data Service Unit
CURR ERR /ALM	Current Error/Alarm
CVs	Code Violations
dB	Decibels
DDS	Digital Data Service
DISA	Disable
DSR	Data Set Ready
DS0	Digital Signal, level zero
DS1	Digital Signal, level one
DTE	Data Terminal Equipment
EF	Error Free
ENA	Enable
EPROM	Erasable Programmable Read Only Memory
ERR	Error
ERR/ALM HIST	Error/Alarm History
ESF	Extended Superframe Format
ES	Errored Seconds
FDL	Facility Data Link
FT1	Fractional T1

HDLC	High-level Data Link Control
ID	Identification
INT	Internal
INT/INV	Internal/Invert
IXC	Inter-exchange Carrier
kbps	Kilo Bits Per Second
LAN	Local Area Network
LBO	Line Build Out
LCD	Liquid Crystal Display
LEC	Local Exchange Carrier
LLB	Line Loopback
LOS/OOF	Loss of Signal/Out of Frame
Mbps	Mega Bits Per Second
NI	Network Interface
NI PERF	Network Interface Performance
NI PERF RPTS	Network Interface Performance Reports
OSC	Oscilliator
PC	Personal Computer
PLB	Payload Loopback
PLL	Phase Lock Loop
PRM	Performance Report Message
POP	Point of Presence
PWR	Power
RAM	Random Access Memory
REV	Revision
RD	Receive Data
REINIT	Reinitialize
RMA	Return Material Authorization
RS (RTS)	Request to Send
RX	Receiver
SES	Severely Errored Seconds
SF	Superframe Format
TEL NUM	Telephone Number
TD	Tranmit Data
TX (XMIT)	Transmit
UTIL	Utilities

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