TSU ACE

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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:

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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 ACE 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 ACE, please contact ADTRAN at (256) 963-8000 for repair/ warranty information. The telephone company may ask you to disconnect this equipment from the network until the problem has been corrected, or until you are sure the equipment is not malfunctioning.
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	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.

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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Chapter 1 Introduction

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

TSU ACE OVERVIEW

This section provides a functional description of the TSU ACE, describes its features, and illustrates its four interfaces Figure 1-1 on page 1-3 shows the front view of the TSU ACE, and Figure 1-2 on page 1-4 shows the rear panel.

Functional Description

The ADTRAN TSU ACE 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, TSU LT**, and **TSU ACE** - 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.

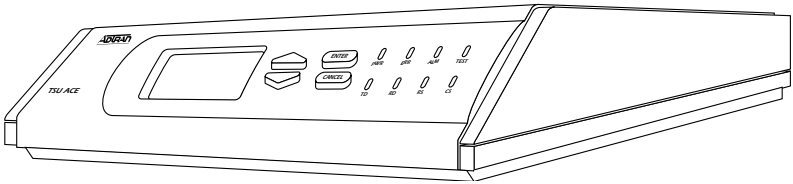

Figure 1-1. TSU ACE Unit - Front View

The TSU ACE 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 ACE Rear Panel

	Number Identification for TSU ACE Rear Panel	
No.	Item	Function
1	Network	T1-FT1 network interface
2	V.35 Nx56/64	DTE port
3	Power Switch	Used to turn power on or off
4	Power Cord	Captive 3-prong power cord

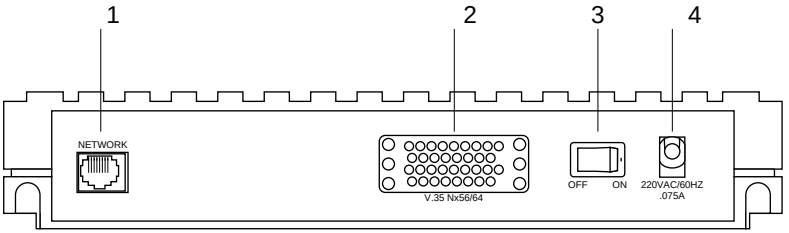

Figure 1-2. TSU ACE Rear Panel

TSU ACE 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, 1:8 and QRSS test patterns.
- Extensive self-test and monitoring provides assurance of proper operation.
- Flexible channel allocation (any starting channel and alternate or contiguous).

TSU ACE Interfaces

The TSU ACE is equipped with two interfaces: *Network DS1 interface per AT&T 62411* and *Nx56/64 serial V.35 high speed interface*. See Figure 1-3 and the following descriptions in this section.

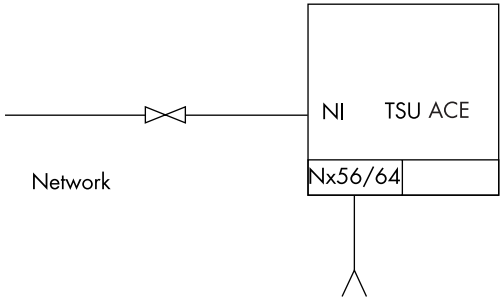

Figure 1-3. TSU ACE Interfaces

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 substitution (B8ZS) coding
- Automatic or manual line build out
- Auto detect or manual settings for D4 or ESF framing
- Network performance monitoring and reporting
- Test loopbacks by local and remote
- Extensive self-test

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-test

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 front panel operation 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 ACE from a PC. It provides complete control over the configuration of the TSU ACE 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 in the form of tables and graphs.

The TSU ACE can be remotely configured using T-WATCH Pro. The ESF FDL or the 8K inband channel is used to connect to the TSU ACE. The PC with T-WATCH Pro installed on it must be connected to an ADTRAN T1 CSU/DSU with a control/chain in port. Such products include: TSU, TSU LT, TSU ESP and the TSU XX0 family of T1 multiplexers. See Figure 5-6 on page 5-9.

TSU ACE Testing

The TSU ACE offers three forms of testing:

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

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 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 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 on page 1-9.

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.

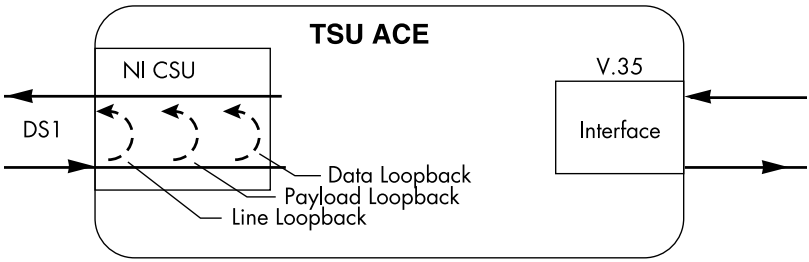

Figure 1-4. Network Loopback Tests

DTE Interface Loopbacks

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

DTE Loopback

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

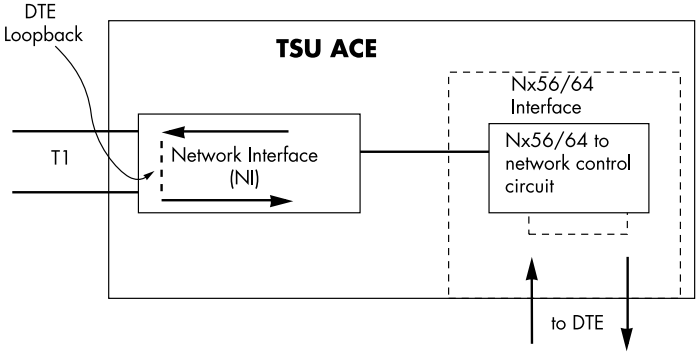

Figure 1-5. DTE Interface Loopback

Pattern Generation

The TSU ACE offers five available test patterns: QRSS, 511, 1:8, All Ones, and All Zeros.

QRSS

The TSU ACE has an internal QRSS pattern generator and detector. The pattern only appears in the DS0s assigned to the Nx56K/64K port. The QRSS test pattern can be used in conjunction with network loopbacks to perform end-to-end tests.

511

The TSU ACE has an internal 511 pattern generator and detector. The pattern only appears in the DS0s assigned to the Nx56K/64K port. The 511 test pattern can be used in conjunction with network loopbacks to perform end-to-end tests.

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

Utilizing 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 configured to use contiguous or alternate channels. Figure 1-6 shows a simple bridge application.

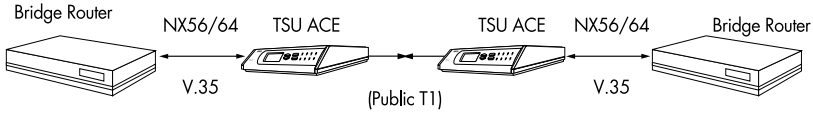

Figure 1-6. Simple Bridge Application on a T1 or FT1 Circuit

Chapter 2 Installation

INSPECTING FOR DAMAGES

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

ITEMS SHIPPED BY ADTRAN

The following items are included in the ADTRAN shipment:

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

ITEMS PROVIDED BY CUSTOMER

- DTE cable(s)

POWER CONNECTION

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

WIRING

Network

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

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

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	—

V.35 Nx56K/64K DTE

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

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

Table 2-2. 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

POWER UP TESTING AND INITIALIZATION

When shipped from the factory, the TSU ACE 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 ACE 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 steps:

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 locked loop verify.

Chapter 3 Operation

OPERATION

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

Front Panel

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

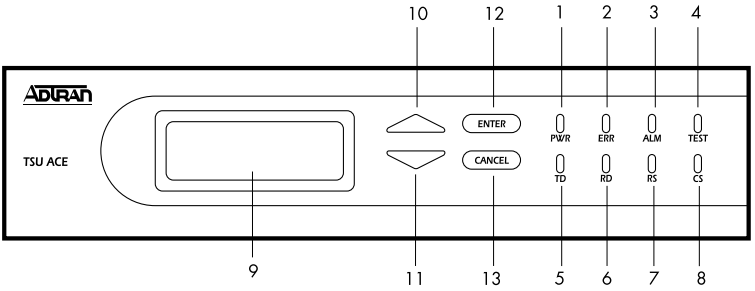

Figure 3-1. Front Panel Layout

Item	Displays	Function
1	PWR	LED ON when power is received by TSU ACE.
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 ACE 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&11	Up/Down	Keyboard arrows used to travel up/down menu trees. Arrows increase/decrease numeric values and scroll 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 ACE 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**.

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**.

Example Menu Operation

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 3-2 on page 3-4.
2	Place the cursor on the **number 2** and press **Enter**.

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** will be visible in the lower right corner.

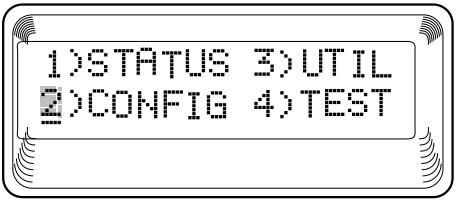

Figure 3-2. Cursor on Menu Item

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)**). See Figure 3-3.

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** will be visible in the lower right corner.

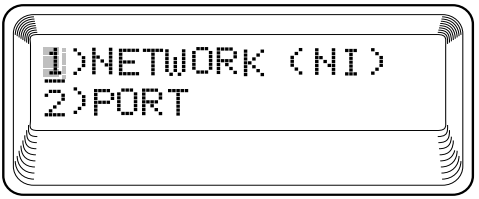

Figure 3-3. Sub-Menu Fields

To Set the Data Field

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

Step	Action
1	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).
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.

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 may select another submenu field or press **Cancel** to return to the submenu.

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 can be found by selecting the following menu choices:

Step	Action
1	Select **STATUS** from the main menu.
2	Select submenu **CURR ERR/ALM**. **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 ACE uses hierarchical menus to access its many features. The main menu level (Figure 3-4) leads to submenus (see Figure 3-5 on page 3-7). All menu operations are displayed in the LCD window. The complete TSU ACE menu diagram is shown in *Appendix A, TSU ACE Menu Tree.*

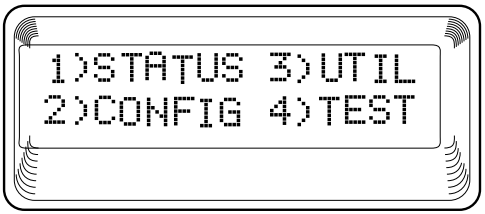

Figure 3-4. TSU ACE Main Menu Screen

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 ACE Menu Tree.

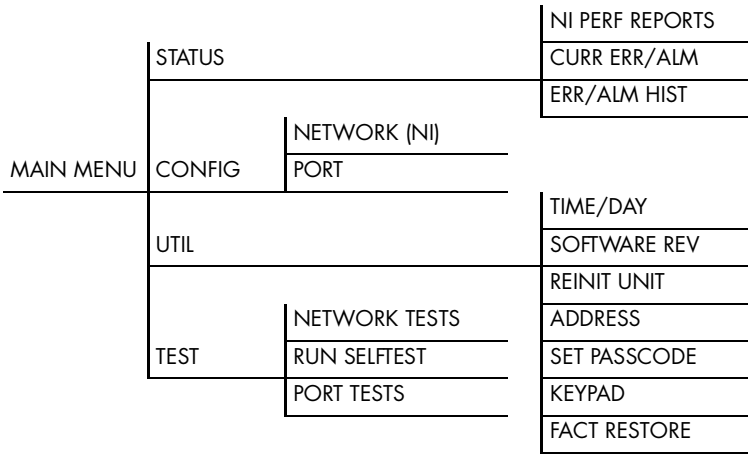

Figure 3-5. TSU ACE Main Menu

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. Repeatedly pressing **Cancel** returns the system to the main menu.

The opening menu is the access point to all other operations. There are four main menu items, **STATUS, CONFIG, UTIL,** and **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.

Four Opening Menu Functions

STATUS

The Status menu provides the ability to view the status of the TSU ACE 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 ACE.

ERR/ALM HIST

Used to view and clear history errors and alarms.

CONFIG

The Configuration menu is used to set the TSU ACE operational configuration. This menu includes the following sub-items.

NETWORK (NI)

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

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 and Product Service or when updates are needed.

REINIT UNIT

Used to re-initialize 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.

KEYPAD

Used to lock the front panel keypad. With the keypad locked, the unit configuration can be viewed but not changed.

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.

The execution of tests 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.

Each of these menu items is discussed in detail in the following chapters.

Chapter 4 Status Menu

STATUS

The **Status Menu** provides the ability to view the status of the TSU ACE operation. See Figure 4-1.

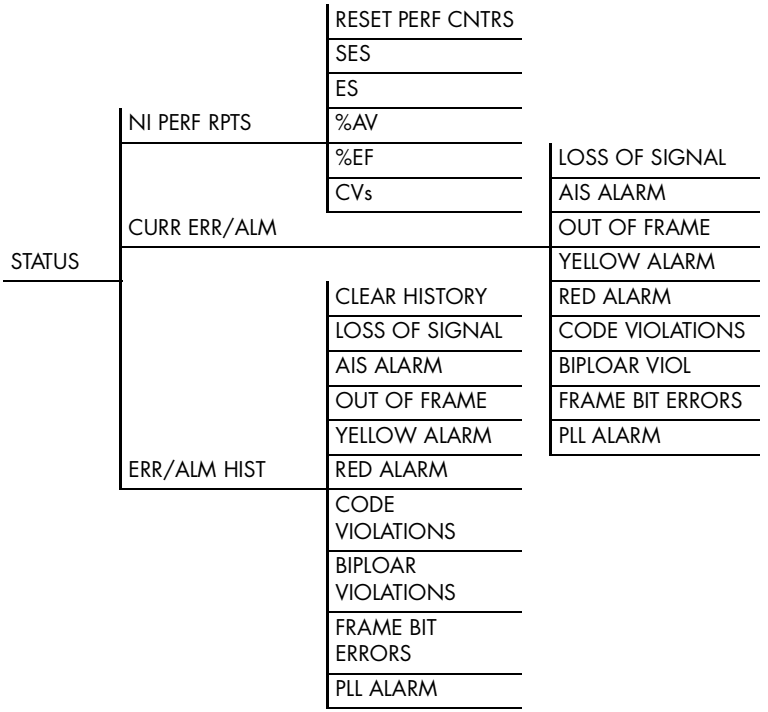

Figure 4-1. Status Menu

NI PERF RPTS

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

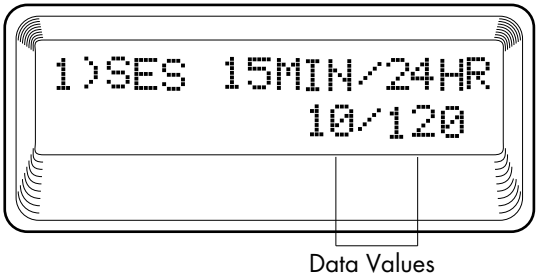

Figure 4-2. Severely Errored Seconds Screen

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 ACE, 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).

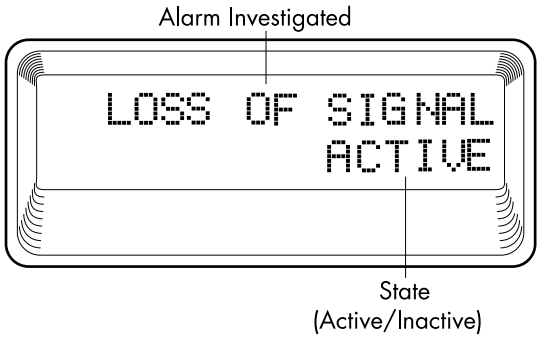

Figure 4-3. Loss of Signal (Current Errors/Alarms) Screens

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

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).

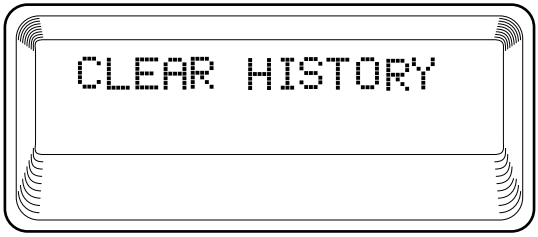

Figure 4-4. Clear History Screen

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

Chapter 5 Configuration Menu

CONFIG

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

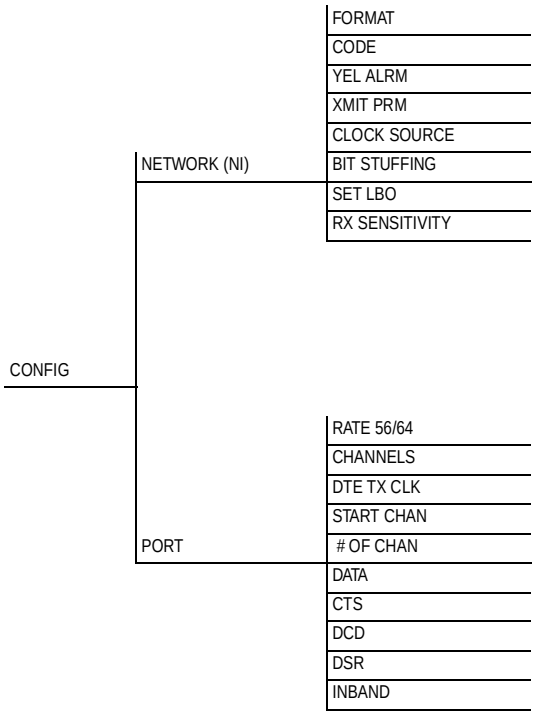

Figure 5-1. Configuration Menu

Network (NI)

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

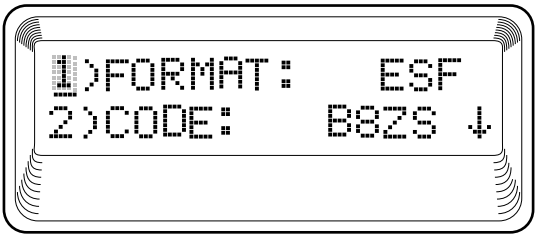

Figure 5-2. Network Submenu

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 ACE Clock Sources

The TSU ACE 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 timed
- DTE timed
- 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.

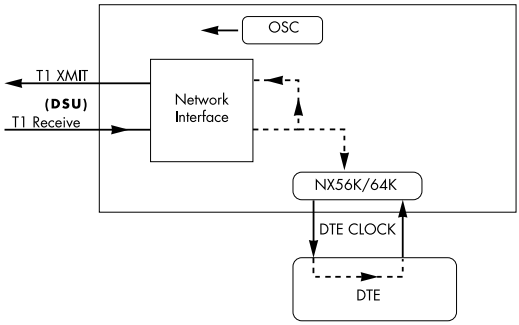

Figure 5-3. Network Timed Clock Source

DTE Timing

The DTE is the source of timing. The TSU ACE 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.

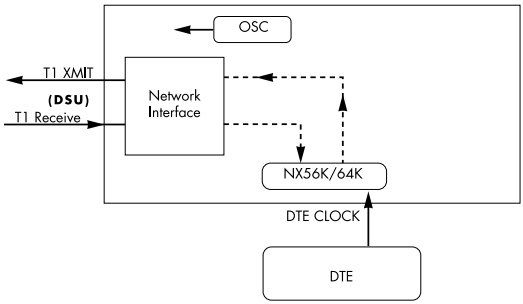

Figure 5-4. DTE Clock Source

Internal Timing

The TSU ACE is the source of timing. The TSU ACE 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.

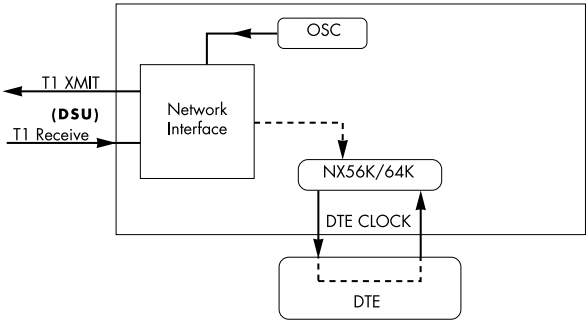

Figure 5-5. Internal Clock Source

BIT STUFFING

When enabled, **BIT STUFFING** causes the TSU ACE 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

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

RX SENSITIVITY

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.

Port

The menu item **PORT** is used to select and 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 ACE 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 the **DTE TX CLK** option is **AUTO**. The **AUTO DTE TX CLK** setting will allow the TSU ACE to automatically detect the delay from the DTE device to the TSU ACE 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 ACE 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.
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 ACEs 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

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

The Inband Configuration Channel is used to enable/disable an 8 kbps remote configuration channel (see Figure 5-6). 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 ACE uses this 8 kbps channel to send and receive configuration data across a T1 span. The in-band channel 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 5-6 on page 5-9). If no T-Watch activity is detected for 10 minutes, the Inband Channel is deactivated.

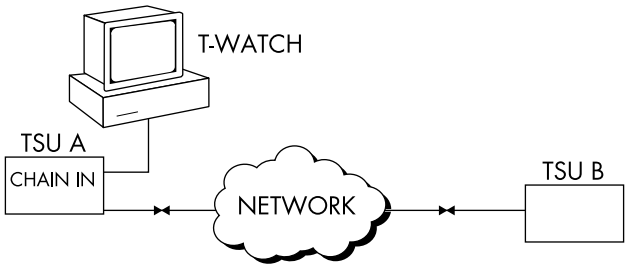

Figure 5-6. Inband Remote Configuration

TSU A must have a control/chain-in port for this application. Products with control/chain-in ports include the TSU, TSU LT, TSU ESP and the TSU XX0 family of T1 multiplexers.

Chapter 6 Utility Menu

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.

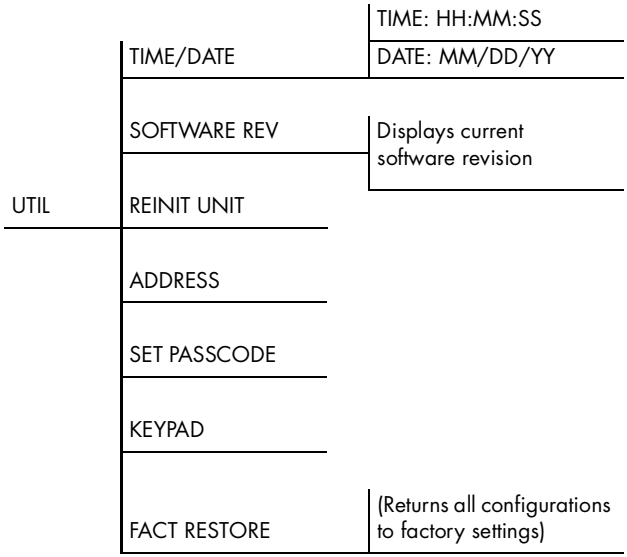

Figure 6-1. Utility Menu

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).

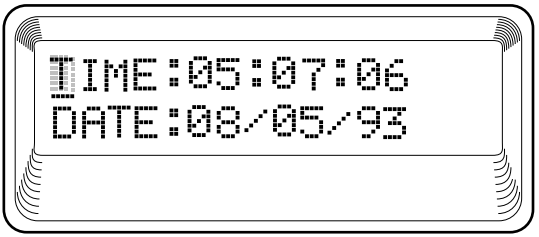

Figure 6-2. Time/Date Screen

Table 6-1. Editing the Time/Date

If you want to	Press this key
Record the entry and move to the next editing position.	**Enter** (after any numeric change)
Move to the next editing position or field	**Enter** without making any changes at the cursor. The **up** and **down arrow keys**
End the editing process	**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 re-initialize 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.

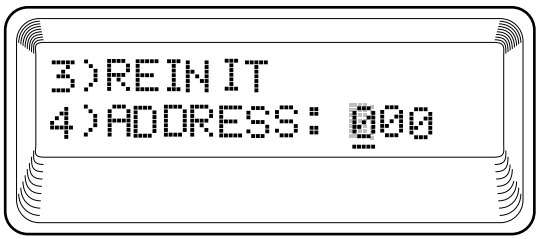

Figure 6-3. Address Screen

Set Passcode

Set Passcode allows a passcode to be set for T-Watch and keypad lockout. When the keypad is locked, the LCD will display **????** in place of the passcode.

Keypad

Allows the user to lock or unlock the front panel keypad. This feature keeps the unit configuration from being changed by unauthorized personel.

When the keypad is **Locked**, option settings can be viewed but not changed. The user-selected passcode is set on the **Set Passcode** screen and is not required to lock the unit.

When **Unlocked** is selected, the user is required to enter the four-digit passcode. If an incorrect passcode is entered, the unit will remain locked.

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.

Chapter 7 Test Menu

TEST

The **TEST MENU** is used to initiate different types of tests of the unit and to view test results (see Figure 7-1 on page 7-2). Test results are displayed in the LCD window. The menu contains three sub-items.

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

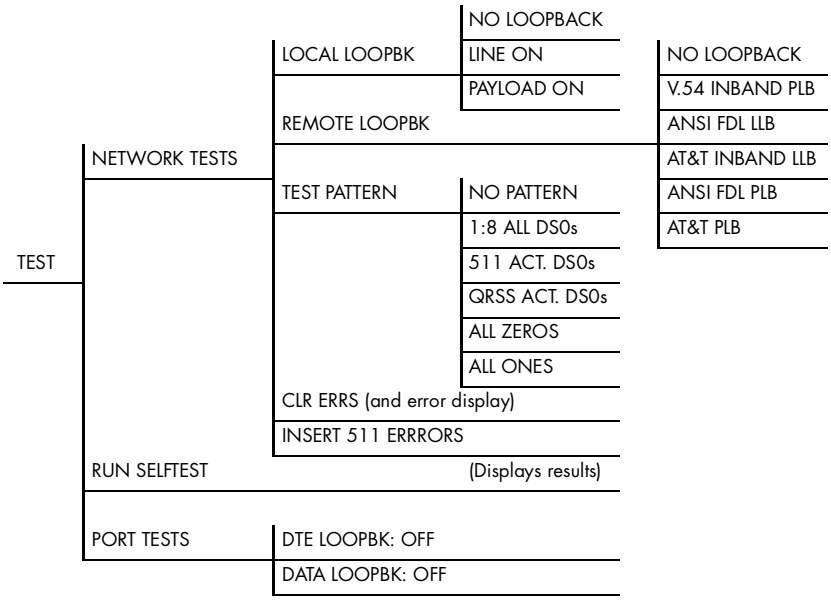

Figure 7-1. Test Menu Tree

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 on page 7-3.

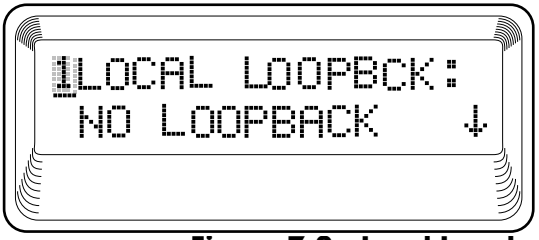

Figure 7-2. Local Loopback Screen

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 LOOPBK
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.

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

AT&T Inband LLB
Activates the line loopback using inband code.

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

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.

No Pattern
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 it into active DS0s.

QRSS Active DS0s
Generates a QRSS test pattern and inserts it into active DS0s.

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. First, it clears out the QRSS and 511 pattern error total when you press **Enter**. Second, it displays a total of the QRSS or 511 pattern errors. If pattern errors are being received, the display is updated accordingly. See Figure 7-3.

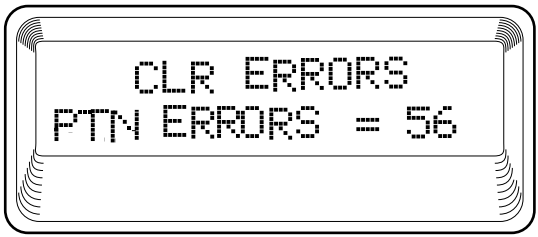

Figure 7-3. Clear Errors Screen

This menu function is very useful for testing end-to-end integrity of the network. First loop up the far end TSU ACE. Then send a 511 or QRSS pattern from the local TSU ACE. 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. The following tests are performed during self-test:

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 locked loop verify

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

NOTE

Executing self-test disrupts normal data flow and prevents remote communication until the self test is completed (approximately 10 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.

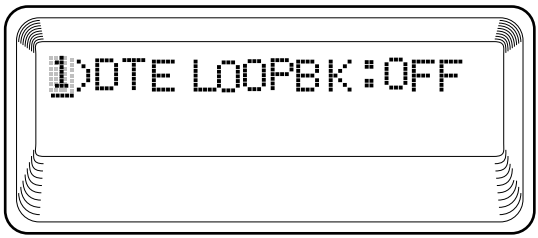

Figure 7-5. Loopback Setting Screen

Chapter 8 Example Operations

TESTING EXAMPLES

Prior to actually using the TSU ACE 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. 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 and QRSS patterns are always sent in the occupied channels.

1. Select **TEST** from the **Main Menu** (see Figure 8-1).

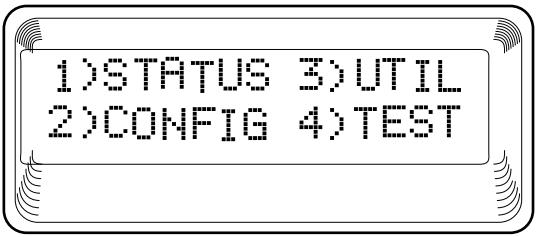

Figure 8-1. Main Menu TEST Selected

2. Use the **arrows** to place the cursor on **TEST.**
3. Press **Enter** to select.

Result: The first two **TEST** submenu items display. See Figure 8-2.

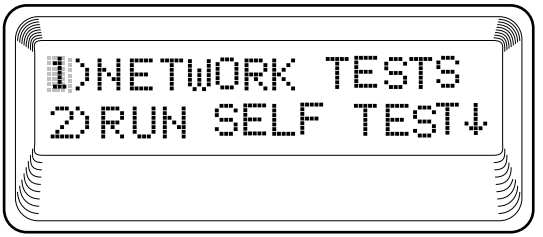

Figure 8-2. Test Menu with NETWORK TESTS Selected

1. Use the **arrows** to place the cursor on **NETWORK TESTS.**
2. Press **Enter** to select .
3. Press **Enter** again to enter the **NETWORK TEST** menu.

Result: 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 8-3.

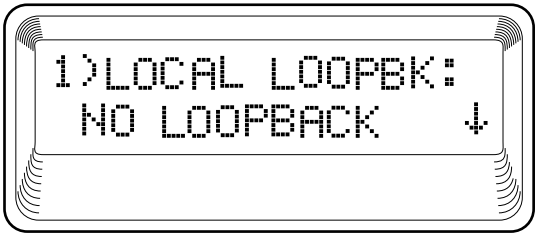

Figure 8-3. Local Loopback Test Menu

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.

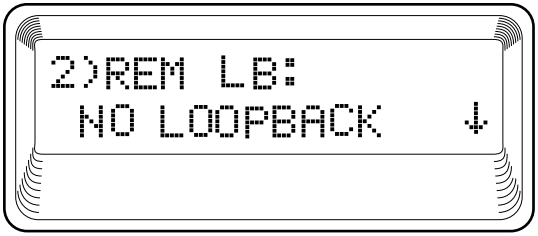

Figure 8-4. Remote Loopback Test Menu

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.

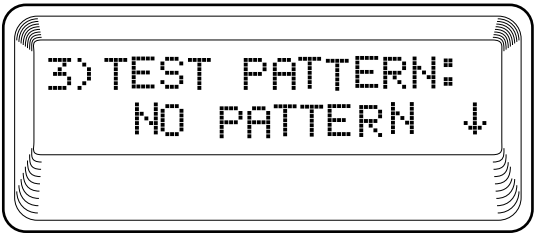

Figure 8-5. Test Pattern Screen

The menu options available for the **Test Pattern** screen are:

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

1. Use the **arrows** to place the cursor on **REMOTE LOOPBK**.
2. Press **Enter** to select.
3. Use the **Up** and **Down arrow**s 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.

When completed, do the following:

1. Use the **arrows** or the **number 3** to select **Test Pattern**.
2. Press **Enter** to activate the **Test Pattern** submenu.
3. Use the arrows to select **511 ACT. DS0s** or **QRSS ACT. DS0s**.
4. Press **Enter** to activate the selection.

Results: The TSU ACE always checks for 511 and QRSS errors. The results of this check are shown under submenu item 4 (see Figure 8-6).

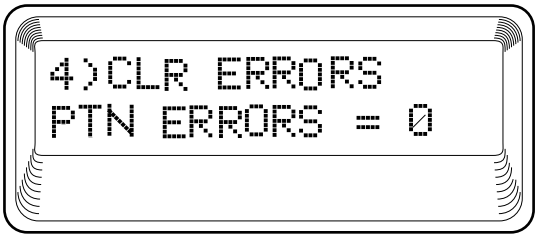

Figure 8-6. Clear Errors Screen

When through viewing the results, do the following:

1. Press **Cancel** to return to submenu item **Test Pattern.**
2. Select **No Pattern** to turn off the test pattern.

Result: The far end remains in loopback until the network **REMOTE LOOPBK** is set to **NO LOOPBACK** under submenu item **REMOTE LOOPBK**.

Appendix A TSU ACE Menu Tree

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

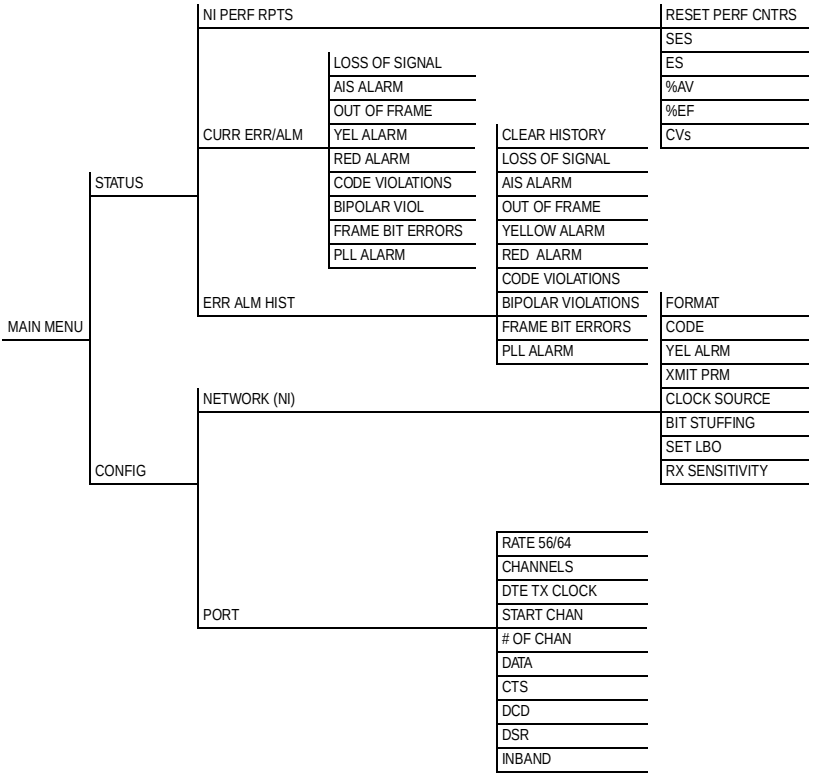

Figure A-1. TSU ACE Menu Tree (Status and Config)

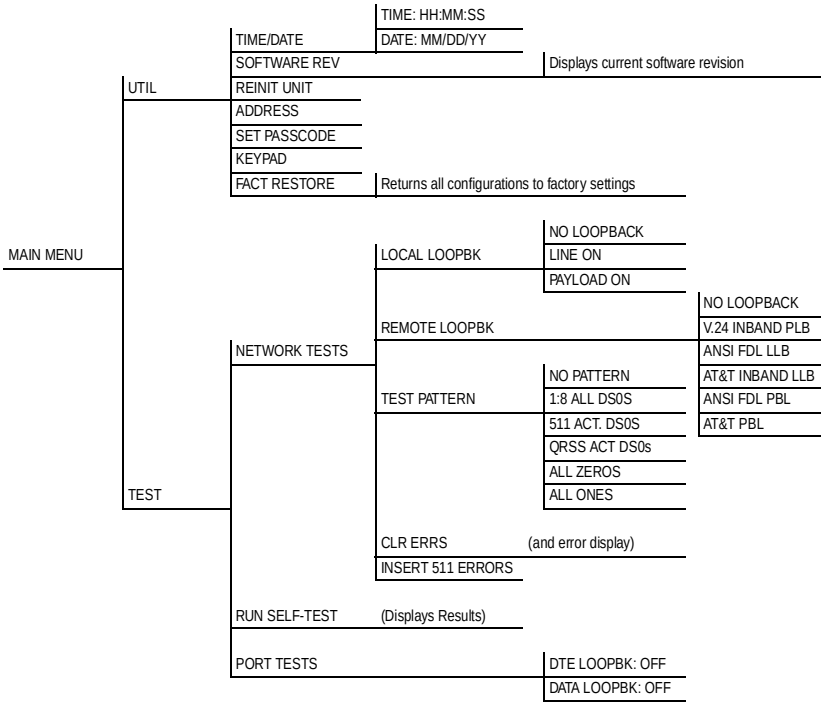

Figure A-2. TSU ACE Menu Tree (Util and Test)

Appendix B DTE Data Rate Chart

The DTE data rate chart is shown below.

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

Acronyms

AIS ..... Alarm Indication Signal
ALM..... Alarm
AMI..... Alternate Mark Inversion
ANSI..... American National Standards Institute
AV ..... Available Seconds
B8ZS ..... Bipolar with 8 Zero Substitution
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 Locked 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.....Receive
SES.....Severely Errored Seconds
SF.....Superframe Format
TEL NUM.....Telephone Number
TD.....Tranmit Data
TX (XMIT).....Transmit
UTIL.....Utilities

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Product Support Information

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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 theCustomer and Product Service (CaPS) department to issue an RMA number. For information regarding equipment currently in house or possible fees associated with repair, contact CaPS directly at the following number:

CAPS Department	(256) 963-8722

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

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

RMA # _____