



TSU

T1-FT1 Data/Channel Service Unit

Part Number 1200060L1

User Manual

61200060L1-1B
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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.

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 affixed to the bottom of the chassis.
2. If your telephone equipment causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't 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 maintain uninterrupted service.
4. If you experience trouble with this equipment, please contact Adtran at **888-4Adtran** 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 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	REN/SOC	FIC	USOC
1.544 Mbps - SF	6.0/F	04DU9-BN	RJ48C
1.544 Mbps - SF and B8ZS	6.0/F	04DU9-DN	RJ48C
1.544 Mbps - ESF	6.0/F	04DU9-1KN	RJ48C
1.544 Mbps - ESF and B8ZS	6.0/F	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.



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

Important Safety Instructions

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

1. Do not use this product near water, such as near a bath tub, wash bowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.
2. Avoid using a telephone (other than a cordless-type) during an electrical storm. There is a remote risk of shock from lightning.
3. Do not use the telephone to report a gas leak in the vicinity of the leak.
4. Use only the power cord, power supply, and/or batteries indicated in the manual. Do not dispose of batteries in a fire. They may explode. Check with local codes for special disposal instructions.

SAVE THESE INSTRUCTIONS

WARRANTY AND CUSTOMER SERVICE

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

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 on the inside back page of this manual.

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T1/FT1 OVERVIEW

T1 digital communication links have been used by the transmitting companies (Telcos) for the transmitting of voice 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 created a demand also 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 1.544Mbps 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 which operate at 64 kbps (DSOs). 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. An enhancement of that framing format is available now called Extended Superframe (ESF). 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 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.

Fractional T1 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.

Fractional T1 local access is available in two forms, 56kbps or a full T1 line. In 56 kbps the required number of 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 OVERVIEW



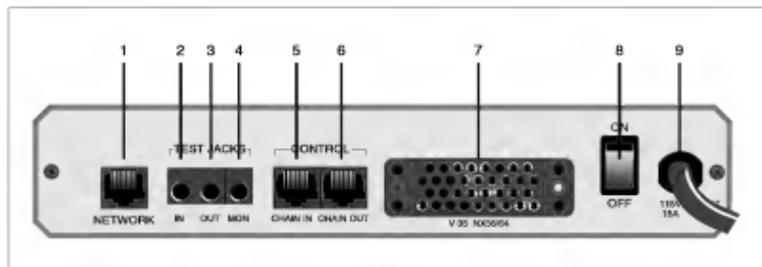
Figure 1-1. TSU

Functional Description

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

1. *TSU* - a T1 CSU/DSU with a single NX56k/64k serial port. See Figure 1-1, above and Figure 1-2 on page 1- 4.
2. *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.
3. *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.

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



Item	Function
1. Network	T1-FT1 Network Interface
Test Jacks	
2. IN	Bantam Test Jack
3. OUT	Bantam Test Jack
4. MON (Monitor)	Bantam Test Jack
Control	
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 3 Prong Power cord

Figure 1-2. TSU Rear Panel

Features

- A DSI 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, 3:24, 511 and 1:8 Test Patterns.
- Extensive self test and monitoring provides assurance of proper operation.
- Flexible channel allocation (any starting channel and alternate or contiguous).

Interfaces

The TSU is equipped with four interfaces. See **Figure 1-3**.

- Network DSI interface per AT&T 621411
- Nx56/64 serial V.35 high speed interface
- Control input (RS232) / Chain port input
- Chain port output

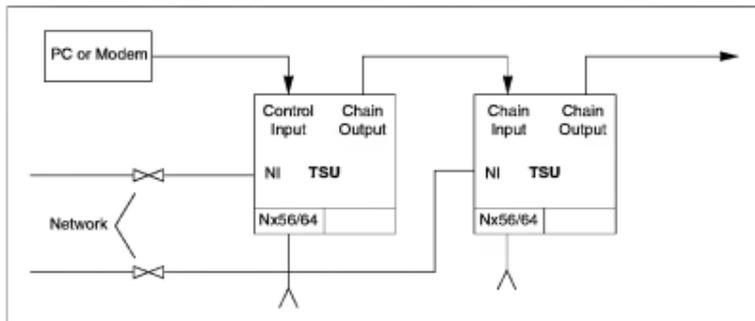


Figure 1-3. TSU Interfaces

Network Interface

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

NI

- AMI or B8ZS coding
- Automatic or manual line build out
- D4 or ESF framing
- Network performance monitoring and reporting
- Test loopbacks by local and remote
- Extensive self test

Nx56/64 Serial Interface

- Data rates: $N \times 56k$ or $N \times 64k$, where $N=1$ to 24 (DS0s)
- Inverted data (Inverted HDLC)
- A V.35 interface
- Standard V.35 connectors
- Test loopbacks with 511 pattern generation and check
- Extensive self test

Control Port Input

- EIA-232 input from a 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

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

Three Methods of Control

Front Panel

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

Adtran PC Program

T-WATCH is the ADTRAN PC control program. It provides complete control over the configuration of the TSU using a graphic interface. The T-WATCH 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 T-WATCH program has the following capabilities.

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

SNMP

The ADTRAN TSU will support the Simple Network Management Protocol (SNMP) through an ADTRAN proxy agent in mid 1994. The proxy agent runs on a PC and can interface to the TSU directly or via a modem, in the same manner as the T-WATCH PC program.

TSU Clock Sources

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

- Network
- DTE Timed
- Internal Timing

NOTE

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

Network Timed

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.

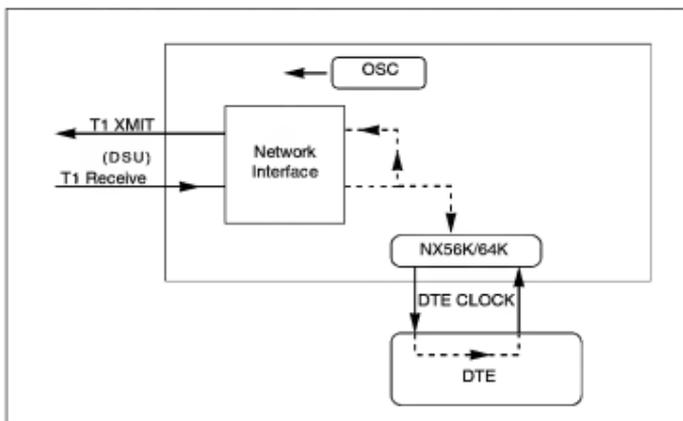


Figure 1-4. Network Timed Clock Source

DTE Timed

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 where it is necessary to have the DTE as the Primary Clock Source, (such as limited distance line drivers). See Figure 1-5.

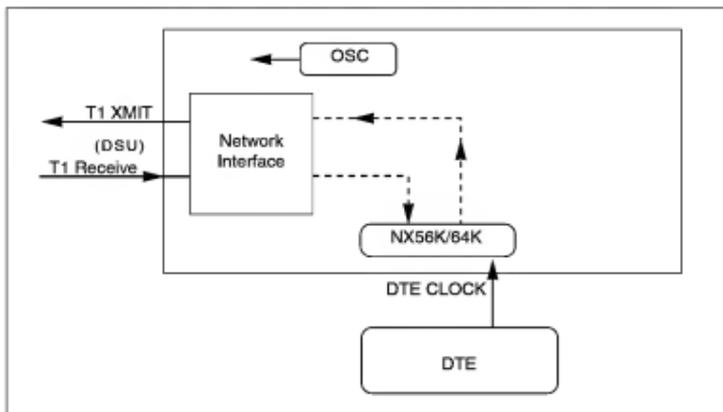


Figure 1-5. DTE Clock Source

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.

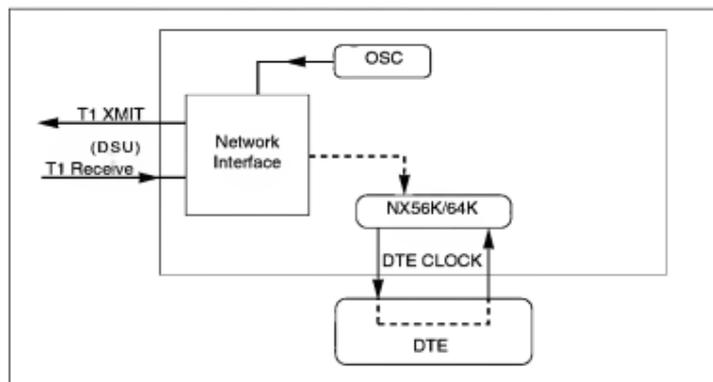


Figure 1-6. Internal Clock Source

TSU Testing

Currently the TSU offers three forms of testing.

- Self Test
- Loopback Tests
- Pattern generation and check

Self Tests

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

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

In addition to the specified self tests, background tests are also run on various parts of the internal electronics. These will run during normal operation to confirm continued correct functioning. The background tests include; 1) monitoring the phase locked loop for lock, 2) the standard background network performance monitoring, as required by ANSI T1.403 and AT&T 54016 for which the results are stored.

Loopback Tests

A number of different loopbacks can be invoked locally from the front panel, by T-WATCH commands or remotely by using special inband codes (AT&T D4 network loop up and loop down codes; 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 EFS FDL, or from T-WATCH via a modem connection.

Network Loopbacks

There are two types of network loopbacks; see Figure 1-7.

- **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.

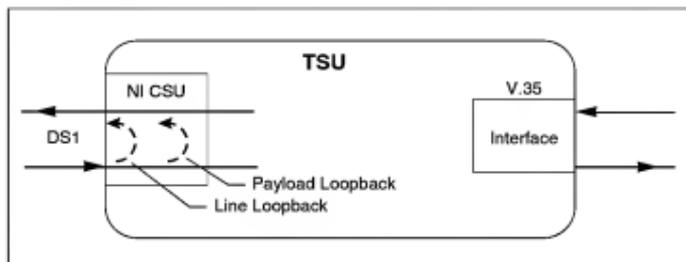


Figure 1-7. Network Loopback Tests

DTE Interface Loopbacks

The Nx56k/64k serial interface offers a DTE loopback. See 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 commands. The DTE (or external test equipment) must provide any test pattern in order to check the DTE interface.

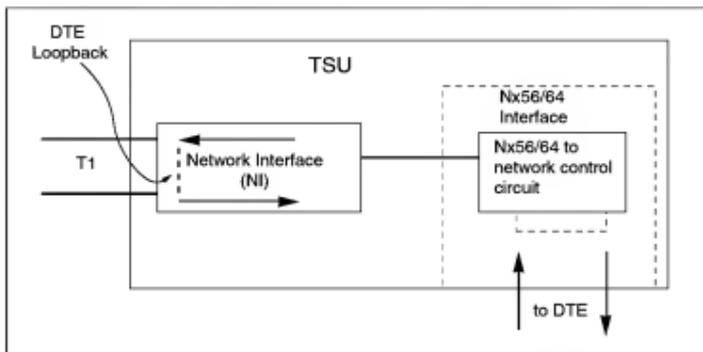


Figure 1-8. DTE Interface Loopback

Pattern Generation

The TSU offers four available test patterns, All Ones, 3:24, and 511 and 1:8.

All Ones

Need definition

3 in 24

The 3:24 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.

511

The 511 pattern is generated and checked by the Nx56k/64k serial interface. It only appears in the DSOs 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 in 8

The 1:8 pattern is used similarly to the 3:24. Each channel of the T1 has only one bit set.

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. See Figure 1-9.

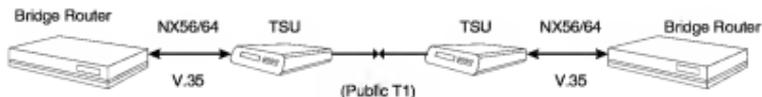


Figure 1-9. Simple Bridge Application on a T1 or FT1 Circuit

UNPACK, INSPECT, POWER CONNECTION

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

ADTRAN Shipments Include

- The TSU unit
- Line interface cable: an 8-position/modular to 8-position modular
- The TSU User Manual

Customer Provides

- 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 115 VAC, 60Hz that is grounded.

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. See Table 2-1 for the pinout for the Network connector.

Connector Type - (USOC) RJ48C

pn - AMP# 555164-2

Table 2-1. Network Pin Connection

Network Pin Connection		
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 TXDATA-TIP	
6, 7, 8	UNUSED	

Control In/Chain In

Used as an EIA 232 port for connection to a computer or modem (Chain In); or another TSU (Chain Out).

See Table 2-2.

Connector Type - RJ48

pn - AMP# 555164-2

Table 2-2. Control In/Chain In Pin Connection

CONTROL PIN CONNECTION		
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

Used to connect to another TSU's Chain In connector. See Table 2-3.

Connector Type - RJ48

pn - AMP# 555164-2

Table 2-3. Chain Out Pin Connection

CHAIN OUT PIN CONNECTION		
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 the 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)

Connector Type = V.35

pn = AMP# 92-4883-3-1

See Table 2-4.

Table 2-4. Primary V.35 Pin Connection

Nx 56k/64/ DTE PIN CONNECTION		
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 is uninitialized and set to factory default conditions. At the first application of power, the unit will automatically execute 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 will momentarily display **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.

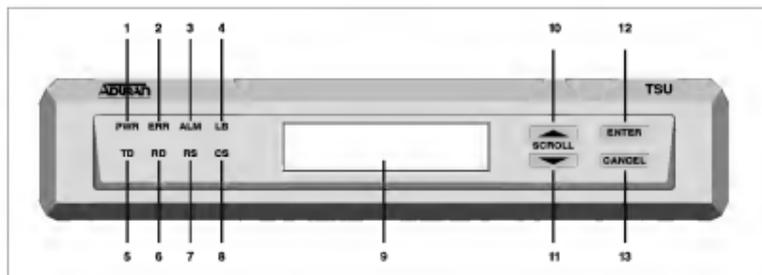
1. Board level tests.
 - RAM tests; EPROM checksum
 - On board data path. Sending a known test pattern through an on board loop.
2. Unit level tests.
 - Front Panel LED verification
 - Phase Lock Loop verify

METHODS OF OPERATION

The TSU can be configured and controlled by two different methods:

- Local Front Panel
- From Adtran's PC Control program, T-WATCH

Front Panel Operation



Item	Function
Displays:	
1 PWR:	LED "ON" when power is received by TSU.
2 ERR:	LED "ON" when errored events have happened in the last 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 RTS active from DTE.
8 CS	LED "ON" when TSU has CTS active toward DTE.
9 LCD WINDOW	A 2X16 Liquid Crystal Display (LCD) window that displays menu items used in configuration and displays information useful in monitoring the unit.
Operation Keys:	
10 UP/DOWN Scroll Keys	Scroll keys used to traverse up/down menu trees, increase/decrease numeric values and scroll through selections.
11 ENTER	Used to choose paths and make selections.
12 CANCEL	Used to exit selections or menu tree branches.

Figure 3-1. Front Panel Layout

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 up and down scroll keys.

Data Field

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

Display Field

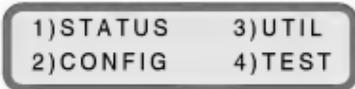
A menu field followed by alarm or error information.

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 scroll keys. (Undisplayed menu items are also available by using the appropriate menu number.)

Example Menu Operation

1. To select a menu item, use the up and down scroll keys to place the cursor on the desired menu item, for example, **2) CONFIG**.



1) STATUS	3) UTIL
2) CONFIG	4) TEST

- With the cursor on the number 2, press the **ENTER** key. 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 scroll key is visible on the lower right corner.

```

1)NETWORK (N1)
2)UNIT          ↓
  
```

- To select the desired submenu item, use the up and down scroll keys to place the cursor on the desired menu item, for example, **1) NETWORK (N1)**.

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 scroll key is visible on the lower right corner.

```

1)FORMAT:   ESF
2)CODE:     B8ZS  ↓
  
```

Setting the Data Field

Data fields that can be edited are preceded by a colon (:).

- Press the **ENTER** key 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).

```

1)FORMAT:   ESF
2)CODE:     B8ZS  ↓
  
```

- Use the up and down scroll keys to scan the available value settings. They 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.

4. Select another submenu field or use the **CANCEL** key 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.

Viewing *Display Only* Data Fields

An example of a **Display Only** data field is found by selecting the following menu choices.

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

To Exit Any Menu Field Operation or Display

Press the **CANCEL** key 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 leads to submenus which are grouped by function. All menu operations are displayed in the LCD window.

1) STATUS	3) UTIL
2) CONFIG	4) TEST

NOTE

This menu structure diagram is a limited overview. A detailed description of each menu item, presented in menu order is shown in Figure 3-2. A complete menu is shown in Appendix A.

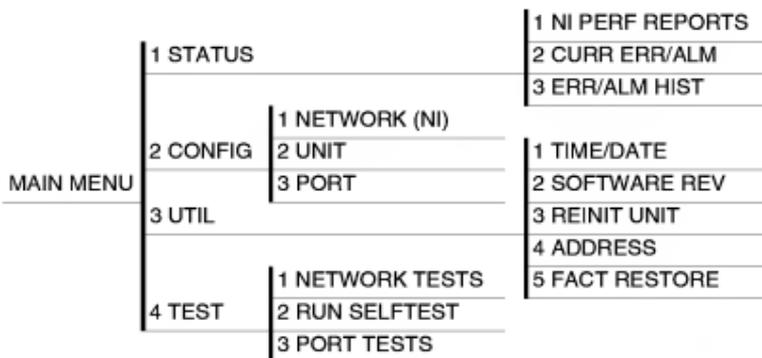


Figure 3-2. The Four Opening Menus

Menu flow is normally depicted from left to right. Arrows on the lower right of the screen indicate the direction of scrolling to view additional menu items. At every level of the menu pressing the **CANCEL** button returns the system to the previous menu level. Pressing the **CANCEL** button repeatedly returns the system to the main menu.

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

The Four Opening Menu Functions

STATUS

The Status menu provides the ability to view the status of the TSU operation. This menu includes the following sub-items.

NI PERF RPTS

Used to view the user's 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.

ERR/ALM HIST

Used to view and clear history errors and alarms.

CONFIG

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

NETWORK (NI)

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

UNIT

Used to control TSU's control port baud rate and to setup the dial out function.

PORT

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

UTIL

The Utility menu is used to view and to set system parameters. This menu includes the following subitems.

TIME/DATE

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

SOFTWARE VERSION

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

ADDRESS

View and change the current Unit Address used for control port access.

FACT RESTORE

Restore 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.

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.



Executing tests will disrupt some normal operations. See individual menu items concerning tests before executing.

MENU OPERATION

Status Menu

The Status menu branch provides the ability to view the status of the TSU operation. See Figure 3-3.

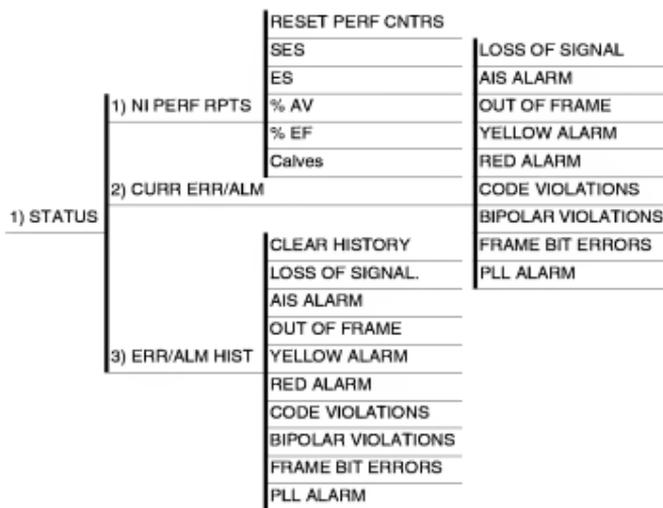


Figure 3-3. Complete Status Menu

Menu flow is normally depicted from left to right. Arrows on the lower right of the screen indicate the direction of scrolling to view additional menu items. At every level of the menu pressing the **CANCEL** button returns the system to the previous menu level. Pressing the **CANCEL** button repeatedly returns the system to the main menu.

NI PERF RPTS, Submenu of 1)Status

The Network Interface Performance Reports displays 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 last 15 minutes and over the last 24 hours.

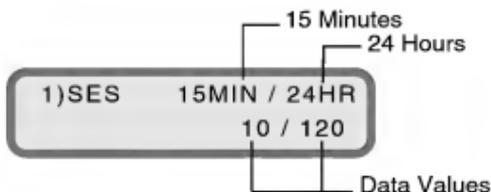
1. With the cursor on main menu item, **1)STATUS**, press **ENTER**. The first two Status submenu items with the cursor on **1)NI PERF RPTS** displays.
2. Press **ENTER**. The results display the first of six items in the Network Interface Performance report. The first menu, as shown below, is used to reset performance counters.
3. Press **ENTER** to invoke this selection and clear all the choices below.



1)RESET PERF CNTRS

4. Use the down key to view the totals in the next figure.

These fields cannot be edited, only cleared as previously discussed. Only the user copy of performance data is cleared.



- 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.

NOTE

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 PRM data.

CURR ERR/ALM Submenu of 1)Status

The Current Error/Alarm menu is used for viewing currently Active/Inactive errors and alarms.

1. With the cursor on main menu item **1)STATUS**, press **ENTER**. The first of three Status submenu items with the cursor on 1)NI PERF RPTS displays.
2. Press the down scroll key.
3. Press **ENTER**.

The results display the first current **ERRORS/ALARMS** screen.



The up and down scroll keys are used to access the complete display of the errors/alarms that are currently active. The alarms and errors which can be seen are shown below.

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	LOS/OOF causing red alarm at NI.
Code Violations	CRC errors in ESF, or BPVs in SF were received at NI.
Bipolar Violations	BPVs in SF or ESF.
Frame Bit Errors	Frame Bits received incorrectly at NI.
PLL Alarm	Unable to sync up to selected clock source.

ERR/ALM Hist Submenu of 1)Status

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 will be **ACTIVE**. If the condition hasn't occurred then the menu will be **INACTIVE**.

1. With the cursor on main menu item **1)STATUS**.
2. Press **ENTER**. The first of three status submenu items display.
3. Press the down scroll key twice. The cursor is on **3)ERR/ALM HIST**.
4. Press **ENTER**. The cursor is on the **CLEAR HISTORY** menu.



CLEAR HISTORY

5. Press **ENTER**. This results in clearing of all the ERROR/ALARM HISTORIES that follow.
6. Use the up and down scroll keys to access the error and alarm conditions.

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

Configuration

The Configuration menu is used to set the TSU operational configuration, including all of the network interface parameters, the allocation of the DS0s and the port parameters. See Figure 3-4.

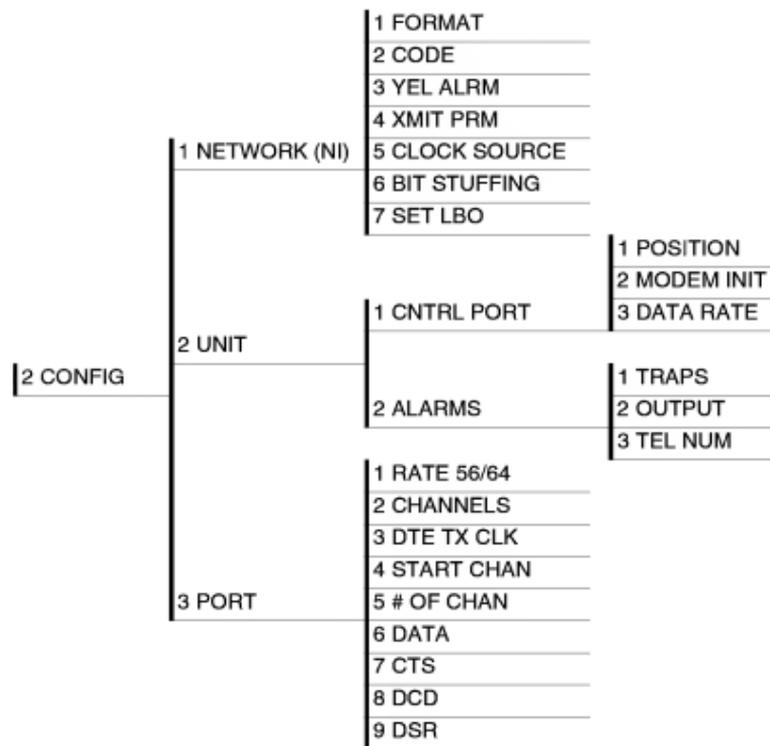


Figure 3-4. Complete Configuration Menu

1) NETWORK (NI) SUBMENU OF 2) CONFIG

This menu is used to access the configuration of parameters associated with the network interface in the TSU. There are seven submenu items that include setting the format, the Line Build Out (LBO), the clock source, etc.

Follow the standard operating procedure to access the Network (NI) menu item.

1. With the cursor on **1)NETWORK (NI)**, press **ENTER**. The results display the first of two submenu items. The down scroll indicates there are additional menu item selections available.

```

1)FORMAT:   ESF
2)CODE:     B8ZS ↓
  
```

2. Continue with standard operating procedures to edit the Network Interface parameters.

The fields and parameters available are as follows.

FORMAT

Sets the frame format for the NI.

Choices: D4, ESF

NOTE

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, DISA

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: ENA, DISA

CLOCK SOURCE

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

Choices: NETWORK, DTE, INTERNAL

BIT STUFFING

When enabled, Bit Stuffing causes the TSU to monitor for ones (1s) density violations and insert a one (1) when needed to maintain ones at 12.5%.

This option should be disabled if B8ZS is enabled, if Nx56 is selected or alternate channels are being used. All of these other options already ensure pulse density requirements.

Choices: ENA, DISA

SET LBO

Selects the Line Build Out for the network interface. In AUTO mode, the TSU will set the LBO based on the strength of the receive signal.

Choices: 0db, -7.5db, -15db, -22.4db, AUTO

2) UNIT, SUBMENU OF 2) CONFIG

The unit submenu is used to change control port and alarm options.

1. Follow standard operating procedures to access the Unit menu item.
2. With the cursor on **2)UNIT**, press **ENTER**. The results display two submenu items.



1) CNTRL PORT

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

POSITION

Determines if this TSU is at the head of a chain of units (directly connected to the modem or PC). The head of the chain is referred to as the Master Unit. Units down the chain are referred to as Slaves or a Slave Unit.

The setting of the position selection is necessary only when using a modem, in which case the head unit should be Master. For all other cases, select SLAVE. (The Master is in charge for control of the modem.)

Choices: MASTER; SLAVE

MODEM INIT

The TSU is capable of initializing a modem. This menu selection is used to effect this initialization and should be selected only when the choice above designates the TSU as the MASTER. 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: ENAB - Enable; DISA - Disable

DATA RATE

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

Choices: 1200, 2400, 9600

2) ALARMS

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

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: ENAB - Enable; DISA - Disable

OUTPUT

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

Choices: DIRECT or DIAL

TEL NUM

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

Example: For number 9:5551212; dial 9, pause, and then send 5551212. This pause could be effected to access an outside line form a PBX, etc.

When editing a specific character, the scroll keys are used to scroll from 0 to 9, then ":" and ";". The new telephone number is entered into the TSU only upon pressing ENTER after typing the ";".

Choices: 20 digits (0-9, : and ;)

 **NOTE**

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

3) PORT, SUBMENU OF CONFIG

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

1. Follow standard operating procedure to access **3)PORT**.
2. Press **ENTER**. The first nine submenu items appear.
3. Continue with standard operating procedures.

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 appear in Appendix II. Choices: 56K or 64K

CHANNELS

This sets the unit to use alternate or contiguous channels in the T1 data stream. If greater 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 or CONT

DTE TX CLK

Controls the clock used by the TSU to accept the transmit (TX) data from the DTE. Normally this is 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. 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, or EXTERNAL

START CHAN

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

Choices: 01 through 24

OF CHAN

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

Choices: 01 through 24

DATA

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

Choices: NORMAL or INVERT

CTS

Used to control characteristics of CTS.

Choices: NORMAL, (see Table 3-1) or 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 3-1) or 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 3-1) or FORCE ON

Table 3-1. Normal Mode of Operation

NORMAL MODE OF OPERATION						
Conditions which cause the Port Control Signals to be deactivated.						
SIGNAL	RTS	V-54 LOOPBK	511 TEST ON	SELFT TEST ACTIVE	NETWK TEST ACTIVE	NETWORK ALARMS
CTS	Follows	OFF	OFF	OFF	OFF	YELLOW ALM
DCD	-	-	OFF	-	PATTERN	OOOF OR AIS
DSR	-	OFF	OFF	OFF	OFF	-

Where "-" = don't care
Force On = On under all conditions

UTIL

The utility menu is used to view and to set system parameters. See Figure 3-5. This includes setting the time and date and resetting all parameters to factory values or to reinitialize the unit. This menu is also used to view the unit's software revision and the unit's ID setting.

3 UTIL	1 TIME/DATE	TIME: HH:MM:SS DATE: MM/DD/YY
	2 SOFTWARE REV	(Displays Current Software Revision)
	3 REINIT UNIT	
	4 ADDRESS	
	5 FACT RESTORE	(Returns all configurations to factory settings)

Figure 3-5. Complete Utility Menu

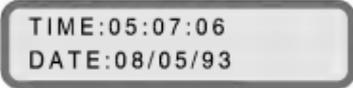
Menu flow is normally depicted from left to right. Arrows on the lower right of the screen indicate the scrolling direction to view additional menu items. At every level of the menu pressing the **CANCEL** button returns the system to the previous menu level. Pressing the **CANCEL** button repeatedly returns the system to the main menu.

1)Time/Date, Submenu of 3)Util

This menu option is used to view or to edit the current time and date. The time and date are maintained during power off conditions.

Follow standard operating procedure to access the **3)UTIL** menu items.

1. With the cursor on **T**IME/DATE press **ENTER**. The results display the current time and date with the cursor on the **T** in Time.



TIME:05:07:06
DATE:08/05/93

2. Press **ENTER** to move to the first time position (hour). Use one or two number keys to set the desired hour.
3. Press **ENTER**. The cursor moves to the second time position (minutes).
4. Use one or two number keys to set the desired minutes. Press **ENTER**. The cursor moves to the third time position (seconds).
5. Use one or two number keys to set the desired seconds. Press **ENTER**. The cursor again moves to the third time position.
6. Press the down scroll key to move to **DATE**. The cursor is on the **D** of **DATE**.
7. To set the Date use the same keystroke pattern as for setting the Time.
8. To exit the **TIME/DATE** setting, press **ENTER** after making the last desired change.
9. Press the **CANCEL** key.

The unit returns to the opening of **TIME/DATE** setting with the cursor on the **T** of **TIME**. Any settings completed with an **ENTER** keystroke have been recorded. Any settings not completed by an **ENTER** keystroke are not recorded.

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 change, the cursor moves to the next editing position.

The up and down scroll keys will also move the cursor to different fields to edit. Pressing **CANCEL** at any time can be used to 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.

Follow standard operating procedure to access the **3)UTIL** menu items.

1. With the cursor on **2)SOFTWARE REV**, press the **ENTER** key. The the current software revision level displays.
2. Use the **CANCEL** key to exit.

3)Reinit Unit, Submenu of 3)Util

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.

1. Follow standard operating procedure to access the **3)UTIL** menu items.
2. With the cursor on **3)REINIT UNIT**, press **ENTER**. The unit reinitializes all the hardware and performs a self-test.

4)Address, Submenu of 3)Util

This submenu is used to access the current Unit Address setting. Unit identification numbers must be between 000 and 256.

1. Follow standard operating procedure to access the **3)UTIL** menu items.

2. With the cursor on **4)ADDRESS**, press **ENTER**.

The results display the prompt to enter the Unit Identification number limited to three digits between 000 and 256.



3)REINIT
4)ADDRESS: 000

3. Press **ENTER** to active the menu. Use the up and down scroll keys to enter each digit. Press **ENTER**.
4. After entering the third digit, press **ENTER** to record the complete Address.

The cursor returns to **4)ADDRESS** for another menu selection to be made.

5)Fact Restore, Submenu of 3)Util

The Factory Restore submenu is used to restore the factory default setting for all unit parameters. This will restore all parameters to the factory settings.

1. Follow standard operating procedure to access the **3)UTIL** menu items.
2. With the cursor on **5)FACT RESTORE**, press **ENTER**. The unit performs a self test before returning to the opening main menu. All factory preset defaults are restored.

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 subitems. See Figure 3-6.

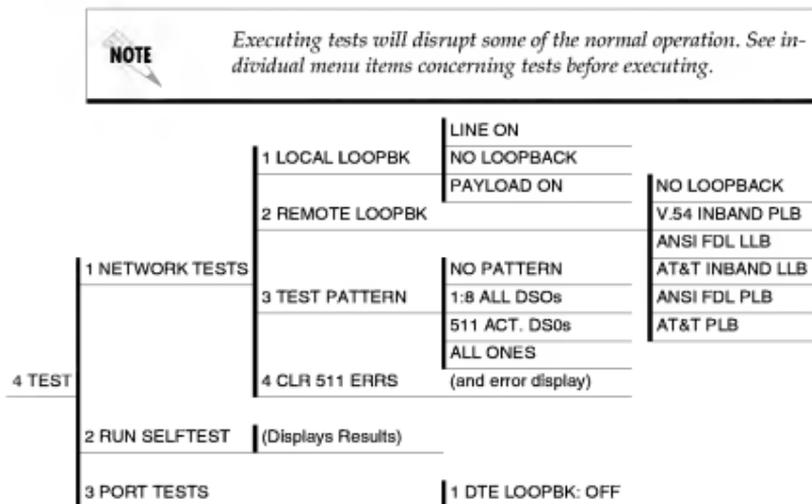


Figure 3-6. Complete Test Menu

Menu flow is normally depicted from left to right. Arrows on the lower right of the screen indicate the scrolling direction to view additional menu items. At every level of the menu pressing the **CANCEL** button returns the system to the previous menu level. Pressing the **CANCEL** button repeatedly returns the system to the main 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.

1. With the cursor on main menu item **4)TEST**, press **ENTER**.

The first two Test submenu items with the cursor on **1)NETWORK TESTS** displays.

2. Press **ENTER**.

The first of three submenu choices with the cursor on **1)LOCAL LOOPBCK** displays. There are three available choices for setting the local loopback.

Line On - Activates the line loopback

Payload On - Activates the payload loopback

No loopback - Deactivates the loopback.

3. Use the up and down scroll keys to select and press **ENTER** to record selection. The cursor returns to the 1 in front of **LOCAL LOOPBACK**.

4. Use the up and down scroll keys to select **2)REMOTE LOOPBACK** or **3)PATTERN**.

2)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 loopup code toward the far end.
- **AT&T Inband LLB** - activates the line loopback using inband code
- **ANSI FDL PLB** - initiates the transmission of an FDL payload loopup code toward the far end
- **AT&T PLB** - indicates 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).*

5. Use the up and down scroll keys to select.
6. Press **ENTER** to record selection. The cursor returns to the 2 in front of **REMOTE LOOPBACK**.
7. Use the up and down scroll keys to select **1)LOCAL LOOPBACK** or **3)PATTERN**.

3)PATTERN - Sets the pattern for the test and initiates the transmission of the pattern. The test is terminated by selecting **NONE**. There are four patterns available.

 - **3:24 All DS0s** - generates a 3 in 24 pattern
 - **5:11 Active DS0s** - generates a 511 test pattern and inserts the pattern into currently active channels
 - **1:8 ALL DS0s** - generates a 1 in 8 pattern in all DS0s
 - **All Ones** - generates an all ones pattern in every channel
 - **None** - terminates pattern generation
8. Use the up and down scroll keys to select; for example, **511 ACTIVE DS0s**.
9. Press **ENTER** to record selection. The TSU starts to generate a 511 test pattern and inserts the pattern into all DS0s.

4)CLR 511 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.

CLR 511 ERRORS
511 ERRORS = 56

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

2)Run Selftest, Submenu of 4)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. The self test procedure consists of the following tests.

- Ram tests; EPROM checksum
- On board data path. Sending a known test pattern through an on-board loop
- Front Panel LED verification
- Phase Lock Loop verify

If a failure is detected, note the failure number prior to contacting ADTRAN technical support.



Executing a self test will disrupt normal data flow and prevent remote communication until the self test is completed (5 seconds).

1. Follow standard operating procedure to access the **4)TEST** menu item.
2. With the cursor on **2)RUN SELFTTEST**, press **ENTER**.
A changing display in the LCD showing the test outcome displays.

SYSTEM SELF-TEST
ALL TESTS PASSED

3. Press the **CANCEL** key to exit.

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 theV.35 interface back towards the DTE.

1. With the cursor on main menu item **4)TEST**, press **ENTER**. The first two Test submenu items with the cursor on **1)NETWORK TESTS** displays.
2. Use the down scroll key to select **3) PORT TESTS**.
3. Press **ENTER**. The loopback setting displays.

1)DTE LOOPBCK: OFF

4. Use the scroll keys to select **OFF** or **ON**.
 - **ON** - the DTE Loopback is activated
 - **OFF** - deactivates looping (returns unit back to normal state)
5. Press the **CANCEL** key to exit.

Prior to actually using the TSU to pass data, it is recommended to run tests on the circuit.

The 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 loopback the far end.
- Send the pattern from both ends and check at both ends.

Far End Looped Back Test

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

Network Interface Test

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

1. At the main menu, use the scroll keys to place the cursor on **4)TEST**.



1) MONITOR	3) UTIL
2) CONFIG	4) TEST

2. Press **ENTER** to select.

The first two test submenu items display.

1) NETWORK TESTS
2) RUN SELF TEST ↓

- Use the scroll keys to place the cursor on **1) NETWORK TESTS**.
- Press **ENTER** to select.
- Press **ENTER** again to enter the **NETWORK TEST MENU**. The beginning display of the submenu items display. The selections available for each menu item are selected with the up and down scrolls.

1) LOCAL LOOPBK:
NO LOOPBACK ↓

LINE ON
PAYLOAD ON
NO LOOPBACK

2) REMOTE LOOPBK:
NO LOOPBACK ↓

V.54 PLB ON
ATT PLB ON
ATT LLB ON
ANSI LLB ON
ANSI PLB ON
NO LOOPBACK

3) TEST PATTERN:
NONE ↓

NO PATTERN
3:24 ALL DS0s
ALL ONES
511 ACTIVE DS0s
1:8 ALL DS0s

4) CLR 511 ERRORS
511 ERRORS = 0 ↑

- Use the scroll keys to place the cursor on **2) REMOTE LOOPBK**.
- Press **ENTER** to select.

8. Use the up and down scroll keys to set **PAYLOAD** in data the field. (Must use V.54 PLB ON For Fractional T1 on Public Networks.)
9. Press **ENTER** to activate a **Remote Payload Loopback**. This initiates the transmission of a *loopup* code toward the far end.
10. When completed use the up and down scroll key or the number **3** to select **3)TEST PATTERN**.
11. Press **ENTER** to activate the **TEST PATTERN** submenu.
12. Use the up and down scroll keys to select **511 ALL DS0s**.
13. Press **ENTER** to activate the selection.
The TSU always checks for 511 errors. The results of this check are shown under submenu item **4**.

3)TEST PATTERN:
511 ALL DS0s ↓

4)CLR 511 ERRORS
511 ERRORS = 0

14. When through viewing the results, press the **CANCEL** key to return to submenu item **3)TEST PATTERN** and select **NONE** to terminate the test and the 511 pattern generation. The far end will still be in loopback until the network **REMOTE LOOPBK** is set to **NONE** under submenu item **2)REMOTE LOOPBK**.

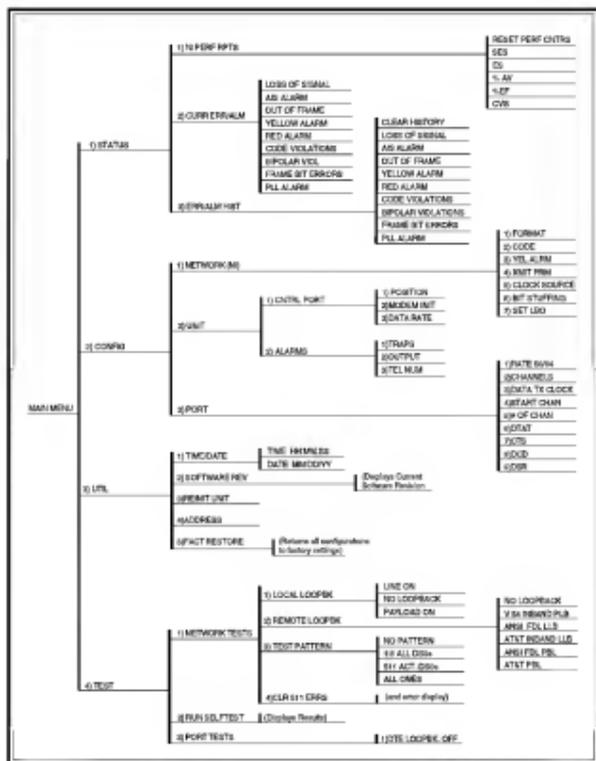


Figure A-1. TSU Complete Menu Diagram

Appendix B DTE Data Rate Chart

DTE DATA RATE vs DS0s (N)		
# of DS0s (N)	DTE RATE = 56K	DTE RATE = 64
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

Figure B-1. DTE DATA RATE CHART

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Product Support Information

Presales Inquiries and Applications Support

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

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

Post-Sale Support

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

Technical Support	(888) 4ADTRAN
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Repair and Return

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

CAPS Department	(256) 963-8722
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Identify the RMA number clearly on the package (below address), and return to the following address:

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

RMA # _____

