

**363-205-105**

**'SLC(R)' SERIES 5 CARRIER SYSTEM LINE TEST UNIT AND LINE  
TEST CONTROLLER USER'S MANUAL - AT&T 363-205-105 - ISSUE  
2**

Refer to Chapter 8

NOTICE: See the Legal- and Support-Information Module for any notices,  
trademarks, ordering information, and other support.

Copyright(c) 1991 AT&T  
All Rights Reserved  
Printed in U.S.A.

# 1. INTRODUCTION

## 1.1 Overview

This manual contains information concerning the description, installation, maintenance, and use of the line test controller (LTC) and the line test unit (LTU) in the LTC/LTU loop test system.

## 1.2 About This Manual

The following descriptions and references provide a brief summary of the contents of this manual:

- o For a detailed description of the LTC/LTU loop test system, see Chapter 2, "DESCRIPTION."
- o For detailed LTU installation and removal procedures at the remote terminal (RT) and LTC software installation procedures at the personal computer (PC), see Chapter 3, "INSTALLATION AND REMOVAL."
- o For a functional description of the LTC administrative and data retrieval modes, including menu screens, and a description of error messages and information on probable causes and responses, see Chapter 4, "LTC SOFTWARE."
- o For additional information concerning the *SLC(R)* Series 5 Carrier System, refer to Chapter 5, "ADDITIONAL REFERENCES," which lists the AT&T practices for the which lists the AT&T practices for the *SLC* Series 5 Carrier System.
- o For LTU maintenance and trouble clearing procedures, see Chapter 6, "APPENDIXES."
- o For maintenance and use of your PC, refer to the documentation that came with the PC.

## 1.3 Background

This manual is written for users who are familiar with **MS-DOS(R)** or **PC-DOS** Disk Operating System and *SLC* Carrier Systems.

To ensure proper LTC software compatibility and operation, you must have the following:

- o An AT&T PC 6300 or *MS-DOS* compatible PC
- o 512K random access memory (RAM) minimum

- o Disk operating system 2.0 or later
- o Bell 212A compatible modem [1200 bits per second (b/s)]
- o SLC Series 5 Carrier System line test controller working disk (see Chapter 3, "INSTALLATION AND REMOVAL").

## 1.4 Conventions Used in This Manual

Text that appears on the LTC PC screen is shown in this manual in bold type. The default value that is supplied with some prompts and menus is displayed in square brackets [ ]; the software uses this value if you press the return key instead of entering a response. Optional entries are shown in this manual in parentheses for your convenience; **these options do not appear on the screen.**

In the following example, PROMPT [DEFAULT] = is the prompt displayed on the screen; ENTRY is displayed as you type on the keyboard. (Options) lists the range of valid entries. Of the options, DEFAULT is used if no other entry is made before the [Return] key is pressed.

**PROMPT [DEFAULT] = ENTRY (Options)**

For example, pressing the [Return] key with the following prompt displayed:

**FIRST SYSTEM ID [1234] =**

enters the system ID number 1234. Whereas, the entry of a new system ID number (for example, 5678) at the prompt:

**FIRST SYSTEM ID [1234] = 5678**

enters system ID number 5678 after the [Return] key is pressed.

**NOTE:**

Valid Series 5 system ID entries are 0001 to 9999 or NONE for a system not being tested.

Keys are shown exactly as labeled, except the backspace key (shown herein as [Backspace]), the return/enter key (shown herein as [Return]), and the shift key (shown herein as [Shift]). When two keys are shown together (for example, [Ctrl] [PrtSc]), it means hold down the first key and press the second one (for example, hold down [Ctrl] and press [PrtSc]). Chapter 4, "LTC SOFTWARE," has more detail on special keys, including [F1] - [F12].

## 2. DESCRIPTION

### 2.1 System Overview

The LTC/LTU is a dedicated routine loop testing system used in testing *SLC* Series 5 Carrier System subscriber loops. The LTU is a microcontroller-based Series 5 RT circuit pack that performs routine customer loop tests and stores the test results in its internal memory. The LTC, which is comprised of an AT&T PC 6300 or *MS-DOS* compatible PC and the PC-based software, is used to administer the LTU, retrieve the test results from the LTU, and process the test results data for display and input to the telephone company's operations support system. The LTC communicates with the LTU over a 1200 b/s data link.

Figure 1 shows the system architecture of the LTU/LTC loop test system.

### 2.2 LTU Description

#### 2.2.1 General

This section describes the physical and functional features of the LTU.

The LTU (Figure 2) is the Series 5 AUA7 plug-in that consists of a mother/daughter board arrangement. The LTU faceplate has two LEDs and two access connectors. The LTU is a dedicated loop tester that is compatible with *SLC* Series 5 Carrier Systems equipped with feature package C (FPC), feature package D (FPD), and other feature packages that may be released in the future.

The LTU gains direct metallic access to the subscriber loops served by a *SLC* Series 5 Carrier System dual channel bank at the RT, automatically performs routine tests on the loops, and stores the test results in its internal memory. Since one LTU is dedicated to each *SLC* Series 5 Carrier System RT dual channel bank (maximum of 192 loops), all LTUs can run the routine loop tests independently. The LTU can test 192 channels (one dual channel bank) in approximately 1 hour.

Each RT dual bank assembly requires an LTU. In addition, the LTU requires that an AUB22 or AUB25 channel test unit (CTU) and an AUA18/AUA19 digital test unit (DTU) be installed in the RT dual bank assembly in order to function properly. The CTU and DTU are standard *SLC* Series 5 Carrier System plug-ins.

The LTU plugs into the sixth line interface unit (LIU) slot of the white RT bank. A cable interfaces a connector on the LTU faceplate to the craft interface unit (CIU) **TEST ACCESS** connector on the CTU faceplate. A faceplate connector is also provided for the LTU

## 363-205-105

internal modem to plain old telephone service (POTS) channel unit (CU) interface that uses a dedicated channel within the Series 5 RT channel bank.

The LTU is compatible with the J1C182AB-1, L1, J1C182AC-1, L1, J1C182AE-1, L1, and J1C182AF-1, L1 backplanes.

### 2.2.2 Routine Loop Testing

The LTU performs the following routine loop tests on each subscriber loop:

- o Insulation
  - TIP to ground resistance with ground on RING
  - RING to ground resistance with ground on TIP
  - TIP to battery cross resistance
  - RING to battery cross resistance.
- o Background Noise
  - C-message weighted TIP/RING noise voltage
- o Foreign Potential
  - Peak voltage from TIP to ground
  - Peak voltage from RING to ground.

### 2.2.3 Testable Loops

The LTU only tests the loops connected to the CUs specified in the following:

- o POTS (loop start mode only)
  - AUA51
  - AUA58
  - AUA59
  - AUA25
- o SPOTS(R) channel unit (loop start mode only)
  - AUA51
  - AUA59

AUA25

- o Frequency-selective ringing (FSR)

AUA57

- o Coin

AUA53

- o Multiparty

AUA55

- o POTS with derived channel alarm.

AUA27

The measurements received from these tests are compared to several thresholds (described later) and the results of each type of test are categorized as good, suspect, moderate (insulation test only), or severe with respect to the channel tested.

The LTU can be installed in systems which use the pair gain test controller (PGTC) or extended test controller (XTC) for demand testing. The LTU is also compatible with systems that are equipped with a remote measurement unit (RMU).

**2.2.4 LTU - BCU Interface**

This section describes the interactions between the LTU and the bank control unit (BCU) during LTU loop testing.

The LTU initiates communication with the RT BCU by specifying the system ID and channel number of the subscriber loop to be tested.

Once communication with the BCU is established, the LTU requests digital access to the channel's DS0 interface and obtains information about the CU serving the loop to be tested. Included in the CU information returned by the BCU is the CU ID that is used to determine if the channel is testable. Given the CU ID, the LTU looks up the idle signaling bit pattern for that CU from a read only memory (ROM) table. The LTU microcontroller compares the received and transmitted signaling bits (ABCD signaling bits) of the CU to the idle bit pattern to determine if the CU is idle or busy. If the CU is busy, the LTU goes to the next channel to be tested and repeats the procedure to check for the idle or busy state. Channels that are found busy are rechecked a maximum of three times (time permitting) until all testable channels are tested.

If the CU is idle, the LTU requests metallic access. This closes the test relay on the CU giving the LTU metallic access to the subscriber loop.

The LTU now begins to test the loop. When the LTU completes the routine loop tests, it writes the test results into memory and terminates communication with the BCU, thus releasing the test access for that channel. This includes the termination of the metallic and digital access to the CU. At this point the BCU is available for routine testing of the next channel.

The LTU repeats this procedure until all the testable channels are tested sequentially from channels 1 through 96 for each system in the dual channel bank.

### 2.2.5 LTU Architecture

#### 2.2.5.1 General

This section discusses the architecture (see Figure 3) of the LTU.

The LTU consists of eight major components: the microcontroller, the signaling monitor, the loop testing circuitry, two communication links, an electronically erasable programmable read only memory (EEPROM), a real time clock, and a modem/universal asynchronous receiver transmitter (UART).

A description of these eight components plus the following additional components that comprise the LTU is contained in the following sections: programmable read only memory (PROM), sanity timer, reset switch, and LEDs and connectors.

#### 2.2.5.2 Microcontroller (uC)

The microcontroller performs all the control and communication functions of the LTU.

A serial port is used as the 1200 b/s interface to the BCUs. A modem/UART is used for the 1200 b/s communication link.

#### 2.2.5.3 Signaling Monitor

The signaling monitor circuit extracts the signaling bits from the serial bit stream provided by the DTU.

The signaling monitor extracts and latches the ABCD signaling bits from the RT CU, whose loop is to be tested, as well as the ABCD signaling bits from the corresponding COT (central office terminal) CU. The four signaling bits of both CUs are read by the LTU microcontroller to determine if the channel is idle.

#### 2.2.5.4 Loop Testing Circuitry

The loop tests performed by the LTU consist of voltage (foreign potential), resistance (insulation), and C-message weighted background noise measurements. The results obtained from these measurements are compared to fixed thresholds to determine if the loop is in a good,

## 363-205-105

suspect, moderate, or severe condition.

Table A lists the tests and the test thresholds.

### 2.2.5.5 Communications Links

The internal UART on the LTU microcontroller is used to communicate with the bank controllers. An additional UART is used to drive a 1200 b/s modem which is used as the communication link to the LTC.

### 2.2.5.6 EEPROM

The LTU has an EEPROM for the storage of system information, test results, and a password.

### 2.2.5.7 Real Time Clock

The LTU has a real time clock that keeps the time (24-hour clock) and the day-of-week data for the LTU. The clock is also used to start and stop the routine loop tests.

The LTU microcontroller continuously reads and compares the clock time to the start and run times specified by the LTC to determine if it is time to start or end the routine tests.

### 2.2.5.8 Modem/UART

The LTU has a 1200 b/s auto-answer modem that interrupts the microcontroller when it detects ringing. If the LTU is busy performing loop testing, then the LTU finishes the current test (maximum delay of approximately 15 seconds) before answering the call to the modem.

The TIP and RING pair of the modem is connected directly to the TIP and RING pair of a POTS or *SPOTS* Channel Unit operating in the loop-start mode. The modem and the CU are isolated from the outside environment.

### 2.2.5.9 PROM

The LTU program resides in the PROM.

### 2.2.5.10 Sanity Timer

The sanity timer provides a mechanism for resetting the microcontroller in case the microcontroller locks up in an infinite loop.

### 2.2.5.11 Reset Switch

The LTU must be set to its *preservice* state to allow initial interaction with the LTC. In the *preservice* state, all values in the EEPROM parameter fields are set to predetermined (default) values. The values in two fields, password and status, must be valid to

support LTC interaction. The default password (000000) is used for the initial LTC/LTU interaction.

The LTU has a 2-position **RLB** (reset LTU board) switch that is used to set the LTU EEPROM to its *preservice* state. The LTU EEPROM is set to the *preservice* state during LTU installation. It may also be necessary to reset the EEPROM of an LTU to the *preservice* state under certain conditions; for example, if the password was changed and cannot be recalled. Resetting the LTU EEPROM to its *preservice* state would allow LTC interaction, thus allowing a new password and other parameters to be entered.

To reset the LTU EEPROM to its *preservice* state, the **RLB** switch is set to the **ENB** (enable) position. When the unit is inserted into the channel bank, the **FAIL** and **BUSY** LEDs will light to indicate that the LTU EEPROM is being initialized or reset to the default values. The **FAIL** and **BUSY** LEDs will flash on and off when the initialization is complete. The LTU is then removed from the channel bank, the **RLB** switch is set to the **DIS** (disable) position, and the LTU is reinserted into the channel bank. The LTU is now in the *preservice* state.

The *in-service* state is established when the *preservice* parameters are replaced with valid data by way of the LTC. The LTU determines its own *preservice/in-service* state and sets the appropriate field in the status register accordingly. The status register contains information on the state/condition of the LTU.

### 2.2.5.12 LEDs and Connectors

The LTU has a **FAIL** and a **BUSY** LED plus a **TEST ACCESS** and **T/R** (tip/ring) connector on the faceplate. The **FAIL** LED is turned on by the microcontroller when the LTU is powered up or if the built-in self-test detects a hardware failure of any LTU circuitry. The **BUSY** LED is turned on while the LTU is performing the routine loop tests or if the LTU is communicating with the LTC. Both LEDs are turned on while the LTU is performing the reset procedure. Once the LTU has finished the reset procedure, both LEDs flash on and off to remind the craftsperson to set the **RLB** switch to the **DIS** position.

The **TEST ACCESS** connector is a 10-pin connector that provides the electrical interface to the CTU. The **T/R** connector is an RJ11 telephone jack that provides the electrical interface to the POTS or *SPOTS* CU.

### 2.2.6 Built-In Self-Test

The built-in self-test is performed during normal LTU operations to determine if the LTU is healthy. The results of this test are reported to the LTC when the LTC begins a communication session with the LTU. The LTU reports a hardware failure if it detects any failure

which cannot be corrected by changing the LTU system parameters from the LTC. Under this condition the LTU turns on the **FAIL** LED and does not start the routine loop tests.

### **2.2.7 LTU/CTU Physical Interface**

The LTU interfaces to the CTU via a ribbon cable connected from the **TEST ACCESS** connector on the LTU to the **TEST ACCESS** connector on the CTU.

### **2.2.8 Electrical Protection**

Since the LTU tests the loop plant, it is exposed to the same environment as an RT CU. The LTU test circuitry provides electrical protection equivalent to that of a CU.

## **2.3 LTC Description**

This section describes the physical and functional features of the LTC.

An AT&T PC 6300 or *MS-DOS* compatible PC serves as the user interface to the LTU. The PC in combination with the LTC software on the controller working disk are referred to as the LTC. The LTC is used to perform the following basic functions:

- o Communication with the LTU
- o Administration of the LTU
- o Retrieval of the LTU test results
- o Processing of the raw LTU test results data.

The LTC communicates with the LTU over a 1200 b/s modem data link. This communication link is used by the LTC for both the administration of the LTU and for retrieval of the raw test results from the LTU.

Administration of the LTU consists of setting and changing LTU system EEPROM parameters including, but not limited to, the following five LTU system parameters:

- (1) Real time clock
- (2) System identification numbers for both Series 5 systems
- (3) Channels excluded from testing
- (4) LTU security password
- (5) Test start and run times.

Data retrieval consists of establishing communications with the LTU and transferring the raw LTU test results data to the LTC for PC screen display or file storage.

Data processing consists of interpreting the raw LTU test results data and writing the processed data to a file that is utilized by the user's operations support system.

The routine customer loop testing is performed by LTUs installed at RT sites (one LTU for each dual bank). Data transfer between the LTC and the LTUs to obtain test results and administer the LTUs is performed from a centrally located remote LTC. The transfer is implemented by dial up modem lines to the LTUs that allow the centralized LTC to perform the following types of activities:

- a. Acquire test results
- b. Change LTU system EEPROM parameters.

Using the menu driven LTC software, the LTC PC operator is permitted to select either one of the above desired types of activities. However, type *b* activities (changing LTU system EEPROM parameters) can only be performed if the administration access path is chosen and a valid login is supplied to the LTU.

For activity *a* (acquiring test results), it is also possible to operate the LTC program unattended using files for input and output. This is called indirect input/output (I/O). In addition, it is possible to set up this activity several hours before actual execution and at the same time also set up a post analysis program to perform further processing on the test results after they have been obtained and interpreted by the LTC. (The post analysis program is an optional program supplied by the customer that resides on the same PC as the LTC software.)

## **2.4 LTC - LTU Interface Overview**

The LTU contains logic and data to automatically conduct a simple series of tests on each customer loop connected to the associated dual channel bank. The results of these tests are stored within the LTU EEPROM at the RT bank pending the dial up access by the LTC. A transfer of the test results to the LTC is performed by the LTU whenever the LTC requests the test results. A valid login password is required for any transaction other than acquiring test results, LTU status, and LTU clock time (this is the principal security measure).

With a valid login the LTC is able to read or set the LTU remote clock and to establish, or change, LTU resident system parameters. The LTU firmware is able to perform a variety of functions including: receiving and processing commands and data from the LTC to support password administration functions, determining channel test permission information, setting the time-of-day clock, etc.

The LTC software includes a terminal emulation, or Set Up, mode to support setting up the access to the LTU port. Once the LTU has been accessed, the appropriate user commands and responses are performed under LTC software control. The user-keyboard-screen interaction is menu based and uses the same man machine language (MML) as the CIU.

The LTU memory (EEPROM) contains test results for transfer to the LTC when requested and system parameters sent from and managed by the LTC. The LTU memory also contains predefined parameter values that the LTU uses in the preservice state to overwrite existing parameter values [for example, an existing password is replaced with 000000 (six zeros)].

There are four general LTC-to-LTU command capabilities:

1. Read or write LTC managed data (administration access required). This capability involves all the LTC system parameters that can be written by the LTC except the password field which cannot be read.
2. Read LTU managed data (administration access or reporting access). The LTU managed data are read-only by the LTC, are managed solely by the LTU, and consist of test results and LTU status.
3. Login and password administration (that is, change password).
4. Logoff.

The normal interactive sequence of events during an exchange between the LTC and the LTU is summarized as follows:

- o The LTC, in the Set Up (terminal emulation) mode, accesses the LTU through a modem.
- o The LTC requests certain information from the LTU and upon receiving the information, the LTC checks it for validity.
- o The LTC displays the Reporting menu.
- o If a successful login is sent by the LTC, the LTU provides administration access and the LTC displays the Administration menu.
- o Commands sent by the LTC are executed by the LTU.
- o The LTC logs off and the LTU disconnects.

The LTC-LTU interface operates using switched data lines and 1200 b/s modems compatible with the host PC (data side) and with Bell System 212A (TIP/RING side). The *visible* ASCII (American Standard Code

## 363-205-105

for Information Interchange) character set is used at the LTC - LTU interface to increase the possibility of this interface being compatible with other data transports and intermediate processors. The *visible* ASCII character set is defined as:

- o Any ASCII character from SP (040 octal) to DEL (0177 octal)
- o The ASCII characters from BEL (007 octal) through CR (015 octal)
- o In the terminal emulation mode, any ASCII character entered from the keyboard.

### 3. INSTALLATION AND REMOVAL

#### 3.1 General

This section describes the procedures for installing and removing the LTU at the RT of the *SLC* Series 5 Carrier System, and the procedures for installing the LTC software on the PC.

#### 3.2 Installing LTU at RT

##### 3.2.1 General

Installation of the LTU consists of five basic steps:

- o Set the LTU EEPROM to its *preservice* state.

Since the LTU must communicate with the LTC for data transfers, the LTU must be initialized into a state which can be recognized by the LTC. This state is known as the *preservice* state.

The LTU performs a built-in self-test when powered up to determine its health.

- o Replace the present 3B1E (or equivalent) protector with a 3B2E protector in order to isolate the LTU modem from the loop plant.
- o Make the modem connection between the **T/R** telephone jack on the faceplate of the LTU and a POTS or *SPOTS* CU.

The modem interface between the LTU and CU must be connected so that the LTU can communicate with the LTC.

- o Make the test access connection between the **TEST ACCESS** connector on the faceplate of the LTU and the **TEST ACCESS** connector on the faceplate of the CTU.

The interface between the LTU and the CTU must be connected via a ribbon cable so that the LTU can communicate with the bank controllers.

##### 3.2.2 Preparation

Verify that the following items are available for installation of the LTU:

QUANTITY	DESCRIPTION
1	AUA7 LTU CP (circuit pack)
1	3B2E protector

## 363-205-105

1	Flat ribbon cable (COMCODE 846372332)
1	2-conductor cable (COMCODE 103732541)
2	Flat cable clips
3	Splicing connectors
2	J clips
1	Modular jack (COMCODE 406103655)

### 3.2.3 Install AUA7 LTU

Since the LTU must communicate with the LTC for administration and data retrieval, the LTU must be set into a state which can be recognized by the LTC before the LTU can be used.

The procedure for resetting the LTU into its *preservice* state is as follows:

1. Obtain an AUA7 LTU CP and inspect for any visible damage.
2. Set the **RLB** (reset LTU board) switch to the **ENB** (enable) position.
3. Plug the AUA7 LTU into the unmarked slot located between the protection LIU (LIU-P) slot and the line switch unit (LSU) slot of the white bank.

This starts the reset procedure. Both **BUSY** and **FAIL** LEDs light indicating that the LTU is resetting its memory to the *preservice* state.

If only the **FAIL** LED lights and remains lighted, a hardware failure has occurred. The LTU should be replaced and the procedure repeated.

4. Remove the AUA7 LTU when reset is complete.

**NOTE:**

The reset process is complete when both LEDs flash on and off. Removing the LTU before the LEDs begin to flash may leave the LTU in an unknown state.

5. Set the **RLB** switch to the **DIS** (disable) position.
6. Reinsert the AUA7 LTU.

The LTU powers-up.

During power up, the microcontroller within the LTU checks the

health of the LTU by performing built-in self-tests. The status of the LTU is reported to the internal status register. The **FAIL** LED lights briefly and then goes off during a normal power-up. If the LTU detects a hardware failure, the **FAIL** LED on the LTU faceplate lights and remains lighted.

The status register information is transferred to the LTC during the initial handshake between the LTU and LTC of every session so that the LTU administrator can be notified of the LTU condition.

7. If neither LED on the AUA7 LTU is lighted, then the LTU is operational and is in its *preservice* state.
8. The interface cabling between the LTU and the CTU and the modem cabling between the LTU and the CU can now be attached.
9. If the **FAIL** LED remains lighted, then the LTU is not operational.

The LTU must be replaced and the LTU installation procedure must be repeated.

#### **3.2.4 Replacing the Protector**

This section describes the procedure for replacing the present protector with a 3B2E protector. Replacing the protector isolates the LTU modem from the external environment.

1. Locate and remove the 3B1E (or equivalent) protector assigned to the VF pair specified in the work order record detail (WORD) document.
2. Insert the 3B2E protector into the vacant slot.

#### **3.2.5 Install Modem Cable Between LTU and POTS CU**

This section describes the procedure for connecting the LTU to the TIP and RING voice-frequency (VF) pair (Figure 4).

1. Remove covers in the cable area between the bank mounting uprights, if present.
2. Locate the VF wire pair, specified on the WORD document or work order, in the cable bundles within the bank uprights.
3. On the protector side of the 710 connector, carefully separate the appropriate TIP and RING pair from the cable bundle.
4. Refer to Figure 5 and insert the TIP lead of the specified VF pair and the TIP (green) wire from the modular jack into the splicing connector supplied.
5. Firmly crimp the connector and check to assure a reliable

connection.

6. Repeat Steps **4** and **5** connecting the RING lead from the VF pair to the RING (red) wire from the modular jack.
7. Insert one of the plugs on the 2-conductor cable into the modular jack and check to assure a reliable connection.
8. Dress the 2-conductor cable to the right side of the bank using the J clips provided (see Figure 4).
9. Attach the J clips to both sides of the bank.
10. Arrange the slack in the cable neatly within the cable area between the frame uprights.
11. Secure the 2-conductor cable to the J clips.
12. Dress the cable over the LSU, or the LSU slot if the LSU is not installed, and plug it into the **T/R** connector on the LTU faceplate. A click should be heard when the plug is installed into the connector indicating that the plug is fully seated and locked into the faceplate connector.
13. Dial the telephone number that is assigned to the LTU being installed. The **BUSY** LED should turn on when the LTU answers the call. If the **BUSY** LED does not light, then the modem cable is not installed properly or is connected to the wrong cable pair.
14. Place the cable bundles into the cable area and replace the cover.

### **3.2.6 Install Interface Cable Between LTU and CTU**

This section describes the procedures for connecting the LTU to the CTU (Figure 4).

1. Attach one of the plugs on the end of the 10-conductor flat ribbon cable to the **TEST ACCESS** connector on the LTU faceplate. Verify that the connector plug is fully seated and locked into the connector jack.
2. Dress the cable around the LSU, or the LSU slot if the LSU is not installed, to the right side of the channel bank.
3. Attach the flat cable clips to the right side of the channel bank.
4. Fasten the cable to the flat cable clip.
5. Fasten the cable to the second cable clip.

6. Dress the cable to the front of the channel bank.
7. Attach the remaining plug on the end of the cable to the **TEST ACCESS** connector on the CTU faceplate. Secure the connector plug using the attached screws.

This completes the LTU installation. The LTU can now be provisioned by the LTC.

### **3.3 Removing LTU From RT**

The following procedure should be performed anytime an AUA7 LTU is removed from an RT bank:

1. Remove the 2-conductor cable from the **T/R** connector on the LTU faceplate.
2. Remove the flat ribbon cable plug from the **TEST ACCESS** connector on the LTU faceplate.
3. Remove the LTU.

### **3.4 Connection of CIU to CTU When LTU is Installed**

Connect a CIU to the CTU as follows:

1. Remove the LTU flat ribbon cable plug from the **TEST ACCESS** connector on the CTU faceplate.
2. Attach the CIU test cable plug to the **TEST ACCESS** connector on the CTU faceplate.

After using the CIU, remove the CIU test cable plug and reconnect the LTU flat ribbon cable plug to the **TEST ACCESS** connector on the CTU faceplate.

### **3.5 Installing the LTC Software on the PC**

#### **3.5.1 General**

The LTC software is available on both 5.25- and 3.5-inch low density (360 KBytes) floppy disks with the contents of both disks being identical. The procedures for installing the software on a PC equipped with dual floppy drives or a PC equipped with a hard disk drive and setting environment variables are presented in this section.

**NOTE:**

The floppy disk containing the LTC software will not start up (boot) the computer.

### 3.5.2 Installation on PC with Dual Floppy Drives

To install the LTC software on a PC with dual floppy drives simply insert the LTC software diskette into either disk drive. Verify that the *current* disk drive coincides with the drive containing the LTC software.

It is suggested that you make a copy of the LTC software diskette to use as your working copy. A duplicate diskette can be made as follows:

1. Remove the *MS-DOS* system diskette from drive A, if present. Insert the LTC software diskette in drive A and the formatted target diskette in drive B.

2. At the **A>** prompt, type:

```
copy a:*. * b:
```

3. When the **A>** prompt is displayed, the copy is complete.

### 3.5.3 Installation on PC with Hard Disk Drive

To install the LTC software on the PC hard disk:

1. Insert the LTC software diskette in either drive A or drive B.
2. Create a sub-directory under the root directory using the following command at the **C>** prompt:

```
mkdir <sub-directory>
```

3. Copy the program files to the sub-directory using one of the following commands at the **C>** prompt.

If the A drive is used, enter this command:

```
copy a:\*.* c:\<sub-directory>
```

If the B drive is used, enter this command:

```
copy b:\*.* c:\<sub-directory>
```

**NOTE:**

The program may be renamed but the file should be an executable file ending with *.exe* (for example, *ltc.exe*).

4. It is suggested that you make a copy of the LTC software diskette to use as your working copy. A duplicate diskette can be made as follows:
  - o At the **C>** prompt, type either

**diskcopy a: a:** (A drive)

or

**diskcopy b: b:** (B drive)

- o Press the [Return] key and the screen displays:

**Insert SOURCE diskette in drive A (or B):**

**Press any key when ready . . .**

- o Insert the LTC software diskette in either drive A or drive B.
- o Press any key.

A message similar to the following is then displayed:

**Copying [xx] tracks**

**[yy] Sectors/Track, 2 Sides**

The contents of the diskette are copied into the computer's memory. After the contents of the diskette have been copied to memory, this message appears on the screen:

**Insert TARGET diskette in drive A (or B):**

**Press any key when ready . . .**

- o Remove the LTC software diskette from drive A or B and insert a formatted diskette that is to be the duplicate copy in drive A or drive B.
- o Press any key.

When the copy process is finished, the screen displays:

**Copy another diskette (Y/N)?**

- o Press the [N] key.

### 3.5.4 Setting PC Variables

If more than one communication port is available for use by the modem, the environment variable LTC\_CPRT should be set to specify the port desired by the user. To specify the port that should be used by the modem, you should use a text editor (for example, EDLIN supplied with the MS-DOS Disk Operating System) to add the following line to the AUTOEXEC.BAT file:

## 363-205-105

```
SET LTC_CPRT=COMX
```

where:

**X = 1 or 2 (port 1 or port 2).**

The *CONFIG.SYS* file should also be modified in order to assure that the LTC software operates properly with the PC. You should use a text editor to add the following lines to the *CONFIG.SYS* file:

```
BUFFERS=30
```

```
FILES=30
```

If the PC is operating with *MS-DOS* Disk Operating System version 3.2 or later, then the following line should also be added to the *CONFIG.SYS* file:

```
SHELL=COMMAND.COM C:\ /E:4000/P
```

## 4. LTC SOFTWARE

### 4.1 Overview

Software for the LTC allows the LTC to communicate with a selected LTU through a dial up port in order to send data to or receive data from the LTU. The LTC PC runs the LTC software and permits the user to set or change parameters in the LTU memory and retrieve test results from the LTU. The software also formats and stores LTU test results for post processing by the telephone company's operations support system.

The LTC software provides for two basic modes of operation: Indirect and Interactive. In the Interactive mode, the user is able to retrieve test results data from the LTU's memory and to set or change system parameters present in the LTU's memory on an interactive basis using the Set Up (terminal emulation) mode (hereafter referred to as simply Set Up), the Reporting menu, the Administration menu, and the Change Test Settings menu.

In the Interactive mode, the LTC software uses Set Up to support setting up the access to the LTU port for data exchange between the LTC and the LTU. While in Set Up, the LTC PC user is required to enter commands using preset function keys and to respond with the appropriate information (for example, modem telephone number) when prompted by the software. Set Up supports the following LTC user features:

- o Selection of the communication port to be used for a call to the LTU
- o Placing a call to the chosen LTU
- o Initiation of a data exchange with the LTU
- o Termination of a call to the LTU (not intended for routine use).

When communication is set up between the LTC and an LTU, the LTC displays dashes (one every 5 seconds) until the user selects the [F10] "initiate LTU session" command. The Reporting menu is then displayed.

In the Reporting menu, the LTC provides a choice of three activities that can be performed. These activities include:

- o Obtain test results: The LTU loop test results are downloaded from the LTU memory so that they can be viewed on the PC or printed out on the printer.
- o Administration access: This activity permits access to the activities or functions available in the Administration menu. The menu items present in the Administration menu are discussed in the next section.

- o End session and return to Set Up: Selection of this activity causes the session between the LTC and the LTU to be terminated and the LTC to be placed in Set Up.

In the Administration menu, the LTC provides a choice of various activities that can be performed. These activities include:

- o Obtain test results: The LTU loop test results are downloaded from the LTU memory so that they can be viewed on the PC or printed out on the printer.
- o Install password: This function allows an existing password to be replaced with a new password.
- o Change test settings: This function allows setting or changing the LTU loop testing parameters and verifying the current test setting values. The parameters that can be set or modified include:
  - a. System IDs
  - b. Test start and run times
  - c. Channel test permission information.
- o Verify remote clock: This function causes the current day of the week and time at both the LTU and the PC to appear on the PC screen. If the time at the LTU is not within 15 minutes of the time at the PC, the LTC prints a warning message.
- o Set remote clock: This function automatically updates the time at the LTU to agree with the time at the PC.
- o End session and return to Set Up: Selection of this activity causes the session between the LTC and the LTU to be terminated and the LTC to be placed in Set Up.

All of the activities provided by the LTC software, except one, must be performed in the Interactive mode. Data retrieval is the one activity that can be performed in either the Interactive or Indirect mode.

In the Indirect mode, the user is able to make use of a disk operating system batch file that initiates execution of the LTC program to retrieve test results data stored at the LTU and prepares the data for post processing by the telephone company's operations support system. The LTC PC user is responsible for creating an input file that is used by the software to sequentially access several LTUs, obtain the test results data from each, and place the data into a file. These activities are started manually (attended) but run unattended on either a delayed time schedule or immediately after entering the

appropriate command.

The software is also responsible for monitoring errors that can occur at various stages of the command/response process, such as the following:

1. Errors detected at the LTC PC keyboard: Upon receiving this type of error condition, the LTC reprompts for a corrected value of the data.

Example of error message:

```
/* RESPONSE CONTAINS INVALID CHARACTER(S) */
```

(Prompt)

2. Errors detected by the LTU: These errors occur during the execution of LTC/LTU interface commands in the LTU. These errors inhibit the writing of data to the LTU memory. Responses to this error condition are dependent upon the command being executed by the LTC. Example of error message:

```
/* LTU DOES NOT ACCEPT DATA  
CHECK LTU STATUS FOR POSSIBLE FAULT */
```

3. Errors detected by the data link: These errors occur whenever data sent over the data link, in either direction, between the LTC and LTU are not received (time out condition) or are incorrectly received and cannot be corrected. These type of errors cause both the LTC and the LTU to hang up and return to the appropriate state or mode.

Example of error message:

```
/* NO COMMUNICATION WITH THE LTU  
REDIAL LTU AND INITIATE SESSION  
POSSIBLE DATA LINK OR LTU FAILURE  
RETURNING TO SET UP MODE */
```

4. Errors detected by the LTC itself: The LTC screens the user's password input. If the password is invalid, an error message is displayed.

Example of error message:

```
/* PASSWORD IS NOT VALID  
RETURNING TO REPORTING ACCESS */
```

## 4.2 Menu Map

The menu map for the LTC software is shown in flowchart format in

Figure 6. Descriptions and use of the menus shown in the menu map are presented later.

### 4.3 Entering Information

#### 4.3.1 General

In Set Up, most characters input from the keyboard are interpreted literally or ignored. Exceptions to this are the keys listed on the static display (the last six lines at the bottom of the screen). In Set Up, characters are sent to the modem or port as they are entered; this allows you to use the LTC as a terminal to control your local modem.

In the Reporting, Administration, and Change Test Settings menus, characters are *collected*; that is, they are not processed until after the [Return] key is pressed. Letters may be entered as uppercase or lowercase. Lowercase letters are mapped to uppercase except in Set Up. A tab is interpreted as a space except in Set Up. Special functions for some of the keys are shown on the static display. These and other special functions (for example, [Backspace] key and @ character) are described later.

#### 4.3.2 Keyboard

The keys in this User's Manual refer to the AT&T PC 6300 WGS keyboard. If the keyboard does not have the keys identified below, refer to the user's guide for your PC to determine equivalent keys.

#### 4.3.3 Special Keys (F1 - F12)

These special keys function as follows in Set Up:

[F1]	enters the Comm Port selection function.
[F2]	exits to the disk operating system.
[F3]	sends the hang up command to the modem. This command drops DTR (data terminal ready) and RTS (ready to send).
[F4]	is not used.
[F5]	is not used.
[F6]	sends a BREAK over the data link.
[F7]	enters the Modem Dial function if modem is AT-compatible. Otherwise, user must enter all modem commands from PC keyboard.
[F8]	is not used.
[F9]	is not used.
[F10]	initiates a session with the LTU.
[F11]	is not used.
[F12]	is not used.

Special keys **F4** and **F5** are active in the Reporting menu, Administration menu, and Change Test Settings menu and

are used to enter the following information:

- [F4] enters Y (yes) and [Return] in response to a prompt.
- [F5] enters N (no, none) and [Return] in response to a prompt.

The [Pause] key should never be used (see Section 4.9, "GETTING OUT OF TROUBLE").

### 4.3.4 Help Key

The [?] is used to request a help message for the current prompt. Help messages list the valid entries showing the expected format or define the range of entries for the prompt. Help messages are described in more detail in GETTING OUT OF TROUBLE.

### 4.3.5 Backspace and Line Erase Characters

The backspace characters are [Backspace] and [Delete]. Each of these erases a single character at a time from the input except when in Set Up. The line erase character is [@], which erases back to the beginning of the line except in Set Up.

### 4.3.6 Print Screen

If your PC has a printer attached, pressing [Ctrl] [PrtSc] turns on printing; pressing [Ctrl] [PrtSc] again turns off printing. The static display shows the status of the print feature [ON (flashing) when the printer is enabled, OFF when the printer is disabled, or NOT AVAILABLE if the PC does not have a printer, the printer's power switch is off, the printer is out of paper, or the PC sends too much data causing the printer's buffer to overflow].

**CAUTION:**

*Do not use [Shift] [PrtSc] unless you are sure it is correct for your printer, the printer is connected to the PC, and the power is on. This may lock up the software and you will have to reboot.*

### 4.3.7 Paging

Screen pages are 19 lines long and 80 characters wide. The keys used for paging are listed on the static display at the bottom of the screen. They are:

- [PgUp] displays previous page (PREV or page-up key).
- [PgDn] displays next page (NEXT or page-down key).
- [Home] displays the oldest page available in memory.
- [End] restores the display to the exact state it was in before paging began, including any blank lines at the bottom. The cursor appears immediately following the last character output to the display.

- [^] scrolls the display up one line.
- [v] scrolls the display down one line.

The static display tells you when these keys are active [PAGING: ON (flashing)]. Paging keys can be used whenever the software is waiting for input from the keyboard. While paging is on, if any key other than one of the paging keys is pressed, the display is restored to the state it was in before paging began, paging is turned off, and the character is entered as a response to the prompt. Pressing [End] restores the display and turns off paging (PAGING: OFF). The paging keys have no effect during unattended operation (Indirect mode).

### **4.3.8 Abort Functions**

#### **4.3.8.1 Abort Using ESC Key**

Using the [Esc] key to escape an activity or command at a prompt (when the software is waiting for input), depends on the mode or menu:

- o In Set Up, the escape character is sent to the port.
- o At the Comm Port and Modem Dial prompts, pressing [Esc] causes a return to Set Up.
- o In Interactive mode (Administration, Reporting, or Change Test Settings menu), pressing [Esc] causes a return to the Reporting or Administration menu, whichever was more recently displayed.

**NOTE:**

The [Esc] key is disabled while the LTC is in the Indirect mode.

Pressing the [Esc] key after sending a command to the LTU may cause the following message to be displayed:

```
/*ESCAPE KEY INTERRUPT:RETURNING TO PREVIOUS MENU*/
```

However, results in this case are unpredictable.

#### **4.3.8.2 Abort Using Function Key**

Pressing function key [F2] when the LTC is in the Indirect mode clears the PC screen and exits from the program back to the disk operating system.

**NOTE:**

The [F2] key is ignored while the LTC is in the Interactive Mode. If the LTC is in Set Up, pressing [F2] causes a return to the disk operating system.

## **4.4 Time-Out Functions**

### **4.4.1 Keyboard Time-Out**

A keyboard time-out feature exists that monitors time intervals between keyboard entries. If the time interval between entries from the keyboard exceeds 10 minutes, the following message is displayed:

---

```
/* SESSION WILL END IN ONE MINUTE,  
   FOR LACK OF KEYBOARD ACTIVITY --  
   PRESS ANY KEY TO CONTINUE. */
```

---

To prevent the session from ending and to reset the 10-minute timer, at least one character must be entered from the keyboard. The character is interpreted as a response to the current prompt. If the user does not enter anything at the keyboard during the next minute, the software displays the following message:

---

```
/* NO INPUT -- SESSION ENDS --  
   RETURNING TO SET UP MODE */
```

---

ends any dialog with the LTU, and exits to Set Up.

The occurrence of the keyboard time-out takes place only under one of the following conditions:

- o The LTC has waited 10 minutes for user input.
- o The user has pressed function key [F1] or [F7] and has not responded to the Comm Port or Modem Dial prompt for 10 minutes or returned to Set Up.

#### 4.4.2 Inactivity Time-Out

A link time-out feature prevents the LTC from tying up resources (the phone line and LTU) when the software is not being used. If the LTU does not receive any activity from the LTC in 60 minutes, it sends a *no activity* message to the LTC and hangs up the modem. When the LTC receives the message and carrier is lost, the software displays the following message:

---

```
/* DATA LINK DISCONNECTED BECAUSE OF INACTIVITY  
   RETURNING TO SET UP MODE */
```

---

hangs up the modem, and returns to Set Up.

#### 4.4.3 Command Time-Out

When a command is sent from the LTC to the LTU, a timer is set which requires that a response be received from the LTU within a prescribed time interval. Multiple attempts are made to send the command to the LTU, but if all attempts fail, the LTC drops the call and displays the following error message:

---

```
/* NO COMMUNICATION WITH THE LTU
   REDIAL LTU AND INITIATE SESSION
   POSSIBLE DATA LINK OR LTU FAILURE
   RETURNING TO SET UP MODE */
```

---

## 4.5 Static Display

The last 6 lines of the 25 line screen are reserved for the static display. This display lists the paging keys, the paging status and print screen status, and the active special key functions. The value displayed after Ver is the version number of the software release you are using. The static display reflects the current status of the LTC software and changes whenever the status changes (that is, mode changes). The static display for Set Up is different from the static display for the Reporting, Administration, and Change Test Settings menus.

1. In Set Up, the static display is:

---

```
SET-UP ACTIVE (Copyright (c) 1989 AT&T. All rights reserved. Ver 1.x.y)
PAGING KEYS -> Up Down Pgup PgDn Home End          PAGING: [ON or OFF]
F1: PORT SELECT          F6: SEND BREAK
F2: EXIT TO DOS          F7: MODEM DIAL          Ctrl PrtSc: [ON, OFF, or
F3: HANG UP              F10: INITIATE LTU SESSION      NOT AVAILABLE]
```

---

2. At the Comm Port (F1) and Modem Dial (F7) prompts, the static display is:

---

```
SET-UP ACTIVE (Copyright (c) 1989 AT&T. All rights reserved. Ver 1.x.y)
PAGING KEYS -> Up Down Pgup PgDn Home End          PAGING: [ON or OFF]
Esc: ABORT COMMAND
F4: YES                  Ctrl PrtSc: [ON, OFF, or
F5: NO                   NOT AVAILABLE]
```

---

3. In Reporting, Administration, and Change Test Settings menus, the static display is:

---

```
SESSIONESTABLISHED(Copyright(c)1989AT&T. Allrightsreserved.Ver1.x.y)
PAGING KEYS -> Up Down Pgup PgDn Home End      PAGING: [ON or OFF]
Esc: ABORT COMMAND
F4: YES                                           Ctrl PrtSc: [ON, OFF, or
F5: NO                                           NOT AVAILABLE]
```

---

4. In the Indirect mode the static display is:

---

```
UNATTENDED      (Copyright(c)1989AT&T. Allrightsreserved.Ver1.x.y)

F2: EXIT TO DOS

                                           Ctrl PrtSc: [ON, OFF, or
                                           NOT AVAILABLE]
```

---

## 4.6 Menu Format

All LTC menus are displayed with a header and followed by the menu list and a prompt. An example of a menu format follows:

---

```
/* CHOOSE ONE OF THE FOLLOWING */
1.ITEM1
2.ITEM2
3.ITEM3
4.ITEM4
5.ITEM5
PROMPT =
```

---

The "=" indicates that the software is waiting for input. An item may be selected by typing in the number, the item name, or the first few letters of the item name sufficient to make it unique, followed by a [Return]. Letters may be entered as lowercase or uppercase but will always be displayed as uppercase. Prompts are displayed as:

**PROMPT [Default] =**

Type in your entry at the "=" followed by [Return]. *Default values*, if present, are shown with square brackets [ ] around the item and may be selected by simply pressing [Return].

Not all of the menus and prompts have default values. Often, the first time a menu or prompt is displayed, no default value is given. For some prompts, after a value has been entered, it becomes the default value for repeated display of the same menu or prompt.

## 4.7 Output Messages

Output messages from the LTC software start with "/\*" on the first line and end with "\*/" on the last line. Completion messages are displayed when a command is completed (for example, following the successful replacement of the current password with a new password). An error message is displayed if any error occurs from keyboard input or internal processing (for example, if a file needed for input is not found). Status messages may be displayed following an entry at a prompt (for example, following the entry of the modem telephone number during Set Up). A warning message is displayed if events or data are not *normal* (for example, if the test run time is too short).

When the software is waiting on a response from the LTU, an in-progress message may be displayed:

---

```
/* IP - COMMAND IS EXECUTING AND COULD TAKE SEVERAL SECONDS TO COMPLETE,
   PLEASE STAND BY... */
```

---

Please be patient when this message appears.

## 4.8 Getting Started

### 4.8.1 Interactive Mode

#### 4.8.1.1 General

After you have loaded the LTC software on the PC using the procedures in Chapter 3, "INSTALLATION AND REMOVAL," enter "ltc" (or the name of the LTC program if it was renamed) to start up the LTC software. This puts you in Set Up.

A typical user scenario is as follows:

- o Select or confirm communication port (Comm Port prompt): [F1]
- o Dial up the LTU (Modem Dial prompt): [F7]
- o Initiate the session with the LTU: [F10]
- o Obtain LTU test results and/or perform administration activities
- o Return to Set Up via menu selection
- o Return to the disk operating system: [F2].

During start-up, the software looks at the communication ports to see if one is available. If no port is available or none has been installed, the software displays the message:

---

```
/* COMM PORT NOT AVAILABLE
   ALL PROCESSING IS STOPPED */
[HIT F2 TO EXIT TO DOS]
```

---

and exits to the disk operating system after the [F2] key is pressed. If only one port is installed, the software uses it as the working port. If two ports are available, the LTC determines whether the user has set the environment variable LTC\_CPRT to COM1 or COM2. If the variable has been set, the software uses the specified port. Otherwise the software selects Port 1. This can be changed by using the Comm Port prompt (F1) discussed in the following section.

#### 4.8.1.2 Set Up

Once in Set Up, the software displays the following screen and waits for an entry ([F1], [F2], [F3], [F6], [F7], or [F10]):

---

```
SET-UP ACTIVE (Copyright (c) 1989 AT&T. All rights reserved. Ver 1.x.y)
PAGING KEYS -> Up Down Pgup PgDn Home End          PAGING: [ON or OFF]
F1: PORT SELECT          F6: SEND BREAK
F2: EXIT TO DOS          F7: MODEM DIAL          Ctrl PrtSc: [ON, OFF, or
F3: HANG UP              F10: INITIATE LTU SESSION          NOT AVAILABLE]
```

---

The function keys that set up a communication link between the LTC and LTU are:

- o Communications Port: [F1]
- o Modem Dial: [F7].

When you have selected either of these prompts in the Set Up (terminal emulation) menu, the static display changes to:

---

```
SET-UP ACTIVE (Copyright (c) 1989 AT&T. All rights reserved. Ver 1.x.y)
PAGING KEYS -> Up Down Pgup PgDn Home End          PAGING: [ON or OFF]
Esc: ABORT COMMAND
F4: YES                      Ctrl PrtSc: [ON, OFF, or
F5: NO                      NOT AVAILABLE]
```

---

The [Esc] key may be used to exit (back up to Set Up) from either of these prompts. The [F4] and [F5] keys are not used at these

prompts.

The modem must be compatible with the AT command set for the Modem Dial prompt to be used (see Modem Dial prompt description). If the modem is not AT command compatible, you should select a communication port, then follow instructions provided by the manufacturer of the modem. When you are connected with the LTU, press [F10] to initiate a session with the LTU.

The Comm Port and Modem Dial prompts are described as follows:

1. Comm Port prompt: In Set Up, press [F1] (PORT SELECT) to display the Comm Port prompt. The software displays the following prompt:

---

```
ENTER COMM PORT NUMBER [Current value] =      (1 or 2)
```

---

If you enter either [Return] or a communication port number followed by a [Return], the software exits to Set Up using either the current value (if [Return] is pressed) or the communication port entered.

If [Esc] is entered, the LTC exits to Set Up without changing the port.

The software checks the requested port and, if valid, directs subsequent output to that port and displays the following completion message:

**/\* OK \*/** If the requested port is invalid, but there is an available valid port, the software displays the message:

---

```
/* COMM PORT [Requested Value] NOT AVAILABLE  
   PORT [Valid Value] HAS BEEN SELECTED */
```

---

If you change communication ports when a call is already established, the call is dropped (that is, hangup is sent). After the communication port has been selected, the software returns to Set Up.

2. Modem Dial prompt: In Set Up, press [F7] (MODEM DIAL) to display the Modem Dial prompt. The software displays the following prompt after it determines that a call is not presently established and a compatible modem is present:

---

```
ENTER TELEPHONE NUMBER FOR THE MODEM [ ] =
```

---

The software returns to Set Up if you enter [Esc].

The software looks at the entered telephone number to verify that it contains only the following characters:

Digits 0 - 9

[ , ] which is a delay indicator passed to the modem

[ - ] which is displayed, but otherwise ignored, and

[W, w] which is a wait for second dial tone indicator passed to the modem.

The software then passes the numbers (including any "W"s and ", "s) to the modem in a dial command. It then displays the message:

```
/* DIALING IS IN PROGRESS */
```

After the communication link between the LTC and the LTU has been established, the message

```
CONNECT
```

or

```
CONNECT 1200
```

is displayed and the LTC software returns to Set Up.

When communication is set up between the LTC and the LTU, the LTC displays dashes (one every 5 seconds) until the user enters a command.

You may enter an AT command at any time before or after the Modem Dial prompt (but only while in Set Up).

If a call is already established when the Modem Dial prompt is selected, the software displays the message:

---

```
/* MODEM ALREADY HAS A CALL -- PRESS  
F3 TO HANG UP MODEM */
```

---

and returns to Set Up.

The software also verifies the presence of a compatible modem before displaying the Modem Dial prompt. Use of the Modem Dial prompt requires a modem compatible with the AT command set (for example, the AT&T Model 4000 Modem, the AT&T Model

4112 Modem, or the Hayes **Smartmodem 1200**(TM)).

**NOTE:**

Although any AT compatible modem will work with the Modem Dial prompt, there may be slight differences in modem operation among the various manufacturers of modems which may affect the LTC screen displays. These differences are not discussed here and should not affect system operation.

If the presence of a compatible modem is not verified, the software displays the message:

---

```
/* CANNOT VERIFY COMPATIBLE MODEM --  
USE CALL SET UP PROCEDURE REQUIRED  
BY YOUR MODEM */
```

---

and returns to Set Up.

#### 4.8.1.3 Reporting Menu

After dialing the LTU and while in Set Up, press [F10] (INITIATE LTU SESSION) to enter the Reporting menu. The menu displayed is:

---

```
/* CHOOSE ONE OF THE FOLLOWING */  
1.OBTAIN TEST RESULTS  
2.ADMINISTRATION ACCESS  
3.END SESSION AND RETURN TO SET UP  
COMMAND =
```

---

**NOTE:**

Status *WARNING* messages may appear on the screen before the menu is displayed. If a status *WARNING* message does appear, refer to Chapter 6, "APPENDIXES" for an explanation of the message.

If the LTC software receives an indication that the LTU built-in self-test has detected errors, the software displays the following error message:

---

```
/* LTU IS REPORTING DATA FAILURES AND ALL RESULTS ARE UNCERTAIN  
LTU MAINTENANCE MAY BE NECESSARY  
IF YOU MAKE CHANGES BE SURE THE LTU VALUES ARE CORRECT */
```

---

followed by the Reporting menu.

The results obtained when selecting an item from this menu are

described in the following:

1. OBTAIN TEST RESULTS: When you select this item from the Reporting menu, the following message is displayed:

```
/* ADJUST THE PRINTER AND PRESS SPACE
   BAR WHEN READY -- USE CTRL PRT-SC TO
   ENABLE OR DISABLE PRINTER */
[HIT SPACE BAR TO CONTINUE]
```

If the LTU is in the *preservice* state, the LTU test results are displayed with both system IDs appearing as *NONE* and all channels reporting as *NOT TESTED* since no system IDs have been entered. If the printer is enabled, a copy of the results is printed in the following format:

---

DROP TEST RESULTS FOR SYSTEMS 1234 AND 5678 AT 08:15

USER NUMBER	SYSTEM ID	CHANNEL NUMBER	SEVERITY OF FAILURE
-----	-----	-----	-----
---	1234	01	SUS
---	1234	02	MOD
---	1234	03	SEV
---	1234	04	NOT TESTED
.	.	.	
.	.	.	
.	.	.	
.	.	.	
---	5678	95	INVALID TEST RESULT
---	5678	96	SUS

```
/* RESULTS FOR CHANNELS NOT SHOWN ARE OK */
```

---

Not all channels may appear in the test results report because channels that pass the tests and are found to be good are not listed in the report.

The *USER NUMBER* is a user supplied identification number (maximum of 16 digits). It is not used in the Interactive mode and is displayed as three dashes. The *USER NUMBER* is used in the indirect mode and will be discussed in the Indirect Mode Overview section.

The *SYSTEM ID* column contains the identification number (four digits) of the dual bank assembly housing the LTU and the CUs associated with the channels that are tested.

The *CHANNEL NUMBER* column contains the individual channel ID

numbers (01 - 96) that coincide with the channel numbers in a Series 5 system.

The *SEVERITY OF FAILURE* column contains the results of the channel tests or an indication that the channel was not tested or that the LTU did not send a valid test result for the channel. The various results that can appear in this column are:

- o SUS (suspect)
  - o MOD (moderate)
  - o SEV (severe)
  - o NOT TESTED
  - o INVALID TEST RESULT.
2. ADMINISTRATION ACCESS: When you select this item from the Reporting menu the LTC prompts for a password. If you enter the correct password, the Administration menu is displayed. Refer to Section 4.8.1.4, "Administration Menu," for a description of this menu.
3. END SESSION AND RETURN TO SET UP: When you select this item from the Reporting menu, the software:
- o Discontinues any dialog that is established with an LTU (responses from the LTU, if any, are not displayed)
  - o Returns to Set Up
  - o Updates the static display at the bottom of the screen.

#### 4.8.1.4 Administration Menu

Using the Administration menu includes selecting menu items when the LTU is in the *preservice* and *in-service* states. In areas where there are differences between selecting menu items with the LTU in the *preservice* state and selecting menu items with the LTU in the *in-service* state, the differences are explained. Otherwise, the following description applies to operation with the LTU in either state.

When you select ADMINISTRATION ACCESS from the Reporting menu, the software prompts you for your password as follows:

**PASSWORD =**

**NOTE:**

The password is never displayed on the LTC PC screen.

Enter the correct password, which will be 000000 (six zeros) if the LTU is in the *preservice* state, and the Administration menu is displayed.

---

```
/* CHOOSE ONE OF THE FOLLOWING */
1.OBTAIN TEST RESULTS
2.INSTALL PASSWORD
3.CHANGE TEST SETTINGS
4.VERIFY REMOTE CLOCK
5.SET REMOTE CLOCK
6.END SESSION AND RETURN TO SET UP
COMMAND =
```

---

To select one of the items in the menu, simply type the number associated with the desired item or the first letter of the item (for example, type the number 1 or letter O to select OBTAIN TEST RESULTS) followed by a carriage return. The results obtained when selecting an item from this menu are described below:

1. OBTAIN TEST RESULTS: When you select this item from the Administration menu, you obtain the same results as choosing OBTAIN TEST RESULTS in the Reporting menu described previously.
2. INSTALL PASSWORD: When you select this item from the Administration menu, the software displays:

**CURRENT PASSWORD =**

Type in the current password again if the LTU is in the *in-service* state or 000000 (six zeros) again if the LTU is in the *preservice* state. The password is not displayed on the screen.

The software then verifies the password and if the password is not correct, the following error message is displayed:

```
/* PASSWORD IS NOT VALID
RETURNING TO REPORTING ACCESS */
```

If the password is correct, the software prompts you for your new password as follows:

**NEW PASSWORD =**

In order for the new password to be valid, it must meet the following criteria:

- o Contain between 8 and 10 characters.

- o Each character must be one of the following:
  - Capital letter (A - Z)
  - Number (0 - 9)
  - Punctuation mark from the following list:
    - ! (exclamation point)
    - " (double quotation marks)
    - # (pound sign)
    - \$ (dollar sign)
    - % (percent sign)
    - & (ampersand)
    - ' (apostrophe)
    - ( (left parenthesis)
    - ) (right parenthesis)
    - \* (asterisk)
    - + (plus sign)
    - , (comma)
    - (minus sign)
    - . (period)
    - / (virgule)
    - : (colon)
    - ; (semicolon)
    - < (less than)
- o Contain at least two letters (A-Z) and two numbers (0-9).
- o Spaces and backspaces are not allowed.
- o When the characters in the new and current passwords are compared to each other according to their relative

positions, no more than four characters are allowed to match.

**NOTE:**

Do not use the passwords in the following example as real passwords.

For example, if the current password is 12ABCDEF, then 89ABCDQR would be a valid new password since it contains two numbers (89), at least two letters (ABCDQR), and only four characters remain unchanged (ABCD). The following passwords are examples of invalid passwords because five or more characters remained unchanged: 12XYCDEF, 34ABCDXF, and 12XBDEX.

Enter your new password at the prompt. The software verifies that the password meets all of the above criteria. If the password does not meet the criteria, the LTC displays:

```
/* NEW PASSWORD IS NOT VALID  
  PASSWORD HAS NOT CHANGED */
```

and returns to the Administration menu. If the new password is valid, the software then prompts you a second time for the new password as follows:

**NEW PASSWORD AGAIN =**

**NOTE:**

Both entries of the new password must match before the current password is replaced with the new password.

Enter the new password again. If the two entries do not match, the following error message is displayed:

```
/* PASSWORDS DO NOT MATCH  
  PASSWORD HAS NOT CHANGED */
```

and the software returns to the Administration menu.

If the two new password entries match and are valid, but the command fails to change the password due to a problem on the link or at the LTU, the following error message is displayed:

```
/* NEW PASSWORD WAS NOT PROCESSED  
  PROBLEM IS AT LTU OR IN DATA LINK  
  PASSWORD WAS NOT CHANGED */
```

If the two new password entries match and are valid and the current password has been replaced with the new password, the following response is displayed:

**/\* PASSWORD CHANGED \*/**

and the software returns to the Administration menu.

**NOTE:**

It is important that you remember the new password since it is not possible to read it once it has been entered. If the password is forgotten, the LTU must be manually restored to the *preservice* state which resets the password back to 000000 (six zeros) but also erases all other information that may have been previously entered into the LTU memory (such as channels that have been denied from testing).

3. CHANGE TEST SETTINGS: When you select this item from the Administration menu, the Change Test Settings menu is displayed. Refer to Section 4.8.1.5, "Change Test Settings Menu," for a description of this menu.
4. VERIFY REMOTE CLOCK: When you select this item from the Administration menu, the current time and day at the LTC and LTU are displayed as follows:

**CURRENT TIME AT LTU = hr:mi day**  
**CURRENT TIME AT PC = hr:mi day**

Where:

hr = hour

mi = minute

day = three letter code for day of week (MON, TUE, WED, THU, FRI, SAT, SUN)

Example: 15:05 TUE (3:05 pm Tuesday)

An appropriate warning message is displayed if the LTU time is:

- o More than 15 minutes but not more than 1 hour different from the PC time
- o More than one hour different from the PC time
- o Set to a different day than the PC time
- o Invalid.

5. SET REMOTE CLOCK: Selection of this menu item automatically changes the time and day settings at the LTU to agree with the time and day settings at the LTC PC. The time and date at the

LTC PC should be set correctly before executing this menu item. After the software has made the necessary changes to time and day settings at the LTU, the following is displayed:

**CURRENT TIME AT LTU** = hr:mi day  
**CURRENT TIME AT PC** = hr:mi day

**NOTE:**

The PC clock time should be verified, using the VERIFY REMOTE CLOCK command, before the SET REMOTE CLOCK command is used.

6. END SESSION AND RETURN TO SET UP: The LTC response to the selection of this menu item is determined by the state of the LTU, *preservice* or *in-service*, during initial access to the Administration menu. If the LTU was in the *in-service* state when the Administration menu was initially accessed, then selection of this menu item takes you out of this menu, returns you to Set Up, and hangs up the modem with the following being displayed:

**/\* SESSION COMPLETE  
RETURNING TO SET UP MODE \*/**

If the LTU was in the *preservice* state when the Administration menu was initially accessed, then the LTC response to the selection of this menu item depends on whether or not you have changed all of the following fields:

- o LTU clock
- o Password
- o System IDs
- o Test start/run times
- o Allow/prohibit testing.

The LTC keeps track of the fields that you have successfully changed and if you have changed all of these fields then selection of this menu item will yield the *in-service* response described previously.

If you have not changed all of these fields, then the following occurs:

1. The LTC selects a field that has not been changed and prompts you for changes to that field as follows:

**NOTE:**

Your screen display will not appear exactly as the one

below. This display shows all of the fields whereas your display will only show one field that you have not changed.

```
/* THE VALUE(S)
FOR THE LTU CLOCK
FOR THE PASSWORD
FOR THE SYSTEM IDS
FOR THE TEST START TIME
FOR THE MAXIMUM TIME THE TEST SHOULD RUN
SPECIFYING CHANNELS FOR WHICH TESTING IS
ALLOWED
MAY NOT BE CORRECT */
```

DO YOU WANT TO CHANGE? [YES]

2. If you decide to change the data in this field (YES response), then continue with Step 3. Otherwise, proceed to Step 6.
3. The LTC enters the prompting sequence for changes to data in that field (for example, if you want to change the password, the LTC prompts you for the old password).
4. After the field is successfully changed, the LTC returns to the menu that contains the field that was changed (Administration menu for LTU clock and password and Change Test Settings menu for all others).
5. If you select the END SESSION AND RETURN TO SET UP menu item again, the LTC searches for another field that has not been changed. If another unchanged field is found, the procedure is repeated from Step 1. Otherwise, proceed to Step 7.
6. If you decide not to change the data in this field (NO response), the LTC makes a note that it has prompted you for changes to this field and treats the data in this field as if it had been changed. The LTC now searches for another field that has not been changed. If another unchanged field is found, the procedure is repeated from Step 1. Otherwise, continue with Step 7.
7. After all fields have either been successfully changed or you have responded NO to prompts to change fields, the LTC displays the following message:

```
/* SESSION COMPLETE
RETURNING TO SET UP MODE */
```

and the LTU is now in the *in-service* state.

#### 4.8.1.5 Change Test Settings Menu

The Change Test Settings menu allows you to set and verify system parameters as follows:

---

```
/* CHOOSE ONE OF THE FOLLOWING */  
1.SYSTEM IDS  
2.ALLOW OR PROHIBIT TESTING  
3.TEST START AND RUN TIMES  
4.VERIFY TEST SETTINGS  
5.RETURN TO ADMINISTRATION MENU  
COMMAND =
```

---

To select one of the items in the menu, simply type the number associated with the desired item name or the first letter of the first word in the item name. The results obtained when selecting an item from this menu are described in the following:

1. SYSTEM IDS: When you select this item from the Change Test Settings menu, the software displays:

**FIRST SYSTEM ID [ ] = (0001 to 9999 or NONE)**

If the LTU is in the *preservice* state, *NONE* appears in the brackets [ ]. Otherwise, the current system ID for the first system is displayed. Type in the system ID of the first system or press [Return] to select the default value. The software then displays:

**SECOND SYSTEM ID [ ] = (0001 to 9999 or NONE)**

*NONE* also appears in these brackets [ ] if the LTU is in the *preservice* state. Otherwise, the current system ID for the second system is displayed. Type in the system ID of the second system or press [Return] to select the default value. After the software has verified and processed the system IDs, it displays:

**/\* OK \*/**

2. ALLOW OR PROHIBIT TESTING: When you select this item from the Change Test Settings menu, you are allowed to either prohibit loop testing of individual channels on a per system basis or permit loop testing on channels that were previously prohibited. If the LTU is in the *preservice* state at the beginning of the session and you want all the channels at the dual channel bank to be tested, no changes are necessary. If you want to prohibit testing on certain channels, then only those channels need to be entered at the "prohibit tests" prompt. It is not necessary to enter the other channels at

the "allow tests" prompt. An entry is needed at the "allow tests" prompt only when you want to test a channel that was previously prohibited.

If both system IDs are *NONE* or if either system ID is invalid (system ID is not within the range of 0001 to 9999), the software displays:

```
/* SYSTEM ID(S) MUST BE SPECIFIED BEFORE  
TEST SETTINGS CAN BE CHANGED */
```

or

```
/* INVALID SYSTEM ID(S) MUST BE CHANGED */
```

respectively, and returns to the Change Test Settings menu.

If at least one valid system ID has been specified, the software displays:

**NOTE:**

The software will display whichever system IDs are valid -- the FIRST SYSTEM, SECOND SYSTEM, or both.

```
/* FIRST (or SECOND) SYSTEM  
SYSTEM ID: [SYSID]  
TESTING IS PROHIBITED ON CHANNEL(S):  
(channel numbers not to be tested) */
```

and prompts you for additions to the list of channels on which testing is prohibited as follows:

**ENTER CHANNELS TO BE CHANGED TO PROHIBIT TESTS =**

Enter each channel ID number, followed by a space, for the channel(s) that you do not want to be tested or enter [Return] if no entries are to be made.

The software then displays the following prompt to allow you to enter the channels that you want to be tested (that is, to remove the channels from the list of channels on which testing is prohibited):

**ENTER CHANNELS TO BE CHANGED TO ALLOW TESTS =**

Enter each channel ID number, followed by a space, for the channel(s) that you want to be tested or enter [Return] if no entries are to be made. The software then displays the following list of channels not to be tested followed by a prompt for changes:

**NOTE:**

The software will display whichever system IDs are valid -- the FIRST SYSTEM, SECOND SYSTEM, or both.

```
/* FIRST (or SECOND) SYSTEM
   SYSTEM ID: [SYSID]
   TESTING IS PROHIBITED ON CHANNEL(S):
   (channel numbers not to be tested) */
```

**WOULD YOU LIKE TO MAKE ANY CHANGES? [YES] =**

If changes are not required, enter "N" or "NO" and the software displays:

```
/* OK */
```

and returns to the Change Test Settings menu. If changes are required, press [Return] or enter "Y" or "YES" and the software prompts you again for changes to the list of channels on which testing is prohibited. Repeat the procedure described previously to add channels to or remove channels from the list. After all changes have been made and the list is correct, at the prompt

**WOULD YOU LIKE TO MAKE ANY CHANGES? [YES] =**

enter "N" or "NO" and the software displays:

```
/* OK */
```

and returns to the Change Test Settings menu.

3. **TEST START AND RUN TIMES:** When you select this item from the Change Test Settings menu, four separate prompts are displayed: two prompts for setting test start time (hour and minute) and two for setting maximum test run time (hours and minutes). The following prompts for setting the test start time appear first:

**TEST START TIME (HOUR) [] = (0 to 23)**

**TEST START TIME (MINUTE) [] = (0 to 59)**

If the LTU is in the *preservice* state, a "0" will appear in the brackets for both prompts.

Enter the hour and minute, respectively, that you want the LTU to begin running the loop tests (for the hour, 0 to 11 is from midnight to 11 am; 12 to 23 is from noon to 11 pm) or enter [Return] if the default time is desired.

The following prompts for the maximum length of time the tests

are to be performed appear next:

**MAXIMUM TIME TESTS SHOULD RUN (HOURS) [ ] = (0 to 23)**  
**MAXIMUM TIME TESTS SHOULD RUN (MINUTES) [ ] = (0 to 59)**

If the LTU is in the *preservice* state, a "0" will appear in the brackets for both prompts.

Enter the maximum number of hour(s) and minutes, respectively, that you want the loop tests to be performed or enter [Return] if the default value is desired. The normal amount of time allocated for the test to be run is usually from one to five hours.

4. **VERIFY TEST SETTINGS:** When you select this item from the Change Test Settings menu, the LTC obtains and displays the current test setting values from the LTU. An example of the output follows:

```

/* ADJUST THE PRINTER AND PRESS SPACE
   BAR WHEN READY -- USE CTRL PRT-SC TO
   ENABLE OR DISABLE PRINTER */
[HIT SPACE BAR TO CONTINUE]

/* FIRST SYSTEM
   SYSTEM ID: 1234
   TESTING IS PROHIBITED ON CHANNEL(S):
     1  3  5  7  9 10 13 15 17 18 19 20
    23 27 28 29 30 31 43 45 67 78 79 80 */

/* SECOND SYSTEM
   SYSTEM ID: 4321
   TESTING IS PROHIBITED ON CHANNEL(S):
     2  4  6  8  9 12 17 18 19 20 26 27
    28 29 30 32 33 37 44 50 72 74 76 78 */

/* TEST START TIME = 01:30
   MAXIMUM RUN TIME = 02:00 */

```

5. **RETURN TO ADMINISTRATION MENU:** Selection of this menu item takes you immediately out of this menu and displays:

```

/* RETURNING TO ADMINISTRATION MODE */

```

followed by the Administration menu.

Before the LTC sends data that are accessible by the Change Test Settings menu to the LTU, it performs a check for invalid data that may have been uploaded from the LTU or for errors that may have occurred during data transmission from the LTU to the LTC that the protocol could not detect. Any time an error is detected in the

data, the following message is displayed:

```
/* DATA VALUE(S) FOR [Field Name from
list below is located here] ARE NOT VALID
VALUES FOR ALL TEST SETTINGS MUST BE VALID
BEFORE THE LTU CAN BE CHANGED
SELECT THE APPROPRIATE MENU COMMAND FOR
CHANGES */

-- CHANNELS ON WHICH TESTING IS ALLOWED OR PROHIBITED

-- SYSTEM ID

-- TEST START TIME

-- MAXIMUM TEST RUN TIME
```

The Change Test Settings menu is then displayed so that you may select the command(s) to make corrections.

## 4.8.2 Indirect Mode Overview

### 4.8.2.1 General

In the Indirect mode, the LTC obtains its input data indirectly from a file (LTC.LTU) instead of direct input from the PC keyboard. This input file enables the LTC to dial up any number of LTUs, one at a time, to retrieve the loop test results from each LTU. The test results and other information retrieved from the LTUs are stored in output files (LTC.LOG and LTC.OUT) in the LTC. A disk operating system batch file (LTCB.BAT) resident in the LTC is used to initiate execution of the LTC program and customer provided post processor.

To operate the LTC in the Indirect mode, you must enter the name of the batch file followed by the wake up option and the time at which you want the LTC to begin retrieving data from the LTUs. The specified time may be any time on a 24-hour clock (0:00 - 23:59) and should be coordinated with the start and run times at the LTUs so that each LTU will have completed its routine tests by the time the LTC calls it to retrieve the test results. If you enter the wake up option without specifying a time, the LTC begins data retrieval immediately after making its preliminary checks.

You must create an input file (LTC.LTU) that contains data required to access and identify each LTU that is to be accessed in the Indirect mode. Directions for creating it are in the next section.

The LTC program writes data to two ASCII output files, LTC.OUT and LTC.LOG. The LTC.OUT file contains the LTU test results for loops that did not pass the routine drop tests. The following is an example of the LTC.OUT file format:

User.Number SID CHID Test Results

Example: 3928 4651 24 MOD

The *User.Number* is a user supplied identification number up to 16 digits in length. The *User.Number* would typically be used to identify a wire center, for instance, or a pair gain cable and count. The *SID* is four numeric characters representing the system identification number. The *CHID* is two numeric characters representing the channel unit identification number. The *Test Results* field is a string of three characters that represents the severity of the failed drop test of the particular CU. The three possible strings that can appear in this field are:

- o SUS (suspect)
- o MOD (moderate)
- o SEV (severe).

The LTC.LOG file contains the following:

- o LTU dial up access numbers
- o User number for each of the LTUs the LTC tries to access
- o Status information for each successfully accessed LTU
- o Unprocessed test result data for each successfully accessed LTU
- o Error messages describing any problems that may have occurred during LTU access and data retrieval
- o A disk out of space message (if free memory space is exhausted).

The LTC creates these two output files initially and re-creates them (overwrites the old contents) every time it runs in the Indirect mode. If it is necessary to save a particular LTC.LOG or LTC.OUT file, copy or rename it.

#### **4.8.2.2 Creating LTC.LTU File**

Before the LTC is operated in the Indirect mode, you must create the LTC.LTU file using a text editor. This file must adhere to a prescribed format to allow successful access to the desired LTUs. Each line of the LTC.LTU file represents a single LTU that is to be accessed and must adhere to the following modem dependent formats:

User.Number LTU.Access.Number (AT command compatible modems)

or

User.Number !ASCII string (non-AT command compatible modems). The *User.Number* is a user supplied identification number up to 16 digits in length. The *LTU.Access.Number* represents the LTU dial up number and consists of up to 20 characters including 0 - 9, ",", "-", and "W" in any sequence. For non-AT command compatible modems, an exclamation point ["!"] (ASCII 041) must precede the ASCII string which includes modem commands, access number, command options, etc. The ASCII string consists of 1 to 64 printable ASCII characters and should be available from the modem user's manual. Comments can also be included in this file and are denoted by the "#" character at the beginning of each comment line.

If the LTC.LTU file is not created before executing the disk operating system batch file, the LTC program prints an error message. A prompt will indicate that pressing the [F2] key returns the LTC program to the disk operating system when the batch file fails to locate the LTC.LTU file in the working directory.

#### 4.8.2.3 Entering Indirect Mode

After the LTC.LTU file is created, you can enter the Indirect mode command line in the LTCB.BAT file with the proper wake up time (or no time) in one of the following formats:

```
LTCB -WU 03:30 (or /WU 03:30)
```

```
LTCB -WU 3:30 (or /WU 3:30)
```

```
LTCB -WU (or /WU)
```

The first two formats specify a delayed start time to begin retrieving the loop test results and the last format specifies an immediate start time.

#### 4.8.2.4 Comm Port Check

After entering the Indirect mode, the LTC program examines the communication ports. A check is made of both communication ports, COM1 and COM2, to verify the number of ports available. If no ports are available, the LTC displays:

```
/* COMM PORT NOT AVAILABLE  
  ALL PROCESSING IS STOPPED */  
[HIT F2 TO EXIT TO DOS]
```

and exits to the disk operating system after the [F2] key is pressed. If one port is available, then the LTC uses that port as the working port. If two ports are available, the LTC checks the

environment variable, LTC\_CPRT, and uses the port specified. If LTC\_CPRT is not set, then the LTC defaults to COM1.

#### 4.8.2.5 File Check

The LTU attempts to read the LTC.LTU file to determine the number of LTUs to be accessed. If the LTC.LTU file does not exist, the error message:

```
/* FILE LTC.LTU NOT AVAILABLE
   ALL PROCESSING IS STOPPED */
[HIT F2 TO EXIT TO DOS]
```

or

```
/* DISK ACCESS FAILED */
[HIT F2 TO EXIT TO DOS]
```

is displayed on the screen. After the [F2] key is pressed, the LTC program then exits to the disk operating system since the input file is required to continue execution of the LTC program in the Indirect mode. You must then create the file using the directions given previously.

An error in reading the LTC.LTU file causes the following message to be displayed:

```
/* FILE LTC.LTU CANNOT BE READ
   ALL PROCESSING IS STOPPED */
[HIT F2 TO EXIT TO DOS]
```

#### 4.8.2.6 Memory Space Check

If the LTC.LTU file is read successfully, the LTC checks to ensure that there is sufficient disk memory space available to store the output and log files for the LTC session for the number of LTUs being accessed. If the memory space is insufficient, the LTC displays:

```
/* DISK IS NEAR OVERFLOW AND PROCESSING MAY NOT
   COMPLETE
   HIT F2 WITHIN 15 SECONDS TO EXIT TO DOS,
   OTHERWISE PROCESSING WILL CONTINUE */
```

and waits 15 seconds for you to respond. If the [F2] key is pressed, the LTC exits to the disk operating system. Otherwise, the LTC continues execution.

**NOTE:**

The user is advised to delete unnecessary files on the disk in order to provide free disk space that is equal to or greater than 1K bytes for each LTU to be accessed (for example, three

LTUs require at least 3K bytes of free disk space).

#### 4.8.2.7 Time Check

If a *wake up* option plus the time is specified, the LTC program checks the time for validity. If the start time is invalid, a message:

```
/* WAKE UP TIME ENTERED IS NOT VALID
   ALL PROCESSING IS STOPPED */
[HIT F2 TO EXIT TO DOS]
```

is displayed on the screen. The LTC program exits to the disk operating system after the [F2] key is pressed requiring you to restart the LTC batch command with the correct start time format.

If any of the above checks fails, resulting in an exit to the disk operating system, the LTC program returns an exit code to the batch file that makes the file exit to the disk operating system without running further commands, such as a customer provided post processor. If all the checks pass, the LTC displays:

```
/* INITIAL CHECKS ALL PASSED
   PROGRAM WILL SLEEP UNTIL [time]
   ENTER F2 TO STOP PROCESSING */
```

and waits until the specified *wake up* time. If no time was entered on the command line, the word *NOW* appears instead of the time and data retrieval begins immediately.

After entering the command line, please wait until the "SLEEP" message appears on the screen before leaving the LTC unattended. This allows any errors that would prevent the LTC from running to be detected and fixed.

You are allowed to abort the test session prior to the expiration of the timer by pressing the [F2] key before the *wake up* time arrives.

#### 4.8.2.8 Unattended Operation

Once the timer function has expired, the LTC program begins execution in the unattended operation using the current set of LTU access numbers to obtain the test results data. The following actions are performed by the LTC during the retrieval of test results in the unattended operation:

1. The LTC tries to read the dial up access number and user number from the LTC.LTU input file. If the file is not found the following error message is displayed and written to the LTC.LOG file:

```
/* FILE LTC.LTU NOT AVAILABLE  
ALL PROCESSING IS STOPPED */
```

and the LTC exits to the disk operating system.

2. A failure to read the LTC.LTU input file results in either of the following two error messages:

```
/* DISK ACCESS FAILED */
```

or

```
/* FILE LTC.LTU CANNOT BE READ  
ALL PROCESSING IS STOPPED */
```

and a return to the disk operating system.

3. The LTU dial up access number and user number are read from the LTC.LTU input file and the LTC tries to write the data to the LTC.LOG file.

4. The LTC checks for the existence of the LTC.LOG file before every write. If the LTC.LOG file is erased after start-up, then the message:

```
/* FILE LTC.LOG CANNOT BE FOUND  
ALL PROCESSING IS STOPPED */
```

is displayed and the LTC returns to the disk operating system.

5. Before each attempt to write data to any file, a check of available disk space is made and if the disk space is insufficient then the message:

```
/* DISK OUT OF SPACE  
ALL PROCESSING IS STOPPED */
```

is displayed and written to the LTC.LOG file and the LTC returns to the disk operating system.

6. If the LTC.LOG file cannot be written then the message:

```
/* FILE LTC.LOG CANNOT BE WRITTEN  
ALL PROCESSING IS STOPPED */
```

is displayed and the LTC returns to the disk operating system.

7. A message is written to the LTC.LOG file consisting of the dialed telephone number and the user number.

8. The LTC sends a command to the modem to go off hook and wait for dial tone.

9. The LTC sends the appropriate command to dial the LTU.
10. If the LTC does not detect carrier on the communication link after 3 dial up attempts, the message:

```
/* FAILURE: CARRIER NOT DETECTED  
CHECK DATA LINK OR LTU */
```

is displayed and written to the LTC.LOG file and the LTC goes on to the next LTU.

11. The LTC detects carrier for a successful communication link between the LTC and the LTU.
12. The LTC requests LTU status information. If status information contains evidence of unrecognized data or hardware failure at the LTU, the following message:

```
/* LTU ACCESS IS TERMINATED  
LTU IS REPORTING DATA FAILURES  
LTU MAINTENANCE MAY BE NECESSARY */
```

is displayed and stored in the LTC.LOG file, the logoff command is sent, and the next LTU is accessed.

If the LTU response does not contain information that tells the LTC that it is communicating with an LTU, the error message:

```
/* LTU NOT RECOGNIZED  
CHECK DATA LINK */
```

is displayed and written to the LTC.LOG file and the LTC goes to the next LTU.

13. The LTC obtains the test results data from the LTU and tries to write the test results data in the LTC.OUT file.
14. The LTC checks for the existence of the LTC.OUT file before every write. If the LTC.OUT file is erased after start-up, then the message:

```
/* FILE LTC.OUT CANNOT BE FOUND  
ALL PROCESSING IS STOPPED */
```

is displayed and written to the LTC.LOG file and the LTC returns to the disk operating system.

15. The LTC determines if enough disk space is available to write the test results data to the LTC.OUT file. If insufficient space is available, then the message:

```
/* DISK OUT OF SPACE  
ALL PROCESSING IS STOPPED */
```

is displayed and written to the LTC.LOG file and the LTC returns to the disk operating system.

16. If the test results data cannot be written in the LTC.OUT file, then the message:

```
/* FILE LTC.OUT CANNOT BE WRITTEN  
ALL PROCESSING IS STOPPED */
```

is displayed and written to the LTC.LOG file and the LTC returns to the disk operating system.

17. After all the LTUs have been accessed, the LTC completes the process by sending the logoff message to the LTU and an on-hook message to the modem.
18. After the LTC.EXE program exits, the batch file initiates execution of the customer's post processor, if it exists. Otherwise, the batch file returns to DOS.

## 4.9 Getting Out of Trouble

### 4.9.1 General

When you encounter trouble while using the LTC PC, error messages are normally displayed on the PC to help you understand the nature of the problem and the recovery action taken by the LTC software and to provide advice to the user. Error messages are displayed when troubles or errors are detected by:

1. The LTC software
2. The keyboard input interface during data input at the keyboard
3. The link between the LTC and the LTU
4. The LTU.

A description of the various types of error messages was presented earlier in this chapter. Examples of some error messages that you might encounter when using the LTC are provided in the following paragraphs. Problems encountered when using the printer are also included in this description.

### 4.9.2 Keyboard Entry Error Messages

Data entry at the keyboard in response to menus and prompts may be in error, in the wrong format, or out of the allowable range. When

you input an invalid entry, the software displays an error message and reprompts for the same parameter. Review the data you have entered for an error. Request a help message (press [ ? ]), when you do not know what entries are valid. All error messages begin with "/\*" on the first line and end with "\*/" on the last line.

There are six basic input forms that are tested for errors by the LTC to insure that the input is correct:

- o Integers
- o Yes/no responses
- o Numbered menu lists
- o Telephone number strings
- o System IDs
- o List of channel numbers.

Examples of each of the six basic input forms are:

1. Integers:

- o Typical values: 0, 1, 2, ... 9999
- o Examples of valid inputs: 2, 0, 9998
- o LTC prompt example:  

```
TEST START TIME (HOUR) = (0 to 23)
```
- o HELP message example:

---

```
/* VALID INPUTS ARE 0 TO 23
   IN STEPS OF 1 */
[redisplay prompt]
```

---

- o Error response to out of range entry (for example, to entry of "10000"):

---

```
/* INPUT OUT OF RANGE - 0 TO 23
   IN STEPS OF 1 */
[redisplay prompt]
```

---

- o Error response to invalid data entry (for example, to

entry of "2.4"):

---

```
/* ERROR: INPUT IS NOT AN INTEGER */  
[redisplay prompt]
```

---

2. Yes/no responses:

- o Typical values: YES, NO
- o Examples of valid inputs: YES, Y, NO, N, [F4], [F5]  
( [F4] = Yes and [F5] = No)
- o LTC prompt example:  
  
DO YOU WANT THESE SETTINGS? (Y or N)
- o HELP message example:

---

```
/* VALID INPUT IS ONE OF: YES, NO */  
[redisplay prompt]
```

---

- o Error response for invalid data input (for example, to entry of MAYBE):

---

```
/* INVALID INPUT - ENTER ONE OF: YES, NO */  
[redisplay prompt]
```

---

3. Numbered menu lists:

- o Typical values:
  - 1. OBTAIN TEST RESULTS
  - 2. ADMINISTRATION ACCESS
  - 3. END SESSION AND RETURN TO SET UP
- o Examples of valid inputs:
  - 1, OB, AD, END, E,  
OBTAIN TEST RESULTS
- o LTC prompt example:

---

```
/* CHOOSE ONE OF THE FOLLOWING */  
1.OBTAIN TEST RESULTS
```

```
2.ADMINISTRATION ACCESS
3.END SESSION AND RETURN TO SET UP
COMMAND =
```

---

- o HELP message example:

HELP message repeats entire menu including prompt.

---

```
/* CHOOSE ONE OF THE FOLLOWING */
1.OBTAIN TEST RESULTS
2.ADMINISTRATION ACCESS
3.END SESSION AND RETURN TO SET UP
COMMAND =
```

---

- o Error response to out of range entry (for example, to entry of "5")
- 

```
/* ERROR: '5' IS NOT IN MENU */
[redisplay entire menu including prompt]
```

---

- o Error response to invalid data entry (for example, to entry of *OBAIN*)
- 

```
/* ERROR: 'OBAIN' IS NOT IN MENU */
[redisplay entire menu including prompt]
```

---

#### 4. Telephone number strings:

- o Typical input: 201-555-4612

- o Examples of valid inputs:

2015554612, 201-5554612, 201,555,4612

- o LTC prompt example:

ENTER TELEPHONE NUMBER FOR THE MODEM =

- o HELP message example:
- 

```
/* ENTER 1 TO 20 DIGITS;
MAY INCLUDE ',' AND '-' AND 'W' */
```

[redisplay prompt]

---

- o Example of response to invalid entry: Entry of too many characters.
- 

```
/* RESPONSE IS TOO LONG */  
[redisplay prompt]
```

---

- o Error response to the entry of invalid characters (for example, to entry of "9,1-800-555-HELP")
- 

```
/* RESPONSE CONTAINS INVALID CHARACTER(S) */  
[redisplay prompt]
```

---

5. System ID(s):

- o Typical input: 575
  - o Examples of valid inputs:  
  
NONE, N, NO, NON, 20, 020, 0020, 196, 0196, key [F5]  
(key [F5] = N)
  - o LTC prompt examples:  
  
(1) FIRST SYSTEM ID =  
  
(2) SECOND SYSTEM ID =
  - o HELP message example:
- 

```
/* ENTER UP TO 4 DIGITS, OR 'NONE', AND RETURN */
```

---

- o Error response to the entry of more than four characters.
- 

```
/* RESPONSE IS TOO LONG */  
[redisplay prompt]
```

---

- o Error response to the entry of invalid characters (for example, to entry of "3A2").
-

```
/* RESPONSE CONTAINS INVALID CHARACTER(S) */  
[redisplay prompt]
```

---

6. List of channel numbers

- o Typical input:

```
1 5 9 10 18 35
```

- o Example of valid inputs:

```
(1) 1 4 2 5 18 96 92
```

```
(2) 1 3 5 7 8 90 96
```

- o LTC prompt examples:

```
(1) ENTER CHANNELS TO BE CHANGED TO PROHIBIT TESTS =
```

```
(2) ENTER CHANNELS TO BE CHANGED TO ALLOW TESTS =
```

- o HELP message example:

---

```
/* ENTER ZERO OR MORE CHANNEL NUMBERS FROM 1 TO 96 IN  
ANY ORDER, SEPARATED BY ONE OR MORE SPACES, AND  
RETURN */
```

---

- o Error response to the entry of more than 300 characters:

---

```
/* RESPONSE IS TOO LONG */  
[redisplay prompt]
```

---

### 4.9.3 LTC/LTU Command Execution Error Messages

These error messages are generated as a result of errors returned from the LTU that occur during execution of LTC/LTU interface commands in the LTU.

If the LTU cannot recognize the command code received from the LTC, it returns an error code to the LTC which displays the following error message:

---

```
/* NO COMMUNICATION WITH THE LTU  
REDIAL LTU AND INITIATE SESSION  
POSSIBLE DATA LINK OR LTU FAILURE  
RETURNING TO SET UP MODE */
```

---

and either returns to Set Up, if operation is in the Interactive mode, or dials up the next LTU, if operation is in the Indirect mode.

In the Administration or Change Test Settings menu, if the LTU receives data from the LTC for EEPROM updating and finds it to be invalid, it returns an error code to the LTC which displays the following error message:

---

```
/* LTU DOES NOT ACCEPT DATA  
CHECK LTU STATUS FOR POSSIBLE FAULT */
```

---

and remains in the Administration menu. This error message will only appear when the user is trying to change a system parameter (for example, password, test settings, or remote clock).

In the Interactive mode, when the user presses the [F10] key, the LTC requests status information from the LTU. If the LTC receives a response but does not recognize the received data as coming from an LTU, the following message is displayed:

```
/* LTU NOT RECOGNIZED  
CHECK DATA LINK  
AND RETRY F10 */
```

and the LTC drops the call and returns to Set Up.

#### 4.9.4 Data Link Error Messages

These error messages are generated as a result of trouble on the link between the LTC and the LTU that prevents the LTC from receiving data from the LTU.

If the LTC receives an error code due to errors present on the data link between the LTC and the LTU, it displays the following error message:

---

```
/* DATA LINK FAILURE  
RETURNING TO SET UP MODE */
```

---

and either returns to Set Up, if operation is in the Interactive mode, or dials up the next LTU, if operation is in the Indirect mode.

#### 4.9.5 Internal LTC Software Errors

When the LTC fails a sanity check (for example, corrupted data) it responds with:

---

```
/* PC EXECUTION ERROR -- ALL PROCESSING HAS BEEN TERMINATED */  
[HIT F2 TO EXIT TO DOS]
```

---

and exits to the disk operating system after key [F2] is pressed.

**NOTE:**

The [*HIT F2 TO EXIT TO DOS*] line will not be displayed if the LTC is in the Unattended state.

If the LTC software locks up or responds unpredictably, it may be necessary to reboot by pressing the [Ctrl] [Alt] [Delete] keys, or by pressing the RESET button.

#### 4.9.6 If the Command Does Not Work

If the command does not work, try the following things:

1. Look for an error message.
2. Verify the command syntax.
3. Try the command again. A number of possible temporary conditions might occur that would not repeat with a second attempt.

If what you are typing does not appear on the screen, try the following:

- o Verify that you are in either the Reporting, Administration, or Change Test Settings menu. In the Set Up (terminal emulation) mode, characters typed in are sent but may not be displayed on the screen.
- o Verify that a prompt is displayed. The software ignores most characters unless a "=" is displayed. If a command is being processed, the software does not accept entries until it is finished.

If the "=" is displayed, but the keyboard does not respond, try pressing [Esc]. As a last resort, reboot (enter [Ctrl] [Alt] [Delete], or press the RESET button).

**NOTE:**

In cases where the LTC is unable to function normally for several minutes or longer, the connection with the LTU may time out and be lost. When this happens, the LTC software returns to Set Up and you must dial into the LTU again.

The [Pause] key should never be used. If it is pressed in error,

press any other key to resume activities where you stopped. If the LTC responds incorrectly, use the [Esc] key (key [3] or key [6] can also be used with the Reporting menu or Administration menu, respectively), and answer the next prompt. If the LTC still responds incorrectly, use [Esc] and try again. In some cases, it may be necessary to back up in this manner several times before the LTC responds correctly.

#### 4.9.7 Completion and Status Messages

Examples of completion messages include:

```
/* OK */
```

when test settings are written successfully,

```
/* PASSWORD CHANGED */
```

when the password is written successfully, and

```
/* DIALING IN PROGRESS */
```

when the user has pressed [F7] (in Set Up) and entered a valid phone number.

If the command fails, an error message is displayed instead of the completion message.

#### 4.9.8 Printer Problems

If the printer does not work, try the following:

1. See if the printer is jammed or if the connectors are loose.
2. Verify that the printer being used is compatible (the AT&T Model 570 has been tested and is compatible with the LTC). Verify that the printer switch settings are correct.
3. Try pressing [Ctrl] [PrtSc] and/or [Esc].
4. Try your printer with another program.
5. Consult printer manual. If your printer has an alternate compatibility mode, change option switches on printer to operate in the alternate mode.

Pressing [Shift] [PrtSc] during printer operation overrides the [Ctrl] [PrtSc] and may cause unwanted results.

If problems occur with the printer (for example, out of paper, paper jammed), the LTC interprets this as though [Ctrl] [PrtSc] had been pressed. The software continues data transmission to the screen and discontinues data transmission to the printer.

If the printer still does not operate properly, reboot the system.

## 5. ADDITIONAL REFERENCES

The following AT&T Practices give additional information concerning the *SLC* Series 5 Carrier System. Check the appropriate numerical index for practice availability.

<b>DOCUMENT</b>	<b>TITLE</b>
363-005-239	SLC Series 5 Carrier System, AUA7 Line Test Unit, Data Sheet
363-099-112IR	SLC Series 5 Carrier System - Line Test Controller and Line Test Unit, Customer Information Release
363-205-100	SLC Series 5 Carrier System, General Description
363-205-400	SLC Series 5 Carrier System, COT Acceptance and Turnup
363-205-401	SLC Series 5 Carrier System, RT Acceptance and Turnup
363-205-402	SLC Series 5 Carrier System, Channel Unit Installation
363-205-406	SLC Series 5 Carrier System, End-to-End System Tests
363-205-500	SLC Series 5 Carrier System, Maintenance and Trouble Clearing
915-710-115	SLC Series 5 Carrier System, Application Engineering, Facility Design Systems

## 6. APPENDIXES

### 6.1 PC Requirements

#### 6.1.1 General

The LTC operates on an AT&T PC 6300 or *MS-DOS* compatible PC meeting the following specifications.

#### 6.1.2 Operating System

- o *MS-DOS* disk operating system version 2.0 or later
- o PC-DOS disk operating system version 2.0 or later.

#### 6.1.3 Video Display

Monochrome or color.

#### 6.1.4 RAM

512 (or more) KBytes.

#### 6.1.5 Disk Storage Required

- o For LTC alone: 360 KBytes.
- o For LTC and telephone company's operations support system combined: Minimum of 2 MBytes.
- o One floppy disk drive (either 3.5 or 5.25 inches) is required for LTC installation.
- o The *working drive* for LTC may be either floppy or hard disk.

#### 6.1.6 Ports Required

One asynchronous 1200 b/s (if an external modem is used).

#### 6.1.7 Modem

- o The TIP/RING side of the modem must be compatible with Bell System 212A standards.
- o Internal or external modem must be PC-compatible on the data side.
- o AT-command compatible (internal or external) is preferred for indirect I/O and required for use of the Modem Dial prompt for dialing.
- o Non-AT-command compatible modems require user verification of suitability and user-furnished command strings in the file LTC.LTU.

### **6.1.8 Printer (Optional)**

- o AT&T Model 570
- o LPT1 parallel port.

### **6.1.9 Other**

No environmental hardening.

## **6.2 LTU Maintenance and Trouble Clearing**

### **6.2.1 LTU Status Indicators**

#### **6.2.1.1 General**

The LTU provides two mechanisms for reporting hardware troubles: the FAIL LED and the STATUS REGISTER.

#### **6.2.1.2 FAIL LED**

The FAIL LED indicates a hardware failure which was detected by the LTU during a built-in self-test. If the FAIL LED is the only LED lighted on the LTU then the LTU should be replaced immediately.

Since the FAIL LED can only be viewed at the RT, this indicator is most useful during the installation of the LTU. In-service troubles are reported to the LTC by the LTU during Interactive or Indirect sessions.

During power-up, it is normal for the FAIL LED to light briefly and then go off.

#### **6.2.1.3 Status Register**

Diagnostic information about the LTU is stored in the status register. The contents of this register are transferred to the LTC each time the LTC successfully dials into the LTU. The status register contains information on the state/condition of the LTU and of various LTU data items.

The contents of the status register are translated into warning messages by the LTC. These messages can be read from the screen (and from the LTC.LOG file if operating in the unattended indirect mode).

#### **6.2.1.4 Alarms**

Since LTU failures do not affect service, the LTU does not provide alarms at the RT or at the COT.

### **6.2.2 Status Warning Messages**

#### **6.2.2.1 General**

The LTU performs a status and self-diagnostic routine at regular intervals. When the LTU receives ringing and answers a call, the LTC requests the LTU status and the LTU sends the contents of the current status register, along with other data, to the LTC. In the Interactive mode, the LTC translates the contents of the LTU status register into one or more warning messages preceded by *WARNING*. In the Indirect mode, the LTC enters the entire status word and the same warning messages into the LTC.LOG file. A description of these warning messages and the procedures for clearing them follows.

**6.2.2.2 /\* WARNING: SYSTEM IDS ARE INVALID OR THE SAME \*/**

This message indicates that both SYSTEM IDs are the same or that at least one of the SYSTEM IDs stored at the LTU is not in the range of 0001 to 9999 or *NONE*.

The user must access the Administration menu and change the current system ID(s) to the correct value(s) for the given system(s).

**6.2.2.3 /\* WARNING: SYSTEMS DO NOT RESPOND TO IDS \*/**

This message indicates that the SYSTEM IDs stored at the LTU are valid, but that at least one of the SYSTEM IDs is not the correct value for the given system. This message also appears if the ribbon cable between the LTU and the CTU is not connected.

The user must access the Administration menu and change the current system ID(s) to the correct value(s) for the given system(s) or connect the ribbon cable between the LTU and the CTU.

**6.2.2.4 /\* WARNING: TEST ALLOWED DATA ARE NOT ALL VALID \*/**

This message indicates that at least one of the channel test permission settings stored on the LTU is invalid (that is, setting is not equal to allow testing or prohibit testing). The user must access the Administration menu and change the invalid channel test permission setting to either allow or prohibit testing.

**6.2.2.5 /\* WARNING: TEST RUN TIME TOO LARGE OR TOO SMALL \*/**

This message indicates that the test run time is greater than 5 hours or less than 1 hour. A short run time may not allow the LTU to complete routine loop testing on the dual bank. A long run time may keep the LTU testing during a busy period.

The user should access the Administration menu and change the test run time.

**6.2.2.6 /\* WARNING: UNRECOGNIZED COMMAND COUNTER = [value] \*/**

This message indicates the number of unrecognized commands that have been received by the LTU since the last time that either the LTC read the LTU's status word or the LTC sent the LTU a valid current password.

Action may not be necessary but, if the value is not zero very often, checks should be made for a noisy line or possible unauthorized connection to the system.

**6.2.2.7 /\* WARNING: LTU IS IN PRESERVICE CONDITION \*/**

This message indicates that the LTU has been reset and contains the *preservice* values for all user settable parameters.

The LTU is ready to be provisioned by the LTC. The user should select the Administration Access item from the Reporting menu in order to perform the provisioning.

**6.2.2.8 /\* WARNING: LTU CLOCK TIME AND LATEST TEST START TIME ARE NOT WITHIN 23 HOURS \*/**

This message indicates that the requested test start time is more than 23 hours from the present time recorded by the LTU clock.

No action is necessary.

**6.2.2.9 /\* WARNING: ROUTINE TESTING WAS INTERRUPTED BY THIS CALL \*/**

This message indicates that the LTU was performing routine loop tests when it responded to the LTC. If the test results are uploaded, it is possible that some of the results may be results remaining from the previous testing session.

No action is necessary.

**6.2.2.10 /\* WARNING: LTU REPORTS UNRECOGNIZED DATA ERROR \*/**

This message indicates that the LTU memory is defective or has been corrupted and probably contains incorrect values for one or more of the LTU parameters.

The user should access the Administration menu and carefully inspect the values for the LTU parameters. If there is any inconsistency, the LTU should be provisioned with the correct value. If the LTU does not accept the new values, then the LTU memory is defective and the LTU should be replaced.

**6.2.2.11 /\* WARNING: LTU REPORTS HARD FAILURE DETECTED \*/**

This message indicates that the LTU's built-in self-test has detected a hardware failure on the LTU.

The user should logon to the LTU via the LTC in Interactive mode, and check the warning messages to determine if this message still appears. If so, the LTU must be replaced and the new LTU must be provisioned. If the message does not appear, this LTU should be monitored closely for the reappearance of this message.

**6.2.2.12 /\* WARNING: LTU AND LTC CLOCKS ARE NOT WITHIN 15 MINUTES \*/**

This message indicates that the LTU and LTC clocks differ by more than 15 minutes but less than 1 hour.

The user must verify that the LTC clock is correct and then access the Administration menu and reset the LTU clock. The user can verify and/or change the LTC clock only while the LTC is in the disk operating system.

**6.2.2.13 /\* WARNING: LTU AND LTC CLOCKS ARE NOT WITHIN 1 HOUR \*/**

This message indicates that the LTU and LTC clocks differ by more than 1 hour.

The user must verify that the LTC clock is correct, and then access the Administration menu and reset the LTU clock. The user can verify and/or change the LTC clock only while the LTC is in the disk operating system.

**NOTE:**

The difference in time between the LTU and LTC clocks may be legitimate if the LTC and LTU are in different time zones or if the clocks have been changed to or from daylight savings time.

**6.2.2.14 /\* WARNING: LTU AND LTC CLOCKS ARE NOT SET TO THE SAME DAY \*/**

This message indicates that the LTU and LTC clocks differ by more than 24 hours.

The user must verify that the LTC clock is correct, and then access the Administration menu and reset the LTU clock.

**NOTE:**

This condition could be legitimate if a call to an LTU is placed at approximately 12 midnight with the LTU and LTC clock times a few minutes apart.

**6.2.2.15 /\* WARNING: LTU CLOCK TIME IS NOT VALID \*/**

This message indicates that the LTU clock contains an invalid time. The valid range for time is between 00:00 and 23:59. The valid range for the day is "SUN" through "SAT".

The user must verify that the LTC clock is correct, and then access the Administration menu and reset the LTU clock.

## **6.3 Using the LTU Test Results to Troubleshoot the LTU**

### **6.3.1 General**

When the LTU is suspected of operating improperly, the test result codes generated by the LTU and transmitted to the LTC can be used to

## 363-205-105

troubleshoot LTU problems. In general, reception of identical test result codes on all channels of one or both systems in a dual bank assembly indicates a potential LTU failure. This section describes various test result codes that could indicate LTU problems.

### 6.3.2 Error/Test Abort Code

#### 6.3.2.1 General

Reception of the *error/test abort* code by the LTC indicates that the LTU was not able to communicate with the bank controller for a particular channel. Various conditions can cause the *error/test abort* code to be generated including a faulty LTU. A check for either of the following conditions, incorrectly specified system IDs and improperly connected test access cable, should be made before replacing the LTU.

#### 6.3.2.2 System IDs

If the system ID for a particular system is improperly specified at the LTC, the *error/test abort* test result code is received for all 96 channels of the system, except for those channels where testing has been prohibited.

Under this condition, the user should access the LTU via the LTC in the administrative mode and correctly specify the system ID for the bank.

#### 6.3.2.3 Test Access Cabling

If the test access cabling between the LTU and the CTU is improperly connected, the *error/test abort* test result code is received for all 96 channels of both systems, except for those channels where testing has been prohibited.

Under this condition, the test access cabling should be inspected and replaced if necessary.

### 6.3.3 Busy Code

The busy code indicates that the customer's loop was not tested because the channel was busy. All channels in both systems of a dual bank assembly appearing consistently busy, may be an indication that the LTU is working improperly and should be replaced. This condition should be watched for at least two days, before a decision is made to replace the LTU.

### 6.3.4 Line Test Failures

A test result of *Sus(pect)*, *Mod(erate)*, or *Sev(ere)* indicates that the customer's loop was found to contain a fault. If all channels report a consistent fault, then the LTU's test circuitry may be malfunctioning, since it is unlikely that all drops would report the same condition, and the LTU should be replaced. This condition should

be watched for at least two days, before a decision is made to replace the LTU.

## 6.4 Test Results

The raw test results retrieved from the LTU are written to the LTC.LOG file. Table B translates the single character raw test result codes from the LTU to a detailed explanation of the code.

An example of an LTC.LOG file is shown in the following:

```
USER # = 12
LTU TEL# = 1W201,555,3016
CURRENT TIME = 08:44
LTU STATUS = 00000000002
/*WARNING:LTU AND LTC CLOCKS ARE NOT WITHIN 1 HOUR*/
TEST START TIME = 01:30
FIRST SYSTEM ID = 1234
RAW LTU DATA
1234567890
      10
      20
      30
      40
      50
ddddCCCC 60
      70
      80
      90
      96

SECOND SYSTEM ID = NONE
RAW LTU DATA
1234567890
?????????? 10
?????????? 20
?????????? 30
?????????? 40
?????????? 50
?????????? 60
?????????? 70
?????????? 80
?????????? 90
???????? 96
```

In the example, the LTC retrieved data from an LTU with a system user number of 12 by dialing the telephone number 1-(201)-555-3016 at 8:44 a.m. The LTU returned a status of 2, which is translated by the LTC to the warning message shown in the example.

**NOTE:**

The LTU can return various status numbers which are translated by

the LTC into one or more warning messages.

The LTU started performing loop tests at 1:30 a.m. The system ID of the first system tested by the LTU is 1234. The test results indicate that channels 51 through 55 were busy when the LTU attempted to test the loops and the loops on channels 56 through 60 have a severe insulation fault. The second system, being in the pre-service state, has a system ID of NONE thus resulting in all channels having a test result of "?".

## 7. USER FEEDBACK FORM

### How Are We Doing?

Document Title: SLC(R) Series 5 Carrier System Line Test Unit and  
Line Test Controller User's Manual

Document Number: 363-205-105      Issue Number: 2  
Publication Date: March 1991

AT&T welcomes your feedback on this document. Your comments can be of great value in helping us improve our documentation.

1. Please rate the effectiveness of this document in the following areas:

	Excellent	Good	Fair	Poor	Not Applicable
Ease of Use					//////////
Clarity					//////////
Completeness					//////////
Accuracy					//////////
Organization					//////////
Appearance					//////////
Examples					
Illustrations					//////////
Overall Satisfaction					//////////

2. Please check the ways you feel we could improve this document:

- |  |   |
|--|---|
| <input type="checkbox"/> Improve the overview/introduction | <input type="checkbox"/> Make it more concise/brief                 |
| <input type="checkbox"/> Improve the table of contents     | <input type="checkbox"/> Add more step-by-step procedures/tutorials |
| <input type="checkbox"/> Improve the organization          | <input type="checkbox"/> Add more troubleshooting information       |
| <input type="checkbox"/> Include more figures              | <input type="checkbox"/> Make it less technical                     |
| <input type="checkbox"/> Add more examples                 | <input type="checkbox"/> Add more/better quick reference aids       |
| <input type="checkbox"/> Add more detail                   | <input type="checkbox"/> Improve the index                          |

Please provide details for the suggested improvement. \_\_\_\_\_

---

3. What did you like most about this document?

---

---

4. Feel free to write any comments below or on an attached sheet.

---

---

---

If we may contact you concerning your comments, please complete the following:

Name: \_\_\_\_\_ Telephone Number: (\_\_\_\_) \_\_\_\_\_

Company/Organization: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_

When you have completed this form, please fold, tape, and return to address below or Fax to: 910-727-3043.

DOCUMENTATION SERVICES  
2400 Reynolda Road  
Winston-Salem, NC 27106

## 8. LEGAL AND SUPPORT INFORMATION

Copyright(c) 1991 AT&T  
All Rights Reserved

### Notice

Every effort was made to ensure that the information was complete and accurate at the time of development. However, information is subject to change.

### Trademarks

NOTE: The following letters enclosed in parentheses are used to mark the first representation of these trademarks in this data base.

(R) = Registered trademark  
(TM) = Trademark  
(SM) = Service mark.

Following is a list of trademarks used throughout this data base.

MS-DOS -- Registered trademark of Microsoft Corporation  
SLC -- Registered trademark of AT&T  
SPOTS -- Registered trademark of AT&T  
SMARTMODEM 1200 -- Trademark of Hayes Microcomputer Products, Inc.

### Ordering Information

The ordering number for this document is AT&T 363-205-105. To order this document, call the AT&T Customer Information Center in Indianapolis, Indiana, on 1-800-432-6600.

### Support Telephone Number

AT&T provides a telephone number for you to use to report errors or to ask questions about the information in this document. The support telephone numbers are:

Outside North Carolina - 1-800-334-0404  
Inside North Carolina - 1-910-727-6681

Developed by the AT&T Document Development Organization.

**List of Tables**

**Table A: LTU Routine Tests**

Type	Tests	Classification	Limits [1]
Insulation	Tip to Ground with Ring Grounded	Severe	0 - 20K ohm
		Moderate	20 - 65K ohm
		Suspect	65 - 250K ohm
	Ring to Ground with Tip Grounded	Good	>250K ohm
	Tip to Battery		
	Ring to Battery		
Background Noise	Tip to Ring with 900 Ohm Termination	Severe	>42dBrnC [2]
		Suspect	30 - 42dBrnC [2]
		Good	<30 dBrnC [2]
Foreign [3] Potential	Tip to Ground	Severe	>80V Peak
		Suspect	30 - 80V Peak
	Ring to Ground	Good	<30V Peak

Notes:

[1] The limits shown are the nominal thresholds.

[2] Approximate C-message filter.

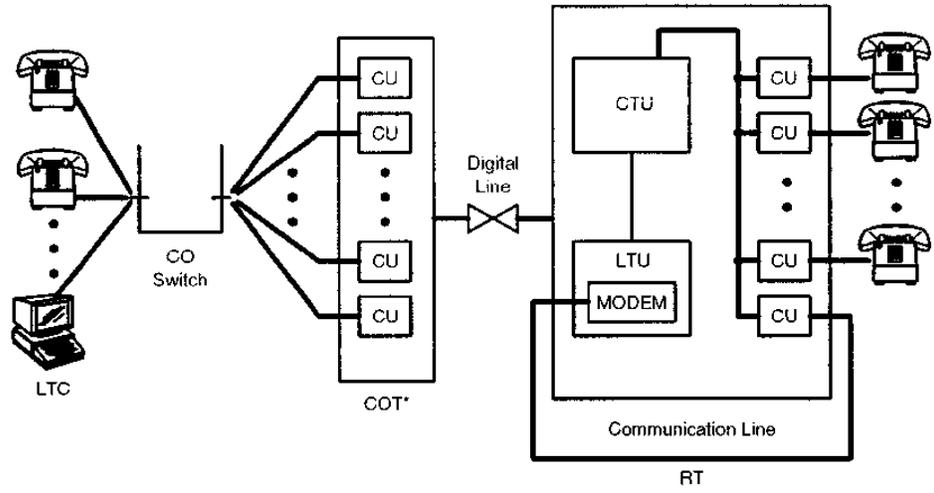
[3] The voltage specification on the power test is defined as the magnitude of the voltage. Therefore, a severe voltage greater than 80 volts actually means that the voltage is less than -80 volts or greater than +80 volts.

Table B: Test Results From the LTU

Category	Character	Reason
Good	sp	Loop passed all tests
Severe	@	Severe Power
	C	Severe Insulation
	G	Severe Insulation, Suspect Noise
	L	Severe Noise
	M	Severe Noise, Suspect Insulation
	N	Severe Noise, Moderate Insulation
	O	Severe Noise and Insulation
	S	Severe Insulation, Suspect Power
	W	Severe Insulation, Suspect Power and Noise
	\\	Severe Noise, Suspect Power
Moderate	]	Severe Noise, Suspect Power and Insulation
	^	Severe Noise, Moderate Insulation, Suspect Power
	-- (dash)	Severe Noise and Insulation, Suspect Power
	B	Moderate Insulation
Suspect	F	Moderate Insulation, Suspect Noise
	R	Moderate Insulation, Suspect Power
	V	Moderate Insulation, Suspect Power and Noise
Suspect	A	Suspect Insulation
	D	Suspect Noise
	E	Suspect Noise and Insulation
	P	Suspect Power
	Q	Suspect Power and Insulation
	T	Suspect Power and Noise
	U	Suspect Power, Noise, and Insulation
Untested	?	Preservice
	a	Non-Testable CU
	b	Empty Slot
	c	Ground Start
	d	Busy CU
	e	Testing Prohibited by LTC Administration
	f	No Even Channel on CU
g	Error/Test Aborted	

## List of Figures

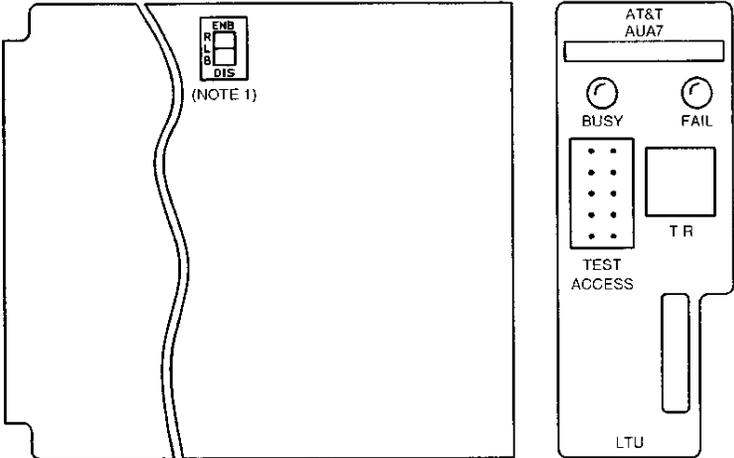
**Figure 1: System Architecture of the LTC/LTU Loop Test System**



\* The COT is not required in an integrated system.



Figure 2: AUA7 Line Test Unit



NOTE 1: The AUA7 has a daughter board that prevents access to the front of the reset LTU board (RLB) switch. However, the switch is accessible from the top of the circuit pack.

Figure 3: LTU Architecture

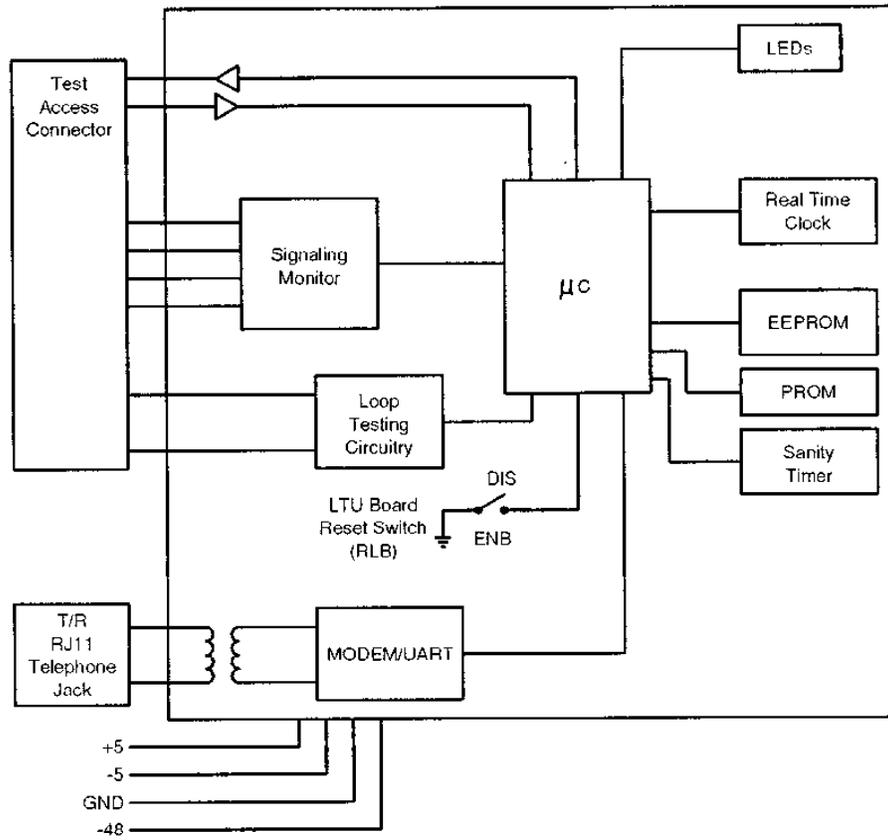




Figure 4: Connection of LTU to VF Pair and CTU

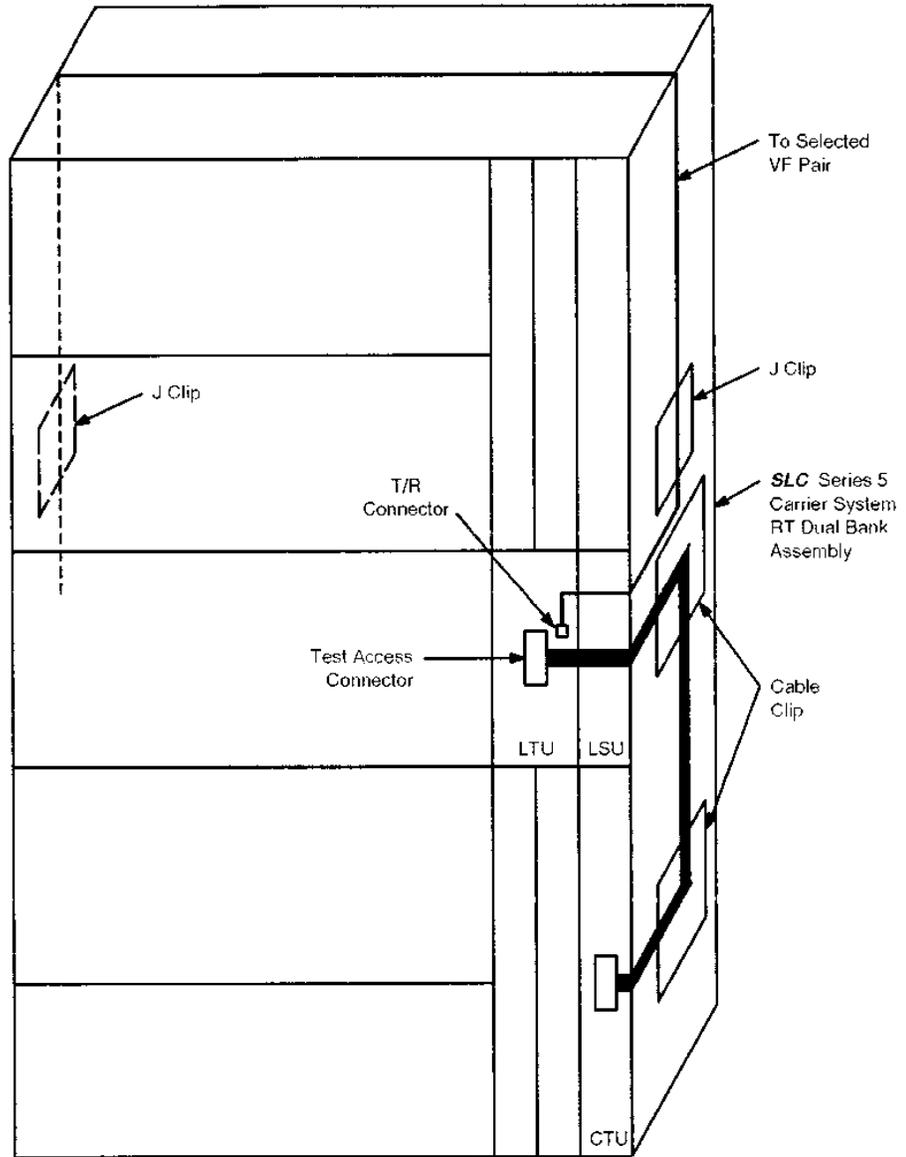


Figure 5: Connection of 2-Conductor Cable to VF Wire Pair

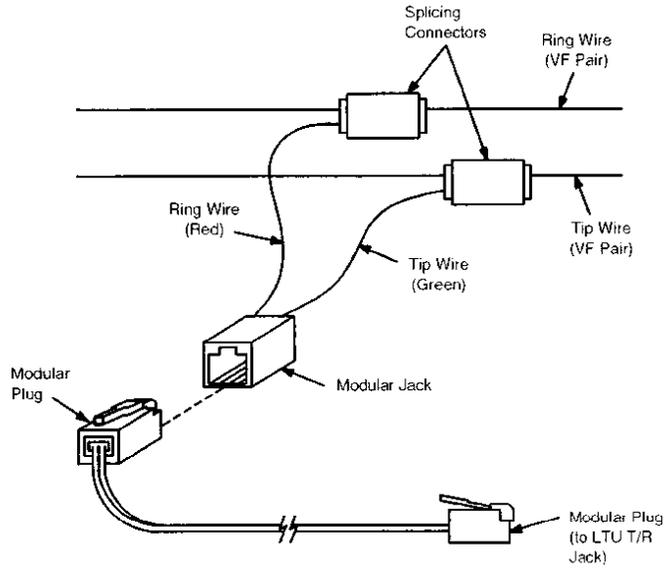
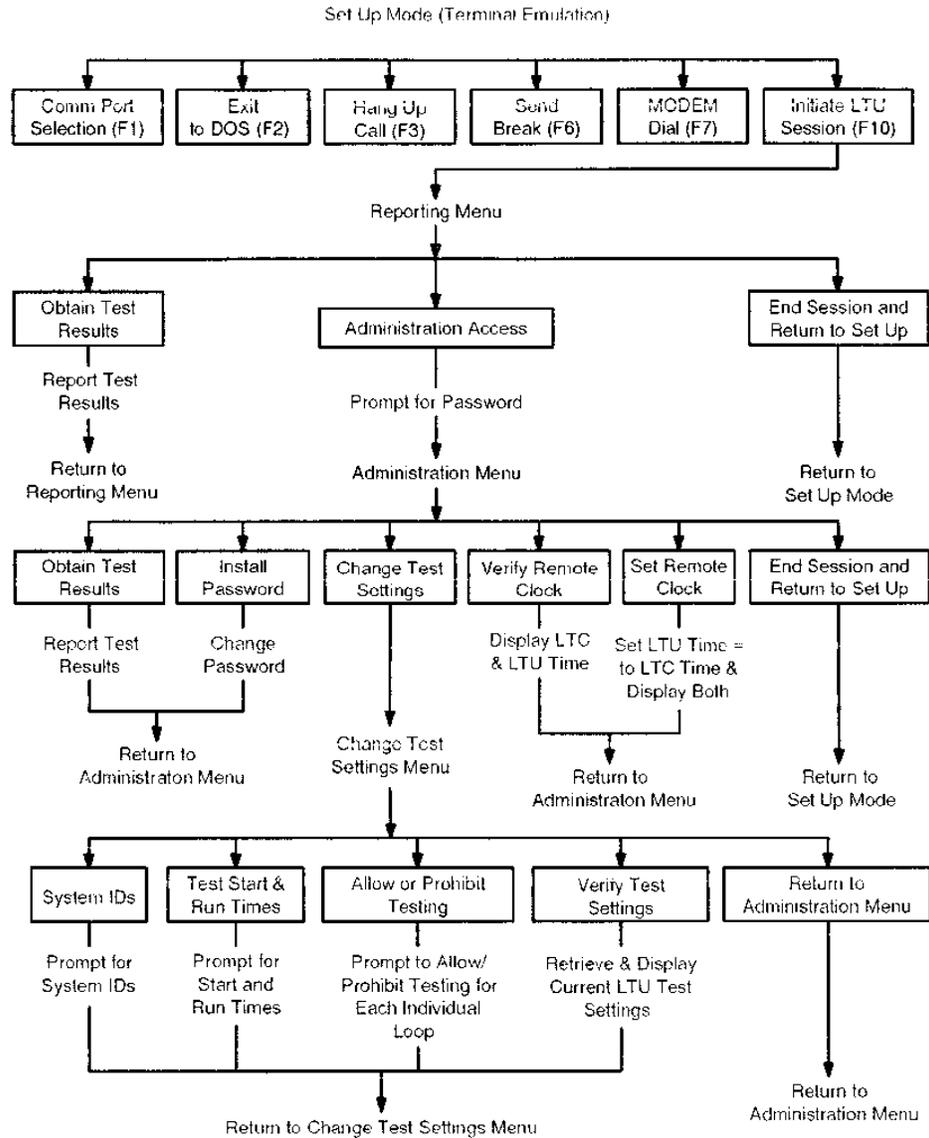


Figure 6: LTC Menu Map



*Glossary: Acronyms*

**ASCII** — American Standard Code for Information Interchange

**BCU** — Bank Control Unit

**CIR** — Customer Information Release

**CIU** — Craft Interface Unit

**CO** — Central Office

**COT** — Central Office Terminal

**CP** — Circuit Pack

**CPRT** — Communication Port

**CTU** — Channel Test Unit

**CU** — Channel Unit

**DIS** — Disable

**DLC** — Digital Loop Carrier

**DOS** — Disk Operating System

**DTR** — Data Terminal Ready

**DTU** — Digital Test Unit

**EEPROM** — Electronically Erasable Programmable Read Only Memory

**ENB** — Enable

**FPC** — Feature Package C

**FPD** — Feature Package D

**FSR** — Frequency-Selective Ringing

**I/O** — Input/Output

**LED** — Light Emitting Diode

**LIU** — Line Interface Unit

**LSU** — Line Switch Unit

**LTC** — Line Test Controller

**LTU** — Line Test Unit

**MML** — Man Machine Language

**PC** — Personal Computer

## 363-205-105

**PGTC** — Pair Gain Test Controller  
**POTS** — Plain Old Telephone Service  
**PROM** — Programmable Read Only Memory  
**RAM** — Random Access Memory  
**RLB** — Reset LTU Board  
**RMU** — Remote Measurement Unit  
**ROM** — Read Only Memory  
**RT** — Remote Terminal  
**RTS** — Ready To Send  
**UART** — Universal Asynchronous Receiver Transmitter  
**VF** — Voice Frequency  
**WORD** — Work Order Record Detail

## *Glossary: Terms and Definitions*

**Channel Number** — The channel identification (CHID) number is a 2-digit number which identifies a particular channel (loop) within a SLC Series 5 carrier system bank. The channel number for a SLC Series 5 Carrier System can range from 1 to 96.

**Demand Testing** — Demand testing refers to tests performed on circuits believed to be (or actually known to be) in trouble. Demand testing can be service affecting and takes priority over routine testing for test resources. However, the implementation of routine testing discussed here blocks demand testing while routine testing is being performed. This is not a concern since demand and routine testing usually occur at mutually exclusive times.

**In-Service** — The LTU in-service state is established when the LTU EEPROM preservice parameters are replaced with valid data by way of the LTC.

**Loop Tests** — Loop tests are those tests performed on the metallic pair connecting the RT to the subscriber premises. The loop tests consist of DC insulation, noise and voltage measurements.

**Preservice** — The LTU preservice state is established when all the values in the LTU EEPROM parameter fields are set to predetermined (default) values and the RLB (reset LTU board) switch is set to the DIS (disable) position.

**Routine Testing** — Routine testing refers to the automatically initiated and remotely controlled testing of subscriber loops as a means for initially detecting (and eventually clearing) troubles before they are reported by the subscriber. Routine testing should not be service affecting. The LTU checks for a busy channel before testing a subscriber loop, but there is the possibility of the subscriber going off-hook while the testing is being performed. In this case the subscriber would not receive dial tone until the testing on the loop was completed. The dial tone would be delayed by a maximum of 9 seconds. This condition would also disrupt the loop measurement results for that subscriber. Remotely controlled means that the routine testing equipment and testing logic reside away from the central office (CO) (that is, at the RT site).