FT100
Installation and
Operation Manual

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FCC REQUIREMENTS

This equipment complies with Part 68 of FCC Rules. Please note the following:

When you order service, the telephone company needs to know:

    A. The Facility Interface Code:

        04DU9-BN (1.544 Mbps superframe format (SF) without line power)
        04DU9-DN (1.544 Mbps SF and B8ZS without line power)
        04DU9-1KN (1.544 Mbps ANSI ESF without line power)
        04DU9-1SN (1.544 Mbps ANSI ESF and B8ZS without line power)

    B. The Service Order Code: 6.0N

        A signal power affidavit will be required to guarantee encoded analog content and billing protection unless this unit is used in combination with an XD type device or no encoded analog signals and billing information are transmitted. A SAMPLE AFFIDAVIT is attached. For most uses, the second box is appropriate.

    C. The USOC Jack Required: RJ48C

        In addition, if requested, please inform the telephone company of the make, model number and FCC registration number, which are on the label.

The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact

<div align="center">

Telenetics
25111 Arctic Ocean
Lake Forest, California 92630

</div>

for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network the telephone company may temporarily disconnect service. If this occurs you will be informed of your right to file a complaint with the FCC.

<div align="center">

WARNING

</div>

    This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used in accordance with the instruction manual. It has been tested and complies with the limits for a Class A computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference. Shielded cables may be necessary with this unit to ensure compliance with the Class A limits.

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

SPECIAL REQUIREMENTS FOR CANADA

Certain requirements exist for data communication products manufactured for use in Canada. Principle among these requirements is the application of the IC label as described below. However, certain data communication products do not require the IC label nor adherence to IC requirements. If this is the case the IC label will not be affixed to the units.

INDUSTRY CANADA (IC) REQUIREMENTS

IC labels are affixed to each unit sold in Canada. This label has the certification number for that particular unit. The numbers are different for each model.

The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. IC does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. For their own protection users should ensure that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION

Users should not attempt to make installation connections themselves, but should contact the appropriate electric inspection authority or electrician.

CANADIAN EMISSION REQUIREMENTS

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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Chapter 1
Introduction

GENERAL

The Telenetics FT 100 Fractional T1 CSU/DSU combines a dual channel, fractional T1 DSU with a T1 ESF CSU. The unit interfaces customer premise data and voice equipment to a T1 transmission facility. High-speed workstations, local and wide-area networks, Private Branch Exchanges (PBXs), facsimiles, and host computers are examples of customer equipment which may communicate over public or private T1 networks using the FT 100.

FUNCTIONAL DESCRIPTION

The FT 100 receives serial data from the customer Data Terminal Equipment (DTE) and multiplexes it onto a 1.544 Mbps DS-1 signal. The DS-1 signal interfaces to the T1 network via an integral ESF CSU. The DTE ports enable data rates from 56 kbps to 1.536 Mbps. The unit complies with DTE interface standards for V.35 or DS-1, and supports all Fractional T1 applications.

Network management and configuration for the FT 100 are provided by several methods. An LCD front panel accesses all configuration and diagnostic options. An RS-232 rear panel interface labeled CONTROL allows configuring and testing the unit via terminal, computer, or remotely via modem. When the RM16M model is installed in the Local-View shelf, configuration and diagnostics are accessible via the Local-View terminal. Operating parameters are stored in nonvolatile memory.

PHYSICAL DESCRIPTION

The FT 100 can be either a standalone desktop unit or the RM16M shelf mount model. When mounted in the shelf, the number of DTE ports is expandable using FT 100 EX expansion cards and special backplane segments.

Front Panel

Three front panel pushbuttons, YES, NO, and HOME, enable user input. A front panel 32-character LCD allows menu driven user operation and real time unit status displays. DTE signal status can be monitored by six LEDs and the LCD on the front panel (Figure 1-1).
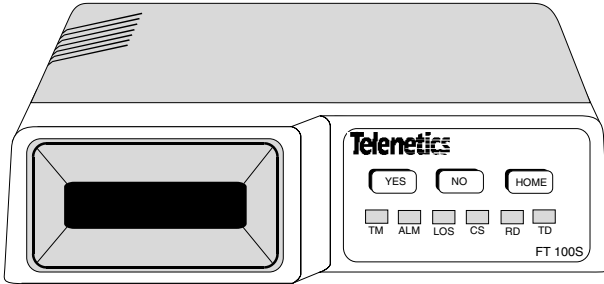
Figure 1-1
Front Panel

Rear Panel

The rear panel (Figure 1-2) contains a power cord, fuse, an 8-pin RJ48C network interface connector, a 9-pin D-type interface connector for external control, and two 25-pin D-type DTE connectors. Since the FT 100 connects directly to the T1 network, it does not include an ON/OFF power switch.
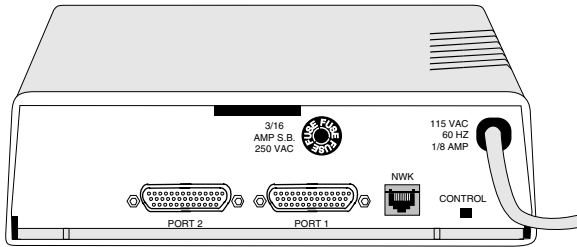
Figure 1-2
Rear Panel

FEATURES

- UDS and Telenetics Data Shelf compatible

- Choice of interfaces including:
  V.35 synchronous or DS-1

- All standard data rates:
  n x 56 kbps, n x 64 kbps (where n = number 1 to 24 of DS0 time slots-- 1.536 Mbps max) asynchronous rates
  300-57.6 kbps

- Fractional T1 compatible

- Uniform synthesized DTE transmit and receive clocks

- Flexible timing options

- Integral CSU

- B8ZS clear channel capability

- ESF or SF framing modes

- ESF diagnostics per AT&T 54016 and ANSI T1.403

- Built-in network and per channel loopback test capability

- Front panel LED status display for DTE ports

- Configuration and diagnostic options via Front panel LCD, RS-232 control port, or Motorola LocalView

Chapter 2
Installation

GENERAL

This chapter provides installation information for the FT 100. If changing hardware options to meet system requirements, refer to Chapter 3 before installation.

☞ **Note**

When requesting T1 network service, personnel operating this equipment must complete the affidavit in the front of this manual.

RECEIPT INSPECTION

Inspect the equipment carefully for damage that may have occurred in shipment. If there is damage or material shortage, contact the shipping agent and Telenetics authorized distributor for advice and assistance. Retain the shipping container and packing material for possible future shipment.

The FT 100 arrives with the following components:

- Standalone housing containing two main circuit boards
- Two user specified piggyback interface boards/adapters
- Power transformer with cable
- T1 line cables
- V.35 adapter (included withV.35 unit)
- User's Guide

The following components must be supplied by the user:

- RS-449 adapter
- Control port adapter

SITE PREPARATION

The installation area should be clean and free from extremes of tempera-ture, humidity, and appreciable shock and vibration. Allow sufficient space at the rear of the unit for cable clearance and airflow. See Figure 2-1.
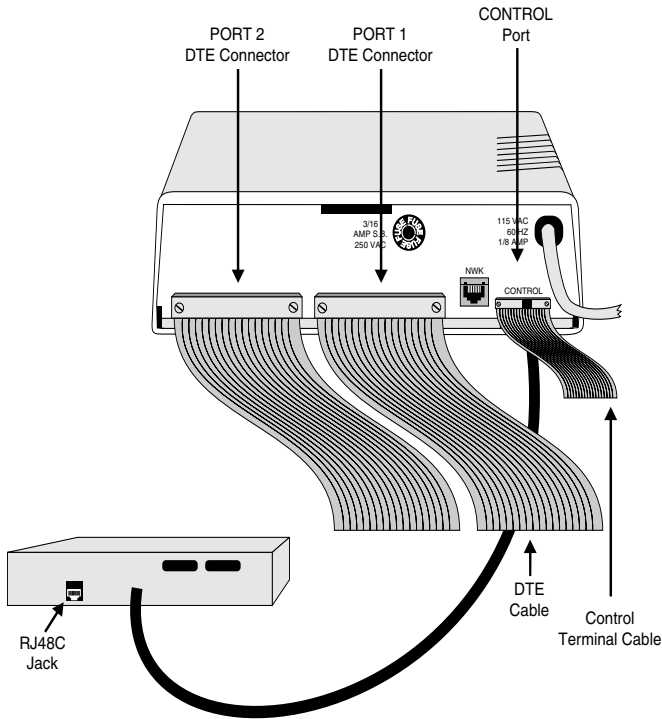
Figure 2-1
Installation

CONNECTIONS

☞ Note

> *Before connecting the unit to the network or the DTE, determine whether the factory setting for Network Transmit LBO is set as required or must be changed. Refer to Chapter 3.*

FT 100 to Network

Network T1 line connections are made through a standard 8-pin RJ48C jack labeled **NWK** on the rear panel. Table 2-1 lists pin connections for the network connector.

Table 2-1. Network Connector Pin Functions

RJ48C Pin	Function
1	Network receive ring (R1)
2	Network receive tip (T1)
3	Not used
4	Network transmit (R)
5	Network transmit (T)
6	Not used
7, 8	Ground

To connect the unit to the network,

1. Insert one end of the supplied cable into the unit's NWK jack.

2. Insert the other end into the RJ48C on the T1 Network interface connector.

FT 100 to Remote Control Device

The 9-pin D-type male connector labeled **CONTROL** on the rear panel connects to the terminal that controls FT 100 operation, or to a modem connected to a remote terminal that controls the unit.

The interface is compatible with EIA RS-232 serial data operation and has pin functions like a Data Circuit-terminating Equipment (DCE) interface.

This is the same type of connector with the same pin connections as found on IBM PC/AT personal computers and compatibles so that standard cables can be used.

Pin connections for this interface are listed in Table 2-2.

Table 2-2. Control Port Connector Pin Functions

DB9 Pin	Function
1	Data carrier detect
2	Receive data
3	Transmit data
4	Data terminal ready
5	Ground
6	Data set ready
7	Request to send
8	Clear to send
9	Not used

To connect the unit to the network,

1. Insert one end of the cable into the unit's **CONTROL** port.

2. Insert the other end into the RS-232 connector on the controlling equipment.

FT 100 to DTE

The 25-pin D-type female connectors on the rear panel connect to the DTE. Table 2-3 through 2-7 show pin connections for the optional DTE connectors available.

To connect the unit to the DTE,

1. Insert the DTE cable into the DTE connector on the unit.

2. Insert the opposite end into the designated DTE.

3. Secure the screws to complete the connection.

Table 2-3. RS530 / RS449 Pin Functions

RS-530 (DB25) Pin	RS-449 (DB37) Pin	Function
1	1	Protective ground
2	4	Transmit data A
3	6	Receive data A
4	7	Request to send A
5	9	Clear to send A
6	11	Data set ready A
7	19	Signal ground
8	13	Receive line signal detect A
9	26	Receive clock B
10	31	Receive line signal detect B
11	35	External transmit clock B
12	23	Transmit clock B
13	27	Clear to send B
14	22	Transmit data B
15	5	Transmit clock A
16	24	Receive data B
17	8	Receive clock A
18	10	Local loopback
19	25	Request to send B
20	12	Data terminal ready A
21	14	Remote loopback
22	29	Data set ready B
23	30	Data terminal ready B
24	17	External transmit clock A
25	18	Test mode

Table 2-4. V.35 Functions

V.35 (DB25) Connector Pin	V.35 (34 pin V.35) Adapter Pin	Function
1	A	Protective ground
2	P	Transmit data A
3	R	Receive data A
4	C	Request to send
5	D	Clear to send
6	E	Data set ready
7	B	Signal ground
8	F	Receive line signal detect
9-12	--	Not used
13	AA/a	Transmit clock B
14	S	Transmit data B
15	Y	Transmit clock A
16	T	Receive data B
17	V	Receive clock A
18	J	Local loopback
19	X	Receive clock B
20	H	Data terminal ready
21	BB/b	Remote loopback
22	--	Not used
23	W	External transmit clock B
24	U	External transmit clock A
25	K	Test mode

Table 2-5. DS-1 Connector Pin Functions

Circuit Function	DS-1 Connector Pin	DS-1 Connector Adapter Pin
Transmit to DTE (T1)	4	2
Transmit to DTE (R1)	17	1
Ground (S1)	5	7
Receive from DTE (T)	2	5
Receive from DTE (R)	15	4
Ground (S)	3	8

V.35 / RS-449 Adapter Installation

Optional adapters are available for converting the DTE connector to a 34-pin V.35 type connector or to a 37-pin RS-449 type connector. Contact your sales representative for ordering information. Pin connections for the V.35 and RS-449 adapters are listed in Tables 2-3 and 2-4. Pin connections for the RS-232 and DS-1 are shown in Tables 2-5 and 2-7.

Table 2-6. DS-1 Connector Pin Functions

Circuit Function	DB15 DS-1 Connector Adapter Pin	DB15 DS-1 Connector Pin
Transmit to DTE (T1)	3	4
Transmit to DTE (R1)	11	17
Ground (S1)	4	5
Receive from DTE (T)	1	2
Receive from DTE (R)	9	15
Ground (S)	2	3

Table 2-7. RS232 Connector Pin Functions

RS232 Pin Number	Circuit Function
1	Protective Ground
2	TX data
3	RX data
4	Request to send
5	Clear to send
6	Data set ready
7	Signal ground
8	Receive line signal detect
9-14	Not used
15	TX clock
16	Not used
17	RX clock
18	Local loopback
19	Not used
20	Data terminal ready
21	Remote loopback

Table 2-7. RS232 Connector Pin Functions (Continued)

RS232 Pin Number	Circuit Function
22-23	Not used
24	External TX clock
25	Test mode

POWER

Power is supplied through a 6-foot line cord with a grounded 3-wire plug (attached to the unit). If chassis ground is available through the third prong of the plug, a separate ground wire is not required.
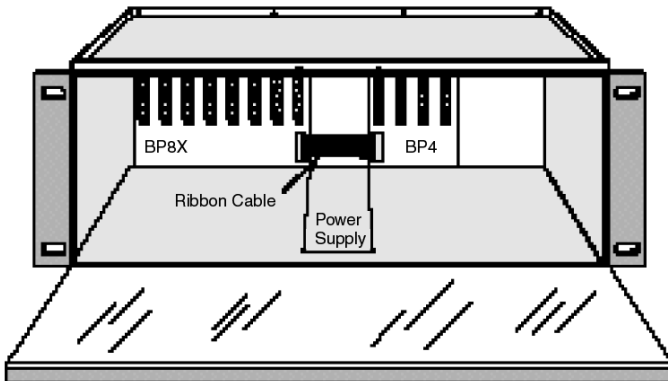
Figure 2-2
Front View

Chapter 3
Hardware Configuration

GENERAL

The FT 100 is factory configured to current industry standards. Because of the number of possible applications, the unit will require some option changes to fit a particular application.

This chapter describes the options that are configured with hardware on the printed circuit board (PCB). Hardware options are selected by two plug-on straps, a dip switch, and installing the interface adapter card. To access these options on the standalone unit, the cover must first be removed.

COVER REMOVAL

⚠ Warning

Do not remove the cover unless the power cord is unplugged.

1. Place the unit on its side on a flat surface.

2. Insert a medium size flat screwdriver blade in one of the bottom rear latch slots. Do not push the screwdriver but lightly pry the handle away from the unit as shown in Figure 3-1. This disengages the lock prong from the latch locks.

3. Assist removal by pushing the cover from the chassis with your fingers on the unit rear edges. Repeat this procedure with the remaining latch slots.

4. To replace the cover, align the latch locks, rear guide grooves, and front lock tabs.

5. Press the cover in place until the latch locks engage the lock prongs.
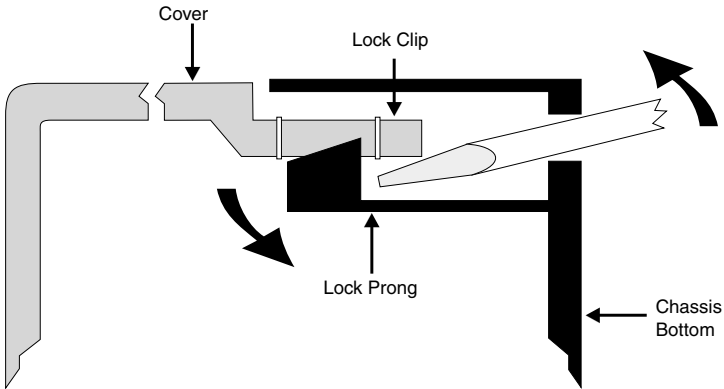
Figure 3-1
Cover Removal

CHANGING OPTION SETTINGS

Figure 3-2 shows the positions of the option straps, the dip switch, and the interface adapter card on the main printed circuit board. Figu re3-3 shows a typical strap application.

- To change a strap setting, lift the jumper strap off and insert it in the new position.
- To change a switch position, use a pointed object to move the desired switch to ON or OFF.
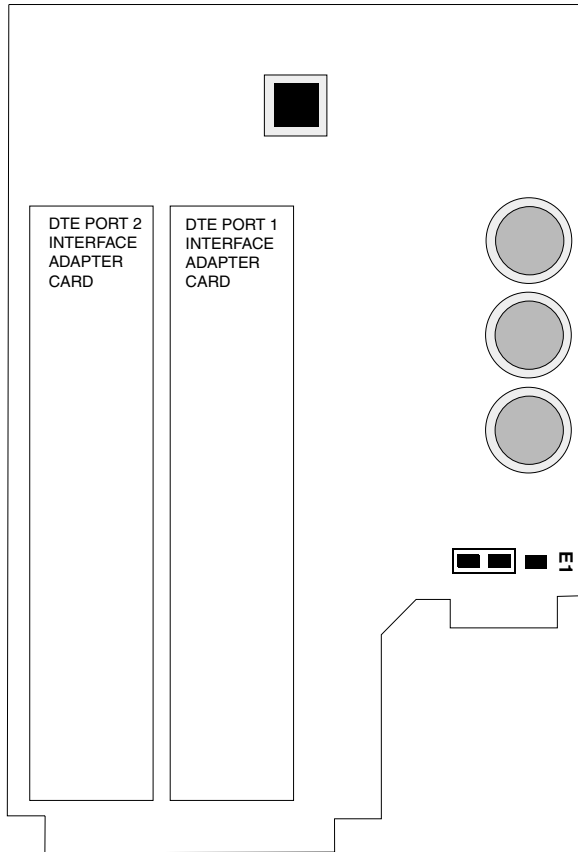
Figure 3-2
Strap and Adapter Card Locations
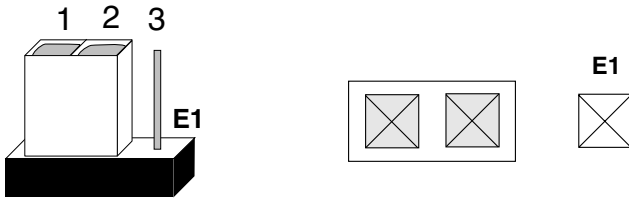
Figure 3-3
Strap Application

Grounding

Signal ground is normally connected to chassis ground. If interference exists, isolate signal ground from chassis ground by moving strap E1 to

DTE INTERFACE OPTIONS

Several standard DTE interfaces are available.

Normally, the FT 100 is purchased with the required interface already installed. However, if application requirements change, the unit can be reconfigured.

The DTE interface type is selected by

- installing the appropriate adapter card onto the main printed circuit board and
- if required, installing an adapter for converting the DTE connector on the rear panel.

Installing an Interface Card

The interface adapter cards are located on the main printed circuit card as shown in Figur e3-2.

To remove a card, remove the stand off screws and carefully lift both ends of the card vertically to unplug the card.

Since the available interface adapter cards are used on various Telenetics products, they may contain switches and straps that must be set according to the product on which they're to be used. For the FT 100 and FT 100EX, the settings are described in the table below. Option cards that were installed at the factory should already be configured properly.

V.35 Card	**RS-530/449 Card**	
#4563699 or 4563956	#4563507	#4563137
Switches 3, 4, 6 ON 1, 2, 5, 7, 8, OFF	Strapped for CHNL	Strapped for TM

For RS-232 type cards contact the Applications Department or you local distributor for configuration information.

To install a card,

1. Ensure the card is configured correctly.

2. Align the connectors.

3. Firmly press the adapter card down at both ends until the card fully seats.

4. Re-install stand off screws.

Using a Conversion Adapter

A DS-1,V.35, or RS-449 connector conversion adapter can be attached to the rear panel DTE connector. These adapters convert the existing 25-pin D-type DTE connector to a 34-pin V.35 connector or 37-pin RS-449 connector.

DS-1 conversion adapter converts the 25-pin D type DTE connector to an 8-pin modular telephone jack (RJ48C).

Chapter 4
Front Panel Option Selection

GENERAL
FT 100 configuration options, operating status, and diagnostics can be observed or changed using the front panel pushbuttons with the LCD. The unit can also be controlled by the control port described in Chapter 6, or by the LocalView terminal when installed in the Local-View shelf.

LCD MENUS
Three main menus provide:

- Port status displays
- Diagnostic options
- Configuration options

Each main menu is supported by submenus, items, and options. While most menu items allow selecting different options, some only display the current status of a signal or function. These provide status monitoring for such features as receive signal frame synchronization and alarm reporting.

Table 4-1 lists all menus.

Using the Pushbuttons to Select Options
Generally, pressing NO scrolls vertically down the columns in Table 4-1 and pressing YES advances horizontally across the columns. Pressing HOME returns to the submenu or main menu header.

If the pushbuttons are pressed and held, the FT 100 automatically scrolls through the menu at a rate of about 4 display advances per second. Options are selected by pressing the YES/NO pushbuttons in answer to prompts or questions. In some cases, option fields on the LCD blink. If this occurs and the displayed selection for the option should be changed, press NO to display another selection. If the displayed selection is the setting required, press YES to select it and advance to the next option field or submenu.

Table 4-1. Menu Options

MAIN MENU		SUBMENU	SUBMENU ITEM	OPTION
M A I N 1	Port Status Display?	Line Status:	Mode / Line Code / Framing / Receive Status	
		Port xx Status	Mode / Interface / Data Rate	
M A I N 2	Diag-nostic Options	T1 Tests?	T1 Local Loopback?	YES / NO
			T1 Network Loopback?	YES / NO
			Remote CSU Loopback?	YES / NO
		DTE Port Tests?	Local Terminal Loopback?	YES / NO
			Remote Terminal Loopback?	YES / NO
			Remote Loopback?	YES / NO
			Remote Loopback with Test Pattern?	YES / NO
			Test Pattern Test?	YES / NO
		Monitor DS0 Display	Channel Data ## nnnnnnnn	*channels* 1-24
		Performance History Display?	Error Free Seconds?	*nn% (0-100)*
			Error Free Events:	*nn (0-65565)*
			24 Hours Total?	ES / BES / SES / UAS / LOFC / LCVS *(1-900 each)*
			15 Minute Interval Data?	

Table 4-1. Menu Options (Continued)

MAIN MENU		SUBMENU	SUBMENU ITEM	OPTION
M A I N **3**	Configu-ration Options?	T1 Line Options?	Framing	SF / ESF
			Line Code	AMI / B8ZS
			Bit Stuffing	Enable Disable
			ESF (PRM) Transmission	Enable Disable
			ESF (AT&T) Mode	Enable Disable
			Timing	Loop / Internal / Port 1 / Port 2 / External (Port 2)
			Line LB	Enable / Disable
			Payload LB	Enable / Disable
			Idle Code	FF / 7F
			Yellow Alarm	Enable / Disable
			CSU/DSU	CSU: 0, -7.5dB, -15dB DSX: 0-133ft, 133-266ft, 266-399ft, 399-533ft, 533-655ft
		DTE Port Options? (V.35, RS530, or RS232 interface card)	Select Port #	1/2
			Select # of Time Slots	0 - 24
			Select Rate Multiple	56K bps 64K bps
			Select DS0 Grouping	Alternating Contiguous
			Select Starting Time Slot	1-24
			Transmit Clock Source	Internal External
			Receive Clock Polarity	Normal Inverted
			CTS Mode	Normal/Forced On

Table 4-1. Menu Options (Continued)

MAIN MENU	SUBMENU	SUBMENU ITEM	OPTION
M A I N 3 C O N T	Configu-ration Options? Cont.	DTE Port Options? Cont. (V.35, RS530, or RS232 interface card)	TM Mode	Normal/Forced Off
		LL Mode	Enable / Disable
		RL Mode	Enable / Disable
		Remotely Activated Loopback	Enable Disable
		DTE Port Options? Cont. (DS-1 interface card)	Select # of Time Slots	0 - 24
		Select Rate Multiple	56K bps / 64K bps
		Select DS0 Grouping	Alternating Contiguous
		Select DS0 Starting	1 - 24
		Select DS-1 Line Length	0-133, / 133-266 / 266-399 / 399-533 / 533-655 feet
		Signaling	Enable / Disable
		Yellow Alarm	Enable / Disable
		T1 Framing	SF / ESF
		Line Code	AMI / B8ZS
		Remotely Activated Loopback	Enable Disable
		Control Port Options?	Mode	Terminal Computer LocalView
		Baud Rate	300 600 1200 2400 4800 9600 19200
		Local Echo	On / Off
		Status	Lock / Unlock
		Set Time?		Set time
		Set Date?		Set data

Powerup Displays

On powerup, the FT 100 displays a sign-on message for 2 seconds which includes the software version number:

```
      FT 100
   VERSION x.xx
```

During this time, the unit performs a self diagnostic test. If the test fails, a message appears describing the malfunction. If the unit passes the test, the product name displays:

```
      FT 100
   T1 ESF CSU/DSU
```

PUSHBUTTON ACTION:

YES-   None

NO-   Advances to PORT STATUS DISPLAY?

HOME-   Redisplays software version message.

PORT STATUS DISPLAY MAIN MENU 1

```
   Port Status
    Display?
```

This menu contains display-only messages for monitoring the status of the line and DTE ports.

PUSHBUTTON ACTION:

YES-   Advances to LINE STATUS: display

NO-   Advances to DIAGNOSTIC OPTIONS? menu

HOME-   Returns to the FT 100 T1 CSU/DSU main menu header

Line Status

> Line Status:
> *Mode LC Fram Rec Status*

The line status display indicates the present status of the FT 100 / T1 network interface. The display includes the four status fields shown in the following table.

Status Field	Mode	Line Code	Framing	Receive Status
Possible Status	NORM	AMI	SF	SYNC
	LLB	B8Z	Fe	LOS
	NLB			AIS
	RLU			YEL
	PLB			
	RCLB			

The Mode field displays the present operating mode of the T1 network interface. Mode status indications are:

- NORM   Normal operation
- LLB   Local loopback
- NLB   Network loopback
- RLU   Remote loop up
- PLB   Payload loopback
- RCLB   Remote CSU loopback

The Line Code field displays the T1 line code option selected during configuration. To change the selection, refer to CONFIGURATION OPTIONS MAIN MENU later in this chapter. Indications are:

- AMI   Alternate mark inversion
- B8Z   Binary 8-zero substitution

The Framing field displays the T1 framing option selected during configuration. Refer to CONFIGURATION OPTIONS MAIN MENU later in this chapter. The framing status indications are:

- SF   Superfame (D4) framing
- Fe   Extended superframe (ESF) framing

The Receive Status field displays the status of the FT 100 T1 network receiver. The receive status indications are:

- SYNC   Frame synchronization is established.
- LOS   Loss of synchronization
- AIS   Alarm indication signal (unframed all ones) is being received.
- YEL   Yellow alarm signal is being received.

PUSHBUTTON ACTION:

YES-   None
NO-   Advances to Port 1 Status:
HOME-   Returns to PORT STATUS DISPLAY? menu

DTE Status

> Port xx Status:
> *Mode Interface Data Rate*

This display indicates the selected DTE port status. The three fields of the display are:

Status Field	Mode	Interface	Data Rate
Possible Status	NORM	V.35	56K - 1536K
	LTL	RS530	
	RTL	DS-1	
	RL	RS232	
	RLTP		
	RAL		
	TP		

The Mode field displays the present operating mode of all FT 100 or FT 100EX DTE ports:

- NORM   Normal operation

- LTL   Local terminal loopback test
- RTL   Remote terminal loopback test
- RL   Remote loopback test
- RLTP   Remote loopback w/test pattern
- RAL   Remotely activated loopback test
- TP   Test pattern test

The Interface field displays the DTE interface configuration that was selected during hardware configuration for that particular port (Chapter 3).

The Data Rate field displays the selected data bit rate for that particular DTE port. Rate values can range from 56 kbps to 1,536 kbps. Refer to the CONFIGURATION OPTIONS MAIN MENU description in this chapter to change the data rate.

PUSHBUTTON ACTION:

YES-   None
NO-   Advances to PORT 2 STATUS
HOME-   Returns to PORT STATUS DISPLAY? menu

DIAGNOSTIC OPTIONS MAIN MENU 2

```
          Diagnostic
           Options?
```

This menu accesses the diagnostic tests, which are divided into four submenus:

- T1 tests
- DTE port tests
- DS0 monitor
- Performance history display

PUSHBUTTON ACTION:

YES-   Advances to T1 TESTS? submenu
NO-   Advances to CONFIGURATION OPTIONS? menu
HOME-   Returns to the FT 100 T1 CSU/DSU main menu header

T1 TESTS

```
       T1 Tests?
```

The T1 line test modes include

- T1 Local Loopback
- T1 Network Loopback
- Remote CSU Loopback.

PUSHBUTTON ACTION:

YES-   Advances to T1 LOCAL LOOPBACK? test mode

NO-   Advances to DTE PORT TESTS? submenu

HOME-   Returns to DIAGNOSTICS OPTIONS? menu

T1 Local Loopback

```
       T1 Local
      Loopback?
```

Figure 4-1 shows the unit in Local Loopback. This test loops the network T1 transmitter output to the receiver input at the network interface. Since the entire T1 data payload is looped back, the DTE port is also looped back. This allows the local DTE to test the local unit. The looped back T1 signal is also transmitted to the network to keep the network active.

All TM LEDs light to indicate a T1 test in progress. Other LEDs function normally.

PUSHBUTTON ACTION:

YES-   Enters Local Loopback; advances to T1 LOCAL IN
        PROGRESS - END?

NO-   Advances to next test mode T1 NETWORK LOOPBACK?

HOME-   Returns to T1 TESTS? submenu
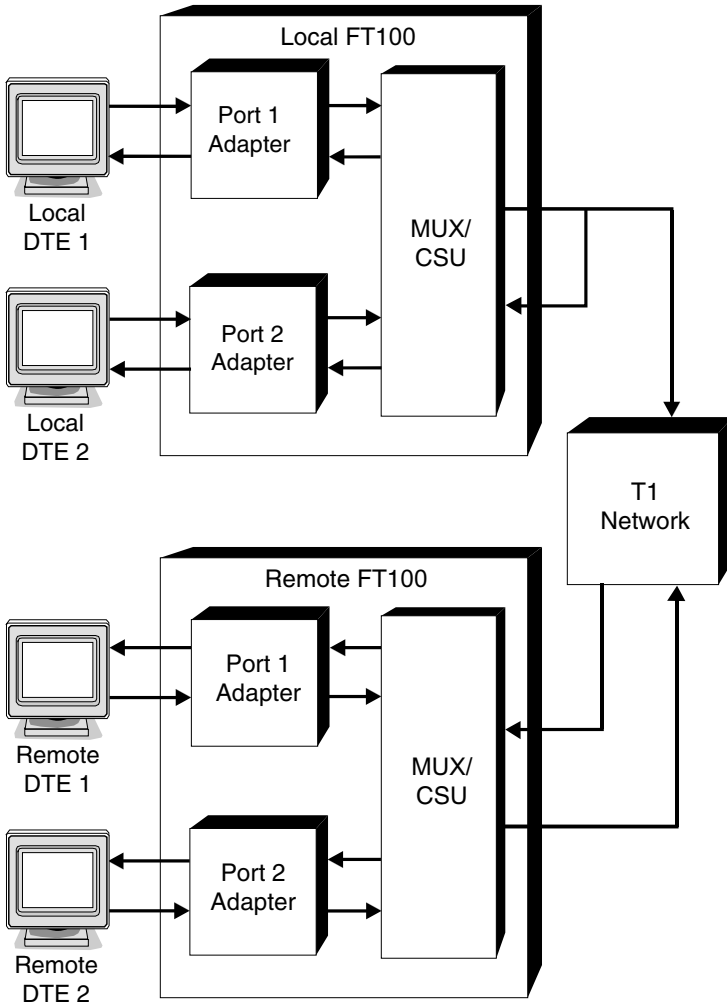
Figure 4-1
T1 Local Loopback

T1 Network Loopback

> T1 Network
> Loopback?

Figure 4-2 shows the unit in Network Loopback. The T1 network received signal is looped back to the network transmitter and also passed to the DTE port. The DTE port transmit signal is blocked. This allows testing the T1 network from a remote FT 100, a remote CSU, or from the telephone company central office.

All TM LEDs light to indicate a T1 test in progress. Other LEDs function normally.

PUSHBUTTON ACTION:

YES-   Enters network loopback; advances to T1 NETWORK LOOP IN PROGRESS - END?
NO-   Advances to Remote CSU Loopback?
HOME-   Returns to T1 TESTS? submenu

Remote CSU Loopback

> Remote CSU
> Loopback?

Figure 4-3 shows the unit in Remote CSU Loopback. When initiated, the local FT 100 transmits a loop-up code causing the remote unit to enter Remotely Activated Network Loopback. The loop-up code is transmitted until the remote unit enters loopback. The local unit then resumes normal operation. The remote unit enters loopback after the loop-up code has been received for at least 4 seconds.

The FT 100 responds to the standard CSU inband loop codes and out-of-band ESF loop codes received on the FDL. When the loop-up code is detected, the unit initiates a T1 network loopback. The loopback is terminated when the loop-down code is received.

When Remote CSU Loopback is terminated, a loop-down code is transmitted causing the remote unit to return to normal operation.
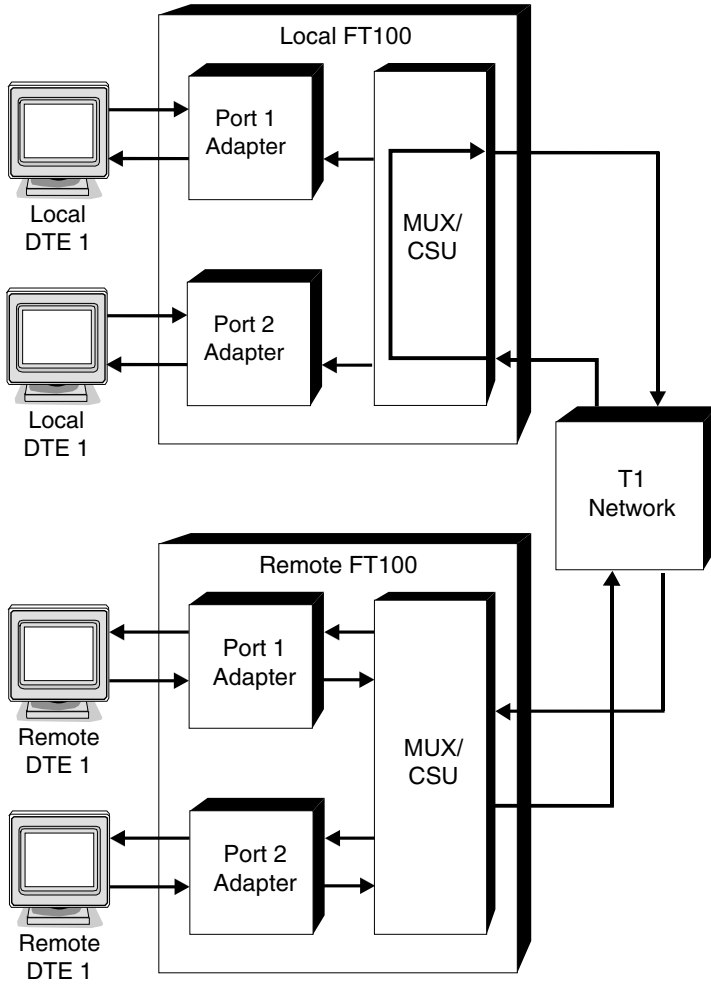
Figure 4-2
T1 Network Loopback
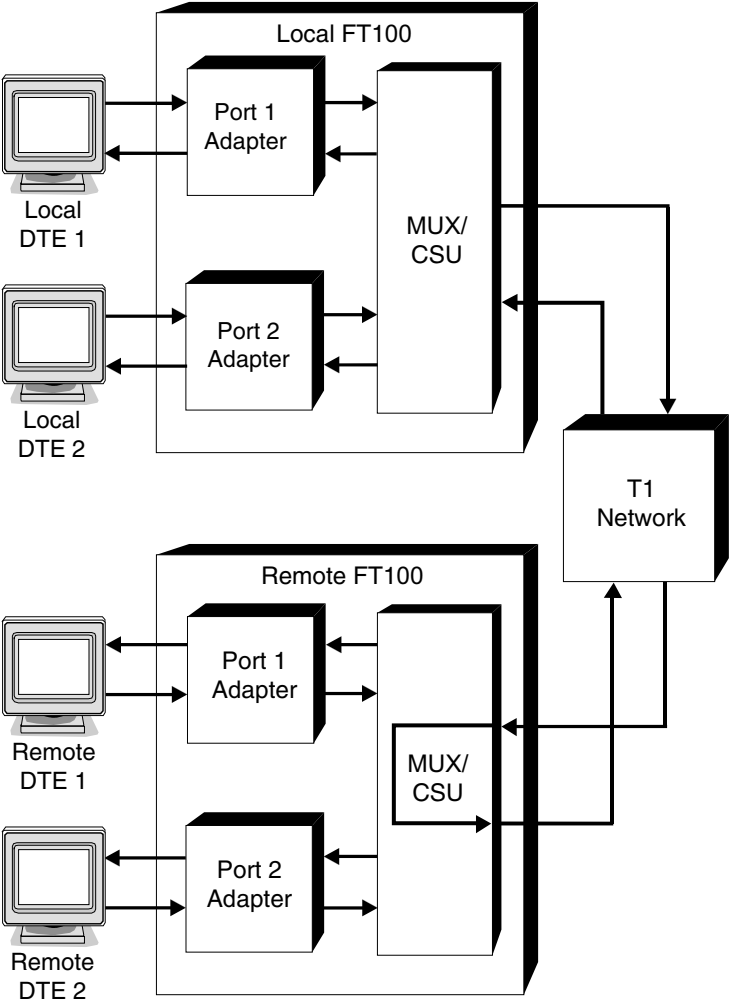
Figure 4-3
Remote CSU Loopback

The loop-up and loop-down codes are compatible with AT&T and ANSI inband loop codes. Therefore, the remote unit can be another FT 100 or a standard CSU device.

Loop-up set code -- repeating bit pattern 10000. Loop-down reset code -- repeating bit pattern 100.

All TM LEDs light to indicate a T1 test is in progress. Other LEDs function normally.

PUSHBUTTON ACTION:

YES-   Initiates Remote CSU loopback; advances to Remote CSU Loop in progress - End?

NO/

HOME-   Returns to T1 Test? submenu

DTE PORT TESTS

DTE Port Tests?

PUSHBUTTON ACTION:

YES-   Advances to the first test mode PORT 1 TESTS?

NO-   Advances to MONITOR DS0 DISPLAY? submenu

HOME-   Returns to DIAGNOSTIC OPTIONS? menu

Port xx Tests?

This submenu display accesses these DTE port test modes:

- Local Terminal Loopback
- Test Pattern
- Remote Loopback
- Remote Terminal Loopback

PUSHBUTTON ACTION:

YES-   Advances to the first test mode LOCAL TERMINAL LOOP-BACK?

NO-   Advances to the next port number
HOME-   Returns to DTE PORT TEST? menu

DTE Port Local Terminal Loopback

```
Port 1 Loc Term
   Loopback?
```

Figure 4-4 shows DTE port 1 in Local Terminal Loopback. Transmit data from the DTE is looped back to the DTE received data line. This allows testing the FT 100 interface adapter card and the cabling to the DTE port from the DTE.

The TM LED lights to indicate a test in progress. Other LEDs function normally.

PUSHBUTTON ACTION:
YES-   Enters local terminal loopback; advances to LOC TERM IN PROGRESS-END
NO-   Advances to REM TERM LOOPBACK? test mode
HOME-   Returns to DTE PORT TESTS? submenu

DTE Port Remote Terminal Loopback

```
Port 1 Rem Term
   Loopback?
```

Figure 4-5 shows the DTE port in Remote Terminal Loopback. Received data from the remote DTE is looped back to the remote DTE. The received data is also passed to the local DTE.

The TM LED lights to indicate a test in progress. Other LEDs function normally.

PUSHBUTTON ACTION:
YES-   Enters remote terminal loopback; advances to REM TERM LOOP IN PROGRESS-END?
NO-   Advances to REMOTE LOOPBACK? test mode
HOME-   Returns to DTE PORT TESTS? submenu
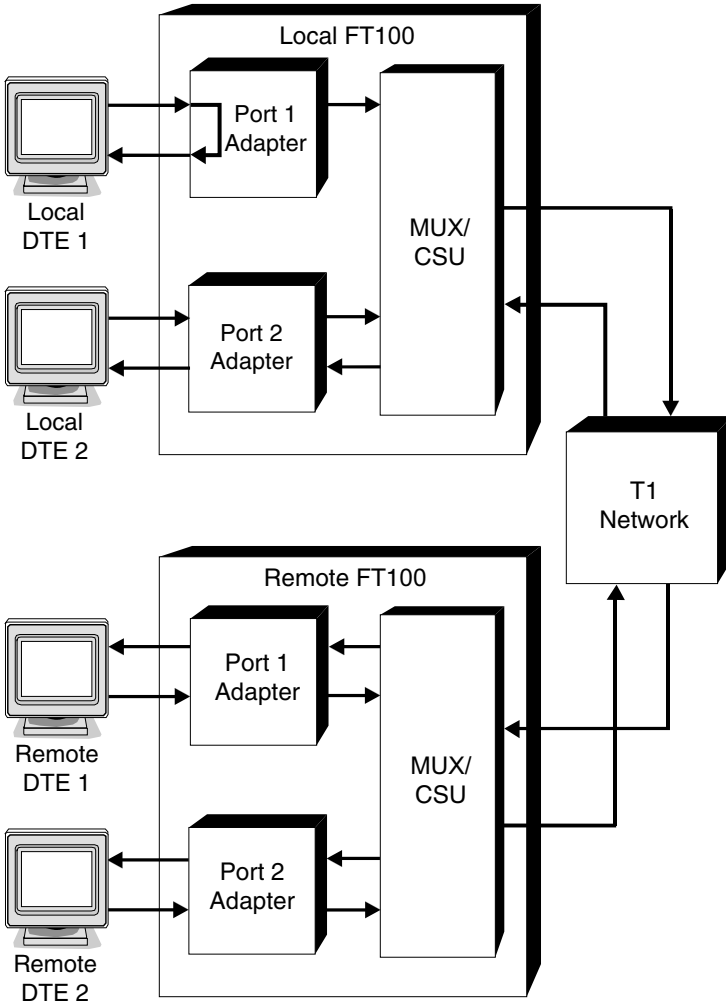
Figure 4-4
Remote CSU Loopback
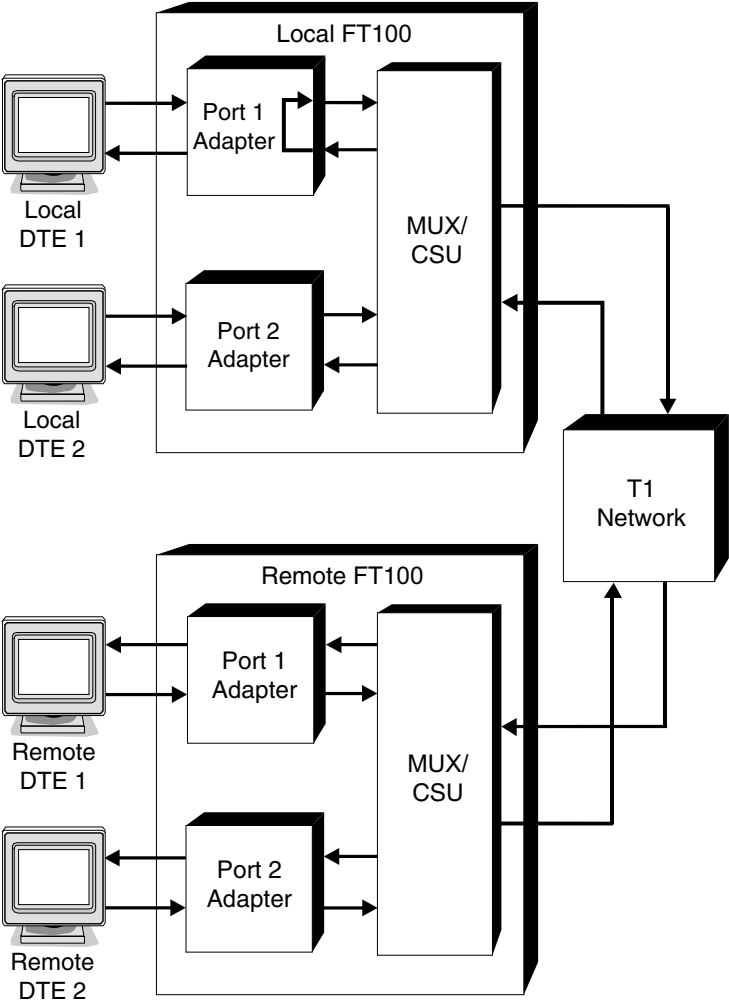
Figure 4-5
Port 1 Remote Terminal Loopback

DTE Port Remote Loopback

> Port 1 Remote
>   Loopback

Figure 4-6 shows DTE port 1 in Remote Loopback. The local FT 100 puts the DTE port on the remote FT 100 in remote terminal loopback by sending a (5 bit) repeating pattern (11110) transmitted inband for at least 5 seconds.

The loop pattern continues until the local FT 100 recognizes that the remote FT 100 is looped. As an option, the local DTE signal may be replaced by an internally generated test pattern.

The test pattern is transmitted to the remote FT 100 and monitored by the local FT 100 for errors indicated by an LCD message.

The TM LED lights to indicate a test in progress. On the remote FT 100, the TM LED blinks to indicate a remotely activated test in progress. Other LEDs function normally.

PUSHBUTTON ACTION:

YES-   Enters remote loopback; advances to WITH TEST PATTERN?

NO-   Advances to TEST PAT TEST? mode

HOME-   Returns to DTE PORT TESTS? submenu
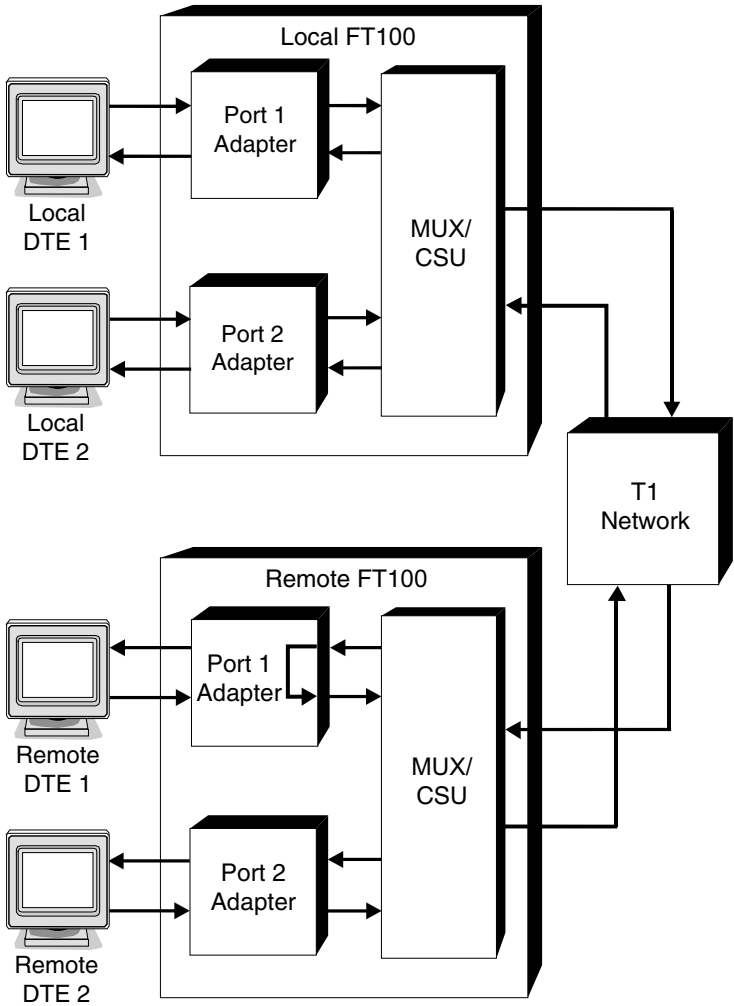
Figure 4-6
Port 1 Remote Loopback

```
┌─────────────────────────┐
│       With Test         │
│       Pattern?          │
└─────────────────────────┘
```

If a test pattern is selected with Remote Loopback, the local unit trans-
mits a 511 test pattern and monitors the receive data signal for this test
pattern. Error information is recorded and can be displayed (see Test
Pattern Test).

PUSHBUTTON ACTION:

YES-   Sends a loop-up pattern to remote DSU with test pattern and
          advances to ATTEMPTING TO LOOP REMOTE DSU
          display
NO-   Sends loop-up pattern to remote DSU without test pattern
          and advances to ATTEMPTING TO LOOP REMOTE DSU
          display
HOME-   Returns to DTE PORT TESTS? submenu

```
┌─────────────────────────┐
│     Attempting to        │
│   Loop Remote DSU        │
└─────────────────────────┘
```

The local FT 100 is sending a loop pattern and waiting for an indication
that the remote unit has entered loopback mode.

If the local unit does not receive the indication, it sends the loop-up code
indefinitely until commanded otherwise.

A message appears on the LCD when the remote unit responds success-
fully followed by the IN PROGRESS-END? display.

PUSHBUTTON ACTION:

YES-   None
NO/
HOME-   Sends loopdown pattern and returns to test request display

```
┌─────────────────────────┐
│      Port 1 (xxx)        │
│   In Progress - End?     │
└─────────────────────────┘
```

The control port is in a test mode where *xxx* is either "Rem w /TP" or "Remote." If Remote Loopback with a Test Pattern is selected, the local unit is also sending and monitoring a 511 test pattern.

PUSHBUTTON ACTION:

YES-   Sends loopdown pattern and returns to test request display
NO-   Advances to BIT ERROR display
HOME-   Returns to DTE PORT TESTS? submenu

```
Looping Down
 Remote DSU
```

The local unit is sending a sequence requesting the remote unit to leave the loopback mode.

The loop-down code is a 5 bit repeating pattern (11100).

PUSHBUTTON ACTION:
YES/NO/
HOME-   Returns to DTE PORT TESTS? submenu

If the unit has been put into a loopback mode by a remote unit, this display appears:

```
 DTE Remotely
Looped up - End?
```

PUSHBUTTON ACTION:

YES-   Takes the unit out of loopback mode, but if the remote unit continues to send the loop-up pattern, the unit returns to loopback mode after a few seconds
NO-   None
HOME-   Returns to DTE PORT TESTS? submenu

DTE Port Test Pattern

```
     Test Pattern
         Test?
```

Figure 4-7 shows the DTE port in the Test Pattern Test. DTE transmitted data is replaced by an internally generated 511 test pattern and sent to the remote FT 100. Also, local receive data is monitored for the same test pattern. An LCD message indicates detected test pattern errors.

The TM LED lights to indicate a test mode in progress. Other LEDs function normally.

PUSHBUTTON ACTION:

YES-   Enters test pattern test; advances to TEST PATTERN IN PROGRESS - END?

NO/

HOME-   Returns to DTE PORT TESTS? submenu

Test In Progress

```
          XXX
    In Progress-End?
```

This display indicates a test is in progress. *XXX* represents the particular test mode.

PUSHBUTTON ACTION:

YES-   Terminates the test

NO-   Advances to next test menu

HOME-   Returns to top of the present test menu
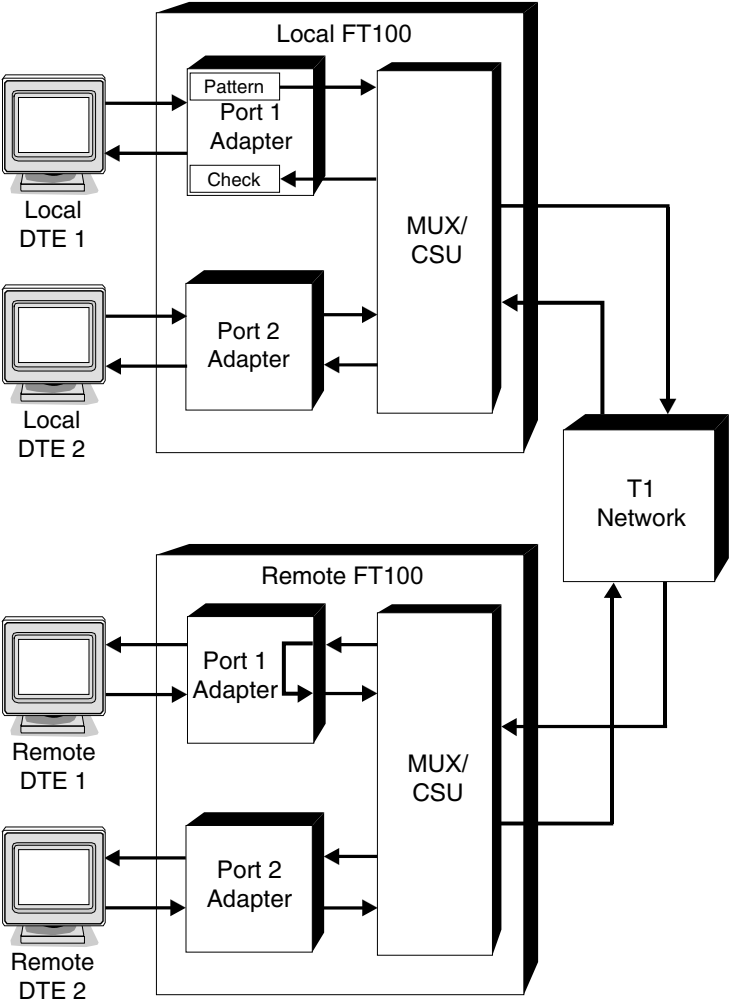
Figure 4-7
Port 1 Test Pattern Test

Bit Errors Display

> Port 1 Test Pat
> Bit Errors: *nnnnnn*

When a test includes a test pattern (RLTP or TP), this display shows the number of errored bits received since the test was entered or restarted.

PUSHBUTTON ACTION:

YES-   No action
NO-   Advances to average BER display
HOME-   Returns to the top of the present test menu

Average Bit Error Rate Display

> Port 1 Test Pat
> Avg. BER: *n.nE-nn*

This display shows the average number of errored bits received since the test was entered or restarted. The value appears in exponential notation.

Avg Ber = # of bit errors
total bits received

PUSHBUTTON ACTION:

YES-   No action
NO-   Advances to the elapsed seconds display
HOME-   Returns to the top of the present test menu

Elapsed Seconds Display

> Port 1 Test Pat
> Elapsed Sec.: *nnnnn*

This display shows the number of seconds that have elapsed since the test was entered or restarted.

PUSHBUTTON ACTION:

YES- No action

NO- Advances to RESTART TEST?

HOME- Returns to the top of the present test menu

Restart Test Display

```
Port 1 Test Pat
 Restart Test?
```

The user can reset the bit error count, average BER, and elapsed seconds for the test pattern tests if desired.

PUSHBUTTON ACTION:

YES- Restarts the error counters and returns to the BIT ERRORS display

NO/

HOME- Returns to the top of the present test menu

SELF TEST

To execute a self test, enter the T1 LOCAL LOOPBACK MODE, then the DTE TEST PATTERN MODE as described earlier in this section. Figure 4-8 shows the FT 100 in self test.

☞ **Note**

All ports may be put into the DTE TESTPATTERN MODE simultaneously.

To terminate the self test, press the HOME pushbutton twice.
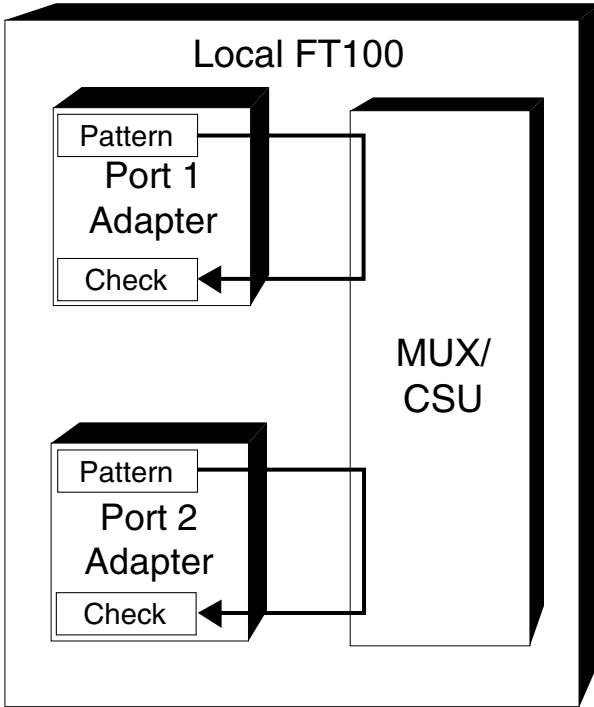
Figure 4-8
Self Test

DS0 MONITOR

> Monitor DS0
> Display?

The user can monitor activity on any selected DS0 data channel on the T1 network receive signal. Data displays on the LCD in an 8-bit field with the least significant bit to the right.

Use the YES/NO pushbuttons to select the DS0 channel number as described following the display diagram below.

PUSHBUTTON ACTION:

YES-   Enters DS0 monitor display
NO-   Advances to the PERFORMANCE HISTORY DISPLAY? submenu
HOME-   Returns to DIAGNOSTIC OPTIONS? menu

```
Channel Data
# # nnnnnnnn
```

PUSHBUTTON ACTION:

YES-   Decrements the displayed channel number # #-# # = 1 to 24
NO-   Increments the displayed channel number # #
HOME-   Returns to the MONITOR DS0 DISPLAY? submenu

PERFORMANCE HISTORY

```
Performance
History Display?
```

The FT 100 continuously monitors the network received signal for various error conditions. This information is accumulated, it is stored in nonvolatile memory, and it can be accessed and displayed on the LCD as well as via the external control port on the controlling DTE monitor. Refer to Chapter 6 for a description of performance history access by the control port.

The Performance History submenu first accesses these two error events:

- % Error free seconds
- Error count

PUSHBUTTON ACTION:

YES-   Advances to ERROR FREE SECS: display
NO/
HOME-   Returns to DIAGNOSTIC OPTIONS? menu

% Error Free Seconds

> Error Free Secs:
>   *nn %*

The percentage of error free seconds for the past 24 hours is displayed.

It is defined as

nn = (# of error free seconds) /
(# of total seconds) X 100

PUSHBUTTON ACTION:

YES-   None
NO-   Advances to the ERROR COUNT DISPLAY?
HOME-   Returns to PERFORMANCE HISTORY DISPLAY?
          submenu

Error Events

> Error Events:
>   *nnn*

This display indicates the total error event count *nnn* since the last time the count was reset.

If ESF framing is selected, an error event is either a CRC error or an Out of Frame Error (OOF).

If SF framing is selected, an error event is either a bipolar violation (BPV) or an OOF error.

PUSHBUTTON ACTION:

YES-   None
NO-   Advances to the CURRENT INTERVAL DISPLAY?
HOME-   Returns to PERFORMANCE HISTORY DISPLAY?
          submenu

Timed Error Data

Performance history is accumulated and stored in intervals of 15 minutes each for a maximum of 24 hours (96 intervals).

```
┌─────────────────────┐          ┌─────────────────────┐
│   24 Hour Totals    │          │   15 Min Interval   │
│                     │          │       Data?         │
└─────────────────────┘          └─────────────────────┘
```

These menus access displays recording error totals within

- the last 24 hours
- the current 15 minute interval
- or any 15 minute interval during the past 24 hour period.

The following error count displays may be accessed:

```
┌─────────────────────┐          ┌─────────────────────┐
│   Interval   ES     │          │   Interval   BES    │
│      #   nnn        │          │      #   nnn        │
└─────────────────────┘          └─────────────────────┘

┌─────────────────────┐          ┌─────────────────────┐
│   Interval   SES    │          │   Interval UAS      │
│      #   nnn        │          │      #   nnn        │
└─────────────────────┘          └─────────────────────┘

┌─────────────────────┐          ┌─────────────────────┐
│   Interval LOFC     │          │   Interval LCVS     │
│      #   nnn        │          │      #   nnn        │
└─────────────────────┘          └─────────────────────┘
```

The first column distinguishes the time option menu for that data. (The first column of each of the Current Interval displays includes the current interval second, 1 to 900.)

The second column records the total error count nnn per the specific type of error data:

ES   Errored seconds
BES   Bursty errored seconds
SES   Severely error seconds

UAS   Unavailable seconds
LOFC Loss of frame count
LCVS Line code violation seconds

```
┌─────────────────────────┐
│     15 Min Interval     │
│         Data?           │
└─────────────────────────┘
```

```
┌─────────────────────────┐
│      Interval # # ?     │
│                         │
└─────────────────────────┘
```

The time menu prompt also accesses an prompt which allows the user to indicate which 15 minute interval (01-96) in the last 24 hours should be displayed.

PUSHBUTTON ACTION:

YES-   At each of the "menu" prompts (*current, 24 hours, or any 15 minutes*), YES advances to the first error count display within the "menu." Within a time option menu, YES advances to the same error data type in the next interval. For example, if BES of interval 2 is currently displayed, pushing YES will advance to BES of interval 3.

NO-   At "menu" prompts, NO scrolls through the time option "menus;" within a time option "menu," NO advances through the six error count displays.

HOME-   Returns to PERFORMANCE HISTORY DISPLAY? submenu

CONFIGURATION OPTIONS MAIN MENU

```
┌─────────────────────────┐
│      Configuration      │
│         Options?        │
└─────────────────────────┘
```

This menu allows displaying and changing how the unit is configured to operate.

The four submenus are:

- T1 line options
- DTE port options
- Control port options
- Set time and date

PUSHBUTTON ACTION:

YES-   Advances to T1 LINE OPTIONS? submenu

NO/

HOME-   Returns to the FT 100 T1 CSU/DSU main menu header

T1 LINE OPTIONS

```
        T1 Line
        Options?
```

This submenu allows viewing and changing the FT 100 / T1 line operating characteristics.

Options accessed by this submenu include:

- T1 framing
- T1 line code
- ESF PRM transmission
- ESF reporting per 54016
- Timing
- Line loopback
- Payload loopback
- Idle code

PUSHBUTTON ACTION:

YES-   Advance to T1 framing option display: T1 FRAMING = SF
          (ESF) CHANGE IT?

NO-   Advances to DTE PORT OPTIONS? submenu

HOME-   Returns to CONFIGURATION OPTIONS? menu

T1 Framing

> T1 Framing = ESF
>   Change It?

The T1 network signal framing mode can be set to either Superframe (SF or D4) or Extended Superframe (ESF) mode.

PUSHBUTTON ACTION:

YES-   Toggles between ESF and SF(D4)
NO-   Saves option selected
HOME-   Returns to T1 LINE OPTIONS? submenu

Line Code

> Line Code = AMI
>   Change It?

Select one of two options for the network T1 line code:

AMI   Alternate mark inversion

B8ZS   Binary 8-zero substitution: With B8ZS, a bipolar violation sequence replaces strings of 8 zeros in the transmit data and insures a minimum ones density to the network.

PUSHBUTTON ACTION:

YES-   Toggles between AMI and B8ZS
NO-   Saves option selected and advances to PRM option
HOME-   Returns to T1 LINE OPTIONS? submenu

Bit Stuffing

> Bit Stuffing = EN
>   Change It?

Bit stuffing for the network T1 line can be DISABLED or ENABLED when using the AMI line code option. This option does not apply to the B8ZS line code option.

PUSHBUTTON ACTION:

YES-   Toggles between DISABLE and ENABLE
NO-   Saves option selected and advances to advances to PRM
        option
HOME-   Returns to T1 LINE OPTIONS submenu

ANSI Performance History

ESF (PRM) = OFF
    Change It?

ESF FRAMING OPTION ONLY
Enable or disable transmission of the performance report message
(PRM) defined by ANSI T1.403. When enabled, the PRM is transmitted
toward the network once per second on the facility data link (FDL). The
PRM contains error performance data accumulated during the previous
4 seconds.

PUSHBUTTON ACTION:

YES-   Toggles between on and off
NO-   Saves option selected and advances to ESF AT&T mode
        option
HOME-   Returns to T1 LINE OPTIONS? submenu

AT&T Performance History

ESF (AT&T) = OFF
    Change It?

ESF FRAMING OPTION ONLY
Enable or disable ESF error reporting as defined by AT&T publication
54016. ESF error reporting allows central office equipment to request
the error performance history from the unit via the FDL. When the
request is received, the unit transmits the 24-hour performance history to
the central office also via the FDL.

PUSHBUTTON ACTION:

YES-   Toggles between on and off
NO-   Saves option selected and advances to TIMING option

HOME-   Returns to T1 LINE OPTIONS? submenu

Timing

Timing = LOOP
     Change It?

This option selects the timing mode. Selections are:

Loop   The unit synchronizes all timing and clocks to the
                 network T1 receive signal. In this mode, the unit
                 supplies transmit and receive clocks to the DTE port.
                 This is the most common selection when the unit is
                 connected to a telephone company T1 service.

Internal   The unit synchronizes all timing and clocks to an
                 internally generated timing source. In this mode, the
                 unit supplies transmit and receive clocks to the DTE
                 port.

Port 1 or 2   The unit synchronizes all timing and clocks to the
                 selected DTE's external transmit clock.

External (Port 2) The unit synchronizes all timing and clocks to a 1.544
                 MHz external clock provided as an input to port 2.

Either internal or DTE port timing can be useful in applications where
the unit is directly connected to another FT 100 or T1 multiplexer, such
as in local area networks and central office bypass connections. In these
applications, only one unit should be selected for internal or DTE port
timing while the other is selected for loop timing.

PUSHBUTTON ACTION:
YES-   Scrolls timing options
NO-   Saves option selected and advances to LINE LB option
HOME-   Returns to T1 LINE O PTIONS? submenu

Line Loopback

> Line LB = DIS
>   Change It?

If Line Loopback is enabled, the unit enters into a network loopback when a Line Loopback code is detected on the network. This signal allows easier fault diagnosis by the T1 service provider. When this option is disabled, the unit ignores an incoming Line Loopback code.

PUSHBUTTON ACTION:

YES-   Toggles between enabled and disabled
NO-   Saves selected option and advances toPAYLOAD LB option
HOME-   Returns to T1 LINE OPTIONS? submenu

Payload Loopback

> Payload LB = DIS
>   Change It?

This option is similar to Line Loopback except that the contents of the DS0s are reframed before being transmitted back out on the network.

PUSHBUTTON ACTION:

YES-   Toggles between enabled and disabled
NO-   Saves selected options and advances to IDLE CODE option
HOME-   Returns to T1 LINE OPTIONS? submenu

Idle Code

> Idle Code = FF
>   Change It?

Select the FF pattern for all ones or the 7F pattern to be inserted into unused DS0s.

PUSHBUTTON ACTION:

YES-   Toggles between idle code FF and 7F
NO-   Saves selected option and advances toYellow Alarm

HOME-   Returns to T1 LINE OPTIONS? submenu

Yellow Alarm

> Yellow Alm = DIS
>   Change It?

This option setting determines whether or not Yellow Alarms will be sent out on the network.

PUSHBUTTON ACTION:

YES-   Toggles between enabled and disabled

NO/

HOME -   Returns to T1 LINE OPTIONS? submenu

NETWORK LINE INTERFACE

> <Interface>, <LBO>
>   Change It?

This option setting determines the T1 network line interface which may be either CSU or DSX-1.

When the CSU T1 network line interface is selected, the amount of line build-out (LBO) must also be selected. LBO is an artificial line circuit that provides line attenuation. The amount of LBO depends on the distance to the last T1 line repeater. The telephone company providing the service determines the amount of LBO required. The following ranges are available:

- 0 dB
- -7.5 dB
- -15dB

When the DSX-1 T1 network interface is selected, the line build-up is determined according to the line length. The following ranges are available:

- 0-133 ft
- 133-266 ft

- 266-399 ft
- 399-533 ft
- 533-655 ft

DTE PORT OPTIONS

V.35, RS-530, or RS-232 Interface Card

> DTE Port
> Options?

This submenu allows viewing and changing the DTE ports operating characteristics. Options accessed by this submenu include

- Port data rate
- DS0 time slot assignment
- Transmit clock source
- Transmit clock polarity
- Receive clock polarity
- Interface control signal options

PUSHBUTTON ACTION:

YES-   Advances to the port data rate display

NO-   Advances to CONTROL PORT OPTIONS? submenu

HOME-   Returns to CONFIGURATION OPTIONS? menu

☞ **Note**

The following options are displayed in blinking fields on the LCD. The option displayed is the present option selected. Pressing NO scrolls through the selections. When the desired selection is displayed, press YES.

Port Data Rate

> Port xx *<type>*
> *nn x rr = <rate>*

The *xx* blinks to prompt the user to either modify Port *xx* settings or advance to the next port.

PUSHBUTTON ACTION:

YES- Select Port xx and advances to data rate selection for this port

NO- Advances to next port

HOME- Returns to DTE PORT OPTIONS? submenu|

Select the data rate from 56 kbps to 1.536 Mbps with the following simple multiplication:

> *nn*   (number of DS0 time slots)
>
> <u>*x*   *rr*</u>   <u>(rate multiple: 56 or 64 kbps)</u>
>   =data rate

The *nn* blinks to prompt the user to confirm the current number of DS0 time slots or to increment the number.

PUSHBUTTON ACTION:

YES- Selects the number of DS0 time slots *nn* and blinks the rate multiple *rr*

NO- Increments the number of DS0 time slots *nn*

HOME- Returns to Port Number Selection

The display remains but the pushbutton action will now act differently so that the rate multiple can be changed:

```
   Port xx <type>
    nn x rr <rate>
```

PUSHBUTTON ACTION:

YES- Selects the rate multiple *rr* and advances to DS0 time slot assignment display

NO- Toggles rate multiple between 56 and 64 kbps

HOME- Returns to Port Number Selection

DS0 Grouping

> Port xx *<type>*
> xxxx CH: *ff* to *ll*

This display allows assigning DS0 time slots to the selected port.

xxxx=   alternating or contiguous DS0 channels
ff=   first DS0 channel number
ll=   last DS0 channel used by the selected port -- automatically
            determined by *ff* and port data rate display *nn* selection

xxxx blinks to prompt the user to confirm the current selection or toggle
to the other one.

PUSHBUTTON ACTION:

YES-   Selects alternating or contiguous DS0 assignment *xxxx* and
         blinks the starting DS0 number *ff*

NO-   Toggles between ALT and CONT DS0 assignment modes

HOME-   Returns to Port Number Selection

> Port xx *<type>*
> xxx CH: ff to ll

PUSHBUTTON ACTION:

YES-   Selects the first DS0 channel number *ff* and advances to the
         transmit clock source display

NO-   Increments the starting DS0 number *ff* and displays the
         ending DS0 number *ll*

HOME-   Returns to Port Number Selection

Transmit Clock Source

> Port xx *<type>*
> Tx CLK = *<source>*

This display selects the DTE transmit clock source:

Internal   The unit uses the transmit clock output to clock DTE
            transmit data into the transmit buffer. Where the DTE is
            located near the unit, internal clock is usually selected.

External   The unit uses the external transmit clock from the DTE to
            clock DTE data. In applications with a high bit rate and a
            long DTE cable, it may be necessary to use the external
            clock option.

In external clock operation, the transmit clock output from the unit is
routed to the DTE and sent back to the unit along with the data line. This
eliminates any phase misalignment between the clock and data signal
due to cable phase delay and insures a proper signal / clock relationship
at the unit input.

PUSHBUTTON ACTION:
YES-   Selects the displayed option and advances to transmit clock
            polarity display
NO-   Toggles between INTERNAL and EXTERNAL options
HOME-   Returns to Port Number Selection

Transmit Clock Polarity

> Port xx *<type>*
> Tx CLK = *<polarity>*

PUSHBUTTON ACTION:
YES-   Selects the displayed clock polarity option and advances to
            receive clock polarity display
NO-   Toggles between NORMAL and INVERT options
HOME-   Returns to Port Number Selection

Receive Clock Polarity

> Port xx *<type>*
> Rx CLK = *<polarity>*

PUSHBUTTON ACTION:

YES-   Selects the displayed clock polarity option and advances to
         the CTS signal operation display

NO-   Toggles between NORMAL and INVERT options

HOME-   Returns to Port Number Selection

CTS Signal Operation

> Port xx *<type>*
> CTS = *<mode>*

The CTS output may be selected for normal operation or forced on.
When normal is selected, CTS is asserted approximately 10 ms after
RTS is received.

PUSHBUTTON ACTION:

YES-   Selects the displayed CTS operation mode and advances to
         the RLSD signal operation display

NO-   Toggles between NORMAL and FORCED ON

HOME-   Returns to Port Number Selection

RLSD Signal Operation

> Port xx *<type>*
> RLSD = <mode>

Select normal or forced on operation for RLSD output. Selecting normal
turns RLSD on when the FT 100 T1 receiver has acquired frame
synchronization and off when frame synchronization is lost or no signal
is present.

PUSHBUTTON ACTION:

YES- Selects the displayed RLSD operation mode and advances to DSR signal operation display

NO- Toggles between NORMAL and FORCED ON

HOME- Returns to Port Number Selection

DSR Signal Operation

Port xx *<type>*
DSR = *<mode>*

Select normal or forced on operation for DSR output. Selecting normal turns DSR on when the FT 100 T1 receiver has acquired frame synchronization and off when frame synchronization is lost or no signal is present.

PUSHBUTTON ACTION:

YES- Selects the displayed DSR operation mode and advances to TM signal operation

NO- Toggles between NORMAL and FORCED ON

HOME- Returns to Port Number Selection

TM Signal Operation

Port xx *<type>*
TM = *<mode>*

The TM signal indicates to the DTE that the unit is in a test mode. Select normal or forced off operation for TM output. Selecting normal turns TM on if the unit is in a test mode.

PUSHBUTTON ACTION:

YES- Selects the displayed TM operation and advances LL signal operation

NO- Toggles between NORMAL and FORCED OFF

HOME- Returns to Port Number Selection

LL Signal Operation

> Port xx *<type>*
> LL = *<mode>*

This option determines whether the unit acknowledges or ignores an LL signal from the DTE.

If enabled, the LL signal causes the DTE port to enter Local Terminal Loopback. Otherwise, the LL signal is ignored.

PUSHBUTTON ACTION:

YES-	Selects the displayed LL operation mode and RL signal operation
NO-	Toggles between ENABLE and DISABLE
HOME-	Returns to Port Number Selection

RL Signal Operation

> Port xx *<type>*
> RL = *<mode>*

This option determines whether the unit acknowledges or ignores an RL signal from the DTE.

If enabled, the RL signal causes the DTE port to enter Remote Terminal Loopback. Otherwise, the RL signal is ignored.

PUSHBUTTON ACTION:

YES-	Selects displayed RL operation mode
NO-	Toggles between ENABLE and DISABLE
HOME-	Returns to Port Number Selection

Remote Loopback Operation

```
      Port xx <type>
   RA/RTL =<mode>
```

This option determines whether the unit acknowledges or ignores a loop-up pattern from the remote CSU/DSU.

Enable   The unit goes into Remote Terminal Loopback when the loop sequence is detected.

Disable   The unit ignores the sequence.

PUSHBUTTON ACTION:
YES-   Selects displayed RA/RTL mode
NO-   Toggles between ENABLE and DISABLE
HOME-   Returns to Port Number Selection

DS-1 Interface

```
      Port xx (DS-1)
       # of CH = nn
```

The xx blinks to prompt the user to either modify port *xx* settings or advance to the next port.

PUSHBUTTON ACTION:
YES-   Select Port *xx* and advances to # of channel selection for this port
NO-   Advances to next port
HOME-   Returns to DTE PORT OPTIONS? submenu

```
      Port xx (DS-1)
       # of CH = nn
```

The *nn* blinks to prompt the user to either modify the # of channels selected for Port *xx* or accept the current number and advance to the next port option.

PUSHBUTTON ACTION:

YES-   Advances to rate multiple option
NO-   Increment the number of channels selected for Port *xx*
HOME-   Returns to Port Number Selection

```
  Port xx (DS-1)
 xx, xxK CHANGES
```

PUSHBUTTON ACTION:

YES-   Advances to DS0 grouping option
NO-   Toggles between 56K and 64K bps
HOME-   Returns to Port Number Selection

```
  Port xx (DS-1)
  xxxx CH: ff to ll
```

This display allows assigning DS0 time slots to the selected port.

xxxx=   alternating or contiguous DS0 channels

f =   first DS0 channel number

ll=   last DS0 channel used by the selected port -- automatically
           determined

xxxx blinks to prompt the user to confirm the current selection or toggle
to the other one.

PUSHBUTTON ACTION:

YES-   Selects DS0 assignment and blinks the starting DS0 number
NO-   Toggles between ALT and CONT DS0 assignment modes
HOME-   Returns to Port Number Selection

```
  Port xx (DS-1)
  xxxx CH: ff to ll
```

PUSHBUTTON ACTION:

YES-   Selects the first DS0 channel number *ff* and advances to line length display

NO-   Increments the starting and ending DS0 numbers *ff* and *ll*

HOME-   Returns to Port Number Selection

> Port xx (DS-1)
> Len = *kk* - *mm* FT

This display allows setting the line build-out for the DS-1 card interface according to the displayed line length. The following ranges are available:

> 0-133 ft.
> 133-266 ft.
> 266-399 ft.
> 399-533 ft.
> 533-655 ft.

PUSHBUTTON ACTION:

YES-   Accept current line length selection and advances to signaling option

NO-   Advances to the next range of line lengths

HOME-   Returns to Port Number Selection

> Port xx (DS-1)
> Signaling = *DIS*

This display setting determines whether or not signaling information is passed from the network to the DTE.

PUSHBUTTON ACTION:

YES-   Accept current selection and advances to Yellow Alarm display

NO-   Toggles between ENABLE AND DISABLE

HOME-   Returns to Port Number Selection

```
   Port xx (DS-1)
  Yellow Alm = DIS
```

This option determines whether or not a yellow alarm is sent back to the DTE upon receiving AIS or LOS from the DTE which is serviced by this particular DS-1 interface.

PUSHBUTTON ACTION:

YES-   Accept current setting and advances to T1 setting display
NO-   Toggles between ENABLE AND DISABLE
HOME-   Returns to Port Number Selection

```
   Port xx (DS-1)
  T1 Framing  =  SF
```

This option selects the type of framing that is used between the DSU and DTE.

PUSHBUTTON ACTION:

YES-   Advances to line code selection
NO-   Toggles between SF and ESF framing
HOME-   Returns to Port Number Selection

```
   Port xx (DS-1)
  Line Code = AMI
```

This option determines the line coding that is used between the DSU and DTE.

PUSHBUTTON ACTION:

YES-   Accept current selection and advances to RA/RTL display
NO-   Toggles between AMI and B8ZS

HOME-   Returns to Port Number Selection

> Port xx (DS-1)
> RA/RTL = DISABLE

This option determines whether or not this particular port responds to a remotely activated remote terminal loopback.

PUSHBUTTON ACTION:
YES-   Returns to Port Number Selection menu
NO-   Toggles between ENABLE AND DISABLE
HOME-   Returns to Port Number Selection menu

CONTROL PORT OPTIONS

> Control Port
> Options?

This submenu allows selecting the control port operating characteristics. The unit can be externally controlled by a terminal or computer connected to the rear panel RS-232 **CONTROL** port or by the Local-View terminal when installed in the Motorola/UDS LocalView shelf. Chapter 6 describes control port operation.

The options are:

- Control mode
- Baud rate
- Local echo
- Status

PUSHBUTTON ACTION:
YES-   Advances to control mode
NO-   Advances to SET TIME submenu
HOME-   Returns to CONFIGURATION OPTIONS? menu

Control Mode

> Mode = <mode>
>   Change It?

The control port mode options are:

Terminal   allows operation with a standard ASCII terminal or computer connected to the control port. Responses from the unit are formatted ASCII text screens.

Computer   allows operation with a computer or modem connected to the control port. Responses from the unit are short unformatted ASCII messages.

LocalView allows operation with the LocalView Management System when installed in a LocalView shelf. In this mode, the rear panel control port is not used.

PUSHBUTTON ACTION:

YES-   Scrolls the options
NO-   Selects the displayed mode and advances to the baud rate option
HOME-   Returns to CONTROL PORT OPTIONS? submenu

Baud Rate

> Bit Rate = *<rate>*
>   Change It?

The baud rate options are:

- 300
- 600
- 1200
- 400
- 4800
- 9600
- 19200

PUSHBUTTON ACTION:

YES-   Scrolls through the baud rate options

NO-   Advances to LOCAL ECHO

HOME- Returns to CONTROL PORT OPTIONS? submenu

Local Echo

```
Local Echo = ON
     change It/
```

This option determines whether or not the unit echoes characters back to the control port terminal.

PUSHBUTTON ACTION:

YES-   Toggles between on and off

NO-   Advances to control port status

HOME- Returns to CONFIGURATION OPTIONS? menu

SETTING A PASSWORD

```
Status = Unlock
   Change It?
```

This submenu gives the user the option of requiring a password for remote access to the unit via the control port.

When the status is "Lock" the control port will prompt the user to enter the password. Refer to Chapter 6 for details on password operation and settings.

When unlocked no password prompt is displayed on the control terminal.

PUSHBUTTON ACTION:

YES-   Toggles between lock and unlock.

NO/

HOME- Returns to CONFIGURATION OPTIONS? menu

SET TIME AND DATE

These options allow setting the realtime clock to the current time and date. The unit uses the realtime clock for performance history time and date stamping. When the performance history is accessed through the control port, the time and date are displayed along with the error history.

```
   hh : mm : ss
    Set Time?
```

PUSHBUTTON ACTION:

YES-   Advances to hour display; accepts current setting for hour, minute, second displays

NO-   Advances to SET DATE? option; in hour, minute, second displays, increments digits for setting

HOME-   Returns to CONFIGURATION OPTIONS? menu

```
   Month dd, year
    Set Date?
```

PUSHBUTTON ACTION:

YES-   Advances to month display; accepts current setting for month, day, and year displays

NO-   Returns to CONFIGURATION OPTIONS? menu; in month, day, and year displays, increments digits for setting

HOME-   Returns to CONFIGURATION OPTIONS? menu

GENERAL

After installation and configuration, the FT 100 operates automatically and unattended.

CONTROLS AND INDICATOR

The FT 100 front panel contains three pushbuttons (YES, NO, HOME), a 2 line by 16 character liquid crystal display (LCD), and six light emitting diodes (LEDs) indicators. The FT 100EX also has six LEDs but no LCD, since they are controlled by the FT 100. Almost all configuration options and diagnostic features can be accessed by using the LCD and pushbuttons. Chapter 4 describes front panel option selection.

LED DESCRIPTION

The six front panel LEDs on the FT 100 and the FT 100EX consist of two sets of the following: (one for each port).

Transmit Data   TD

Transmit data indicates activity on the DTE transmit data line. Flashing indicates data is being transmitted. On indicates a low state and off indicates a high state or no data being transmitted.

For a DS-1 port, this LED lights as an indication that the link between the DSU and DTE is in sync.

Receive Data   RD

Data is being received if this LED is flashing. On indicates a low state on the line and off indicates a high state or no data being received.

For a DS-1 port, this LED lights as an indication that the network is in sync.

Test Mode   TM

Test mode indicates that the unit is in a test mode. When the FT 100 is in a T1 test, all the TM LED's turn on including those of the FT 100EX's.

Chapter 6
Control Port Operation

GENERAL

The rear panel port labeled **CONTROL** provides the connection for configuration and status display via terminal monitor.

The control port is an EIA-232 compatible serial interface. Tab le2-2 lists pin connections for this interface. The interface is the same as the serial I/O connector on AT style personal computers so that standard cables can be used.

☞ **Note**
   Connection applications are shown in Figur e6-2 and Figure 6-3.

Using Control Port Commands

Control port commands are entered from the control keyboard and consist of short character strings followed by a carriage return which select and display the various menus and options.

Figure 6-1 provides a menu flow chart indicating the access path via command through the available menus.

Any command or option choice can be entered from any screen. This feature allows easier configuration changes when the user is familiar with the command strings.

Refer to Chapter 4, Front Panel Option Selection for further information on options.

Main Menu   Option Menus   Options   Settings
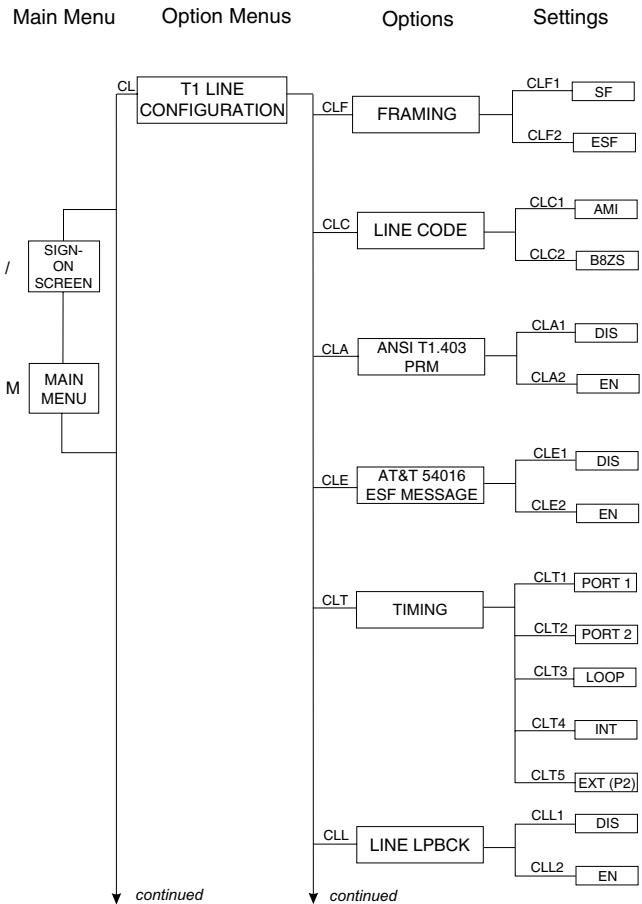
Figure 6-1
Menu Flow Chart
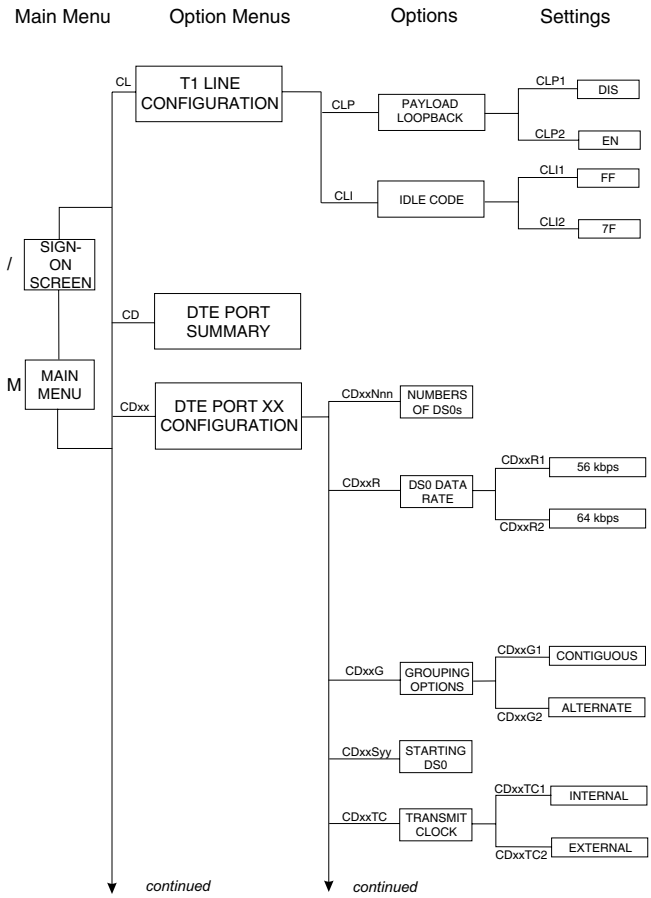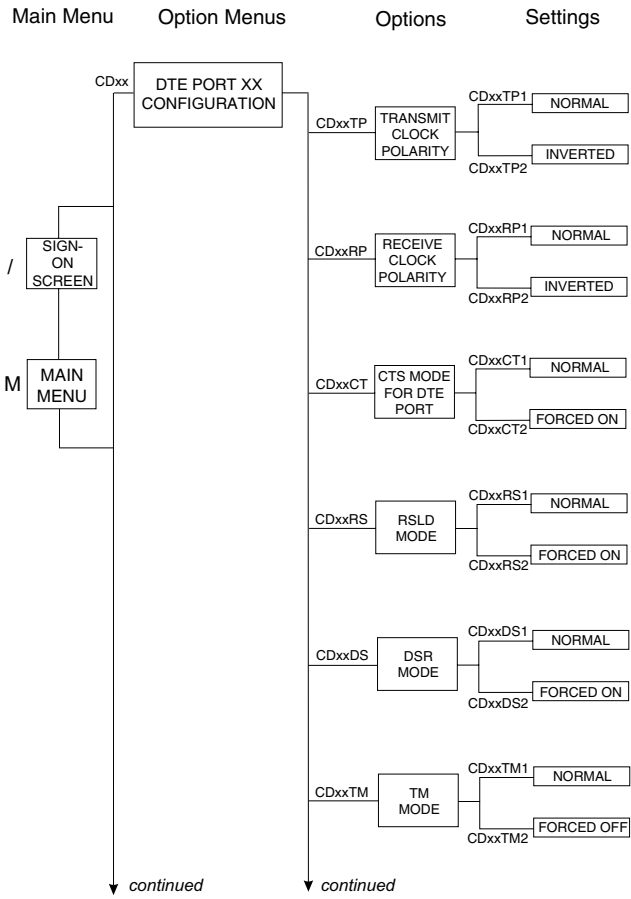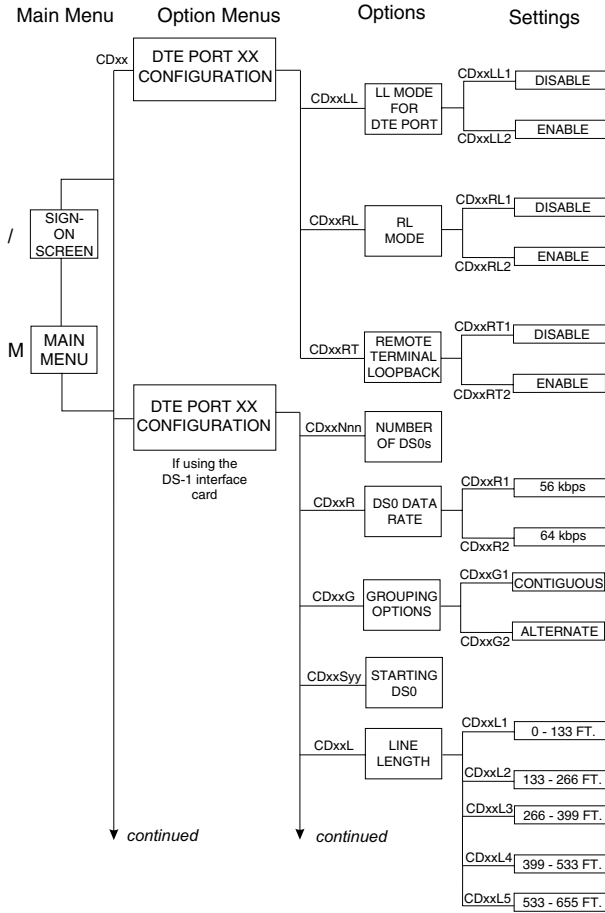
Main Menu   Option Menus   Options   Settings

Figure 6-1 Cont.
Menu Flow Chart

Main Menu	Option Menus		Options		Settings

CDxx — DTE PORT XX CONFIGURATION

CDxxTP — TRANSMIT CLOCK POLARITY
- CDxxTP1 — NORMAL
- CDxxTP2 — INVERTED

CDxxRP — RECEIVE CLOCK POLARITY
- CDxxRP1 — NORMAL
- CDxxRP2 — INVERTED

CDxxCT — CTS MODE FOR DTE PORT
- CDxxCT1 — NORMAL
- CDxxCT2 — FORCED ON

CDxxRS — RSLD MODE
- CDxxRS1 — NORMAL
- CDxxRS2 — FORCED ON

CDxxDS — DSR MODE
- CDxxDS1 — NORMAL
- CDxxDS2 — FORCED ON

CDxxTM — TM MODE
- CDxxTM1 — NORMAL
- CDxxTM2 — FORCED OFF

/ — SIGN-ON SCREEN

M — MAIN MENU

continued   *continued*

Figure 6-1 Cont.
Menu Flow Chart

Figure 6-1 Cont.
Menu Flow Chart
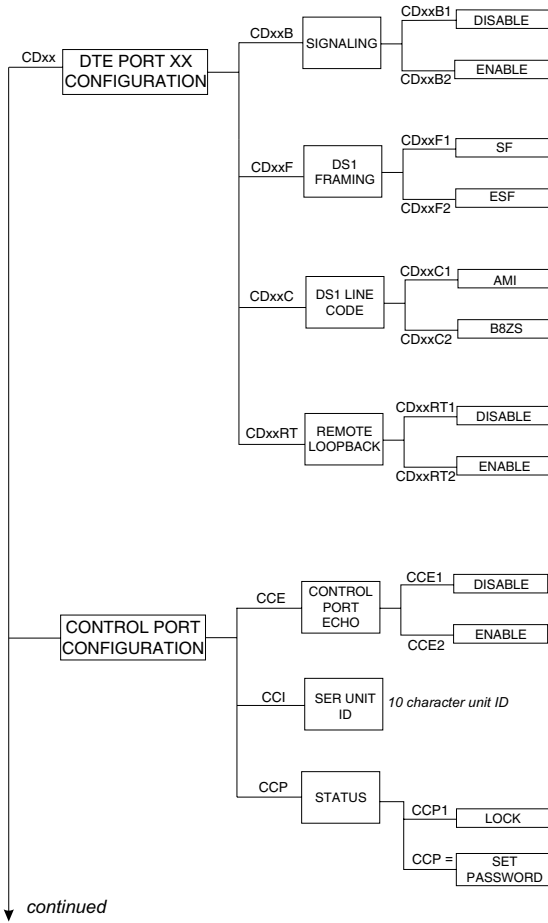
Figure 6-1 Cont.
Menu Flow Chart
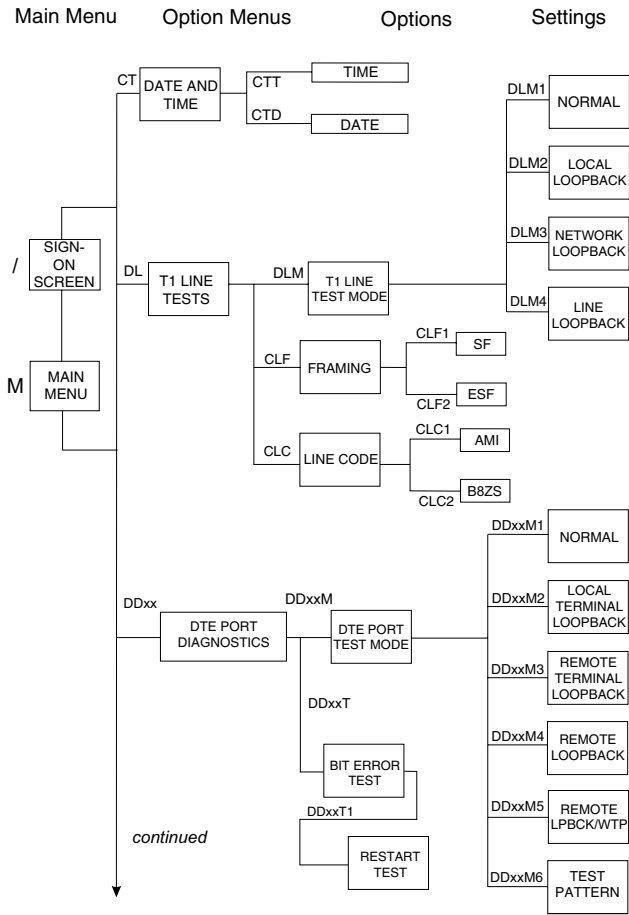
Figure 6-1 Cont.
Menu Flow Chart
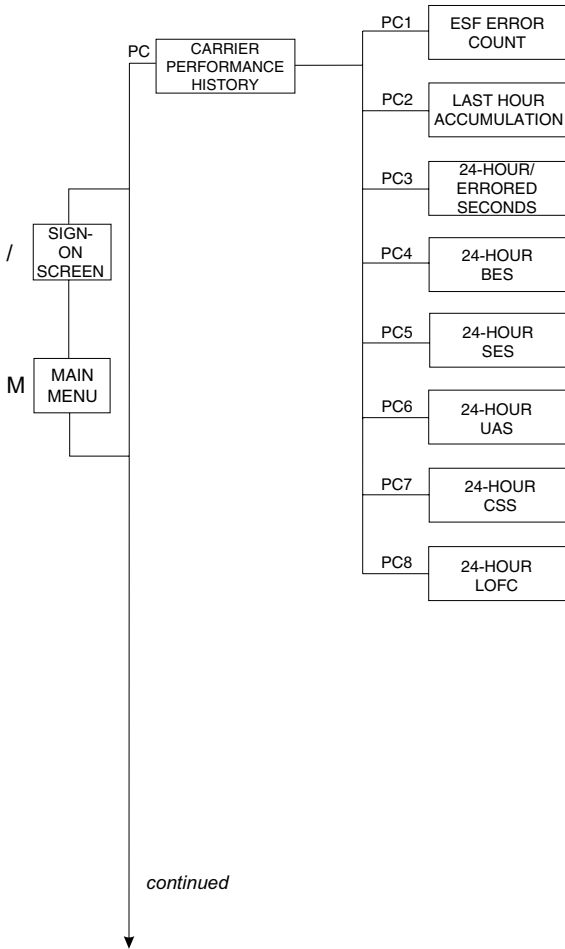
Figure 6-1 Cont.
Menu Flow Chart
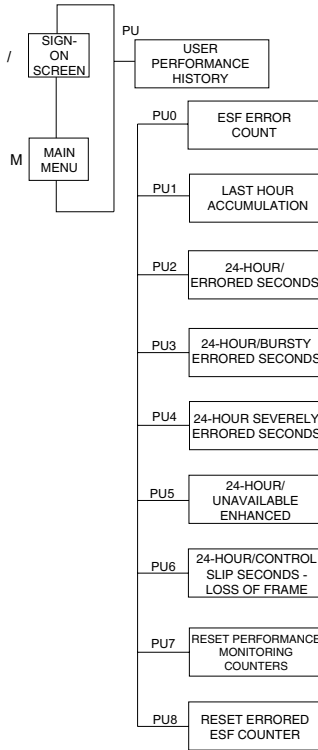
Figure 6-1 Cont.
Menu Flow Chart

CONNECTING TO A TERMINAL

To operate the unit with a CRT terminal:

1. Connect the FT 100 control port to a terminal with a standard PC 25 pin to 9 pin conversion cable. Refer to Table 2-2 for pin connections.

2. Using the front panel, select terminal operation and the desired control port baud rate, and enable local character echo if desired.

Word length is fixed at 8 data bits with 1 stop bit and no parity.

3. Enter a / on the keyboard to display the sign-on screen.

The following illustration shows connection application to a terminal.
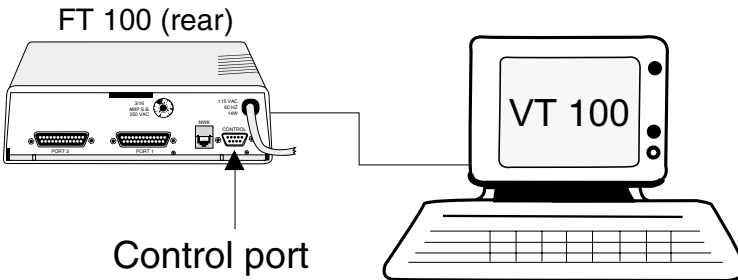
Figure 6-2
Terminal Connection

CONNECTING TO A MODEM

The FT 100 can be controlled remotely by a telephone line modem connected to the control port.

While not required, it is recommended that a modem with an error control protocol like MNP be used for remote control to prevent control command errors from accidentally reconfiguring the unit.

1. Connect a null modem device or crossover cable between the FT 100 control port and modem. Refer to Table 2-2 for control port pin connections.

2. Using the front panel, select terminal operation, the desired control port baud rate, and local echo if desired.

Word length is fixed at 8 data bits with 1 stop bit and no parity.

3. Enter a **/** on the keyboard to display the sign-on screen.

The following illustration shows connection application to a modem.
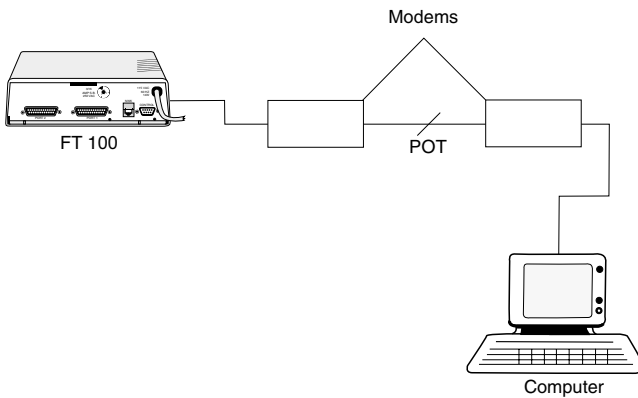
Figure 6-3
Modem Connection

MAIN MENU

The Main Menu accesses all other menus, configuration commands, and option settings. After the illustrations of the first three menus, this manual discusses the menus without further illustrations.

Enter any command from any screen for faster configuration changes. The user does not have to choose options only from the menu or option selections currently displayed. Chapter B, lists all menus and options.

Enter M to display the Main Menu. See Figur e6-4.

```
===============================================================================
       TIME: 14:26:09                              DATE: 11/26/96
                                FT100

                              MAIN MENU
===============================================================================

            T1 LINE CONFIGURATION:   CL
                 DTE PORT SUMMARY:   CD
         DTE PORT xx CONFIGURATION:   CDxx
         CONTROL PORT CONFIGURATION:   CC
                 SET TIME & DATE:   CT
    REMOTE CONFIGURATION COMMANDS:   CR


                 T1 LINE DIAGNOSTICS:   DL
            DTE PORT xx DIAGNOSTICS:   DDxx


       CARRIER PERFORMANCE HISTORY:   PC
          USER PERFORMANCE HISTORY:   PU


===============================================================================
ENTER SELECTION:
```

Figure 6-4
Main Menu

Entering	Displays
CL	T1 Line Configuration Options:

- Framing
- Line code
- ANSI.403 PRM
- AT&T 54016 ESF message
- Timing
- Line loopback
- Payload loopback
- Idle code

Entering	Displays
CD	DTE Port Summary
CDxx	Port xx Configuration Options:

- Numbers of DS0s
- Data rate
- Grouping options
- Starting DS0
- Transmit clock
- Transmit clock polarity
- Receive clock polarity
- CTS mode
- RSLD
- DSR
- TM
- Local loopback
- Remote loopback
- Remote terminal loopback

CC	Control Port Configuration Options:

- Echo
- Status

CT	Time and Date Options

DL   T1 Line Test Options:

            • Normal, local loopback
            • Network loopback
            • Line loopback
            • Framing
            • Line code

DDxx   the DTE Port Test Options:

            • Local terminal loopback
            • Remote terminal loopback
            • Remote loopback with test pattern
            • Test pattern

PC   Carrier Performance Options

PU   User Performance Options

T1 LINE CONFIGURATION
Enter CL   to display the T1 Line Configuration Option Menu

Entering   Displays

CLF   T1 Framing
            Select SF or ESF.

CLC   T1 Line Code
            Select AMI or B8ZS.

CLA   ANSI T1.403 PRM
            (Performance Report Message
            Select disable or enable.

CLE   AT&T ESF 54016 Message
            Select disable or enable.

CLT   T1 Timing
            Select port 1, port 2, loop, internal.

CLL   Line Loopback
                             Select enable or disable.

CLP   Payload Loopback
                             Select enable or disable.

CLI   Idle code
                             Select FF or 7F.

Example: To select the T1 Framing option,

Entering CL   at the ENTER SELECTION prompt displays the two
                             choices for T1 framing:

                             Superframe (SF) or Extended superframe (ESF)

Entering CLF2 chooses ESF framing.

Figure 6-5 shows the screen after this sequence of commands.

```
:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
      TIME: 14:32:28               |     .              DATE: 11/26/96
                                  FT100
                                  LOCAL
                        T1 LINE CONFIGURATION MENU
:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::


                      FRAMING :    CLF    ESF
                    LINE CODE :    CLC    B8ZS
                 BIT STUFFING :    CLB    DISABLE
               ANSI T1.403 PRM :    CLA    DISABLE
       AT&T 54016 ESF MESSAGE :    CLE    DISABLE
                    T1 TIMING :    CLT    LOOP
               LINE LOOPBACK :    CLL    DISABLE
             PAYLOAD LOOPBACK :    CLP    DISABLE
                    IDLE CODE :    CLI    FF
                 YELLOW ALARM :    CLY    DISABLE


:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
ENTER SELECTION:
```

Figure 6-5
T1 Line Configuration Menu

Any command can be used to display a menu or set another option can be selected at this point.

DTE PORT SUMMARY
Enter CD   to view a summary of the DTE port configurations:

```
===============================================================================
     TIME: 14:34:17                              DATE: 11/26/96
                                FT100
                                LOCAL
                    DTE PORT CONFIGURATION SUMMARY
===============================================================================
|        |              DS0 ASSIGNMENT                | DS0  | PORT | PORT  |
|        |0|0|0|0|0|0|0|0|0|1|1|1|1|1|1|1|1|1|1|2|2|2|2|2| RATE | RATE | TYPE  |
| PORT   |1|2|3|4|5|6|7|8|9|0|1|2|3|4|5|6|7|8|9|0|1|2|3|4|(kbps)|(kbps)|       |
|--------+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+------+------+-------|
|  01    |X|X| | | | | | | | | | | | | | | | | | | | | | |  56  | 112  | V.35  |
|  02    | | |X|X|X| | | | | | | | | | | | | | | | | | | |  64  | 192  | DS-1  |
===============================================================================
TYPE 'CDxx' TO EDIT PORT xx CONFIGURATION
```

Figure 6-6
DTE Port Configuration Summary

The twenty-four columns indicate which DS0s are selected for each port.

The rates for individual DS0s and whole ports are displayed along with the port type, which is determined from the interface card that is installed in the unit.

DTE PORT CONFIGURATION (V.35, RS-530, RS-232 CARD)
Enter CDxx   to display DTE Configuration Options.

Entering	Displays
CDxxNnn	Number of DS0s Select 00 through 24.
CDxxR	DS0 Rate Select 56 or 64 kbps.

CDxxG	DS0 Grouping Select alternate or contiguous.
CDxxSyy	Starting DS0 Select 01 through 24.
CDxxTC	Transmit Clock Select internal or external.
CDxxTP	Transmit Clock Polarity Select normal or inverted.
CDxxRP	Receive Clock Polarity Select normal or inverted.
CDxxCT	CTS Mode Select normal or forced on.
CDxxRS	RLSD Select normal or forced on.
CDxxDS	DSR Mode Select normal or forced on.
CDxxTM	TM (test) Mode Select normal or forced on.
CDxxLL	Local Loopback Select disable or enable.
Entering	Displays
CDxxRL	Remote Loopback Select disable or enable.
CDxxRT	Remote Terminal Loopback Select disable or enable.

DS-1 INTERFACE

Entering	Displays
CDxxN	Number of DS0s Select 00 through 24.
CDxxR	DS0 Rate Select 56 or 64 kbps.
CDxxG	DS0 Grouping Select alternate or contiguous.
CDxxS	Starting DS0 Select 1 through 24.
CDxxL	DS-1 Line Length 0-133, 133-266, 266-399, 399-533, 533-655.
CDxxB	DS-1 Signaling Select disable or enable.
CDxxF	DS-1 Framing Select SF or ESF.
CDxxC	DS-1 Line Code Select AMI or B8ZS
CDxxRT	Remote Loopback Select disable or enable.

CONTROL PORT CONFIGURATION

Entering	Displays
CC	the Control Port Configuration Menu, which allows the user to select the desired external control port operating mode. The mode and bit rate are only displayed here. The echo option is selectable.
CCE	Echo Options. Select disable if double characters appear on terminal or enable if no characters appear.
CCI	Unit Identification Code Select up to 10 characters.

CCP   Password: When the control port status is locked, the unit asks for the correct password upon initiating terminal control mode or locking the terminal. This prevents unauthorized users from altering option settings (applicable if a modem is used with the control port of the FT 100). Entering the correct password unlocks the control port.

If the control port status is unlocked, no password prompt appears.

Set or change the password using the CCP=command in control mode. The control port may be locked or unlocked at any time from the LCD front panel.

TIME AND DATE

Entering   Displays

CT   the Update Time And Date Menu, which allows setting the time and date. The unit contains an onboard battery driven realtime clock used as the reference for error history reporting.

CTThh:mm:s   to update the time, where hh is the hour, mm is the minute, and ss is the second.

CTDdd/mm/yy   to update the date, where dd is the day, mm is the month, and yy is the year.

T1 LINE TEST OPTIONS

Entering   Displays

DLM   the T1 Line Tests Menu, which allows initiating tests and monitoring the network portion of the unit. (Refer to "DIAGNOSTIC OPTIONS MAIN MENU 2" section in Chapter 4 section if needed.)

DLM1   to initiate a T1 Local Loopback.

DLM2   to initiate a T1 Network Loopback.

DLM3   to terminate T1 Loopbacks.

DLM4   to initiate a Line Loopback.

DTE PORT TESTS
Entering   Displays

DDxxM   the DTE Port Test Menu. (Refer to "DIAGNOSTIC
                OPTIONS MAIN MENU 2" section in Chapter 4
                section if needed.)

DDxxM1   to return to normal operation

DDxxM2   to activate a Local Terminal Loopback.

DDxxM3   to activate a Remote Terminal Loopback.

DDxxM4   to activate a Remote Loopback.

DDxxM5   to activate a Remote Loopback with Test Pattern.

DDxxM6   to activate a Test Pattern.

PERFORMANCE HISTORY
The FT 100 continuously monitors the network received signal for error
conditions and alarms.

Performance history information is stored in nonvolatile memory and
can be accessed and displayed by the local user or transmitted to a
remote FT 100 or other T1 terminating facility used for network
management.

Entering PC   carrier performance history

                or

                PU user performance history

displays the carrier or user performance history menu.

These two main menus for performance history are described after the sections that list and describe the various error conditions.

ERROR CONDITION CATEGORIES

The unit monitors these error conditions and alarms:

- CSU status error events
- Frame sync ESF error count
- Loss of signal SF error count
- AIS detect errored seconds
- Yellow alarm bursty errored seconds
- Severely errored seconds
- Unavailable seconds
- Loss of frame count
- Line code violation seconds
- % error free seconds

Error Events ESF Error Count (ESF framing only) contains a count of ESF error events. An ESF error event is either a CRC error or an Out of Frame Error (OOF).

SF Error Count (SF framing only) contains a count of SF error events. An SF error event is either a bipolar violation (BPV) or an out of frame error.

Error Second (ES) is any second in which an ESF (or SF) error event occurred.

Bursty Errored Second (BES)

ESF framing   is an errored second with more than one but less than 320 ESF error events with no OOF detected.

SF framing   is an errored second with more that one but less than 320 SF error events with no OOF detected.

Severely Errored Second (SES)

ESF framing   is an errored second either with an OOF detected or with 320 or more ESF errored events.

SF framing   is an errored second either with an OOF detected or
               with 320 or more SF errored events.

Unavailable Second (UAS) is a count of seconds in which service is
unavailable. An unavailable state is declared at the onset of 10 consecu-
tive SES and is cleared at the onset of 10 consecutive seconds with no
SES. Also, an unavailable state is declared during power off times of
less than 24 hours. If the CSU power is off for more than 24 hours, all
error history is reset.

Loss of Frame Count (LOFC) is the number of times a loss of frame is
declared. Loss of frame is declared after 2.5 seconds of continuous loss
of signal or OOF. Loss of frame is cleared after 2.5 seconds of no loss of
signal or OOF.

Line Code Violation Second (LCVS) is any second with one or more
bipolar violations. If B8ZS coding is selected, only bipolar violations
which are not part of the B8ZS code are counted.

% Error Free Seconds is defined as { (# of error free seconds) / (# of
total seconds) X 100 }. The # of total seconds is counted from the last
error history reset to a maximum of 24 hours.

Error Reporting Menus

The performance menus allow the user to select error history display
options. Error data for the preceding 24 hours is accumulated in 15
minute intervals and stored in error history registers (nonvolatile
memory). Two sets of error history registers are maintained by the unit.

ESF Per AT&T Pub 54016

When selected for AT&T 54016 ESF mode, the two error history regis-
ters maintained by the unit are the following:

Carrier Error History Registers is reserved for use by the carrier or
remote T1 interface. The Carrier (or far end T1 terminating equipment)
can read these registers over the ESF Data Link (FDL) using the TABS
protocol defined by AT&T 54016. The local user can obtain a display of
the carrier's error history registers but cannot reset them.

User Error History Registers is for use by the local user. These registers can be displayed and reset if preferred by the local user.

ESF PER ANSI T1.403

When selected for ANSI T1.403 ESF mode, the two error history registers are the following:

Local Error History Registers contains error data pertaining to the locally received signal from the network.

Carrier Error History Register contains error data pertaining to the remotely received signal. This error data is the accumulation of received Performance Report Messages (PRMs) received by the CSU from the network and is a measure of the error performance of the T1 line as observed by the T1 network receive equipment. The PRM protocol is described in ANSI Standard T1.403.

SF Error

When SF framing is selected, the two error history reporting registers are the same as inAT&T 54016. The only difference is that the carrier cannot read the carrier registers since there is no FDL.

Local Error History ANSI T1.403

The local performance history allows display of error history data accumulated by the local FT 100 when ANSI T1.403 ESF mode is selected.

The Local 1-Hour Performance Data screen displays a summary of error history accumulated during the previous hour. Also displayed are the 24-hour totals for each error count.

The Local 24-Hour Performance Data screen displays all accumulated 15-minute intervals during the previous 24 hours.

Remote Error History Per AT&T 54016

When in the AT&T 54016 ESF mode, remote error history is available over the ESF data link as defined by AT&T Technical Reference 54016. The desired remote error history information may be requested by entering the appropriate selection preceded by an 'R' (see below). If the

request is successful, the proper report is displayed. If the request is unsuccessful, the status line indicates an ESF data link communications error.

The Remote ESF Performance Data report shows ESF errors counted at the remote FT 100. Also, the status of both the DS-1 network and the Payload Loopback are shown.

The Remote 1-Hour Performance Data report displays the ES, UAS, BES, SES, CSS and LOFC performance data gathered at the remote FT 100 for the last hour period (the data is stored in 15- minute intervals).

The Remote 24-Hour Performance Data reports display their respective error event performance data gathered at the remote FT 100 for the last 24-hour period (the data is stored in 15-minute intervals).

Carrier Performance History

The Carrier Performance History Menu allows viewing error performance data accumulated by the FT 100 when in theAT&T 54016 ESF mode or SF mode. The user can view these registers, but cannot reset the data. The 'R' in the command string is used to gather remote error history information if desired.

Entering	Displays
(R)PC1	the ESF error count.
(R)PC2	to request the 1-hour performance report.
(R)PC3	to request the 24-hour ES report
(R)PC4	to request the 24-hour BES report.
(R)PC5	to request the 24-hour SES report.
(R)PC6	to request the 24-hour UAS report.
(R)PC7	to request the 24-hour CSS report.
(R)PC8	to request the 24-hour LOFC report.

User Performance History

The User Error History Menu allows for displaying the user error history options when AT&T 54016 ESF mode or SF mode is selected. The 'R' in the command string is used to gather remote error history information if desired.

Entering	Displays
(R)PU0	the ESF error count.
(R)PU1	the previous 1-hour accumulation of error data.
(R)PU2	to display the previous 24-hour accumulation of errored seconds.
(R)PU3	the previous 24-hour accumulation of bursty errored seconds data.
(R)PU4	the previous 24-hour accumulation of Severely Error Seconds data.
(R)PU5	the previous 24-hour accumulation of unavailable seconds data.
(R)PU6	the previous 24-hour accumulation of control slip seconds and loss of frame count data.
(R)PU7	to reset the performance monitoring counters.
(R)PU8	to reset the errored ESF counter.

REMOTE FT 100 CONFIGURATION

The FT 100 has the capability of configuring a remote FT 100 using the ESF Facility Data Link and a proprietary protocol. Remote configuration is accomplished through the use of the control port or LocalView. Since the ESF Data Link is utilized for this feature, the framing option on all units must be selected for "ESF".

The following is description of the various command strings used in remotely configuring an FT 100.

Configuration Control   CRC

    The choice for this option determines whether the information displayed
for the various control port screens pertains to the local unit or remote
unit. If the configuration control is selected for remote configuration, all
the information displayed on the various option and summary screens
shows the configuration of the remote unit at the time that its configura-
tion was last downloaded (CR1 command). If the configuration control
is selected for local configuration, the configuration information is that
of the local unit.

Remote Configuration Mode   CRM

    The choice for this option determines which FT 100 may actually
handle all of the configuration for both units. The FT 100 that is selected
for slave mode may be configured from the master unit and request the
configuration from the master unit but may not change it.

Get Remote Configuration   CR1

    This command initiates the actual downloading of the remote FT 100's
configuration information. Once this is complete, the option and
summary screens for the remote unit may be viewed by selecting the
configuration control on the local unit for remote configuration.

Send Remote Configuration   CR2

    This command initiates actual transmission of the configuration infor-
mation across the data link to the remote FT 100.

☞ **Note**

    *The remote FT 100's configuration is not actually updated
until this command is successfully executed.*

When changes are made to the various configuration options for the
remote FT 100, they are stored in the local FT 100. Therefore, that infor-
mation must be sent across the network using this command before the
remote unit reflects any of the changes made.

Send Remote Unit ID   CR3

    Sends the remote FT 100's unit ID across the data link after being deter-
mined and entered at the local unit.

Send Remote Password   CR4
 Sends the remote FT 100's password across the data link after being
 determined and entered at the local unit.

Send Remote Time and Date   CR5
 Sends the remote FT 100's time and date across the data link after being
 determined and entered at the local unit.

COMMAND ENTRY
 The following is an example of a screen when a command is entered
 from the control port.

```
clf
==============================================================================
LOCAL T1 LINE FRAMING STATUS: ESF
CLF1: SF   CLF2: ESF
ENTER OPTION:
```

Figure 6-7
Command Entry Screen

Chapter 7
Maintenance

GENERAL

The unit contains no electronic components that can be serviced or replaced by the user. Repairs should not be attempted by the user.

⚠ Warning

Disconnect ac/dc power before performing maintenance. Although dangerous voltage levels are not exposed, disconnecting power will ensure an electric shock hazard is not present.

FUSE

If the ac power fuse or the external power input fuse fails, replace it with one of equal rating. Repeated failure indicates a more serious problem. If this happens, refer to the section on maintenance.

MAINTENANCE

The unit provides maintenance free service. Periodically it is necessary to remove dust that has collected on internal components. Remove dust with a soft bristle brush and low pressure air or vacuum.

Before attempting diagnostic tests, check that all connectors and plugs are firmly inserted. The test procedures will identify the faulty component in a bad communications link.

GENERAL

This section discusses basic troubleshooting and also provides information on where to find further help, if necessary. In nearly all cases where you have a problem with the FT100, you can quickly resolve the problem with a few simple steps. This section deals with the most common problems that you might encounter during installation and while operating your FT100.

⚠️ **Caution**

Do not attempt to repair the FT100 yourself. Both FCC and IC regulations prohibit user servicing.

The first step is to identify where in the system the problem lies.

Before you begin troubleshooting, consider the following:

- Has the problem always been there, or did it start recently?

- If the problem started recently, what has changed since the FT100 last worked? Are you trying to communicate with a different remote device, or has the remote device's configuration changed?

- Is the problem intermittent, or can you duplicate it at will? Does the FT100 work with other remote devices?

The answers to these questions may help you identify the source of the problem. If you do not know where the problem lies, or if the problem seems to be in the FT100, the following troubleshooting tips may help you pinpoint and correct the problem. Each describes a problem symptom, and explains the possible causes and solutions. If the problem persists even after following the troubleshooting procedures, contact Telenetics for assistance. See Service and Support at the end of this guide.

COMMON QUESTIONS AND ANSWERS

1. Why won't the FT100 respond to the Central Office's request for error history?

   • **Possible Solution:** Either the option is disabled or the Central Office is not requesting the same format that the FT100 is configured to send. Determine which type of error history (ANSI/ AT&T) is being requested and verify selection on the FT100.

2. Can my service provider put the FT100 into a network loopback to test the connection to the device?

   • **Possible Solution:** The line loopback option on the FT100 must be enabled before the FT100 will respond to a loopback code from the network service provider. Set the Line Loopback option to Enabled and have the service provider attempt the loopback again.

3. Why do I keep getting intermittent CRC errors or pattern slips?

   • **Possible Solution:** A common occurrence is that the T1 timing source on one or both of the units in the circuit are improperly selected. It is important that only ONE point (local, remote, or telco) provides master timing source and that all other points synchronize to that master timing source. Reference the "Timing" section on page 4-34 for descriptions of timing options.

4. Whenever I try to run B8ZS line coding, I get errors when I try to run data, but if I select NONE or B7SUB line coding it works fine. What is wrong?

   • Contact the service provider and verify that the T1 connection supports B8ZS on all trunks of the connection and that no trunks are AMI only.

☞ **Note**

Sometimes incorrect wiring only causes marginal failures that standard troubleshooting cannot pin point. Always re-check the connections into the unit and any other equipment associated with the circuit. Also, check the actual pin outs against the wiring diagrams.

The following cable illustration may be helpful in troubleshooting problems.
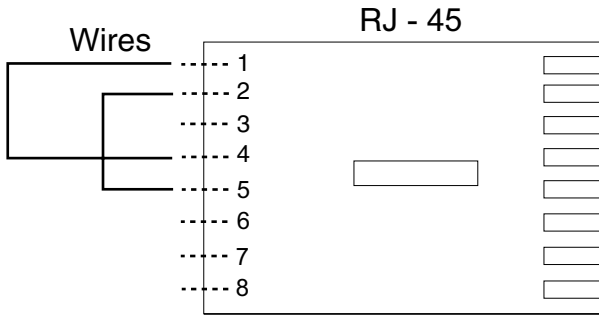
Figure 8-1
Network Loopback Cable

BEFORE YOU CONTACT TELENETICS

Our technical support staff will be glad to help you. To make your call to them as clear and helpful as possible, please complete this worksheet in its entirety before you contact Telenetics.

Make sure you have gone through the troubleshooting procedures.

Write down the name of your product:

Write down the serial number found on the bottom of the unit: _____

Write down the document number found on the bottom right corner of the User's Guide title page: _____

Have the following information available:

- What tests, if any, you have run and what the results were (loopback test, for example);
- What the LED status indicators have indicated, if anything.

Have the equipment running (as your problem permits).

Contact Telenetics at: (949) 455-4000

NETWORK INTERFACE

Line Rate
  1.544 Mbps ± 75 bps

Line Code
  Bipolar, AMI or B8ZS

Input Signal
  +3.5 dB DSX to -34 dBDSX

Output Signal
  DSX-1 w/LBO

Transmit LBO
  Selectable 0, 7.5, 15 dB

Receive LBO
  Automatic

Impedance
  100 ohms nominal

Framing
  SF or ESF

Jitter Tolerance
  Per AT&T pub 62411

Connector
  RJ48C 8-pin modular jack

NETWORK LOOPBACK CODES

Set Code
  10000 per AT&T pub 54016

Reset Code
100 per AT&T pub 54016

Detection Time
5 secs per AT&T pub 54016

DTE INTERFACE

Data Port Configuration
V.35, RS-530/449, RS-232, or DS-1

Data Rates
n x 56 kbps or n x 64 kbps
(n=1 to 24 DS0 time slots)
= from 56 kbps to 1.536 Mbps

Electrical
V.35, RS-530/449, RS-232, or DS-1

Connector
25-pin D-type female, adapters available

CONTROL PORT

Electrical
RS-232

Rate
300 to 19200 bps, asynchronous, 8 bit data, no parity

Connector
9-pin D-type male connector, IBM PC/AT PC compatible

POWER SUPPLY

Power source
115 Vac

Power Consumption
  6 watts, typical

MECHANICAL

Dimensions
  Shelf module - 9.5" x 6.3" x 0.9"
  Single unit housing - 10" x 7" x 2"

ENVIRONMENTAL

Operating Temperature
  0 to 50 degrees C

Storage Temperature
  -40 to 70 degrees C

Relative Humidity
  0 to 95% noncondensing

Appendix B
Control Port Command Quick Reference

GENERAL

The following table contains a quick reference guide for Control port commands.

Control Port Commands	Option	Menu Location
/	Accesses sign-on screen	
M	Accesses main menu	
CL	T1 line configuration	Main
CD	DTE port summary	
CD*xx*	DTE port *xx* configuration	
CC	Control port configuration	
CT	Update time and date	
DL	T1 line tests	
DD*xx*	DTE port *xx* tests	
PC	Carrier performance display	
PU	User performance display	
CLF	Framing	T1 line
CLL	Line code	
CLP	ANSI T1.403 PRM (performance report message)	
CLM	AT&T 54016 message	
CLT	Timing	
CD*xx*N	Number of DS0s	DTE port
CD*xx*R	DS0 rate	
CD*xx*G	DS0 grouping	
CD*xx*RP	Receive clock polarity	
CD*xx*S	Starting DS0	
CD*xx*TC	Transmit clock	
CD*xx*TP	Transmit clock polarity	

Control Port Commands	Option	Menu Location
CD*xx*CT	CTS mode	
CD*xx*RS	RLSD mode	
CD*xx*DS	DSR mode	
CD*xx*TM	TM mode	DTE port *cont.*
CD*xx*LL	LL mode	
CD*xx*RL	RL mode	
CCE	echo	Control Port
CTThh:mm:ss	time update	
CTDdd/mm/yy	date update	
DL1	T1 Local Loopback	T1 line tests
DL2	T1 Network Loopback	
DL3	T1 Loopbacks	
DD*xx*1	Local Terminal Loopback	DTE port tests
DD*xx*2	Remote Terminal Loopback	
DD*xx*3	Remote Loopback	
DD*xx*4	Remote Loopback with Test Pattern	
DD*xx*5	Test Pattern	
DD*xx*6	Port *xx* test	
(R)PC1	ESF error count	Carrier performance history
(R)PC2	1-hour performance	
(R)PC3	24 hour ES	
(R)PC4	24 hour BES	
(R)PC5	24 hour SES	
(R)PC6	24 hour UAS	
(R)PC7	24 hour CSS	
(R)PC8	24 hour LOFC	
(R)PU1	ESF error count	User performance history

Control Port Commands	Option	Menu Location
(R)PU2	1-hour performance	
(R)PU3	24-hour ES	
(R)PU4	24-hour BES	
(R)PU5	24-hour SES	User performance history *cont.*
(R)PU6	24-hour UAS	
(R)PU7	24-hour CSS	
(R)PU8	24-hour LOFC	
(R)PU9	24-hour LCVS	
(R)RU1	reset performance monitoring counters	
(R)RU2	reset ESF error counter	

Appendix C
T1 Overview

GENERAL

T1 refers to the primary digital telephone carrier system used in North America. T1 is one line type of the PCM T-carrier hierarchy listed in Table C-1. T1 describes the cabling, signal type, and signal regeneration requirements of the carrier system.

Table C-1. PCM T-Carrier Hierarchy

Line	Signal	Line Rate	Number of TDM Channels
T1	DS-1	1.544 Mbps	24
T1C	DS-1C	3.152 Mbps	48
T2	DS-2	6.312 Mbps	96
T3	DS-3	44.736 Mbps	672
T4	DS-4	274.176 Mbps	4032

T1 was first installed in the early 1960s and was used only to carry voice trunks between central offices. Since then, T1 facilities have been provided by telephone companies to customers who need many outside lines. Since a T1 line supports up to 24 simultaneous voice and / or data calls, a large savings in both cable and service cost can be realized by replacing many individual local loops with a single T1 link to the Central Office. In addition to telephone-company provided T1 services, many private T1 networks have been implemented such as LAN gateways and PBX-to-PBX links.

The signal transmitted on a T1 line, referred to as the DS1 signal, consists of serial bits transmitted at the rate of 1.544 Mbps. The type of line code used is called Alternate Mark Inversion (AMI).

The AMI line code is produced by transmitting a pulse for logic one data bits and no pulse for logic zero data bits. The signal is called AMI because pulses alternate in polarity for each logic one bit. If the first one bit in a bit stream is a + 3V pulse, the next one bit will be a - 3V pulse on the T1 line.

Since zero bits are no pulses, the AMI code does not allow long strings of zero data. A minimum ones density is required on the T1 line so that receiving equipment and line repeaters can recover clocking information. An alternative line code which allows long strings of zeros is called bipolar with eight zero substitution (B8ZS). This method replaces strings of eight zeros with a specific double bipolar violation sequence. The double bipolar violation sequence consist of two bipolar violations. The bipolar violation sequence is recognized by receiving equipment and converted back to zeros. The violation sequence provides the necessary pulse density.

FRAMING FORMATS

The Data Signal Level Zero (DS0) is the standard 64 kbps data signal used for both voice and data transmission on a T1 line. The T1 signal is organized as a series of frames with 24 DS0 time slots and 1 framing time slot for each frame. Each DS0 time slot consists of an 8-bit data channel while the framing time slot is just one bit long. This results in a single frame which is 193 bits long (24 channels x 8 bits per channel + 1 frame bit). The resulting frame rate is 8000 frames per second (1.544 Mbps).

Figure C-1 shows the Superframe Format (SF). SF framing, also known as D4 framing and the M24 multiplexer format, defines a group of 12 frames as a superframe. The 193rd bit of each frame is referred to as the multiframe alignment bit or F bit. T1 receiving equipment uses the F bit to identify the beginning of a superframe as well as the position of each frame in the superframe.
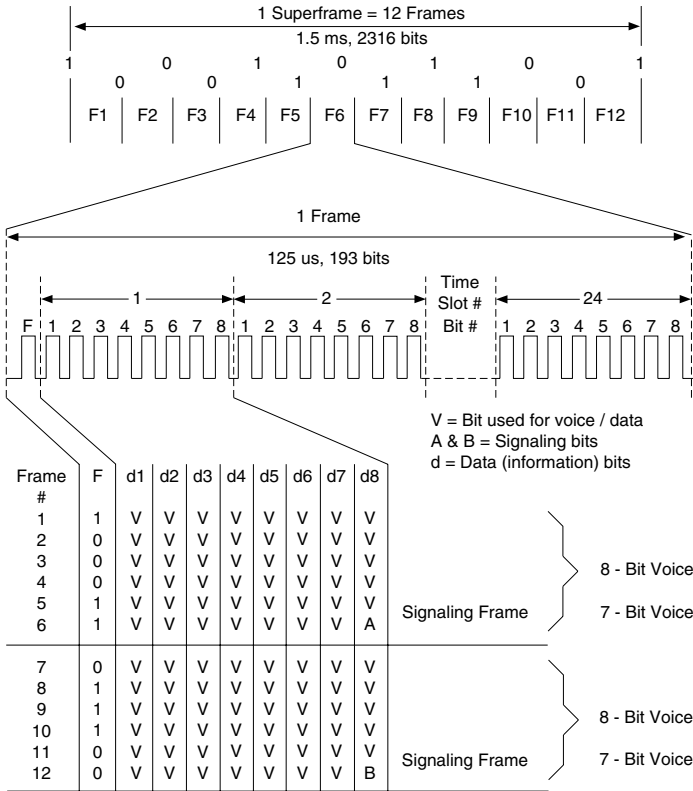
Figure C-1
Superframe Format

Call supervision signaling for each channel is presented in bit 8 of every channel during frames 6 and 12 of the superframe. This process is called Robbed Bit Signaling. The signaling information is used for establishing and terminating calls. This method of signaling prevents the use of the entire 64 kbps DS0 channels for data (non-voice). Therefore, only 56 kbps (7 bits per DS0) data can be transmitted without the inherent error due to signaling. Voice transmission is unaffected by robbed bit signaling.

ESF Framing

Figure C-2 shows the Extended Superframe Format (ESF). ESF format or Fe framing is the newest DS1 framing format. This format extends the multiframe structure from a 12 frame superframe to a 24 frame extended superframe. Data channeling for ESF framing is the same as SF (24 DS0 channels per frame), but the function of the framing (F) bit position in each frame is redefined for ESF. The new F bit contains the following three functions:

- Cyclic redundancy check
- Facility data link
- Framing pattern sequence

This redefinition of the F bit allows several new features for maintenance and performance monitoring which are not available with SF framing.

The Cyclic Redundancy Check (CRC-6) is an error check sequence which is transmitted in the F bit position. The T1 receiving equipment receives this sequence and compares it with a locally computed check value which is based on the received data in all DS0 channels in the extended superframe. This process gives the equipment the ability to detect most errors which occur in the DS1 signal. The CRC-6 data is transmitted at a rate of 2 kbps.
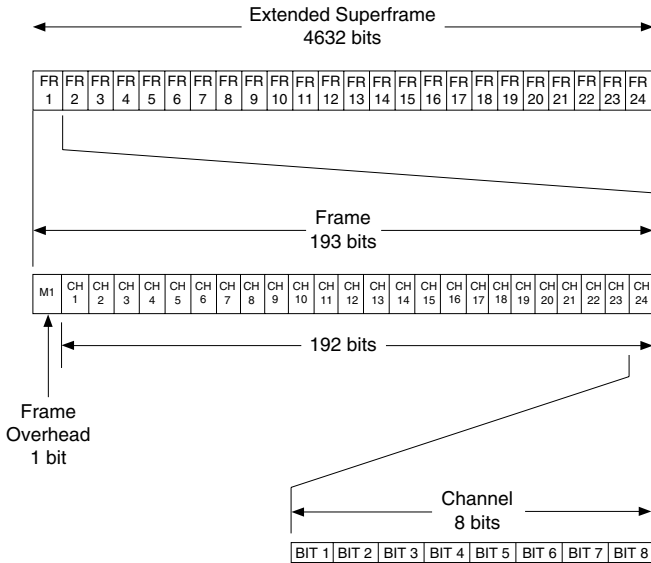
Extended Superframe
4632 bits

| FR 1 | FR 2 | FR 3 | FR 4 | FR 5 | FR 6 | FR 7 | FR 8 | FR 9 | FR 10 | FR 11 | FR 12 | FR 13 | FR 14 | FR 15 | FR 16 | FR 17 | FR 18 | FR 19 | FR 20 | FR 21 | FR 22 | FR 23 | FR 24 |

Frame
193 bits

| M1 | CH 1 | CH 2 | CH 3 | CH 4 | CH 5 | CH 6 | CH 7 | CH 8 | CH 9 | CH 10 | CH 11 | CH 12 | CH 13 | CH 14 | CH 15 | CH 16 | CH 17 | CH 18 | CH 19 | CH 20 | CH 21 | CH 22 | CH 23 | CH 24 |

192 bits

Frame
Overhead
1 bit

Channel
8 bits

| BIT 1 | BIT 2 | BIT 3 | BIT 4 | BIT 5 | BIT 6 | BIT 7 | BIT 8 |

Figure C-2
Extended Superframe Format

The Facility Data Link (FDL) is also transmitted in the F bit position and provides a separate low speed data channel on the T1 circuit which does not interfere with the main data transmission. This out-of-band data channel can be used for communicating general maintenance information or for transmitting user defined information within the T1 link. Two standard protocols for error maintenance data communication over the FDL exist and are discussed below. The data rate for the FDL is 4 kbps.

The third function provided in the F bit position is the Framing Pattern Sequence (FPS). The 2 kbps bit sequence defines frame and multiframe boundaries and allows location of the CRC-6 and FDL bits by the receiving equipment.

Call supervision signaling is provided in the same way as SF framing (Robbed Bit Signaling) with one difference. Since the extended super-frame is 24 frames long, frames l8 and 24 in addition to frames 6 and 12 contain signaling information in bit 8 of each DS0 channel.

An alternative method of providing signaling is called Common Channel Signaling. Instead of robbing a bit from each data channel, an entire DS0 channel is reserved for signaling. Since bits are no longer robbed in the remaining 23 data channels, these channels may be used for 64 kbps data transmission. This is the preferred method for achieving clear channel capability in the emerging Integrated Services Digital Network (ISDN) environment.

Framing Format Conversion

Much of the presently installed customer T1equipment is compatible only with SF framing. When ESF lines are installed, conversion from ESF to SF at the customer premise may be necessary to use SF equip-ment. A CSU with this conversion option usually performs the conver-sion. The conversion process replaces the ESF F bit sequence with the SF F bit sequence on the receive side and inserts the ESF F bit sequence on the network transmit side.

PERFORMANCE MONITORING

An operator or network manager can monitor the quality of a T1 link to enable quick response to line or equipment failure. Also, monitoring equipment can maintain a line quality history to identify increasing error rate trends.

SF T1 equipment is limited to monitoring the following conditions:

- BPV count. Receiving Equipment can detect and count bipolar violations to measure error caused by line or repeater problems. Logic errors or errors in data encoding which the transmitting equipment or repeaters can introduce cannot be detected.

- LOS. Loss of signal.

- Ones density. T1 specifications require a minimum pulse density of 12.5%. CSUs insert pulses in the outgoing signal if necessary to insure the minimum density is transmitted.

ESF framing allows logic errors to also be detected due to the CRC-6 error check sequence embedded in the F bit. When the receiving equipment obtains error information, it can communicate the information to the far end of the T1 link over the FDL channel. Two standard protocols report errors using the FDL: AT&T Publication 54016 and ANSI T1.403.

The AT&T method requires that the T1 terminating equipment, the CSU for example, maintain a 24-hour performance error history. This error history is transmitted to the Central Office over the FDL after an error history request message is received from the Central Office. In many CSUs, an alternate set of registers is maintained in the CSU to allow customer access to the same error information.

The ANSI method requires that the CSU transmit a performance report message (PRM) each second over the FDL. This PRM is not sent to any specific remote location, but is broadcast so that any PRM receiving device on the T1 line can intercept the message. Rather than transmitting an entire 24-hour history, the PRM contains error information pertaining to only the previous 4 seconds. It is the responsibility of the PRM receiver to accumulate the information and store it for 24 hours or the time desired. This method allows performance monitoring points at different locations along a T1 network so that error localization can be determined.

Other proprietary methods of collecting and reporting ESF error information have been implemented to enhance the remote T1 device maintenance capabilities. Besides ESF error information, CSU configuration and loop testing functions can be performed remotely using the FDL data channel. Since these added features are nonstandard, equipment from different manufacturers is not compatible as far as the proprietary functions are concerned.

Appendix D
Service and Support

GENERAL

The following list of direct telephone numbers can quickly put you in touch with the service or party of your choice. Remember, at Telenetics, total customer satisfaction is only a phone call away.

TELENETICS TECHNICAL SUPPORT CENTER

Telephone: (949) 455-4000

This number connects you with Telenetics. Use this number to gain access to our experienced staff members trained to provide you with the best service and support Telenetics has to offer.

- *Technical Telephone Support.* Contact our Technical Support Group if you cannot identify or solve a technical problem with your Telenetics product. Be prepared to provide the model number of the equipment requiring support (recorded prompts will provide some assistance with this).

- *On-site Service Activity or Status.* Access this feature to initiate an on-site service call or to obtain the status or estimated time of arrival (ETA) for an existing on-site request.

- *Equipment Installation, Removal or Upgrade.* Use this feature to schedule the installation, removal or upgrade of your Telenetics products.

- *Request Unit Replacement, Factory Repair Services or Status.* Access this feature to obtain information about under-warranty unit replacements, unit replacement of non-contracted equipment, factory repair services, or the status of a unit replacement or equipment returned for repair.

CUSTOMER RESPONSE CENTER

Telephone: (949) 455-4000   FAX: (949) 455-4010

Use this number to obtain product specifications and descriptive literature on Telenetics products.

INTERNET/WORLD WIDE WEB

Telenetics has a home page on the Internet. It provides a variety of product information, including specifications, frequently asked questions (FAQs), and other topics.

http://www.telenetics.com

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Raymar Information Technology, Inc.
Limited Warranty

One Year Limited Hardware Warranty
Raymar Information Technology, Inc., dba Raymar-Telenetics, warrants their products against defects in hardware, material and workmanship under normal use for one (1) year from the date of purchase. Raymar will, at no charge, either repair the product (with new or reconditioned parts), or replace it (with a new or reconditioned product). Repaired replacement products are warranted for either 90 days or the remainder of the original warranty period, whichever is longer. This warranty extends to the original end-user only.

What This Warranty Does Not Cover
This warranty does not cover: (a) software; (b) installation or service of the product; (c) conditions resulting from consumer damage such as improper maintenance or misuse, abuse, accident or alteration; (d) all plastic surfaces (including display screens) and all other exposed parts that are scratched or damaged due to normal use; (e) operation of our products with equipment not supplied by Raymar (f) products which have had the serial number removed or made illegible; or (g) products rented to others. This warranty applies only to hardware products manufactured by or for Raymar Information Technology, Inc. and identified by the Raymar-Telenetics trademark, trade name or product identification logo affixed to them. Refer to the Service and Support section of the User's Guide for service after the warranty expires. No warranty is made as to coverage availability or grade of service provided by the carrier.

General Provisions
This warranty sets forth Raymar's entire hardware responsibilities regarding this product. Repair, replacement or refund of the purchase price is at Raymar's discretion. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER EXPRESS WARRANTIES, IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ARE LIMITED TO THE DURATION OF THIS LIMITED WARRANTY. IN NO EVENT SHALL RAYMAR BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS, OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THIS RAYMAR PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW. WITHOUT LIMITING THE FOREGOING, RAYMAR SHALL HAVE NO LIABILITY FOR ANY DATA STORED IN OR USED WITH THE PRODUCT, INCLUDING THE RECOVERY COSTS OF SUCH DATA OR PROGRAMS.

State Law Rights
SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS. THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. This warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

Provincial Law Rights
SOME PROVINCIAL LAWS DO NOT ALLOW THE EXCLUSION OR LIMITATION OF IMPLIED WARRANTIES, THE EXCLUSION OR LIMITATION OF WARRANTY COVERAGE IN CERTAIN SITUATIONS. SOME OF THE ABOVE LIMITATIONS OR EXCLUSIONS CONTAINED IN THIS LIMITED WARRANTY MAY NOT APPLY TO YOU. This warranty gives you specific rights, and you may have other rights which vary from province to province.

How To Use Raymar's Limited Warranty Service
To take advantage of this warranty, you must do the following:
• If you are having trouble with your product, contact Raymar service using the appropriate number from the Service and Support section of the User's Guide. If it is determined that your product requires service, you will be issued a Return Materials Authorization (RMA) form.
• Pack the defective product securely for shipping. Include only the units pre-approved by service on your RMA form.
• This warranty is void if the product is damaged in transit, you must insure your shipment.
• Ship the defective product, proof of date of purchase, and the RMA form to the address specified.
• Display your RMA number prominently on the outside of the shipping box. Customer is responsible for freight in, door to door. Raymar is responsible for return shipping costs.
• To ensure prompt service, please write on the RMA form a brief description of the problem you are experiencing with the product.
  Raymar Information Technology, Inc.
  7325 Roseville Road
  Sacramento, CA 95842
  Service Hotline (800) 747-1522
  http://support.telenetics.com or e-mail to techsupport@raymarinc.com

Raymar Information Technology, Inc.
Return Merchandise Authorization (RMA) Procedure

Before returning any Raymar-Telenetics product, an RMA number must be obtained.

The most convenient way to obtain an RMA number for a product purchased from Raymar-Telenetics is to call **1-800-747-1522 (+1-916-783-1951)**. When doing so, please have the following information ready:

- Company name
- Full billing address, as well as the address for the location where the product should be returned once repaired or replaced
- Telephone & Fax numbers
- Email address
- Product model number and serial number

For each item being returned, please include the product model number, the serial number, a description of the problem being encountered, and the cause of the problem (if known).

Please note that prior to authorizing a return, a product support specialist may call to verify that the product is properly installed or may ask you to perform tests to insure that the product has actually failed.

The product must be properly packed and returned to:

Raymar-Telenetics
7325 Roseville Road
Sacramento, CA 95842

The RMA number must be legibly displayed on the shipping carton. Raymar-Telenetics will not be responsible for any product returned without an RMA number.

If the product is out of warranty, estimates for repair rates and any applicable shipping costs will be communicated by a customer service representative. Currently, Raymar-Telenetics accepts purchase orders or credit cards as payment methods.

Repairs currently require 5 – 10 business days and are returned via UPS Ground.