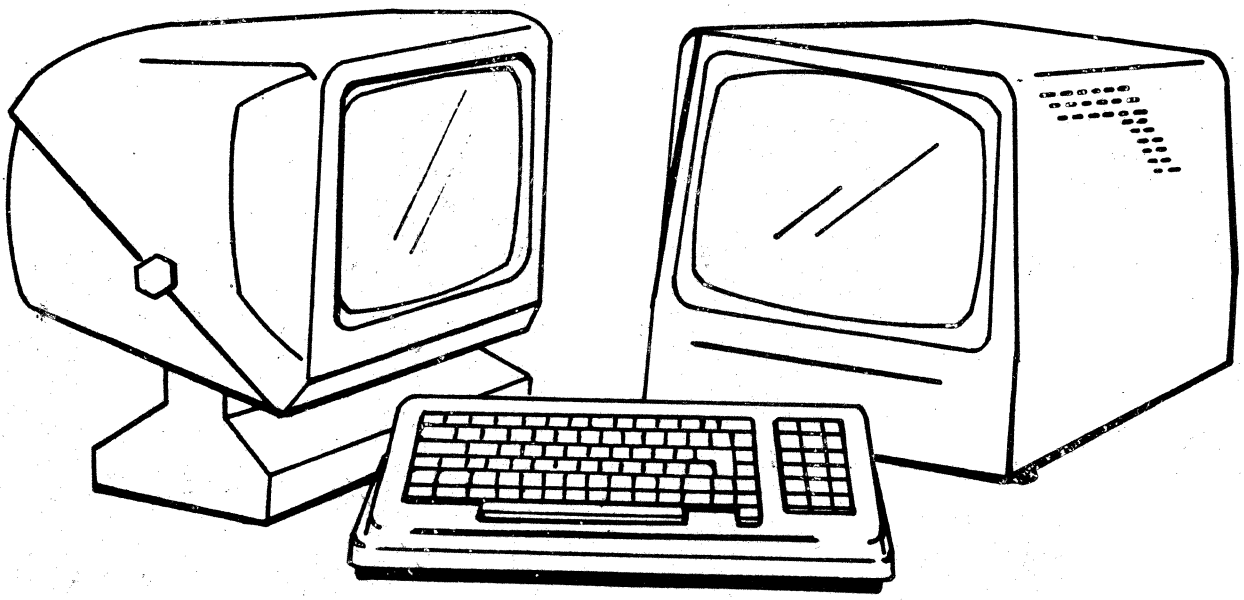
TELERAY

MODEL 100

CRT DATA TERMINAL



INSTRUCTION MANUAL

RESEARCH INC
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PHONE (612) 941-3300 • TWX 910-576-2837 • TELEX 29-0502

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September 1981

Revision C

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Section 1

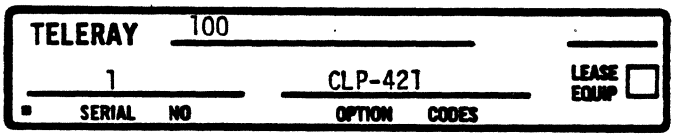
GENERAL INFORMATION AND SPECIFICATIONS

This manual contains information for the installation, operation, maintenance and repair of the Model 100 Teleray terminal.

The Teleray is a microprocessor-controlled CRT terminal. Non-volatile memory storage retains operator setup of terminal parameters and programmed functions even when terminal power is off. Serial communications are full or half duplex with or without local echo. The terminal provides six character attributes, full cursor control, line monitoring capability, and smooth scroll. Display capacity can be operator selected for either 24 lines of 80 characters or 24 lines of 132 characters. There are many programmable features, such as double-wide and double-height characters, communication parameters, operator programmable functions and automatic screen shutdown. Full editing, protection, and block transmission capabilities are also selectable. The Model 100 is designed to be completely modular, providing easy replacement of any assembly.

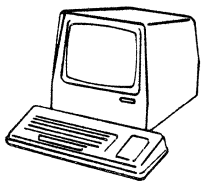
The terminal consists of a display cabinet that houses the monitor module, the power supply module and the logic module, and an optional detached keyboard. Both are designed for use on desk or table top.

The option codes and special feature codes that have been installed in the Teleray will be listed on the rear panel label shown below. An insert describing any installed special feature will also be provided.



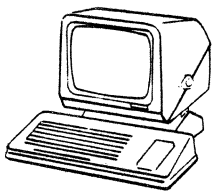
Option Code	Description
CLP	Current loop is installed.
SFXXX	Special feature number XXX is installed.
CVD	Composite video is installed.
ACG	Alternate character generator is installed.
GRN	Green phosphor monitor is installed.
AMB	Amber phosphor monitor is installed.
PX	Power supply X option is installed. X is selected for 220 V or 240 V operation, and varies by cabinet type.

M



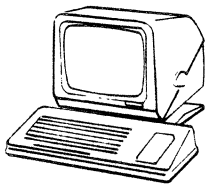
Metal Enclosure, Detached Keyboard
Display: 13-3/4" (349mm) H x 13-1/4" (337mm) W x 13-3/4" (349mm) D
Keyboard: 3-1/4" (83mm) H x 18-1/2" (470mm) W x 7" (179mm) D
Weight: 36 lbs. (16 Kg)

E



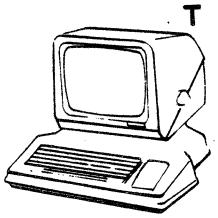
Molded Enclosure, Detached Keyboard
Display: 15-1/2" (394mm) H x 14-7/8" (378mm) W x 12-1/2" (317mm) D
Keyboard: 3-1/4" (83mm) H x 18-1/2" (470mm) W x 7" (179mm) D
Weight: 25 lbs. (11.3 Kg)

L



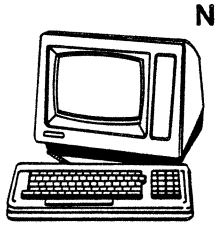
Compact Molded Enclosure, Detached Keyboard
Display: 15-1/4" (387mm) H x 14-1/2" (368mm) W x 12-1/2" (318mm) D
Keyboard: 3-1/4" (83mm) H x 18-1/2" (470mm) W x 7" (179mm) D
Weight: 23 lbs. (10.4 Kg)

T



Molded Enclosure, Integral Keyboard
Keyboard Display: 14-1/2" (362mm) H x 18-1/2" (470mm) W x 15-1/4" (387mm) D
Weight: 24 lbs. (10.9 Kg)

N



Injection Molded Enclosure, Detached Keyboard, 12" CRT
Display: 15" (381mm) H x 17" (432mm) W x 17" (432mm) D
Keyboard: 3-1/4" (83mm) H x 18-3/4" (476mm) W x 7" (178mm) D
Weight: 30 lbs. (13.6 kg)

NN

Injection Molded Enclosure, Detached Keyboard, 15" CRT
Display: 15" (381mm) H x 17" (432mm) W x 17" (432mm) D
Keyboard: 3-1/4" (83mm) H x 18-3/4" (476mm) W x 7" (178mm) D
Weight: 30 lbs. (13.6 kg)

POWER REQUIREMENTS

115 V ± 10%
or (optionally)
220 V ± 10%
240 V +15%, -10%
40 Watts
137 BTU/Hr

Connections: Detachable 3-wire cord mating with internal line filter.

ENVIRONMENTAL

Operating Temperature: 40° to 115°F (4° to 46°C)

Storage Temperature: -40° to 149°F (-40° to 65°C)

Relative Humidity: 10% to 90%, non-condensing

Modularity: Logic, power, keyboard and display modules, accessible and replaceable without tools

SAFETY

One amp line fuse -- UL, CSA listed.

DISPLAY

Type:	CRT, P4 grey phosphor, non-glare screen, optional P31 green phosphor; light on dark, or dark on light, user-programmable
Height:	15.24 cm (6 inches)
Width:	21.59 cm (8-1/2 inches)
Format:	24 lines by 80 columns (40 columns in Wide mode) 24 lines by 132 columns (66 columns in Wide mode)
Character Field:	7 x 9 dot matrix (plus descenders) in 8 x 12 field
Character Size:	2.6mm x 5.0mm (.10 inch x .20 inch) in 80-column mode 1.6mm x 5.0mm (.06 inch x .20 inch) in 132-column mode
Cursor:	Blinking block or blinking underline, user programmable
Refresh Rate:	50 or 60 Hz, user programmable
Character Set:	96-character ASCII subset (upper/lower case, punctuation, and numerics) plus £ for United Kingdom set, 32-character special graphics set and 32 control characters. Choice of # or £ symbol user programmable.
Attributes:	Bold, Blink, Underline, Overline, Inverse, Blank, Protect

KEYBOARD

Layout:	75-key, sculptured typewriter-style keyboard with an 18-key calculator-type numeric pad.
Rollover:	N-Key
Repeat:	Auto repeat at 15 or 30 characters per second after half second delay (except SET-UP, ESC, NO SCROLL, TAB, RETURN and any key pressed with the control key). Auto repeat rate user programmable.
Indicator Lights:	Seven status LEDs.

COMMUNICATIONS

Protocol:	Standard asynchronous
Baud Rate:	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 19200; one stop bit, except 110, which uses two stop bits.
Character Length:	7 or 8 bits per character (peripheral port permanently set to 7)
Parity:	Even, odd, mark, space, or none (parity not checked for mark and space parity).
Peripheral Interface:	Supplied standard; bi-directional.

Section 2

INSTALLATION

2-1 Introduction

Several characteristics of the Model 100 Teleray can be set by an installer from the keyboard. These characteristics include communications format, display refresh rate, etc. Setting these characteristics is described in Section 3, SET-UP Mode. Some of the characteristics can also be set by the host computer. The Initial Installation section provides information for preparing the terminal and its site, and information for connecting the Teleray to the host computer and any attached devices.

2-2 Initial Installation

A. Unpacking

The Teleray terminal has been carefully packed to ensure safety during shipment. Inspect the carton for external signs of damage before opening. To unpack, simply open the top of the carton, remove the top layer of foam and lift the Teleray out of the carton. Note all problems on the bill of lading to ensure processing of claims. After the terminal has been unpacked, inspect for damage to the terminal. Check immediately for broken or missing parts.

B. Site Selection

The Teleray terminal is designed for desk or table top mounting. The detached keyboard permits the keyboard to be located within 30 inches (.75 meters) of the monitor. Rubber mounting feet are provided on the base of the terminal to protect the desk or table top and to provide spacing for air flow beneath the unit. Keep the ventilation slots clear. Blocking these slots by placing objects beside or under the Teleray may cause the terminal to overheat.

C. Power Connections

The Teleray is equipped with a 6-foot (1.8-meter) power cable with an attached 3-prong (grounded) power plug.

CAUTION

Verify the power requirements on the back of the terminal chassis to determine voltage and line frequency requirements. Do not plug unit in if power rating on label does not match available line power.

D. Initial Connections

1. Connect the keyboard cable to the keyboard jack on the rear of the terminal.
2. Connect power cord to appropriate power source.
3. Operate the power switch to the ON position and allow a 1- to 2-minute warmup period. During this period, the Teleray will automatically perform the power up self-test, sound the bell and then clear the screen.

E. Preliminary Local Mode Checkout

The following procedure utilizes some of the more important features of the Teleray 100 and is designed to familiarize an installer with some of its features.

1. After the warmup period, determine that no error was detected during the power up self-test. (A character will be shown at the cursor position if there is an error.)

2. Place the terminal in SET-UP mode by typing the SET-UP key. The display should be similar to that shown in Section 3, Figure 3-1-1, SET-UP A Mode presentation.

3. Adjust the brightness of the display by typing the Cursor Up (↑) key or the Cursor Down (↓) key. With each stroke of the key, the display should increase/decrease in brightness. Select a comfortable level.

4. Check the condition of the ON LINE/LOCAL LED indicators. If the ON LINE indicator is On, select LOCAL by typing the 4 key on the main keyboard.

5. Check the number of characters per line by observing the character ruler in the SET-UP A presentation. If 80 characters, select 132 characters by typing the 9 key on the main keyboard.

6. Exit SET-UP mode by pressing the SET-UP key.

7. Type the following sequence: ESC < ESC # 8. The screen should now display 24 lines x 132 columns of the character £ . The £ character will be both overlined and underlined.

8. Return to SET-UP mode and then press the 0 (zero) key on the main keyboard. This should self test the Teleray and clear the screen.

9. Return to SET-UP A mode by typing the SET-UP key, then enter the SET-UP B mode by typing the 5 on the main keyboard. Display should be similar to that shown in Section 3, Figure 3-1-2.

10. Position the cursor over the third character in the first group of feature switches (use the cursor control keys). Change the state of this character (either 0 or 1) to the opposite state by typing the 6 key on the main keyboard. Note that the CRT screen background is in the reverse state.

11. Set the CAPS LOCK key on the left side of the keyboard to the UP (Off) position.

12. Type a grouping of shifted and unshifted characters and observe the display on the CRT.

13. Press CTRL and then the G key. The bell should sound.

14. Depress the CAPS LOCK key and it will lock in the On position. Repeat Step 12 above and observe that the characters are displayed in upper case only. (Shifting of the number and symbols group is still controlled by the SHIFT key.)

15. Type the sequence ESC P 0 1, then type your name. The bell should "click" as you type. Then type the sequence ESC \ . Now type the F1 key. Your name should appear on the Teleray screen.

This completes preliminary checkout of the Teleray 100.

2-3 Internal Controls

These controls are preset at the factory and should not normally need adjustment.

SAFETY WARNING

Hazardous voltages of 115, 220 VAC and 15 K VDC are present when the terminal is on, and may remain after power is removed. Use caution when working on internal circuits, and do not work alone.

When handling the cathode ray tube, caution is required as the internal phosphor is toxic. Safety glasses and gloves must be used whenever the CRT tube is handled. Should the tube break and skin or eyes be exposed to the phosphor, rinse the affected area with cold water and consult a physician.

This terminal is supplied with a cord set that includes a safety ground. Do not use this terminal with an ungrounded outlet, missing ground pin, or any adaptor that will defeat the safety ground.

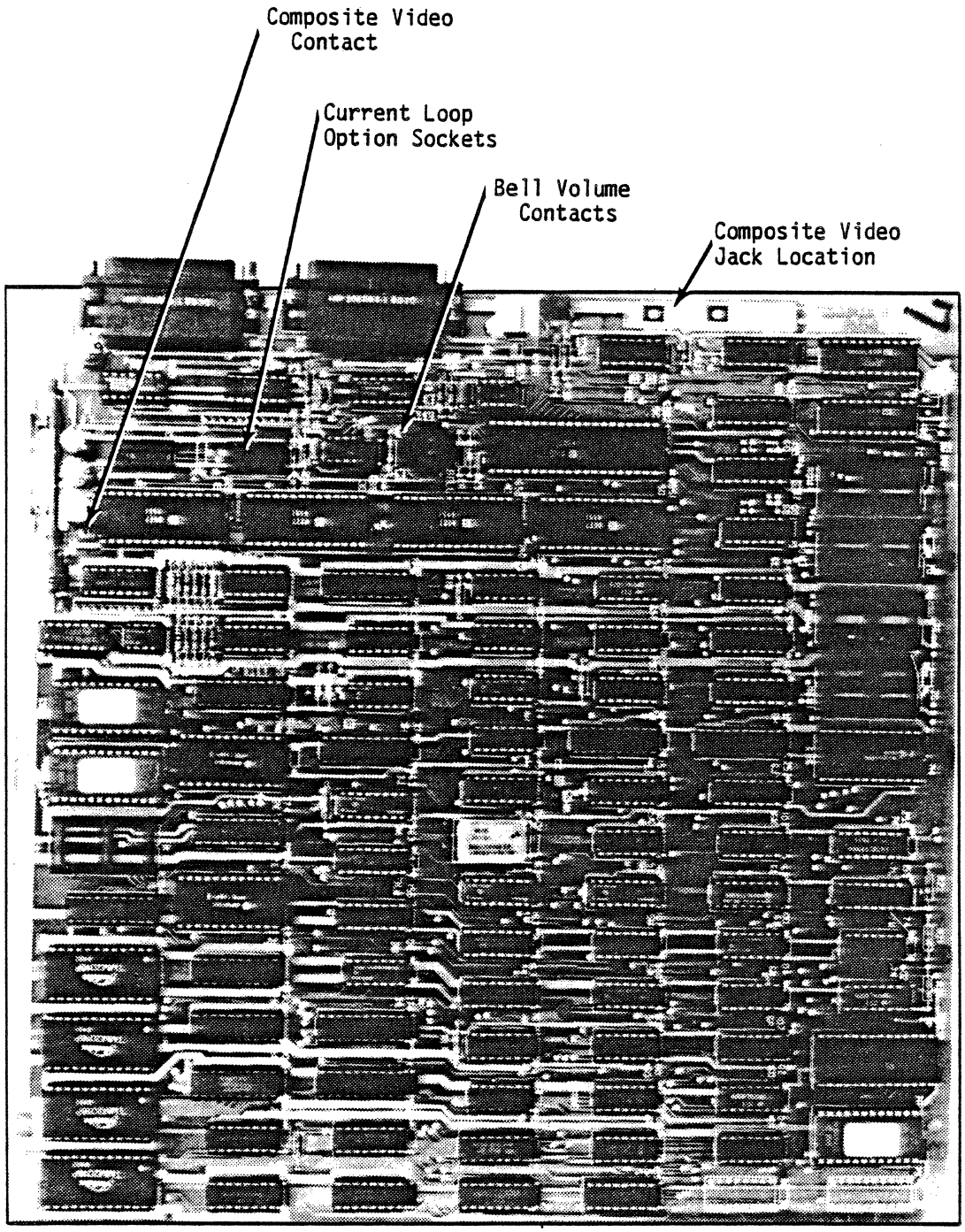
Ensure that power is turned off before connecting or disconnecting the keyboard cable.

A. Logic Module Internal Controls

Bell Volume - Grid Location 3C

The test points located adjacent to the bell are provided for reducing the volume of the bell tone should it be necessary. These points can be shorted together to eliminate the bell completely; a 20 ohm resistor will reduce the volume approximately 50%.

The outline of the logic module is shown below.



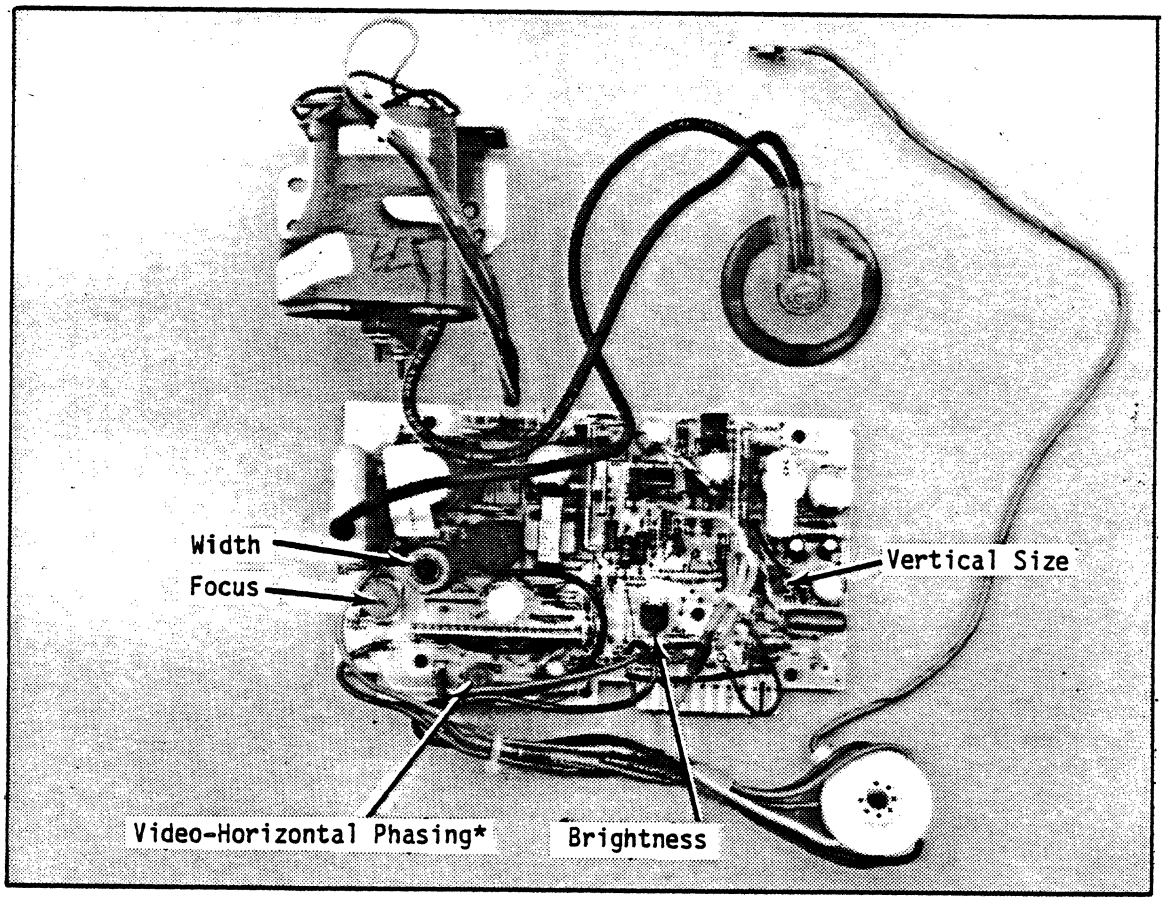
B. Monitor Internal Controls

Normally, these controls should not need adjustment. They are located below the CRT tube on the upper chassis. The names of the controls explain their function.

CAUTION

No work should be attempted on an exposed chassis by anyone not familiar with servicing procedures and precautions.

The SET-UP mode contrast controls should be correctly set before attempting these adjustments.



*This control should be adjusted with 132 columns displayed.

MONITOR CIRCUIT CARD

2-4 Communications Connections

A. Serial I/O

DP25S connector, 25-pin miniature, for on-line communications interfacing in Remote mode. Pin assignments:

RS232C (Standard)

1 - Protective Ground
2 - Transmitted Data
3 - Received Data
4 - Request to Send
5 - Clear to Send
7 - Signal Ground
8 - Carrier Detect
20 - Data Terminal Ready

Electrical Characteristics

Teleray Output Voltages - On all signals designated "from Teleray", the mark, or unasserted state, is -6.0 V to -12.0 V; the space, or asserted state, is +6.0 V to +12.0 V.

Teleray Input Voltages - On signals designated "to Teleray", -25.0 V to -0.75 V or an open circuit is interpreted as a mark or unasserted state, and +25.0 V to +0.75 V is interpreted as a space or asserted state. Voltages greater in magnitude than $\pm$ 25 V are not allowed. These levels are compatible with EIA STD RS232C and CCITT Recommendation V.28.

Full Duplex Protocol

Full duplex operation is implemented for full duplex modems (Bell 103). If local echo is disabled, keyed data transmits from the terminal and is not displayed. If local echo is enabled, keyed data transmits from the terminal and to the display. The Data Terminal Ready signal is asserted and Carrier Detect is ignored. If Clear to Send is connected but not asserted, then no data is transmitted.

Half Duplex Protocol

Half duplex is implemented for half duplex modems (Bell 202). Local echo is enabled causing keyed data to transmit from the terminal and to the display. Request to Send is asserted upon keyboard data entry and negated following transmission of a Line Feed or a Form Feed. In Edit mode, Request to Send is asserted during a block transmission only. Clear to Send must be asserted for data to transmit.

Signal descriptions follow:

Protective Ground - Pin 1

This conductor is electrically bonded to the Teleray chassis. Use of this conductor for reference potential purposes is not allowed.

Transmitted Data (from Teleray) - Pin 2

The Teleray transmits serially encoded characters and break signals on this circuit, which is held in the mark state when neither characters nor break signals are being transmitted.

Received Data (to Teleray) - Pin 3

The Teleray receives serially encoded characters generated by the user's equipment on this circuit.

Request to Send (from Teleray) - Pin 4

Asserted at all times when terminal is powered up.

Clear to Send (to Teleray) - Pin 5

Must be asserted to allow the Teleray to transmit.

Signal Ground - Pin 7

This conductor establishes the common ground reference potential for all voltages on the interface. It is permanently connected to the Teleray logic ground and to the Teleray chassis.

Carrier Detect (to Teleray) - Pin 8

Ignored at all times.

Data Terminal Ready (from Teleray)- Pin 20

Data Terminal Ready is asserted at all times except under the following conditions:

1. Terminal is not powered up.
2. Terminal is in Local mode.
3. The 3.5-second interval following the pressing of SHIFT-BREAK.

B. Optional Current Loop (for Serial I/O)

The optional current loop module installs in the logic board module at grid locations 1C and 2C (see Section 2-3-A). When installed, the current loop signals become active in the serial I/O connector on the pins shown below.

To activate the current loop, a jumper is required on the serial I/O connector from Pin 18 to Pin 3. When the current loop is installed, the RS232 signals remain active and may be used without removing the option, although different cable connectors are required.

Current Loop (Optional)

12 - Transmitted Data +
24 - Transmitted Data -
13 - Received Data +
25 - Received Data -

18 to 3 enables current loop.

In most current loop applications, the Teleray will be connected in a passive configuration (current is supplied to the Teleray). The transmitter and receiver are both passive, both optically isolated, and the transmitter goes to the mark state when power is turned off.

Conversion from active to passive (or vice versa) requires reconfiguring the current loop module.

In active mode, either the transmitter or the receiver or both may be connected so that the Teleray sources the 20 mA of current. In active mode, isolation is not present and the transmitter will go to the space state when power to the Teleray is turned off.

Electrical Characteristics

The electrical characteristics of the 20 mA current loop interface are shown below:

Transmitter

	Min	Max
Open circuit voltage	5.0 V	60 V
Voltage drop marking	-	3.0 V
Spacing current	-	2.0 mA
Marking current	10 mA	40 mA

Receiver

	Min	Max
Voltage drop marking	-	2.5 V
Spacing current	-	8.0 mA
Marking current	12 mA	40 mA

In addition to the above specifications for passive operation, active mode will place the transmitter or receiver in series with a source of 15 V $\pm$ 5% and 600 ohms.

C. Peripheral Interface

The Teleray Model 100 has a bi-directional RS232 peripheral interface. The Data Terminal Ready and Request to Send signals must be asserted for the peripheral port to operate.

DP25S connector, 25-pin miniature, for interfacing with RS232 printer or other peripheral device. Pin assignments:

RS232C (Standard)

1 - Protective Ground
2 - Received Data (to Teleray)
3 - Transmitted Data (from Teleray)
4 - Request to Send
20 - Data Terminal Ready

NOTE: 5,6,8 - Always Asserted

Electrical characteristics are identical to those of the serial I/O interface.

D. Optional Composite Video

The Teleray can be optionally supplied with a composite video output. This output is similar to EIA RS170 with the following exceptions:

1. Horizontal rate is 18.6 KHz, not 15.7 KHz.

2. Video rate is 22 MHz, exceeding the band width of most RS170 type monitors.

This composite output is fully compatible with the high resolution remote monitors sold by Teleray.

Section 3

SET-UP MODE

3-1 Introduction

The selection and storage of the terminal's features is performed in a mode called SET-UP mode. When SET-UP mode is activated, the status of the features stored in the temporary memory is displayed on the screen. Screen data is not lost and will be displayed when SET-UP mode is exited. Figures 3-1-1, 3-1-2 and 3-1-3 show SET-UP Modes A, B and C, respectively. The descriptive text in these figures describe which terminal status is represented by each portion of the display.

The operator can then change the features displayed and store any new feature selections, either temporarily by leaving SET-UP mode or, on a fixed basis, by performing a "save" operation.

To enter SET-UP mode, press the SET-UP key. This puts the terminal into SET-UP A. Pressing the numeral 5 on the main keyboard will cause the terminal to go to SET-UP B. Pressing the numeral 5 key again will cause the terminal to go to SET-UP C mode. Pressing the SET-UP key again will cause the terminal to leave SET-UP mode. The SET-UP features are a series of options in the Teleray that allow the terminal to be tailored to its operating environment. Many of these machine states are also changeable by escape sequences or by the host computer.

Table 3-1 enumerates these features and how to change them. Descriptions of these operations follow Table 3-1.

Table 3-1 - SET-UP Mode Features

	SET-UP Mode Location (See Fig. 3-1)	Key Used	Descriptive Paragraph Number
TERMINAL STATUS			
Change SET-UP Mode	A, B or C	5	3-1
Save Status & Functions	A, B or C	Shift & S	3-2-A
Recall Previous Status	A, B or C	Shift & R	3-2-B
Reset to Initial State	A, B or C	0	3-2-C
Tab Default	A, B or C	Shift & T	3-2-D
General Default	A, B or C	Shift & D	3-2-E
COMPUTER COMMUNICATIONS			
Line-Local Mode	A, B or C	4	3-3-A
Line Monitor Mode On/Off	B-5-3	6	3-3-B
Local Echo On/Off	B-5-2	6	3-3-C
Half or Full Duplex	C-F-4	6	3-3-D
Receive Baud Rate	B	↑ and ↓	3-3-E
Transmit Baud Rate	B	↑ and ↓	3-3-F
For 8 Bits per Character	B-4-3	6	3-3-G
Parity Enable	B-4-2	6	3-3-G
Parity Sense	B-4-1	6	3-3-G
Parity Type	B-5-1	6	3-3-G
Auto XON/XOFF Enable	B-2-4	6	3-3-H
Program Answerback Message	A, B or C	Shift & A	3-3-I
Programming Device Attributes Message	A, B or C	Shift & B	3-3-J
OPERATOR CONVENIENCE FEATURES			
Right Margin Bell On/Off	B-2-1	6	3-4-A
Keyclick On/Off	B-2-2	6	3-4-B
Auto Key-Repeat On/Off	B-1-2	6	3-4-C
Auto Key-Repeat Rate (30/15 cps)	B-6-4	6	3-4-C
Screen Background Normal/Inverse	B-1-3	6	3-4-D
Screen Brightness	A, B or C	↑ and ↓	3-4-D
Cursor Character (___ or ■)	B-1-4	6	3-4-D
Smooth Scroll On/Off	B-1-1	6	3-4-E
Smooth Scroll Rate (5, 10, 15, or 20 lps)	B-6-2, B-6-3	6	3-4-E
Screen Saver On/Off	B-5-4	6	3-4-F
APPLICATION DEPENDENT FEATURES			
New Line Mode On/Off	B-3-3	6	3-5-A
Right Margin Wrap On/Off	B-3-2	6	3-5-B
Refresh Rate (60/50 Hz)	B-4-4	6	3-5-C
U.S. or U.K. Character Set	B-3-1	6	3-5-D
V52 or ANSI Mode	B-2-3	6	3-5-E
Tab Stop Settings	A	2 and 3	3-5-F
80 or 132 Characters per Line	A, B or C	9	3-5-G
Wide (40-66 Char.) or Normal Mode	B-6-1	6	3-5-G
Dynamic Functions Execution	C-F-3	6	3-5-H
PRINTER CONTROL			
Print On-Line Mode On/Off	C-E-4	6	3-6-A
Print Extent Mode	C-D-2	6	3-6-B
Print Termination Character	C-D-1	6	3-6-B
Print Speed	B	↑ and ↓	3-6-C
Print Parity Enable	C-E-2	6	3-6-C
Print Parity Sense	C-E-1	6	3-6-C
Print Parity Type	C-E-3	6	3-6-C

	SET-UP Mode Location (See Fig. 3-1)	Key Used	Descriptive Paragraph Number
EDITING CONTROL			
Edit Mode On/Off	C-A-1	6	3-7-A
Edit Key Execution	C-A-2	6	3-7-B
Guarded Area Transfer (All/Unprotected)	C-A-3	6	3-7-C
Space Compression On/Off	C-A-4	6	3-7-D
Transmit Extent (Line, Page, or Message)	C-B-1, C-B-2	6	3-7-E
Transmit Termination Character	C-B-3	6	3-7-E
Transmit Key Execution	C-B-4	6	3-7-F
Bold Protect	C-C-1	6	3-7-G
Underline Protect	C-C-2	6	3-7-G
Blink Protect	C-C-3	6	3-7-G
Inverse Protect	C-C-4	6	3-7-G
Normal Protect	C-D-1	6	3-7-G
Overline Protect	C-F-1	6	3-7-G
Blank Protect	C-F-2	6	3-7-G
Erasure Mode (All/Unprotected)	C-D-2	6	3-7-H

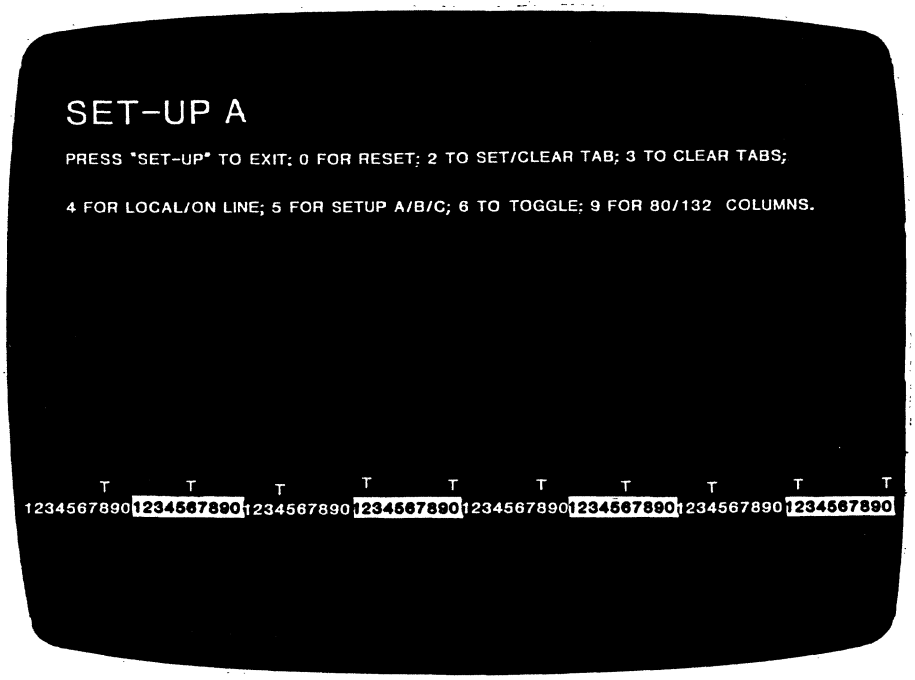
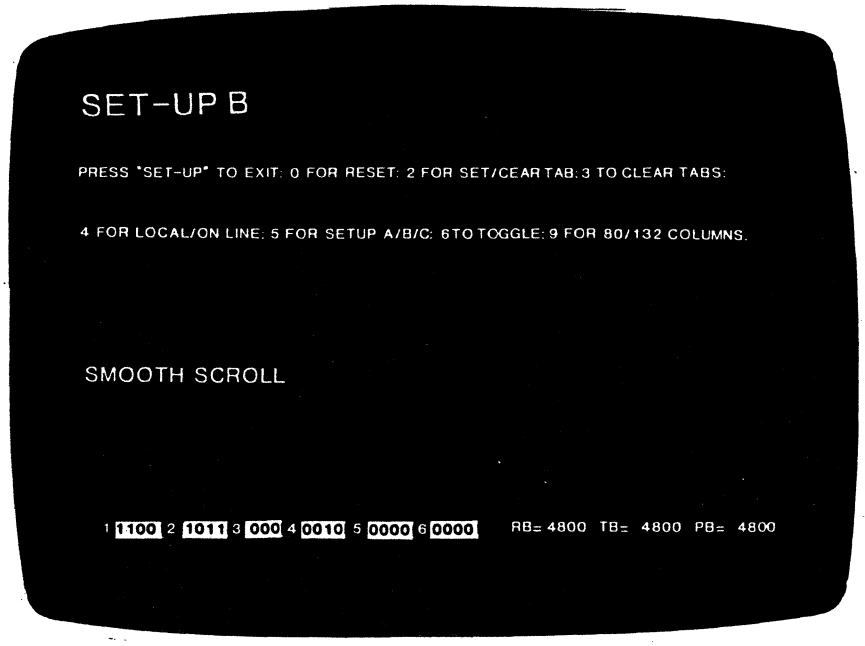
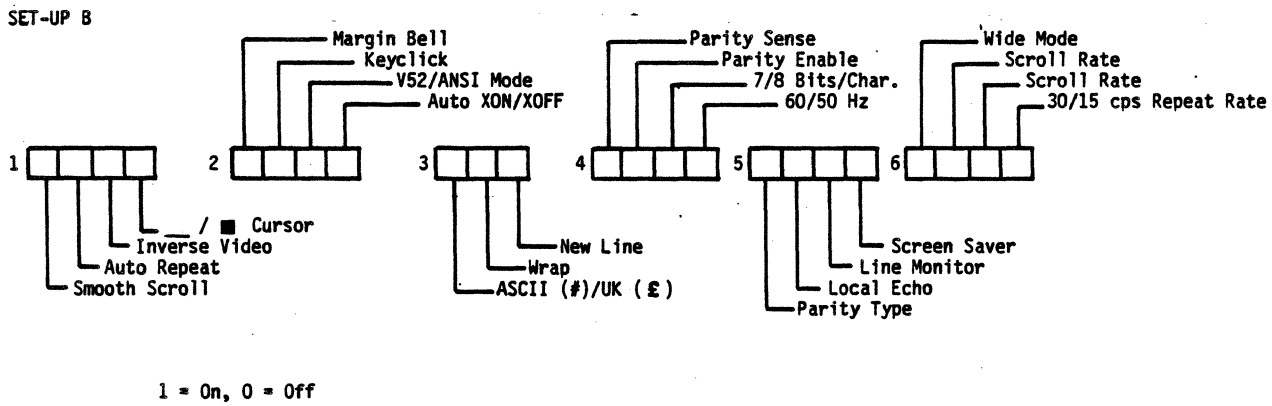


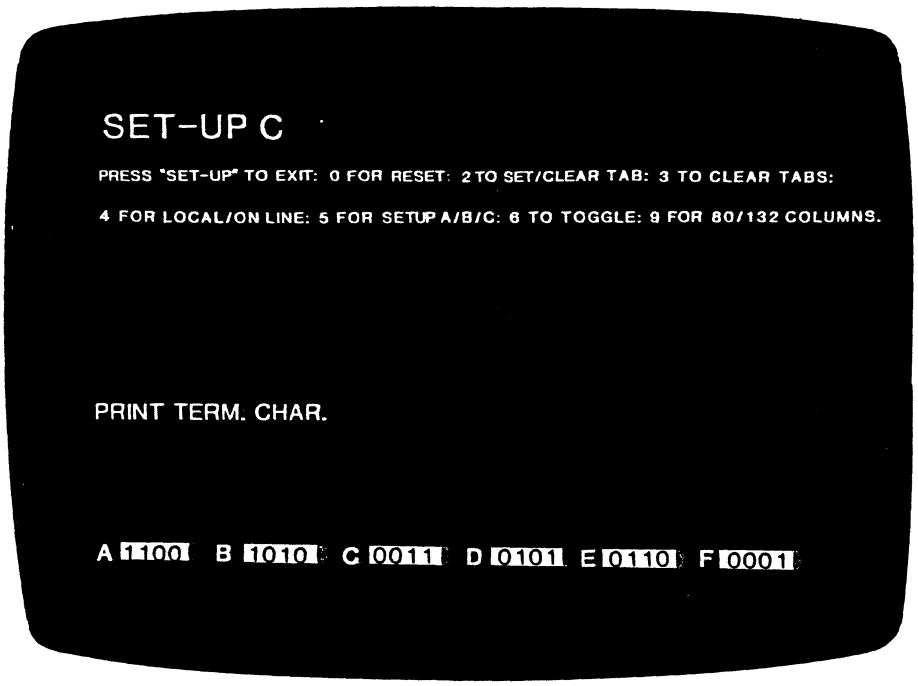
Figure 3-1-1 - SET-UP Mode A





1 = On, 0 = Off

Figure 3-1-2 - SET-UP Mode B



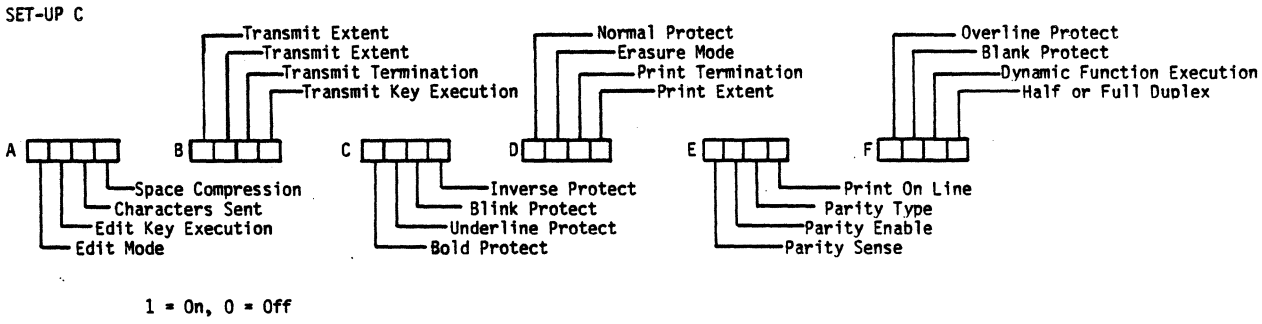


Figure 3-1-3 - SET-UP Mode C

3-2 Terminal Status - SET-UP Mode Commands

A. Saving the SET-UP Features

SET-UP features may be changed and stored on either a temporary or a fixed basis. To temporarily store a feature, exit SET-UP mode after changing the feature; the terminal now reacts according to the new setting. If a recall operation is performed, the terminal is reset, or the terminal power is turned off, all temporary feature settings are replaced by the features that have been stored on a fixed basis.

To store SET-UP feature settings on a fixed basis, perform a Save operation. This is a simple operation that is accomplished by performing the following steps:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and S keys simultaneously. The cursor will resume blinking when the Save operation is complete.

Once these steps have been performed, SET-UP features that had been temporarily stored and the dynamic programmable function sequences will now be stored in the non-volatile memory.

B. Recalling Previous Status

The temporarily stored SET-UP feature settings may differ from the settings that have been stored on a fixed basis. If you wish to return to the fixed settings, perform the recall operation as follows:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and R keys simultaneously. The screen will clear and after a brief wait, the terminal will return to SET-UP A mode.

C. Reset to Initial State

The Teleray may be reset from the keyboard. When the terminal is reset, the terminal memory is cleared and the self-test program is run as if the terminal power switch had been turned Off and then back On. To reset the terminal:

1. Place the terminal in SET-UP mode.

2. Press the 0 (zero) key on the main keyboard. The Teleray will be reset, the power on self-test will be run, and the terminal will set according to the fixed SET-UP features.

When a reset operation is performed, the contents of the screen are destroyed and any options present may be affected.

D. Tab Default

The tab default condition may be invoked from the keyboard. The tab default state is a tab stop at every eighth character position. To initialize the tabs:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and T keys simultaneously. The tab column will reappear with tabs set to every eighth position.

E. General Default

The general default condition is to have the dynamic programmable functions clear and all SET-UP features off, except for the following:

Parity Enable	On
Parity Sense	Even
Erasure Mode	Erase All
Local/On Line	On Line
Receiver Baud	2400
Transmitter Baud	2400
Peripheral Baud	2400
Device Attributes	ESC [? 1 ; 2 c

Answerback is blank
Tab Stops set to every eighth position

The general default condition can be invoked from the keyboard by the following steps:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and D keys simultaneously. The default condition will appear in SET-UP mode, but will not be saved in non-volatile memory. A Save operation may be used to save the default conditions.

3-3 Computer Communications - SET-UP Mode Commands

A. On-Line/Local

The On-Line/Local feature allows the operator to easily place the terminal in either an On-Line or a Local (off-line) condition. When the terminal is on-line (the keyboard ON-LINE indicator is On), all characters typed on the keyboard are sent directly to the computer and messages from the computer are displayed on the screen. In the Local condition (the keyboard LOCAL indicator is On), the terminal is logically disconnected from the computer; messages are not sent to or received from the computer; and characters typed on the keyboard are displayed on the screen directly.

B. Monitor Mode

When the Teleray is placed in this mode, all control characters including Escape and Delete are treated as data and entered into the display memory. Monitor mode allows the Teleray to be used as a line monitor. This mode also allows display entry of control characters, which can be used to view a programmed function. In Monitor mode, the Teleray automatically wraps on the right margin.

C. Local Echo Mode

When the Teleray is in the On-Line mode and in the Local Echo mode, all data that is transmitted from the Teleray will also be displayed on the screen. This will allow the Teleray to be operated in certain "Half Duplex" environments where the modem protocol signals are not being used.

D. Full/Half Duplex

When Half Duplex mode is enabled, Local Echo is enabled and Auto XON/XOFF is disabled by the Teleray. In Half Duplex, the terminal communicates to the host computer through a modem over a single transmission line. Although characters display on the screen as they are typed (due to Local Echo mode), no transmission occurs until the end of a line. If the Teleray is in Edit mode, then transmissions occur when the ENTER key is pressed.

When Full Duplex mode is enabled, Local Echo is disabled and Auto XON/XOFF is enabled by the Teleray. Each character transmits as it is typed unless the terminal is in Edit mode (see Section 3-7-A). The Local Echo and Auto XON/XOFF features are only altered when the Full/Half Duplex feature is changed and may be selected for any state thereafter. Full and Half duplex refer to types of modem control and therefore only apply to On-Line mode.

E. Receive Baud Rate

The receive speed must be set to match the computer transmit baud rate. The Teleray is capable of receiving at any one of the following preselected baud rates: 50, 75, 110, 134.5, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600 and 19,200 baud.

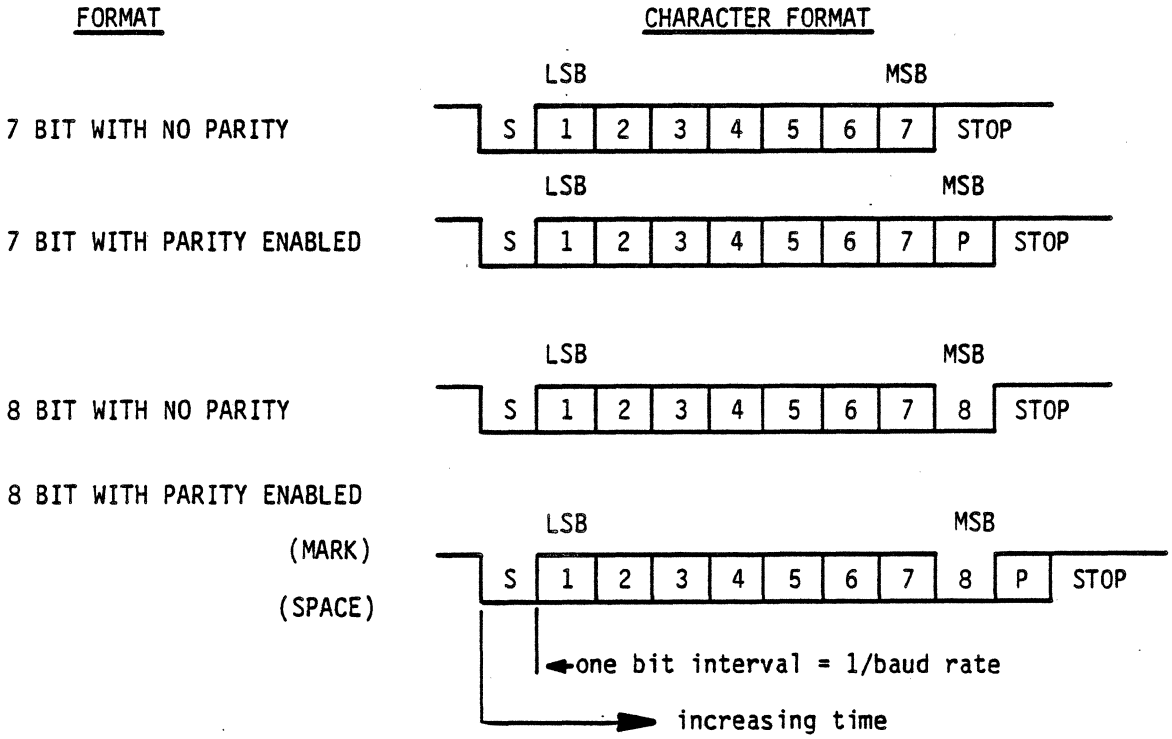
The receive baud rate is independent of the transmit baud rate; the terminal may receive data at one baud rate and transmit data at a different baud rate.

F. Transmit Baud Rate

Transmit baud rate must be set to match the computer receive baud rate. The Teleray is capable of transmitting at any one of the following preselected transmit baud rates: 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600 and 19,200 baud.

G. Asynchronous Character Format

Using the 7-bit, 8-bit, parity enable, parity sense and parity type settings, the Teleray can be configured to operate with computers requiring seven or eight bits with odd, even, mark, space or no parity. These modes must be set to match the computer with which the Teleray will be communicating. Figure 3-3-1, Asynchronous Character Format, describes some typical data formats.



S = START BIT, ALWAYS A 0
LSB = LEAST SIGNIFICANT DATA BIT
MSB = MOST SIGNIFICANT DATA BIT
STOP = STOP BIT(S), A MINIMUM OF 2 AT 110 BAUD, 1 AT ALL OTHERS
P = PARITY BIT, ODD, EVEN, MARK OR SPACE

Figure 3-3-1 - Asynchronous Character Format

Modes and their actions:

1. 7-Bit/8-Bit - Sets the communications character to either seven or eight bits.

2. Parity Enable - Configures the Teleray to add a parity bit to each character as it is transmitted.

3. Parity Sense and Type - The four on/off combinations of parity sense and parity type are used to choose even, odd, mark and space parity.

Parity Type \ Parity Sense	Reset ("0")	Set ("1")
Reset ("0")	ODD	EVEN
Set ("1")	MARK	SPACE

NOTE

The combination of Parity Enable and 8-bit modes and the combination of Parity Disable and 7-bit modes should generally be avoided.

H. Auto XON/XOFF Mode

The Teleray is capable of automatically generating synchronizing codes XON (DC1) and XOFF (DC3). The XOFF code is used to stop the transmission of data from the computer to the terminal; the XON code is used to resume transmission. With the feature enabled, the Teleray will generate the XOFF code when one of the following events occur:

1. The internal buffer is nearly full.

2. The NO SCROLL key is pressed.

3. The terminal is placed in SET-UP mode.

4. CTRL-S is pressed.

When the buffer empties, the NO SCROLL key is pressed again, the terminal is taken out of SET-UP mode, or CTRL-Q is pressed, the Teleray will transmit the XON code to resume transmission from the computer to the terminal.

If the host computer software does not support the XON/XOFF codes, data sent during buffer full conditions or when the terminal is in SET-UP mode may be lost.

The Teleray will stop transmission when an XOFF (DC3) code is received and will resume transmission when an XON (DC1) code is received. Entering and exiting SET-UP mode will also resume transmission.

I. Progamming the Answerback Message

Answerback is a question and answer sequence where the host computer asks the terminal to identify itself. The answerback feature provides the Teleray with the capability to identify itself by sending a message to the host. The entire answerback sequence takes place automatically without affecting the screen or requiring operator action. The answerback message may also be transmitted by typing CTRL-BREAK.

An answerback message can be set into the Teleray using the following steps:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and A keys simultaneously. The terminal will respond by placing A = on the screen. (The SHIFT key is required; the CAPS LOCK key will not work here.)

3. Type the message delimiter character, which may be any character not used in the actual answerback message. The message delimiter character is not a part of the answerback message. If a mistake is made when typing the answerback message, type the message delimiter character again and go back to Step 2. This is the only way to correct errors in the answerback message.

4. Type the answerback message. The message may be up to 20 characters, including space and control characters. Control characters will be displayed if they are entered in the answerback message.

5. Type the message delimiter character. Once the message delimiter character is typed, the answerback message will disappear from the screen.

Once the above steps have been completed, the answerback message will be temporarily stored and can be saved with the Save operation.

J. Programming the Device Attributes Message

The device attributes message is initiated by an ESC [c from the host computer. The message transmitted to the host computer informs the computer of the capabilities of the terminal. This question and answer session takes place automatically. Different types of computers need differing device attributes messages to allow the Teleray to operate.

The following is a list of commonly used device attributes messages:

ESC Sequence	Significance
ESC [? 1 ; 1 c	VT100*
ESC [? 1 ; 2 c (default)	VT100* with advanced video
ESC [? 1 ; 11 c	VT100* with advanced video and printer port
ESC [? 4 ; 2 c	VT132*
ESC [? 4 ; 11 c	VT132* with printer port

*DEC trademark (Digital Equipment Corporation)

A device attributes message can be set into the Teleray using the following steps:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and B keys simultaneously. The terminal will respond by placing B = on the screen. (The SHIFT key is required; the CAPS LOCK key will not work here.)

3. Type the message delimiter character, which may be any character not used in the device attributes message. If a mistake is made when typing the device attributes message, type the message delimiter character and go back to Step 2. This is the only way to correct errors in the device attributes message.

4. Type the device attributes message. The message may be up to nine characters, including space and control characters. Control characters will be displayed if they are entered in the device attributes message.

5. Type the message delimiter character. Once the message delimiter character is typed, the device attributes message will disappear from the screen.

Once the following steps have been completed, the device attributes message will be temporarily stored and can be saved with a Save operation.

3-4 Operator Convenience Setup

A. Right Margin Bell

The margin bell feature is much the same as the bell in a typewriter. If the cursor is eight characters from the end of the current line while typing, the Teleray sounds a tone to alert the operator. The volume of the bell tone can be tempered if necessary; see Installation, Section 2-3, Internal Controls.

B. Keyclick Tone

The keyclick is a tone that is generated every time a code transmitting key is pressed. The keyclick may be turned on or off to suit the operator's needs.

C. Auto Repeat

The auto repeat feature allows a key to be automatically repeated after the key has been held down for more than one-half second. The auto repeat feature affects all keyboard keys except the following:

ESC	RETURN
NO SCROLL	CTRL and any key
TAB	

The repeat rate can be set to 15 characters per second or 30 characters per second in SET-UP mode.

D. Screen Presentation

The SET-UP mode Inverse Screen control allows the normal screen mode to be either light characters on a dark background or dark characters on a light background. The and keys will increase and decrease, respectively, the screen brightness when the Teleray is in SET-UP mode. This setting may be saved. The cursor character can be selected to be either a blinking underline (__) or a blinking block (■).

E. Smooth Scroll

Scrolling is the upward or downward movement of existing lines on the screen to make room for new lines at the bottom or top of the screen. It can be performed in two ways: jump scroll or smooth scroll. In jump scroll mode, new lines appear on the screen as fast as the computer sends them to the terminal. At the higher baud rates, the data is very difficult to read due to the rapid movement of the lines. This can be corrected by either writing the pages from the top down or by invoking smooth scroll mode.

In smooth scroll mode, a limit is placed on the speed at which new lines of data may be sent to the terminal. The movement of lines occurs at a smooth, steady rate, allowing the data to be read as it appears on the screen. The Teleray supports four smooth scroll rates: 5, 10, 15, or 20 lines of data per second may be added to the screen.

The Auto XON/XOFF feature should be enabled and supported by the host computer to ensure that data is not lost when smooth scroll mode is enabled.

F. Screen Saver

After 12 minutes of inactivity, the Teleray display will automatically shut down to maximize tube life. Any keyboard or I/O activity will instantly restore the display without a loss of data. This feature can be enabled or disabled in SET-UP mode.

3-5 Application Dependent Feature Setup

A. New Line Mode

The new line feature enables the RETURN key on the terminal to function like the RETURN key on an electric typewriter. When the new line feature is enabled, pressing the RETURN key generates the carriage return (CR) and line feed (LF) codes. When a line feed code is received, the code is interpreted as a carriage return and line feed.

When the new line feature is disabled, the RETURN key generates only the CR code; an LF code causes the terminal to perform a line feed only.

If double line feeds occur consistently, turn this feature off since the computer is already performing this function automatically.

B. Right Margin Wrap

When this feature is enabled, the 41st, 67th, 81st or 133rd character (depending upon the line size selected) inserted on a line is automatically placed in the first character position of the next line. If the wrap-around feature was not enabled, this character and all following characters would be overwritten into the last character position of the current line.

C. Refresh Rate

During the initial installation, the terminal display should be set to the power line frequency. In the U.S., this is set to 60 Hz.

D. U.S. and U.K. Character Set

The Teleray contains character sets for the United States and United Kingdom. The difference between the two character sets is one character, the # or £ symbol. When the standard U.S. character set is selected, the shifted 3 key on the main keyboard displays the # character; the £ character is displayed when the U.K. character set is selected. The character set can also be selected by the ANSI mode SCS sequence (see Section 6).

E. ANSI/V52 Mode

The Teleray Model 100 terminal follows two different programming standards -- American National Standards Institute (ANSI) and V52. In ANSI mode, the Model 100 will generate and respond to coded sequences per ANSI Standards X3.41-1974 and X3.64-1977. In V52 mode, the Model 100 terminal is compatible with older software using the Teleray V52 video terminal. Commands available in both ANSI and V52 modes are detailed in the coding sections of this manual.

F. Tab Stop Settings

Just like a typewriter, the Teleray Model 100 can jump or tab to preselected points on a line. These tab stops may be individually changed, or totally cleared and then set. In SET-UP A mode, the 2 key is used to selectively set or clear a tab stop as the cursor is advanced along the ruling on the bottom of the screen. The 3 key will clear all tabs.

G. Screen Data Format

The Teleray is capable of displaying either 80 or 132 characters per line. In the 80 character per line mode, the screen is 80 characters wide by 24 lines high. In the 132 character per line mode, the screen is 132 characters wide by 24 lines high. In the 132 character per line mode, the displayed lines are physically the same width as in the 80 character per line mode, but the characters are more compact. When changing from 80 to 132 character per line mode or vice-versa, the current contents of the screen are lost.

The Teleray also has a Wide mode. In Wide mode, there are 40 or 66 characters per line. Data is <u>not</u> lost when changing from Wide to Normal mode.

H. Dynamic Functions Execution

The dynamic programmable functions can operate two different ways. The contents of a function can execute locally within the Teleray, or the contents of a function can transmit from the Teleray. If the terminal is in Local mode, a function will always execute locally.

3-6 Printer Control

A. Print On-Line Mode On/Off

In Local mode, Print On-Line mode causes the Teleray to be on-line with the attached printer. The Teleray transmits data to the printer with XON/XOFF control, and also receives data from the printer keyboard for the screen. In On-Line mode, Print On-Line mode causes incoming data to be displayed on the Teleray as well as going to the printer when in Printer Controller mode (see Section 6-9-B). Print On-Line mode causes printer keyboard data to transmit to the host computer regardless of Printer Controller mode.

B. Print Extent Mode On/Off - Form Feed Mode On/Off

When Print Extent mode is on, all characters on the screen are sent to the printer during a Print Screen command; when off, any characters within the scrolling window are sent. When Form Feed mode is on, a single form feed (FF) character is appended to the characters sent by the Print Screen command. When off, no print termination character is added. Carriage Return and Line Feed characters are always sent as part of the Print Screen function.

C. Printer Communications Features

These features set the printer communications in a manner identical to setting the computer communications features. SET-UP mode commands are provided for printer baud rate, parity enable, parity sense and parity type. See 3-3-D through 3-3-F for more detailed information.

3-7 Editing Control

A. Edit Mode On/Off

In Edit mode, the editing features of the Teleray are enabled. These features include block transmission of data and text editing. The LINE INSERT, LINE DELETE, CHAR INSERT, CLEAR HOME, TAB, BACK TAB, ENTER, DELETE CHARACTER, and DELETE keys perform screen editing operations, and all other keyboard keys operate locally.

B. Edit Key Execution

In Edit key execute mode, pressing the SHIFT and EDIT keys causes the Teleray to alternately enter or exit Edit mode. In Edit key transmit mode, pressing the SHIFT and EDIT keys causes a control sequence to transmit from the Teleray. The host computer must echo this control sequence to enter or exit Edit Mode (see Section 6-8-J).

C. Guarded Area Transfer

When in Edit mode, either all data transmits from the Teleray or only the unprotected data. This feature is useful in reducing the amount of transmitted data if the host computer only needs the unprotected data.

D. Space Compression

With space compression on, trailing spaces at the end of a field are replaced with a control code (Record Separator). Spaces at the end of a line are simply dropped. This feature reduces the amount of data transmitted to the host computer.

E. Transmit Extent - Transmit Termination Character

Block transmissions, which are allowed in Edit mode, can be selected for page, line, or message. The page selection allows transmission of the entire scrolling window. The line selection allows transmission of the entire cursor line. The message selection allows transmission of some portion of the scrolling window up to but not including the cursor position. The starting position of the message transmission is either the start of the scrolling window or the position of the cursor where the last transmission occurred. Each type of block transmission will be terminated with a Form Feed if the transmit termination feature is enabled.

F. Transmit Key Execution

In Transmit key execute mode, pressing the ENTER key causes a block transmission. In Transmit key transmit mode, pressing the ENTER key causes a control sequence to be transmitted to the host computer. The host computer must then send a control sequence to the Teleray before a block transmission will occur. The ENTER key will only cause a block transmission in Edit mode.

G. Graphic Rendition Protection

Each graphic rendition (bold, blink, underline, inverse, overline, and blank) or any combination thereof can designate a protected field. When a graphic rendition is protected, the data associated with it cannot be changed or deleted from the keyboard while in Edit mode. If not in Edit mode, protection of characters is ignored unless the Teleray is in Protect mode.

H. Erasure Mode

Erasure mode determines which characters on the screen can be erased. With Erasure mode on, all characters on the screen can be erased. With Erasure mode off and Edit mode on, only unprotected characters can be erased. The off state inhibits the ability of the host computer to overwrite characters on the screen. Normal keyboard entry is not affected by Erasure mode.

Section 4

MAINTENANCE AND TESTING

4-1 User Maintenance

The keyboard keys are the only moving parts of the Teleray and require no preventive maintenance by the owner. The Teleray surfaces may be cleaned with soap and water or any mild detergent. Cleaners with solvents should not be used.

The Teleray packaging is not designed to be weatherproof; there are several openings in the case through which liquids, coins, paper clips and other objects can fall. Such objects would disturb the electronic operation of the terminal if they came into contact with the circuitry. For this reason, avoid putting drinks and metal objects on the top of the terminal, or using excessive water to clean the terminal. Rubbing the keys with a dry or barely moist cloth should suffice to clean them.

CAUTION

Do not use cleaner containing organic solvents which are harmful to the faceplate or keytops.

In addition, the following routine maintenance procedures should be performed:

A. Weekly

Check operation of all switches and check all connectors and cables for looseness, abrasion, etc.

B. Yearly

1. Inspect monitor screen during operation for burned-in characters (i.e., terminal has been operated for extended periods at high intensity with contrast turned up and constant data pattern displayed). If a pattern has been etched on the screen, reposition the CRT beam using the yoke ring magnets.

2. Ensure that the ventilation slots are clear. Blocking these slots by placing objects on top of or under the Teleray may cause the terminal to overheat.

3. Perform the self-test operations described in the following section taking any required corrective action if a failure is encountered.

4-2 Local Testing

A. Screen Alignment Test - ESC # 8

This command causes the screen to be filled with underlined and overlined £ symbols. This character has a dense dot pattern for focus adjustment and is asymmetrical vertically and horizontally so that yoke nonlinearities are easily observed. This display can be used to adjust the monitor for focus and alignment. The command is only active if the Teleray is in ANSI mode.

B. Self-Testing

The terminal is automatically tested whenever the Teleray is turned on. The self-test can also be induced in the following ways:

1. Typing the 0 key in SET-UP A mode.

2. Entering a Reset function (ESC c).

3. Entering an Invoke Self-Test command. The Invoke Self-Test command can perform additional tests not included in the Reset Self-Test (see 4-2-D).

NOTE

If the CAPS LOCK key is depressed during self-testing, the keyboard error symbol (4) will be displayed at the end of the test unless a more serious error is encountered.

There are two broad categories of errors: fatal and non-fatal.

Fatal errors cause the terminal to immediately stop all operations. No intelligible information is displayed on the screen; however, the screen most likely contains a random pattern of characters.

Non-fatal errors do not halt the terminal processor. Instead, the terminal is forced to Local mode, and an error code character is displayed in the upper-left corner of the screen.

There are five types of non-fatal errors:

1. (RAM) Program RAM or display RAM error
2. (NVM) Non-volatile memory error
3. (KBD) Keyboard missing or malfunction
4. (SIO) Serial or peripheral data loopback error
5. (EIA) EIA modem control error

Section 4-2-C shows the possible nonfatal error characters that may appear on the screen and the failure represented by each character.

C. Non-Fatal Error Codes

Character Displayed	------Fault Detected------					Character Displayed	------Fault Detected------				
	RAM	NVM	KBD	SIO	EIA		RAM	NVM	KBD	SIO	EIA
1	X					@					X
2		X				A	X				X
3	X	X				B		X			X
4			X			C	X	X			X
5	X		X			D			X		X
6		X	X			E	X		X		X
7	X	X	X			F		X	X		X
8				X		G	X	X	X		X
9	X			X		H				X	X
:		X		X		I	X			X	X
;	X	X		X		J		X		X	X
<			X	X		K	X	X		X	X
=	X		X	X		L			X	X	X
>		X	X	X		M	X		X	X	X
?	X	X	X	X		O	X	X	X	X	X

FAULT TYPES

RAM = Random Access Memory
NVM = Non-Volatile Memory
KBD = Keyboard
SIO = Serial Input/Output (serial and peripheral interfaces)
EIA = SIO Control Signals (serial and peripheral interfaces)

D. Invoked Self-Test - ANSI Mode Only (ESC [2; P_s y)

This command is used to start one or more of the various self-tests on the Teleray. The selective parameter (P_s) indicates which test(s) is to be performed. The parameter value is arrived at by taking the weight of each test and adding them together. A parameter value of 0 causes a reset.

Test	Weight
Power-up checksum	1
Interface Test (Loop Back)	2 (Turn-around plugs needed)*
EIA Test	4 (Turn-around plugs needed)*
Repeat tests until power-off	8

*Tests peripheral interface as well as serial interface; therefore, both plugs are needed. A turn-around plug can be manufactured by using a DB25P connector with the following connections (only).

Pin 2 to Pin 3
Pin 4 to Pin 5
Pin 8 to Pin 20

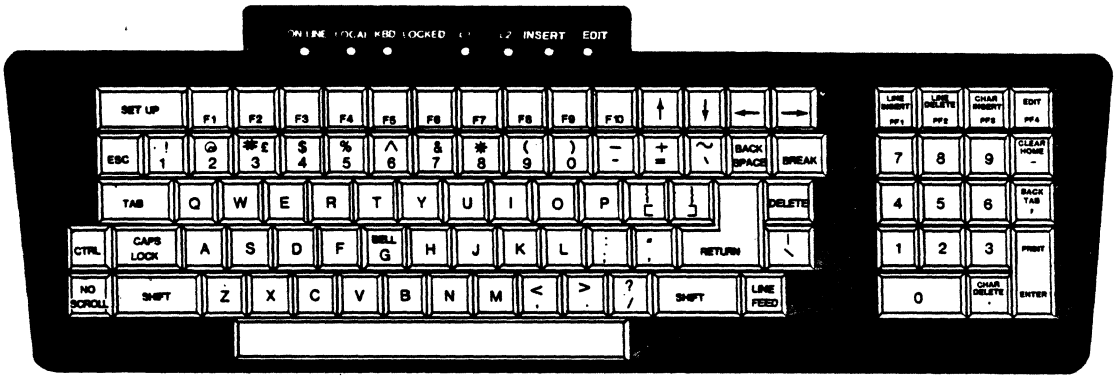
Section 5

KEYBOARD

5-1 General

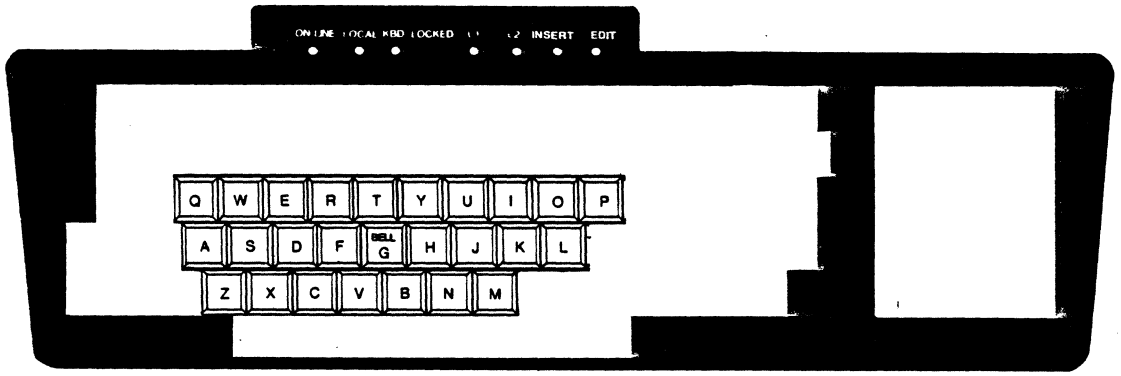
The keyboard is fully detachable from the terminal (except for "T" style) for operator comfort and optional space utilization. The coiled handset cord leading from the keyboard is terminated in a telephone type 4-pin connector; the cord supplied is compatible with those commonly used on Western Electric type telephones. Do not attempt to plug your keyboard into your telephone. The Teleray 100 keyboard has seven LED indicators: three are used to indicate the (legended) terminal status; the remaining four are used by the host computer to alert the operator of application dependent conditions. (See Section 6-2.)

The figure below shows the keyboard.



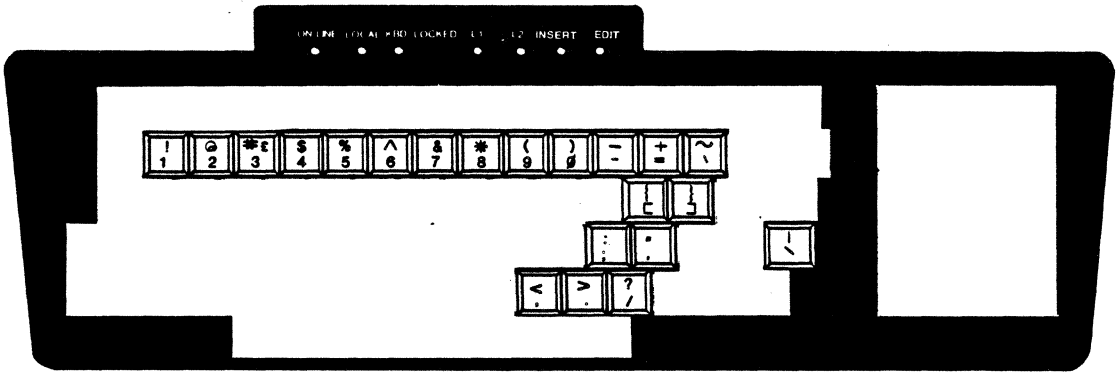
5-2 Alphabetic Keys

The keys shown below generate the appropriate ASCII character. Both upper and lower case can be generated under control of the SHIFT and CAPS LOCK keys.



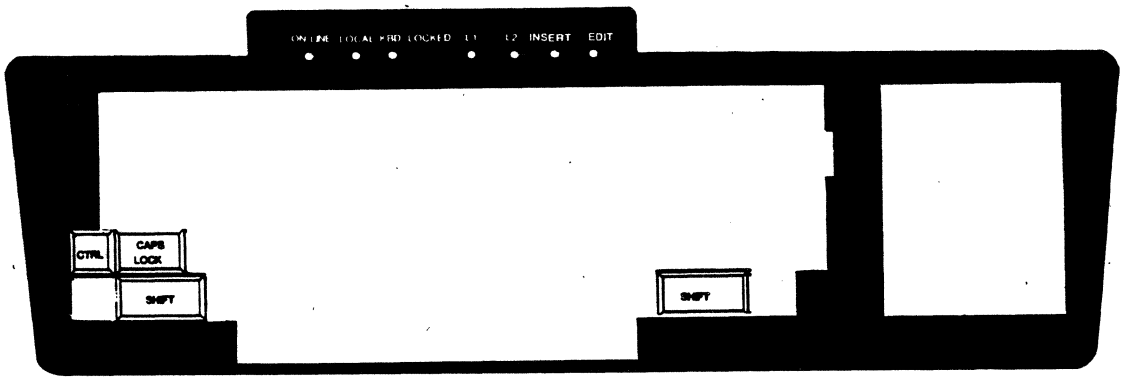
5-3 Numeric and Special Symbols

The keys shown below generate the appropriate ASCII character. In the unshifted position, the character indicated by the lower legend is generated; in the shifted position, the character indicated by the upper legend is generated. The position of CAPS LOCK does not affect the operation of these keys.



5-4 Keyboard Mode Keys

The keys shown below are used to change the character codes transmitted by the alphabetic, numeric and special symbol keys. All 128 ASCII characters can be generated by the keyboard. Table 5-4-1 details the keyboard coding.



5-5 Dedicated Keys

The keys shown below generate fixed ASCII codes regardless of the position of the SHIFT, CAPS LOCK or CONTROL keys. The codes transmitted by the cursor keys and by the numeric block depend on the operating modes of the terminal. Tables 5-5-1, 5-5-2 and 5-5-3 enumerate these characters.

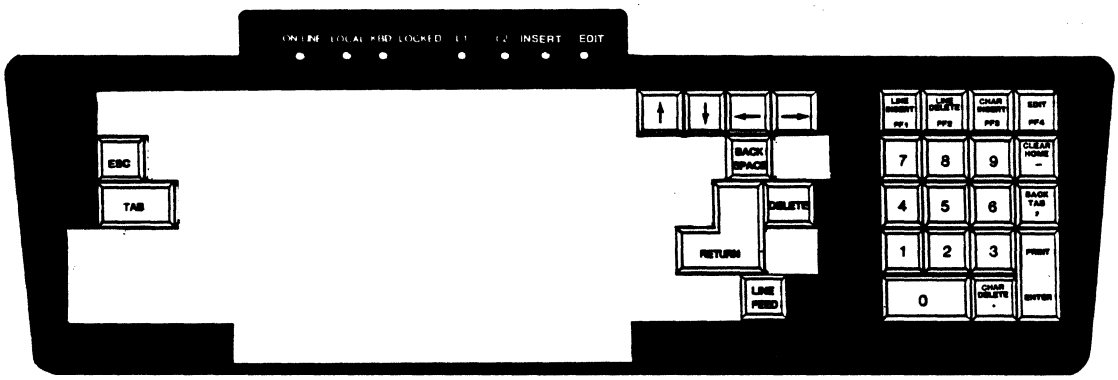
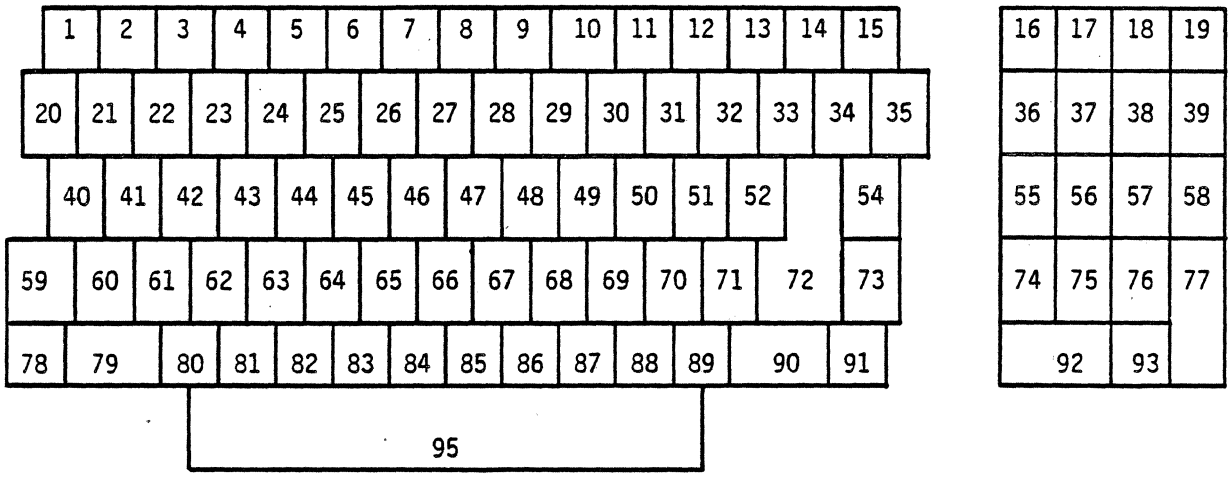


Table 5-4-1 - Keyboard Coding

Key Numbering Scheme



Key No.	Unshifted	Shifted	Control
1	----------Unencoded----------		
2 thru 11	---Dynamically Programmable--		
20	ESC	ESC	ESC
21	1	!	
22	2	@	NUL
23	3	# or £	
24	4	$	
25	5	%	
26	6	^	
27	7	&	
28	8	*	
29	9	(	
30	0	)	
31	-	_	
32	=	+	
33	`	~	RS
34	BS	BS	BS
35	BREAK	BREAK-DISCONNECT	ANSWERBACK
40	HT	HT	HT
41	q	Q	DC1
42	w	W	ETB
43	e	E	ENQ
44	r	R	DC2
45	t	T	DC4
46	y	Y	EM
47	u	U	NAK
48	i	I	HT
49	o	O	SI
50	p	P	DLE
51	[	{	ESC
52	]	}	GS

Key No.	Unshifted	Shifted	Control
54	Delete	DELETE	DELETE
59	----------Unencoded----------		
60	----------Unencoded----------		
61	a	A	SOH
62	s	S	DC3
63	d	D	EOT
64	f	F	ACK
65	g	G	BEL
66	h	H	BS
67	j	J	LF
68	k	K	VT
69	ℓ	L	FF
70	;	:	
71	'	"	
72	return	return	return
73	\	|	FS
78	----------Unencoded----------		
79	----------Unencoded----------		
80	z	Z	SUB
81	x	X	CAN
82	c	C	ETX
83	v	V	SYN
84	b	B	STX
85	n	N	SO
86	m	M	CR
87	,	<	
88	.	>	
89	/	?	US
90	----------Unencoded----------		
91	LF	LF	LF
95	SP	SP	NUL

Table 5-5-1
Cursor Keys - Codes Transmitted

Key Pressed	Key No.	V52 Mode (ESC [? 2 ℓ to enter mode)	ANSI Mode (ESC < to enter mode)	ANSI Mode and Cursor Key Mode (ESC [? 1 ℓ to enter mode)
	12	ESC A	ESC [A	ESC O A
	13	ESC B	ESC [B	ESC O B
	14	ESC C	ESC [C	ESC O C
	15	ESC D	ESC [D	ESC O D

Table 5-5-2
Preprogrammed Function Keys - Codes Transmitted

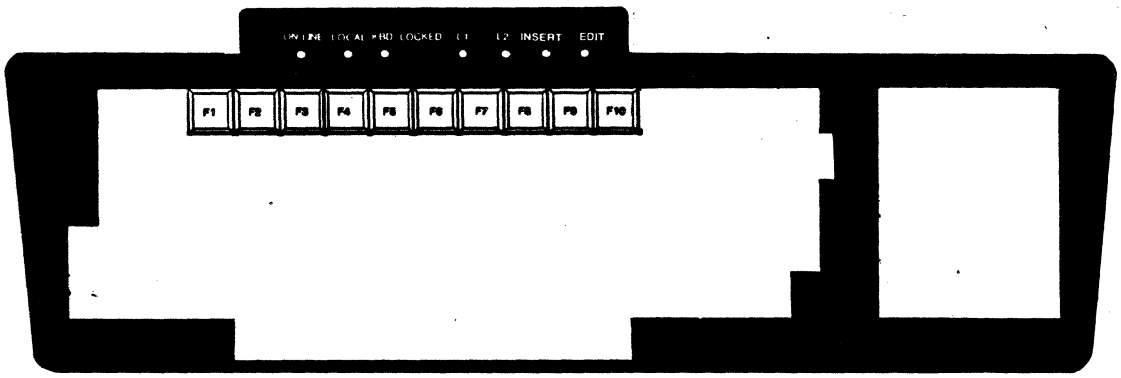
Key Pressed	Key No.	V52 Mode	ANSI Mode
PF1	16	ESC P	ESC O P
PF2	17	ESC Q	ESC O Q
PF3	18	ESC R	ESC O R
PF4	19	ESC S	ESC O S

Table 5-5-3
Numeric Keys - Codes Transmitted

Key Pressed	Key No.	Numeric Mode	Alternate Keypad Mode (ESC = to enter mode; ESC > to enter numeric mode)	
			In V52 Mode	In ANSI Mode
0	92	0	ESC ? p	ESC O p
1	74	1	ESC ? q	ESC O q
2	75	2	ESC ? r	ESC O r
3	76	3	ESC ? s	ESC O s
4	55	4	ESC ? t	ESC O t
5	56	5	ESC ? u	ESC O u
6	57	6	ESC ? v	ESC O v
7	36	7	ESC ? w	ESC O w
8	37	8	ESC ? x	ESC O x
9	38	9	ESC ? y	ESC O y
-	39	-	ESC ? m	ESC O m
,	58	,	ESC ? ℓ	ESC O ℓ
.	93	.	ESC ? n	ESC O n
ENTER	77	CR	ESC ? M	ESC O M

5-6 Dynamic Programmable Function Keys

The keys shown below will generate the ASCII sequences that have been stored in the program function memory. If the function has not been defined, pressing the key will not perform any action. Once programmed, these functions can be saved in non-volatile memory by the Save operation. Dynamic programmable functions 11 through 20 are invoked by holding the SHIFT key while pressing Keys F1 through F10, respectively. See Section 6-4.



5-7 Special Operation Keys

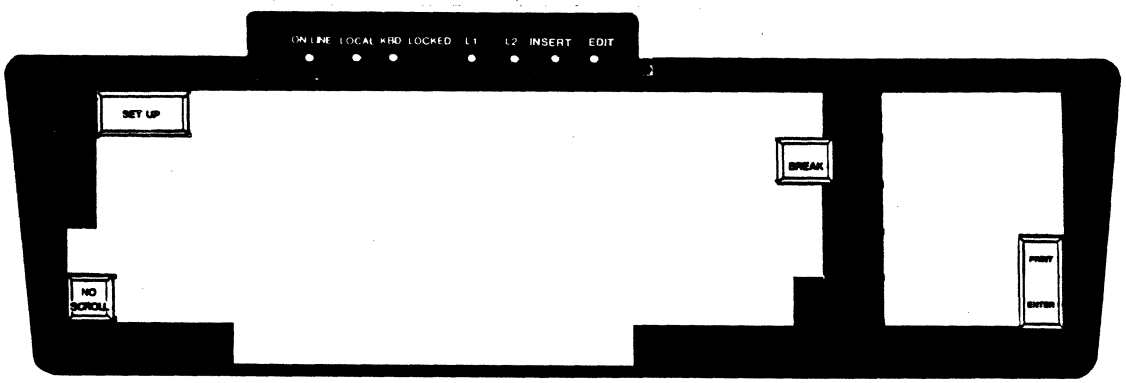
Pressing the BREAK key causes a 250 millisecond spacing condition on the data line. SHIFT and BREAK causes a 3.5 second spacing condition of the data line, and causes the Data Terminal Ready lead to go low for 3.5 seconds. Pressing CTRL and BREAK will initiate transmission of the answerback message if such a message has been previously entered in SET-UP mode.

The NO SCROLL key alternately transmits the DC3 (XOFF) and DC1 (XON) control codes if the Auto XON/XOFF Set-Up feature has been enabled. These codes are used to stop/start transmissions from the host computer, provided that the host recognizes these codes. If the Auto XON/XOFF feature is disabled, the NO SCROLL key will transmit no codes. See "Buffering" in the Operations section for further details.

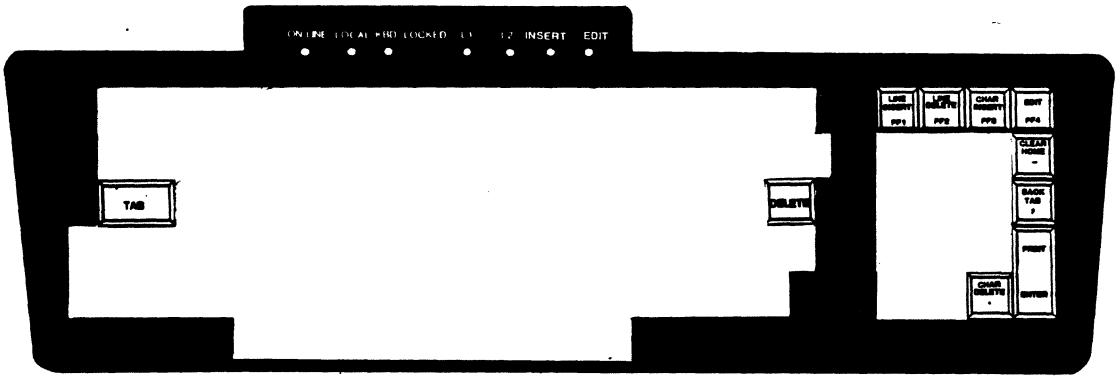
The SET-UP key is used to alternately enter and exit SET-UP mode, and to interrupt an undesired long-time function. Pressing this key will also unlock the keyboard and resume transmission. SET-UP mode is described in the Operations section.

If the Auto XON/XOFF feature is enabled, this key will transmit the XOFF code (DC3) when SET-UP mode is entered and transmit the XON code (DC1) when SET-UP mode is exited. If the Auto XON/XOFF feature is disabled, the SET-UP key will transmit no codes when entering/exiting SET-UP mode.

Pressing the SHIFT and ENTER keys causes a Print Screen (see Section 6-9-D). Auto Print mode (see Section 6-9-A) will be alternately entered and exited by pressing the CONTROL and ENTER keys.



5-8 Editing Keys



The SHIFT and EDIT keys are used to alternately enter and exit Edit mode. When in Edit mode, the EDIT LED is lit and certain numeric pad keys including DELETE and TAB from the main keyboard operate differently than when used in interactive mode. (See Section 6-5 on editing functions.)

Pressing the LINE INSERT key causes one blank line to be inserted on the screen without moving any protected fields or non-scrolling areas. The LINE DELETE key operates in a similar fashion to LINE INSERT except that one line is deleted instead of inserted. If an attempt is made to insert or delete outside of the scrolling window or on a protected line, the bell sounds and no operation occurs.

The CHAR INSERT key is used to alternately enter and exit Character Insert mode. In Character Insert mode, the INSERT LED is lit and all characters typed in a field will insert, causing trailing characters within that field to be dropped. If an attempt is made to insert a character in a protected field or outside of the scrolling window, the bell sounds and the character inserts at the next unprotected position.

Pressing the CLEAR HOME key causes the cursor to move to the top left of the scrolling window and the scrolling window to clear. The protected fields and the attributes are not cleared by this operation.

The TAB key causes the cursor to move forward (left to right and top to bottom) to the next tab stop, the start of the next field, or the start of the next unprotected field. The BACK TAB key causes the cursor to move backward (right to left and bottom to top) to the next tab stop, the start of the next unprotected field, or the start of the next line.

The ENTER key (not shifted) initiates a block transmission when in Edit mode. The type of block transmission may be selected in SET-UP mode.

Pressing the CHAR DELETE key will cause the cursor character to be deleted with a space inserted at the end of the field. If an attempt is made to delete a character in a protected field or outside of the scrolling window, the bell sounds and the cursor moves to the next unprotected position. The DELETE key operates in a similar fashion to CHAR DELETE except that the cursor is moved one position to the left before the character delete operation occurs. In this case, a character is deleted in the last unprotected position if an attempt is made to delete a character in a protected field or outside of the scrolling window.

Section 6

CODING DESCRIPTION

6-1 Reports and Messages

A. Answerback

Answerback is a question and answer sequence by which the host computer asks the terminal to identify itself. The answerback feature provides the Teleray with the capability to identify itself by sending a message to the host. The host computer requests the answerback message with the control character ENQ. When the Teleray receives the ENQ, it will transmit the programmed answerback messages. The entire answerback sequence takes place automatically without affecting the screen or requiring operator action. The answerback message may also be transmitted by the operator typing CTRL-BREAK.

An answerback message can be set into the Teleray using the following steps:

1. Place the terminal in SET-UP mode.

2. Press the SHIFT and A keys simultaneously. The terminal will respond by placing A = on the screen. (The SHIFT key is required. The CAPS LOCK key will not work here.)

3. Type the message delimiter character, which may be any character not used in the actual answerback message. The message delimiter character is not a part of the answerback message. If a mistake is made when typing the answerback message, type the message delimiter character again and go back to Step 2. This is the only way to correct errors in the answerback message.

4. Type the answerback message. The message may be up to 30 characters, including space and control characters. Control characters will be displayed if they are entered in the answerback message.

5. Type the message delimiter character. Once the message delimiter character is typed, the answerback message will disappear from the screen.

Once the above steps have been completed, the answerback message will be temporarily stored and can be saved with the Save operation (SHIFT and S).

B. Cursor Position

Request - ANSI Only: ESC [6 n
Report - ANSI Only: ESC [P_n; P_n R

The host computer may request the active position. The Teleray will respond with a report where the first parameter (P_n) is the decimal line number and second parameter (P_n) is the decimal column number of the active position.

C. Device Status

Request - ANSI Only: ESC [5 n
Report - ANSI Only: ESC [P_s n

The host computer may request the status of the Teleray. The Teleray will respond one of the following parameters (P_s).

P_s	Meaning
0	No malfunctions; device ready
3	Malfunction; device may not be operable

D. Device Attributes Request - ANSI Only: ESC [c or ESC [0 c or ESC Z
Report - ANSI Only: ESC [? 1; 2 c (default)

The host computer may request the terminal configuration. The Teleray will respond with a control sequence that indicates the terminal configuration. To program the device attributes message, follow the steps given in Section 3-3-J (programming similar to answerback).

E. Identify Request - V52 Only: ESC Z
Report - V52 Only: ESC / Z

The host computer may request the terminal type. The Teleray will respond with a sequence informing the computer that it is a V52 type terminal.

F. Printer Status Request - ANSI Only: ESC [? 1 5 n
Report - ANSI Only: ESC [? P_s n

The host computer may request the status of the printer interface. The Teleray will respond with one of the following parameters (P_s):

P_s	Meaning
10	Printer ready
11	Printer not ready (DTR or CTS off)

G. Terminal Parameters Request - ANSI Only: ESC [P_s x
Report - ANSI Only: ESC [P_s; par; nbits; tbaud; rbaud; clk; flags

The host computer may request the parameters set in the terminal and whether unsolicited reports may be sent. The Teleray will respond with the following parameters:

(2)P_s	Parameter Meaning
0 (or none)	This message is a request, and the terminal is allowed to send unsolicited reports, but will only report in response to a request.
1	This message is a request, and the terminal may now only report in response to a request.
2	This message is a report.
3	This message is a report, and the Teleray is only reporting in request status sequence: par; nbits; tbaud; rbaud; clk; flags.

Status	Values
par	1 = no parity; 2 = space parity; 3 = mark parity; 4 = odd parity; 5 = even parity
nbits	1 = 8 bits per character; 2 = 7 bits per character
tbaud	Communication transmit baud; see table (3)
rbaud	Communication receive baud; see table (3)
clk	1 (always)
flags	0

(3)

Baud Rate	Value	Baud Rate	Value	Baud Rate	Value	Baud Rate	Value
50	0	150	32	1800	72	7200	80
75	8	300	48	2400	88	9600	112
110	16	600	56	3600	96	19200	120
134.5	24	1200	64	4800	104		

6-2 Programming LEDs and Bell

A. LED Indicators

The keyboard has seven light emitting diodes (LEDs), of which two are committed to the complementary On-Line/Local function. The power-on condition is implicitly shown by one of the two LEDs being on; that is, if the keyboard is connected and power is on, one of these LEDs will be on.

A third LED indicates a "keyboard locked" condition. In this condition, the keyboard has been "turned off" automatically by the terminal due to a full buffer or by the host through the transmission of an XOFF to the terminal.

The four remaining LEDs are programmable and can be assigned any meaning for specific applications. To avoid confusion, the host computer is not allowed to alter the state of the INSERT or EDIT LEDs while in Edit mode. The code sequence is:

ESC [P_S q

Load the four programmable LEDs on the keyboard according to the parameter(s).

P_S	Parameter Meaning
0	Clear LEDs L1 through L4
1	Light L1
2	Light L2
3	Light INSERT (L3)
4	Light EDIT (L4)

LED numbers are indicated on the keyboard.

B. Bell

The bell tone is produced upon receipt of the ASCII BEL code. The bell is also used to generate the audible keyclick, which can be enabled in SET-UP mode; a bell tone is also produced by entering data eight columns from the right margin if enabled in SET-UP mode. A short duration tone is given during programming of the dynamic programmable functions; long tones are issued when the function memory is within 10 characters of capacity. A very long tone (approximately 1.65 seconds) sounds during initial power on; this tone indicates normal operation.

6-3 Character Sets and Graphics

The Teleray Model 100 contains a United States character set, a United Kingdom character set, and a special graphics character set. An additional character set is available in Line Monitor mode for display of the ASCII control characters. An optional alternate character generator ROM can be supplied; commands for its control are built into the standard machine.

The U.S. character set is the graphics of ASCII (American Standard Code for Information Interchange). The United Kingdom set differs only in the substitution of the £ symbol for the # symbol. The keyboard is dual legended.

The U.S. or U.K. character set can be selected in SET-UP mode. In V52 mode, the graphics character set is invoked by the sequence ESC F; ESC G returns the Teleray to the ASCII character set. In ANSI mode, G0 and G1 character sets can be designated from one of the five possible character sets. The G0 and G1 sets are invoked by the codes SI and SO (Shift In and Shift Out), respectively.

The control sequences and the graphics character set are listed in Section 7-8.

6-4 Dynamic Programmable Functions

A. Introduction

The Teleray contains 20 programmable functions. Any ASCII sequence may be assigned to these functions; 880 characters of memory are available to be used by the functions in any combination. The functions can be used to store forms, control sequences, or answer back messages. They are particularly useful for storing ANSI escape sequences to provide an operator with editing or clear keys. The dynamic programmable functions are stored in non-volatile memory by the SET-UP mode Save operation.

The dynamic programmable functions can also be used to provide a "Wake Up" service following long-time functions, such as Print Screen. Implementing this Wake Up service would require programming a function with the message desired to be returned when the Print was complete; and then issuing the Print command, immediately followed by a command invoking the programmed function. When the Teleray has completed the Print, it will examine the input buffer and execute the function.

Example of "Wake Up" Service

Computer Transmits:	Teleray Does:
ESC P 12 MESSAGE ESC \	
	Defines programmable function 12 with MESSAGE.
TEXT	
	Receives text on display screen.
ESC [i (Print screen) ESC [1 2 t Waits	
	Prints text.
	Examines input buffer and executes function 12 -- this transmits MESSAGE to computer.
Receives MESSAGE - Knows that Print is complete	

There are 10 dynamic programmable function keys on the keyboard (Functions 1 through 10); the other functions are initiated by using the SHIFT key (shifted F1 = F11; shifted F2 = F12, etc.).

B. Using Dynamic Programmable Functions

The functions will be initiated by either the appropriate keys on the keyboard or may be initiated by the sequence ESC [P_S t. The stored function sequence performs exactly like keyboard input. P_S is a decimal number from 1 through 20, inclusive. If an illegal or undefined function number is given, the sequence will be ignored. When a function is initiated, the ASCII sequence stored in the function memory is treated by the Teleray as a keyboard input. Control characters and ESC sequences will be executed and/or transmitted as determined by the operating modes. If the function programming includes a command to execute another programmed function, this included command will not be executed. Programmed functions can be examined by using Line Monitor and Local modes. When On-Line, the functions can be selected to execute locally within the Teleray. See Section 6-8-L.

C. Programming the Dynamic Programmable Functions

Programming of the functions is initiated by the sequence ESC P, followed by the 2-digit function number. Both digits must be used (e.g., 01, 02, etc.). If an illegal function number is given, the sequence will be ignored (the two succeeding characters will not be ignored). As the function is being programmed, the bell "clicks" as each character or local operation is entered. When the last 10 characters of programmable function memory are entered, the bell will beep (with a long tone) to warn the operator that the memory is nearly full. As the function is being programmed, the program data will be executed. For example, if the program sequence contains a Clear Page function, the screen will be cleared. If the programming sequence is given for a function that has been previously defined, the old program will be discarded and a new definition entered. The function contents are saved in non-volatile memory by the SET-UP mode Save operation.

Function definition will be ended by:

End Function Definition (ESC \ ) - recommended
Reset to Initial State - also restores programmed function memory to saved condition
Execute to Programmed Function - will perform function
Exceeding the Programmable Function Memory Size - the Bell will beep (and not click anymore)

6-5 Clears, Tabs and Edit Functions

A. Erase Display ANSI: ESC [P_s J
V52: ESC J

Some or all of the characters in the display are cleared upon receipt of this sequence. If a parameter is not sent, a parameter of zero is assumed. This applies to V52 mode where no parameter can be sent. Any line completely cleared will be changed to single width.

P_s (1)	Meaning
0	Clear from the active position to the end of the display
1	Clear from the start of the display through the active position
2	Clear the entire display

B. Erase Line ANSI: ESC [P_s K
V52: ESC K

Some or all of the characters in the active line are cleared upon receipt of this sequence. If a parameter is not sent, a parameter of zero is assumed. This also applies to V52 mode where no parameter can be sent.

P_s (1)	Meaning
0	Clear from active position to the end of the line
1	Clear from the start of the line through the active position
2	Clear the entire line

(1) Any other parameters will cause no operation.

C. Erase All/Unprotect ANSI: ESC [6 h / ESC [6 l
SET-UP: Mode C

Erase All causes all characters and attributes to be cleared by sequences for Erase Line and Erase Display. Erase Unprotect applies only when Edit mode is on (see Section 6-5-K). With Erase Unprotect on, the Erase Line and Erase Display sequences cause only unprotected characters and no attributes to be cleared. This mode also inhibits the ability of the host computer to overwrite protected areas.

D. Reset to Initial State ANSI: ESC c
SET-UP: 0 key

After receipt of this sequence, the Teleray will return to the same state it would if power had just been turned on. This means that the terminal setup will be lost, except those that were stored in non-volatile memory.

E. Horizontal Tab Set ANSI: ESC H
SET-UP: 2 key

Set one horizontal tab stop at the active position.

F. Tabulation Clear ANSI: ESC [P_s g
SET-UP: 3 key

If no parameter is sent, a parameter of zero is assumed.

P_s (1)	Meaning
0	Clear the horizontal tab stop at the active position
3	Clear all horizontal tab stops

(1) Any other parameters will cause no operation.

G. Delete Character ANSI Only: ESC [P_n P

The number of characters specified by the parameter P_n (one character is assumed when no parameter is given) are deleted from the active line starting with the active position. Characters to the right of the active position move P_n characters to the left, leaving P_n spaces on the end of the field.

H. Delete Line ANSI Only: ESC [P_n M

The number of lines specified by the parameter P_n (one line is assumed when no parameter is given) are deleted from the display starting with the active line. Remaining lines move up P_n lines, leaving P_n lines, which are filled with spaces and the same attributes present on the preceding line. Delete line operates within the scrolling window only (see Section 6-6-D).

I. Insert Line ANSI Only: ESC [P_n L

The number of lines specified by the parameter P_n (one line is assumed when no parameter is given) are inserted into the display, starting at the active line. Remaining lines move down P_n lines, adding P_n lines, which are filled with spaces and the same attributes present on the succeeding line. Insert line operates within the scrolling window only (see Section 6-6-D).

J. Insert/Replacement Mode ANSI Only: ESC [4 h / ESC [4 ℓ

Insert mode lights INSERT keyboard indicator, and entered characters insert at the active position. All characters to the right of and including the active position shift one character to the right when one character is inserted. Characters shifted past the end of the field are lost. Replacement mode does not light INSERT, and entered characters replace the character at the active position. The active position moves one character to the right when one character is replaced.

K. Edit Mode On/Off ANSI: ESC [? 10 h / ESC [? 10 ℓ
Keyboard: SHIFT and EDIT (PF4)

The on state causes the EDIT indicator to light and the designated edit functions to operate. LINE INSERT, LINE DELETE, CHAR INSERT, CLEAR HOME, TAB, BACK TAB, ENTER, DELETE CHARACTER, and DELETE perform screen editing operations, and all other keyboard keys operate locally (except for those keys which have local or remote settings in SET-UP mode). Keyboard input cannot overstrike or erase protected fields unless an escape sequence is entered. (Protected fields are defined by either graphic renditions or SPA and EPA.) The ENTER key initiates a block transmission when Edit mode is on. In the off state, the EDIT indicator does not light, and the Teleray operates as an interactive terminal.

L. Block Transmit ANSI: ESC 5
Keyboard: ENTER

This sequence initiates transmission of some portion of the Teleray screen to the host computer if the terminal is in On-Line mode. Every line transmitted is either terminated by a Carriage Return or a Carriage Return and a Line Feed depending on whether the Line Feed/New Line mode (see Section 6-8-I) is reset or set, respectively. Transmissions can be terminated by a Form Feed character (see Section 6-5-Q). Transmission boundary conditions can be defined to be a line or a page (see Section 6-5-M), and if page transmission is selected, an additional choice of window or message (see Section 6-5-N) is available. The type of data transmitted can be selected to be all characters or unprotected characters (see Section 6-5-O) and for space compression (see Section 6-5-P).

M. Transmit Line/Page ANSI: ESC [? 11 h / ESC [? 11 ℓ
SET-UP: C Mode

Transmit Line allows block transmission of the entire cursor line. The line to be transmitted must be within the scrolling window (see Section 6-6-D). Transmit Page allows transmission of the scrolling window or some message within the scrolling window (see Transmit Window/Message).

N. Transmit Window/Message ANSI: ESC [16 h / ESC [16 ℓ
SET-UP: C Mode

Transmit Window allows block transmission of the entire scrolling window (see Section 6-6-D). Transmit Message allows transmission to the cursor from either the previous cursor position or the start of the scrolling window. The transmitted message must be within the scrolling window.

O. Guarded Area Transfer All/Unprotect ANSI: ESC [1 h / ESC [1 ℓ
SET-UP: C Mode

Transfer All allows transmission of all of the characters on the screen. Transfer Unprotect allows transmission of characters which are not within protected fields (see Sections 6-6-F and 6-6-G). Each protected field is replaced by a single record separator during transmission (see Figure 6-5-1).

P. Space Compression On/Off ANSI: ESC [? 13 h / ESC [? 13 ℓ
SET-UP: C Mode

The on state causes trailing spaces in a field or on the end of a line to be suppressed. Suppressed spaces at the end of a field which are not at the end of a line are replaced with a record separator during transmission. The off state allows transmission of all characters on the screen (see Figure 6-5-1).

Text:

Name:Teleray Terminal #1

Underline is protected and New Line is on.

Space Compression	Transmit All	Transmitted Data
0	0	R_STeleray R_S#1 C_RL_F
0	1	Name:Teleray Terminal #1 C_RL_F
1	0	R_STeleray$R_S$$R_S$#1$C_RL_F$
1	1	Name:R_STelerayR_STerminalR_S#1C_RL_F

R_S=Record Separator
C_R=Carriage Return
L_F=Line Feed

Figure 6-5-1

Q. Transmit Termination Character FF/None ANSI: ESC [Ps !
SET-UP: C Mode

This sequence either causes a form feed to be appended to a block transmission or no form feed to be appended.

P_s Value	Meaning
0	No form feed
1	Form feed

R. Form Transmit ANSI Only: ESC 6

This sequence causes the entire screen with all the character attributes to transmit. Character attributes transmit in the same form required to place them on the screen. All characters transmit without regard to protection or space compression on a field by field basis. A control sequence is prefixed to the transmission which indicates which graphic renditions are protected (see Section 6-6-F). Two control sequences prefix each transmitted field indicating which graphic renditions are on and indicating the state of the independent protect attribute (see Sections 6-6-E and 6-6-G). Every line transmitted is terminated by a Carriage Return or a Carriage Return and a Line Feed, depending on whether the Line Feed/New Line mode is reset or set, respectively (see Section 6-8-I and Figure 6-5-2).

Text:

Terminal:Teleray Quality:Excellent

Price***** Just Right

New Line mode is off

Transmitted Data:

E_S[;4 } E_SWE_S[;4mTerminal:E_SWE_S[mTeleray E_SWE_S[;4mQuality:E_SWE_S[Excellent C_R
E_SVE_S[mPrice***** E_SWE_S[mJust Right C_R

E_S=Escape
C_R=Carriage Return

Figure 6-5-2

6-6 Display Format

A. Column Mode 132/80 ANSI: ESC [? 3 h / ESC [? 3 ℓ

The On state causes a 132-column display format. The Off state causes an 80-column display format. Changing column mode causes the display to clear and the active position to be the first column and first line (home position).

B. Wide Mode On/Off ANSI: ESC [? 2 0 h / ESC [? 20 ℓ
SET-UP: B Mode

The On state causes all lines in the display to become double width. The Off state causes all lines in the display to become single width. Changing Wide mode causes no loss of data, but only the first 40 or 66 characters of each line will be displayed with column mode set to 80 or 132 characters, respectively.

C. Line Length ANSI Only: ESC # P_s

The line length sequence causes the active line to display in the format selected by P_s. When changing from single-width characters to double-width characters, data that no longer displays is lost.

P_s	Meaning
1	Set 80-column format (1)
2	Set 132-column format (1)
3	Double-height/double-width character top half line
4	Double-height/double-width character bottom half line
5	Single-width/single-height character line
6	Double-width/single-height character line

(1) These parameters do not cause a change in the character width or height.

D. Set Top and Bottom Margins ANSI Only: ESC [P_t; P_b r

This sequence sets the top and bottom margins to define the scrolling window. Parameter P_t is the line number of the top line in the scrolling window, and parameter P_b is the line number of the bottom line in the scrolling window. The minimum size of the scrolling window allowed is two lines; i.e., the top margin must be less than the bottom margin. The cursor is placed in the home position defined by Origin mode (see Section 6-7-I).

E. Select Graphic Rendition ANSI Only: ESC [P_s;...P_s m

Select the character attribute(s) specified by the given parameter(s). All data following this sequence will have the same graphic rendition until a new occurrence of the sequence. A new sequence selecting character attributes will add attributes to any previous attributes. Only a parameter of zero will turn attributes off.

P_s	Attribute
0 or none	Normal; cancel previous
1	Bold on
2	Blank on
3	Overscore on
4	Underscore on
5	Blink on
7	Inverse on

F. Select Protected Graphic Renditions ANSI Only: ESC [Ps;...Ps }

Select the character attribute(s) which are to act as protect attribute(s). The parameter(s) assign a graphic rendition protection status affecting future entry. This sequence does not initiate any graphic renditions.

P_s Value	Attribute
0 or none	Normal; cancel previous
1	Bold protected
2	Blank protected
3	Overscore protected
4	Underscore protected
5	Blink protected
7	Inverse protected
254	Normal protected

G. Start Protected Area/End Protected Area ANSI Only: ESC V / ESC W

All data following the SPA sequence will be tagged with a protect attribute. The protect attribute is independent of the graphic renditions, and the SPA and EPA sequences do not affect SGR (see Section 6-6-E), nor does SGR affect EPA and SPA. All data following the EPA sequence will no longer be tagged with a protect attribute.

6-7 Cursor Manipulation

A. Cursor Up ANSI: ESC [P_n A
V52: ESC A

This sequence causes the active position to move P_n lines up without changing the column position. P_n equal to zero causes the cursor to move one line up. An attempt to move the cursor above the top margin does not move the cursor. In no P_n parameter is given, a value of zero is assumed. No parameter can be given in V52 mode.

B. Cursor Down ANSI: ESC [P_n B
V52: ESC B

This sequence causes the active position to move P_n lines down without changing the column position. P_n equal to zero causes the cursor to move one line down. An attempt to move the cursor below the top margin does not move the cursor. If no P_n parameter is given, a value of zero is assumed. No parameter can be given in V52 mode.

C. Cursor Right ANSI: ESC [P_n C
V52: ESC C

This sequence causes the active position to move P_n columns to the right. P_n equal to zero causes the cursor to move one column to the right. An attempt to move the cursor beyond the last column does not move the cursor. If no P_n parameter is given, a value of zero is assumed. No parameter can be given in V52 mode.

D. Cursor Left ANSI: ESC [P_n D
V52: ESC D

This sequence causes the active position to move P_n columns to the left. P_n equal to zero causes the cursor to move one column to the left. An attempt to move the cursor to the left of the last column does not move the cursor. If no P_n parameter is given, a value of zero is assumed. No parameter can be given in V52 mode.

E. Cursor Home ANSI: ESC [H or ESC [f
V52: ESC H

This sequence causes the active position to move to the first line, first column in the display. If in Relative Origin mode, the home position is the first line, first column of the scrolling window (see Section 6-7-I).

F. Next Line ANSI: ESC E

Moves the cursor to the next line, first column. If the cursor starts at the bottom margin, a scroll up occurs.

G. Index ANSI: ESC D

This sequence causes the active position to move down one line without changing the column position. If the cursor starts at the bottom margin, then a scroll up occurs.

H. Reverse Index ANSI: ESC M
V52: ESC I

This sequence causes the active position to move up one line without changing the column position. If the cursor starts at the top margin, a scroll down occurs.

I. Relative/Absolute Origin Mode ASNI Only: ESC [? 6 h / ESC [? 6 l

Relative origin mode causes the display origin to be within the scrolling window; the upper left corner, top margin line, first column. Cursor positioning is done relative to this origin, and the cursor cannot be positioned outside of the scrolling window. Absolute origin mode causes the display origin to be absolute; the upper left corner of the display first line, first column. Cursor positioning is absolute and not affected by any scrolling window margins.

J. Direct Cursor Positioning ANSI: ESC [P_n; P_n H or ESC [P_n; P_n f
V52: ESC Y P_l P_c

This sequence causes the active position to move to the position specified by the two parameters. The first parameter specifies the line number, and the second parameter specifies the column number. In V52 mode, the Y is followed by two ASCII codes that are converted to decimal numbers according to Table 7-1, V52 Cursor Positioning. In ANSI mode, the parameters are decimal numbers indicating either line or column position. If a parameter is omitted or equal to zero, a value of one is assumed. The display origin used for positioning reference is defined by Origin mode (see Section 6-7-I).

K. Save Cursor ANSI Only: ESC 7

This sequence causes the cursor position, graphic rendition (character attributes) and character sets to be saved.

L. Restore Cursor ANSI Only: ESC 8

This sequence causes the saved cursor position, graphic rendition (character attributes) and character sets to be restored.

6-8 Mode Control

A. Auto Repeat Mode On/Off ANSI: ESC [? 8 h / ESC [? 8 l
SET-UP: B Mode

With auto repeat on, a keyboard key that is held down for more than one-half second will automatically repeat at the selected auto key-repeat rate (see Section 6-8-B). Some keyboard keys do not auto repeat (see Section 3-4-C).

B. Auto Key-Repeat Rate 30/15 cps ANSI: ESC [? 2 1 l / ESC [? 2 1 h
SET-UP: B Mode

The On state causes a 15 cps keyboard auto repeat rate, and the Off state causes a 30 cps auto repeat rate (cps means characters per second).

C. Screen Mode Normal/Inverse
ANSI: ESC [? 5 l / ESC [? 5 h
SET-UP: B Mode

Normal mode causes the screen to be dark with light characters. Inverse mode causes the screen to be light with dark characters.

D. Scroll Mode On/Off
ANSI: ESC [? 4 h / ESC [? 4 l
SET-UP: B Mode

The On state causes "jump" scrolling. The Off state causes smooth scrolling at the selected smooth scroll rate (see Section 6-8-E).

E. Smooth Scroll Rate 5/10 lps
ANSI: ESC [? 2 2 l / ESC [? 2 2 h
SET-UP: B Mode

The On state causes a 10 lps smooth scroll rate. The Off state causes a 5 lps smooth scroll rate (lps means lines per second).

F. Right Margin Wrap On/Off
ANSI: ESC [? 7 h / ESC [? 7 l
SET-UP: B Mode

The On state causes characters entered into the last column of the active line to replace characters previously entered in that column and the active position remains in the last column. The Off state causes the second character entered into the last column of the active line to display at the first column of the next line with the active position moving to the second column of the new line.

G. ANSI/V52 Mode
ANSI: ESC [? 2 l
V52: ESC <
SET-UP: B Mode

The ANSI sequence enters V52 mode. The V52 sequence enters ANSI mode. Once either ANSI or V52 mode is entered, only control sequences applicable to that mode will be executed.

H. Local Echo Mode On/Off
ANSI: ESC [1 2 h / ESC [1 2 l
SET-UP: B Mode

Local Echo mode only applies when the Teleray is on line. The On state causes keyboard data to transmit from the Teleray to the host computer and execute on the Teleray display. The Off state causes keyboard data to transmit from the Teleray only.

I. Line Feed/New Line Mode
ANSI: ESC [2 0 l / ESC [2 0 h
SET-UP: B Mode

In the reset state, a line feed causes the active position to move to the next line without changing column position. In the set state, a line feed causes the active position to move to the first column of the next line, and a typed RETURN key transmits a carriage return and a line feed. In both states, if the cursor was at the bottom margin, a scroll up occurs.

J. Edit Key Execute/Transmit
ANSI: ESC [? 16 h / ESC [? 16 l
SET-UP: C Mode

In Edit key execute mode, pressing the SHIFT and EDIT keys causes the Teleray to alternately enter or exit Edit mode. In Edit key transmit mode, pressing the SHIFT and EDIT keys causes a control sequence to transmit from the Teleray. The control sequence which transmits is ESC [? 16 h or ESC [? 16 l depending on whether Edit mode is off or on, respectively. The host computer can then decide whether or not to echo this sequence to achieve the desired mode change. In Local mode, the Edit key is always in execute mode.

K. Transmit Key Execute/Transmit ANSI: ESC [? 14 h / ESC [? 14 l
SET-UP: C Mode

The ENTER key will initiate transmissions only in Edit mode (see Section 6-5-K). In Transmit key execute mode, pressing the ENTER key causes a block transmission. In Transmit key transmit mode, pressing the ENTER key causes an ESC S to transmit from the Teleray. The host computer can then respond with an ESC 5 to request a block transmission (see Section 6-5-L). No transmissions occur in Local mode.

L. Dynamic Function Keys Execute/Transmit ANSI: ESC [? 23 h / ESC [? 23 l
SET-UP: C Mode

In function keys execute mode, pressing one of the dynamic programmable function keys or receipt of a control sequence to initiate a function causes that function to execute locally within the Teleray. In function keys transmit mode, pressing one of the dynamic programmable function keys or receipt of a control sequence to initiate a function causes the contents of that function to transmit from the Teleray. The functions are always in execute mode when in Local mode.

M. Protect Mode On/Off ANSI Only: ESC [? 24 h / ESC [? 24 l

This feature can be turned on and off at any time, but the on/off state applies only when Edit mode is off. In the on state, protected characters cannot be overstruck or erased by the host computer. Insert and delete line operate only between lines with protected data, and insert and delete character operate only within a field instead of an entire line. In the off state, the Teleray operates as a non-editing character mode terminal.

N. Keyboard Action Locked/Unlocked ANSI Only: ESC [2 h / ESC [2 l

With keyboard action locked, all keyboard characters typed are lost except for SET-UP. Entering and exiting Set-Up mode will clear the keyboard locked condition. With keyboard action unlocked, all keystrokes are executed in the Teleray as normal.

6-9 Peripheral Interface

All of the following print modes allow the printer to send XON and XOFF codes to the Teleray to prevent printer buffer overflow. The same effect can be achieved by connecting a Busy/Ready signal to either DTR or RTS on the peripheral connector. DTR and RTS must be asserted (+12 V) for the Teleray to transmit out the peripheral port. If the Print On-Line bit in SET-UP mode is set, printer keyboard data is also recognized by the Teleray and transmits to the host computer.

A. Auto Print Mode On/Off ANSI: ESC [? 5 i / ESC [? 4 i
V52: ESC ^ / ESC _
KEYBOARD: CTRL and ENTER

Auto Print mode on causes the active line to be printed whenever the cursor moves off the active line by a line feed, form feed, or vertical tab character. Each time the cursor moves off the active line, that line is printed without any alteration. Trailing spaces on the end of the printed line are not sent to the print, but the print terminates with a CR and an LF character.

B. Printer Controller Mode On/Off ANSI: ESC [5 i / ESC [4 i
V52: ESC W / ESC X

With Printer Controller mode on, the Teleray operates as a controller for an attached printer. All data coming into the Teleray is sent to the printer. If Print On Line mode is off, data is not displayed on the Teleray. If Print On Line mode is on, data displays and executes within the Teleray and is sent to the printer. Data coming into the Teleray from the printer transmits to the host computer, except XON and XOFF. Auto XON/XOFF must be enabled for XON and XOFF codes from the printer to reach the host computer (see Section 3-3-G).

C. Print Line ANSI: ESC [? 1 i
V52: ESC V

The active line transmits to the attached printer. Trailing spaces on the end of the printed line are not sent, but the print terminates with a CR and an LF character.

D. Print Screen ANSI: ESC [0 i or ESC [i
V52: ESC]
KEYBOARD: SHIFT and ENTER

The portion of the screen selected by Print Extent mode transmits to the attached printer (see Section 6-9-E). Trailing spaces on the end of each printed line are not sent, but each line terminates with a CR and an LF character. If print termination character is on, the Print Screen will terminate with an FF character (see Section 6-9-F).

E. Print Extent Full/Window ANSI: ESC [1 9 h / ESC [1 9
SET-UP: C Mode

Print Extent Full causes Print Screen to print the entire display. Print Extent Window causes Print Screen to print the scrolling window. This is the portion of the display between the top and bottom margins (see Section 6-6-D).

F. Print Termination Character FF/None ANSI: ESC [1 8 h / ESC [1 8 ℓ
SET-UP: C Mode

The On state causes Print Screen to terminate with a form feed character. The Off state causes no print screen termination character. The last line of a print screen is always terminated with a carriage return and a line feed character.

6-10 Buffering and Time Fill

A. XON/XOFF Buffer Control

The Teleray operates at transmission speeds up to 19,200 baud. However, the terminal may not be able to keep up with incoming data with some messages. The terminal stores incoming characters in a 256-character buffer and processes them on a first-in/first-out basis. In Auto XON/XOFF mode, when the content of the buffer reaches 32 characters, the terminal will transmit a DC3 (XOFF). On this signal, the host should suspend its transmission to the terminal. If the host fails to stop transmitting when the buffer reaches 112 characters, the terminal will transmit a second DC3 (XOFF). This is a last warning to the host that the terminal is about to temporarily revoke any smooth scroll or no scroll conditions. Eventually, if the host stops transmitting, the terminal will deplete the buffer. When 16 characters remain in the buffer, the terminal will transmit DC1 (XON) to signal the host that it may resume transmission.

If the host fails to respond to an XOFF from the terminal in a timely manner, the buffer will continue to fill. When the 256-character capacity of the buffer is exceeded, a condition occurs called "buffer overflow". To determine if the buffer will overflow, use the following formulas:

No. of characters to overflow = 224 - [3 X (receiver speed/transmit speed)]

Time to respond to XOFF = No. of characters to overflow X
(bits per character + parity bit + 2)/receiver speed

In addition to the buffer-filling conditions, there are two other means of transmitting XOFF and XON: the NO SCROLL key and CTRL S/CTRL Q keys. If the XON/XOFF feature is enabled, the Teleray will coordinate these three sources of XOFF and XON so that the desired effect occurs. For example, if the buffer-filling condition has caused an XOFF to be sent, and then the operator types the NO SCROLL key, a second XOFF is not sent. Instead of sending an XON when the buffer empties, the Teleray waits until the operator types the NO SCROLL key again before sending XON. If the user transmits an XOFF to the host (by CTRL S or NO SCROLL), the host should not echo any further type-in until the user types XON. This places the burden of not overloading the host's output buffer on the user.

Also, entering SET-UP mode causes the Teleray to temporarily stop taking characters from the buffer. An XOFF will be sent if the buffer becomes nearly full.

Use of the CTRL S and CTRL Q keys will also be synchronized with the NO SCROLL key. If the XON/XOFF feature is disabled, the buffer-filling condition will not send an XOFF, the NO SCROLL key is disabled, and CTRL S (DC3) and CTRL Q (DC1) will be transmitted as typed.

B. Smooth Scroll Buffer Control

Smooth scroll limits the received data rate to a maximum of 5, 10, 15, or 20 lines per second. If the Teleray is in Smooth Scroll mode and if the incoming data in the buffer exceeds 128 characters (the point at which a 128-character buffer machine will lose data), the Teleray will automatically revoke Smooth Scroll mode and start processing the input buffer in Jump Scroll mode. If the terminal screen had stopped scrolling because the NO SCROLL key was pressed, then the Teleray will also resume scrolling. The Teleray will remain in Jump Scroll mode until the input buffer content has been reduced to 16 characters. If the message contains "normal text" (few long-time functions), the Teleray can be placed in Smooth Scroll mode and the message transmitted without adherence to XON/XOFF protocol.

C. Reset and Self-Test Timing Restrictions

Two of the terminal functions, reset and self-test, reinitialize the terminal and erase the buffer. This means that if characters are received subsequent to the commands to perform these two functions and the characters are placed in the buffer, the character would be destroyed without being processed.

1. Immediately after sending the terminal the commands to perform self-test functions, the host may act as if it had received XOFF from the terminal, thus sending no more characters until it receives XON. The terminal will transmit XON only after it completes the specified operation and the XOFF/XON feature is enabled.

2. When the first method cannot be implemented, a delay of no less than 10 seconds may be used to allow the terminal time to complete the invoked function. This method, however, does not guarantee against the loss of data when an invoked function has detected an error.

D. Suspending Transmission from Teleray

The Teleray recognizes received XOFF (DC3) and XON (DC1). Receipt of XOFF will inhibit the Teleray from transmitting any codes except XOFF and XON. From three to seven keystrokes on the keyboard will be stored in a keyboard buffer (some keys transmit two or three codes; e.g., cursor controls; a dynamic programmable function could contain up to 880 characters). If the keyboard buffer overflows, keyclicks will stop and the KBD LOCKED LED will come on. Transmission resumes upon receipt of XON.

E. Operating Without XON/XOFF Protocol

Software that does not support receipt of the XOFF/XON signals from the terminal can still use the Teleray provided the software limits messages within the buffer length or organizes the text to be displayed so that long-term function timing requirements are not exceeded at the operating baud rate, or inserts time fill as outlined in the table below.

Normal terminal processing time is 485 microseconds for text characters and 115 microseconds for a NUL (time fill) character. The New Line operation requires 2.5 milliseconds. The smooth scroll rate in effect will slow the New Line handling time. The worst case time fill requirements for several operation are listed below. These worst case computations do not include complex operations such as erasing only unprotected data while in Edit mode.

	New Line or Reverse Index									
Baud Rate	Smooth Scroll 5 lps	Smooth Scroll 10 lps	Smooth Scroll 15 lps	Smooth Scroll 20 lps	Smooth Scroll Off	Erase Line	ESC [Function	Insert* or Delete* Line	Erase Page	Other Function
19200	384	192	128	96	14	18	5	15	307	0
9600	192	96	64	48	3	4	0	5	139	
4800	96	48	32	24	1	0		1	60	
2400	48	24	16	12	0			0	25	
1200	24	12	8	6					12	
600	12	6	4	3					6	
300	6	3	2	2					3	
150	3	2	1	1					2	
110	2	1	0	0					1	
75	1	0							0	

*Single line case

DELETE CHARACTER

At 19200 - 3 characters can be deleted without time fill
At 9600 - 15 characters can be deleted without time fill
At 4800 - 39 characters can be deleted without time fill
At 2400 - 132 characters can be deleted without time fill

6-11 Coding Description Summary

The following table lists the ASCII control characters that are interpreted by the Teleray Model 100 and the action taken by the Teleray.

Control Character	Function	V52 Mode Control Sequences	Function
NUL	Time Fill	ESC A	Cursor One Up
ENQ	Transmit Answerback	ESC B	Cursor One Down
BEL	Ring Bell	ESC C	Cursor One Right
BS	Cursor One Left	ESC D	Cursor One Left
HT	Cursor to Tab Stop	ESC F	Invoke Special Graphics
LF	Line Feed or New Line	ESC G	Invoke ASCII Character Set
VT	Same as LF	ESC H	Cursor to Home
FF	Same as LF	ESC I	Reverse Line Feed
CR	Cursor Full Left	ESC J	Erase to End of Screen
SO	Invoke G0 Char. Set	ESC K	Erase to End of Line
SI	Invoke G1 Char. Set	ESC V	Print Line
DC1	XON	ESC W	Print Controller Mode On
DC3	XOFF	ESC X	Print Controller Mode Off
CAN	Cancel this Escape Sequence	ESC Y P_ℓ P_c	Position Cursor at Line P_ℓ, Column P_c
SUB	Same as CAN	ESC Z	Transmit Identity ESC/Z
ESC	Introduce Escape Sequence	ESC =	Enter Alternate Keypad Mode
DEL	Time Fill	ESC >	Exit Alternate Keypad Mode
		ESC]	Print Screen
		ESC	Auto Print On
		ESC _	Auto Print Off

In ANSI mode, the Teleray Model 100 is compatible with the control sequences and semantics specified in ANSI X3.64-1977.

The following modes, which are specified in the ANSI X3.64-1977 standard, may be considered to be permanently set, permanently reset, or not applicable, as noted. Refer to that standard for further information concerning these modes.

Mode Mnemonic	Mode Function	State
CRM	Control representation	Reset
EBM	Editing boundary	Reset
FEAM	Format effector action	Reset
FETM	Format effector transfer	Reset
HEM	Horizontal editing	NA
MATM	Multiple area transfer	NA
PUM	Positioning unit	NA
SATM	Selected area transfer	NA
SRTM	Status reporting transfer	Reset
TSM	Tabulation stop	Reset
VEM	Vertical editing	NA

The following table summarizes the control sequences interpreted by the Teleray in ANSI mode.

ANSI Mode Control Sequence		ANSI Mode Control Sequence	
ESC # 1	Set Line to 80 Mode	ESC V	Start Protected Area
ESC # 2	Set Line to 132 Mode	ESC W	End Protected Area
ESC # 3	Double-Height Line, Top Half	ESC Z	Transmit Identity Sequence
ESC # 4	Double-Height Line, Bottom Half	ESC c	Reset to Initial State
ESC # 5	Normal-Height, Width Line	ESC [? 1 i	Print Cursor Line
ESC # 6	Double-Width Line	ESC [2; P_s y	Invoke Self Tests
ESC # 8	Screen Alignment Fill	ESC [1; 2 c(default)	Device Attributes Response
ESC (0	Special Graphics to G0	ESC [P_n A	Cursor P_n Up
ESC (1	Alternate Standard ROM to G0	ESC [P_n B	Cursor P_n Down
ESC (2	Special Alternate ROM to G0	ESC [P_n C	Cursor P_n Right
ESC (A	U.K. Set to G0	ESC [P_n D	Cursor P_n Left
ESC (B	U.S. Set to G0	ESC [H	Set Tab Stop
ESC) 0	Special Graphics to G1	ESC [P_l; P_c H	Cursor Position
ESC) 1	Alternate Standard ROM to G1	ESC [P_s J	Erase in Display
ESC) 2	Special Alternate ROM to G0	ESC [P_s K	Erase in Line
ESC) A	U.K. Set to G1	ESC [P_l; P_c R	Cursor Position Report
ESC) B	U.S. Set to G1	ESC [c	Transmit Identity
ESC 5	Block Transmit	ESC [P_l; P_c f	Cursor Position
ESC 6	Transmit Form	ESC [P_s q	Clear Tab Stops
ESC 7	Save Cursor and Character Set	ESC [P_s h (1)	Set Mode (1)
ESC 8	Recall Cursor and Character Set	ESC [i	Print Screen
ESC =	Set Keyboard Application Mode	ESC [P_s l (1)	Reset Mode (1)
ESC >	Set Keyboard Numeric Mode	ESC [P_s; P_s...P_s m	Select Char. Attributes
ESC D	Index	ESC [P_s n	Send Status Report
ESC E	New Line	ESC [P_s; P_s...P_s q	Load LEDs
ESC M	Reverse Index	ESC [P_t; P_b r	Set Scrolling Window

(1)

P_s	Mode
1	Guarded Area Transfer All/Unprotected
? 1	Cursor Key Mode On/Off
2	Keyboard Action Locked/Unlocked
? 2	ANSI/V52
? 3	80/132 Columns
4	Insert/Replacement Mode On/Off
? 4	Scroll Mode On/Off
? 5	Inverse/Normal
6	Erase All/Unprotected
? 6	Address Origin
? 7	Auto Wrap On/Off
? 8	Auto Repeat On/Off
? 10	Edit Mode On/Off
? 11	Transmit Line/Page
12	Local Echo On/Off
? 13	Space Compression On/Off
? 14	Transmit Key Local/Remote
? 16	Edit Key Local/Remote
18	Print Termination FF/None
19	Print Extent Scrolling Window/Full
20	Line Feed/New Line
? 20	Wide Mode On/Off
? 21	Auto Key-Repeat Rate 30/15 cps
? 22	Smooth Scroll Rate 10/20 lps
? 23	Dynamic Function Keys Transmit/Execute
? 24	Protect Mode On/Off

Section 7

CODING SUMMARY TABLES

7-1 - V52 MODE CURSOR POSITIONING

ESC Y P_ℓ P_c

P_ℓ Line No.	Char.	P_c Col. No.	Char.	P_c Col. No.	Char.	P_c Col. No.	Char.
1	Space	1	Space	28	;	55	V
2	!	2	!	29	<	56	W
3	"	3	"	30	=	57	X
4	#	4	#	31	>	58	Y
5	$	5	$	32	?	59	Z
6	%	6	%	33	@	60	[
7	&	7	&	34	A	61	\
8	'	8	'	35	B	62	]
9	(	9	(	36	C	63	^
10	)	10	)	37	D	64	_
11	*	11	*	38	E	65	`
12	+	12	+	39	F	66	a
13	,	13	,	40	G	67	b
14	-	14	-	41	H	68	c
15	.	15	.	42	I	69	d
16	/	16	/	43	J	70	e
17	0	17	0	44	K	71	f
18	1	18	1	45	L	72	g
19	2	19	2	46	M	73	h
20	3	20	3	47	N	74	i
21	4	21	4	48	O	75	j
22	5	22	5	49	P	76	k
23	6	23	6	50	Q	77	l
24	7	24	7	51	R	78	m
		25	8	52	S	79	n
		26	9	53	T	80	o
		27	:	54	U		

Note: Any undefined coordinate character will be ignored.

*Indicates the state of this feature/mode is saved in non-volatile memory.

Reports and Messages	ANSI Mode	V52 Mode	SET-UP Mode
*Program Answerback	NA	NA	SHIFT & A Key
Request (of Teleray) Answerback	ENQ	ENQ	NA
Request Cursor Position	ESC [6 n	NA	NA
Cursor Position Response	ESC [P_n; P_n R (1)	NA	NA
Request Teleray Status	ESC [5 n	NA	NA
Status Response (if OK)	ESC [0 R	NA	NA
Status Response (if malfunction)	ESC [3 R	NA	NA
Program Identity	NA	NA	Shift & B Key
Request Identity	ESC Z or ESC [c or ESC [0 c	ESC Z	NA
Response to Identity Request	ESC [? 1; 2 c (default)	ESC / Z	NA
Request Printer Status	ESC [? 1 5 n	NA	NA
Printer Ready Response	ESC [? 1 0 n	NA	NA
Printer Not Ready Response	ESC [? 1 1 n	NA	NA
Request Terminal Parameters	ESC [P_s x (2)	NA	NA
Report Terminal Parameters	ESC [P_s; status; x (2)	NA	NA

(1) First P_n is decimal line number
Second P_n is decimal column number

(2) P_s	Parameter Meaning
0 (or none)	This message is a request, and the terminal is allowed to send unsolicited reports, but will only report in response to a request.
1	This message is a request, and the terminal may now only report in response to a request.
2	This message is a report.
3	This message is a report, and the Teleray is only reporting in request status sequence: par; nbits; tbaud; rbaud; clk; flags.

Status	Values
par	1 = no parity; 2 = space parity; 3 = mark parity; 4 = odd parity; 5 = even parity
nbits	1 = 8 bits per character; 2 = 7 bits per character
tbaud	Communication transmit baud; see table (3)
rbaud	Communication receive baud; see table (3)
clk	1 (always)
flags	0

(3)

Baud Rate	Value	Baud Rate	Value	Baud Rate	Value	Baud Rate	Value
50	0	150	32	1800	72	7200	80
75	8	300	48	2400	88	9600	112
110	16	600	56	3600	96	19200	120
134.5	24	1200	64	4800	104		

*Indicates the state of this feature/mode is saved in non-volatile memory.

7-3 TESTING

Testing	ANSI Mode	V52 Mode	SET-UP Mode
Reset to Initial State (2)	ESC c	NA	0 Key
Screen Alignment Fill	ESC # 8	NA	NA
Invoke Self Test (2)	ESC [2; P_s y (1)	NA	NA

(1) Test — Weight - Add weight for each device test; sum is P_s

Power Up	1
Interface Test	2 Turn-around plugs needed
EIA Test	4 Turn-around plugs needed
Run until power off or error	8

(2) Error code summary

Character Displayed	Fault Detected: RAM	NVM	KBD	SIO	EIA	Character Displayed	Fault Detected: RAM	NVM	KBD	SIO	EIA
1	X					@					X
2		X				A	X				X
3	X	X				B		X			X
4			X			C	X	X			X
5	X		X			D			X		X
6		X	X			E	X		X		X
7	X	X	X			F		X	X		X
8				X		G	X	X	X		X
9	X			X		H				X	X
:		X		X		I	X			X	X
;	X	X		X		J		X		X	X
<			X	X		K	X	X		X	X
=	X		X	X		L			X	X	X
>		X	X	X		M	X		X	X	X
?	X	X	X	X		O	X	X	X	X	X

FAULT TYPES

RAM = Random Access Memory
NVM = Non-Volatile Memory
KBD = Keyboard
SIO = Serial Input/Output (serial and peripheral interfaces)
EIA = SIO Control Signals (serial and peripheral interfaces)

7-4 COMMUNICATIONS CHARACTER FORMAT SETUP

Computer	SET-UP Mode	Peripheral	SET-UP Mode
* Transmit Baud Rate	B	* Baud Rate	B
* Receive Baud Rate	B	* 7 Bits/8 Bits	C
* 7 Bits/8 Bits	B	* Parity Sense	C
* Parity Sense	B	* Parity Enable	C
* Parity Enable	B	* Parity Type	C
* Parity Type	B		

*Indicates the state of this feature/mode is saved in non-volatile memory.

7-5 SPECIAL KEYBOARD CODES

Key	V52 Mode Code	ANSI Mode Code
PF1	ESC P	ESC O P
PF2	ESC Q	ESC O Q
PF3	ESC R	ESC O R
PF4	ESC S	ESC O S

Key	V52 Mode Code	ANSI Mode Code	ANSI Cursor Key[1] Mode Code
	ESC A	ESC [A	ESC O A
	ESC B	ESC [B	ESC O B
	ESC C	ESC [C	ESC O C
	ESC D	ESC [D	ESC O D

(1)ESC [? 1 h enters Cursor Key mode
ESC [? 1 ℓ exits Cursor Key mode

Key	Numeric Mode Code	V52 Alternate[2] Keypad Mode	ANSI Alternate[2] Keypad Mode
0	0	ESC ? p	ESC O p
1	1	ESC ? q	ESC O q
2	2	ESC ? r	ESC O r
3	3	ESC ? s	ESC O s
4	4	ESC ? t	ESC O t
5	5	ESC ? u	ESC O u
6	6	ESC ? v	ESC O v
7	7	ESC ? w	ESC O w
8	8	ESC ? x	ESC O x
9	9	ESC ? y	ESC O y
-	-	ESC ? m	ESC O m
,	,	ESC ? ℓ	ESC O ℓ
.	.	ESC ? n	ESC O n
Enter	CR	ESC ? M	ESC O M

(2)ESC = enters Alternate Keypad mode
ESC > enters Numeric Keypad mode

7-7 LEDS AND BELLS

Ring Bell

ASCII BEL code in all modes

Programmable LEDs

ESC [P_s; P_s;..P_s q

P_s Value	Action
0 or none	All off
1	L1 on
2	L2 on
3	INSERT on
4	EDIT on

7-6 CONTROL CHARACTER DISPLAY AND GENERATION

Line Monitor Display	Control Character	Keyboard Generation Press[3] Control &
A_K	ACK	F
B_L	BEL	G
B_S	BS	H
C_N	CAN	X
C_R	CR	M
D_1	DC1	Q
D_2	DC2	R
D_3	DC3	S
D_4	DC4	T
D_L	DLE	P
E_M	EM	Y
E_Q	ENQ	E
E_T	EOT	D
E_C	ESC	[
E_B	ETB	W
E_X	ETX	C
F_F	FF	L
F_S	FS	\
G_S	GS	]
H_T	HT	I
L_F	LF	J
N_K	NAK	U
N_L	NUL	2 or space bar
R_S	RS	~
S_I	SI	O
S_O	SO	N
S_H	SOH	A
S_X	STX	B
S_B	SUB	Z
S_Y	SYN	V
U_S	US	/
V_T	VT	K

(3)Dedicated keys on keyboard for several of these codes. See Keyboard, Section 5.

*Indicates the state of this feature/mode is saved in non-volatile memory.

7-8 CHARACTER SETS AND GRAPHICS

Character Sets (GO and G1 Designations)

Character Set	GO Designator	G1 Designator	V52 Mode
United Kingdom (UK)	ESC (A	ESC) A	NA
United States (USASCII)	ESC (B	ESC) B	ESC F
Special graphics characters	ESC (0	ESC) 0	ESC G
Alternate character ROM (optional)	ESC (1	ESC) 1	NA
Alternate character ROM (optional)	ESC (2	ESC) 2	NA

SO code invokes G1
SI code invokes GO

Special Graphics Character Set

ASCII Character	Graphic Character	
_		Blank
/	◆	Diamond
a	▒	Checkerboard (error indicator)
b	HT	horizontal tab
c	FF	form feed
d	CR	carriage return
e	LF	line feed
f	°	Degree symbol
g	±	Plus/minus
h	NL	new line
i	VT	vertical tab
j	┘	Lower right corner
k	┐	Upper right corner
l	┌	Upper left corner
m	└	Lower left corner
n	+	crossing lines
o	-	Horizontal line - Scan 2
p	-	Horizontal line - Scan 4
q	-	Horizontal line - Scan 6
r	-	Horizontal line - Scan 8
s	-	Horizontal line - Scan 10
t	├	Left "T"
u	┤	Right "T"
v	┴	Bottom "T"
w	┬	Top "T"
x	!	Vertical bar
y	≤	Less than or equal to
z	≥	Greater than or equal to
{	π	Pi
|	≠	Not equal to
}	£	UK pound sign
~	·	Centered dot

USA STANDARD CODE
FOR INFORMATION INTERCHANGE

Bit Numbers								0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b_7	b_6	b_5	b_4	b_3	b_2	b_1	Column → / Row ↓	0	1	2	3	4	5	6	7
			0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
			0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
			0	0	1	0	2	STX	DC2	"	2	B	R	b	r
			0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
			0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
			0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
			0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
			0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
			1	0	0	0	8	BS	CAN	(	8	H	X	h	x
			1	0	0	1	9	HT	EM	)	9	I	Y	i	y
			1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
			1	0	1	1	11	VT	ESC	+	;	K	[	k	{
			1	1	0	0	12	FF	FS	,	<	L	\	l	|
			1	1	0	1	13	CR	GS	-	=	M	]	m	}
			1	1	1	0	14	SO	RS	.	>	N	^	n	~
			1	1	1	1	15	SI	US	/	?	O	_	o	DEL

CONTROL FUNCTION DEFINITIONS

NUL	Null, or all zeros	DC1	Device control 1
SOH	Start of heading	DC2	Device control 2
STX	Start of text	DC3	Device control 3
ETX	End of text	DC4	Device control 4
EOT	End of transmission	NAK	Negative acknowledge
ENQ	Enquiry	SYN	Synchronous idle
ACK	Acknowledge	ETB	End of transmission block
BEL	Bell, or alarm	CAN	Cancel
BS	Backspace	EM	End of medium
HT	Horizontal tabulation	SUB	Substitute
LF	Line feed	ESC	Escape
VT	Vertical tabulation	FS	File separator
FF	Form feed	GS	Group separator
CR	Carriage return	RS	Record separator
SO	Shift out	US	Unit separator
SI	Shift in	SP	Space
DLE	Data link escape	DEL	Delete

*Indicates the state of this feature/mode is saved in non-volatile memory.

7-9 FUNCTION KEYS, CLEARS, TABS, EDIT FUNCTIONS, AND TRANSMIT FUNCTIONS

Function Keys	ANSI Mode	V52 Mode	SET-UP Mode
*Define Dynamic Function P_s	ESC P P_s text	ESC P P_s text	NA
End Dynamic Function Definition	ESC \	ESC \	NA
Perform Dynamic Function P_s	ESC [P_s t	ESC [P_s t	NA
Alternate Keypad Mode On/Off	ESC = / ESC >	ESC = / ESC >	NA
Alternate Cursor Key Mode On/Off	ESC [? 1 h / ESC [? 1 l	NA	NA

Clears	ANSI Mode	V52 Mode	SET-UP Mode
To End of Line	ESC [K or ESC [0 K	ESC K	NA
From Beginning of Line	ESC [1 K	NA	NA
Entire Line	ESC [2 K	NA	NA
To End of Screen	ESC [J or ESC [0 J	ESC J	NA
From Beginning of Screen	ESC [1 J	NA	NA
Entire Screen	ESC [2 J	NA	NA
Reset (Clears Entire Screen)	ESC c	NA	0 Key

Tabs	ANSI Mode	V52 Mode	SET-UP Mode
Cursor to Next Tab Stop	HT	HT	NA
Set Tab Stop in Current Column	ESC H	NA	A
Clear Tab Stop in Current Column	ESC [g	NA	A
Clear All Tab Stops	ESC [3 g	NA	A

Edit Functions	ANSI Mode	V52 Mode	SET-UP Mode
Delete P_n Characters	ESC [P_n P	NA	NA
Delete P_n Lines	ESC [P_n M	NA	NA
Insert P_n Lines	ESC [P_n L	NA	NA
Insert/Replacement Mode	ESC [4 h / ESC [4 l	NA	NA
*Edit Mode On/Off	ESC [? 10 h / ESC [? 10 l	NA	C
*Edit Key Transmit/Execute	ESC [? 16 h / ESC [? 16 l	NA	C
*Erase All/Unprotected	ESC [6 h / ESC [6 l	NA	C

Transmit Functions	ANSI Mode	V52 Mode	SET-UP Mode
Block Transmit	ESC 5	NA	C
Transmit Form	ESC 6	NA	C
*Transmit Key Transmit/Execute	ESC [? 14 h / ESC [? 14 l	NA	C
*Transmit Line/Page	ESC [? 11 h / ESC [? 11 l	NA	C
*Transmit Window/Message	ESC [16 h / ESC [16 l	NA	C
*Guarded Area Transfer All/Unprotect	ESC [1 h / ESC [1 l	NA	C
*Space Compression On/Off	ESC [? 13 h / ESC [? 13 l	NA	C
*Transmit Term. Char. FF/None	ESC [1 ¦ / ESC [0 ¦	NA	C

*Indicates the state of this feature/mode is saved in non-volatile memory.

Display Format	ANSI Mode	V52 Mode	SET-UP Mode
*80/132 Columns Mode	ESC [? 3 ℓ / ESC [? 3 h	NA	A
*Wide Mode On/Off	ESC [? 2 0 h / ESC [? 2 0 ℓ	NA	B
Current Line to 80 Columns	ESC # 1	NA	NA
Current Line to 132 Columns	ESC # 2	NA	NA
Current Line to Double High Top Half	ESC # 3	NA	NA
Current Line to Double High Bottom Half	ESC # 4	NA	NA
Current Line Normal	ESC # 5	NA	NA
Current Line Wide	ESC # 6	NA	NA
Start Protected Area	ESC V	NA	C
End Protected Area	ESC W	NA	C
Set Scrolling Window Between P_t and P_b	ESC [P_t; P_b r (1)	NA	NA
Select Character Attributes	ESC [P_s; P_s;...P_s m (2)	NA	NA
Select Protected Graphic Renditions	ESC [P_s; P_s; ... P_s (3)	NA	C
Protect Mode On/Off	ESC [? 24 h / ESC [? 24 ℓ	NA	C

(1) P_t is decimal number specifying top line
P_b is decimal number specifying bottom line

(2)

P_s Value	Attribute
0 or none	Normal; all attributes off
1	Bold on
2	Blank on
3	Overscore on
4	Underscore on
5	Blink on
7	Inverse on

(3)

P_s Value	Attribute
0 or none	Normal; cancel previous
1	Bold protected
2	Blank protected
3	Overscore protected
4	Underscore protected
5	Blink protected
7	Inverse protected
254	Normal protected

Cursor Manipulation	ANSI Mode	V52 Mode	SET-UP Mode
One Up or P_n Up	ESC [P_n A	ESC A	NA
One Down or P_n Down	ESC [P_n B	ESC B	NA
One Right or P_n Right	ESC [P_n C	ESC C	NA
One Left or P_n Left	ESC [P_n D or BS	ESC D or BS	NA
Full Left (Cursor Return)	CR	CR	NA
Home	ESC [H or ESC [f	ESC H	NA
Line Feed	LF or VT or FF (4)	LF	NA
New Line	LF or VT or FF (4) or ESC E	LF (4)	NA
Index	ESC D	NA	NA
Reverse Index	ESC M	ESC I	NA
Address Origin Window/Absolute	ESC [? 6 h / ESC [? 6 ℓ	NA	NA
Direct Address	ESC [P_n; P_n H or ESC [P_n; P_n f(5)	ESC 4 $P_ℓ$ P_c(6)	NA
Request Position Report	ESC [6 n	NA	NA
Cursor Position Response	ESC [P_n; P_n R (5)	NA	NA
Save Cursor, Attributes and Character Set	ESC 7	NA	NA
Restore Cursor, Attributes and Character Set	ESC 8	NA	NA

(4) ESC [2 0 h sets LF to New Line function
ESC [2 0 ℓ sets LF to Index function
SET-UP Mode B - Block 3 - Bit 3

(5) First P_n is decimal line number
Second P_n is decimal column number

(6) $P_ℓ$ is line code; P_c is column code
Codes are single characters per Table 7-1

*Indicates the state of this feature/mode is saved in non-volatile memory.

Operator Convenience Modes	ANSI Mode	V52 Mode	SET-UP Mode
*Right Margin Bell On/Off	NA	NA	B
*Keyclick On/Off	NA	NA	B
*Auto Key-Repeat On/Off	ESC [? 8 h / ESC [? 8 l	NA	B
*Auto Key-Repeat Rate 30/15 cps	ESC [? 2 1 l / ESC [? 2 1 h	NA	B
*Screen Background Normal/Inverse	ESC [? 5 l / ESC [? 5 h	NA	B
*Screen Brightness Level	NA	NA	B
*Cursor Character (__ or ■)	NA	NA	B
*Smooth Scroll On/Off	ESC [? 4 h / ESC [? 4 l	NA	B
*Smooth Scroll Rate 5/10 lps	ESC [? 2 2 l / ESC [? 2 2 h	NA	B
*Screen Saver On/Off	NA	NA	B
Installation/Applications Mode Control			
*Right Margin Wrap On/Off	ESC [? 7 h / ESC [? 7 l	NA	B
*US/UK Character Set	(1)	NA	
*60/50 Hz Refresh Rate	NA	NA	B
*ANSI/V52 Mode	ESC [? 2 l	ESC <	B
*Save Status & Functions	NA	NA	SHIFT & S Key
Recall Status & Functions	NA	NA	SHIFT & R Key
*Local/On Line Mode	NA	NA	4 Key
*Local Echo On/Off	ESC [1 2 h / ESC [1 2 l	NA	B
*Line Feed/New Line Mode	ESC [2 0 l / ESC [2 0 h	NA	B
*Full/Half Duplex	NA	NA	C
*Dynamic Function Keys Transmit/Execute	ESC [? 23 h / ESC [? 23 l	NA	C
Keyboard Action Locked/Unlocked	ESC [2 h / ESC [2 l	NA	NA
Peripheral Interface			
*Print On Line On/Off			C
Auto Print Mode On/Off	ESC [? 5 i / ESC [? 4 i	ESC ^ / ESC -	NA
Printer Controller Mode On/Off	ESC [5 i / ESC [4 i	ESC W / ESC X	NA
Print Cursor Line	ESC [? 1 i	ESC V	NA
Print Screen	ESC [i	ESC]	NA
*Print Extent Full/Window	ESC [1 9 h / ESC [1 9 l	NA	C
*Print Termination FF/None	ESC [1 8 h / ESC [1 8 l	NA	C

(1) See Section 7-8

*Indicates the state of this feature/mode is saved in non-volatile memory.