MODEL 16
INSTRUCTION
MANUAL

The following notice is provided in accordance with the United States Federal Communications Commission's (FFC) regulations.

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

For service in Minnesota, call (612) 941-3300.
For service in the rest of the United States, call 1-800-328-6397.

PREFACE

This Instruction Manual contains information needed by the user for installation, setup, operation, and care of the Model 16 Teleray terminal.

For users who wish to perform their own remedial maintenance, the following Model 16 Reference Manual is available by order from the Teleray Division of Research, Inc.

KA063218-001 – Model 16 Reference Manual

TABLE OF CONTENTS

Section 1 – GENERAL INFORMATION & SPECIFICATIONS

Section 2 – INSTALLATION & MAINTENANCE

Section 3 – KEYBOARD

Section 4 – SELECTION MENUS

Section 5 – OPERATIONS

Section 6 – CODING SUMMARY ARRANGED BY CODE

Section 7 – CODING SUMMARY ARRANGED BY FUNCTION
(With Defaults Shown)

Appendix A – Index

Appendix B – Comments Postcard

SECTION 1

GENERAL INFORMATION & SPECIFICATIONS

1-1   Introduction

The Teleray Model 16 is a microprocessor-controlled, multipage CRT terminal with asynchronous ASCII input/output capabilities. Non-volatile memory storage allows for the retention of operator Selection Menu parameters, 32 programmable functions, and 64 programmable keyboard functions, even when the terminal is powered off. The Model 16 features a serial I/O port and a bi-directional auxiliary peripheral port. Serial communications are full or half duplex, with or without local echo, and the terminal provides line monitoring capabilities.

The Teleray Model 16 offers five character visual attributes, six area qualifications, extensive cursor control, smooth scroll, scrolling window, and horizontal scrolling. Logical line lengths and logical page lengths are user definable on the Model 16. Physical data display capacity is 1920 characters, or 24 lines of 80 characters. The display page also includes a 25th bottom line, for status and operator information purposes. The standard Teleray Model 16 includes four pages of volatile display memory. Optional configurations are eight pages of volatile or four pages of non-volatile, or eight pages of non-volatile display memory.

Other Model 16 features include communications parameters, operator functions, automatic screen saver, full editing, protection, and character/block mode transmission capabilities. The flexibility of the Model 16 is enhanced with a graphic character set, line drawing set, and mosaic character set. Calculator mode, utilizing the terminal's standard numeric keypad, adds to the versatility of the Teleray Model 16.

1-2   Physical Description

The Teleray Model 16 terminal consists of a display cabinet which houses the monitor module, power supply module, and logic module. All enclosure styles include a detached keyboard which can be positioned for optimal user convenience. Model 16 enclosure styles are designed for use on a desk, table top, or in rack-mounted applications (see Section 1-3, Packaging Configurations).

1-3 Packaging Configurations

M

Metal Enclosure, Detached Keyboard
Display Cabinet: 13-3/4"
(349mm) H x 13-1/4" (337mm)
W x 17" (432mm) D
Keyboard: 3-1/4" (83mm) H x
18-1/2" (470mm) W x 7"
(179mm) D
Weight: 36 lbs. (16 Kg)

N

Injection Molded Enclosure, Detached Keyboard, 12" CRT
Display Cabinet: 15" (381mm)
H x 17" (432mm) W x 17"
(432mm) D
Optional tilt base available
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 Cabinet: 15" (381mm)
H x 17" (432mm) W x 17"
(432mm) D
Optional tilt base available
Keyboard: 3-1/4" (83mm) H x
18-3/4" (476mm) W x 7"
(178mm) D
Weight: 39 lbs. (17.7 kg)

R

Rack Mounted Enclosure, 12" CRT
Display Cabinet: 12-1/4"
(311mm) H x 19" (483mm) W x
17" (432mm) D
Keyboard: 7" (178mm) H x
19" (483mm) W x 3" (76mm) D
Weight: 36 lbs. (16.4 kg)

C
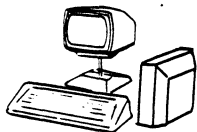
Executive Style Enclosure, Detached Keyboard, 9" CRT
Display Cabinet: 15-1/2"
(394mm) H x 10" (254mm) W x
10" (254mm) D with stand or
optional desk clamp
Control Electronics: 4-1/2"
(115mm) H x 11-1/2" (293mm)
W x 11-3/4" (299mm) D
Keyboard: 3-1/4" (83mm) H x
18-3/4" (476mm) W x 7"
(178mm) D
Weight: 30 lbs (13.6 Kg)

POWER REQUIREMENTS

115 V ± 10% or (optionally)
230 V ± 15%
40 Watts
137 BTU/Hr

Connections: Detachable 3-wire cord mat-
                  ing 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.

Meets FCC regulations for a Class A computing
device.

1-4 Specifications

DISPLAY

Type: Light on dark, or dark on light, user-programmable

Size:

Height:		Width:		
	6" (152mm)		8-1/2" (216mm)	M, N, R Enclosures
	5" (127mm)		6-1/2" (165mm)	C Enclosure
	7" (178mm)		9-1/2" (241mm)	NN Enclosure

Format: 24 lines by 80 columns + 25th status (bottom) line

Character Field: Variable character matrix with descenders in 8 x 10 dot field

Character Size:
2.6mm x 5.0mm (.10 inch x .20 inch) - M, N, R enclosures
3.8mm x 7.0mm (.15 inch x .28 inch) - NN enclosure
1.7mm x 3.5mm (.07 inch x .14 inch) - C enclosure

Cursor: Any character or graphic; blinking or steady, user programmable

Refresh Rate: 50 or 60 Hz, user programmable

Character Set: 128-character ASCII (including 32 control characters), 64-character line drawing graphics set, and 64 mosaic graphic characters.

Visual Attributes: Dim, blink, underline, inverse, blank

Area Qualifications   Protect, numeric, alphabetic, right justify, protected transmitting, and space filled fields.

KEYBOARD

Layout: 75-key, matte finish, sculptured typewriter-style keyboard with an 18-key calculator-type numeric pad. Deep dished F and J keys, dimpled 5 key on numeric pad.

Rollover: N-Key

Repeat: Auto repeat at 15 or 30 characters per second after half second delay. Auto repeat rate user programmable.

Indicator Lights: Seven status LEDs

COMMUNICATIONS

Protocol: Standard asynchronous - ANSI X3.4, X3.16, X3.64, EIA RS232C compatible

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.

Parity: Even, odd, mark, space, or none (parity not checked for mark, space, or none parity settings).

Peripheral Interface: Standard; bi-directional.

MEMORY CAPACITY

Dynamic Program Functions:
512 bytes, non-volatile via battery backup.
Battery - BR2325MM or equivalent.
Battery Life - Two years minimum, five years typical.

Display Memory: 7760 bytes (four pages of 24 x 80 plus one bottom line). User can organize this memory.

1-5 Label Designations

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.

```
┌─────────────────────────────────────────────────────────┐
│  TELERAY_____   16N USA 1 GRN1 _____      MN47          │
│                                                           │
│      11-1111            CLP SF421                         │
│  ■  SERIAL   NO        OPTION   CODES                     │
└─────────────────────────────────────────────────────────┘
```
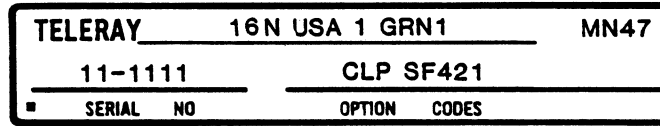
Model Number Interpretation

| 16 | N | USA | 1 | GRN | 1 | CLP   SF421 | Service Code |

These fields describe options installed.

CLP   SF421
Option Codes

one digit
POWER SUPPLY
1 = 115V
2 = 220V

two letters
CABINET TYPE
M N NN C
R (detached kybd)
RR (rackmounted kybd)

three letters
MONITOR TYPE
WHT = P4 Phosphor
GRN = P31 Phosphor
AMB = LA Amber

three letters
PROGRAM VERSIONS
USA = Standard
APL = APL version
000 = Special feature installed
Other codes for national
language versions

one digit
SHIPPING ACCESSORY PACKAGE
1 = Standard

CLP   Current loop is installed
SFXXX   Special feature number XXX is installed
CVD   Composite video is installed
8VM   Configured for 8 pages volatile memory
4NV   Configured for 4 pages non-volatile memory
8NV   Configured for 8 pages non-volatile memory

1-4

SECTION 2
INSTALLATION

2-1 Introduction

Several characteristics of the Model 16 Teleray can be set by an installer from the keyboard. These characteristics include communications format, display refresh rate, etc. Setting these characteristics is decribed in Section 4, Selection Menus. All 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 and Checkout

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 marked end of the carton 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 damaged parts. An Installation Report Form is included to assist you in reporting any possible problem.

B. Site Selection

The Teleray terminal is designed for desk or table top mounting. The detached keyboard permits the keyboard to be located independently 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 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 and sound the bell.

E. Preliminary Local Mode Checkout

The following procedure utilizes some of the more important features of the Teleray 16 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. (Zero characters and a fault message will appear on the left of the bottom line if there is an error.)

2. Check the condition of the ON LINE/LOCAL LED indicators. If the ON LINE indicator is On, select LOCAL using the LOCAL key.

3. Place the terminal in the Selection Menu by holding the SHIFT and typing the STATUS key. The bottom line display should display the current brightness level (see Section 4). (Move the category indicator using SHIFT and →,← keys, and the feature indicator using the unshifted →, ← keys. The Teleray will prompt you through the selections.)

4. 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.

5. Exit from the Selection Menu by pressing the STATUS key. The bottom line should now display the status indicators.

6. Type the following sequence: ESC [16; 7 y. The screen should now display 24 lines by 80 columns of the character ♪. The ♪ character will be underlined and several areas of the screen will have visual attributes displayed. The bottom status line will remain unchanged.

7. Return to the Selection Menu and change the sixth feature in the first category (Ergonometric Controls). The screen display will change from light on dark to dark on light.

8. Type the sequence ESC [? 2 J (or type the CLEAR PAGE key) to clear the screen.

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

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

11. Depress the CAPS LOCK key and it will lock in the On position. Repeat Step 10 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.)

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

13. 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.

14. Type the sequence ESC [9 b. Your name should appear nine more times (if you had used ESC [255 b, it would appear 255 times.)

15. Return to the Selection Menu and change the second feature in the third category (Applications Controls). This will allow you to set the correct time. Type the status key, and the correct time will be displayed on the bottom line.

16. Type the sequence ESC [144 space q. The cursor will now be displayed as a heart.

This completes preliminary checkout of the Teleray 16.

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 adapter that will defeat the safety ground.

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

The outline of the logic module is shown below.

Serial I/O   Peripheral I/O   Bell and Bell   Composite Video Option
                                Jumper Contacts

Current Loop   Program Memory
Sockets

                                                    Battery (all units)

                                                    Optional Memory
                                                    Locations

                                                    Normally Empty

Non-Volatile Battery   Location for installation
Backup Card   of non-volatile battery
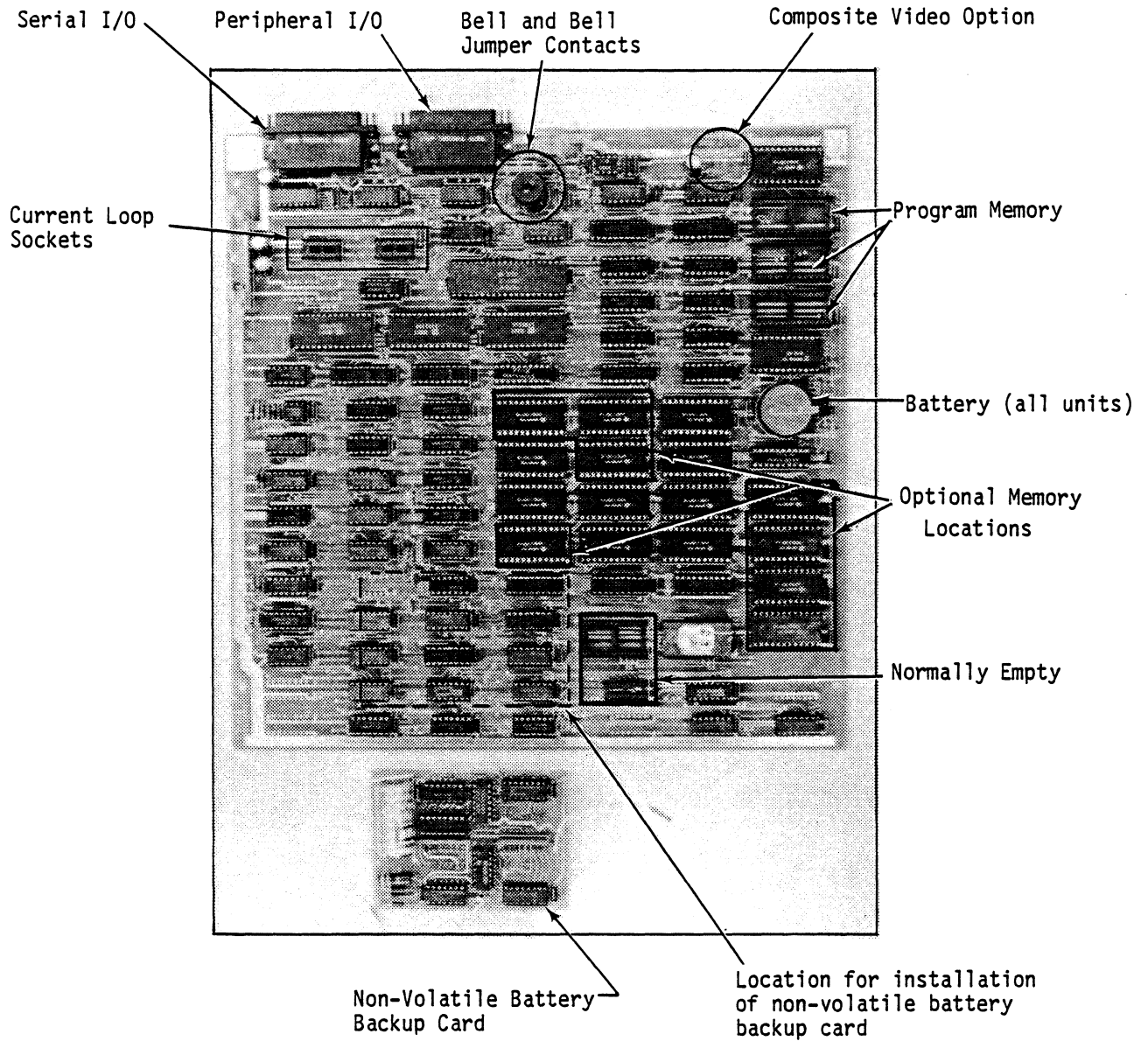   backup card

Figure 2-1: Logic Module

2-4

Monitor Internal Controls

Normally, these controls should not need adjustment. (The Selection Menu contrast controls should be set before attempting these adjustments.) They are located on the circuit card immediately adjacent to the CRT tube on the upper chassis. The names of the controls explain their function. Their position on the circuit card changes with different cabinet styles and monitor options. Additional details are included in the Teleray Model 16 Reference Manual.

CAUTION

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

Width
(Requires plastic
allen wrench to adjust)

Vertical Size
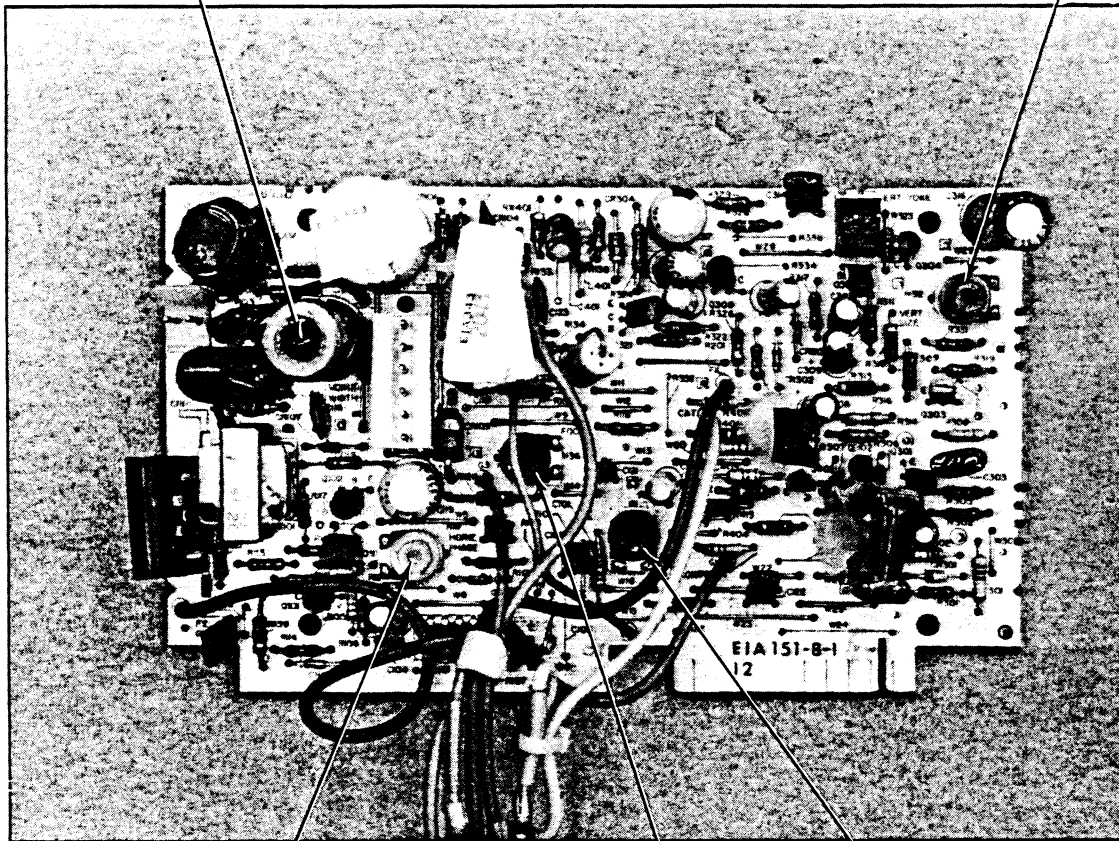
Horizontal Phase

Focus

Brightness

Figure 2-2: Monitor Controls

2-4 Communications Connections

A. Serial I/O Interface

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

<u>RS232C (Standard)</u>

1 - Protective Ground
2 - Transmitted Data
3 - Received Data
4 - Request to Send
5 - Clear to Send
6 - Data Set Ready (Peripheral Port only)
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 Block 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 in Character mode, asserted during transmits in Block mode. May also be used for Busy Ready if Serial I/O Busy Ready is selected; see Section 5-5 B.

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
Must be asserted to allow the Teleray to receive.

Data Set Ready (to Teleray)
Busy Ready   – Pin 6
This peripheral port signal is used to control the flow of data to the peripheral port. Its active level and its control effect can be programmed in the Selection Menu or by escape sequence.

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.

EIA RS232C Signals

CCITT Circuit Number	EIA RS232C	Title	TELERAY Serial I/O Pin No.	Comments
101	AA	Protective Ground	1	Chassis Ground
103	BA	Transmitted Data from terminal	2	Logical "0" = High +12V Logical "1" = Low -12V Idle = High
104	BB	Received Data to terminal	3	Logical "0" = High +12V Logical "1" = Low -12V Idle = High
105	CA	Request to Send signal from terminal	4	Goes high when terminal is ready to transmit
106	CB	Clear to Send signal to terminal	5	Must be high to allow terminal to transmit
107	CC	Data Set Ready from modem (Busy/Ready)	6	Signals that the modem is available; unused by terminal
102	AB	Signal Ground	7	Logic Ground
109	CF	Carrier Detect signal to terminal	8	Must be high to allow terminal to receive
108/2	CD	Data Terminal Ready signal from terminal	20	High when Teleray is On Line

B.   Peripheral I/O Interface

The Teleray Model 16 has a bi-directional RS232 peripheral interface.

Pin assignment and electrical characteristics are identical to those of the serial I/O interface, except that the Data Set Ready (Pin 6) signal is also supplied.

C. **Optional Current Loop (for Serial I/O only)**

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, and both are optically isolated from the Teleray power and grounding. 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, the signals are not electrically isolated from Teleray's ground, 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 ± 5% and 600 ohms.

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.   The signal is non-interlaced.
2.   Video rate is 13 MHz, exceeding the band width of some RS170 type monitors.
This composite output is fully compatible with the high resolution remote monitors sold by Teleray.

2-5   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 enclosure 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.   Annually

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.

C.   Bi-Annually

Teleray recommends changing the non-volatile memory batteries bi-annually. While the typical battery will last five years or longer, an atypical battery may last only two years. If the battery is changed with power applied to the Teleray, the non-volatile memory will not have to be rewritten.

CAUTION

There are hazardous voltages inside the Teleray. Changing batteries should be performed only by someone familiar with servicing procedures and safety precautions.

2-6 Local Testing Summary

A. Screen Alignment Test – ESC [16; 7 y

This command causes the screen to be filled with underlined ♪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.

B. Self-Testing

The terminal is automatically tested whenever the Teleray is turned on. The screen display test and the display memory are not tested during the automatic power on test if a non-volatile memory option is installed in the Teleray. The self-test can also be induced in the following ways:

1. Entering a Reset to Default State function (ESC [255; 255 space y).

2. Entering an Invoke Self-Test command (ESC [16; y). The Invoke Self-Test command can perform additional tests not included in the Reset Self-Test (see 5-11).

SECTION 3
KEYBOARD

3-1 General Information

The keyboard is detachable from the terminal for operator comfort and optimal space utilization. The keytops are sculptured with a dimpled 5 in the numeric pad and "deep dished" F and J keys. The coiled 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 16 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.

The figure below shows the keyboard.
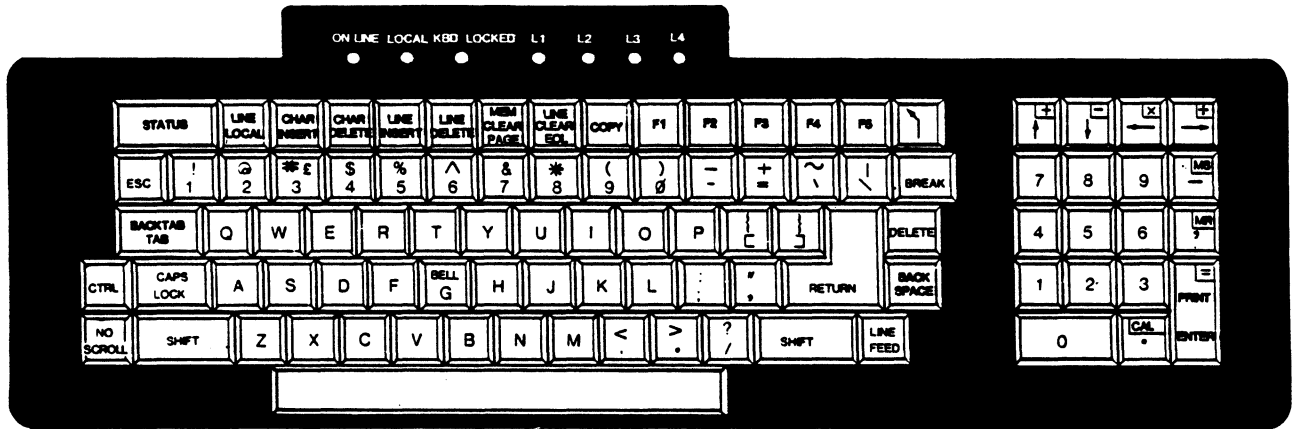
3-2 Alphabetic Keys

The keys shown below generate the appropriate ASCII character. Both upper and lower case can be generated; upper case under control of the SHIFT and CAPS LOCK keys.
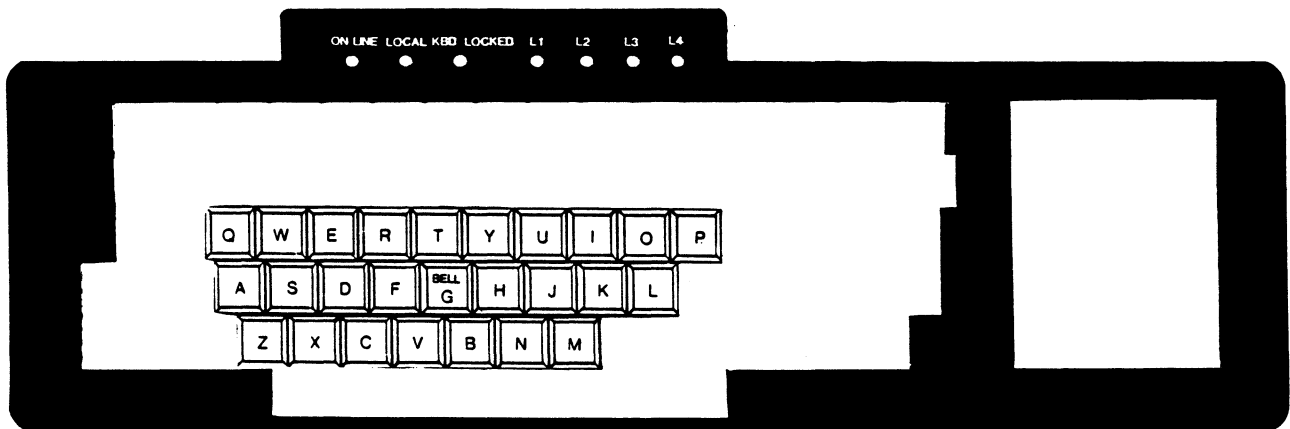
3-3 Numeric and Special Symbols

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.
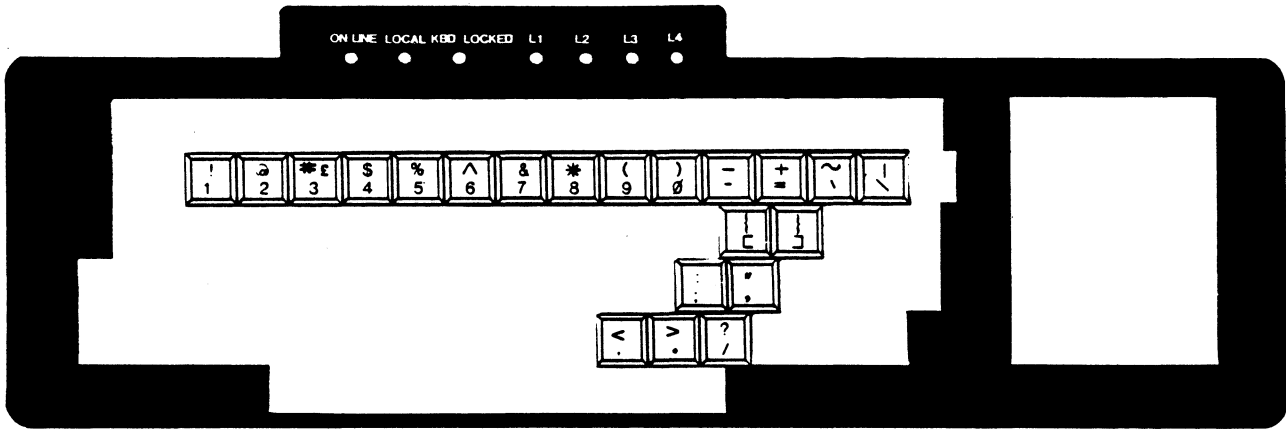
3-4 Keyboard Mode Keys

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 3-1 details the keyboard coding.
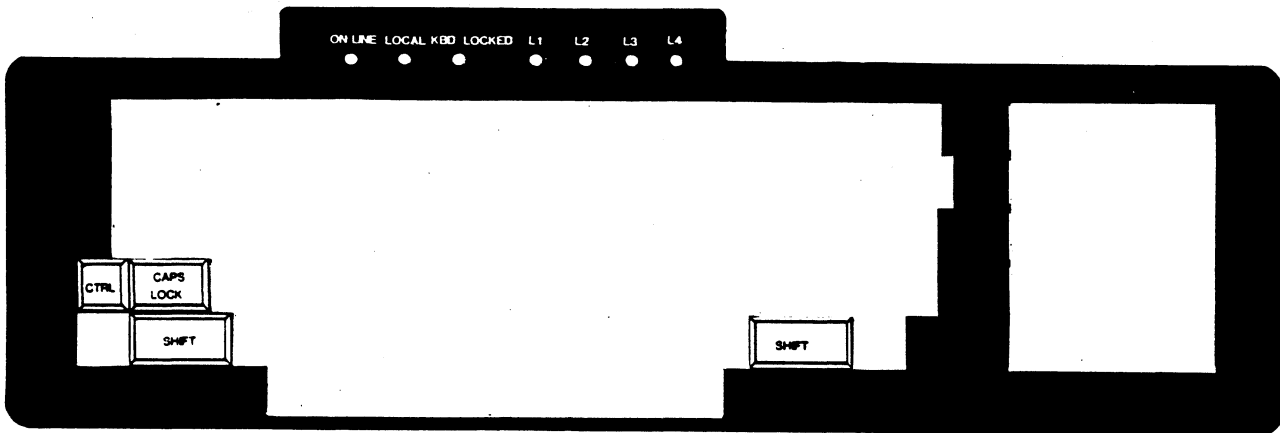
3-5   Dedicated Keys

The keys shown below generate fixed ASCII control character codes.

```
    ON LINE  LOCAL  KBD  LOCKED    L1    L2    L3    L4
      ●       ●      ●     ●       ●     ●     ●     ●

  ┌─────┐
  │ ESC │
  └─────┘     ┌─── BACKTAB SHIFTED
  ┌──────┐    │
  │BACKTAB│                                    ┌──────┐
  │  TAB  │                                    │DELETE│
  └──────┘    └─── TAB UNSHIFTED               └──────┘
                                    ┌──────┐   ┌──────┐
                                    │RETURN│   │ BACK │
                                    │      │   │SPACE │
                                    └──────┘   └──────┘
                                        ┌──────┐
                                        │ LINE │
                                        │ FEED │
                                        └──────┘
```
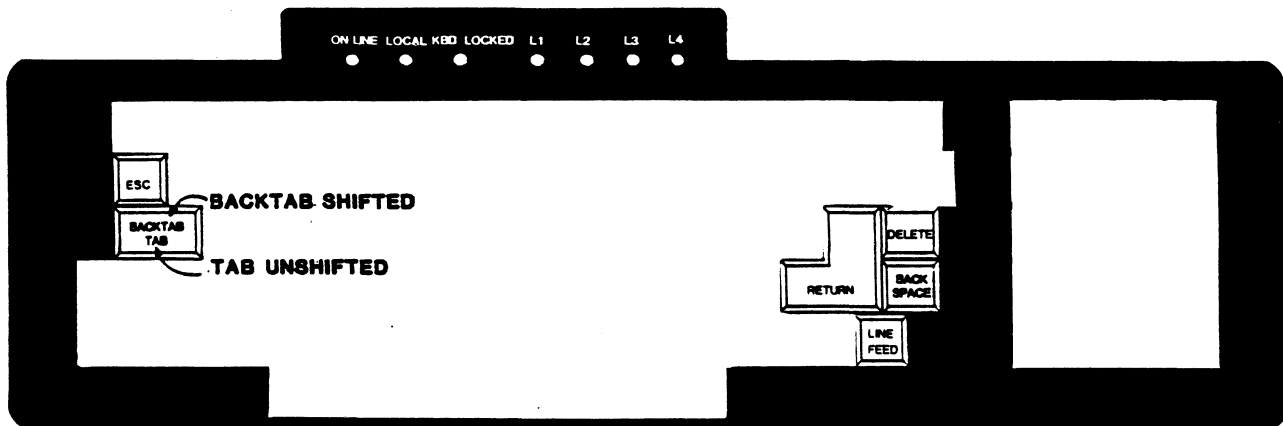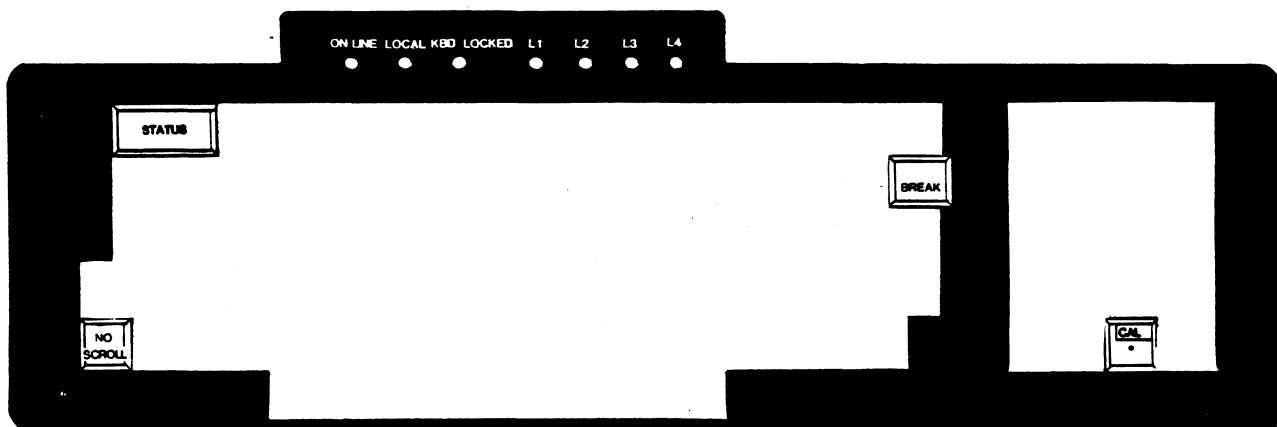
3-6   Special Operation Keys

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.

The NO SCROLL key alternately transmits the DC3 (Suspend) and DC1 (Resume) control codes if the Suspend/Resume 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 Suspend/Resume feature is disabled, the NO SCROLL key will transmit no codes. See "Buffering" in Section 5-5, Operations, for further details.

The STATUS key is used to enter and exit the Selection Menu. Shift and Status will interrupt an undesired long-time function, and will also unlock the keyboard and resume transmission.

Pressing SHIFT and STATUS will display the Teleray's Selection Menu (see Section 4). Pressing SHIFT and the . in the numeric keypad will invoke Calculator mode. In either Calculator mode or Selection Menu, the numeric keypad is used to perform special functions and is not available for use as a numeric pad.

If the Suspend/Resume feature is enabled, the Status key will transmit the Suspend code (DC3) when the full page Selection Menu is displayed and transmit the Resume code (DC1) when the menu is exited. If the Suspend/Resume feature is disabled, the STATUS key will transmit no codes when entering or exiting the Page Selection Menu.

```
    ON LINE  LOCAL  KBD  LOCKED    L1    L2    L3    L4
      ●       ●      ●     ●       ●     ●     ●     ●

  ┌──────┐
  │STATUS│
  └──────┘
                                              ┌──────┐
                                              │BREAK │
                                              └──────┘

  ┌──────┐                                         ┌──────┐
  │  NO  │                                         │ CAL  │
  │SCROLL│                                         │  .   │
  └──────┘                                         └──────┘
```

3-7 Macro (Reprogrammable) Keys

The keys shown below can be reprogrammed with any 8-character sequence (a macro). The only ASCII characters that may not be entered are NUL and : (colon). Different macro sequences can be assigned to these keys in both shifted and unshifted positions.
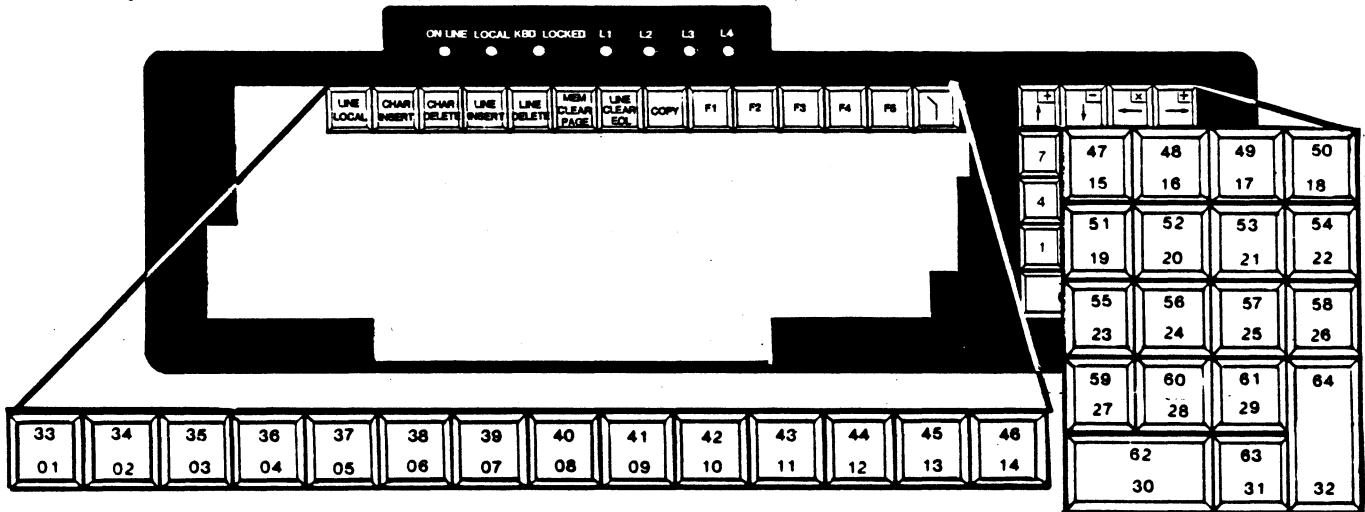
The key numbers shown in the above figure are the macro numbers called by the keytop in that position on the keyboard. Table 3-2 shows the codes programmed in these macros by the Teleray factory; these are called the default values. The Reset to Default State command will reprogram these keys to default values; no other command, including Reset to Initial State, will modify the macro contents except for the Reprogram Macro Key sequences. These sequences are:

Reprogram Macro Key – Local	ESC P L P_s text: P_s text...
Reprogram Macro Key – Keyboard	ESC P K P_s text: P_s text...
Reprogram Macro Key – Transmitting	ESC P T P_s text: P_s text...
End Macro Key Definition	ESC \

where:

 text may be any character or sequence except "ESC P L...", "ESC P K...", "ESC P T...", or "ESC \ " or ":". Program function sequences may be included.

P_s is the 2-digit macro number for the keys as shown in the figure above.

: is used to separate functions; this allows definition of several macros with one escape sequence.

There are three types of macro keys: Local, Transmitting, and Keyboard. Local macros operate locally only; no code is transmitted by them, and the ESCape sequence is executed within the Teleray. Transmitting macros are not interpreted by the Teleray, and the macro contents are transmitted to the host computer. If the host echoes the character sequence, it will be interpreted. Keyboard macros are treated as keyboard input; if the Teleray is in Local mode, they will be acted on locally; in Remote and Character modes, they will be transmitted. If macro keys are to be used to invoke Dynamic Programmable Functions, these macros will normally be Local macros. Figure 3-1 illustrates the operations of these macros.

The programming sequences need only redefine those macro keys you wish to change. Macro keys can be reprogrammed singly or in groups. The macros are stored in non-volatile memory to minimize required reprogramming. If no text (an empty text string) is supplied for a particular P_s, that keyboard macro will not have any effect on the Teleray when that key is pressed. This technique is recommended for those applications requiring certain keys to be disabled.

Keytops for the macro keys are provided to match the default coding. Alternate or special keys can be provided as required for the application. Section 5-7, Figure 5-12a, contains a keyboard diagram with the macro keys shown blank for use in recording your applications.
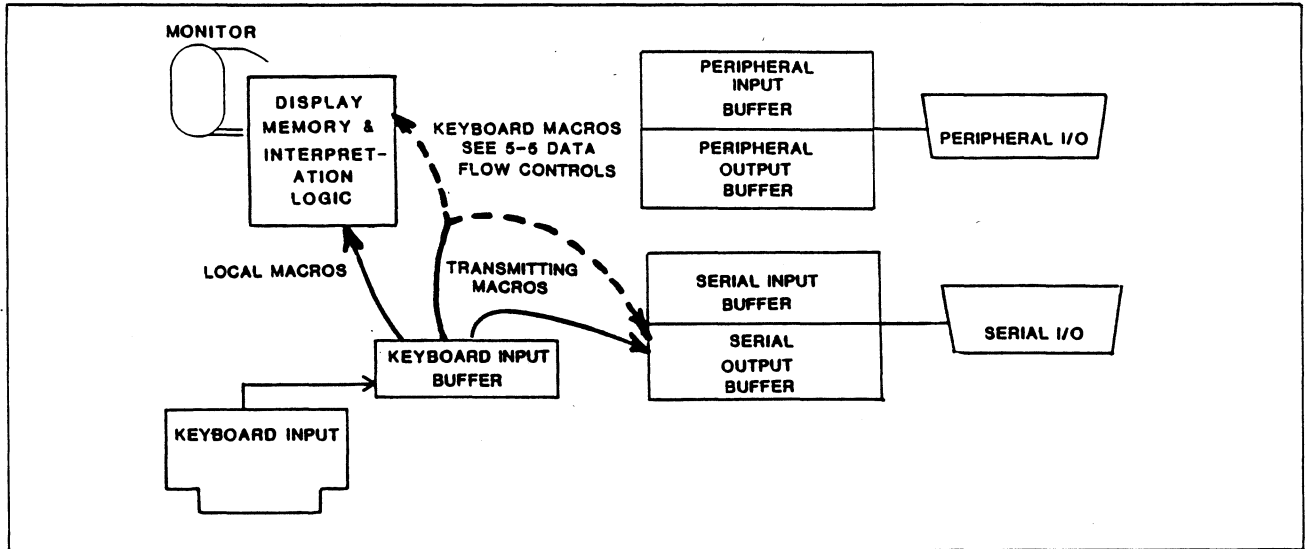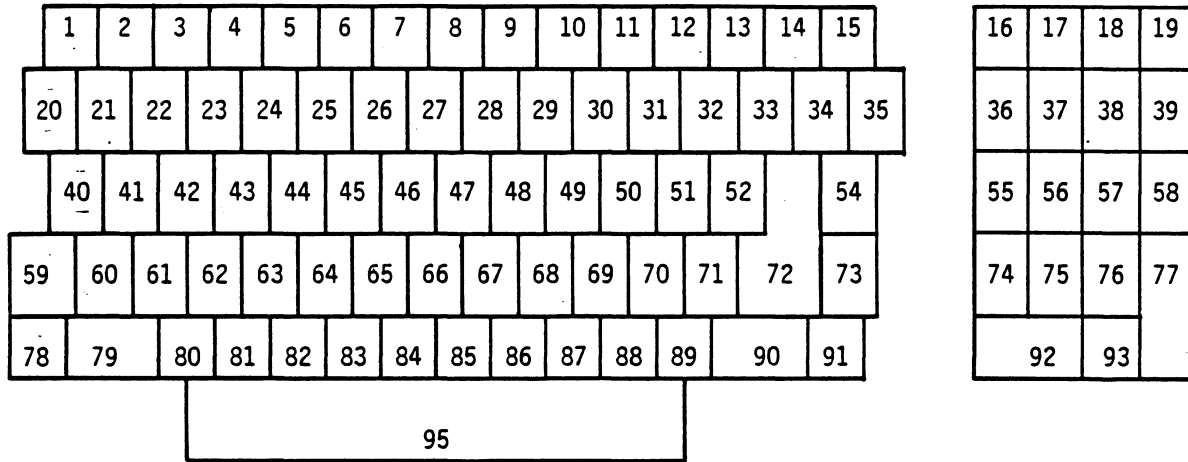
MONITOR

DISPLAY MEMORY & INTERPRET- ATION LOGIC

KEYBOARD MACROS SEE 5-5 DATA FLOW CONTROLS

PERIPHERAL INPUT BUFFER

PERIPHERAL OUTPUT BUFFER

PERIPHERAL I/O

LOCAL MACROS

TRANSMITTING MACROS

SERIAL INPUT BUFFER

SERIAL OUTPUT BUFFER

SERIAL I/O

KEYBOARD INPUT BUFFER

KEYBOARD INPUT

Figure 3-1: Macro Operations

Table 3-1 – Macro Key Default Values

Macro #	Type	Default Value	Macro #	Type	Default Value
01	L	ESC [? 12 h Local	33	L	ESC [? 12 ℓ Remote (on-line)
02	L	ESC [@ Insert Char	34	L	ESC [⌒ Insert in Para.
03	L	ESC [P Delete Char	35	L	ESC [p Delete Char in Para.
04	L	ESC [L Insert Line	36	L	ESC [L Insert Line
05	L	ESC [M Delete Line	37	L	ESC [M Delete Line
06	L	ESC [2 J Erase Page	38	L	ESC [? 2 J Erase Memory
07	L	ESC [0 K Erase to End of Line	39	L	ESC [2 K Erase Line
08	L	ESC [5 i Copy On	40	L	ESC [4 i Copy Off
09	L	ESC [01 u ⎫ See	41	L	ESC [06 t ⎫ See
10	L	ESC [02 u ⎪ Dynamic	42	L	ESC [07 t ⎪ Dynamic
11	L	ESC [03 u ⎬ Prog.	43	L	ESC [08 t ⎬ Prog.
12	L	ESC [04 u ⎪ Funct.	44	L	ESC [09 t ⎪ Funct.
13	L	ESC [05 u ⎭ 5-7	45	L	ESC [10 t ⎭ 5-7
14	L	ESC [H CR	46	K	ESC [H
15	K	ESC [A One Up	47	K	ESC M Reverse Index
16	K	ESC [B One Down	48	K	ESC D Index
17	K	ESC [D One Left	49	K	ESC [D One Left
18	K	ESC [C One Right	50	K	ESC [C One Right
19	K	7	51	K	7
20	K	8	52	K	8
21	K	9	53	K	9
22	K	–	54	K	–
23	K	4	55	K	4
24	K	5	56	K	5
25	K	6	57	K	6
26	K	,	58	K	,
27	K	1	59	K	1
28	K	2	60	K	2
29	K	3	61	K	3
30	K	0	62	K	0
31	K	.	63	K	ESC [? 26 h Calc mode
32	K	CR	64	L	ESC [i Print

Table 3-2 - Keyboard Coding

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

16	17	18	19

| 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |

| 36 | 37 | 38 | 39 |

| 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 54 |

| 55 | 56 | 57 | 58 |

| 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 |

| 74 | 75 | 76 | 77 |

| 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 |

| 92 | 93 |

| 95 |

Key No.	Unshifted	Shifted	Control
1	—————Unencoded—————		
2 thru 15	—Macro (Programmable) Keys—		
20	ESC	ESC	ESC
21	1	!	1
22	2		NUL
23	3	#	ESC
24	4	$	FS
25	5	%	GS
26	6		RS
27	7	&	US
28	8	*	DEL
29	9	(	9
30	0	)	0
31	-		-
32	=	$\mp$	=
33	`	~	RS
34	\			FS
35	BREAK	BREAK-DISCONNECT	ANSWERBACK
40	HT	ESC [Z	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	CR	CR	CR
73	BS	BS	BS
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

The macro keys are described in Section 3-7.

SECTION 4
SELECTION MENUS

The Teleray Model 16 contains many user-selectable features and modes of operation. The host computer can select features and change modes with ESCape sequences. The operator can change them with the same ESCape sequences or, more simply, with a special display form called a Selection Menu.

This Selection Menu form can be used in one of two ways: as a full-page (66 lines) menu, or sequentially as a single selection line on the terminal's bottom (25th) line. The choice of page selection or line selection menus can be made either by ESCape sequence or within each menu. These choices are described in Section 5-3, Application Controls. The selection page menu format allows the operator to see all of the choices that are available on a single display page. When this page is accessed, the terminal's internal display memory is used to store the menu messages; consequently, the display memory contents are erased. The selection line menu accesses all of the same parameters as the full-page menu, but accesses them sequentially. The selection line menu does not erase the display memory.

Figure 4-1 represents the Selection Menu. Each individual block in the leftmost group represents a category of selections; each block in the rightmost group represents a feature selection. The current category and feature being selected within these blocks is indicated with a diamond instead of a square block. Of course, the prompt associated with the category and feature appears on the screen so that you do not have to memorize the meaning of each block. The blocks and diamonds serve to indicate your current position in the menu. The Teleray will remember the most recent access to the Selection Menu and will automatically return to that position whenever the Selection Menu is accessed.

In Selection mode, the keyboard's numeric keypad block is specially interpreted. The remainder of the Teleray remains active, and the display memory will not be disturbed. The CURSOR RIGHT and CURSOR LEFT keys are used to select features within the category. When shifted, the CURSOR RIGHT and CURSOR LEFT keys are used to select categories. CURSOR RIGHT moves forward in the selection sequence; CURSOR LEFT moves backward.

There are three types of selections: On/off selections; parametric selections; and numeric selections. The CURSOR UP and CURSOR DOWN keys are used to make on/off selections, respectively. The current state of each selection is shown on the display immediately following the feature prompt. These messages are designed to be self-explanatory. The CURSOR UP and CURSOR DOWN keys are used to course through the parameter list for parametric selections. The current state of each selection is displayed. Numeric selections are entered using the numeric keypad (only). Again, the current state of each selection will be displayed. Whenever selection choices are changes, they will be automatically saved in non-volatile memory.

Lock/Unlock Selection   ESC [P_s; P_s space v / ESC [P_s; P_s space u

Each selection feature can be locked via an ESCape sequence so that this feature can no longer be changed from the keyboard. Features that have been locked will appear as dim blocks. If an entire category of features has been locked, the category indicator will appear dim.

These ESCape sequences can be entered from either the computer or from the I/O ports. The second P_s selection parameter is the number of the selection feature within the category; the first P_s is the number of the category. The categories and features are numbered in the order they appear on the Teleray screen (and the order they appear on the following page top to bottom). Example: ESC [3; 7 space v locks the Screen Saver feature (in the Application Controls category). ESC [1; 6 space u unlocks the inverse video features (in the Ergonometric Controls category). If a parameter of 0 (zero) or if no parameter is given, the entire category will be locked or unlocked.

The selections available in each category are described in the appropriate operations section. The figure on the following page will assist in identifying the categories and locating these sections, and contains blanks for recording your settings.

◆▮▮▮▮▮▮	1 ERGONOMETRIC CONTROLS	◆▮▮▮▮▮▮▮▮▮	1	Brightness_____
		▮◆▮▮▮▮▮▮▮	2	Scroll Type_____
		▮▮◆▮▮▮▮▮▮	3	Scroll Rate _____
		▮▮▮◆▮▮▮▮▮	4	Keyboard Auto Repeat_____
		▮▮▮▮◆▮▮▮▮	5	Auto Repeat Rate_____
		▮▮▮▮▮◆▮▮▮	6	Inverse Video_____
		▮▮▮▮▮▮◆▮▮	7	Margin Bell Column_____
		▮▮▮▮▮▮▮◆▮	8	Cursor Blink_____
		▮▮▮▮▮▮▮▮◆	9	Cursor Character_____
		▮▮▮▮▮▮▮▮▮◆	10	Keyclick_____

▮◆▮▮▮▮▮	2 MEMORY STRUCTURE	◆▮▮▮▮▮▮▮▮▮	1	Tab Column_____
		▮◆▮▮▮▮▮▮▮	2	Left Margin Column_____
		▮▮◆▮▮▮▮▮▮	3	Right Margin Column_____
		▮▮▮◆▮▮▮▮▮	4	Left Margin Wrap_____
		▮▮▮▮◆▮▮▮▮	5	Right Margin Wrap_____
		▮▮▮▮▮◆▮▮▮	6	Scrolling_____
		▮▮▮▮▮▮◆▮▮	7	Page Advance_____
		▮▮▮▮▮▮▮◆▮	8	Characters Per Line_____
		▮▮▮▮▮▮▮▮◆	9	Lines Per Page_____
		▮▮▮▮▮▮▮▮▮◆	10	Number of Pages_____

▮▮◆▮▮▮▮	3 APPLICATION CONTROLS	◆▮▮▮▮▮▮▮▮▮	1	Monitor Mode_____
		▮◆▮▮▮▮▮▮▮	2	Set Hours_____
		▮▮◆▮▮▮▮▮▮	3	Set Minutes_____
		▮▮▮◆▮▮▮▮▮	4	New Line_____
		▮▮▮▮◆▮▮▮▮	5	Function Loading_____
		▮▮▮▮▮◆▮▮▮	6	Screen Refresh Rate_____
		▮▮▮▮▮▮◆▮▮	7	Screen Saver_____
		▮▮▮▮▮▮▮◆▮	8	Answerback_____
		▮▮▮▮▮▮▮▮◆	9	Terminal Identity_____
		▮▮▮▮▮▮▮▮▮◆	10	Selection Menu_____

▮▮▮◆▮▮▮	4 COMMUNICATIONS FORMAT	◆▮▮▮▮▮▮▮	1	Serial Baud Rate_____
		▮◆▮▮▮▮▮▮	2	Serial Parity Type_____
		▮▮◆▮▮▮▮▮	3	Serial Parity Check_____
		▮▮▮◆▮▮▮▮	4	Serial Duplex _____
		▮▮▮▮◆▮▮▮	5	Prphl Baud Rate_____
		▮▮▮▮▮◆▮▮	6	Prphl Parity Type_____
		▮▮▮▮▮▮◆▮	7	Prphl Parity Check_____
		▮▮▮▮▮▮▮◆	8	Prphl Duplex_____

▮▮▮▮◆▮▮	5 DATA FLOW CONTROLS	◆▮▮▮▮▮▮▮▮	1	Local/Remote_____
		▮◆▮▮▮▮▮▮▮	2	Block/Character_____
		▮▮◆▮▮▮▮▮▮	3	Serial Copy_____
		▮▮▮◆▮▮▮▮▮	4	Serial Suspend-Resume_____
		▮▮▮▮◆▮▮▮▮	5	Serial Local Echo_____
		▮▮▮▮▮◆▮▮▮	6	Prphl Copy_____
		▮▮▮▮▮▮◆▮▮	7	Prphl Suspend-Resume_____
		▮▮▮▮▮▮▮◆▮	8	Prphl Busy-Ready_____
		▮▮▮▮▮▮▮▮◆	9	Prphl Busy-Ready Level _____

▮▮▮▮▮◆▮	6 BLOCK TRANSMIT FORMAT	◆▮▮▮▮▮▮▮▮	1	Transmit _____
		▮◆▮▮▮▮▮▮▮	2	Transmit to Cursor_____
		▮▮◆▮▮▮▮▮▮	3	Transmit Guarded_____
		▮▮▮◆▮▮▮▮▮	4	End of Line Suspend_____
		▮▮▮▮◆▮▮▮▮	5	Serial Space Suppression_____
		▮▮▮▮▮◆▮▮▮	6	Serial Space Substitution____
		▮▮▮▮▮▮◆▮▮	7	Prphl EOL Suspend_____
		▮▮▮▮▮▮▮◆▮	8	Prphl Space Suppression_____
		▮▮▮▮▮▮▮▮◆	9	Prphl Space Substitution____

▮▮▮▮▮▮◆	7 TRANSMIT TERMINATORS	◆▮▮▮▮▮▮▮▮▮	1	Serial Start of Transmit Code_____
		▮◆▮▮▮▮▮▮▮	2	Serial Guarded Field Code_____
		▮▮◆▮▮▮▮▮▮	3	Serial End of Line Code _____
		▮▮▮◆▮▮▮▮▮	4	Serial End of Page Code___
		▮▮▮▮◆▮▮▮▮	5	Serial End of Transmit Code_____
		▮▮▮▮▮◆▮▮▮	6	Prphl Start of Transmit Code_____
		▮▮▮▮▮▮◆▮▮	7	Prphl Guarded Field Code_____
		▮▮▮▮▮▮▮◆▮	8	Prphl End of Line Code_____
		▮▮▮▮▮▮▮▮◆	9	Prphl End of Page Code_____
		▮▮▮▮▮▮▮▮▮◆	10	Prphl End of Transmit Code_____

Figure 4-1: Selection Menu

SECTION 5
OPERATIONS

5-1 Ergonometric Controls

These controls are provided to increase operator comfort. All of the features can be changed in the Teleray Selection Menu and are immediately stored in non-volatile memory.

A. Display Features

Screen Brightness Level	ESC [P_n space s
Cursor Character Select	ESC [P_s space q
Cursor Character Blink/Steady	ESC [? 33 h / ESC [? 33 ℓ
Screen Background Dark/Light	ESC [? 5 ℓ/ ESC [? 5 h
Smooth Scroll/Jump Scroll	ESC [? 3 h / ESC [? 3ℓ
Scroll Rate 6/12	ESC [? 22 ℓ/ ESC [? 22 h

The ↑ and ↓ keys will increase and decrease, respectively, the screen brightness in the Selection Menu; the ESCape sequence shown can be used to set the brightness to any absolute value between 0 and 64; 0 is off, 64 is fully bright.

The cursor character can be selected from any character in the Teleray repertoire. Figure 5-1 lists all possible values for these (decimal) parameters. Other language versions of the Teleray have the same character substitutions in this table as in the ASCII set. The cursor character will blink once per second when the cursor blink feature is selected. If the steady cursor is selected, it will only blink when it is placed over a "non-space" character.

	0 THRU 19	20 THRU 39	40 THRU 59	60 THRU 79	80 THRU 99	100 THRU 119	120 THRU 139	140 THRU 159	160 THRU 179	180 THRU 199	200 THRU 219	220 THRU 239	240 THRU 255
0	Nu	D4	(	<	P	d	×	Ω					
1	Sh	Nk	)	=	Q	e	y	Θ					
2	Sx	Sy	*	>	R	f	z	µ					
3	Ex	Eb	+	?	S	g	{	π					
4	Et	Cn	,	@	T	h	¦	♥					
5	Eq	Em	−	A	U	i	}	♦		∘			
6	Ak	Sb	.	B	V	j	⌐	♣		↑			
7	Bl	Ec	/	C	W	k	■	♠		←			
8	Bs	Fs	0	D	X	l	2	¶		↓			
9	Ht	Gs	1	E	Y	m	3	§		→			
10	Lf	Rs	2	F	Z	n	x	©					
11	Vt	Us	3	G	[	o	÷	TM					
12	Ff		4	H	\	p	°	½					
13	Cr	!	5	I	]	q	±	¼					
14	So	"	6	J	^	r	≤	⊙					
15	Si	#	7	K	_	s	≥	↑					
16	Dl	$	8	L	`	t	≠	√					
17	D1	%	9	M	a	u	∞	¢					
18	D2	&	:	N	b	v	Σ	∮					
19	D3	'	;	O	c	w	∫	♪					

Figure 5-1: Decimal Character Selection Table

5-1

The screen background dark/light feature allows the normal screen mode to be either light characters on a dark background or dark characters on a light background. The "inverse" text presentation format selection will reverse the background of the appropriate field.

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 or display memory. 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 eliminated 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 two vertical smooth scroll rates: 6 or 12 lines of data per second may be selected. The Teleray employs smooth horizontal scrolling to keep the cursor in view when operating with logical line lengths greater than 80 characters per line. The 24 line by 80 character display window can be "panned" smoothly through the display memory.

The Auto Suspend/Resume feature should be enabled and supported by the host computer to ensure that data is not lost when Smooth Scroll mode is enabled. If data is transmitted to the Teleray faster than allowed by the selected smooth scroll rate, the Teleray will automatically revoke smooth scroll when incipient input buffer overrun is sensed and will momentarily enter Jump Scroll mode. The Teleray will remain in Jump Scroll mode until the input buffer is emptied to a safe level. The Smooth/Jump Scroll menu selection is not affected by this automatic operation. See Section 5-5-B.

B.   Keyboard Features

Auto Repeat On/Off   ESC [? 8 h / ESC [? 8ℓ
Auto Key Repeat Rate 30/15 cps   ESC [? 21 ℓ/ ESC [? 21 h
Keyclick On/Off   ESC [? 28 h / ESC [? 28ℓ
Right Margin Bell Column   ESC [P_n space r

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.

The repeat rate feature can be selected to 15 characters per second or 30 characters per second. 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.

The margin bell feature is much the same as the bell in a typewriter. When the cursor enters the column eight characters from the end of the current logical line while typing, the Teleray sounds a tone to alert the operator. The column in which the bell is sounded can be selected in the Menu or by ESCape sequence. The numeric parameter in the ESCape sequence is the number of characters from the end of the current logical line right margin in which the bell will be sounded.

5-2 Memory Structure

The Teleray Model 16 display memory can be user-configured into the organization best suited for the application. Teleray's memory structure is configured by resetting the logical line length, the logical page length, and the number of pages. If the 4-page or 8-page non-volatile memory options are installed, memory not desired as display memory can be allocated as non-volatile dynamic program function memory; the logical line length, logical page length, and the number of pages to be used as display memory are user-specified. The remaining memory will be used as non-volatile dynamic program memory. Excess volatile memory cannot be used as non-volatile dynamic program function memory.

The display and optional non-volatile function memory is cleared when the memory structure is modified.

A. Tab Operations

Cursor to Next Tab Stop	HT
Set Tab Stop in Current Column	ESC H
Clear Tab Stop in Current Column	ESC [g
Clear All Tab Stops	ESC [3 g
Back P_n Tab Stops	ESC [P_n Z

Just like a typewriter, the Teleray Model 16 can tab (jump) to preselected points on a line. These tab stops may be individually changed, or totally cleared and then individually set. Columnar tab stops apply to all lines in the page. Default stops are preset in Columns 1, 9, 17, 25, 33, 41...(every eight columns to the end of the logical line). If all columnar tab stops are cleared, a columnar tab stop is implied in Column 1. In Protect mode, implicit tab stops are set at the beginning of every unprotected area; columnar tab stops do not operate in Protect mode.

The Selection Menu provides a convenient method for operator selection of columnar tab stops. A dim inverse field is presented with a single bright character indicating the current tab stop entry position. The column number of this entry position is indicated; tab stops in the dim field are indicated by a "T". The operator can add tab stops with the unshifted ↑ key and may delete them with the unshifted ↓ key. The shifted ↑ and ↓ keys will move the field through the logical line.

B. Line Length

Logical Line Length - Default 80 characters per line. Saved in non-volatile memory, changed in the Selection Menu or by ESC [P_n ? q.

Set Left; Right Margins - Defaults: left-column 1; right-column 80. Changed in the Selection Menu or by ESC [P_n; P_n s.

The logical line length can be reset to any integer number from 20 through 255 inclusive. The display line length is fixed at 80 columns; line lengths shorter than 80 columns will appear left justified with unused character positions on the right automatically blanked. If more than 80 characters is selected as the logical line length, smooth horizontal scrolls will automatically keep the cursor in view. This operation can be further controlled or restricted by setting left or right margins. All operations that reference a horizontal line position will reference the logical line length, not the 80-character physical display line length.

C. Page Length

Logical Page Length - Default: 24 lines per page. Saved in non-volatile memory, changed in the Selection Menu or by ESC [P_n ? p

Set Top; Bottom Margins - Default: Line 1; last line in page. Changed by ESC [P_n; P_n r

The logical page length can be reset to any integer value from 4 to 255 inclusive; however, it cannot be set to a number that would exceed the memory capacity of the Teleray. If this is attempted, the Teleray will automatically reset the logical page length to the maximum allowed by the memory available. The display line length is fixed at 24 lines. The top and bottom margins override the page size setting and can be used to form display windows which do not affect the organization of the remainder of the display memory. More than 24 lines are useful for forms that occupy more than a single display page. A single very long page length is important in Character (non-block) mode applications involving searching or editing computer files. Page lengths less than 24 may be used to form "scrolling windows" within the display page, or may be used to format data or text blocks into segments forming complete application records, forms, or files.

D. Number of Pages

Select P_n Pages - Default 4 pages. Saved in non-volatile memory, changed in the Selection Menu or by ESC [P_n space p.

The number of pages can be reset to any integer number from 1 through 255 inclusive; however, it cannot be set to a number that would exceed the memory capacity of the Teleray. If this is attempted, the Teleray will automatically reset the number of pages to the maximum allowed by the memory available. Figure 5-2 illustrates the number of lines available with various characters per line sizes. The ▨ shaded area in the figure represents the display of the Teleray; the ▨ shaded area represents the default memory structure. The number of pages available in the machine is computed from the number of lines available less the amount of memory reserved for additional non-volatile function memory (only if an option is installed) divided by the logical page size. Formulas for memory structure and examples are on the following page.
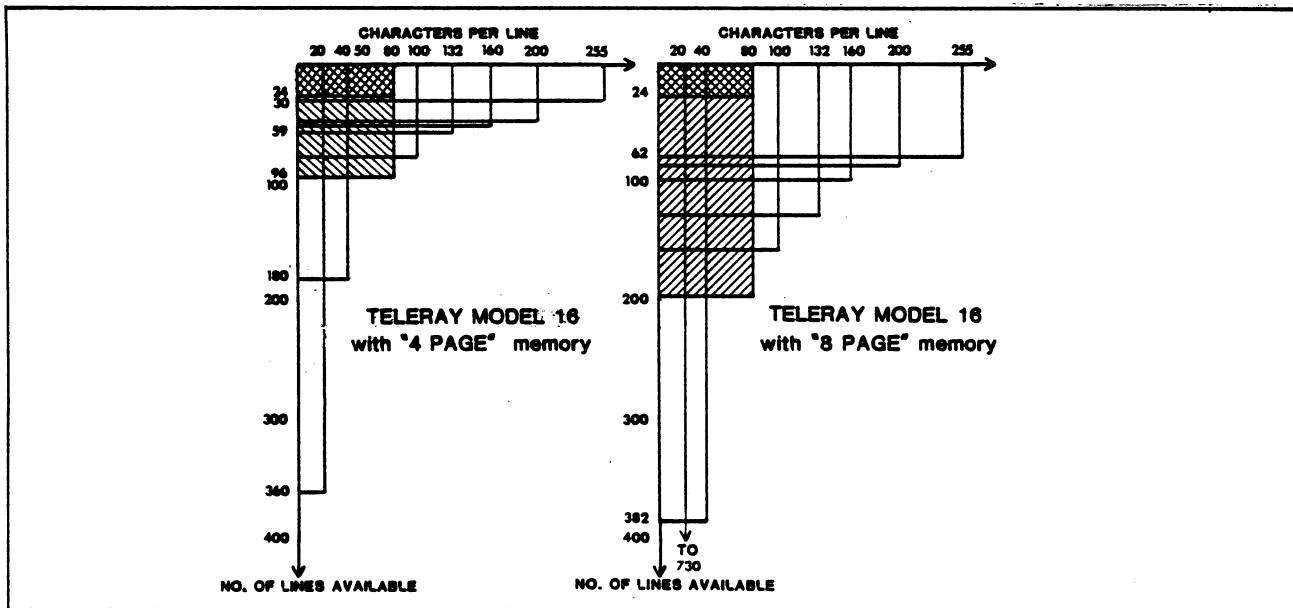

Figure 5-2: Teleray Available Memory

Memory Available: 4-page machine – 15,744 characters
                                     8-page machine – 32,128 characters

```
Formulas

M = Memory Available - R

      M
N = ------
    2L + 4

     N
P = ---
     Q


Note:  Discard all fractions; partial
lines or pages are not usable except
as function memory.
```

```
Legend

Memory usable = M
Memory reserved for function memory = R
Logical line length = L
Number of lines available = N
Number of pages = P
Logical Page Length = Q
```

Example 1

4-page Teleray
Zero characters reserved for
function memory.

$$M = 15,744 - 0 = 15,744$$

Logical line length = 160 characters

No. of lines available $N = \dfrac{15,744}{2 \cdot 160 + 4}$

$$N = 48 \text{ (discard fraction)}$$

24 lines per page.
Number of pages P = 2 (no fraction)

Table 5-1: Number of Lines & 24-Line Pages Available
at Selected Logical Line Lengths

Characters Per Line	No. of Lines		No. of 24-Line Pages	
	4-Page Teleray	8-Page Teleray	4-Page Teleray	8-Page Teleray
20	360	730	15	30
40	180	382	7	15
72	106	217	4	9
80	96	195	4	8
100	77	157	3	6
132	59	128	2	5
160	48	99	2	4
200	38	79	1	3
255	30	62	1	2

Example 2

8-page Teleray
4000 characters reserved for function
memory.

$$M = 32,128 - 4000 = 28,128$$

Logical line length = 40 characters

No. of lines available $N = \dfrac{28,128}{2 \cdot 40 + 4}$

$$N = 334 \text{ (discard fraction)}$$

24 lines per page.
Number of pages P = 13, fraction .952.
This fraction can be used as additional
function memory for 4000 + .952 x 24 x 40 =
4,914 characters total.

Example 3

8-page Teleray
Zero characters reserved for function
memory.

$$M = 32,128 - 0 = 32,128$$

Logical line length = 132 characters

No. of lines available $N = \dfrac{32,128}{2 \cdot 132 + 4}$

$$N = 119$$

Set machine for 119 lines per page to
organize machine as a 119-line scrolling
machine.

E.   **Margin Wraps**

Right Margin Wrap On/Off – Default OFF. Saved in non-volatile memory, changed in the Selection Menu or ESC [? 7 h / ESC [? 7 𝓁.

Left Margin Wrap On/Off – Default OFF. Saved in non-volatile memory, changed in the Selection Menu or by ESC [? 29 h / ESC [? 29 𝓁.

If left margin wrap is ON and a backspace function is initiated from Column 1, the cursor will move to the last column in the preceding logical line. Smooth horizontal scrolls will be initiated if necessary to keep the cursor visible. A backspace initiated in the left margin wrap OFF mode will be ignored. Right margin wraps operate analogously and will be initiated by data or space entry. A wrap is not performed on the cursor right function. If a left wrap is initiated from the Home (top left) position of the current display page or if a right wrap is initiated from the bottom line rightmost position of the logical lines, the actions taken will depend on the condition of the Scrolling On/Off and Page Stop/Page Auto Advance modes described below.

F.   **Scrolling**

Scrolling Off/On – Default OFF. Saved in non-volatile memory, changed in the Selection Menu or by ESC [? 30 𝓁/ ESC [? 30 h.

Page Stop/Page Auto Advance – Default page stop. Saved in non-volatile memory, changed in the Selection Menu or by ESC [? 31𝓁 / ESC [? 31 h.

These two controls affect how the Teleray will act when an attempt is made to position the cursor beyond a page boundary using an Index or Reverse Index command, or if an attempt is caused by the implicit cursor movement associated with character entry.

Scrolling	Page	Action Taken
On	Stop	Scrolls occur within current page
On	Auto Advance	Scrolls occur in all display memory pages
Off	Stop	Overwrite within current pages
Off	Auto Advance	Automatically "flip" into next page in the display memory

The cursor will not move backward (no action will be taken) beyond the first character of the first page of memory, nor will it move forward beyond the last character of the last page of memory. These controls do not affect the operation of Next Page or Previous Page. Scrolling is automatically set OFF (without affecting non-volatile memory) when Protect mode is invoked; the mode will be set to its non-volatile memory condition when Protect mode is revoked. To scroll all of memory from the bottom page, memory must be organized as a single long page. Scrolling must be on, and the Teleray must be in Page Advance mode.

G.   **Interactions of Margins and Pages** (see also 5-9)

Memory pages are a convenient way to organize the Teleray's memory if the application requires using forms of a specific length (one page per form) or if most records are of a fixed length. Changing the memory logical line or logical page length erases the display memory because it involves reformatting the entire display memory.

If the Teleray is to be used in a bottom line entry interactive environment, it is usually advisable to set the machine for one display page with scrolling and advance on. This allows scrolls to occur throughout memory. Alternatively, setting the page length to 24 lines will allow fast searching of the Teleray display using the previous page and next page operations; macro keys can be programmed for that purpose.

Top and bottom margins are used to restrict scrolling or data entry to a specific area within a page. This is particularly useful when a presentation format surrounding an operator entry area exceeds one line; if a single line of format is sufficient, use of the bottom message line is recommended. The margin settings must not exceed the display page, and they may not overlap a page boundary.
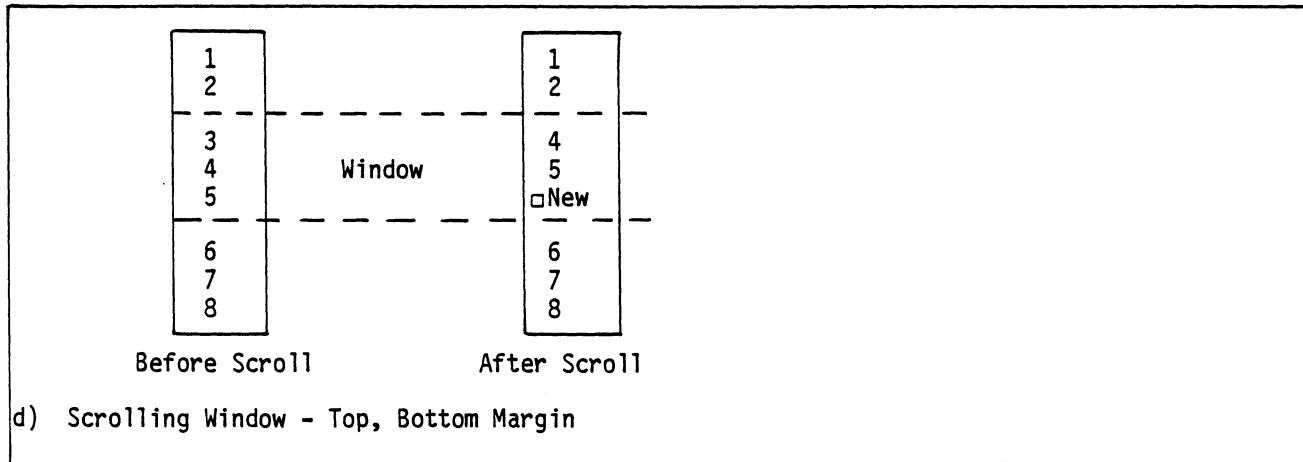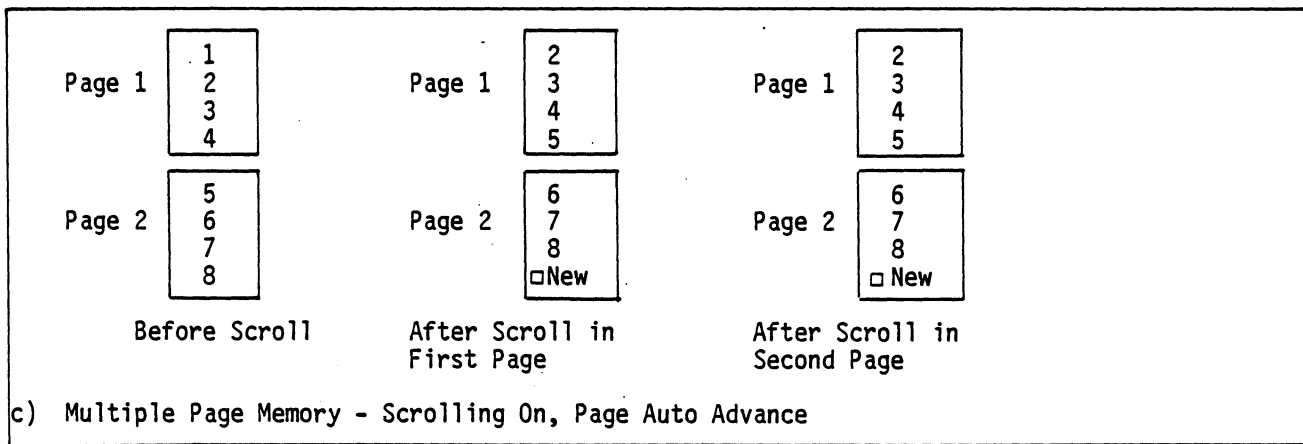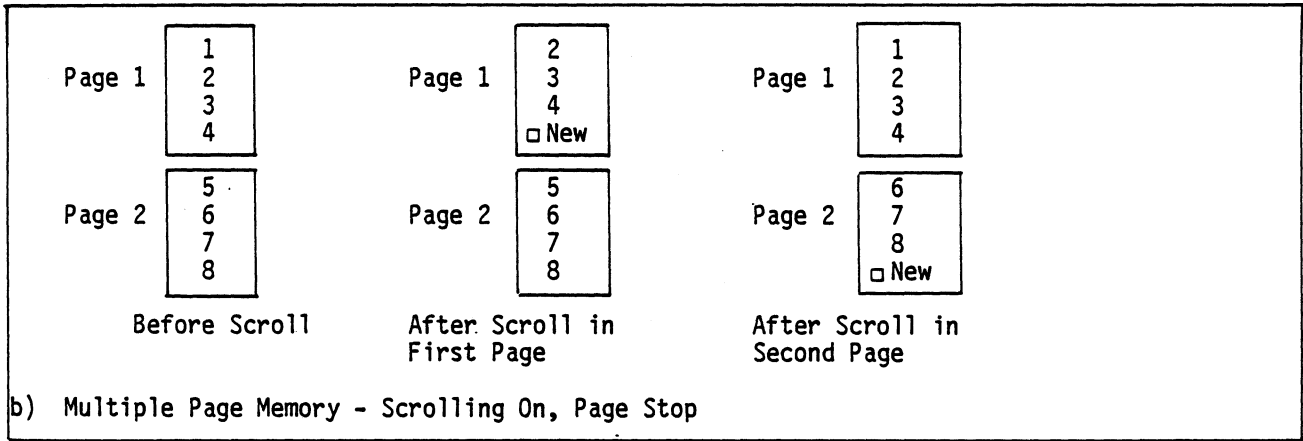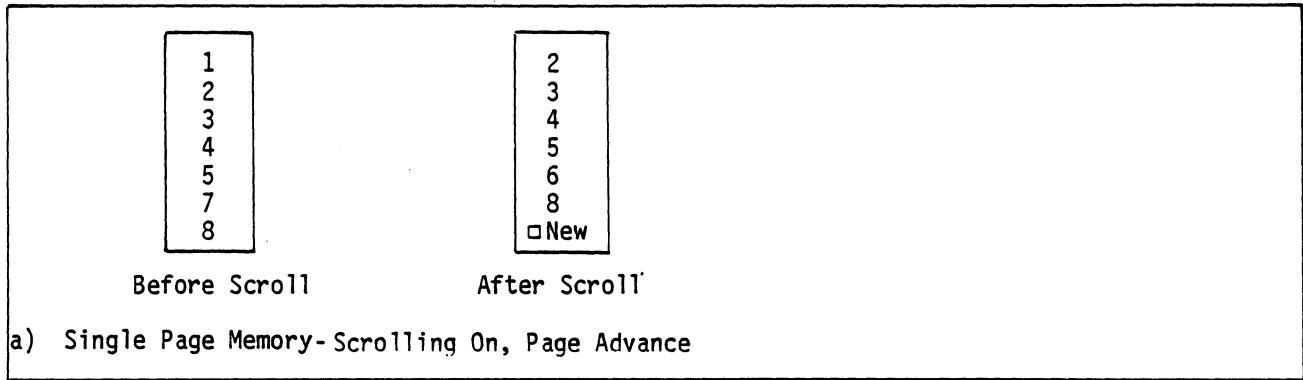
```
        1                    2
        2                    3
        3                    4
        4                    5
        5                    6
        7                    8
        8                 □ New

   Before Scroll        After Scroll
```

a) Single Page Memory- Scrolling On, Page Advance

```
           1              2              1
Page 1     2      Page 1  3      Page 1  2
           3              4              3
           4           □ New             4

           5              5              6
Page 2     6      Page 2  6     Page 2   7
           7              7              8
           8              8           □ New

    Before Scroll    After Scroll in    After Scroll in
                     First Page         Second Page
```

b) Multiple Page Memory - Scrolling On, Page Stop

```
           1              2              2
Page 1     2      Page 1  3      Page 1  3
           3              4              4
           4              5              5

           5              6              6
Page 2     6      Page 2  7     Page 2   7
           7              8              8
           8           □New            □ New

    Before Scroll    After Scroll in    After Scroll in
                     First Page         Second Page
```

c) Multiple Page Memory - Scrolling On, Page Auto Advance

```
        1                    1
        2                    2
    - - - - - - - - -    - - - - - - - - -
        3                    4
        4      Window         5
        5                  □New
    - - - - - - - - -    - - - - - - - - -
        6                    6
        7                    7
        8                    8

   Before Scroll        After Scroll
```

d) Scrolling Window - Top, Bottom Margin

Figure 5-3: Scrolling Page/Margin Interactions

THIS PAGE INTENTIONALLY LEFT BLANK

5-3   Application Controls, Operator Alerts, and Bottom Line Displays

A.   Application Controls

Monitor Mode/Normal	ESC [3 h / ESC [3 ℓ
New Line Mode/Line Feed	ESC [20 h / ESC [20 ℓ
50/60 Hz Refresh Rate	ESC [? 34 h / ESC [? 34ℓ
Screen Saver On/Off	ESC [? 32 h / ESC [? 32 ℓ
Selection Menu Line/Page	ESC [? 50 ℓ/ ESC [? 50 h

When the Teleray is placed in Monitor mode, all control characters including Escape, NUL, 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 allows display entry of control characters, which can also be used to view a programmed function. In Monitor mode, the Teleray automatically wraps on the right margin.

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 selected, 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 line feed feature is selected, 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.

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. This selection also changes the number of lines presented on the optional composite video signal to remain compatible with television systems in countries where the television signals are based on 50 Hz refresh rates.

If Screen Saver is enabled, 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. The SHIFT keyboard key can be used to restore the screen without affecting the Teleray memory. This feature can be enabled or disabled in the Selection Menu.

The Selection Menu form can be used in one of two ways, as a full-page (66 lines) menu or sequentially as a single selection line on the terminal's bottom (25th) line. The choice of page selection or line selection menus can be made by ESCape sequence or within each menu. When the Selection Menu is changed, the new menu will appear on the Teleray display as soon as any key is struck. Changing the menu from single line to full page will erase the Teleray display memory.

B.   Operator Alerts

Sound Bell	Bel
Keyboard Lock/Unlock	ESC [2 h / ESC [2 ℓ
Illuminate/Extinguish LEDs	ESC [P_s; P_s;...P_sq

The bell tone is produced upon receipt of the ASCII BEL code. A queue of eight characters is used to ensure that closely spaced bell commands are not lost. The bell is also used to generate the audible keyclick, which can be selected in the feature menu; a bell tone may also be produced by entering data eight columns from the right margin. 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.

With keyboard action locked, all keyboard characters typed are lost except for STATUS. Entering and exiting STATUS will clear the keyboard locked condition.

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 a Suspend to the terminal.

Whenever the On Line, Local and Keyboard Lock feature selections are changed, the appropriate LED will be placed in the proper condition. It is strongly recommended that the host computer not interfere with this operation by attempting reprogramming of these three LEDs except for diagnostic uses.

P_s	LED Action
0 or none	All off
1	L1 on
2	L2 on
3	L3 on
4	L4 on
5	On Line on
6	Local on
7	Keyboard Locked on

C. **Bottom Line (25th Line)**

1. General Information

In addition to the 24 display lines used for application information, the Teleray has a 25th line presented below the 24th. Table 5-2 shows the displays that can be presented and shows how to access them.

Table 5-2: Bottom Line Displays

Title	Access By
Teleray Status Line	ESCape sequence or STATUS key
Calculator Line	ESCape sequence or SHIFT and numeric keys
Message Line	STATUS key if "MSG" indicator is on the bottom line
Self Test Result Line	Automatic on completion of self test
Line Selection Menu	SHIFT and STATUS key
Page Selection Menu Prompts	SHIFT and STATUS key
No Display	ESCape sequence or retyping request for current display

Each of these display lines, except for Self Test Result, is also stored in the Teleray's memory. When these lines are requested by the operator or by ESCape sequence, their previous contents will be displayed on the status line. This means that if the computer sends a message to the status line and the operator is using it for another display, the current contents of the display line will not be lost. However, self test values are not saved, nor are previous host computer messages.

An ESC [space w sequence can be used to turn off, or blank, the current bottom display line. If the display line is turned off, the message indicator will still appear. If the bottom line is being used to display the terminal status, calculator mode, single line setup mode, or self test display, and if any other mode is requested, the new operation will have precedence.

2. Status Line - On: ESC [? 27 h   Off: ESC [? 27ℓ

This line displays the current status of the terminal. The clock, cursor column, cursor line number, and cursor page number are displayed, and the state of the copy-on-line and Protect mode features is indicated. A special field will indicate if an incorrect data entry is attempted in a field that has a special attribute, such as alphanumeric only, numeric only, must fill, etc.

3. Calculator Line - On: ESC [? 26 h   Off: ESC [? 26 ℓ

The calculator line is enabled by pressing the SHIFT and the numeric keypad PERIOD "." symbol; this key is reverse legended CAL. In Calculator mode, the numeric keypad keys are specially interpreted to perform the operations indicated by the reverse background legends shown on the keytops and in the figure below. MS performs a memory save operation; MR performs memory recall. The shifted = key will clear the current operand. The memory is cleared by storing zero. The shifted +, - keys will change the sign of the current operand.

These keys do not transmit ASCII sequences but are used to control the calculator built into the Teleray, which uses the bottom line to indicate current operations and totals. The remainder of the terminal remains active, and the display memory contents will not be disturbed by using the calculator line. When entering or leaving calculator line mode, the current contents of the calculation will not be lost. Any intermediate operations that have been partially entered but are not yet complete will be lost, but the total and the memory will be saved. The calculations are 10-digit full floating point.
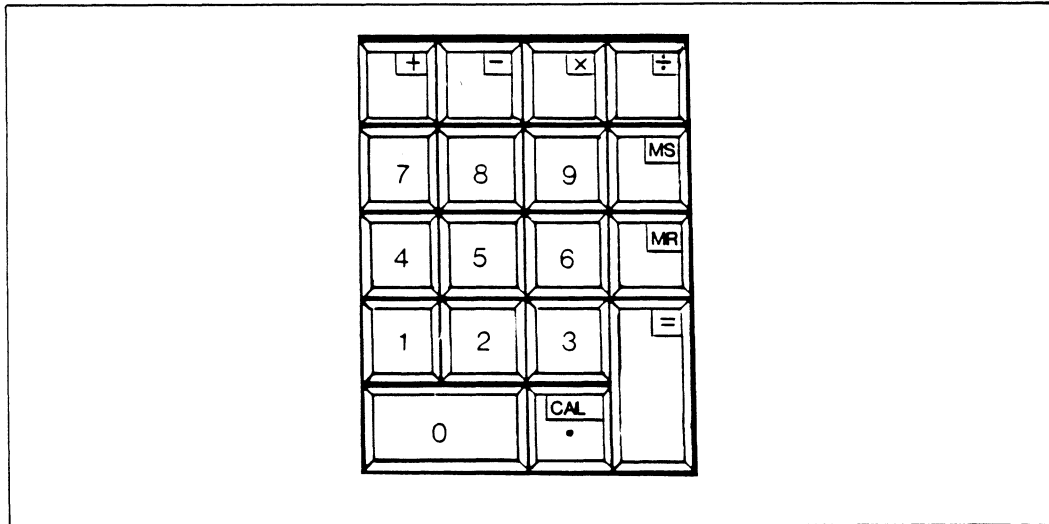
Figure 5-4: Calculator Keypad

4. Message Line - ESC P M text ESC \

When a text message is sent from the host computer, it is not immediately displayed. Instead, a small message indicator appears on the far right-hand side of the Teleray's bottom line. This message will appear regardless of what the bottom line is currently being used for. If the message indicator is being displayed, pressing the upper left keyboard key labeled STATUS will store the current bottom display line and place the computer message on the bottom line. If a message is being displayed and the Teleray receives another message, the second message will be immediately displayed. The maximum text message accepted by Teleray is 80 characters of displayable text. Attributes may not be used on the message line. The No Display escape sequence (ESC [space w) will clear the current message line.

5. Self Test Result Line

The Teleray bottom line is used to store the self test result. This line will be automatically written following the automatic self testing performed during the power-up sequence, following a reset to initial state sequence, following a reset to default sequence, or following completion of a host computer or operator-directed self test sequence. These directed tests are invoked by ESCape sequences (see Section 5-11, Tests, Reports, and Messages). The self test result is displayed in the following format from left to right.

ROM	Read Only Memory Test
DSP	Display Memory Test
KBD	Keyboard Test
SIO	Serial Input/Output Test
PIO	Peripheral Input/Output Test
NVM	Non-Volatile Memory Test

Following these 1-character test reports (1 = Pass; 0 = Failed) will be a code that indicates the current Teleray program revision level, a copyright indicator, followed by the name TELERAY. When the self test is transmitted to the computer, only the display up to but not including the copyright indicator will be transmitted.
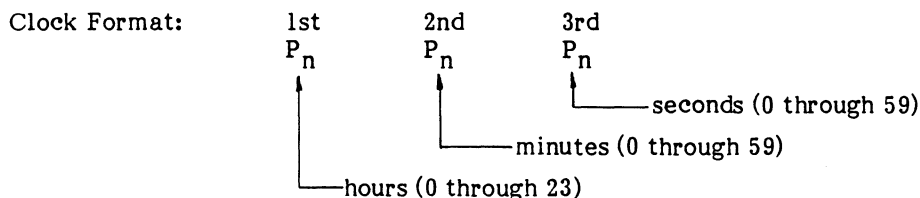
D. **Lock/Unlock Selection Features**

Lock Selection - ESC [P_n; P_n space v
Unlock Selection - ESC [P_n; P_n space u

Each category and feature can be locked against manual intervention by the keyboard. ESCape sequences keyed on the keyboard will unlock the appropriate feature. If a category or feature is locked, it will still be displayed; the diamond or rectangle graphically representing its position in the menu will be displayed dim. The category and feature prompts will still be displayed and the selection description displayed.

E. **Clock**

Set Clock Time   ESC [P_n; P_n; P_n ? s
Request Time   ESC [? 7n
Report Clock Time   ESC [P_n; P_n; P_n ? r
Delay Next Operation   ESC [P_n; P_n; space t

The Teleray contains a crystal controlled clock. This clock can be written or read by the computer and by the operator. The clock is displayed on the status line.

Clock Format: 1st   2nd   3rd
                   P_n P_n P_n

└──────seconds (0 through 59)

└──────minutes (0 through 59)

└──────hours (0 through 23)

Status display is a 12-hour clock (no AM, PM)
Computer clock is a 24-hour clock, military time format
(e.g., 14 = 2 PM, 2 = 2 AM, etc.)

The clock can also be used to inhibit Teleray operations for specific periods of time. The delay format is: first P_n in seconds 0 through 59, second P_n in tenths of seconds. During the delay interval, data is accepted into the input buffers, but is not processed. The keyboard is locked during the delay interval. The delay is useful in conjunction with the operator alerts and is useful for performing rudimentary animation with the graphic character set.

Multiple uses of this ESCape sequence in succession can be used to obtain virtually any desired time delay.

Note that while a delay is in effect the cursor disappears from the screen, the keyboard is locked, and the passing of data from the communications interfaces to the display memory is inhibited.

F. **Answerback and Identity Messages**

Program Identity Sequence   ESC P I text ESC \
Request Identity Sequence   ESC [c
Response to Identity Sequence   text, default is ESC [? 1; 2 c
Program Answerback   ESC P A text ESC\
Request Answerback   ENQ
Response to Answerback Request   text, default is TELERAY

Answerback and Identity are question and answer sequences used by the host computer to identify or locate the Teleray. These messages may contain a maximum of 20 characters. These sequences may be viewed in the Selection Menu, but may only be changed via ESCape sequences. Also see Section 5-11-C, Reports.

G. **Function Loading Interpreted/Transparent** - ESC [? 23 ℓ / ESC [? 23 h

As Dynamic Programmable Functions are being loaded, the data and control sequences being loaded into the DPF may be either ignored (transparent) or interpreted (executed). See Sections 5-7-B and 5-7-C for detailed information on the DPFs.

5-4 Communications Format

A. Asynchronous Character Format

The Teleray can be configured to operate with computers requiring odd, even, or mark parity. These modes must be set to match the computer with which the Teleray will be communicating. Figure 5-5, Asynchronous Character Format, describes the data format.
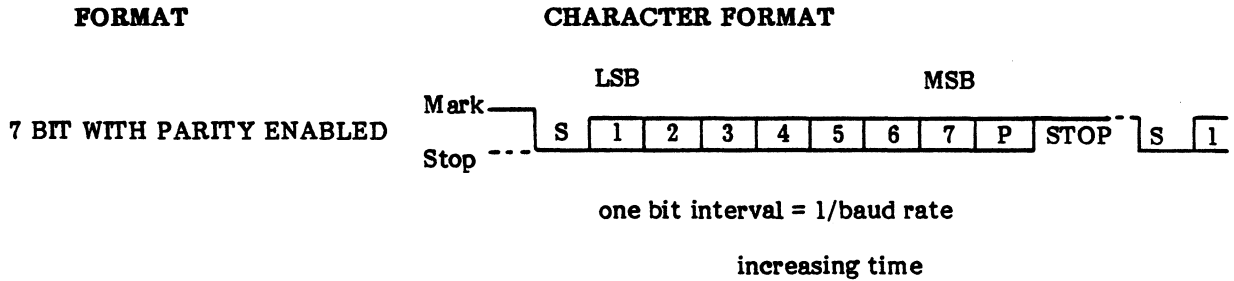
FORMAT   **CHARACTER FORMAT**

LSB   MSB

7 BIT WITH PARITY ENABLED

Mark ─
Stop --- | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | P | STOP | S | 1 |

one bit interval = 1/baud rate

increasing time

Figure 5-5 - Asynchronous Character Format

B. Baud Rates

Set Baud Rates   ESC [P_S; P_S ?

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, 150 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600 and 19,200 baud.

The receive baud rate is automatically set to the transmit baud rate; the terminal may not receive data at one baud rate and transmit data at a different baud rate.

The baud rates can be changed in the feature Selection Menu or by ESCape sequence. If the Teleray and computer baud rates are mismatched, the Teleray will not recognize a command to change baud rates, but the ESCape sequences can be used to achieve a host computer coordinated change.

The first P_S selects for serial port; second P_S selects for peripheral port.

P_S	Baud Rate	P_S	Baud Rate
0 (or none)	2400	8	1200
1	50	9	1800
2	75	10	2400
3	110	11	3600
4	134.5	12	4800
5	150	13	7200
6	300	14	9600
7	600	15	19200

C. Parity

Set Parity	ESC [P_s; P_s ? $\sim$
Serial I/O Parity Check/None	ESC [? 37 ℓ / ESC [? 37 h
Peripheral I/O Parity Check/None	ESC [? 45 ℓ / ESC [? 45 h

The parity settings can be likewise changed. If the parity check is enabled, characters received by the Teleray will be tested for correct parity. An ASCII SUB character (displayed as S_B) will be substituted for any character found to be in error. The serial port and peripheral port can have different parity settings. Data sent into the Teleray's peripheral port which is destined for the host computer, and data sent into the Teleray's serial port which is destined for the peripheral port will have parity regenerated by the Teleray.

The first P_s selects for serial port; second P_s selects for peripheral port.

P_s	Parity Setting
0	None (8 bits mark parity)
1	Odd
2	Even
3	Mark
4	Space

D. Half Duplex/Full Duplex

Serial I/O Full Duplex/Half	ESC [? 36 ℓ/ ESC [? 36 h
Peripheral I/O Full Duplex/Half	ESC [? 44 ℓ/ ESC [? 44 h

These modes can be changed in the Selection Menu or by ESCape sequence. Full and Half Duplex are serial communication protocols. Full Duplex is normally used with Character mode transmission without a terminal supplied local echo. Half Duplex is normally used with Block mode transmission and will frequently require a terminal supplied local echo. See Data Flow Controls for these selections. Table 5-3 illustrates ·the interactions of Full and Half Duplex with Character-Block modes. Changing duplex modes do not affect Suspend-Resume or Local Echo modes.

Table 5-3: Serial I/O Protocol

(Also see Section 5-5, Data Flow Controls)

	ON-LINE-AND-FULL AND CHARACTER	ON-LINE FULL AND BLOCK	ON-LINE AND HALF AND CHARACTER	ON-LINE AND HALF AND BLOCK
DATA TERMINAL READY	ON (+12V)	ON (+12)	ON (+12)	ON (+12)
REQUEST TO SEND	Will be held on (+12V)	Will be held on (+12V)	On during execution of transmit functions; turned on when operator first types and held on until an LF or NL is typed.	On during execution of transmit functions only.
KEYBOARD DATA TO DISPLAY	NO	YES	Local echo controls	YES
SERIAL DATA INTO DISPLAY	Only if Carrier Detect is on (+12V)	Only if Carrier Detect is on (+12V)	Only if Carrier Detect is on (+12V)	Only if Carrier Detect is on (+12V)
SERIAL DATA OUT STATE	Mark unless Clear to Send is on (+12V) then: All keyed data. Displayed data also during execution of a transmit operation.	Mark unless Clear to Send is on (+12V) then: Mark except: display data during execution of a transmit operation.	Mark unless Clear to Send is on (+12V) then: All keyed data. Display data during a transmit operation.	Mark unless Clear to Send is on (+12V) then: Mark except: display data transmitted under control of the transmit operations.

THIS PAGE INTENTIONALLY LEFT BLANK

5-5   Data Flow Controls

A.   Data Routing

Local/Remote Mode	ESC [? 12 h / ESC [? 12 ℓ
Character/Block Mode	ESC [? 25 ℓ/ ESC [? 25 h
Copy Serial Input to Peripheral	
Copy Interpreted On/Off	ESC [? 7 i / ESC [? 6 i
Copy Transparent On/Off	ESC [5 i / ESC [4 i
Local Echo Serial Port Off/On	ESC [12 ℓ/ ESC [12 h
Copy Peripheral Input to Serial	
Copy Interpreted On/Off	ESC [? 9 i / ESC [? 8 i
Copy Transparent On/Off	ESC [7 i / ESC [6 i

In Character mode, each character code is transmitted individually as the appropriate data key is pressed; blocks may also be transmitted by pressing the transmit keys. In Block mode, keyed data goes directly to the Teleray display and can only be transmitted by the transmit functions.

The On-Line/Local selection 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 (unless the Teleray is also in Block mode). In the Local mode (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 always displayed on the screen directly.

Local/Remote and Character/Block selections apply only to keyboard data; the Copy Serial Input to Peripheral and Copy Peripheral Input to Serial selections are still relevant in all combinations of Local/Remote Character/Block.

Data flow control within the Teleray is described in Figure 5-6. This figure graphically illustrates the interactions of Local/Remote and Character/Block modes described above. Feature selections are provided to allow either port to be used to connect to a computer, printer, or magnetic storage device.
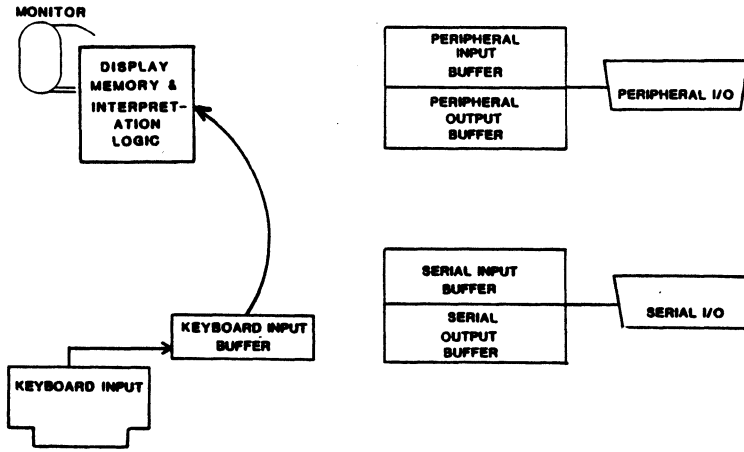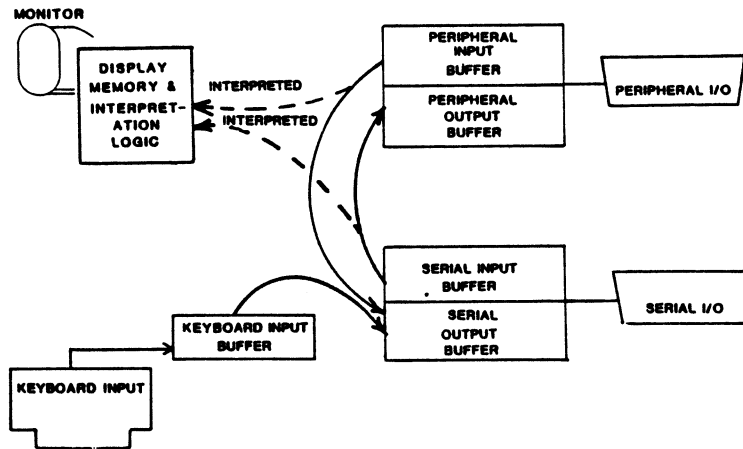
a) Local Mode (Copy Peripheral Off)
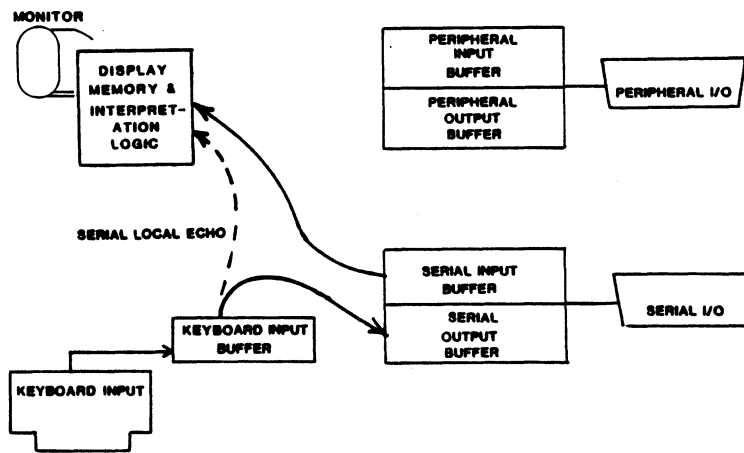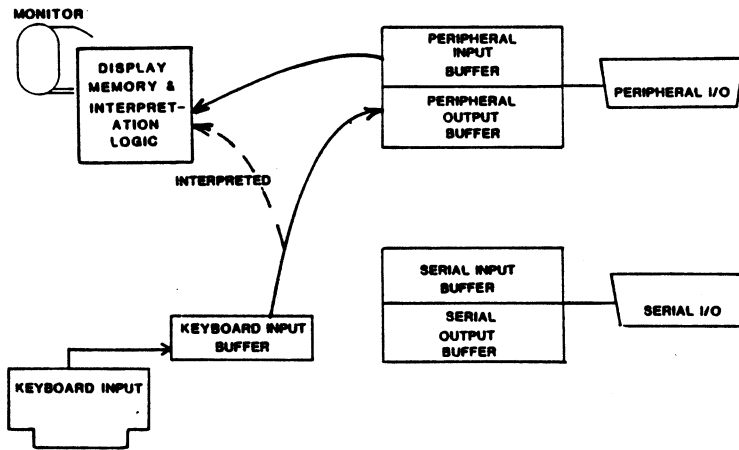
b) Remote and Character Modes
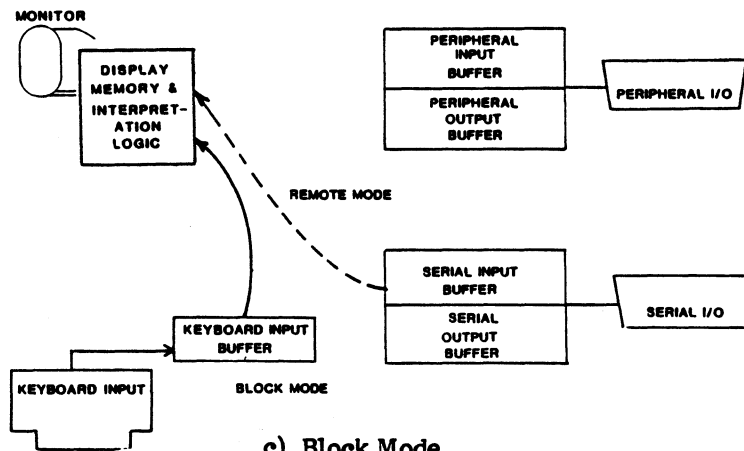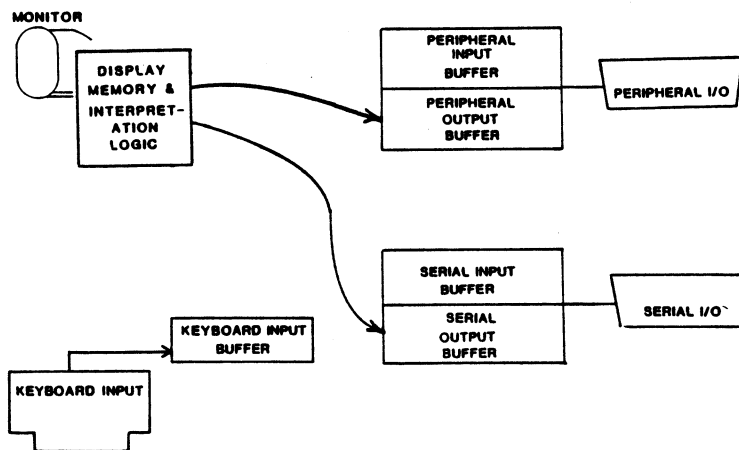
c) Block Mode

Figure 5-6: Data Flow Controls

d) Remote and Character and Copy Modes


e) Peripheral Copy in Local and Character Modes

f) Transmits

B. Suspend/Resume and Buffering

Enable/Disable Peripheral Busy-Ready Detect	ESC [? 41 h / ESC [? 41 ℓ
Peripheral Busy-Ready Level High/Low	ESC [? 42 h / ESC [? 42 ℓ
Suspend (XOFF)	DC3
Resume (XON)	DC1
Enable/Disable Suspend-Resume - Peripheral	ESC [? 46 h / ESC [? 46 ℓ
Enable/Disable Suspend-Resume - Serial I/O	ESC [? 38 h / ESC [? 38 ℓ
Enable/Disable Busy-Ready - Serial I/O	ESC [? 35 h / ESC [? 35 ℓ
Serial Input Buffer	256 characters
Serial Output Buffer	16 characters
Peripheral Input Buffer	256 characters
Peripheral Output Buffer	16 characters
Bell Queue	8 characters

The peripheral port has an additional input signal provided on Pin 6 called Busy/Ready. When asserted, this signal indicates to the Teleray that the connected device is ready to accept data; when negated, the device is busy. This allows a printer with limited buffer capacity to control the flow of data to it. The Teleray will use its internal buffers to smooth the data flow and if connected to a host computer, will use Suspend/Resume (X-ON X-OFF on a teletype) protocol to signal to the host if overrun occurs.

Both the serial I/O and peripheral I/O ports will support Suspend/Resume protocol. This protocol feature can be individually selected for each port.
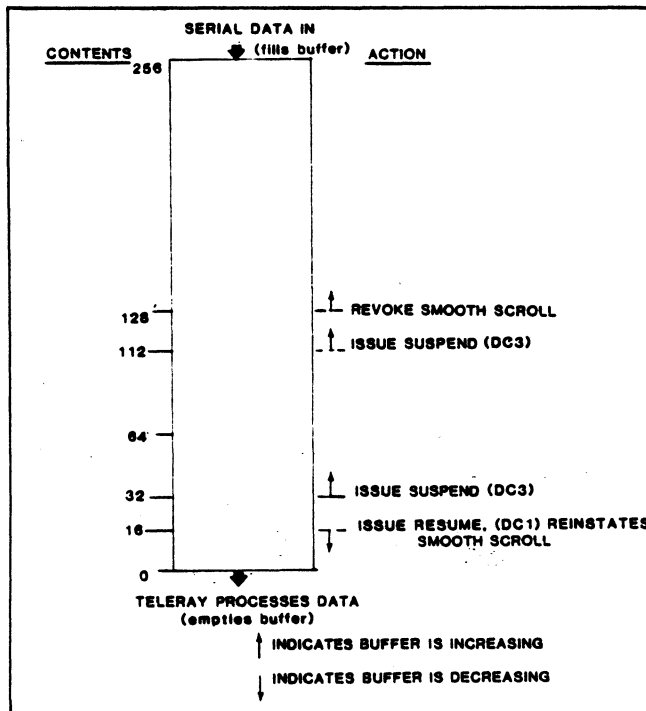
The Teleray operates at transmission speeds up to 19200 baud. However, the terminal or a connected auxiliary device may not be able to keep up with incoming data with some messages. The terminal stores incoming characters in a 256-character buffer and processes them on a first-in/first-out basis. If the Suspend/Resume feature is selected, if the serial input when the content of the buffer reaches 32 characters, the terminal will transmit a DC3. 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. 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 to signal the host that it may resume transmission. Figure 5-7 illustrates the serial input buffer protocol.

Figure 5-7: Input Buffer Controls

If the host fails to respond to a DC3 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 formula:

Time to respond to Suspend = No. of characters to overflow x 10 - receiver speed

In addition to the buffer-filling conditions, there are two other means of transmitting Suspend and Resume: the NO SCROLL key and CTRL mode keyboard keys. If the Suspend/Resume feature is enabled, the Teleray will coordinate these three sources so that proper data flow is maintained.

Smooth scroll limits the received data rate to a maximum of 6 or 12 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. Figure 5-7 illustrates the serial input buffer protocol. If the message contains "normal text" (few extended-time functions), the Teleray can be placed in Smooth Scroll mode and the message transmitted without adherence to Suspend/Resume protocol.

The Teleray may alternatively be configured to operate with a busy-ready signal on the serial I/O port. Instead of issuing suspend and resume codes, the Teleray will negate or assert the Request to Send signal on Pin 4. In all other aspects, the buffer protocol described above is identical. Note that Busy-Ready will not operate unless Suspend-Resume is enabled.

Three of the terminal functions, reset to initial state, reset to default, and self-test, reinitialize the terminal and erase the buffer. This means that if characters are received immediately subsequent to these commands, these characters 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 Suspend from the terminal, thus sending no more characters until it receives Resume. The terminal will automatically transmit a Resume code after it completes these operations if the Suspend/Resume feature is selected.

2. When the first method cannot be implemented, a delay of no less than 12 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.

C. Suspending Transmissions from Teleray

The Teleray recognizes received Suspend (DC3) and Resume (DC1) codes from either port. Receipt of Suspend will inhibit the Teleray from transmitting any codes except Suspend and Resume. From three to seven keystrokes on the keyboard will be stored in a keyboard buffer (some keys transmit multiple codes so that the exact amount varies). If the keyboard buffer overflows, keyclicks will stop and the KBD LOCKED LED will come on. Transmission resumes upon receipt of Resume. Also see Section 5-6.

THIS PAGE INTENTIONALLY LEFT BLANK

5-6 Block Transmits

A. Text Transmits

Ready to Transmit	ESC S
Transmit Text (Serial I/O Port)	ESC 5
Transmit Text (Peripheral I/O Port)	ESC [i or ESC [o i

Block transmits may be initiated by either macro keys or ESCape sequences. The keyboard macro capability allows reprogramming of the ENTER key, which is frequently used to initiate block transmissions. The sequence ESC S is commonly used to indicate that the terminal (operator) is ready to transmit to the computer. The computer would then send the appropriate ESCape sequence to initiate the block transfer of its choice. The macro key also allows programming of the appropriate ESCape sequence directly. If programmed as a local macro, the transfer would immediately take place. If programmed as a transmitting macro, the ESCape sequence would be sent to the computer, and the echo of the ESCape sequence would initiate the transfer. The keyboard macro capability eliminates the need for a "transmit key execution" mode.

Select Text for Transmission	ESC [P_s; P_s ? t
Transmit from Beginning to Cursor/to End	ESC [18 h / ESC [16 ℓ
Start Select Area (SSA)	ESC F
End Select Area (ESA)	ESC G

Unless otherwise set, all transmissions start at the beginning of the current page and terminate at the end of the page. During transmission, the keyboard is locked. Feature selections allow transmission of the page, line, window (area between margins, if set), memory, or the area demarked by Start of Selected Area (SSA) and the End of Selected Area (ESA). Figure 5-8 lists parameter values for the ESCape sequences.

First P_s selects for serial port; second P_s selects for peripheral port.

P_s	Area Transmitted
0	Page
1	Line
2	Window
3	Memory
4	Selected Area (SSA to ESA)

Figure 5-8: ESCape Sequence Parameter Values

A feature selection allows transmission of either the entire selected area, or the transmission can be truncated at the current cursor position. Transmissions always begin with the chosen area. The SSA and ESA commands place invisible markers in the Teleray's display memory. When a transmit operation is initiated, the terminal will search its memory from the current cursor position backward until it finds an SSA marker. The transmission will begin at this marker and will end at either the original cursor position or at the first subsequent ESA marker.

B. Form Transmits

Transmit Form and Text	ESC 6

This sequence causes the entire screen with all the character attributes to transmit. Character attributes transmit in the same format required to place them on the screen. All characters transmit without regard to protection or space suppression. A control sequence is prefixed to the transmission which indicates which graphic renditions are protected. Two control sequences prefix each transmitted field indicating which graphic renditions are on and indicating the state of the independent protect attribute. These control sequences are identical to the sequences normally used to place graphic renditions on the display. Every line transmitted is terminated by the selected terminator in effect. Figures 5-9 and 5-10 are examples of such a transmission.

Transmit Guarded Fields/Transmit Without Guarded Fields   ESC [1 ℓ/ ESC [1 h

Certain protected areas of the display may be guarded against transmission (see 5-8, Protect Mode). This feature selection permits the guarded designation to be honored or ignored in block transmissions.
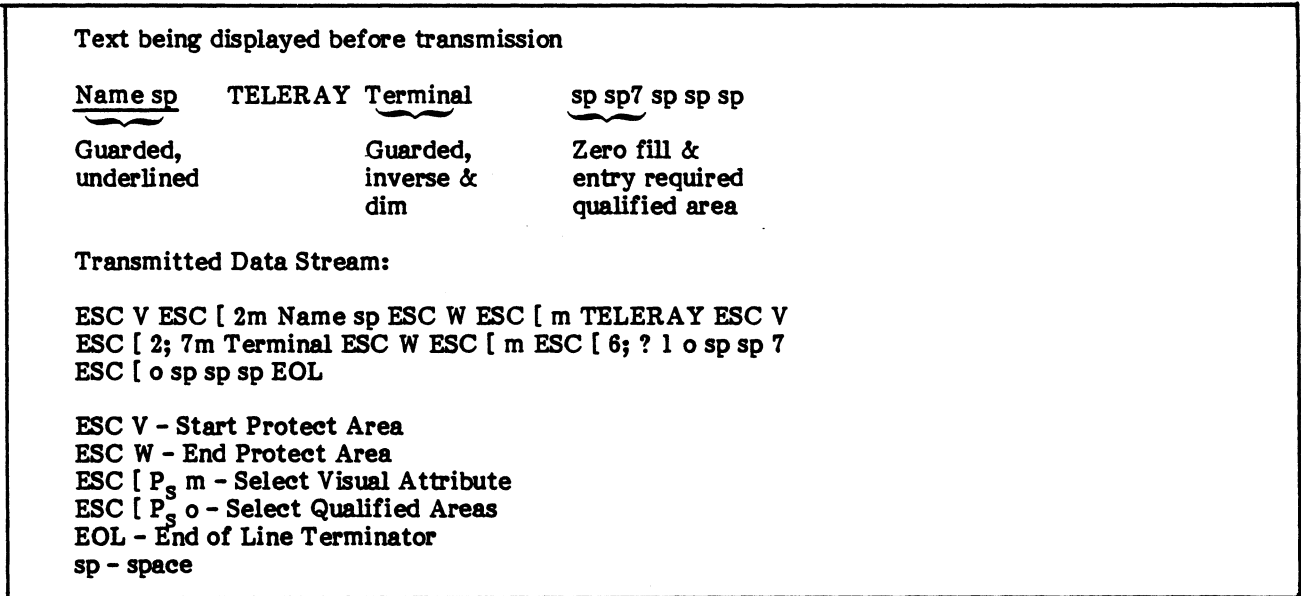
```
Text being displayed before transmission

Name sp        TELERAY  Terminal       sp sp7 sp sp sp
‿‿‿                     ‿‿‿            ‿‿‿

Guarded,                Guarded,        Zero fill &
underlined              inverse &       entry required
                        dim             qualified area


Transmitted Data Stream:

ESC V ESC [ 2m Name sp ESC W ESC [ m TELERAY ESC V
ESC [ 2; 7m Terminal ESC W ESC [ m ESC [ 6; ? 1 o sp sp 7
ESC [ o sp sp sp EOL


ESC V - Start Protect Area
ESC W - End Protect Area
ESC [ P_s m - Select Visual Attribute
ESC [ P_s o - Select Qualified Areas
EOL - End of Line Terminator
sp - space
```

Figure 5-9: Example of Transmit Text and Form

C. Space Transmission/Suppression

Space Suppression On/Off Serial	ESC [? 13 h / ESC [? 13ℓ
Space Suppression On/Off Peripheral	ESC [? 15 h / ESC [? 15ℓ
Space Substitution for Fields On/Off Serial	ESC [? 40 h / ESC [? 40ℓ
Space Substitution for Fields On/Off Peripheral	ESC [? 48 h / ESC [? 48ℓ

If the space supression feature is selected, unwritten spaces on the right-hand side of each line can be suppressed on each transmission. Also, a space can be substituted for each character of protected or otherwise guarded fields. This feature allows spacing over preprinted forms and provides full line transmission for applications requiring them. These selections can be made independently for each port.

```
Text being displayed before transmission

Name sp        TELERAY  Terminal       sp sp 7 sp sp sp
‿‿‿                     ‿‿‿            ‿‿‿

Guarded                 Guarded         Zero fill
                                        qualified area
```

Modes			Transmitted Data Stream
Space Suppression	Transmit Guarded	Space Substitution	
Off	Data	Off	Name sp TELERAY Terminal 007 sp sp sp EOL
Off	Data	On	sp sp sp sp sp TELERAY sp sp sp sp sp sp sp sp 007 sp sp sp EOL
Off	Separator	Off	GRT TELERAY GRT 007 sp sp sp EOL
Off	Separator	On	GRT TELERAY GRT 007 sp sp sp EOL
On	Data	Off	Name sp TELERAY Terminal 007 EOL
On	Data	On	sp sp sp sp sp TELERAY sp sp sp sp sp sp sp sp 007 EOL
On	Separator	Off	GRT TELERAY GRT 007 EOL
On	Separator	On	GRT TELERAY GRT 007 EOL

```
GRT - Guarded Field Replacement Identifier
EOL - End of Line Terminator
sp - space
```

Figure 5-10: Example of Guarded Fields Transmission

D. Suspending Transmits

Serial Auto Suspend on End of Line/Normal   ESC [? 39 h / ESC [? 39ℓ
Peripheral Auto Suspend on End of Line/Normal   ESC [? 40 h / ESC [? 40ℓ
Select End of Line Resume Characters   ESC [P_s; P_s ? y

This feature selection will cause each transmission to automatically pause immediately after transmitting the End of Line terminator. The Teleray will not transmit any further text until the selected EOL resume character is received from the appropriate port. Any text received while the Teleray is waiting for this character will be ignored and discarded. When the selected EOL resume character is received, the Teleray will resume the transmission at the beginning of the next line.

The EOL resume characters are selected independently for each port (first P_s for the serial port, second for the peripheral port) by the ESCape sequence shown. Any value of P_s from zero through 127 will be used with Table 5-1, Decimal Character Selection Table, to determine the EOL resume character. These selections are stored in non-volatile memory. Both default values are Carriage Return (13).

E. Transmit Terminator Selections

Select Start of Transmission Identifier (SOT)   ESC [P_s; P_s
Select Guarded Field Replacement Identifier (GRT)   ESC [P_s; P_s ? z
Select End of Line Terminator (EOL)   ESC [P_s; P_s ?
Select End of Page Terminator (EOP)   ESC [P_s; P_s ?¦
Select End of Transmission Terminator (EOT)   ESC [P_s; P_s ¦

These Selection Menu features allow application formatting of the data stream representing text stored in the Teleray (Figure 5-11). These terminators can be selected independently for the serial I/O and peripheral I/O ports. The Start of Transmission identifier is prefixed to each block transmission. The Guarded Field Replacement identifier is used to replace the guarded fields when transmitting a formatted (protected) text. End of Line, End of Page, and End of Transmission terminators are independently selected and are suffixed to the appropriate transmission. Figure 5-11 lists the terminators, Figure 5-11a illustrates the positioning of these terminators in the transmitted text stream.

First P_s selects for serial port; second P_s selects for peripheral port.

P_s Value	Identifier	P_s Value	Identifier	P_s Value	Identifier
0	Default	13	CR	26	SUB
1	SOH	14	SO	27	ESC
2	STX	15	SI	28	FS
3	ETX	16	DLE	29	GS
4	EOT	17	DC1	30	RS
5	ENQ	18	DC2	31	US
6	ACK	19	DC3	32	NUL
7	BEL	20	DC4	33	None
8	BS	21	NAK	34	DEL
9	HT	22	SYN	35	LF CR
10	LF	23	ETB	36	CR LF
11	VT	24	CAN		
12	FF	25	EM		

Figure 5-11: Transmission Terminators

Transmit Type	Transmission Format – Terminators
Line	SOT text EOL EOT
Page	SOT text EOL text...EOL EOP EOT
Window	SOT text EOL text...EOL EOT
Memory	SOT text EOL text...EOL EOP text...EOL EOP EOT
Selected Area	SOT text EOL text...EOL EOT

Figure 5-11a – Transmission Format – Terminators

THIS PAGE INTENTIONALLY LEFT BLANK

5-7   Programmable Functions

A.   Macro Keys

Reprogram Macro Key (Local)   ESC P L P_s text: P_s text...
Reprogram Macro Key (Transmitting)   ESC P T P_s text: P_s text...
Reprogram Macro Key (Keyboard)   ESC P K P_s text: P_s text...
End Macro Key Sequence Definition   ESC \

Local macros operate locally only; no code is transmitted by them, and the macro ESCape sequence is interpreted by the Teleray. Transmitting macros are not interpreted by the Teleray, and the macro contents are transmitted to the host computer. If the host echoes the character sequence, it will be interpreted. Keyboard macros are treated as keyboard input. If the Teleray is in Local mode, they will be acted on locally; in Remote and Character modes, they will be transmitted. For a complete description of the programming and operation of these keys, see Section 3-7, Macro Keys.

Section 5-7, Figure 5-12a, contains a keyboard diagram with the macro keys shown blank for use in recording your applications.

B.   Dynamic Programmable Functions (DPF)

Define Dynamic Function P_s ESC P P_s text
End Dynamic Function Definition   ESC \
Locally Perform Dynamic Function P_s ESC [P_s u
Transmit Dynamic Function P_s Contents   ESC [P_s t
Enable Transmits to Dynamic Function P_s ESC [P_s z
Load Functions Transparent/With Interpretation   ESC [? 23 h / ESC [? 23 ℓ
Clear all Dynamic Function Memory   ESC [2 space x

The Teleray contains 32 dynamic programmable functions (DPF). Any ASCII sequence may be assigned to these DPFs. The first 16 (01 through 16) functions can be allocated in any combination to the 512 bytes of function memory. Optional versions that include non-volatile display memory allow reassignment of excess display memory for use as function memory. See Section 5-2, Memory Structure. DPFs 17 through 32 are reserved for use with this reassignable memory.

C.   Programming the DPFs

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 (any 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.

A Selection Menu feature allows the function information to be interpreted while it is being loaded or to be ignored (transparent) while being loaded.

Dynamic programmable functions can also be programmed with display memory text using the Enable transmit to Function. When this ESCape sequence is keyed or received, the Teleray enters a special mode in which the subsequent transmit operations do not transmit to a port but instead transmit to the function memory.

If the programming sequence is given for a DPF that has been previously defined, the old program will be discarded and a new definition entered. The DPF contents are automatically saved in non-volatile memory.

Function definition will be ended by:

End Function Definition (ESC \ ) - recommended
Reset to Initial State
Reset to Default State - also sets DPFs to factory condition
Execute Programmed Function - will perform function
Exceeding the Function Memory Available - the Bell will beep (and not click anymore)

D. Executing Dynamic Programmable Functions

Locally Perform DPF	ESC [Ps u
Transmit DPF Contents	ESC [Ps t

The DPF execution will be initiated by the sequence shown. Ps is a decimal number from 1 through 32, inclusive. If an incorrect function number is given, the sequence will be ignored. When a DPF is initiated, the ASCII sequence stored in the function memory is executed locally or transmitted. Figure 5-12 illustrates the two types of DPFs. DPF contents can be examined using the combination of Monitor and Local modes. The ESCape sequence for the DPF must be manually entered and the Teleray placed in Monitor mode just prior in the sequence to the terminating character (lower case u). Embedded control characters and ESCape sequences will be displayed (and not executed) in these modes. If the function programming includes a command to execute another programmed function, this included command will not be executed.
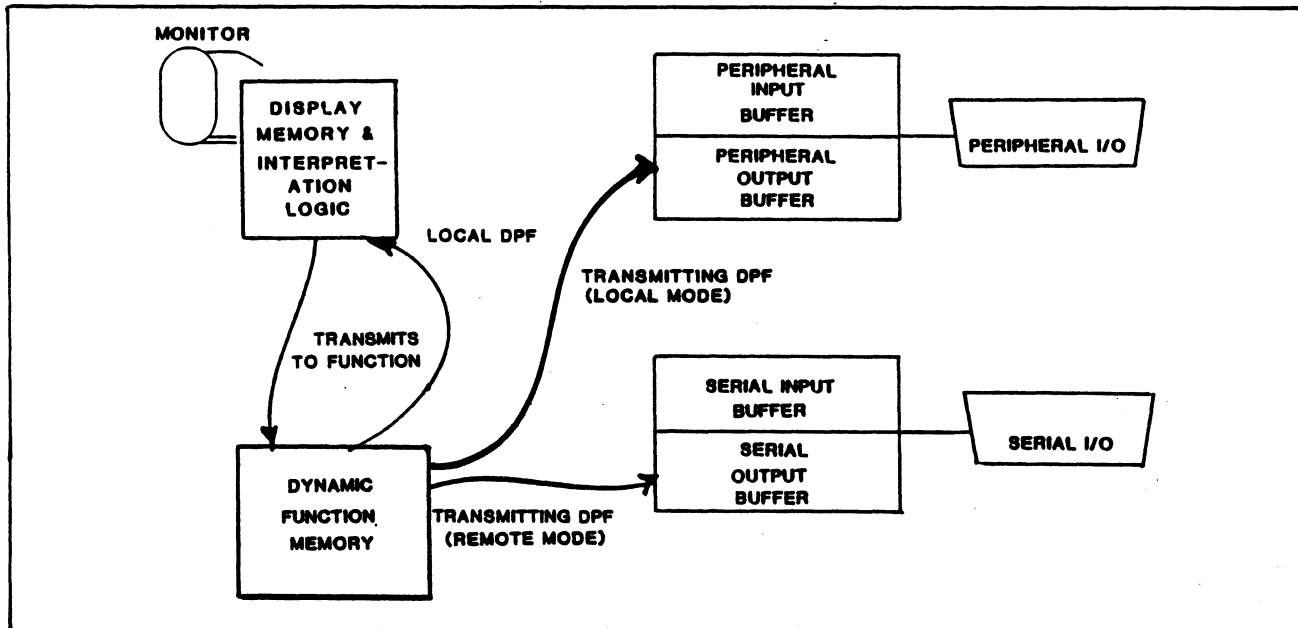
Figure 5-12: Dynamic Programmable Functions

E. Keys for DPFs

There are five DPF keys on the keyboard (Functions 01 through 05); the other functions are initiated by using the SHIFT key (shifted F01 = F06; shifted F02 = F07, etc.). These macro keys have been programmed at the factory with the ESCape sequences to call these DPFs. DPFs 01 through 05 have been programmed as local DPFs; 06 through 10 as transmitting DPFs. The keyboard macros may be user reprogrammed to provide more or fewer DPF keys.

F. Applications

The DPFs can be used to store macro key definitions providing multiple alternate keypad modes. The functions can be used to store forms, control sequences, or answer back messages. Multiple, lengthy forms can easily be accommodated with additional memory available with the non-volatile memory options. DPFs are particularly useful for storing lengthy ANSI ESCape sequences to provide an operator with additional editing or special purpose keys. The dynamic programmable functions are automatically stored in non-volatile memory.

Program function memory can be used as a local forms cache memory. This will reduce host/terminal data transfers when forms are used repetitively.

The dynamic programmable functions can also be used to provide a "Wake Up" service following extended time functions, such as Transmit to Peripheral Port. Implementing this Wake Up service would require programming a function with the Transmit command, immediately followed by a command invoking the programmed function. When the Teleray has completed the transmit, it will examine the input buffer and execute the function.

<p align="center">Example of "Wake Up" Service</p>

Computer Transmits:	Teleray Does:
ESC P 12 MESSAGE ESC TEXT ESC [i (Transmit Peripheral) ESC [1 2 t Waits Receives MESSAGE - Knows that Print is complete	Defines programmable function 12 with MESSAGE. Receives text on display screen. Transmits text. Examines input buffer and executes function 12 — this transmits MESSAGE to computer.
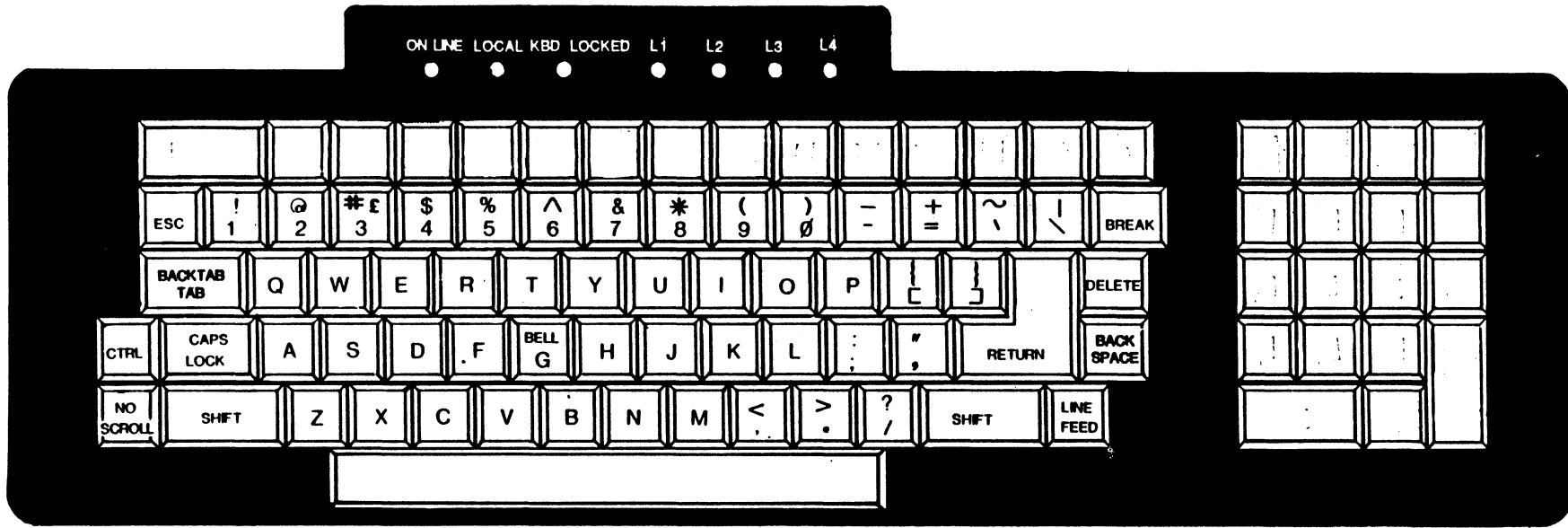
Figure 5-12a: Keyboard with Blank Macro Keys

5-30

5-8 Text Presentation Format

Select Visual Attributes [1]	ESC [P_s; P_s;...P_s m
Start Protected Area	ESC V
End Protected Area	ESC W
Duplicate Rendition	ESC [space z
Protect Mode On/Off	ESC [? 24 h / ESC [? 24 ℓ
Select Qualified Areas [2]	ESC [Ps; Ps;...Ps o
Erase to Protected Spaces/Non-Protected Spaces [3]	ESC [? 49 h / ESC [? 49 ℓ

[1]
P_s Value	Attribute
0 or none	Normal; all attributes off
2	Dim on
4	Underscore on
5	Blink on
7	Inverse on
8	Blank

[2]
P_s Value	Area Qualification
0 or none	Normal; cancel previous
3	Numeric only
4	Alphabetic only
5	Right justify
6	Zero fill
8	Protected, transmitting
? 2	Must fill
? 1	Entry required

[3] See Section 5-10.

Select Visual Attributes (Graphic Rendition)   ESC [P_s;...P_s m

Selects the character attribute(s) specified by the given parameter(s). All data following this sequence will have the same attribute 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. All visual attributes are automatically protected in Protect mode.

Start Protected Area/End Protected Area (SPA/EPA)   ESC V / ESC W

All data entered following the SPA sequence will be tagged with a protect attribute. The protect attribute is independent of the character attributes (graphic renditions), and the SPA and EPA sequences do not affect character attributes. All data following the EPA sequence will no longer be tagged with a protect attribute. Tagged characters are not protected until Protect mode is set to on.

Duplicate Rendition   ESC [space z

This operation may be used to protect or unprotect an area of the Teleray without entering individual characters within the area. The current graphic rendition (visual attribute) in effect and the current SPA/EPA status will be applied to each character in the area. All data between the cursor and the first preceding SPA or EPA will be tagged with the protect attribute and with the current visual attribute.

Protect Mode On/Off   ESC [? 24 h / ESC [? 24 ℓ

In Protect mode, those fields which have been identified as protected will be guarded from keyboard input. (Also, see 5-6, Transmit Guarded Fields.) The cursor will be allowed into protected areas, but any attempted entry will be automatically preceded by a tab operation. In most applications, these fields will be part of an operator entry form. Protected qualified areas have an implicit tab stop on their forward boundary so that the tab operation can be used to step through the form. Columnar tab stops do not operate in Protect mode.

Select Qualified Areas   ESC [P_s; P_s;...P_s o

Selects the area qualifications specified by the individual parameter(s). All text following this sequence will have the same qualifications until a new occurrence of the sequence or until the end of the line. An additional (new) sequence will add qualifications to any previous qualification. A parameter value of 0 or the sequence without a parameter will cancel previous qualifications. Internal control of the qualified areas requires two control bytes for each qualified area, one for the beginning of the field (area) and one for the end. These control bytes occupy memory locations, but are not displayed.

Numeric and Alphabetic Qualifications

The terminal will reject all characters not listed below. A prompt will appear on the bottom line for attempted incorrect entry.

Characters Accepted:	Alphabetic	Numeric
	Upper/lower case alphabetic, space, period, comma, hyphen	Digits, space, period, comma, minus sign, plus sign

Right Justify Qualification

Whenever the cursor enters a Right Justify field and any text is entered, the cursor will automatically be positioned to the right-hand edge of that field. As data is entered, it will automatically shift to the left within the field. Each entry is then right justified as it is entered.

Zero Fill Qualification

Whenever a zero fill field is transmitted, all space characters within that field will be replaced with zero characters. Note that "normal" fields are space filled.

Entry Required Qualification

If a field contains an entry required qualification, at least one character entry (other than space) is required before tabbing from the field. If an attempt to tab from an entry required field is made, the bell is sounded, the cursor is moved to the start of the field, and an operator prompt is presented on the bottom line.

Must Fill Qualification

For any type of field, you may specify "MUST FILL" qualification. This signifies that if any character position within the field contains a valid character, then every character position within the field must contain a valid character. The "MUST FILL" qualification is checked as the cursor is about to leave the field. If "MUST FILL" is in effect and all character positions of the field do not contain valid characters, the bell is sounded, the cursor moves to the start of the field, and an error message appears on the bottom line. To correct the situation, re-enter the data item in a manner which ensures that all character positions contain a valid character.

Protected Transmitting Qualification

These fields are guarded from operator entry the same as those areas established using SPA and EPA. However, these qualified areas are not guarded from transmission and are always included in subsequent block transmissions. This allows embedding of host computer usage codes in the form.

5-9 Cursor Positioning, Tabs, and Text Movement

Cursor Up   ESC [P_n A

This sequence causes the active position to move P_n lines up without changing the column position. Pn 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. If no Pn parameter is given, a value of zero is assumed.

Cursor Down   ESC [P_n B

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

Cursor Right   ESC [P_n 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 unless right margin wrap is selected. If no P_n parameter is given, a value of zero is assumed.

Cursor Left   ESC [P_n 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 first column does not move the cursor even if left margin wrap is selected. If no P_n parameter is given, a value of zero is assumed.

Backspace   BS

This control character causes the active position to move one column to the left. An attempt to move the cursor to the left of the first column does not move the cursor unless left margin wrap is selected.

Full Left (Cursor Return)   CR

Places the active position on the left margin or on the beginning of the line if no margin has been set.

Cursor Home   ESC [H or ESC [f

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.

Line Feed/New Line Mode   ESC [20 ℓ/ ESC [20 h

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.

Next Line   LF or ESC E

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

Index   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.

Reverse Index   ESC M

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.

Relative/Absolute Origin Mode   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, left margin column is Home. Cursor positioning is 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. If absolute, cursor positioning is not affected by any scrolling window margins.

Direct Cursor Positioning   ESC [P_n; P_n H or ESC [P_n; P_n f

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. The parameters are <u>decimal numbers</u> 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.

Request Position Report   ESC [6 n

Causes the Teleray to transmit the current cursor location to the computer.

Cursor Position Response   ESC [P_n; P_n R

Teleray's response to the Request Position Report. The first parameter specifies the line number; the second parameter specifies the column number.

Save Cursor   ESC 7

This sequence causes the cursor position, graphic rendition (character attributes), area qualifications, and character set designation and invocation to be saved in non-volatile memory.

Restore Cursor   ESC 8

This sequence causes the saved cursor position, graphic rendition (character attributes), area qualifications, and character sets to be restored from non-volatile memory.

Tab Operations

Cursor to Next Tab Stop	HT
Set Tab Stop in Current Column	ESC H
Clear Tab Stop in Current Column	ESC [g
Clear All Tab Stops	ESC [3 g
Back P_n Tab Stops	ESC [P_n Z

Just like a typewriter, the Teleray Model 16 can tab (jump) to preselected points on a line. These tab stops may be individually changed, or totally cleared and then individually set. Columnar tab stops apply to all lines in the page. Default stops are preset in Columns 1, 9, 17, 25, 33, 41...(every eight columns to the end of the logical line). If all columnar tab stops are cleared, a columnar tab stop is implied in Column 1. In Protect mode, implicit tab stops are set at the beginning of every unprotected area and the columnar tabs are ignored.

Display Movement (for related information, see 5-2, Memory Structure)

Scroll Display Text Up P_n Lines	ESC [P_n S
Scroll Display Text Down P_n Lines	ESC [P_n T
Scroll Display Text Right P_n Columns	ESC [P_n sp A
Scroll Display Text Left P_n Columns	ESC [P_n sp @
Forward P_n Pages	ESC [P_n U
Reverse P_n Pages	ESC [P_n V

Whenever an attempt is made to horizontally move the cursor out of the display window (80 columns) but still within the logical line length, the display will automatically "pan" to accommodate this movement and keep the cursor within view. These movements will be made with a smooth horizontal scroll, if smooth scroll is enabled. If incipient buffer overrun is sensed, the horizontal display will be immediately placed in the new position. Combinations of smooth horizontal and vertical scrolls may occur simultaneously with certain combinations of cursor manipulation.

The Next Page/Previous Page operations are graphically described in Figure 5-13. The next/previous page operation places the cursor in the home position in the new page. The display window is automatically moved to keep the cursor in view. If the smooth scroll feature is selected, this window movement will be smooth; otherwise, it will immediately jump to the new page. If margins are invoked in the current page, they will be in effect in the new page in the same line and column positions.
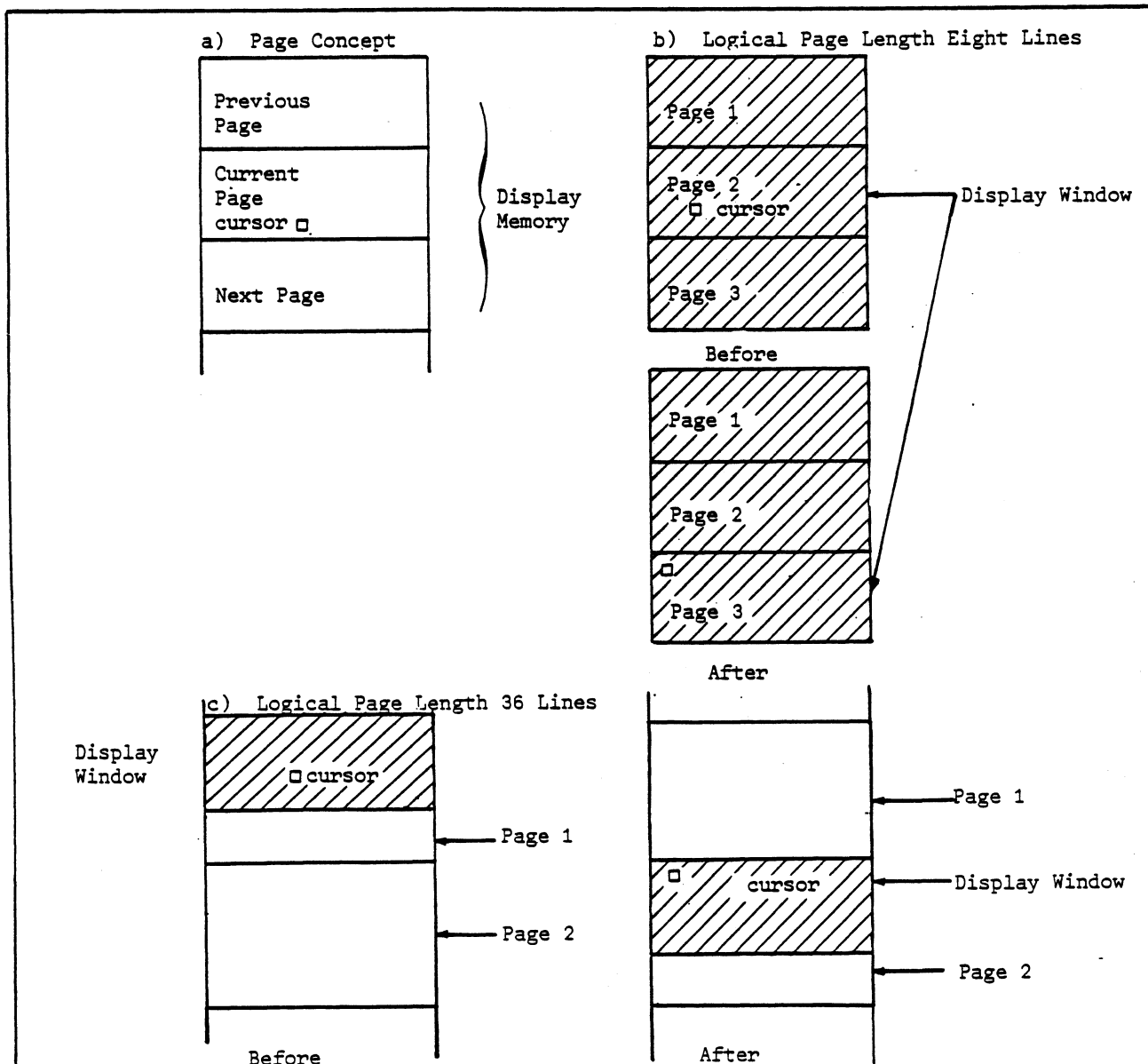
Figure 5-13: Next Page Examples

5-35

THIS PAGE INTENTIONALLY LEFT BLANK

5-10 Erases, Resets, and Edits

A. Erases

Erase from Cursor to Right Margin	ESC [0 K
Erase from Cursor to Left Margin	ESC [1 K
Erase from Cursor Entire Line to Both Margins	ESC [2 K
Erase from Cursor to Bottom Margin	ESC [0 J
Erase from Cursor to Top Margin	ESC [1 J
Erase from Cursor Entire Page Within Margins	ESC [2 J
Erase from Cursor to End of Memory	ESC [? 1 J
Erase All Pages	ESC [? 2 J
Erase from Cursor to End of Field	ESC [0 N
Erase from Cursor to Beginning of Field	ESC [1 N
Erase Entire Field	ESC [2 N
Erase to Protected Spaces/Non-Protected Spaces	ESC [? 49 h / ESC [? 49l

The erase functions allow selective clearing of the Teleray's display memory. The character position the cursor is located in is always erased. The field erase operates in the unprotected areas between protected fields in Protect mode. The erase operation places either protected or non-protected spaces in the Teleray memory. These spaces are not protected against operator entry until the terminal is placed in Protect mode (see Section 5-7).

B. Resets

Reset to Initial State	ESC c
Reset to Default Conditions	ESC [255; 255 space y

After receipt of the Reset to Initial State, the Teleray will return to the same state it would be in if power had just been turned on. This means that the terminal's input buffer will be cleared, so this command should not be followed immediately by additional commands. This command does not affect the contents of the programmable functions, keyboard macros, feature menu selections, or any other parameters stored in non-volatile memory. If a non-volatile memory operation is installed, the Teleray will not erase the display memory. The Reset to Default command will perform all the operations in the reset to initial state, and the non-volatile memory will be rewritten to its "factory" condition. All functions, macros, and menu selections will be reset. The Reset to Default will always erase the display memory.

C. Edits

Repeat Previous P_n Times	ESC [P_n b

This sequence causes the Teleray to repeat the previous graphic character, control character, or control sequence P_n times. It may be included in a macro key or a programmable function, and it provides a very powerful method for rapid entry of repetitive displays. Parameter values through 255 will be accepted.

Select Editing Extent	ESC [P_s Q

This controls the extent of Insert/Delete Character controls. For P_s = 0, the edit is restricted to operating within the current margins; for P_s = 1, the edit is restricted to the current line; for P_s = 2, the edit is restricted to the current field (if no fields are in effect, the current page).

Insert P_n Characters	ESC [P_n @

Inserts one or more erased characters at the cursor position according to the parameter by shifting the character at the cursor position and all following characters forward. The contents of the character positions at the other end of the shifted part are removed. The position of the cursor is not changed. A parameter value of zero or one will insert one erased character. A parameter value of N will insert N erased characters. The number of following characters which are affected is controlled by the Select Editing extent (above). In Protect mode, the editing extent selection will be ignored; in Protect mode, the editing extent will always be the field between protected areas.

Delete P_n Characters   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. The number of following characters which are affected is controlled by the Select Editing extent. In Protect mode, the editing extent selection will be ignored; in Protect mode, the editing extent will always be the field between protected areas.

Insert P_n Lines   ESC [P_n L

Inserts one or more erased lines at the active line according to the parameter by shifting the contents of the active line and all following lines downward. The contents of the lines at the other end of the shifted part are removed. The cursor is moved to the left margin. A parameter value of zero or one inserts one erased line. A parameter value of N inserts N erased lines.

Delete P_n Lines   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 have no (normal) display attributes.

Insert P_n Characters in Text Block   ESC [P_n ~
Delete P_n Characters in Text Block   ESC [P_n p

These operations are identical to the Insert and Delete P_n Characters except that these operations extend to the end of the current text block. The end of the current text block is defined as the first display memory location containing four or more contiguous space characters. The search for the end of the text block is performed before the insert/delete operation.

Delete P_n Words   ESC [? P_n w

This operation is identical to the delete character except that the "word" the cursor is currently located on is deleted. The word is defined as the block of characters in which the cursor is positioned bounded on each end by either a space character or a margin. If the cursor is positioned in the middle of a word, only the portion of the word beneath the cursor and to the right of the cursor will be deleted. A parameter value of N will remove the word the cursor is in and the subsequent N-1 words.

Reinstate Last Deleted Word P_n Times   ESC [P_n ? v

Inserts one or more text words at the cursor position according to the parameter by shifting the character at the cursor position and all following characters forward. The extent of this operation is controlled by editing extent mode. Only the last deleted word will be reinstated.

Reinstate Last Deleted Line P_n Times   ESC [P_n ? u

Inserts one or more text lines at the cursor position according to the parameter by shifting the contents of the active line and all following lines downward. The extent of this operation is controlled by editing extent mode.

Insertion/Replacement Mode   ESC [4 h / ESC [4 ℓ

In Insertion mode, 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. In Replacement mode, all entered characters replace the character at the active position. The active position moves one character to the right when one character is replaced.

5-11 Tests, Reports, and Messages

A. Self Testing

Invoke Self Test [1]   ESC [16; P_s y

[1]

P_s	Meaning
0 or 1	All Tests
2	ROM Test - Read Only Memory test
3	DSP Test - Display Memory test
4	KBD Test - Keyboard test
5	SIO Test (turn around plug needed) - Serial I/O
6	PIO Test (turn around plug needed) - Peripheral I/O
7	CRT Test (fills screen)
8	Repeat specified test until error (will perform all if no parameters included)
9	NVM Test

The invoke self test command is used to start one or more of the various self tests on the Teleray. The selective parameter (Ps) indicates which test(s) is to be performed. The self test results are reported on the bottom line.

When testing the peripheral interface, the peripheral "busy-ready" signal should be disabled. This can be done by typing the sequence ESC [? 41 1 or as a menu selection.

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; the screen will likely contain a random pattern of characters.

Non-fatal errors do not halt the terminal processor. Instead, the errors are reported on the bottom line. Test failures are indicated with a 0, non-failures with a 1. The test reports are arranged, left to right, ROM, DSP, KBD, SIO, and PIO.

B. Turn-Around Plug

A turn-around plug can be manufactured by using a DP25P (male) connector with the following connections (only).

        Pin 2 to Pin 3
        Pin 4 to Pin 5 to Pin 6
        Pin 8 to Pin 20

C. Reports

Program Answerback	ESC P A text ESC \
Request Answerback	ENQ
Response to Answerback Request	text, default is TELERAY
Program Identity Sequence	ESC P I text ESC \
Request Identity Sequence	ESC [c
Response to Identity Sequence	text, default is ESC [? 1; 2 c

The answerback and identity may be up to 20 characters in length.

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 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. The answerback message can be viewed in the Selection Menu but cannot be changed as a selection; it is permanently locked. It can only be reprogrammed by the ESCape sequence shown.

Identity is a similar question and answer sequence. 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 expect differing device identity messages. The identity message can be viewed in the Selection Menu but is permanently locked. It can only be reprogrammed by the ESCape sequence shown.

Request Teleray Status   ESC [P_s n

P_s Value	Status Report Requested
5	Send short form status
6	Send cursor position (see Cursor)
? 7	Send time (see Clock)
? 8	Send detailed Teleray status
? 15	Send peripheral port status

Responses to Status Requests

ESC [P_s n

P_s Value	Meaning	
0	Teleray ready	first two comprise
3	Malfunction	short form status
? 10	Peripheral port ready	
? 11	Peripheral port not ready	

Response to Detailed Status Request

ESC P R text ESC\ where text is the self test contents of the bottom line; includes program revision level.

The status requests and possible responses shown allow the computer to interrogate the Teleray and learn its current condition. The self test bottom line display is transmitted; this report should not be requested without first requesting the self test. It is recommended that the keyboard be locked prior to invoking the self test to eliminate potential operator interference on the bottom line.

5-12 Graphic Sets and Control Characters

A.   Standards

The control character set employed by Teleray is described in ANSI X3.4 ASCII. Extensions to the ASCII code space are defined by ANSI X3.64, "Additional Controls For Use With American National Standard Code For Information Interchange." The corresponding international standard is ISO DP 6429. These standards define a set of encoded control functions to facilitate data interchange with 2-dimensional imaging devices, such as CRT and printer terminals. Additional controls and features in the Teleray which are not included in this standard were coded as "private use" parameters as described in X3.64.

The control sequences shown in this manual are described in terms of the ASCII character equivalent. Designating or invoking alternate graphic sets does not affect the relationship.

B.   Graphic Character Sets

The Teleray has four resident graphic sets: an ASCII set, a UK set, a Line Drawing set, and a Mosaic set. The Teleray can have only one graphic set in use at one time. These graphic character sets are invoked (placed in "use") with either of two complementary locking shifts or by a non-locking single shift. The locking shift Shift In (SI) invokes the G0 graphic set; Shift Out (SO) the G1 graphic set. The G0 or G1 set remains in use until the next occurrence of SO or SI. A single character from the G2 set can be displayed using the single shift (ESC N). The single shift selects the single next character from the G2 set; the set in use automatically reverts to the G0 or G1 set as invoked by the most recent occurrence of SO or SI.

Designation of the contents of G0, G1, or G2 is selected from the four resident graphic sets using the ESCape sequences shown in Figure 5-17. The designation or invocation of G0, G1, or G2 does not change text already in the Teleray display memory. Designation of G0, G1, or G2 does not change the graphic set in use unless the designation of the G set currently in use is changed.

The graphic set designations and invocation are stored in non-volatile memory. The mosaic set is designed so that the cells in the character block have a direct relationship to the six low order ASCII bit values. See Figure 5-14. The UK set is identical to ASCII except that the pound sterling symbol ( ) is substituted for the # symbol. The line drawing and mosaic sets are illustrated in Figure 5-16.
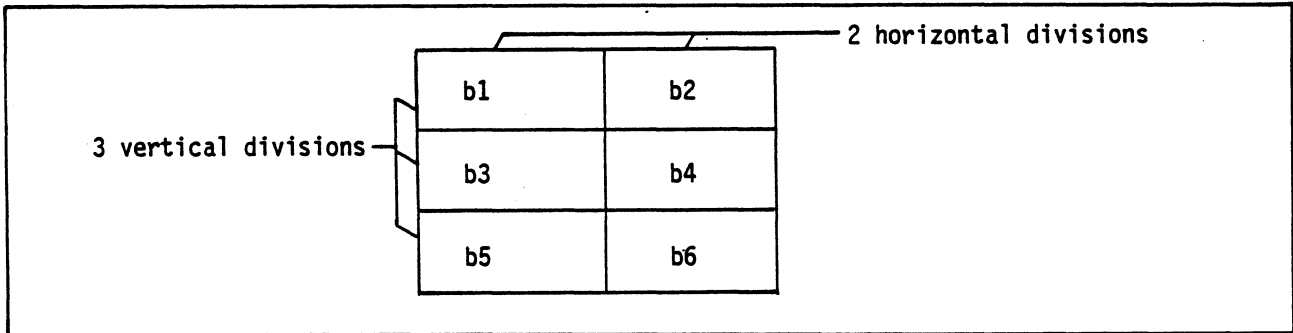
Figure 5-14: Mosaic Character Cell Composition

5-41

USA STANDARD CODE FOR INFORMATION INTERCHANGE

b4	b3	b2	b1	COLUMN / ROW	0 (000)	1 (001)	2 (010)	3 (011)	4 (100)	5 (101)	6 (110)	7 (111)
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

Figure 5-15 ASCII Character Set

LINE DRAWING

ROW \ COLUMN	2	3	4	5	6	7
0		0	^{2}	♥		
1	!	1	^{3}	♦		
2	"	2	X	♣		
3	#	3	÷	♠		
4	$	4	°	℘		
5	%	5	±	§		
6	&	6	≤	©		
7	'	7	≥	TM		
8	(	8	≠	1/2		
9	)	9	∞	1/4		o
10	*	:	Σ	⊙		↑
11	+	;	∫	†		←
12	,	<	Ω	√		↓
13	−	=	⊖	¢		→
14	.	>	ν	£		
15	/	?	π	♪		

MOSIAC SETS

ROW \ COLUMN	2	3	4	5	6	7
0		0				
1	!	1				
2	"	2				
3	#	3				
4	$	4				
5	%	5				
6	&	6				
7	'	7				
8	(	8				
9	)	9				
10	*	:				
11	+	;				
12	,	<				
13	−	=				
14	.	>				
15	/	?				

Figure 5-16 Line Drawing and Mosaic Sets
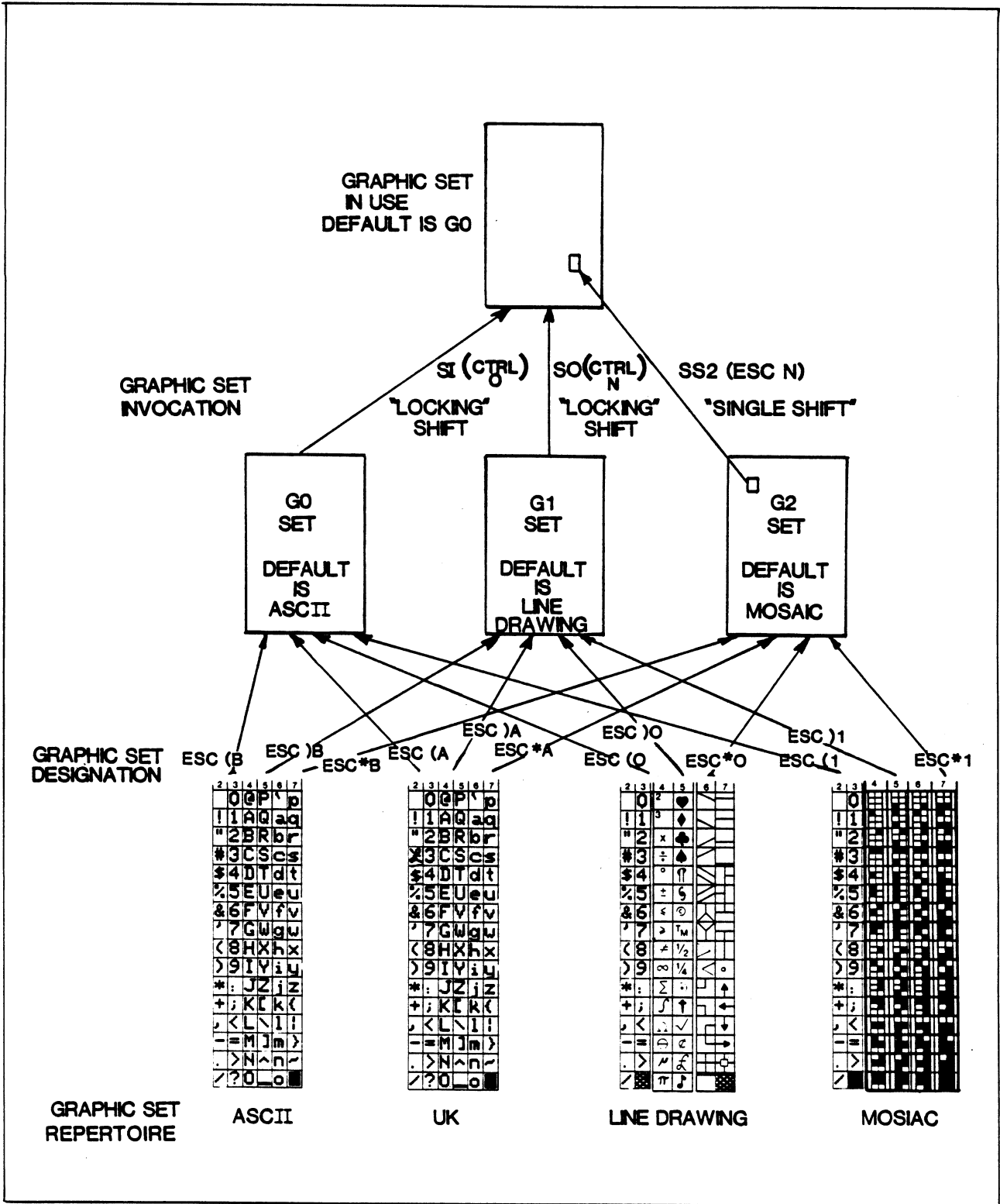
Figure 5-17: Graphic Sets

SECTION 6
CODING SUMMARY ARRANGED BY CODE

The following table lists the control sequences interpreted and transmitted by the Teleray Model 16. They are collated in ASCII order ignoring parameters.

Control Character	Function
NUL	Time Fill
ENQ	Transmit Answerback
BEL	Ring Bell
BS	Cursor One Left
HT	Cursor to Tab Stop
LF	Line Feed or New Line
VT	Same as LF
FF	Same as LF
CR	Cursor Full Left
SO	Invoke G0 Char. Set
SI	Invoke G1 Char. Set
DC1	Resume
DC3	Suspend
CAN	Cancel this Escape Sequence
SUB	Same as CAN
ESC	Introduce Escape Sequence
DEL	Time Fill
ESC (P_s	Designate G0 Character Set - Default is ASCII
ESC) P_s	Designate G1 Character Set - Default is Line Drawing Graphics Set
ESC * P_s	Designate G2 Character Set - Default is Mosaic Character Set

P_s Value	Selection
0	Special Graphics Set
1	Mosaic Character Set
A	UK Set
B	ASCII

Control Character	Function
ESC 5	Transmit a Block to Serial Port
ESC 6	Transmit Text and Form to Serial Port
ESC 7	Save Cursor, Attribute Tag and Character Set
ESC 8	Restore Cursor, Attribute Tag and Character Set
ESC 9	Break
ESC D	Index
ESC E	Next Line
ESC F	Start Selected Area
ESC G	End Selected Area
ESC H	Set a Horizontal Tab Stop - Default Columns 1, 9, 17, 25...
ESC M	Reverse Index
ESC N	Single Shift - Invoke G2 Set for 1 Character (only)
ESC P P_s text ESC \	Enter Text into Program Function P_s (P_s from 01 through 32)
ESC P A text ESC \	Reprogram Answerback Message with Text
ESC P I text ESC \	Reprogram Identity Sequence with Text
ESC P K P_s text: P_s text...ESC \	Reprogram Macro Key P_s with Keyboard Operating Text
ESC P L P_s text: P_s text...ESC \	Reprogram Macro Key P_s with Local Operating Text
ESC P M text ESC \	Display Text as a Status Line Message
ESC P T P_s text: P_s text...ESC \	Reprogram Macro Key P_s with Transmitting Text
ESC P R text ESC \	Teleray Report to Detailed Status Request - Current test result display on bottom (25th) line is transmitted

Control Character	Function
ESC S	Teleray Ready to Transmit a Block
ESC V	Start of Protected Area SSA
ESC W	End of Protected Area ESA
ESC [P_n @	Insert P_n Space Characters
ESC [P_n A	Cursor Up P_n Characters
ESC [P_n B	Cursor Down P_n Characters
ESC [P_n C	Cursor Right P_n Characters
ESC [P_n D	Cursor Left P_n Characters
ESC [P_n; P_n H	Cursor to Line no P_n; Column no P_n

ESC [P_s J   Erase in Display

P_s Value	Area Erased
0	Cursor to Bottom Margin
1	Top Margin to Cursor
2	Between All Margins
? 1	Cursor to End of Last Page
? 2	All Pages

ESC [P_s K   Erase in Line

P_s Value	Area Erased
0	Cursor to Right Margin
1	To Cursor from Left Margin
2	Entire Line Between Margins

Control Character	Function
ESC [P_n L	Insert P_n Lines
ESC [P_n M	Delete P_n Lines
ESC [P_s N	Erase in Field

P_s Value	Area Erased
0	Cursor to End of Field
1	Beginning of Field to Cursor
2	Entire Field

Control Character	Function
ESC [P_n P	Delete P_n Characters
ESC [P_s Q	Select Editing Extent – Default is Between Margins

P_s Value	Area Selected
0	Edit Between Margins
1	Edit Within Line
2	Edit Within Field

Control Character	Function
ESC [P_n; P_n R	Response to Cursor Position Line no P_n; Column no P_n
ESC [P_n S	Scroll Display Text Up P_n Lines
ESC [P_n T	Scroll Display Text Down P_n Lines
ESC [P_n U	Forward P_n Pages
ESC [P_n V	Reverse P_n Pages
ESC [P_n Z	Back Tab P_n Stops
ESC [P_n b	Repeat Previous Character or Control Sequence P_n Times
ESC [c	Request Identity Sequence
ESC [P_n; P_n f	Cursor to Line no P_n; Column no P_n

Control Character	Function
ESC [P_S g	Clear Tab Stops

	P_S Value	Action
	0	Remove Tab Stop at Cursor Location
	3	Remove all Tab Stops

Control Character	Function
ESC [P_S; P_S;...h	Set Mode Specified by P_S (also see ESC [P_S; P_S;...ℓ)

Set Mode Meaning	P_S Value	Reset Mode Meaning
Transmit Without Guarded Fields	1	Transmit Guarded Fields
Keyboard Lock	2	Keyboard Unlock
Monitor Mode	3	Normal Mode
Insertion Mode	4	Character Replacement Mode
Serial Port Local Echo On	12	Serial Port Local Echo Off
Transmit to Cursor	16	Transmit to End
New Line Mode	20	Line Feed Mode
Smooth Scroll	? 3	Jump Scroll
Display Dark on Light	? 5	Display Light on Dark
Addressing Relative to Window	? 6	Addressing Absolute
Right Margin Wrap On	? 7	Right Margin Wrap Off
Keyboard Auto Repeat	? 8	No Auto Repeat
Local Mode	? 12	On-Line Mode
Serial Port Space Suppression	? 13	No Space Suppression
Peripheral Port Suppression	? 15	No Peripheral Port Suppression
Keyboard Repeat Rate 15 cps	? 21	Keyboard Repeat Rate 30 cps
Smooth Scroll Rate 12 lps	? 22	Smooth Scroll Rate 6 lps
No Interpretation During Function Loading	? 23	Interpretation During Function Loading
Protect Mode On	? 24	No Protection
Block Mode	? 25	Character Mode
Calculator Mode	? 26	Normal Mode
Display Terminal Status	? 27	Status Display Off
Keyclick On	? 28	Keyclick Off
Left Margin Wrap	? 29	No Left Margin Wrap
Scrolling On	? 30	Scrolling Off
Auto Page Advance	? 31	Page Advance Stop
Screen Saver On	? 32	Screen Saver Off
Cursor Character Blink	? 33	Cursor Character Steady
50 Hz Refresh Rate	? 34	60 Hz Refresh Rate
Serial Port Busy-Ready	? 35	No Serial Port Busy-Ready
Serial Port Half Duplex	? 36	Serial Port Full Duplex
Serial Port No Parity Check	? 37	Serial Port Parity Check
Serial Port Suspend Resume	? 38	Serial Port No Suspend Resume
Serial Transmit Auto Suspend on EOL	? 39	No Auto Suspend
Space Substitution for Fields, Serial	? 40	No Space Substitution
Peripheral Busy-Ready Detect	? 41	Busy-Ready Not Sensed
Busy-Ready Level High	? 42	Busy-Ready Level Low
Peripheral Port Half Duplex	? 44	Peripheral Port Full Duplex
Peripheral Port No Parity Check	? 45	Peripheral Port Parity Check
Enable Suspend Resume Peripheral Port	? 46	No Suspend Resume Peripheral Port
Peripheral Transmit Auto Suspend on EOL	? 47	No Auto Suspend
Space Substitution Peripheral Port	? 48	No Space Substitution Peripheral Port
Erase to Protected Spaces	? 49	Erase to Non-Protected Spaces
Selection Menu Page	? 50	Selection Menu Line

Control Character	Function
ESC [Ps i	Data Flow Commands (Media Copy)

P_S Value	Meaning
0	Block Transmit to Peripheral Port
4	Copy Serial Transparent to Peripheral Off
5	Copy Serial Transparent to Peripheral On
6	Copy Peripheral Transparent to Serial Off
7	Copy Peripheral Transparent to Serial On
? 6	Copy Serial to Peripheral w/Interpret. Off
? 7	Copy Serial to Peripheral w/Interpret. On
? 8	Copy Peripheral to Serial w/Interpret. Off
? 9	Copy Peripheral to Serial w/Interpret. On

Control Character	Function
ESC [P_S; P_S;...ℓ	Reset Mode (see ESC [P_S; P_S;...h)
ESC [P_S; P_S;...m	Select Graphic Rendition

P_S Value	Meaning
0	Normal; No Visual Attributes
2	Dim On
4	Underscore On
5	Blink On
7	Inverse On
8	Blank

Control Character	Function
ESC [P_S; P_S;...n	Request Teleray to Report

P_S Value	Meaning
5	Send Short Form Status
6	Send Cursor Position
? 7	Send Time
? 8	Send Detailed Status
? 15	Send Peripheral Status

Control Character	Function
ESC [P_S n	Teleray Status Report

P_S Value	Meaning
0	Teleray Ready
3	Malfunction
? 10	Peripheral Port Ready
? 11	Peripheral Port Not Ready

Control Character	Function
ESC [P_S; P_S;...o	Define Area Qualification

P_S Value	Meaning
0	Normal (Cancel Previous)
3	Numeric Only
4	Alpha Only
5	Right Justified
6	Zero Fill (else space filled)
8	Protected Transmittable
? 1	Entry Required
? 2	Must Fill

Control Character	Function
ESC [P_n p	Delete P_n Characters Within Text Block
ESC [P_s; P_s;...q	Program Keyboard Indicators

P_s Value	Indicators
0	All Off
1	L1 On
2	L2 On
3	L3 On
4	L4 On
5	On-Line On (Automatically Reset)
6	Local On (Automatically Reset)
7	Keyboard Locked On (Automatically Reset)

Control Character	Function
ESC [P_n; P_n r	Set Top; Bottom Margins
ESC [P_n; P_n s	Set Left; Right Margins
ESC [P_s t	Transmit Dynamic Programmable Function P_s
ESC [P_s u	Locally Perform Dynamic Programmable Function P_s
ESC [16; P_s y	Self-Test Terminal – Results to Status Line – See ESC $\wedge$ 4

P_s Value	Test Performed
0 or 1	All Tests
2	ROM – Program
3	DSP – Display RAM
4	KBD – Keyboard
5	SIO (requires jumper plug)
6	PIO (requires jumper plug)
7	CRT (fills screen)
8	Repeat Previous Test Until Error
9	NVM Test

Control Character	Function
ESC [P_s z	Enable Transmits to Dynamic Programmable Function P_s ESC \ Terminates Function Definitions
ESC [P_s; P_s {	Select Start of Transmission Identifying Character (First P_s selects for serial port; second for peripheral port. Default values are "none".)

P_s Value	Identifier	P_s Value	Identifier	P_s Value	Identifier
0	Default	13	CR	26	SUB
1	SOH	14	SO	27	ESC
2	STX	15	SI	28	FS
3	ETX	16	DLE	29	GS
4	EOT	17	DC1	30	RS
5	ENQ	18	DC2	31	US
6	ACK	19	DC3	32	NUL
7	BEL	20	DC4	33	None
8	BS	21	NAK	34	DEL
9	HT	22	SYN	35	LF CR
10	LF	23	ETB	36	CR LF
11	VT	24	CAN		
12	FF	25	EN		

Control Character	Function
ESC [P_s; P_s |	Select End of Transmission Identifier – Default is EOT (See ESC [P_s; P_s { for format.)
ESC [P_n ~	Insert P_n Characters in Text Block
ESC [P_n Space @	Scroll Display Text P_n Columns Left
ESC [P_n Space A	Scroll Display Text P_n Columns Right
ESC [P_n Space p	Select P_n Pages – Default is 4
ESC [P_s Space q	Select Cursor Character – P_s from 0 through 256 selects from table in Section 5-1 in ascending ASCII order.

Control Character	Function
ESC [P_n Space r	Select Right Margin Bell P_n Columns from Right Margin – Default is 8
ESC [P_n Space s	Specify Screen Brightness Level from 0 through 64
ESC [P_n; P_n Space t	Delay Machine P_n 1st P_n Seconds; 2nd .1 Seconds
ESC [P_s; P_s Space u	Unlock Selection in Category P_s; Feature P_s
ESC [P_s; P_s Space v	Lock Selection in Category P_s; Feature P_s
ESC [Space w	Exit Selection Menu
ESC [2 Space x	Clear all Dynamic Function Memory
ESC [255; 255 space y	Reset to Default Conditions
ESC [space z	Duplicate Rendition
ESC [P_n ? p	Set Logical Page Length to P_n Lines
ESC [P_n ? q	Set Logical Line Length to P_n Characters
ESC [P_n; P_n; P_n ? r	Report Time (to Host) P_n hours; P_n minutes; P_n seconds
ESC [P_n; P_n; P_n ? s	Set Time (to Teleray) P_n hours; P_n minutes; P_n seconds
ESC [P_s; P_s ? t	Select Text for Transmission Serial Port; Peripheral Port

P_s Value	Text Selected
0	Page (Default)
1	Line
2	Window
3	Memory
4	Selected Area, SSA to ESA (See ESC F, ESC G)

Control Character	Function
ESC [P_n ? u	Reinstate Last Deleted Line P_n Times
ESC [P_n ? v	Reinstate Last Deleted Word P_n Times
ESC [? P_n w	Delete P_n Words
ESC [P_s; P_s ? y	Select Serial, Peripheral End of Line Resume Character
ESC [P_s; P_s ? z	Select Guarded Field Identifier Characters – Default is HT (See ESC [P_s; P_s {)
ESC [P_s; P_s ? {	Select End of Line Terminator Characters – Default is LF CR (See ESC [P_s; P_s {)
ESC [P_s; P_s ? ¦	Select End of Page Terminator Characters – Default is FF (See ESC [P_s; P_s {)
ESC [P_s; P_s ? }	Select Baud Rate for Serial Port; Peripheral Port

P_s Value	Rate	P_s Value	Rate
0	2400 (default)	8	1200
1	50	9	1800
2	75	10	2400
3	110	11	3600
4	134.5	12	4800
5	150	13	7200
6	300	14	9600
7	600	15	19200

Control Character	Function
ESC [P_s; P_s ? ~	Set Parity for Serial Port; Peripheral Port

P_s Value	Parity Setting
0	None (8 bits no parity)
1	Odd
2	Even
3	Mark
4	Space

Control Character	Function
ESC \	String Terminator for Control Sequences
ESC c	Reset to Initial State

SECTION 7
CODING SUMMARY ARRANGED BY FUNCTION

S   indicates modifiable in Selection Menu
*   indicates state saved in non-volatile memory
¶   indicates default condition
ℓ   indicates lower case L

7-1   Ergonometric Controls

S * Screen Brightness Level	ESC [P_n space s
S * Smooth Scroll/Jump Scroll (1)	ESC [? 3 h / ESC [? 3ℓ ¶
S * Smooth Scroll Rate 6/12 lps	ESC [? 22 ℓ ¶ / ESC [? 22 h
S * Auto Key-Repeat On/Off	ESC [? 8 h / ESC [? 8ℓ ¶
S * Auto Key-Repeat Rate 30/15 cps	ESC [? 21 ℓ ¶ / ESC [? 21 h
S * Screen Background Dark/Light	ESC [? 5 ℓ ¶ / ESC [? 5 h
S * Right Margin Bell Column (2)	ESC [P_n space r
S * Cursor Character Blink/Steady (3)	ESC [? 33 h ¶ / ESC [? 33ℓ
S * Cursor Character Select	ESC [P_n space q
S * Keyclick On/Off	ESC [? 28 h / ESC [? 28ℓ ¶

(1)   Smooth scroll temporarily revoked automatically if input buffer attempts to overflow.

(2)   Set P_n to zero to disable Bell; Bell rings P_n columns from end of logical line. Default = 8.

(3)   If steady, cursor blinks only if placed on a non-space character.

7-2   Memory Structure Controls

Set Top, Bottom Margins (1)	ESC [P_n; P_n r
S * Set Left, Right Margins (1)	ESC [P_n; P_n s
S * Left Margin Wrap On/Off	ESC [? 29 h / ESC [? 29ℓ ¶
S * Right Margin Wrap On/Off	ESC [? 7 h / ESC [? 7ℓ ¶
S * Scrolling Off/On (2)	ESC [? 30 ℓ ¶ / ESC [? 30 h
S * Page Stop/Page Auto Advance	ESC [? 31 ℓ ¶ / ESC [? 31 h
S * Set Logical Line Length to P_n Characters (3)	ESC [P_n ? q
S * Set Logical Page Length to P_n Lines	ESC [P_n ? p
S * Select Number of Pages (4)	ESC [P_n space p

(1)   Margins must be smaller than logical page size.
Defaults are Line 1; last line of page.

(2)

Scrolling	Page	Action on Reaching Page Boundary
On	Stop	Scroll within page
On	Advance	Scroll into next page
Off	Stop	Overwrite in current page
Off	Advance	Auto "flip" into next page

Cursor will not move backward or scroll beyond first page or forward beyond last page.

(3)   255 characters per line maximum.

(4)   Remainder used as dynamic programmable function if non-volatile memory option installed (255 lines per page maximum).

7-3 Application Controls, Operator Alerts, and Bottom Line Displays

A. Application Controls

S * Monitor Mode/Normal	ESC [3 h / ESC [3 ℓ ¶
S * New Line Mode/Line Feed	ESC [20 h / ESC [20 ℓ ¶
S * 50/60 Hz Refresh Rate	ESC [? 34 h / ESC [? 34 ℓ ¶
S * Selection Menu Line/Page	ESC [? 50 ℓ ¶ / ESC [? 50 h
S * Screen Saver On/Off	ESC [? 32 h / ESC [? 32 ℓ ¶

B. Operator Alerts

Sound Bell	Bel
Keyboard Lock/Unlock	ESC [2 h / ESC [2ℓ ¶
* Illuminate/Extinguish LEDs (1)	ESC [P_s; P_s;...P_s q

(1) P_s Action

0 or none	¶All off
1	L1 on
2	L2 on
3	L3 on
4	L4 on
5	On Line on (Automatically reset)
6	Local on (Automatically reset)
7	Keyboard Locked on (Automatically reset)

C. Bottom Line Displays

Start/End Message Line Message (1)	ESC P M text ESC \
Enter/Exit Calculation Mode	ESC [? 26 h / ESC [? 26 ℓ ¶
Exit Selection Mode (Blank Bottom Line)	ESC [space w
Display Terminal Status On/Off (2)	ESC [? 27 h / ESC [? 27 ℓ ¶
Display Self Test Result (3)	Automatic on self test completion
Lock Selection Feature (4)	ESC [P_s; P_s space v
Unlock Selection Feature (4)	ESC [P_s; P_s space u

(1)   Message to be placed on the bottom line is bracketed between the ESC sequences shown. No text will erase the bottom line. MSG indicator will indicate to the operator that a message is waiting if the bottom line is being used to display terminal status, Selection Menu, or self test result.

(2)   Terminal status displays current condition of: clock, cursor column number, line number, page number, entry error, function memory.

(3)   Includes program revision level and self test results.

(4)   Each selection feature can be separately locked. First P_s selects group; second P_s selects item. (See Page 4-1.)

D. Clock

Set Clock Time (1)	ESC [P_n; P_n; P_n ? s
Request Time	ESC [? 7 n
Report Clock Time (1)(2)	ESC [P_n; P_n; P_n ? r
Delay Next Operation (3)	ESC [P_n; P_n space t

(1) Format

1st P_n ⟶ hours (0 through 23)

2nd P_n ⟶ minutes (0 through 59)

3rd P_n ⟶ seconds (0 through 59)
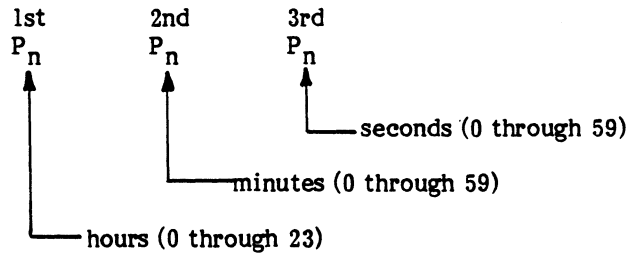
(2) Status display is a 12-hour clock (no AM, PM)
Computer clock is a 24-hour clock, military time format
(e.g., 14 = 2 PM, 2 = 2 AM, etc.)

(3) First P_n in seconds 0 through 59; second P_n in tenths of seconds. Data accepted into buffers but not processed; keyboard is locked during delay interval.

7-4 Communications Format

S * Set Baud Rates (1)	ESC [P_s; P_s ? }
S * Set Parity (2)	ESC [P_s; P_s ? ~
S * Serial I/O Parity Check/None	ESC [? 37 h / ESC [? 37 ℓ ¶
S * Peripheral I/O Parity Check/None	ESC [? 45 h / ESC [? 45 ℓ ¶
S * Serial I/O Full Duplex/Half	ESC [? 36 ℓ ¶ / ESC [? 36 h
S * Peripheral I/O Full Duplex/Half	ESC [? 44 ℓ ¶ / ESC [? 44 h

(1) First P_s selects for Serial port; second P_s selects for Peripheral port.

P_s	Baud Rate	P_s	Baud Rate
0 (or none)	2400	8	1200
1	50	9	1800
2	75	10	2400
3	110	11	3600
4	134.5	12	4800
5	150	13	7200
6	300	14	9600
7	600	15	19200

(2) First P_s selects for Serial port; second P_s selects for Peripheral port.

P_s	Parity Setting
0	None (8 bits no parity)
1	Odd
2	Even
3	Mark
4	Space

7-5 Data Flow Controls

S *	Local/Remote Mode (1)		ESC [? 12 h / ESC [? 12ℓ ¶
S *	Character/Block Mode (2)		ESC [? 25 ℓ ¶ / ESC [? 25 h
S *	Copy Serial Input to Peripheral –		
		Copy Interpreted On/Off	ESC [? 7 i / ESC [? 6 i ¶
		Copy Transparent On/Off	ESC [5 i / ESC [4 i ¶
S *	Enable/Disable Suspend-Resume – Serial I/O		ESC [? 38 h / ESC [? 38 ℓ ¶
*	Enable/Disable Serial Busy-Ready		ESC [? 35 h / ESC [? 35 ℓ ¶
S *	Local Echo Serial Port Off/On (3)		ESC [12 ℓ ¶ / ESC [12 h
S *	Copy Peripheral Input to Serial –		
		Copy Interpreted On/Off	ESC [? 9 i / ESC [? 8 i ¶
		Copy Transparent On/Off	ESC [7 i / ESC [6 i ¶
S *	Enable/Disable Suspend-Resume – Peripheral		ESC [? 46 h / ESC [? 46 ℓ ¶
S *	Enable/Disable Peripheral Busy-Ready Detect		ESC [? 41 h / ESC [? 41 ℓ ¶
S *	Peripheral Busy-Ready Level Low/High (4)		ESC [? 42 h / ESC [? 42 ℓ ¶
	Suspend		DC3
	Resume		DC1
	Bell Queue 8 Characters		
	Serial Input Buffer 256 Characters		
	Serial Output Buffer 16 Characters		
	Peripheral Input Buffer 256 Characters		
	Peripheral Output Buffer 16 Characters		

(1) Operates on Serial I/O port.

(2) Operates on keyboard data; transmitting functions will continue to transmit.

(3) Operates on keyboard data and transmitting functions.

(4) Always active; jumper in plug to disable.

7-6   Block Transmits

	Ready to Transmit	ESC S
	Transmit Text (1) (Serial I/O Port)	ESC 5
	Transmit Text (1) (Peripheral I/O Port)	ESC [i or ESC [o i
	Transmit Form and Text	ESC 6
	Start Select Area (SSA)	ESC F
	End Select Area (ESA)	ESC G
S *	Select Text for Transmission (2)	ESC [P_s; P_s ? t
S *	Transmit from Beginning to Cursor/to End	ESC [16 h / ESC [16 ℓ ¶
S *	Serial Auto Suspend on End of Line/Normal	ESC [? 39 h / ESC [? 39 ℓ ¶
S *	Peripheral Auto Suspend on End of Line/Normal	ESC [? 47 h / ESC [? 47 ℓ ¶
*	Select End of Line Resume Characters (3)	ESC [P_s; P_s ? y
S *	Space Suppression On/Off Serial	ESC [? 13 h / ESC [? 13 ℓ ¶
S *	Space Suppression On/Off Peripheral	ESC [? 15 h / ESC [? 15 ℓ ¶
S *	Space Substitution for Fields On/Off Serial	ESC [? 40 h / ESC [? 40 ℓ ¶
S *	Space Substitution for Fields On/Off Peripheral	ESC [? 48 h / ESC [? 48 ℓ ¶
S *	Transmit Guarded Fields/Transmit without Guarded Fields	ESC [1 ℓ ¶ / ESC [1 h
S *	Select Start of Transmission Identifier (4)	ESC [P_s; P_s { Default is none
S *	Select Guarded Field Replacement Identifier (4)	ESC [P_s; P_s ? z Default is HT
S *	Select End of Line Terminator (4)	ESC [P_s; P_s ? { Default is LF CR
S *	Select End of Page Terminator (4)	ESC [P_s; P_s ? ¦ Default is FF
S *	Select End of Transmission Terminator (4)	ESC [P_s; P_s ¦

(1) Text is selected by settings of "Select Text" and "Transmit from Beginning to Cursor/to End".

(2) First P_s selects for Serial port; second P_s selects for Peripheral port.

P_s Value	Area Transmitted
0	Page
1	Line
2	Window
3	Memory
4	Selected Area (SSA to ESA)

(3) First P_s selects for Serial port; second P_s selects for Peripheral port. Default is Carriage Return. Uses Decimal Selection Table, Page 5-1.

(4) First P_s selects for Serial port; second P_s selects for Peripheral port.

P_s Value	Identifier	P_s Value	Identifier	P_s Value	Identifier
0	Default	13	CR	26	SUB
1	SOH	14	SO	27	ESC
2	STX	15	SI	28	FS
3	ETX	16	DLE	29	GS
4	EOT	17	DC1	30	RS
5	ENQ	18	DC2	31	US
6	ACK	19	DC3	32	NUL
7	BEL	20	DC4	33	None
8	BS	21	NAK	34	DEL
9	HT	22	SYN	35	LF CR
10	LF	23	ETB	36	CR LF
11	VT	24	CAN		
12	FF	25	EN		

7-7 Programmable Functions

A. Macro Keys

* Reprogram Macro Key (Local) (1)(2)   ESC P L P_s text: P_s text...

* Reprogram Macro Key (Transmitting) (1)(2)   ESC P T P_s text: P_s text...

* Reprogram Macro Key (Keyboard) (1)(2)   ESC P K P_s text: P_s text...

   End Macro Key Sequence Definition   ESC \

(1) Typical Sequence:

ESC P ☐ P_s text: P_s text: P_s text: P_s text...ESC \

            ⎣L⎦ for local; ⎣T⎦ for transmitting, ⎣K⎦ for keyboard; text limited to eight characters maximum.

P_s = 2-digit key number for key to be reprogrammed; only include P_s text for those functions to be reprogrammed.

(2) Local macros always operate locally; no code is transmitted. Transmitted macro keys always transmit; there is no local effect unless the host computer echoes the macro character string. Keyboard macro keys are treated as keyboard input (e.g., local in Local mode, transmitting in Remote and Character modes, etc.).

B. Dynamic Programmable Functions

   * Define Dynamic Function P_s (1)   ESC P P_s text

     End Dynamic Function Definition   ESC \

     Locally Perform Dynamic Function P_s ESC [P_s u

     Transmit Dynamic Function P_s Contents   ESC [P_s t

     Enable Transmits to Dynamic Function P_s ESC [P_s z

S * Load Functions Transparent/With Interpretation   ESC [? 23 h / ESC [? 23 ℓ ¶

     Clear all Dynamic Function Memory   ESC [2 space x

(1) P_s is 2-digit dynamic programmable function number 01 through 32.

7-8 Text Presentation Format

Start Protected Area   ESC V

End Protected Area   ESC W

Duplicate Rendition   ESC [space z

Protect Mode On/Off   ESC [? 24 h / ESC [? 24 ℓ ¶

Select Qualified Areas (1)   ESC [P_s; P_s;...P_s o

Select Visual Attributes (2)   ESC [P_s; P_s;...P_s m

(1) P_s Value	Area Qualification
0 or none	Normal; cancel previous
3	Numeric only
4	Alphabetic only
5	Right justify
6	Zero fill (else will be space filled)
8	Protected, transmitting
? 1	Entry required
? 2	Must fill

(2) P_s Value	Attribute
0 or none	Normal; all attributes off
2	Dim on
4	Underscore on
5	Blink on
7	Inverse on
8	Blank

7-9   Cursor Positioning

A.   Cursor Manipulation

One Up or P_n Up	ESC [P_n A
One Down or P_n Down	ESC [P_n B
One Right or P_n Right	ESC [P_n C
One Left or P_n Left	ESC [P_n D or BS
Full Left (Cursor Return)	CR
Home	ESC [H or ESC [f
Line Feed (1)	LF
New Line (1)	LF or ESC E
Index	ESC D
Reverse Index	ESC M
Address Origin Window/Absolute	ESC [? 6 h / ESC [? 6 ℓ ¶
Direct Address (2)	ESC [P_n; P_n H or ESC [P_n; P_n f
Request Position Report	ESC [6 n
Cursor Position Response (2)	ESC [P_n; P_n R
* Save Cursor, Attributes and Character Set (in NVM)	ESC 7
Restore Cursor, Attribute Tag and Character Set	ESC 8

(1)   ESC [20 h sets LF to New Line function   }   Also select what CR and LF
       ESC [20 ℓ sets LF to Index function   }   keys transmit

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

B.   Tab Operations (Default stops every eighth column)

	Cursor to Next Tab Stop	HT
S *	Set Tab Stop in Current Column	ESC H
S *	Clear Tab Stop in Current Column	ESC [g
	Clear All Tab Stops	ESC [3 g
	Back P_n Tab Stops	ESC [P_n Z

C.   Text Movement

Scroll Display Text Up P_n Lines (1)	ESC [P_n S
Scroll Display Text Down P_n Lines (1)	ESC [P_n T
Scroll Display Text Right P_n Columns (2)	ESC [P_n space A
Scroll Display Text Left P_n Columns (2)	ESC [P_n space @
Forward P_n Pages	ESC [P_n U
Reverse P_n Pages	ESC [P_n V

(1)   All 24 lines if window not specified or if set to 24. Scrolls also auto
      matically initiated by moving cursor past page or window boundaries.

(2)   Scrolls may also be initiated by moving cursor past page boundaries.

7-10 Erases, Resets, and Edits

A. Erases

Erase from Cursor to Right Margin (1)	ESC [0 K
Erase from Cursor to Left Margin	ESC [1 K
Erase Entire Line to Both Margins	ESC [2 K
Erase from Cursor to Bottom Margin (2)	ESC [0 J
Erase from Cursor to Top Margin	ESC [1 J
Erase Entire Page Within Margins	ESC [2 J
Erase from Cursor to End of Pages	ESC [? 1 J
Erase All Pages	ESC [? 2 J
Erase Field	ESC [P_s N (3)
*Erase to Protected Spaces/Non-Protected Spaces	ESC [? 49 h / ESC [? 49 ℓ ¶

(1) To end of logical line if no margin.

(2) To end of page if no bottom margin.

(3) P_s

0 or none	From cursor to end of field
1	From cursor to beginning
2	Entire field

B. Resets

Reset to Initial State	ESC c
Reset to Default Conditions	ESC [255; 255 space y

C. Edit Functions

Repeat Previous P_n Times	ESC [P_n b
Insert P_n Characters (1)	ESC [P_n @
Delete P_n Characters (1)	ESC [P_n P
Select Editing Extent (2)	ESC [P_s Q
Insert P_n Characters in Text Block	ESC [P_n ~
Delete P_n Characters in Text Block	ESC [P_n p
Delete P_n Words	ESC [P_n ? w
Reinstate Last Deleted Word P_n Times	ESC [P_n ? v
Insert P_n Lines	ESC [P_n L
Delete P_n Lines	ESC [P_n M
Reinstate Last Deleted Line P_n Times	ESC [P_n ? u
Insert/Replacement Mode	ESC [4 h / ESC [4 ℓ ¶

(1) Operation extent selected by editing extent mode.

(2) Edit within the window for P_s = 0 or nothing
Edit within the line for P_s = 1
Edit within the field for P_s = 2

7-11 Tests, Reports, and Messages

A. Self Testing

Reset to Initial State   ESC c
Invoke Self Test (1)(2)   ESC [16; P_s y

(1) P_s Meaning

        0 or 1   All Tests (except SIO and PIO tests)
        2   ROM Test
        3   DSP Test
        4   KBD Test
        5   SIO Test (turn around plug needed)
        6   PIO Test (turn around plug needed)
        7   CRT Test (fills screen)
        8   Repeat specified test until error (will perform all if no parameters included)
        9   NVM Test

(2)   Test results and internal program revision level reported on bottom line;
      also see Reports and Messages.

B. Reports and Messages

S * Program Answerback   ESC P A text ESC \
     Request Answerback   ENQ
     Response to Answerback Request   text, default is TELERAY
S * Program Identity Sequence   ESC P I text ESC \
     Request Identity Sequence   ESC [c
     Response to Identity Sequence   text, default is ESC [? 1; 2 c
     Request Teleray Status   ESC [P_s n

	P_s Value	Status Report Requested
	5	Send short form status
	6	Send cursor position (see Cursor)
	? 7	Send time (see Clock)
	? 8	Send detailed Teleray status
	? 15	Send peripheral port status

Responses to Status Requests

ESC [P_s n	P_s Value	Meaning
	0	Teleray ready
	3	Malfunction
	? 10	Peripheral port ready
	? 11	Peripheral port not ready

Response to Detailed Status Request

ESC P R text ESC   where text is the self test result on the bottom line. The self test should
be invoked immediately prior to the detailed status request.

GRAPHIC SET
IN USE
DEFAULT IS G0

GRAPHIC SET
INVOCATION

SI (CTRL O)   SO (CTRL N)   SS2 (ESC N)

"LOCKING"   "LOCKING"   "SINGLE SHIFT"
SHIFT   SHIFT

G0   G1   G2
SET   SET   SET

DEFAULT   DEFAULT   DEFAULT
IS   IS   IS
ASCII   LINE   MOSAIC
            DRAWING

GRAPHIC SET   ESC (B   ESC)B   ESC (A   ESC)A   ESC)O   ESC)1
DESIGNATION   ESC*B   ESC (A   ESC*A   ESC (O   ESC*O   ESC (1   ESC*1

GRAPHIC SET
REPERTOIRE   ASCII   UK   LINE DRAWING   MOSIAC

7-11
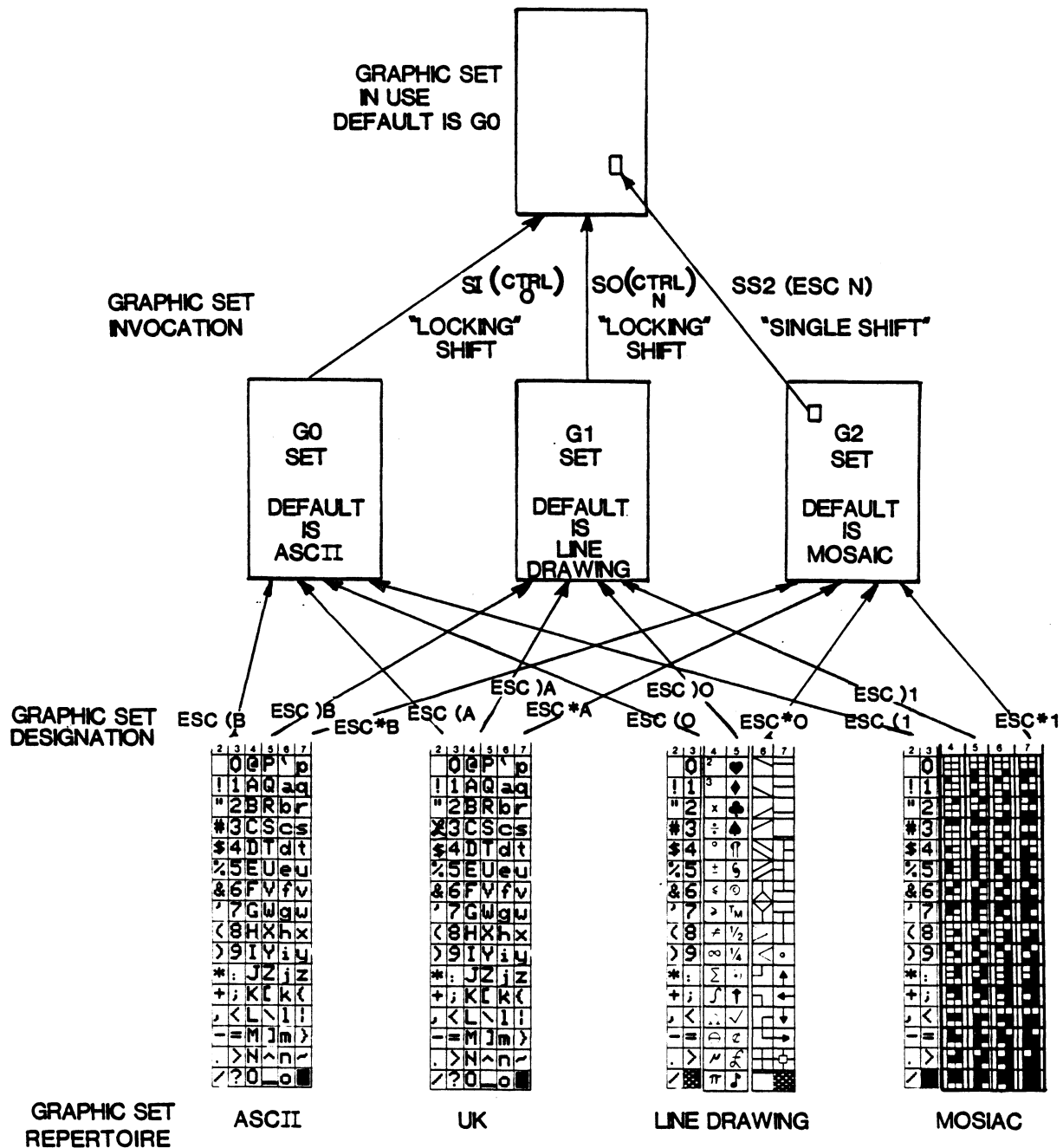
Control Character Display and Generation

Monitor Mode Display	Control Character	Keyboard Generation Press[1] 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	3
E_B	ETB	W
E_X	ETX	C
F_F	FF	L
F_S	FS	4
G_S	GS	5
H_T	HT	I
L_F	LF	J
N_K	NAK	U
N_L	NUL	2 or space bar
R_S	RS	6
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	7
V_T	VT	K
	DEL	8

[1] Dedicated keys on keyboard for several of these codes.

USA STANDARD CODE FOR INFORMATION INTERCHANGE

b_4	b_3	b_2	b_1	COLUMN / ROW	$0\,0\,0$ (0)	$0\,0\,1$ (1)	$0\,1\,0$ (2)	$0\,1\,1$ (3)	$1\,0\,0$ (4)	$1\,0\,1$ (5)	$1\,1\,0$ (6)	$1\,1\,1$ (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

INDEX

Your Comments, Please...

Your comments assist us in improving the usefulness of our publications. Comments are an important part of the inputs used in preparing updates to manuals.

Please complete the questionnaire, fold it up, and return it to us. If you prefer not to give us your name, just leave the last part, name and address, blank. All comments and suggestions become the property of Teleray.

Thank you for your help.

* * *

What was your initial reaction to this Instruction Manual? Would you consider it complete and accurate? Do you consider it easy to use?

What sections did you find most helpful?

What sections did you find most difficult?

What errors or omissions have you found in it?

Are you generally satisfied with the contents?

Suggested improvements:

Other comments:

Name_____Street_____

Title_____ City/State/Zip_____

Organization_____ Telephone_____

Thank you for your help. No postage necessary if mailed in the USA.

Edition 2.3

PLEASE FOLD AND TAPE
NOTE: U.S. Postal Service will not deliver stapled forms

‖ ‖‖

BUSINESS REPLY MAIL
First Class Permit No. 9147 Minneapolis, U.S.A.

Postage will be paid by addressee

TELERAY DIV.
RESEARCH INC.,
BOX 24064
MINNEAPOLIS, MN 55424

ATTN: TELERAY SERVICE MS 203

TELERAY