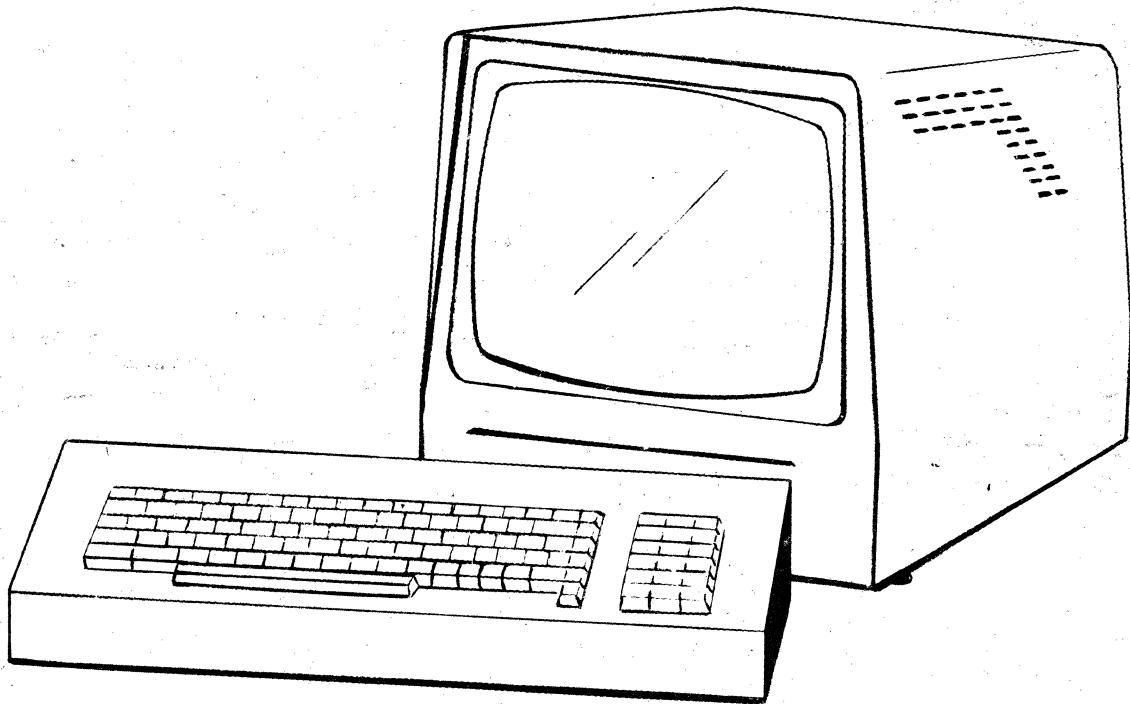


# TELERAY

10 SERIES

## CRT DATA TERMINAL



## INSTRUCTION MANUAL



**RESEARCH INC**

BOX 24064 MINNEAPOLIS, MINNESOTA USA 55424

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

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Section I

GENERAL INFORMATION

This manual contains information for the installation, operation, maintenance and repair for the 10 Series Teleray terminal. The Teleray terminal is a microprocessor controlled cathode ray tube keyboard/display terminal with asynchronous ASCII input/output capabilities.

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

The option codes and special feature codes which 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.

<b>TELERAY 1060</b>		
<u>80000-45-202</u>	<u>CLP-SF421</u>	LEASE <input type="checkbox"/>
SERIAL NO.	OPTION CODES	EQUIP.

<u>Option Code</u>	<u>Description</u>
CLP	Current loop is installed
SFXXX	Special feature number XXX has been installed.

## Section 2

### INSTALLATION

#### 2-1 Unpacking

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

#### 2-2 Site Selection

The Teleray terminal is designed for desk or table top mounting. The detached keyboard permits the keyboard to be located within 30 inches (.75 meters) of the monitor. Rubber mounting feet are provided on the base of the terminal to protect the desk or table top and to provide spacing for air flow beneath the unit.

#### 2-3 Power Connections

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

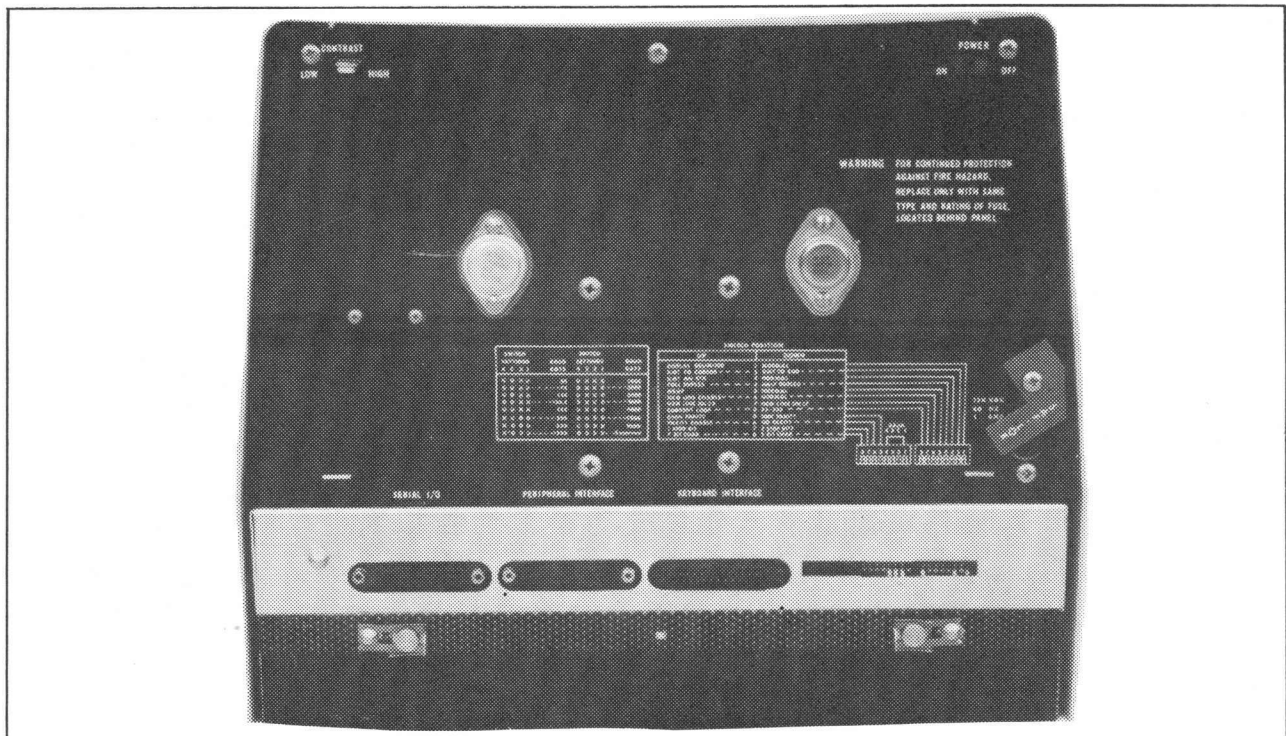
#### CAUTION

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

The standard terminal operates on 110 volt, 50 or 60 Hz power. For 220 volt operation, the power supply must be appropriately jumpered. Instructions for reconnecting the terminal for 110V or 220V operation are printed on the power supply inside the Teleray.

#### CAUTION

This modification is simple to install only if proper tools are available. Improper installation voids any warranty on this module and on any equipment it is connected to.



## 2-4 Communications Connections

The connectors for the Serial I/O and for the Peripheral table are located at the back of the terminal. The EIA RS232 Signals Table lists the pin assignments for these connectors.

### A. Serial I/O

The Serial I/O Protocol Table lists the operation of the output signals. The table also shows the effect of the input signals on the Teleray.

#### NOTE

**The Teleray will not transmit data unless the Clear to Send signal is ON and will not receive data unless the Carrier Detect signal is ON.**

If the Teleray is connected to a device which does not have a complete complement of control signals the interface cable must be strapped to simulate the missing signals. This is done by jumpering pins 4 and 5 together and by jumpering pins 8 and 20 together.

### B. Peripheral

The Peripheral Pin Assignment was chosen to allow the use of a "I to I" cable. The outputs are held in the ON condition and the inputs are unused by the Teleray peripheral interface. This interface is designed to operate with a receive only device such as a printer.

#### EIA RS232C Signals

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

**Serial I/O Protocol**

(Also See Section 5-1)

	LOCAL	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	OFF (-12V)	ON (+12V)	ON (+12V)	ON (+12V)	ON (+12V)
REQUEST TO SEND	OFF	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	YES	NO	YES	YES	YES
SERIAL DATA INTO DISPLAY	NO	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	Mark	Mark unless Clear to Send is on (+12V) then: All keyed data. Displayed data during execution at a transmit function	Mark unless Clear to Send is on (+12V) then: Mark except: display data during execution of a transmit function	Mark unless Clear to Send is on (+12V) then: All keyed data. Display data during execution of a transmit function	Mark unless Clear to Send is on (+12V) then: Mark except: display data transmitted under control of the transmit functions

### C. (Optional) Current Loop

The Serial I/O connector is used for both RS232 and the current loop. With the current loop option installed, either the RS232 interface or the current loop interface can be used. Selection between the two interfaces is accomplished via a rear panel switch. The RS232 modem control inputs (Clear to Send and Data Set Ready) are not used by the Teleray when the current loop is selected but the outputs are driven. Current loop pin assignment is:

PIN		
12	+	Transmit Loop
24	-	
<hr/>		
13	+	Receive Loop
25	-	

The current loops are optically isolated from the Teleray Power supply. Protective ground or signal ground connections are not required. The transmit and receive loops may be connected in series for a two wire connection.



## 2-5 Communications Character Modes

These modes must be set to match the computer with which the Teleray will be communicating with. The modes are determined by rear panel switches; see rear panel or Section 5 for instructions.

### One/Two Stop Bit Modes

These rear panel switch selected modes determine if a minimum of one or two stop bit(s) will be appended to and checked for on each transmitted character. Most computers use one stop bit.

### Parity Enable/Disable Modes

The parity Enable/Disable switch enables and disables both the parity generation and the parity checking. If parity is disabled a parity bit will not be generated. If disabled the communications character which is transmitted, will be one bit shorter than the character transmitted when parity is enabled. If parity is incorrectly set most or all of the received data on the Teleray display will be SUB (<sup>S</sup>B) characters.

### Seven/Eight Bit Modes

The 7 bits or 8 bits switch controls the length of the communications character exclusive of the parity or stop bit positions. When set to 8 bits the Teleray will automatically put a 1 in the 8th bit position on transmission and will ignore the 8th bit on reception.

### Commonly Used Communications Character Mode Settings

Parity Odd	Set to Parity ENABLE, 7 Bits, 1 or 2 Stop Bits
Parity Even	Set to Parity ENABLE, 7 Bits, 1 or 2 Stop Bits - most common
Parity High	Set to Parity DISABLE, 8 Bits, 1 or 2 Stop Bits - sometimes called "Mark Parity"
No Parity	Set to Parity DISABLE, 7 Bits, 1 or 2 Stop Bits

### NOTE

The combination of Parity Enable and eight bit modes should generally be avoided.

### Baud Rates

The Serial I/O baud rate can be changed from the rate selected on the four rear panel baud rate switches to any other of the fifteen available rates by an ESC [ followed by the appropriate character shown in the table below. Once changed, the baud rate remains fixed until it is changed again, until a Reset to Initial State sequence (ESC g) has been performed, or until power is turned off. In the latter two cases, the rate reverts to the rate set by the rear panel switches.

The peripheral baud rate can be changed to any of the other fifteen available rates by an ESC \ followed by the appropriate character shown below. Once changed, the rate remains fixed until it is changed again or until power is turned off; in which case the rate reverts to the rate set by the rear panel switches.

Program Sequence	Baud Rate	Rear Panel Switch Positions				
		4	3	2	1	
Serial I/O: ESC [ then	0	50	U	U	U	U
Peripheral ESC \ then	1	75	D	U	U	U
	2	110	U	D	U	U
	3	134.5	D	D	U	U
	4	150	U	U	D	U
	5	300	D	U	D	U
	6	600	U	D	D	U
	7	1200	D	D	D	U
	8	1800	U	U	U	D
	9	2000	D	U	U	D
	:	2400	U	D	U	D
	;	3600	D	D	U	D
	<	4800	U	U	D	D
	=	7200	D	U	D	D
	>	9600	U	D	D	D
	?	Res	D	D	D	D

U = Up  
D = Down

### Section 3

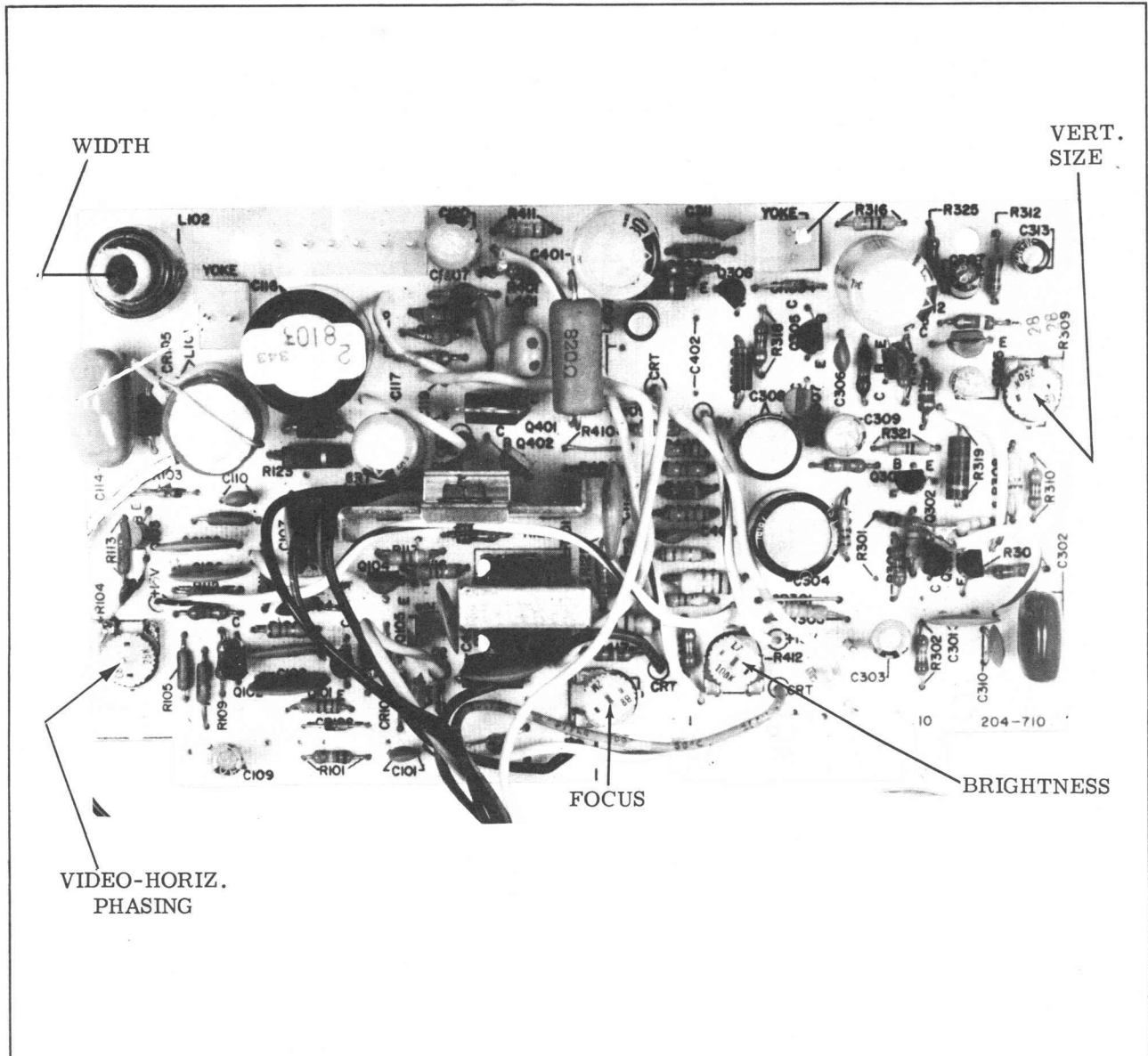
## INSTALLER/OPERATOR CONTROLS

### 3-1 Internal Controls - MONITOR

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

#### CAUTION

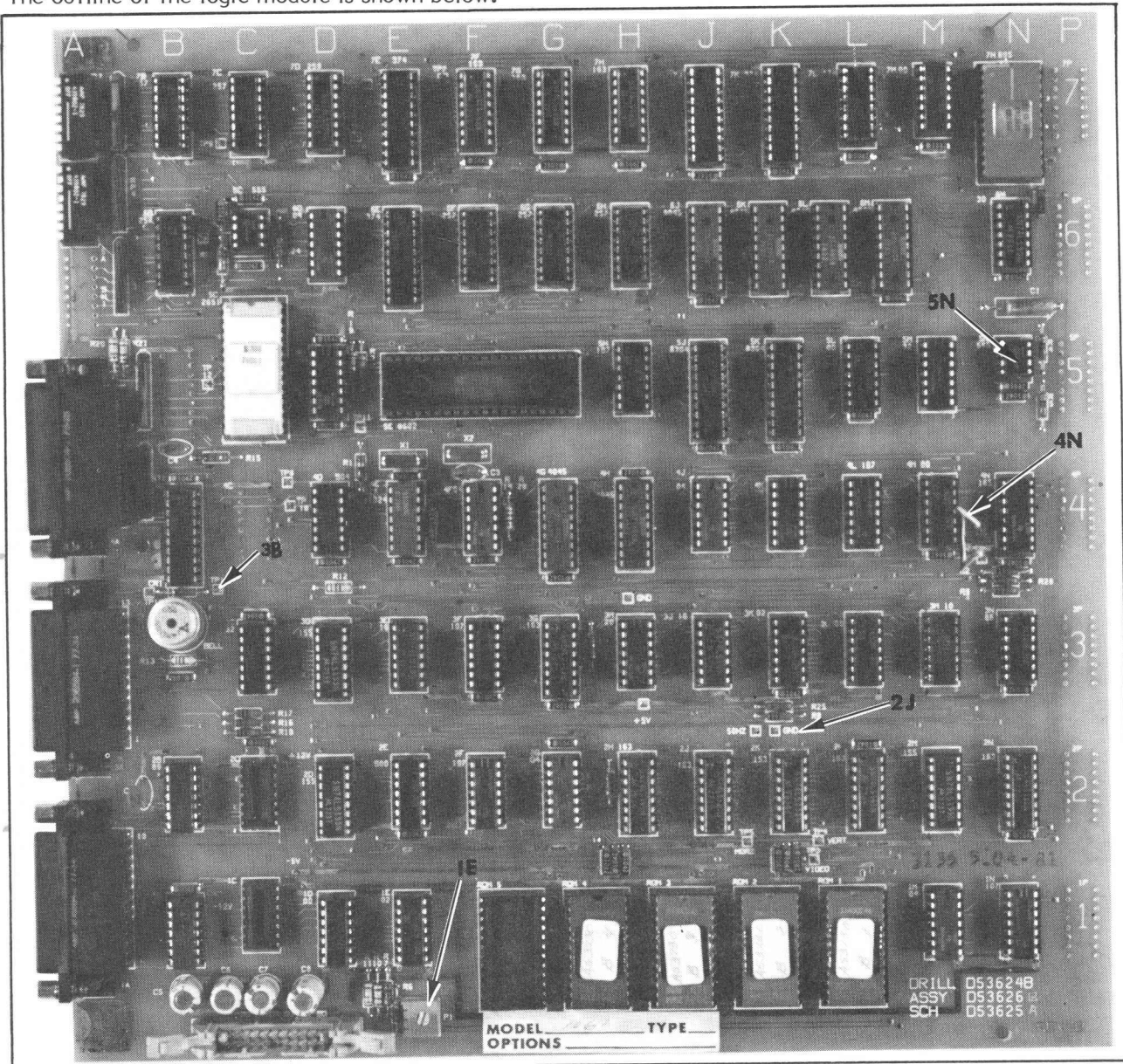
No work should be attempted on any exposed monitor chassis by anyone not familiar with servicing procedures and precautions.



MONITOR CIRCUIT CARD

### 3-2 Internal Controls - LOGIC MODULE

The outline of the logic module is shown below.



#### A. 50 Hertz Refresh - Grid Location 2J

When a jumper is added between the test points marked "50 Hz" and "GND" the logic will refresh the CRT at 50 Hertz; with no jumper installed the refresh rate is 60 Hertz. Some monitor adjustment is required when this strap is changed.

#### B. Inverse - Grid Location 4N

When a jumper is added between the test points marked "Inverse" and "GND" the display will change from the normal white characters on a black background to black characters on a white background. Those field modifiers (see Operation section) which provides inverse fields will still function.

#### C. Dim Level - Grid Location 1E

A potentiometer is provided to set the brightness level of the dim fields. A small screwdriver or similar tool is required. Clockwise rotation of the slot increases brightness. Adjustment of this setting is easier if power is applied to the Teleray so that the effect of the adjustment can be observed.

### CAUTION

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

The rear panel contrast control should be correctly set before attempting this adjustment.

#### D. Bell Volume - Grid Location 3B

Test points 13 and 14 located near 3B are provided for reducing the volume of the Bell tone should it be necessary. These points can be shorted together to eliminate the Bell completely; a 20 ohm resistor will reduce the volume approximately 50%.

#### E. BLINK/BLANK - Grid Location 5N

When the circuit in location is removed, Blink fields will become Blank fields (see 5.6).

### 3-3 Rear Panel Controls

On/Off - Power on/off switch

Contrast - Display contrast potentiometer

Logic Variables - Two banks of eight DIP switches each, mounted on the logic board, are accessible through an elongated hole in the rear panel. The switch positions shown below are for the "M" package. Optional cabinetry may change the position of these switches. The actual position of each of these switches is marked on the rear panel of all 10 Series Telerays.

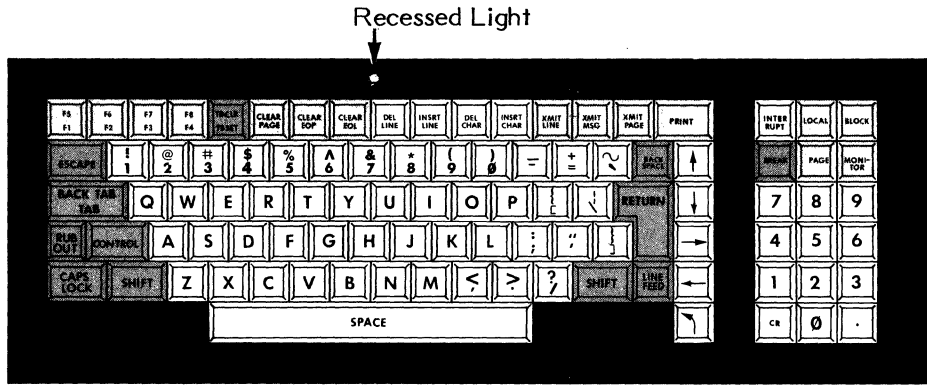
	UP	Switch No.	DOWN	
<b>Right Most Switch</b>	Display Field Modifiers	1		} <b>Right Block</b>
	Xmit to Cursor	2	Xmit to End	
	Xmit an ETX	3		
	Full	4	Half Duplex	
	Wrap	5		
	New Line	6		
	New Line on CR	7	New Line on LF	
	I-Loop	8	RS-232	
-----				
<b>Left Most Switch</b>	4 Baud Switches	1-4	Baud	} <b>Left Block</b>
	Even	5	Odd	
	Parity Enabled	6	No Parity	
	1 Stop Bit	7	2 Stop Bits	
	7 Bits	8	8 Bits	

Further descriptions of the effect of these switches on terminal operations is provided in the appropriate segment of the Operation section of this manual.

## Section 4

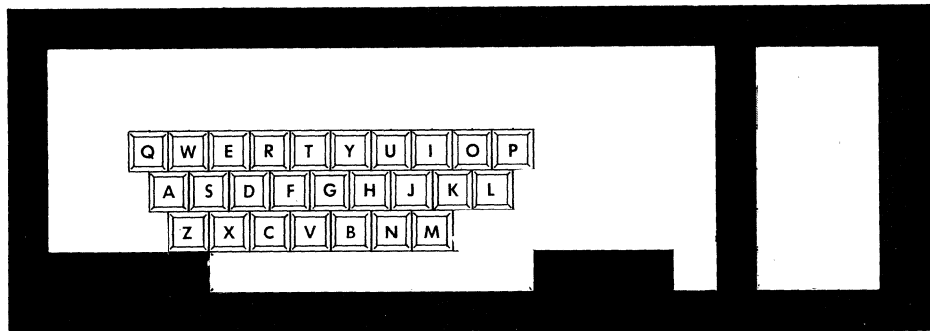
### KEYBOARD

The figure below describes the keyboard with the largest available standard keys. Not shown are optional or special layouts which contain more or fewer keys. A recessed light is provided to indicate that the remote keyboard has been correctly connected to the Teleray display.



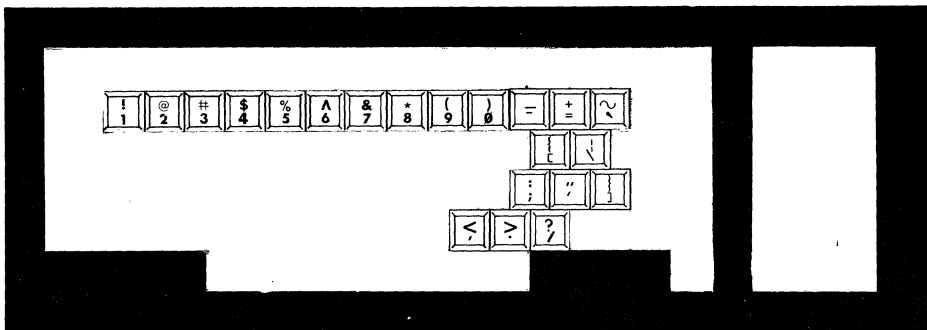
#### Alphabetic Keys

The keys shown below generate the appropriate ASCII character. Both upper and lower case can be generated under control of the shift and caps lock keys.



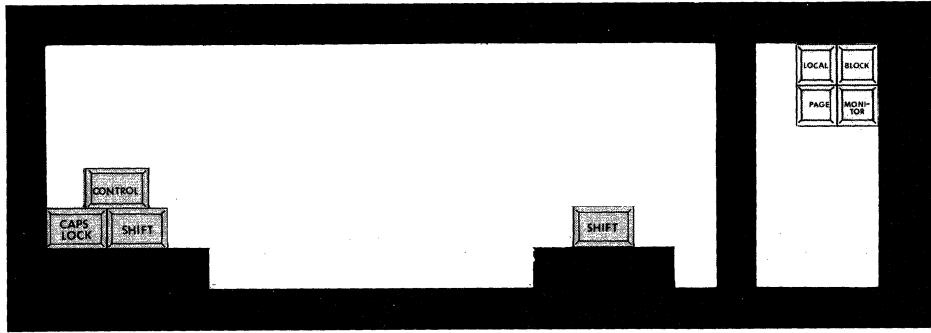
#### Numeric and Special Symbols

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 in the upper legend. The position of caps lock does not affect the operation of these keys.



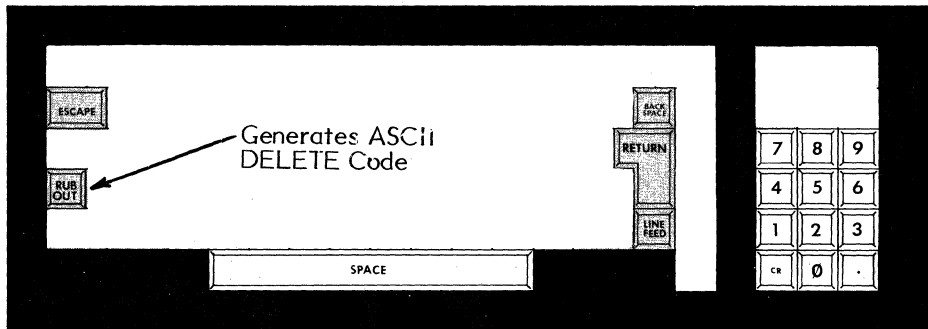
### Mode Keys

The keys shown below control the mode of the keyboard and/or terminal.



### Dedicated Keys

The keys shown below generate a single ASCII code regardless of the position of the shift, caps lock or control keys.



### Programmable Function Keys

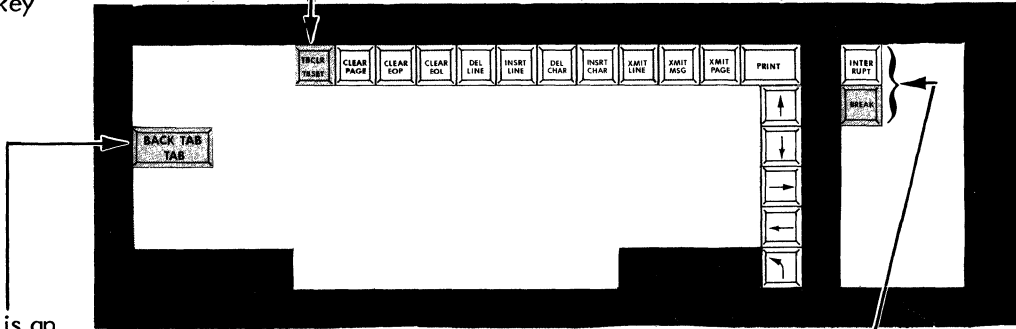
The keys shown below will generate the ASCII or local operation sequences which have been stored in the program function memory. If the function has not been defined (see 5-5), pressing the key will not perform any action.



## Local Operation Keys

The keys shown below do not generate ASCII codes but only perform the function indicated by the keytop legend. When defining a programmable function, all of these keys (except Interrupt) can be stored in a programmable function definition for local operation. The operation performed by these keys can also be performed by the appropriate Escape Sequence from either the keyboard or from the Serial I/O interface.

Operation is selected  
by shift key



This key is an exception, it generates ASCII TAB character unshifted and performs a Back Tab function when shifted.

There are no equivalent Escape sequences for these keys

## Section 5

### OPERATION

#### 5-1 Communications Modes

##### Character/Block Modes

In Character mode, each character code is transmitted individually as the appropriate data key is pressed; blocks may be transmitted by pressing the transmit keys.

In Block mode, keyed data goes to the Teleray display and is only transmitted by the transmit functions.

##### Half/Full Duplex Modes

Full Duplex operation is used with Full Duplex type modems (Bell 103 or equivalent); Half Duplex mode with Half Duplex modems (Bell 202 or equivalent). These modes are selected by a rear panel switch.

###### Full Duplex Operation

When the Teleray is in Character mode and Full Duplex mode, keyed data are transmitted; the data will not go to the Teleray display unless the remote computer echoes it. The Serial I/O Request to Send signal is held ON in these modes. In the Block and Full Duplex modes, keyed data goes to the Teleray display and does not go to the Serial I/O port. Keyed data is transmitted only by the transmit functions.

###### Half Duplex Operation

If the Teleray is in Character mode and Half Duplex mode, a local copy is imaged on the screen as items are keyed and transmitted. The Serial I/O Request to Send signal is asserted upon initiation of keyboard data entry and negated following transmission of Line Feed or New Line code.

In the Block and Half Duplex modes, the Request to Send signal is asserted only during a block transmission. Keyed data goes only to the Teleray display and can be transmitted only by the transmit functions.

##### Local/Remote Modes

In Local mode the Teleray keyboard and programmable functions are executed within the Teleray. No data is transmitted and the Request to Send and Data Terminal Ready signals are negated. The Print function will operate in Local mode. In Remote mode the Request to Send signal is determined by Full/Half Duplex mode and keyed data is transmitted as determined by the Full/Half Duplex and Character/Block modes.



## 5-2 Operating Modes

### Wide/Normal Character Modes

The normal display format of the Teleray is 24 lines of 80 characters. Receipt of an ESC m sequence will change the format to 24 lines of 40 characters (Wide mode). In Wide mode, the first 40 characters of each line are expanded to twice their normal size. The display memory still contains 80 characters on each line and all wrap and cursor positioning operations will be performed accordingly. The Teleray will remain in Wide mode until an ESC l (lower case L) or a Reset to Initial State is entered; either will return the format to 24 lines of 80 characters.

### Monitor Mode

When the Teleray is placed in this mode (via keyboard switch) all control characters including Escape and Delete are treated as data and entered into the display memory. Monitor mode allows the Teleray to be used as a line monitor. This mode also allows display entry of control characters for subsequent block transmission and also can be used to view a programmed function. Monitor mode does not affect local operation keys. In Monitor mode, the Teleray automatically wraps on the right margin.

### Right Margin Wrap Mode

This mode is selected by the rear panel switch. When data is entered in the 80th column of any line, the cursor will automatically be positioned in the first column of the next line. A cursor right function from column 80 will also cause the cursor to go to the first column of the next line. This "wrap" can cause a scroll to occur or can cause the cursor to go to the top line (depending on the condition of Scroll/Page mode) if the cursor was in the 24th line.

If Right Margin Wrap mode is not selected and the cursor is in the 80th column a cursor right function or entry or any data which moves the cursor will not advance the cursor; the cursor will remain in the 80th column and the data in that column will be rewritten.

### New Line Mode

This mode is selected by a rear panel switch. In New Line mode the receipt of the New Line character causes both a Carriage Return and a Line Feed to be executed by the terminal. The New Line character can be selected as either the LF character or the CR character by an additional rear panel switch. Pressing either the CR or LF key will cause the cursor to go to the first column of the next line in New Line mode. When the Teleray is not in New Line mode, the Line Feed and Carriage Return commands are treated as separate functions.

### Scroll/Page Modes

These modes are selected by the keyboard switch legended "Page". In Scroll mode (up position), attempts to position the cursor below the bottom line will cause all displayed data to move up one line. The top line of data is irrecoverably lost and a blank line inserted on the bottom of the displayed page. In Page mode (down position) when an attempt is made to position the cursor below the bottom line, the cursor will "wrap" to the top line. No scrolling occurs. When the Teleray is placed in Protect mode, the Teleray will automatically go to Page mode.

### Protect Mode

The Teleray will enter Protect mode upon receipt of an "ESC W" sequence and will leave Protect mode when it receives an "ESC X". These sequences may come from the keyboard, a programmable function, or from the Serial I/O. The fields which are to be protected must be defined before the Teleray is placed in Protect mode (see "Fields"). The cursor cannot be placed in protected fields nor can these fields be modified in Protect mode. Clear functions will erase only unprotected data.

In Protect mode, scrolling, editing functions and columnar tabs are disabled. The first non-protected character position to the right of each protected field becomes the tab stop for tabbing operations. In Protect mode, the protected fields are not transmitted; a single FS code is substituted for them (see Transmits).

### Keyboard Lock Mode

In Keyboard Lock mode, all keyboard data are discarded. The Keyboard Lock mode is entered by an "ESC b" sequence from either the keyboard or the Serial I/O. The Keyboard Unlock sequence, ESC c, is accepted only from the I/O port. The Interrupt key on the keyboard may be pressed to unlock the keyboard manually. The Keyboard Lock mode is automatically entered during any extended time operation (such as Print). Upon completion of these operations the keyboard will be unlocked.

### Disable/Enable Display Modes

When Disable Display mode (ESC e) is entered, subsequent data from the keyboard, or from one of the functions, or from Serial I/O port, will not go to the Teleray display. Local operation keys are not effected by this mode. The data will be routed to the programming area for one of the programmable functions, to the peripheral interface, or the serial interface, but will not go to the display portion of the Teleray. Control codes (for example: Clear Page) will not be executed in the terminal but will be merely passed to the appropriate destination. When the Enable Display (ESC f) mode is entered, the Teleray returns to normal. The Disable Display mode will allow the remote computer to download the functions in the Teleray without interfering with the operator. A typical download sequence follows:

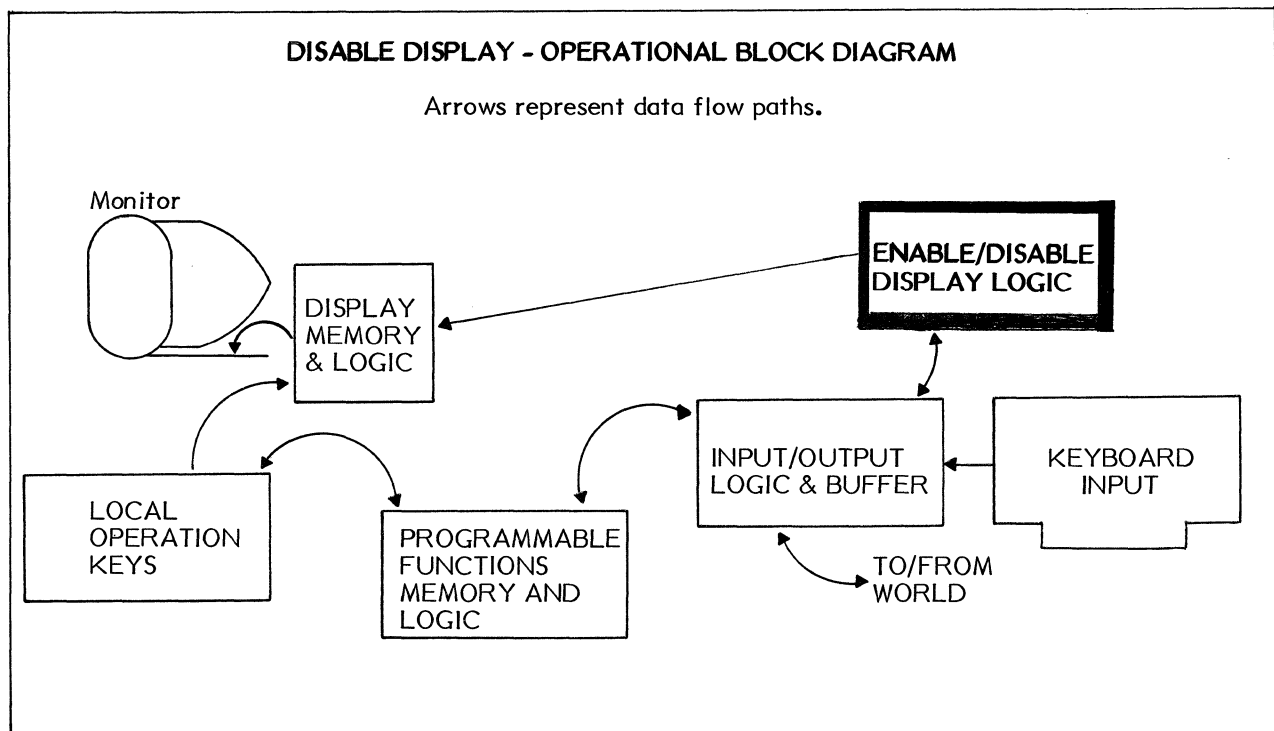
1. Lock keyboard (ESC b)
2. Disable display (ESC e)
3. Define function (ESC U#) where # is the 2nd digit function number
4. The message which is to be loaded into the function
5. End definition (ESC V)
6. Enable display (ESC f)
7. Enable keyboard (ESC c)

The Disable Display mode can also be used to route print data which is not desired on the Teleray display to the peripheral interface. If the following sequence were sent to the Teleray:









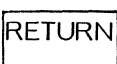
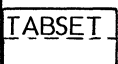
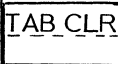

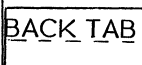
1. Disable Display (ESC e)
2. Peripheral ON (DC2)
3. Text - DATE
4. Enable Display (ESC f)
5. More Text - NAME
6. Peripheral Off (DC4)

DATE would go only to the printer, NAME would go to both the printer and to the display.

The Disable Display mode is also useful within the programmed function sequence to exclude portions or all of the programmed function sequence from going to the Teleray screen. For example: If the functions were programmed to initiate sequences for control of the Teledisk, operator may not want these sequences to go to the display area of the Teleray but would want to transmit them to the Teledisk. Such function definitions would contain a Disable Display in the beginning of the programmed sequence and an Enable Display at the end of the programmed sequence.



### 5-3 Cursor Manipulation

Local Operation Key	Dedicated Key	ESC Then	CTRL And	Description
		A		Cursor Up one line - local operation
		B		Cursor Down one line
		C		Cursor Right one column
		D	H(BS)	Cursor Left one column
		H		Cursor Home (upper left)
				Writes a space in Teleray display and moves the cursor right one column.
			J(LF)	Line Feed - Advances the cursor to the next line (or beginning of next line if in New Line mode).
			M(CR)	Carriage Return - Moves cursor to first column of line (or next line if New Line function selected).
			F	Set a Columnar Tab stop. Defines a stop in the current column on the display.
			E	Clears a Columnar Tab Stop.
			I(HT)	Advances cursor to next tab stop or beginning of non-protected field.
		d		Moves cursor to previous tab stop or beginning of non-protected field.
		G		Clears all Tab Stops.

## Basic Moves

The cursor can be moved one position up, down, right, left or to home (line one, column one), using either the non transmitting local operation keys or by using the sequence: ESC and A, B, C, D or H respectively. Backspace will move the cursor one left; the space character will move the cursor one character to the right (destructively). Line Feed moves the cursor one down; Carriage Return places the cursor on the left margin (also, see New Line mode).

## Margin Wraps

When a cursor left function is initiated with the cursor in the first column, the cursor will move to the 80th column of the preceding line (assuming the 80th column of that line is not protected). When a cursor left function is initiated with the cursor in the Home position, the cursor moves to the 80th column of the 24th line. A one up function in the top line, will position the cursor in the same column, Line 24. The actions taken on the right and bottom margins depend on the condition of the WRAP and SCROLL modes as previously described.

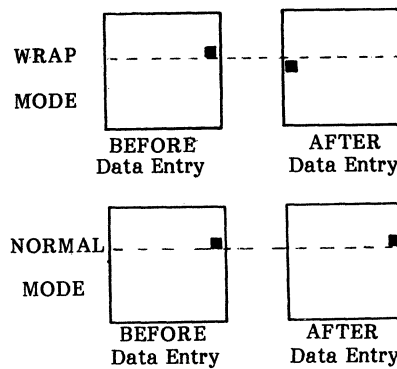
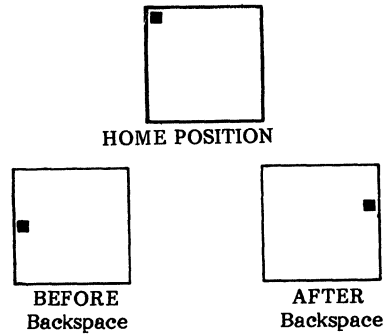
## Tabs

The Teleray accommodates a total of 16 columnar tab stops. A columnar tab stop can be set in any column position by first moving the cursor to that position and then either pressing the Tab Set key, or the sequence ESC F. Any existing tab stop can be cleared by moving the cursor to that position and pressing the Tab Clear (shifted Tab Set) key. The Clear Tabs function (ESC G) clears all tab stops simultaneously. Tab stops do not occupy display positions.

When the Tab/Back Tab key is pressed, the cursor moves forward or backward, respectively, to the next tab stop. If necessary the cursor will move to the next (previous) line when searching for a tab stop. In Protect mode the columnar tabs are ignored and the character position to the right of each protected field acts as a tab stop. If no tab stops have been set the cursor will not move.

## Cursor Address Write and Read

The cursor can be moved directly to any line-column coordinate using the sequence ESCape Y - line code - column code. The sequence ESC followed by lower case a will cause the Teleray to Read (transmit) its cursor position (line code, then column code). An illegal coordinate in an addressing sequence will be ignored; this allows the cursor to be moved to another line without changing the column or to another column without changing the line.



## CURSOR COORDINATE POSITIONING

Press ESC . . . then Y . . .  
then Line Code . . . then Column Code

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

Notes: Any undefined coordinate character will be ignored.

5-4 Clears and Edits

Clear Functions

Local Operation Key	ESC Then	CTRL And	Description
CLEAR EOL	K		Clear to End of Line from and including cursor location. Cursor remains in same location.
CLEAR EOP	J		Clears the display to the end of the page from and including the cursor location. The cursor remains in the same location.
CLEAR PAGE	j	L(FF)	Clears the page and resets the cursor to home.
	g		Resets to Initial State. Clear all memory including function keys and fields. Reinitializes.

The Clear functions include Clear End of Line, Clear End of Page and Clear Page.

The Clear EOL and Clear EOP do not change the cursor position. The current cursor location is cleared. The Clear Page function clears the entire display and places the cursor at home. None of the preceding clears clear data in protected fields. Non-protected field modifiers will be cleared. The Reset to Initial State reinitializes the Teleray. It has the same effect as removing and reapplying AC power except that its action will be inhibited if the Teleray is in the Disable Display mode. The display is cleared, the programmable function memory is cleared and any operation which may have been underway will be terminated.

Before:

```

THE QUICK BROWN
FOX JUMPED OVER
THE LAZY DOG'S
    
```

After:  
Clr. to End  
of Page

```

THE QU
    
```

## Edit Functions

Local Operation Key	ESC Then	CTRL And	Description
INSERT CHAR	P		Insert Characters - Space character is inserted and all characters in line shifted right one column.
DELETE CHAR	Q		Delete Character - Character is deleted and all characters in line shifted left one column.
INSERT LINE	L		Insert Line - Line of spaces inserted and current line and all other lines move down one line.
DELETE LINE	M		Delete Line - Current line is erased and all lines below are moved up one line.

A space character is inserted in the current cursor position by an insert character operation. The data at the cursor location and all data to the right on that line moves one location to the right. Subsequent lines are not affected and characters shifted past the 80th column are lost.

Before: INSERT CHARACTER  
THE QU~~U~~K BROWN

After: THE QU~~U~~CK BROWN

A character can be deleted at the current cursor position. The character delete causes all characters to the right of the cursor position to shift one position to the left and a space character is entered in the 80th column.

Before: DELETE CHARACTER  
THE QU~~U~~CK BROWN

After: THE QU~~U~~K BROWN

On an insert line operation, the line the cursor is currently on and all lines below are scrolled down one line position and a line of 80 spaces is placed in the line occupied by the cursor. The cursor is placed on the left margin.

#### INSERT LINE

Before:

```
THE QUICK BROWN
THE LAZY DOG'S
```

After:

```
THE QUICK BROWN
THE LAZY DOG'S
```

A line can also be deleted by the delete line operation. In this operation the line the cursor is presently on is removed from the display and all succeeding lines are shifted up one line. The cursor is placed on the left margin.

#### DELETE LINE

Before:

```
The Quick Brown
Jumped
Jumped
The Lazy Dog
```

After:

```
The Quick Brown
Jumped
The Lazy Dog
```

## 5-5 Programmable Functions

The Teleray contains 32 programmable functions. Any ASCII sequence may be assigned to these functions; 527 characters of memory are available to be used by the functions in any combination. Programmable functions cannot be used to call other programmable functions. The functions can be used to store forms, control sequences, or answer back messages. The functions can also be used as a buffer from high speed communications. The message to be displayed can be loaded into a function (up to 527 characters) and followed by a command to execute the function. The programmable function can also be used to provide a "Wake Up" service following long time functions such as Print. Implementing this Wake Up service would require programming a function with the message desired to be returned when the Print was complete and then giving the Teleray the Print command immediately followed by a command invoking the programmed function. When the Teleray has completed the Print, it will examine the input buffer and execute the function.

Example of "Wake Up" Service	
Computer transmits	Teleray does
ESC U 32 MESSAGE ESC V	Defines programmable function 32 with MESSAGE.
TEXT	Receives text.
ESC O (Print)	Prints text.
ESC T32	
Waits	Examines input buffer and executes function 32 - this transmits MESSAGE to computer.
Receives Message - Knows that Print is complete.	

The first 8 programmable functions have keys assigned to them on the keyboard; the other functions can only be initiated by the appropriate ESC sequence (see below). Other keyboard arrangements with additional keys assigned to these functions are available, consult factory for details.

### Using Programmable Functions

The functions will be initiated by either the appropriate keys on the keyboard (first 8) or may be initiated by 4 character sequence - ESC T, followed by the function number. The function number must be a two digit number from 01 through 32, inclusive. Both digits must be used (e.g., 01, 02, etc.) If an illegal or undefined function number is given the sequence will be ignored. When a function is initiated, the ASCII sequence stored in the function memory is treated by the Teleray as a keyboard input. Control characters and ESC sequences will be executed and/or transmitted as determined by the operating modes. If the function programming includes a command to execute another programmed function, this included command will not be executed. Programmed functions can be examined by using Monitor mode.

### Programming the Programmable Functions

Programming of the functions initiated by the sequence ESC U, 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 ESC U sequence will be ignored (the two succeeding characters will not be ignored). As the function is being programmed the bell "clicks" as each character or local operation is entered. When the last ten characters of programmable function memory are entered, the bell will beep (with a long tone) to warn the operator that the memory is nearly full. As the function is being programmed, the program data will be executed. For example, if the program sequence contains a Clear Page function, the screen will be cleared. This execution of program function data can be inhibited by use of the Disable Display mode. If the programming sequence is given for a function which has been previously defined, the old program will be discarded and a new definition entered.



Function programming is terminated using the sequence ESC V. Function definition will be ended by:

End Function Definition (ESC V) - recommended

Interrupt - not recommended

Reset to Initial State (ESC g) - also clears all programmed function memory

Execute to Programmed Function (ESC T##) - will perform function ##

Exceeding the Programmable Function Memory Size - the Bell will beep (and not click any more)

### **Special Considerations for Programmable Functions**

Use of the following functions within a programmable function require some insight into the operation of the Teleray.

Reset to Initial State (ESC g) - This function resets the entire Teleray to the initial state; this includes clearing all of the programmable function memory. Therefore, a Reset to Initial State can be placed in a function (using Monitor or Disable Display mode) but when the function is executed the function memory will be cleared and cannot be performed a second time.

Enter/Leave Protect Mode (ESC W/ESC X) - If a function is being programmed to include protected data such as a form and if the function is to invoke Protect mode after placing the form on the Teleray screen, repeated operation of this function will not appear consistent on the display unless the function includes a Leave Protect mode and Clear Screen command in the beginning of the function programming. The reason for this is that the first time the function is performed the Teleray will be placed in Protect mode. When the function is next performed it will be unable to place the form in the protected locations and the form will be juxtaposed on itself.

Tab Sets/Clears - If these functions are included in a programmable function, they should be preceded by a function which places the cursor in a known column. Switchable functions include: Absolute Position (ESC Y), Cursor Return, Home and Clear Page. This procedure will ensure that the Tabs are placed in the same position each time the function is executed.

Lock Keyboard, Disable Display - Although not necessary, or even suitable in all applications, these functions will frequently be used in pairs. The use within function programming will prevent operator interference with the keyboard (Lock Keyboard) or eliminate undesired information going to the Teleray display (Disable Display). In these circumstances care should be taken to ensure that the terminal is returned to operator useable condition by including the Unlock Keyboard and/or Enable Display in the end of the function programming.

Local Operations - These operations can only be entered into a programmable function by the operator. See Section 4, Keyboard, for the complete list of local operations. When a programmed function is performed any local operation it contains will be performed locally; no code will be transmitted. It is strongly recommended that local operation not be included in programmed functions but that the ESC sequence equivalents be used to perform the desired operation.

Break - Break is a local operation and as such can only be entered in a programmable function by the operator. If included it must be positioned as the last character in the function because performance of the break command will override the transmission of data.

## 5-6 Operator Communications

### Bell

An audible tone (a "beep") is produced on receipt of the BEL control code (Control G) from either the keyboard or the Serial I/O interface. When keyboard entry moves the cursor past the 72nd character position in any line or into the 24th line the beep is also produced. Serial I/O cursor manipulation will not generate the tone, nor will Tab absolute cursor position, etc. During programming of a programmable function the bell will "click" as each character is entered in the function memory. During entry of the last 10 characters of programmable function memory the bell beeps. To reduce the volume of the Bell tone, see Installation section.

### Interrupt

The Interrupt switch may be used by the operator to abort any operation currently underway and return the terminal to an idle state. When performed the Interrupt will "beep" the bell; the contents of the display memory, programmed memory, or communication modes will not be changed by this function. Interrupt does take the Teleray out of Protect mode.

### Break

When pressed this switch will generate a 250 msec "break" (space) signal on the Serial I/O transmit data line if the Teleray is in Remote mode.

### Keyboard Light

A recessed light is provided on the keyboard above the keys. When illuminated it indicates that the keyboard has been correctly connected to the Teleray display and that the Teleray power switch is ON.

### Parity Error

If parity is enabled and a parity error or a framing error (stop bits missing) occurs an ASCII SUB character will be substituted for the erroneous character on the Teleray display. The SUB character will be displayed as <sup>S</sup>B.

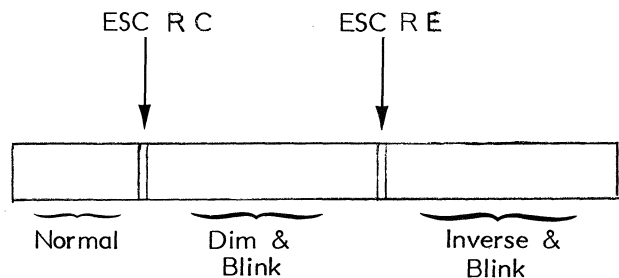
### Fields

Dim, Blink, Underline, Inverse Video and Protected fields may be established on the Teleray in any combination. These fields are started, changed, or ended by entering a special character (field modifier) in the Teleray memory. Any combination of field modifiers occupy only one display memory location. The field modifiers are entered in the memory using the sequence ESC R followed by the modifier code (see Table below). All data following the field modifier in the display (until the end of the 80 character line) will have the characteristics shown in the table below. To change or terminate a field before the end of the line, another field modifier character is entered in the memory.

Field modifiers are displayed as either a space or as a "|" depending on the position of the rear panel switch. In Unprotected mode, a space code will be substituted for the modifiers during block transmissions. In Protect mode, an FS (File Separator code) will be substituted for the protected field. The cursor cannot be placed in a display position containing a field modifier character.

Undesired field modifiers can be removed using the Search and Clear modifier function (ESC S). This function will search the display in the forward direction until a field delimiter is found, will remove that modifier and position the cursor in the modifier position. In Protect mode, those modifiers in protected fields will not be removed. The search will "wrap" from the end to the beginning of the display; if no modifier is found, the cursor will be repositioned on the starting location.

ESC R Then	Field Characteristics	ESC R Then	Field Characteristics
@	Normal (ends all others)	P	Protect Only
A	Blink	Q	Protect Blink
B	Dim	R	Protect, Dim
C	Dim, Blink	S	Protect, Dim, Blink
D	Inverse	T	Protect, Inverse
E	Inverse, Blink	U	Protect, Inverse, Blink
F	Inverse, Dim	V	Protect, Inverse, Dim
G	Inverse, Dim, Blink	W	Protect, Inverse, Dim, Blink
H	Underline	X	Protect, Underline
I	Underline, Blink	Y	Protect, Underline, Blink
J	Underline, Dim	Z	Protect, Underline, Dim
K	Underline, Dim, Blink	^	Protect, Underline, Dim, Blink
L	Underline, Inverse	\	Protect, Underline, Inverse
M	Underline, Inverse, Blink	]	Protect, Underline, Inverse, Blink
N	Underline, Inverse, Dim	^	Protect, Underline, Inverse, Dim
O	Underline, Inverse, Dim, Blink	-	Protect, Underline, Inverse, Dim, Blink



### 5-7 Transmits, Buffering and Peripheral Interface

Local Operation Key	ESC Then	CTRL And	Description
XMIT LINE	i		Transmits a line from the start of the line. Spaces to the right of text are not transmitted.
XMIT MSG		C(ETX)	Transmits from previous $E_X$ to the current cursor location. Places an $E_X$ (ETX) in the current cursor location.
XMIT PAGE	I		Used to delimit the start of a Transmit Message. Placed in memory by ETX code or automatically on message transmit. Displayed as $E_X$ .  Transmits the displayed characters from the start of memory to the end of page or to the cursor as selected by Transmit to End, Transmit to Cursor.
<b>Peripheral Interface Controls</b>			
		R(DC2)	Peripheral Interface Enable: Display data as received is transmitted on the Peripheral Interface.
		T(DC4)	Peripheral Interface Disable: This code deactivates the peripheral interface.
PRINT	0		Print All: Contents of display memory are transmitted to the peripheral as in a memory transmit function except that the protected fields are also transmitted regardless of the state of Protect mode.

## Transmits

The terminal operates in either a character-by-character transmission mode (Character mode) or in a block transmission mode (Block mode). In Character mode, as keys are operated the data are transmitted character-by-character. In Block mode, keyed data is placed in the Teleray display memory for subsequent transmission. Data are transmitted from the display only by the Transmit Line, Transmit Message and Transmit Page functions. If the Teleray was previously placed in Monitor mode and control characters or escape sequences were entered into the display, these control characters and sequences will be transmitted with the data but will not be executed. The following is a description of the three transmit functions and how the rear panel switch (transmit to cursor - transmit to end) affects each function.

### Transmit Line

**Partial Line** - With the rear panel switch in the Xmit to Cursor position, the Transmit Line function transmits the data from the start of line to the cursor position.

**Full Line** - With the rear panel switch in the Xmit to End position, the Transmit Line function transmits the line the cursor is on.

### Transmit Message


With the cursor positioned at the end of the message to be transmitted, the Transmit Message function transmits the data from the first ETX preceding the cursor (or Home), to the cursor position. An ETX (displayed as "EX" but not transmitted) is entered at the cursor position before transmission.

### Transmit Page

**Partial Page** - With the rear panel switch in the Xmit to Cursor position, the Transmit Page function transmits the data from Home to the cursor position.

**Full Page** - With the rear panel switch in the Transmit to End position, the Xmit Page function transmits the entire page.

These transmissions can be initiated by ESC followed by i, l, or Z for line, message or page, respectively or by the Xmit Line, Xmit Msg and Xmit Page keys. During these transmissions the keyboard is locked and the cursor scans the transmitted data. When transmission is completed, the cursor returns to its original position except after a Transmit Message the cursor is placed in the character position immediately following the ETX which was entered.

 Shaded areas are transmitted.

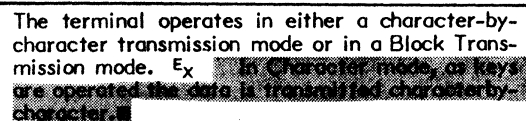
Transmit Line in transmit to Cursor mode.

 The terminal operates in either

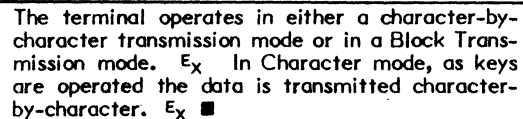
Transmit Line in Transmit to End mode

 The terminal operates in either

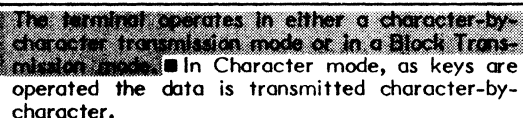
Transmit Message

 The terminal operates in either a character-by-character transmission mode or in a Block Transmission mode.  $E_x$  In Character mode, as keys are operated the data is transmitted character-by-character.

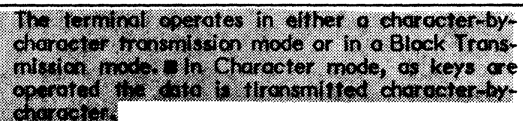
Transmit Message

 The terminal operates in either a character-by-character transmission mode or in a Block Transmission mode.  $E_x$  In Character mode, as keys are operated the data is transmitted character-by-character.  $E_x$  ■

Transmit Page in Transmit to Cursor Mode

 The terminal operates in either a character-by-character transmission mode or in a Block Transmission mode. ■ In Character mode, as keys are operated the data is transmitted character-by-character.

Transmit Page in Transmit to End Mode

 The terminal operates in either a character-by-character transmission mode or in a Block Transmission mode. ■ In Character mode, as keys are operated the data is transmitted character-by-character.

Non-written spaces to the right of any data on each line are suppressed. LF and CR, or New Line codes are appended to the end of each line as selected by the New Line and NL on LF-NL on CR switches. An ETX code will or will not be appended to each transmission as selected by the position of the rear panel ETX on Transmit switch. An ASCII FS (File Separator) character is substituted for any Field Modifier characters which have been placed in the display.

(Dim data shown is prefixed with a Dim-Protect field modifier and followed by a "Normal" field modifier)

### Transmission of Protected Fields

In Protected mode, the transmit functions do not transmit the protected fields. Instead, one ASCII FS (Forms Separator) code is substituted for each protected field. If there is a protected field to the right of a non-protected field, the entire non-protected field will be transmitted. In non-protected mode, the transmit functions do transmit the protect fields and a space character is substituted for any Field Modifier character in the display.

### Suspend/Resume

During block transmission from the Teleray data transfer is suspended when a DC3 (Control and S) character is received from the computer. Transmission is resumed when a DC1 (Control Q) character is received from the computer. If the computer sends any other character, number or control code when a data transfer has been suspended the block transmission is aborted and the data remaining in memory is not sent.

### Enable Busy/Ready

To facilitate data transferred from a computer an enable busy/ready mode is provided. The mode is enabled by an ESC h command from the computer. When the Teleray buffer is 10 characters from full the Teleray sends a DC3 (Control S) "Busy" command to request temporary suspension of transmission from the computer. The Teleray sends a DC1 (Control Q) "Ready" command to the computer when there are 10 characters remaining in the buffer. This mode is not reset with an Interrupt command. To disable this mode a Reset to Initial State or power shut off is required.

#### Prepared Text

```

NAME TELERAY
ADDRESS RESEARCH INC, PO24064
CITY MPLS STATE MINN
COMMENTS THE 1061 IS
A VERSATILE
TERMINAL
  
```

#### Transmitted If Not Protected

```

SP NAME SP TELERAY LF
SP ADDRESS SP RESEARCH SP INC, SP PO24064 LF
SP CITY SP MPLS SP SP SP FS STATE FS MINN LF
SP COMMENTS SP THE SP 1061 SP IS LF
A SP VERSATILE LF
TERMINAL LF ETX
LF (one for each blank line)
ETX
  
```

#### Transmitted If Protected

```

FS TELERAY LF
FS RESEARCH SP INC, SP PO24064 LF
FS MPLS SP SP SP FS MINN LF
FS THE SP 1061 SP IS LF
A SP VERSATILE SP LF
TERMINAL LF ETX
LF (one for each blank line)
ETX
  
```

Note: LF or CR if in New Line Mode;  
else LF followed by CR.

LF = Line Feed  
FS = File Separator  
SP = Space  
ETX = End of Text (only transmitted if Transmit to ETX is selected)

## Buffering

The Teleray contains a 64 character input buffer. Function codes which take a long time to execute (e.g.; Insert Line, Print, etc.) can be immediately followed by data if the buffer length is not exceeded. If the buffer length will be exceeded, the ASCII NUL character should be used for "time fill".

## Peripheral Interface

The peripheral port provides an RS232 serial asynchronous interface. The peripheral interface is designed to operate with a receive only device such as a printer. Following a peripheral-on command (DC2) from the keyboard or the I/O interface, data are transmitted to the peripheral port as received or as entered on the keyboard. The peripheral baud rate will be set to the I/O baud rate (either as set by rear panel switches or as changed by ESC sequence) for concurrent printing. A peripheral-off command (DC4) will turn off the peripheral interface.

Any displayed data can also be transmitted by the peripheral interface in "block" fashion by using the Print command. All data, including protected fields (with SPACE characters substituted for Field Modifiers), are transmitted at the peripheral baud rate. The peripheral baud rate can be changed from the rate selected on the rear panel baud rate switches to any other of the fifteen available rates by an ESC \ followed by the appropriate character shown in the table below. Once changed, the baud rate remains fixed until it is changed again, until a Reset to Initial State sequence (ESC g) has been initiated, or until power is turned off. In the latter two cases, the rate reverts to the rate set by the rear panel switches.

Program Sequence	Baud Rate	Rear Panel Switch Positions			
		4	3	2	1
Serial I/O: ESC [ then	0	U	U	U	U
Peripheral ESC \ then	1	D	U	U	U
	2	U	D	U	U
	3	D	D	U	U
	4	U	U	D	U
	5	D	U	D	U
	6	U	D	D	U
	7	D	D	D	U
	8	U	U	U	D
	9	D	U	U	D
	:	U	D	U	D
	;	D	D	U	D
	<	U	U	D	D
	=	D	U	D	D
	>	U	D	D	D
	?	D	D	D	D

U = Up  
D = Down

**Section 6**  
**CARE AND REPAIR**

**6-1 General**

Maintenance consists of routine cleaning of the cabinet, keyboard and faceplate with an anti-static cleaner and a soft cloth.

**CAUTION**

**Do not use cleaner containing organic solvents which  
are harmful to the faceplate or key tops.**

In addition, the following routine maintenance procedures are to be performed:

**A. Weekly**

Check operation of all switches on the front panel and check all rear panel connectors and cables for looseness, frayed installation, etc.

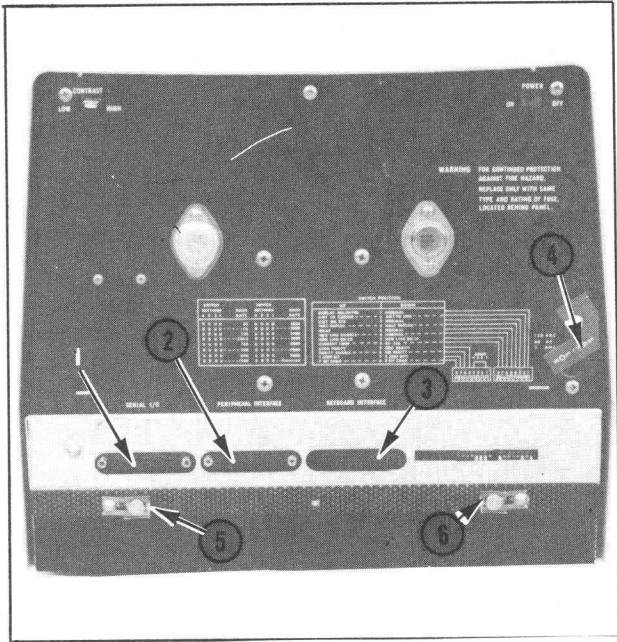
**B. Yearly**

Inspect monitor screen during operation for burned in characters (i.e., terminal has been operated for extended period at high intensity with contrast turned up and constant data pattern displayed). If a pattern has been etched on the screen consult service technician or see Teleray Service Manual for procedures required to reposition the CRT yoke.

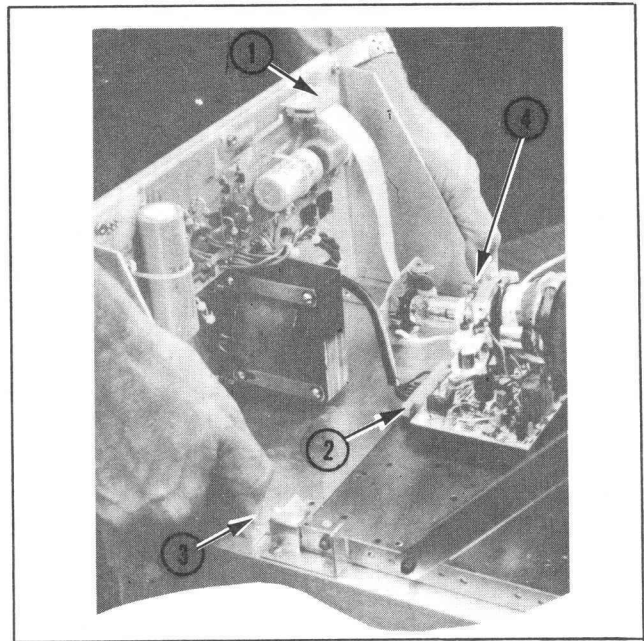
**6-2 Troubleshooting**

When a malfunction occurs use one of the following procedures:

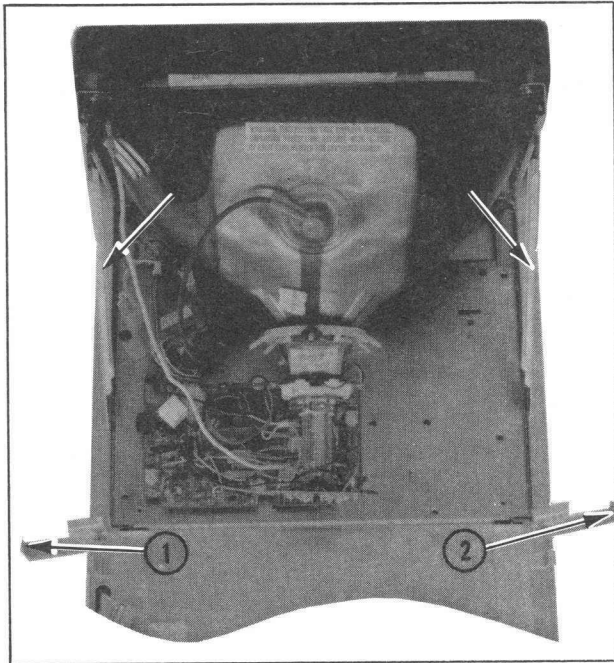
1. Call the Service Center for troubleshooting instructions.
2. If you have a second terminal or replacement parts, use the procedures on page 6-2 for removal and replacement. The procedures shown are for the "M" chassis. Procedures for optional cabinetry are similar.



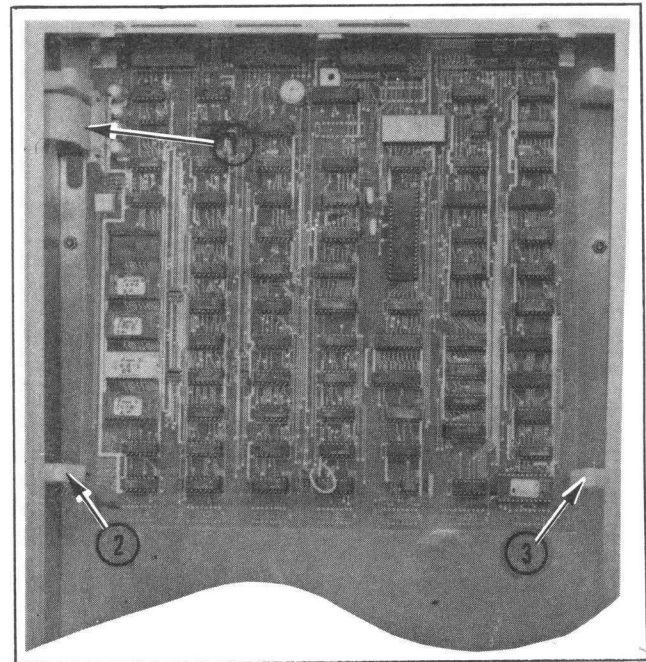
Chassis Removal - Remove connectors from SERIAL I/O PORT (1), PERIPHERAL INTERFACE (2), KEYBOARD INTERFACE (3), and POWER INPUT (4). Press chassis release snap fasteners (5 and 6) toward center then push chassis forward to clear outer shroud.



Power Supply Removal - Release locks on circuit board connector (1) and pull clear of power supply. Grasp monitor board connector (2) by edges and rock back and forth to remove. Press out on sides (3 and 4) of power supply to release locking latches. Pull power supply back to clear rear retainers on chassis and remove.



Monitor Removal - Release locking levers (1 and 2) on sides of chassis to release monitor. Grasp monitor by braces (3 and 4) and pull up and back to remove.



Logic Board Removal - Release locks on logic board connector (1) and remove from logic board. Press in front board retainers (2 and 3) lift board up and out to remove from chassis.



Section 7  
CODING SUMMARY

Table I

**CURSOR COORDINATE POSITIONING**

Press ESC . . . then Y . . .  
then Line Code . . . then Column Code

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

**Notes:** Any undefined coordinate character will be ignored.

## FUNCTIONAL SUMMARY

### Communications Modes

Character/Block.....Keyboard Switch  
 Half/Full Duplex.....Rear Panel Switch  
 Local/Remote.....Keyboard Switch

### Communications Character Modes

One/Two Stop Bit.....Rear Panel Switch  
 Parity Enable/Disable.....Rear Panel Switch  
 Seven/Eight Bit.....Rear Panel Switch  
 Baud Rates.....Rear Panel Switch or ESC [ Table I

### Operating Modes

Wide/Normal Characters.....ESC m / ESC l  
 Monitor.....Keyboard Switch  
 New Line.....Rear Panel Switches  
 Right Margin Wrap.....Rear Panel Switch  
 Scroll/Page.....Keyboard Switch  
 Enter/Leave Protect.....ESC W / ESC X  
 Keyboard Lock/Unlock.....ESC b / ESC c  
 Disable/Enable Display.....ESC e /ESC f

### Operator Communications

Fields.....ESC R and Table 2  
 Search & Clear Delimiter.....ESC S  
 Bell.....BEL (CTRL G)  
 Interrupt.....Keyboard Switch  
 Break.....Keyboard Switch  
 Parity Error.....Automatic <sup>S</sup>B display

### Programmable Functions

Execute Programmed Function.....ESC T Number (2 digit, 01 through 32)  
 Define Function.....ESC U Number (2 digit, 01 through 32)  
 End Function Definition.....ESC V

### Peripheral Interface

Print.....Keyboard Switch or ESC O (oh)  
 Peripheral On.....DC2 (CTRL R)  
 Peripheral Off.....DC4 (CTRL T)  
 Change Peripheral Baud.....ESC \ Table I

### Transmits and Buffering

Line.....Keyboard Switch or ESC i  
 Message.....Keyboard Switch or ESC I  
 Page.....Keyboard Switch or ESC Z  
 Xmit to Cursor/End.....Rear Panel Switch  
 Xmit an ETX.....Rear Panel Switch  
 Time Fill.....NULL  
 Suspend/Busy.....DC3 (CTRL S)  
 Resume/Ready.....DC1 (CTRL Q)  
 Enable Busy/Ready.....ESC h

### Cursor Manipulation

One Up.....Keyboard Switch or ESC A  
 One Down.....Keyboard Switch or ESC B or LF (CTRL J)  
 One Right.....Keyboard Switch or ESC C or Space  
 One Left.....Keyboard Switch or ESC D or BS (CTRL H)  
 Home.....Keyboard Switch or ESC H  
 Left Margin.....CR (see New Line)  
 Absolute Position.....ESC Y Table 4  
 Position Read.....ESC a  
 Tab Set.....Keyboard Switch or ESC F  
 Clear This Tab.....Keyboard Switch  
 Clear All Tabs.....ESC G  
 Tab.....Keyboard Switch or HT (CTRL I)  
 Back Tab.....Keyboard Switch or ESC d

### Clears and Edits

Clear EOL.....Keyboard Switch or ESC K  
 Clear EOP.....Keyboard Switch or ESC J  
 Clear Page.....Keyboard Switch or j or FF (CTRL L)  
 Reset to Initial State.....ESC g  
 Insert Character.....Keyboard Switch or ESC P  
 Delete Character.....Keyboard Switch or ESC C  
 Insert Line.....Keyboard Switch or ESC L  
 Delete Line.....Keyboard Switch or ESC I

# USA STANDARD CODE FOR INFORMATION INTERCHANGE

BIT NUMBERS							$0_00$	$0_01$	$0_10$	$0_11$	$1_00$	$1_01$	$1_10$	$1_11$		
$b_7$	$b_6$	$b_5$	$b_4$	$b_3$	$b_2$	$b_1$	COLUMN →	ROW ↓	0	1	2	3	4	5	6	7
			0	0	0	0				0	NUL	DLE	SP	0	@	P
			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

**Table 2 Baud Rate**

Program Sequence Serial I/O: ESC [ then Peripheral ESC \ then	Baud Rate	Rear Panel Switch Positions			
		4	3	2	1
0	50	U	U	U	U
1	75	D	U	U	U
2	110	U	D	U	U
3	134.5	D	D	U	U
4	150	U	U	D	U
5	300	D	U	D	U
6	600	U	D	D	U
7	1200	D	D	D	U
8	1800	U	U	U	D
9	2000	D	U	U	D
:	2400	U	D	U	D
;	3600	D	D	U	D
<	4800	U	U	D	D
=	7200	D	U	D	D
>	9600	U	D	D	D
?	Res	D	D	D	D

U = Up  
D = Down

**Table 3 Control Character Generation and Monitor Mode Display**

Displayed As	Control Character	Press* Control &
A <sub>K</sub>	ACK	F
B <sub>L</sub>	BEL	G
B <sub>S</sub>	BS	H
C <sub>N</sub>	CAN	X
C <sub>R</sub>	CR	M
D <sub>1</sub>	DC1	Q
D <sub>2</sub>	DC2	R
D <sub>3</sub>	DC3	S
D <sub>4</sub>	DC4	T
D <sub>L</sub>	DLE	P
E <sub>M</sub>	EM	Y
E <sub>Q</sub>	ENQ	E
E <sub>T</sub>	EOT	D
E <sub>C</sub>	ESC	[
E <sub>B</sub>	ETB	W
E <sub>X</sub>	ETX	C
F <sub>F</sub>	FF	L
F <sub>S</sub>	FS	
G <sub>S</sub>	GS	]
H <sub>T</sub>	HT	I
L <sub>F</sub>	LF	J
N <sub>K</sub>	NAK	U
N <sub>U</sub>	NUL	2
R <sub>S</sub>	RS	\
S <sub>I</sub>	SI	O
S <sub>O</sub>	SO	N
S <sub>H</sub>	SOH	A
S <sub>X</sub>	STX	B
S <sub>B</sub>	SUB	Z
S <sub>Y</sub>	SYN	V
U <sub>S</sub>	US	?
V <sub>T</sub>	VT	K

**Table 4 Field Modifiers**

ESC R Then	Field Characteristics
@	Normal (ends all others)
A	Blink
B	Dim
C	Dim, Blink
D	Inverse
E	Inverse, Blink
F	Inverse, Dim
G	Inverse, Dim, Blink
H	Underline
I	Underline, Blink
J	Underline, Dim
K	Underline, Dim, Blink
L	Underline, Inverse
M	Underline, Inverse, Blink
N	Underline, Inverse, Dim
O	Underline, Inverse, Dim, Blink
P	Protect Only
Q	Protect Blink
R	Protect, Dim
S	Protect, Dim, Blink
T	Protect, Inverse
U	Protect, Inverse, Blink
V	Protect, Inverse, Dim
W	Protect, Inverse, Dim, Blink
X	Protect, Underline
Y	Protect, Underline, Blink
Z	Protect, Underline, Dim
[	Protect, Underline, Dim, Blink
\	Protect, Underline, Inverse
]	Protect, Underline, Inverse, Blink
^	Protect, Underline, Inverse, Dim
-	Protect, Underline, Inverse, Dim, Blink

\*Dedicated keys on keyboard for several of these codes. See Keyboard description.

CODING SUMMARY

Row	Control Characters		Escape Sequences		
	0	1	4	5	6
0	NUL "Time Fill"	DLE	@	P Insert Char	
1	SOH	DC1 Resume/ Ready	A One Up	Q Delete Character	a Table 4 Read Cursor Posn.
2	STX Limit Transmit	DC2 Peripheral On	B One Down	R Table 2 Field Modifier	b Lock Keyboard
3	ETX	DC3 Suspend/ Busy	C One Right	S Search/Clr. Modifier	c Unlock Keyboard
4	EOT	DC4 Peripheral Off	D One Left	T Execute Programmed Function	d Back Tab
5	ENQ	NAK	E Clear Tab Stop	U Define Function	e Disable Display
6	ACK	SYN	F Set Tab Stop	V End Function Definition	f Enable Display
7	BEL Bell	ETB	G Clear All Tab Stops	W Enable Protect	g Reset to Initial State
8	BS One Left	CAN	H Home	X Leave Protect	h Enable/ Busy
9	HI Tab	EM	I Transmit Message	Y Table 4 Load Cursor Position	i Transmit Line
10	LF Line Feed	SUB Parity Error	J Clear to EOP	Z Transmit Page	j Clear Page
11	VT	ESC Introduce Sequence	K Clear to EOL	[ Table 1 Set I/O Baud	k
12	FF Clear Page	FS	L Insert Line	/ Table 1 Set Periph Baud	l Normal Character Format
13	CR Cursor Return	GS	M Delete Line	]	m Wide Character Format
14	SO	RS	N	^	n
15	SI	US	O Print	-	o