
TeleVideo® Model 950 CRT Terminal Installation and User's Guide



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This manual is written for the latest Model 950 firmware. Earlier firmware (i.e., 1.0) functions may not correspond to this manual.

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1. INTRODUCTION

This manual explains how to install, operate, program, and troubleshoot the Model 950 terminal. The manual has been designed to help you use the terminal easily regardless of your previous experience with terminals.

1.1 TERMINAL OVERVIEW

The Model 950 is a compact state-of-the-art "smart" terminal that provides high level performance at low cost. Compatible with most computer systems, the Model 950 fits a wide variety of applications in the end-user environment.

The following features are standard:

- Monitor mode
- Protected fields
- Addressable/readable cursor
- Line and character insert/delete
- Local and duplex edit
- Upper and lower case characters
- Tabbing
- X-On/X-Off and Data Terminal Ready control
- Split screen with line lock
- Programmable function keys (11 keys with 22 functions)
- 15 special graphics characters
- On-screen status (25th) line
- Programmable user line
- Buffered auxiliary printer port
- Dedicated editing keys
- Smooth scrolling
- Etched CRT face to reduce glare
- 14 x 10 character resolution
- 20 mA current loop communications
- Detached keyboard
- Typewriter-styled keyboard with numeric keypad
- Self testing

1.1.1 Options

The terminal may be ordered with several options that enhance its already-comprehensive list of features. These options, available at additional cost, are:

- An additional 24 lines of memory, allowing total memory to be divided into either one 48-line page or two 24-line pages.
- An additional 48 lines of memory which can be added provided the optional 24 lines of memory (described above) have been installed. The total memory can be divided into one 96-line page, two 48-line pages, or four 24-line pages.
- An integral modem/dialer

1. INTRODUCTION

1.2 HOW TO USE THIS MANUAL

1.2.1 Contents

The manual contains the following chapters:

2. INSTALLATION

How to install the terminal and make field modifications.

3. OPERATION

How to set up the terminal and use the basic operator controls.

4. PROGRAMMING

Describes the controls which enable you to include the terminal features in application programs.

5. TROUBLESHOOTING AND SERVICE

What to do if you have a problem with the terminal.

APPENDICES

Specifications, limited warranty, and ASCII code chart.

INDEX

OPERATOR'S QUICK REFERENCE GUIDE

Listing of all control and escape commands.

SWITCH SETTING SUMMARY

1.2.2 Symbols

Throughout the manual, special symbols are used to call your attention to information of special importance. The symbols used are as follows:



Information for every operator.



Warning concerning the safety of the operator or possible loss of data. *When you see this note, STOP and read the note before proceeding!*

1.2.3 Commands

Escape Sequences—Escape sequences are shown here with a space before alphanumeric character(s). For example, the sequence shown as

ESC c

involves pressing only the ESCAPE key and a lower case character "c." This space is *not* to be entered as part of the sequence; it is included only for the sake of clarity.

1. INTRODUCTION

The ESCAPE key is used in conjunction with one alphanumeric character and is always pressed and released before the second key is pressed.

Control Commands—The symbol used in this manual to represent the CONTROL (CTRL) key is ^.

The CONTROL (CTRL) key is always used simultaneously with the other character in the command; i.e., the CTRL key is pressed first and held down while the other key is pressed. (It is similar in action to the SHIFT key.)

Entering Commands—In order for commands to work as expected, the command must be entered exactly as shown. Notice whether the command requires upper or lower case, a number one or a lower case “L,” a zero or an upper case “oh.”

1.2.4 Terminology—The optional lines of memory allow you to create pages which are longer than the 24-line screen display. In the following chapters, the following terms will be used:

Page	An amount of memory, defined by the memory chips installed. May be 24, 48, or 96 lines. The memory which constitutes one page may not all be visible at one time, since the screen displays only 24 lines at a time.
Screen or display	The 24-line terminal viewing area.

2. INSTALLATION

This manual is written for the latest Model 950 firmware. Earlier firmware (i.e., 1.0) functions may not correspond to this manual.

2.1 UNPACKING

To unpack the terminal, turn the opened packing carton on its side and slide the terminal out. It is not important to keep the terminal upright.

After you unpack the terminal, inspect it thoroughly for hidden damage and loose components or fittings, using the following checklist:

1. Remove the terminal cover by removing the four Phillips screws underneath the terminal—two in the front and two in the back. Lift up the cover carefully. (Figure 2-1 shows the location of the screws.)

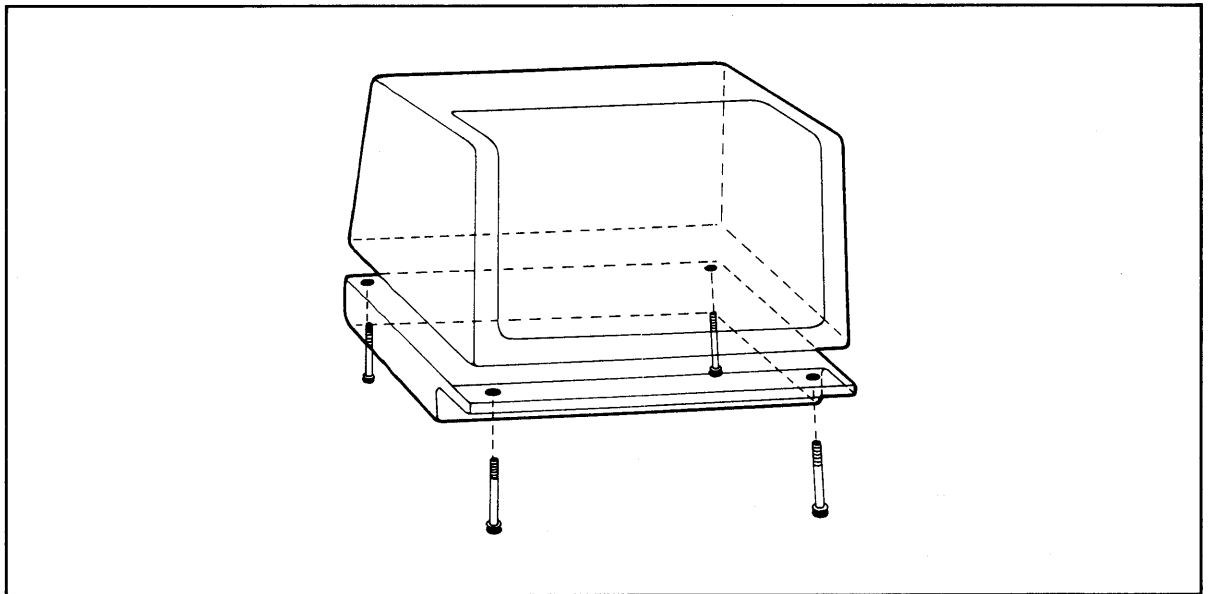


Figure 2-1 Location of Screws in Cabinet

2. Inspect the keyboard and display cabinet interior for shipping damage.



If the CRT tube is broken, always wear heavy rubber gloves or use tongs to pick up the broken CRT fragments since the coating on the inside of the tube is poisonous.

EVEN AFTER THE POWER IS TURNED OFF, CHARGES ARE RETAINED BY THE CRT AND CAPACITORS. ALWAYS DISCHARGE THEM TO GROUND BEFORE TOUCHING THEM. NEVER REACH INTO THE TERMINAL ENCLOSURE UNLESS SOMEONE CAPABLE OF GIVING AID IS PRESENT.

3. Examine cable harnesses for stress, loose or broken wires, or broken cable ties.
4. Examine all internally-mounted components for loose or missing hardware.

2. INSTALLATION

5. Tighten any loose hardware.
6. Clean any loose debris from the cabinet interior.
7. Replace the cover. Do not overtighten the screws.

2.2 PREPARING THE SITE

Make sure you are ready with the proper power and a sufficiently-large table.

2.2.1 Power Requirements

115 VAC 60 Hertz at 0.5 amp

OR

230 VAC 50 Hertz at 0.25 amp

NEMA standard 5-15R, 3-prong receptacle (US only)

2.2.2 Physical Requirements

You will need a sturdy, level surface for the terminal. The dimensions are:

Cabinet 16.50 inches (41.9 cm) wide

14.00 inches (35.6 cm) high

14.25 inches (36.2 cm) deep



In addition, allow 4 inches (10.2 cm) above and behind the terminal for ventilation.

2.3 INSTALLATION

PROTECT YOURSELF!

As you install the terminal, observe standard safety precautions (as you would any electrical or electronic equipment).

The actual installation consists of only five steps:

1. Connect the keyboard to the terminal (2.3.1).
2. Configure the terminal for either 115 or 230 VAC operation (2.3.2).
3. Connect the terminal to the computer or a modem (and to a printer, if used) (2.3.3 and 2.3.4)
4. Configure the terminal by setting exterior switches (2.3.5).
5. Plug the terminal into the wall outlet (2.3.6).

2.3.1 Connecting the Keyboard

Connect the end of the keyboard cable to the connector labeled *P6* on the rear of the terminal (Fig. 2-2).

2. INSTALLATION

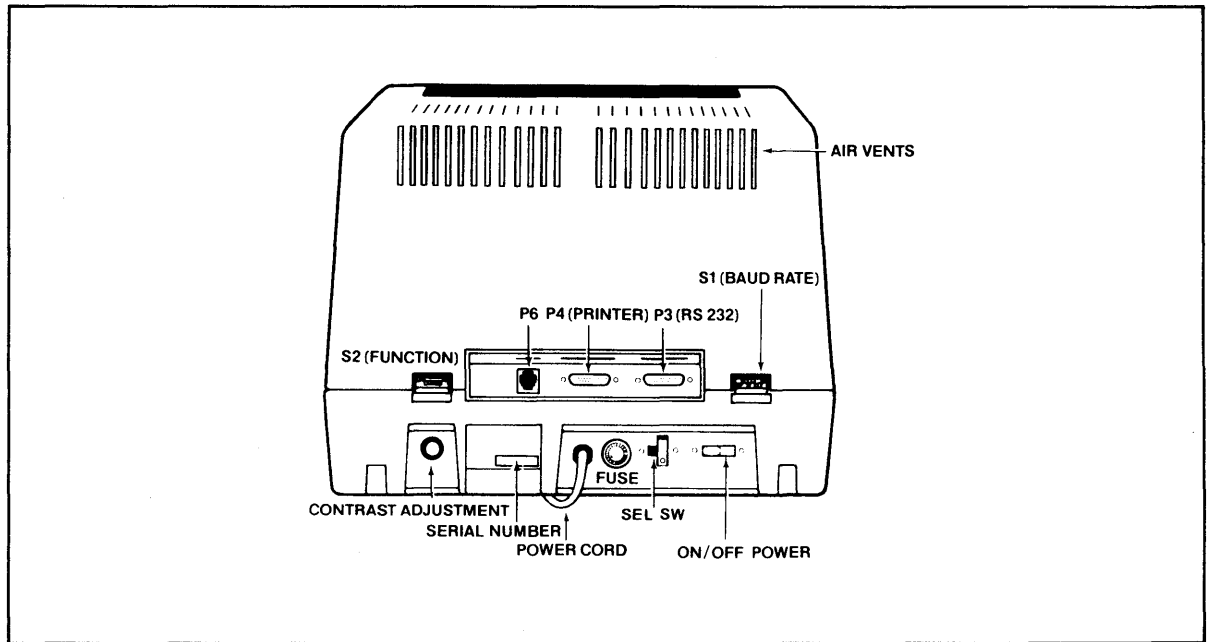


Figure 2-2 Rear View of Terminal

2.3.2 Power Configuration

Check the power select switch on the rear of the terminal. If necessary, change it to match your power requirements (either 115 or 230 V) and reinstall the switch blocking strip. You will set Hertz to match your power frequency when you set Switch S2, dipswitch 9.

2.3.3 Connecting the Terminal to a Computer System or Modem

You can connect the terminal directly to your computer system or indirectly with a modem using the pin connector labeled P3.

You can use either RS232C or current loop. An RS232C interface limits the maximum distance between the terminal and computer or modem to 50 feet (if shielded, twisted-pair cable is used). A current loop interface allows the terminal to be located up to 1,000 feet from the computer.

For an RS232C installation, use a shielded, twisted-pair cable with a connector which has been configured to match the pin connector assignments listed in Table 2-1a.

Table 2-1b lists the pin assignments of the P3 connector for current loop. For a current loop installation, configure the cable connector as described in Table 2-2. The current loop configuration can be any *one* of the following:

1. Full duplex, active transmit, active receive
2. Full duplex, active transmit, passive receive
3. Full duplex, passive transmit, active receive
4. Full duplex, passive transmit, passive receive
5. Half duplex, either active or passive transmit/receive

2. INSTALLATION

Table 2-1 P3 Pin Connector Assignments

a. Computer Interface
(Reference EIA Standard RS232C for Signal Definitions)

Pin No.	Signal Name
1	Frame Ground
2	Transmit Data Output
3	Receive Data Input
4	Request to Send Output
5	Clear to Send Input
6	Data Set Ready Input
7	Signal Ground
8	Carrier Detect Input
20	Data Terminal Ready Output

b. Current Loop

Pin No.	Signal Name
9	20 mA source (+ 12V, no load)
10	Detected current loop data
12	Current Loop +, Receive
13	Current Loop -, Transmit
14	20 mA source (+ 12V, no load)
24	Current Loop -, Receive
25	Current Loop +, Transmit

Table 2-2 Configuration of Computer Interface Connector for Current Loop

Transmission	Current Source*	Cable Connector Jumpers	Pin Connection
1. Full duplex transmit	Active	9 to 25	7- 13+
	Passive	—	13- 25+
2. Full duplex receive	Active	14 to 12 3 to 10	7- 24+
	Passive	3 to 10	12+ 24-
3. Half duplex	Active	3 to 10 9 to 25 12 to 13	7- 24+
	Passive	3 to 10 12 to 13	24- 25+

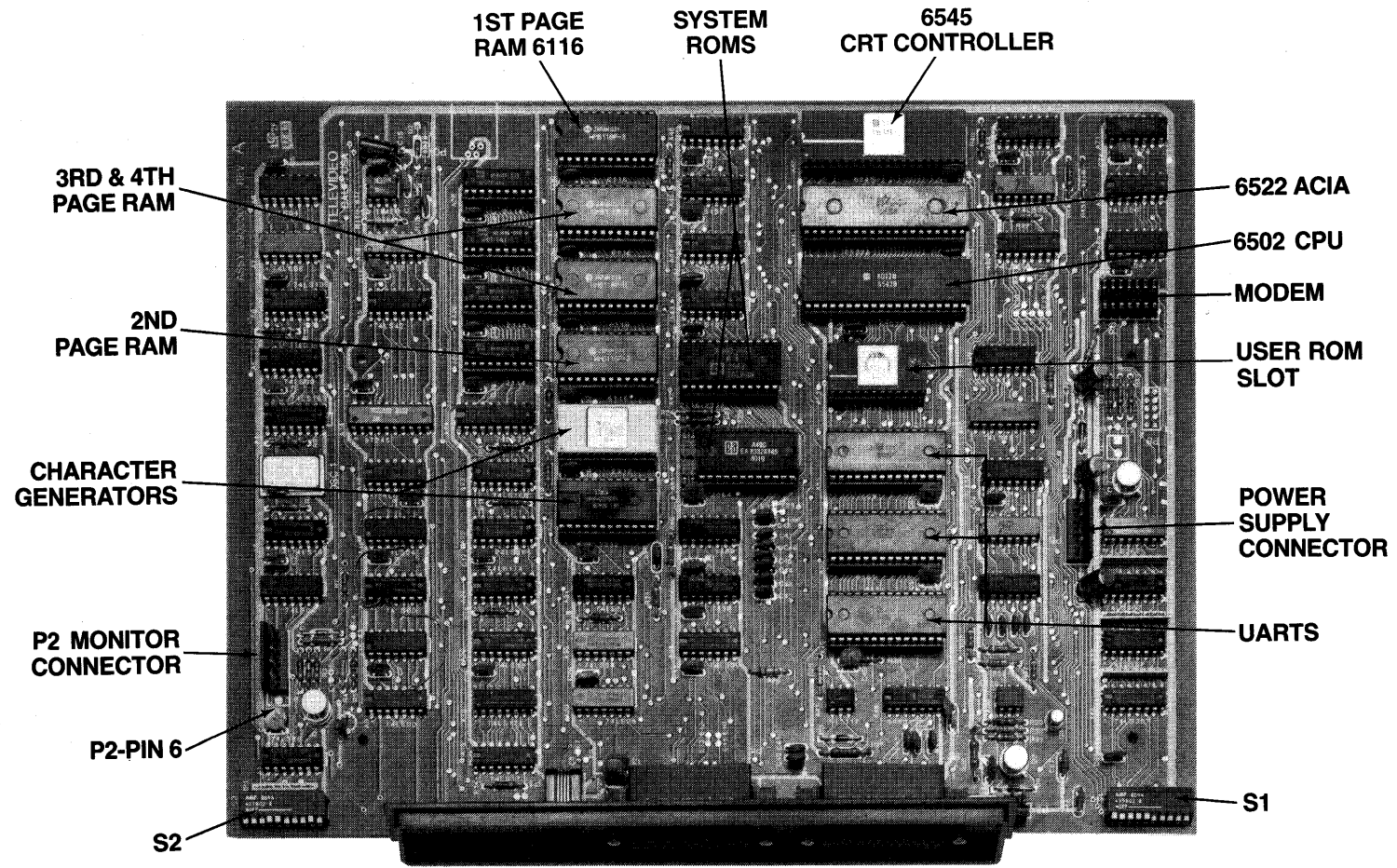


Figure 2-3 Logic Board

2. INSTALLATION

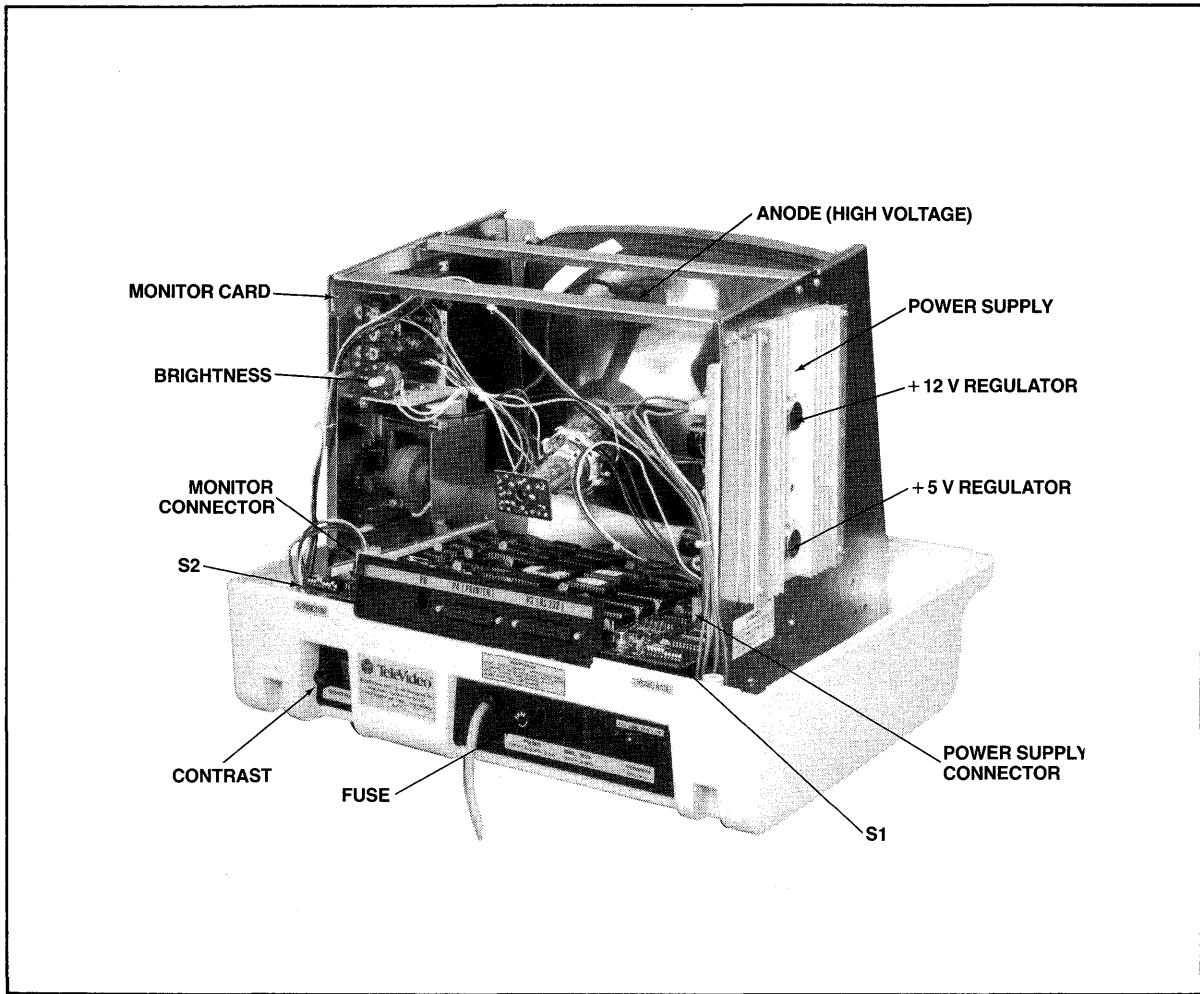


Figure 2-4 Terminal Interior

2.3.4 Connecting the Terminal to a Printer

Your terminal can be connected to an auxiliary serial printer to make a hard copy of data displayed on the screen. The terminal's serial printer interface allows the terminal to be used with most RS232-compatible serial printers currently available on the market.

The serial printer interface is a 25-pin connector labeled *P4*. Table 2-3 defines the printer interface pin connections.

2. INSTALLATION

Table 2-3 P4 (Serial Printer Interface) Pin Connector Assignments
(Reference EIA Standard RS232C for Signal Definitions)

Pin No.	Signal Name
1	Protect Ground
2	Receive Data (input)
3	Transmit Data (output)
4	Request to Send (input)
5	Clear to Send (output)
6	Data Set Ready (output)
7	Signal Ground
8	Data Carrier Detect (output)
20	Data Terminal Ready (input)

2.3.5 Configuring the Terminal for the Computer and Printer

Two switches (located on the rear of the terminal as shown in Fig. 2-2) allow you to configure the terminal to operate according to the requirements of your computer system and printer and change the operation of the terminal.

The switchable features are:

Baud Rates—You can select any of 15 baud rates according to the requirements of your computer system and printer.

Hertz—You can set the Hertz switch to match your powerline frequency.

Parity, Stop Bits, and Word Structure—You can set the parity, number of stop bits, and number of bits in the word structure to match the requirements of your computer system.

Communications—You can select half or full duplex (conversational mode), local, or block mode.

Video Display—You can cause the display to be green on black or black on green.

Keyclick—You can select keyclick or silent key action.



These parameters can also be changed by codes entered from the keyboard or sent from the computer.

Switch Settings—Two external switches (S1 and S2) on the rear of the terminal can be set to control many of the possible parameters described above. The possible switch settings are listed in Tables 2-4a through 2-4d. Figure 2-5 shows a typical switch setting.

2. INSTALLATION

Table 2-4 External Switch Settings

a. S1 and S2

Switch	Dipswitch	Position		Function
		Open (Up)	Closed (Down)	
S1	1,2,3,4			Computer baud rate; see Table 2-4b
	5	x	x	Seven-bit word structure Eight-bit word structure
	6	x	x	Two stop bits One stop bit
	7,8,9,10			Printer baud rate; see Table 2-4b
S2	1	x	x	Duplex edit Local edit
	2	x	x	Blinking cursor Steady cursor
	3,4,5			Parity; see Table 2-4c
	6	x	x	Green on black display Black on green display
	7,8			Communication mode; see Table 2-4d
	9	x	x	60 Hertz ¹ 50 Hertz ¹
	10	x	x	Keyclick off Keyclick on

Note

1. Set to match powerline frequency to avoid screen flicker.

2. INSTALLATION

Table 2-4b Switch S1 Settings for Baud Rates

Terminal Printer	Dipswitches				Baud Rates
	1 7	2 8	3 9	4 10	
	D	D	D	D	9600
	U	D	D	D	50
	D	U	D	D	75
	U	U	D	D	110
	D	D	U	D	135
	U	D	U	D	150
	D	U	U	D	300
	U	U	U	D	600
	D	D	D	U	1200
	U	D	D	U	1800
	D	U	D	U	2400
	U	U	D	U	3600
	D	D	U	U	4800
	U	D	U	U	7200
	D	U	U	U	9600
	U	U	U	U	19200

Legend

D = Down/closed/0

U = Up/open/1

Table 2-4c Switch S2 Settings for Parity

	Dipswitch			Parity Setting
	3	4	5	
	X	X	D	No parity
	D	D	U	Odd parity (receive/transmit)
	D	U	U	Even parity (receive/transmit)
	U	D	U	Mark (transmit parity disabled)
	U	U	U	Space (transmit parity disabled)

Legend

X = Either up or down

D = Down/closed/0

U = Up/open/1



If word structure, parity, or stop bits are set incorrectly, the terminal will only display "@" signs when data is received (if any data is received).

2. INSTALLATION

Table 2-4d Switch S2 Settings for Communication Mode

Dipswitch		Communication
7	8	
D	D	Half duplex
D	U	Full duplex
U	D	Block
U	U	Local

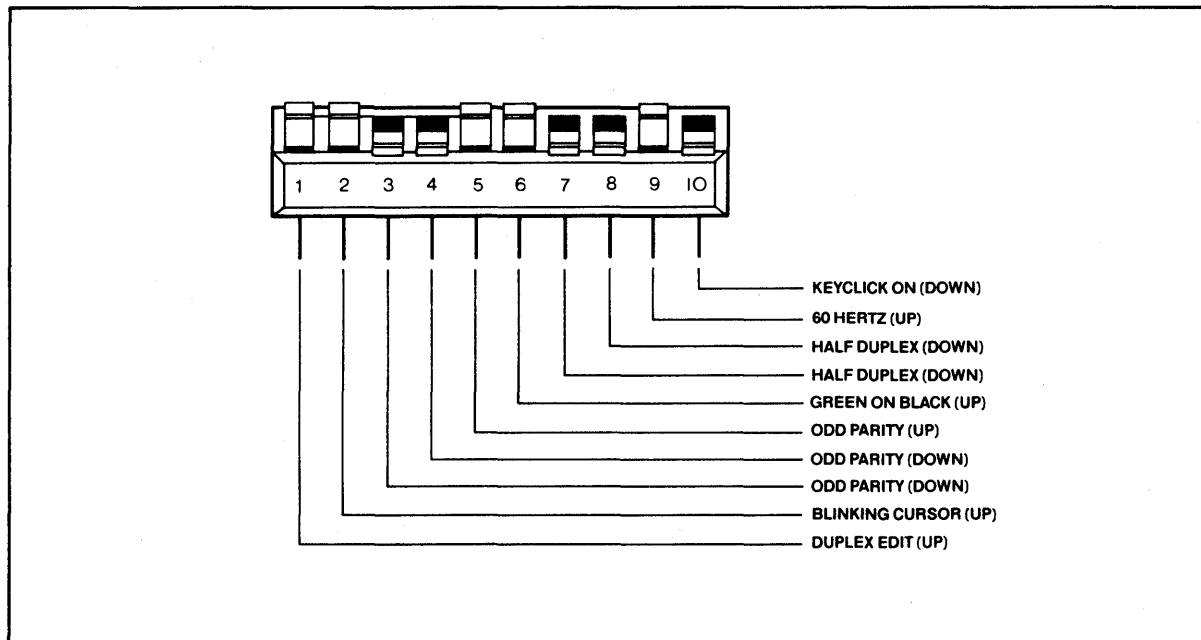


Figure 2-5 A Typical S2 Switch Setting



Whenever you change any switches, turn the terminal power off and back on. This allows the software to scan all new switch positions.

Set the dipswitches prior to turning on power to the terminal and record the switch settings on the form in 5.4.1.

2.3.6 Plugging the Terminal In

After all cables have been connected and switches set, plug the terminal into the wall outlet.

2. INSTALLATION

2.4 INSTALLATION CHECKLIST

Before you turn on the terminal, answer the following questions:

1. Does your power plug match the wall socket?
2. Did you set the power selector switch to match your power requirements?
3. Is the interface cable to the computer system properly wired and attached to both the terminal and the computer?
4. If you are using a printer, did you plug in the printer interface connector?
5. Did you set the switches for the correct
Baud rate (both for terminal and printer)?
Stop bits?
Word structure?
Parity?
6. Did you set switches for the desired communication mode?
7. Did you plug the terminal into the wall outlet?
8. Did you plug the keyboard into the terminal?

2.5 FIELD MODIFICATIONS

2.5.1 Composite Video Option

If you wish to drive a monitor in addition to or other than the terminal monitor, modify the logic board (Fig. 2-3). Add an Amphenol BNC connector (Part 227169-5) to the rear of the terminal case. (See Fig. 2-4 for recommended placement of the connector.)

Connect the center lead of the BNC connector to P2 pin 6 and the BNC ground lead to P2 pin 3. Cut the trace between E1 and E2. Install a jumper between E3 and E4.



The monitor should not be more than 10 feet from the terminal.

2.5.2 Additional Pages of Screen Memory

The terminal can be modified to provide additional pages of screen memory. If you ordered the terminal with this additional memory, this modification will have been made at the factory before the terminal was shipped. You can perform this modification in the field later by following these directions.

To add 24 lines (one page) of screen memory to the terminal, you will need to add one chip. This will provide a total of 48 lines of memory. You can increase this total to 96 lines by adding two more chips to the second chip. (You can not add only two chips; you must add a total of either one or three chips.)

2. INSTALLATION

You will need 2 K by 8 bit static RAM chips with a maximum rise time of 150 nanoseconds. (These may be purchased from your dealer or distributor.) Approved manufacturers include the following:

Brand	Part No.
Hitachi	HN 6116-150nt
Toshiba	TMM 2016-150ns
Mostek	MK 4802N-150ns

To install the chip(s), follow these steps:

1. Remove the terminal cover by removing the four Phillips screws underneath the terminal—two in the front and two in the back. Lift up the cover carefully. (Figure 2-1 shows the location of the screws.)



Even after the power is turned off, charges are retained by the CRT and capacitors. Always discharge them to ground before touching them. Never reach into the terminal enclosure unless someone capable of giving aid is present.

2. Add chip(s) to the logic board as described in Table 2-5.



Install the chips carefully to avoid bending the pins. Each chip has a half-moon notch on the side or a depression on the top. This notch or depression must be oriented to match the orientation of the other chips on the logic board (Fig. 2-6).

3. Replace the cover, being careful not to overtighten the screws.

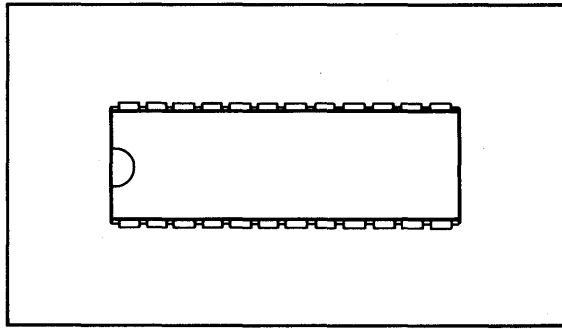
Table 2-5 Adding Screen Memory Chips to the Logic Board

Lines of Memory Being Added	No. of Chips Added	Location on Logic Board of New Chips
24	One	Position A34
48*	Two	Positions A35 and A36

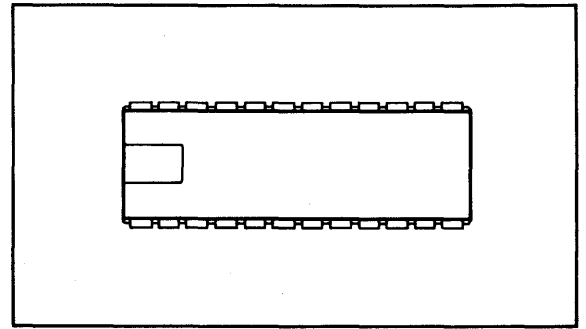
Note

*You must add a chip into Position A34 before you add chips into Positions A35 and A36.

2. INSTALLATION



a. *Notch in Chip*



b. *Depression in Chip*

Figure 2-6 *Notches and Depressions in Chips*

3. OPERATION

This manual is written for the latest Model 950 firmware. Earlier firmware (i.e., 1.0) functions may not correspond to this manual.

3.1 INTRODUCTION

In this chapter you will learn:

- To turn on and adjust the terminal's display screen
- The functions of the various keys on the keyboard
- To direct data to the computer system and the printer through send commands
- To change the default set-up values
- To communicate with your computer system

3.2 TURNING ON THE TERMINAL

1. Make sure the AC power plug is plugged into a grounded outlet.
2. Locate the ON/OFF rocker switch on the rear of the terminal (Figure 3-1). Push the end of the switch which is marked with a white dot.
3. Listen for a beep within one second (indicating that power is on and the terminal has scanned the switch settings).
4. Watch for the cursor to appear in the upper lefthand corner of the screen within 10 to 15 seconds.
5. Adjust the contrast control on the rear of the terminal for the desired screen intensity.
6. Adjust the tilt of the screen by unscrewing the knob which is between the two front legs of the terminal.
7. Refer to Chapter 5 if the installation does not proceed as indicated.

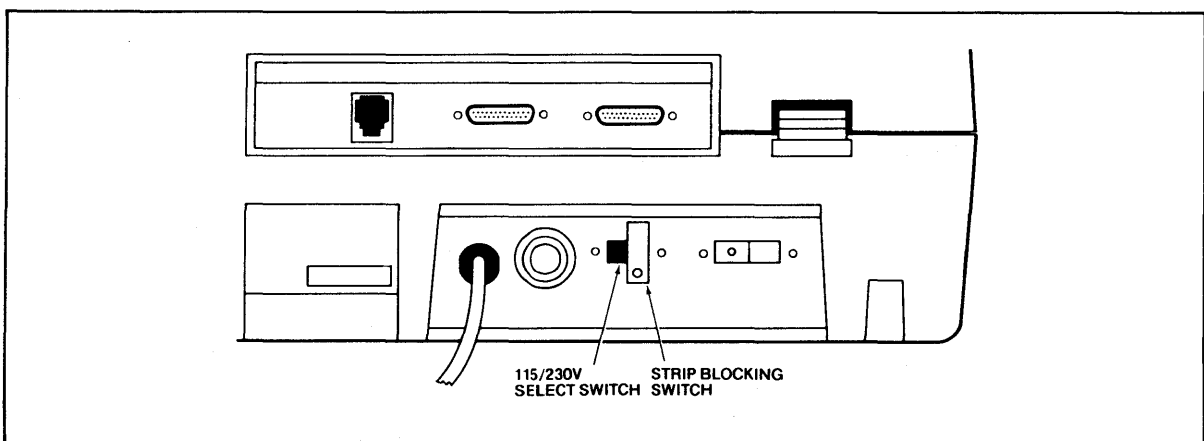


Figure 3-1 Rear Panel

3. OPERATION

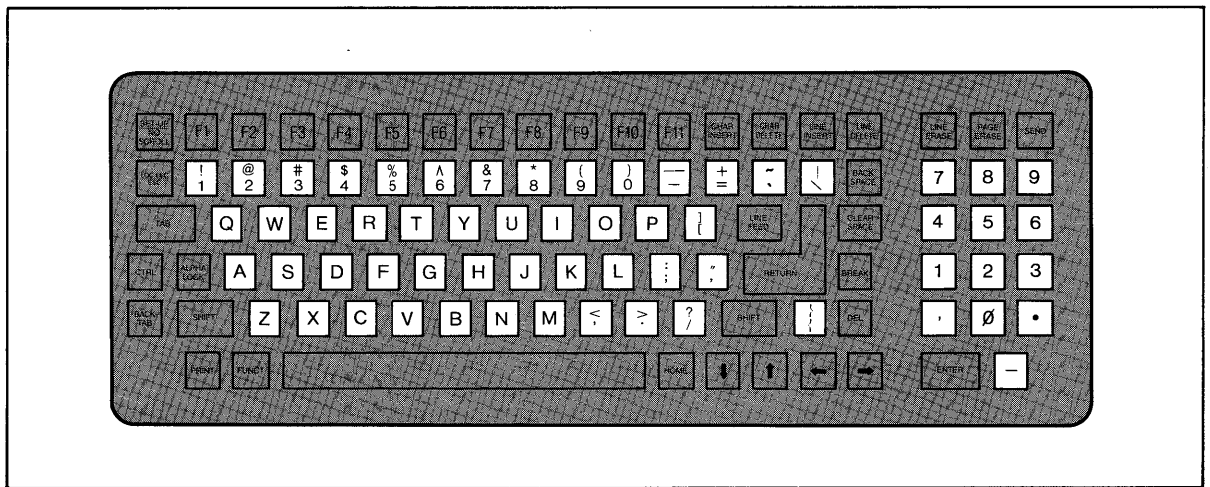
3.3 KEYBOARD CONTROLS

Figure 3-2 illustrates the keyboard layout. The character keys highlighted in Figure 3-2a include all alphabetic characters (a through z), numbers (0 through 9), punctuation marks, and mathematical symbols. All alphanumeric keys repeat when pressed for more than one-half second.

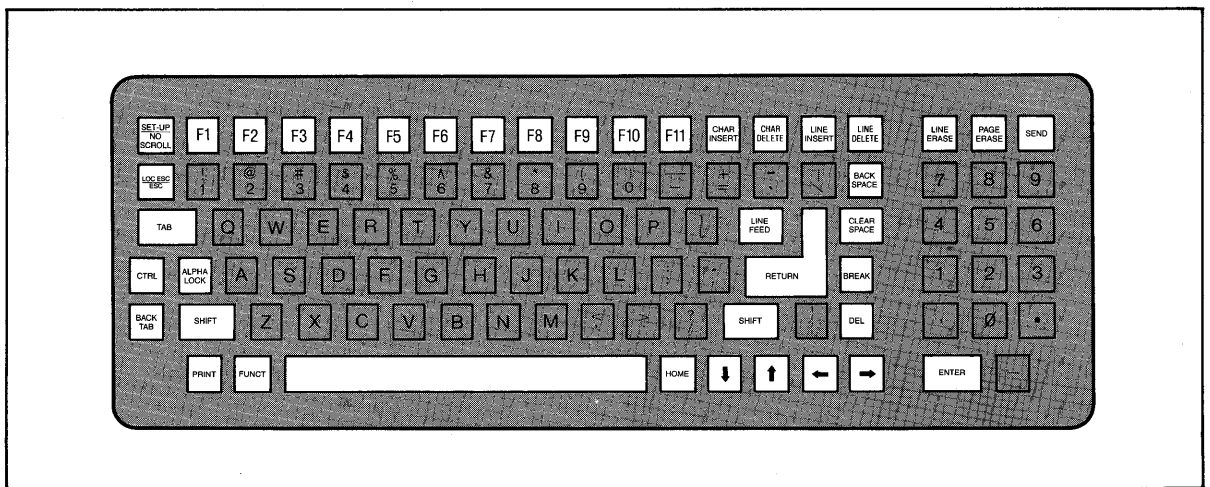
Table 3-1 summarizes the function of the special keys which are highlighted in Figure 3-2b. Many of these keys are also listed in the Operator's Quick Reference Guide on the inside back cover.



Protect mode, which is frequently referred to in Table 3-1, is explained fully in 4.14.



a. Character Keys



b. Special Keys

Figure 3-2 Keyboard Layout

3. OPERATION

Table 3-1 Function of Keys

Key Name	Transmitted? (Y/N)*	Repeat Action? (Y/N)	Description
Space Bar	Y*	Y	Causes a blank space to appear on the display and transmits an ASCII space code (20 Hex).
SHIFT	N	N	Selects upper character inscribed on a key, changes operation of most special keys, and capitalizes alpha characters.
ALPHA LOCK	N	N	Locks the SHIFT keys so that all alpha keys transmit codes for upper-case characters. The key is pressed to lock and pressed again to release.
TAB	Y*	Y	Moves the cursor forward to typewriter tabs (protect mode off; see 4.14) or to the start of the next unprotected field (protect mode on). (Same as ^ I.)
BACK TAB	Y*	Y	Moves the cursor backward to typewriter tabs (protect mode off) or to the start of the previous unprotected field (protect mode on). (Same as ESC I.)
CTRL (Control)	N	N	Generates normally-nondisplayed ASCII control codes when used with another key. The control key combinations are used for special action by the terminal and/or the application program in the computer.
CTRL			<p>The CTRL key is always used <i>simultaneously</i> with the other character in the command; i.e., the CTRL key is pressed first and held down while the other key is pressed. (It is similar in action to the SHIFT key.) Use of the control key is indicated by ^.</p> <p>When the CTRL key is used with an alpha or some symbol keys, output data of the character which is typed becomes 00 through 1F Hex, thus changing the code transmitted by that character. For example, if <i>M</i> alone is pressed, the code for <i>M</i> is sent. If you press ^<i>M</i>, the code for a CR is sent.</p>

Note

*Not transmitted if in local edit mode.

3. OPERATION

Table 3-1 continued

Key Name	Transmitted? (Y/N)*	Repeat Action? (Y/N)	Description
ESC (Escape)	Y*	N	<p>The ESC key sends an ASCII code for escape to the display processor. The key is generally used to momentarily leave (escape) an application program in order to use a special feature or function.</p> <p>Another function of the ESC key is to cause the next control character entered to be displayed on the screen. This facilitates putting control characters on the screen without going into monitor mode.</p> <p>The ESC key is used in conjunction with one alphanumeric character in the command sequence; i.e., <i>the ESC key is pressed and released before the second key is pressed.</i></p> <p>If your computer does not echo back escape codes, the LOCAL ESCAPE key (i.e., SHIFT and ESCAPE) allows you to use the terminal features without transmitting them to the computer.</p>
RETURN/ ENTER	Y*	N	<p>The RETURN and ENTER keys can be used interchangeably. (Same as ^M.) They send the ASCII code for a carriage return (CR) to the computer.</p> <p>If the entire current line is protected, the code moves the cursor to the next unprotected position on the page.</p> <p>The terminal's auto wraparound function eliminates the need to manually enter a CR and a LF at the end of each 80-character line.</p>
HOME	Y*	N	<p>Moves the cursor to the first unprotected character position on the page (usually column one of row one). (Same as ^_.)</p>
LINEFEED	Y*	Y	<p>Sends the ASCII code (OAH) for a linefeed (LF) to the computer. The code causes the terminal to transmit an LF code to the computer and the cursor to be moved down one line on the screen in half duplex or to be echoed by the computer in full duplex. (Same as ^J.)</p> <p>See also 4.15 for descriptions of linefeed when auto page and/or protect mode are on.</p>

Note

*Not transmitted if in local edit mode.

3. OPERATION

Table 3-1 continued

Key Name	Transmitted? (Y/N)*	Repeat Action? (Y/N)	Description
BACKSPACE ←	Y*	Y	Moves the cursor one character to the left. (Same as ^H.)
↑	Y*	Y	Moves the cursor up one line. (Same as ^K.)
↓	Y*	Y	Moves the cursor down one line. If the cursor is on the bottom line of the screen, the display will roll up one line. If additional memory has been installed, a page may be longer than the visual screen. In that case, if the cursor is on the bottom line of the page, the code has no effect (except in block mode). (Same as ^V.)
→	Y*	Y	Moves the cursor one character to the right. (Same as ^L.)
DEL (Delete)	Y*	Y	The DEL key sends an ASCII DEL character to the computer. The computer echoes the code back to the terminal to be performed. This is usually interpreted by the computer as a character erase code.
CLEAR SPACE	Y*	Y	Replaces all unprotected characters on the page with spaces. Shifted CLEAR SPACE (same as ESC *) clears the entire page to nulls and turns off protect and half intensity modes.
BREAK	Y*	N	Transmits a 250-millisecond break pulse to the computer.
PRINT	Y*	N	PRINT causes all data on a page from the home position to the cursor position to be output through the printer port. Data is output with a CR, LF, and null (or CR and null) automatically inserted at the end of each 80-character line. (Same as ESC P.) Shifted PRINT prints all data from the home position to the cursor position (not necessarily 80-character lines). (Same as ESC L.)
FUNCT			The FUNCT key transmits a user-selected character bracketed by ^A (SOH) and a carriage return (CR).

Note

*Not transmitted if in local edit mode.

3. OPERATION

Table 3-1 continued

Key Name	Transmitted? (Y/N)*	Repeat Action (Y/N)	Description
F1 through F11 (Function)	Y*	N	Transmit a three-code sequence to the computer (default) or may be user-programmed. When received, may initiate a special form or subroutine in the program that causes the terminal to display or perform a special function.
SET UP/ NO SCROLL	Y*	N	<p>Stops screen updating during normal operation. Manually sets the operating characteristics of the terminal through the status line.</p> <p>During normal operation, the no scroll function is active. When NO SCROLL is pressed once, the terminal stops screen updating; when pressed again, screen updating resumes.</p> <p>If the receive buffer fills up while update is disabled, the terminal will send X-Off to the computer, causing it to stop sending data. When update is reenabled, the buffer will empty, X-On will be sent, and data will be transmitted to the computer.</p> <p>Shifted SET-UP/NO SCROLL displays the terminal operating characteristics and permits manual changes to these values on the status line.</p>
CHARACTER INSERT	Y*	Y	<p>Enters a space at the cursor position, causing all succeeding characters to shift one position to the right. All characters shifted past the 80th character will be lost (unless page edit is on).</p> <p>Shifted CHAR INSERT changes edit mode from edit to insert. (Table 4-11.)</p>
CHARACTER DELETE	Y*	Y	<p>Deletes the character at the cursor position and causes all succeeding characters to shift one position to the left.</p> <p>Shifted CHAR DELETE changes edit mode from insert to edit.</p>
LINE INSERT	Y*	Y	<p>LINE INSERT creates an entire line of space characters on the cursor line. The data on the cursor line and all following lines will shift down one line (the last line on the page will be lost).</p> <p>Shifted LINE INSERT changes the edit mode from line to page.</p>

Note

*Not transmitted if in local edit mode.

3. OPERATION

Table 3-1 continued

Key Name	Transmitted? (Y/N)*	Repeat Action? (Y/N)	Description
LINE DELETE	Y*	Y	LINE DELETE causes the entire line at the cursor position to be deleted. All following lines will shift up one line. Shifted LINE DELETE changes the edit mode from page to line.
LINE ERASE and PAGE ERASE	Y*	Y	LINE ERASE and PAGE ERASE replace the unprotected data (from the cursor to the end of the line or page) with a space of the proper intensity. Shifted LINE ERASE and shifted PAGE ERASE cause a line erase to null or a page erase to null.
SEND	Y*	N	Sends all unprotected data on the page from home through the cursor position to the computer. Shifted SEND sends all data from the first column through the cursor position.

Note

*Not transmitted if in local edit mode.

3.3.1 Cursor

The lighted rectangular block on the screen is the entry spot for the following character to be typed. It is called a *cursor*. As you reach the end of a line, the cursor automatically *wraps around* to the beginning of the next line; you do not need to enter a carriage return at the end of each line.

You can change the appearance of the cursor itself. To do this, either change the dipswitches on the rear (described in Table 2-4a) or follow the instructions in 4.6.

The cursor can be moved around the screen by pressing one of the cursor control keys (marked with an arrow) if you are in the local edit mode, by entering an escape sequence (described in Chapter 4), or pressing LINEFEED (to move it down one line). To return the cursor quickly to the top left position on the screen (referred to as *home*), press the HOME key.

Cursor movement is affected by the use of auto page and/or protect mode. Refer to 4.13 and 4.14.

3. OPERATION

3.4 SETTING UP THE TERMINAL

The bottom line on the screen is a status line which displays the following information:

- Currently-selected cursor position
- Edit mode
- Communication mode
- Terminal baud rate

Additional information such as terminal or printer busy and some error messages will appear automatically when appropriate. The terminal default values (those selected by switch settings) will be displayed until they are changed using the procedure described here. You can also change these values either locally or from the computer using the escape and control sequences for each value.

The possible values for the status line are summarized in Table 3-2 and described in greater detail in the following sections.

The left block on the status line displays the cursor position. This value automatically changes as the cursor is moved and cannot be changed by entering the status line.

To change the other values on the status line, follow these steps:

1. Press SHIFT and SET-UP at the same time.
2. Look for the cursor to appear in the block which displays either DUPE or LOCE.
3. Press T to change the values of a block. Figure 3-3 lists the values which may appear in the status line blocks.
4. Press → to move the cursor to the next status line block to be changed.
5. Press T to select a new value.
6. Press SHIFT and SET-UP at the same time to leave the status line and return to normal operation.



At the next power on, the status line will return to default values.

3.5 EDITING

While entering or changing text on the screen in the local edit mode, you can delete or insert a character, a line (either partially or completely) or the data on the screen (either partially or completely) using the editing keys described in Table 3-1.

Deletions will start with the column position of the cursor.

3. OPERATION

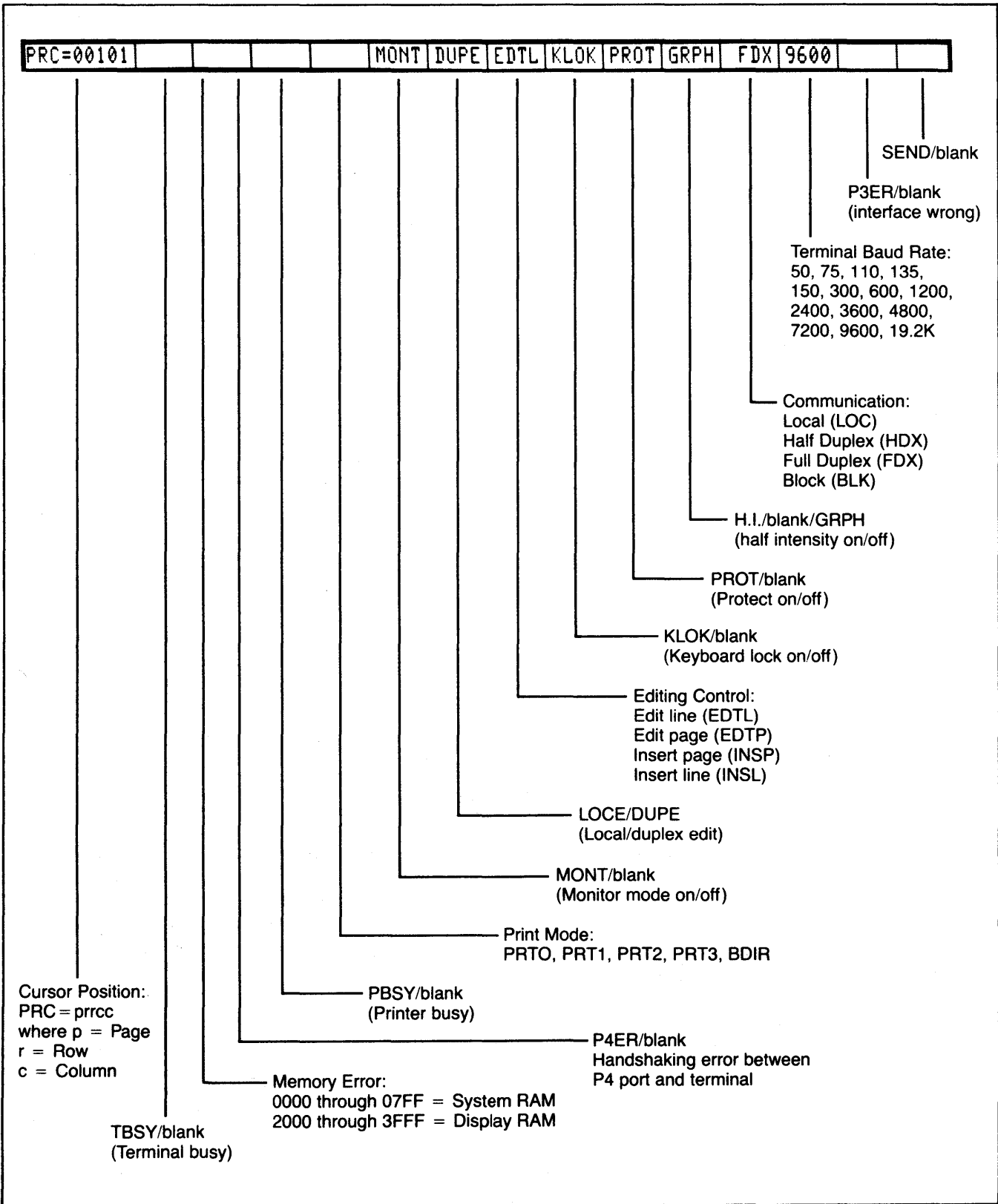


Figure 3-3 Status Line Fields

3. OPERATION

3.6 COMMUNICATING WITH THE COMPUTER

The terminal can communicate with the computer in any of four communication modes:

- Local
- Block
- Half duplex (conversational)
- Full duplex (conversational)

The selection can be made using one of three methods:

- Changing switch settings (2.3.5)
- Changing the status line (3.4)
- Using escape sequences (4.22)

The communications flow caused by these modes is illustrated in Figure 3-4.

3.6.1 Local Mode

In local mode, you can enter or change text and the results are sent only to the screen. The port leading to the computer is turned off.

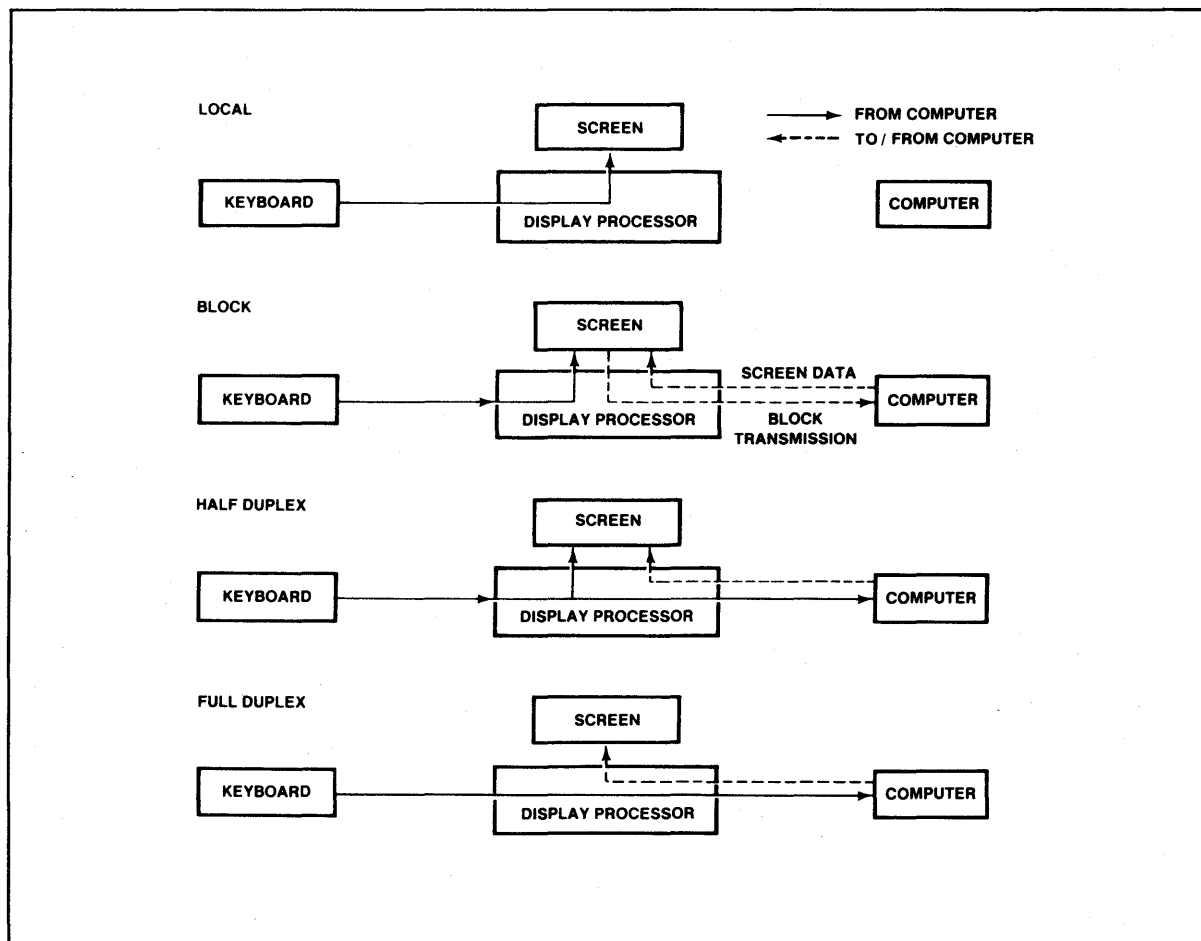


Figure 3-4 Communications Flow

3. OPERATION

3.6.2 Block Mode

In block mode, the terminal sends the results to the screen. When you are satisfied with the results of the data entry or changes made in the local mode, you can send the data to the computer in a block. Block mode allows you to make all corrections before transmission.

3.6.3 Half Duplex

The half duplex mode sends keyboard entries to the screen and to the computer at the same time.

3.6.4 Full Duplex

The full duplex mode sends keyboard entries to the computer only. If the computer is programmed to act upon a code received from a keyboard entry, it may echo the result back to the terminal. (The time needed to echo back the information is so short it will seem to happen simultaneously.) For example, if A is pressed on the keyboard, the computer will probably send the A back to the terminal screen.

3.6.5 Conversational Modes

In conversational modes, communication with the computer occurs on a continuous basis. The terminal is conversational in either half or full duplex modes.

3.7 EDITING

The editing keys allow you to edit text without using control or escape sequences. The keys available are:

- Character insert
- Character delete
- Line insert
- Line delete
- Line erase
- Page erase

These keys are described in detail in Table 3-1 and in Section 4.24.

3.8 PRINTING

You can use PRINT and SHIFT/PRINT to print data as described in detail in Tables 3-1 and 4-21. Using other sequences (as described in 4.30), you can exercise more control over the printing.

4. PROGRAMMING

This manual is written for the latest Model 950 firmware. Earlier firmware (i.e., 1.0) functions may not correspond to this manual.

4.1 INTRODUCTION

Your computer programs can control the terminal by transferring to it the appropriate ASCII codes. This chapter describes the features which can be utilized in your programs.

4.2 MONITOR MODE

You can display control commands to make program debugging easier. This is called *monitor mode* and it can be used in local mode or through the computer.

To enable monitor mode via the computer, enter

ESC U

To terminate the display of the control commands, enter either

ESC u or ESC X

You can enter monitor mode while in local mode by entering

SHIFT/ESC U

To terminate monitor mode while in local mode, enter either

SHIFT/ESC X or SHIFT/ESC u

Table 4-1 lists the monitor mode control characters and Figure 4-1 shows the monitor mode control characters as they will appear.

4.3 USER AND STATUS LINES

You can replace the status line with a line programmed with up to 79 characters of data. This is called the *user line*.



While the 25th line contains 80 characters, the first character position is used for the video attribute of the line and cannot be used for data.

Both the status and the user line can be sent to the computer.

4.3.1 User Line

To display the user line, press

ESC g

4. PROGRAMMING

To load the user line with data:

1. Display the user line (if desired) by entering ESC g.
2. Press
ESC f
3. The first character position is used for the video attribute for the user line. (Default is reverse video.) You can also add another attribute at any position in the line. To enter a video attribute for all or part of the user line, enter

ESC G n

where n is the position at which the attribute will begin and is a value from Table 4-2.

4. Enter up to 79 characters of text. (The message will appear on the user line as it is entered.)
5. You can move the cursor to any position by sending TAB plus the position (using a value from Table 4-2).
6. Press
RETURN
to end the programming mode.

To send the user line to the computer, press (in sequence)

ESC Z 0

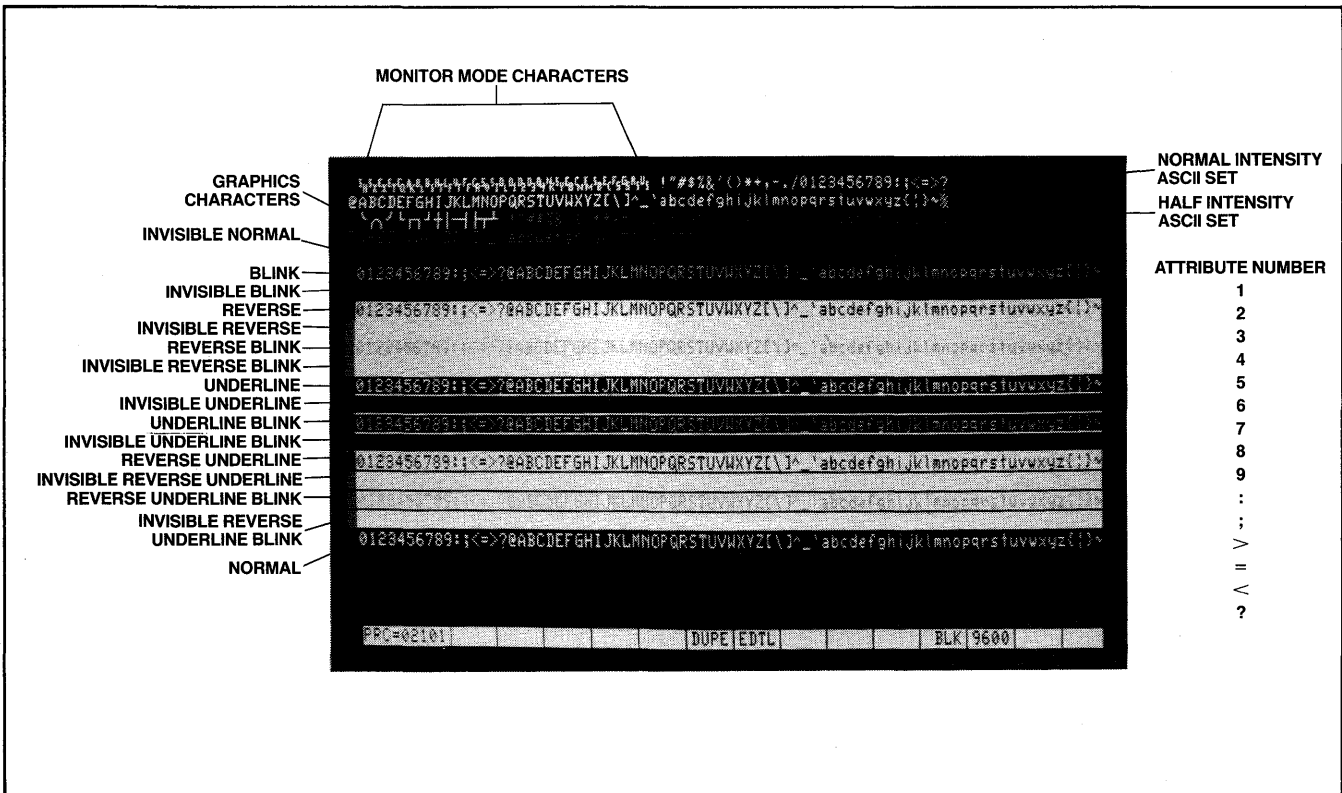


Figure 4-1 Video Attributes and Monitor Mode

4. PROGRAMMING

To redisplay the status line after displaying the user line, press

ESC h

Table 4-1 Monitor Mode Control Characters

Code	ASCII	Hex	Character Displayed
^@	NULL	00	none
^A	SOH	01	S _H
^B	STX	02	S _X
^C	ETX	03	E _X
^D	EOT	04	E _T
^E	ENQ	05	E _O
^F	ACK	06	A _K
^G	BEL	07	B _L
^H	BS	08	B _S
^I	HT	09	H _T
^J	LF	0A	L _F
^K	VT	0B	V _T
^L	FF	0C	F _F
^M	CR	0D	C _R
^N	SO	0E	S _O
^O	SI	0F	S _I
^P	DLE	10	D _L
^Q	DC1	11	D ₁
^R	DC2	12	D ₂
^S	DC3	13	D ₃
^T	DC4	14	D ₄
^U	NAK	15	N _K
^V	SYN	16	S _Y
^W	ETB	17	E _B
^X	CAN	18	C _N
^Y	EM	19	E _M
^Z	SUB	1A	S _B
^[	ESC	1B	E _C
^\ ^]	FS GS	1C 1D	F _S G _S
^^	RS	1E	R _S
^_ DEL	US DEL	1F 7F	U _S ⌘

4. PROGRAMMING

Table 4-2 Cursor Coordinates

Row/ Column	ASCII Code Transmitted	Row/ Column	ASCII Code Transmitted	Row/ Column	ASCII Code Transmitted
1	Space	33	@	65	'
2	!	34	A	66	a
3	"	35	B	67	b
4	#	36	C	68	c
5	\$	37	D	69	d
6	%	38	E	70	e
7	&	39	F	71	f
8	'	40	G	72	g
9	(	41	H	73	h
10	)	42	I	74	i
11	*	43	J	75	j
12	+	44	K	76	k
13	,	45	L	77	l
14	-	46	M	78	m
15	.	47	N	79	n
16	/	48	O	80	o
17	0	49	P	81	p
18	1	50	Q	82	q
19	2	51	R	83	r
20	3	52	S	84	s
21	4	53	T	85	t
22	5	54	U	86	u
23	6	55	V	87	v
24	7	56	W	88	w
25	8	57	X	89	x
26	9	58	Y	90	y
27	:	59	Z	91	z
28	;	60	[	92	{
29	<	61	\	93	|
30	=	62	]	94	}
31	>	63	^	95	~
32	?	64	-	96	DEL/RUB

4.3.2 Status Line

To send the status line to the computer, press (in sequence)

ESC Z1

4.4 LINE LOCK

The line lock feature allows you to lock the 80-character line on which the cursor is positioned into screen memory until the lock is released. The line will remain fixed in position on the screen regardless of the action of the remainder of the screen data (i.e., scrolling). The line lock function may be used to set up a stationary 80-character line or group of lines while other screen data scrolls past. Once line lock is cleared, all lines on the page can scroll normally.

4. PROGRAMMING

You may lock multiple lines in any sequence; however, no more than 23 of the 24 lines on each page may be locked.

To enable line lock, enter

ESC ! 1

To disable line lock, enter

ESC ! 2



This command will unlock the entire screen.

4.5 DISABLING/ENABLING THE KEYBOARD

You can disable (lock) all keys except FUNCT, PRINT, BREAK, SET-UP, NO SCROLL, and the function keys using a command sent from the computer.

Once the keyboard is disabled, it can only be enabled by another command.



If your applications program echoes all codes, the keyboard may be accidentally disabled.

To disable the keyboard, enter

ESC #

The keyboard will remain disabled until one of the following occurs:

The terminal receives an ESC " sequence

You press BREAK twice while holding down the SHIFT key

You change the status line

4.6 CURSOR DISPLAY

The cursor may appear in any of five ways. To change the appearance of the cursor without changing the rear switch settings, enter one of the following escape sequences:

Appearance	Command
Cursor not displayed	ESC .0
Blinking block cursor	ESC .1
Steady block cursor	ESC .2
Blinking underline cursor	ESC .3
Steady underline cursor	ESC .4

4. PROGRAMMING

4.7 KEYCLICK AND BELL

You can control keyclick (the noise made as each key is activated) and sound the terminal's bell with the following code sequences:

Function	Command
Keyclick on	ESC >
Keyclick off	ESC <
Ring bell	^G

4.8 SMOOTH SCROLL

The smooth scroll feature prevents display jitter as text lines scroll up or down and the slower rate of scrolling allows you to more easily read the scrolling text.

When smooth scroll is on, the screen scrolls smoothly at a rate of six data rows per second. Without smooth scroll, screen data scrolls as fast as it is received.

To activate smooth scroll, enter

ESC 8

To turn off smooth scroll, enter

ESC 9



The computer must respond to X-On/X-Off commands or DTR control in order for this feature to work correctly.

4.9 VIDEO DISPLAY

The video display feature turns the screen on (default) or off. You could use this to blank the screen while the computer is building a form or writing a long data list. The following commands control video display:

Screen Display	Command
On	ESC n
Off	ESC o

4.10 VISUAL ATTRIBUTES

The visual attributes of each character as well as the spaces on the screen may be controlled to define the appearance of the screen (either wholly or partially).

Two methods may be used to set visual attributes. The method used determines whether the attribute will occupy a space and how much of the display will be affected. The two methods are summarized in Table 4-3.

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Table 4-3 Visual Attributes

Method	Uses	Affects	Attribute Occupies Space?
1	Escape sequence	Partial/whole line/screen	Yes
2	Switch setting or escape sequence	Whole screen	No

The following attributes are available:

- Normal Video** Restores the background of the screen to that selected by rear terminal switch settings.
- Reverse Video** Changes the background of the screen to the reverse of that which appears at power on (default). If the screen is normally black with green characters, it will now be green with black characters. If method one is used, this attribute starts with the cursor position and continues until another attribute is encountered.
- Half Intensity** Changes the intensity to half of normal on a character-by-character basis.



Half intensity differs from other visual attributes in two ways:

- 1. Once it is set, it affects all characters entered (regardless of cursor position) until it is turned off.*
- 2. This attribute character never occupies a character space.*

- Underline** Creates a solid line below all characters on the line (including the line created by the underscore key). This attribute starts with the cursor position and continues until another attribute is encountered. (Changed only by method one.)
- Blink** Causes all characters to blink. This attribute starts with the cursor position and continues until another attribute is encountered. (Changed only by method one.)
- Blank** Causes all data entered on the line to be invisible to you although the cursor will move and be transmitted to the computer. (A typical application might be payroll information.) This attribute starts with the cursor position and continues until another attribute is encountered. (Changed only by method one.)

4. PROGRAMMING

Setting Visual Attributes

Method One

To set a visual attribute which can affect part or all of the screen, follow these steps:

1. Place the cursor one position *before* you want the attribute to start.



Remember that each attribute occupies a character position. If you type over the attribute, it will be lost unless you have protected it using protect mode.

2. Enter the appropriate escape sequence as listed in Table 4-4.

Table 4-4 *Escape Sequences for Visual Attributes*

Attribute	Escape Sequence
Normal (default) video	ESC G 0
Invisible normal video	ESC G 1
Blink	ESC G 2
Invisible blink	ESC G 3
Reverse video (reverse of default)	ESC G 4
Invisible reverse	ESC G 5
Reverse and blink	ESC G 6
Invisible reverse and blink	ESC G 7
Underline	ESC G 8
Invisible underline	ESC G 9
Underline and blink	ESC G :
Invisible underline and blink	ESC G ;
Reverse and underline	ESC G <
Invisible reverse and underline	ESC G =
Reverse and underline and blink	ESC G >
Invisible reverse and underline and blink	ESC G ?

Method Two

This method changes the entire screen display using switches on the rear of the terminal or an escape sequence. Changing the display with those switches or with the escape sequence described in this section differs from the video attributes described above in two ways:

The attribute occupies no space on the screen

The entire screen is affected

Table 4-5 summarizes the effect of these escape sequences in combination with the rear switch settings.

4. PROGRAMMING

Table 4-5 Screen Attributes

Rear Switch Setting	Escape Sequence	Function	Effect
Normal (green on black)	ESC b	Set reverse background	Changes screen to reverse video (black on green)
Reverse (black on green)	ESC b	Set reverse background	No effect since screen is already reversed with switch setting
Normal	ESC d	Set normal background	No effect since screen is already normal
Reverse	ESC d	Set normal background	Changes screen to normal video (green on black)

4.11 SPECIAL GRAPHICS

The special graphics feature converts all alphanumeric characters received while this feature is active to one of 15 special graphic characters.

When this feature is being used, the SHIFT key has no effect and the status line displays GRPH. When special graphics is inactive, the status line displays either a space (or H.I. if half intensity was previously set).

To control the special graphics mode, use the following commands:

Status	Code Sequence
Special graphics on	ESC \$
Special graphics off	ESC %

The graphics characters which will be displayed are shown in Figure 4-2 with the corresponding alphanumeric characters.

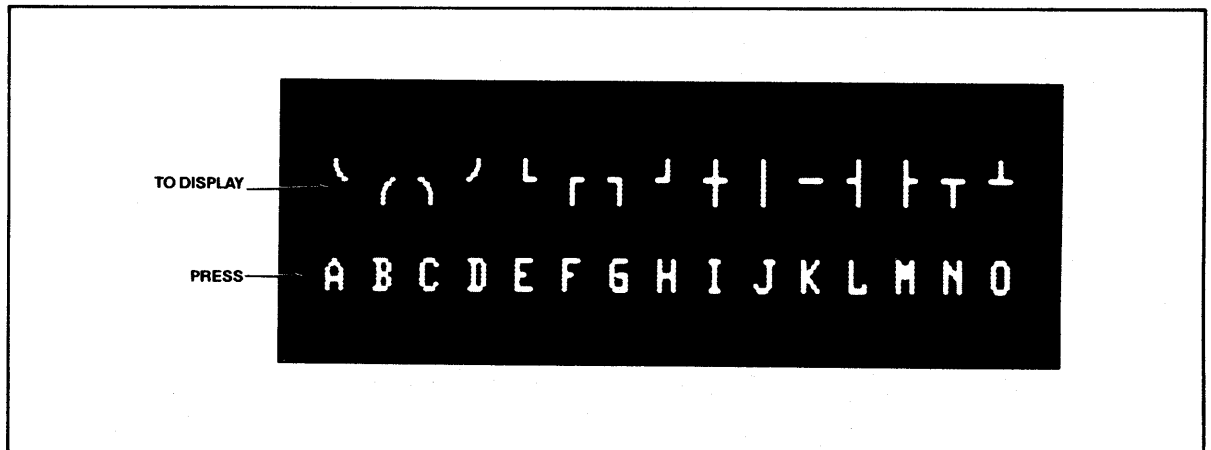


Figure 4-2 Special Graphics Characters

4.12 ADDITIONAL SCREEN MEMORY

You can add additional screen memory to the terminal by installing one or three chips in addition to the standard chip (which provides 24 lines or one page of memory).

4. PROGRAMMING

If your terminal contains the second chip (providing an additional 24 lines), you can divide the total 48 lines into either two 24-line pages or one 48-line page. If your terminal contains the four chips (adding 48 lines to the 48 provided by the first two chips), you can divide these 96 lines into four 24-line pages (standard), two 48-line pages, or a single 96-line page. You can scroll back and forth within the pages, one screen (page) at a time.

To set the number of lines per page, enter

ESC \ n

where n = 1 for 24 lines per page
2 for 48 lines per page
3 for 96 lines per page

To look at the next page of memory, enter

ESC K

To print the current page and look at the next page, enter

ESC P or ESC L

To look at the previous page of memory, enter

ESC J

If you move forward (or backward) to the next page, the cursor will be located in the same position on the new page as it was on the previous page.

4.13 AUTO PAGE

Auto page requires the installation of the additional screen memory chips (4.12). With the auto page feature on, when the cursor reaches the end of the screen, the screen flips to a new page and the cursor moves to the first unprotected position on the new page. (The flipping action of auto page is similar to viewing photographic slides.) If the cursor is at the home position and it receives the back space command, the screen flips to the previous screen and moves the cursor to the last unprotected position on the new page. If the cursor is in the home position of the first page when the back space command is received, the cursor will not move.

When auto page is not used and additional memory chips have been installed, the screen scrolls through the total pages, allowing you to view 24 lines at a time. This scrolling action is similar to the action of a movie camera which is panning a scene.

To turn on auto page, enter

ESC v

This new page will appear as a whole new page (i.e., the page does not scroll into view).

To turn auto page off, enter

ESC w

4.14 PROTECT MODE

4.14.1 Introduction

Using protect mode during the creation of a page allows you to:

- Protect designated areas of the page from future change by the operator
- Control transmission of those areas

4. PROGRAMMING

Using protect mode involves two procedures:

- Creating the areas to be protected using protected writing
- Protecting all of those areas with protect mode

4.14.2 Application

A typical application would be the creation of a form, leaving blank spaces for later entry of variable information. Were the form headings not protected by protect mode, they would be vulnerable to change or accidental deletion as the form was being filled in.

4.14.3 Effect

Fields input under protected writing appear on the screen at one half the regular intensity. When protect mode is in effect, the cursor is not able to enter those fields, but will instead advance across those fields to the first unprotected field when you use → or ←. ↑, ↓, or linefeed will, however, move the cursor to the protected field. The screen does not scroll up in protect mode. If the whole screen is protected, the cursor will go to the home position and will not move. At no time, however, can any data be entered in the protected field.

4.14.4 Input

Individual areas (fields) which will be given blanket protection from later change are created using protected writing mode.



Information must be input using this procedure if it is to be protected later.

1. Position the cursor where the first protected character is to be located.
2. Enter
ESC)

This turns on protected writing mode. Until the mode is reset, each character entered will be displayed at *half intensity*. The status line will display *H.I.*

3. Enter the information to be protected in that area of the screen.
4. Proofread the entry and correct it if necessary.
5. Enter
ESC (
to end data entry in that area and turn off protected writing mode.
6. Move the cursor to the next area to be protected and repeat.

4.14.5 Protection

When all areas to be protected have been entered correctly, the *whole screen* is ready to be protected from change (protect mode on). Once this protection is given, the cursor will not be able to enter those areas unless the protection is removed.

1. To turn on protect mode, enter
ESC &

4. PROGRAMMING



The position of the cursor during this escape sequence is irrelevant.

2. Look for *PROT* on the status line, indicating that protect mode is on.

With protect mode on, all half-intensity, graphics, and attribute characters are protected from overwriting or erasure. All data and visual attributes within the protected areas are protected.

To disable protect mode (remove the protection), enter

ESC '

The absence of *PROT* on the status line indicates that protect mode is off.

4.15 NORMAL AND REVERSE LINEFEED

You can cause a normal linefeed with the sequence

^J

To move the cursor up one line (reverse linefeed), send

ESC j

Using auto page and/or protect mode can affect where the cursor will move when a linefeed or reverse linefeed is received.

Tables 4-6 and 4-7 summarize the effect of auto page and protect mode when linefeed and reverse linefeed are used.



Linefeeds received by the terminal under certain conditions may result in the loss of data. Read the following control code explanations carefully.

Table 4-6 Effects of Auto Page and Protect Mode on Linefeed Actions

Auto Page	Protect Mode	Description
Off	Off	With auto page (4.13) on and protect mode (4.14) off, a linefeed advances the cursor to the next line on the page. If the cursor is at the bottom of the screen, linefeeds cause the display to roll up one line for each linefeed. If the cursor is also at the bottom of the page, a linefeed causes a new line of data to appear at the bottom of the screen and results in the loss of the top line of data on the page. The new line contains the insert character (4.20), which is normally spaces, but may be programmed to be any other character.
On	Off or On	Linefeed advances the cursor to the next line on the page. When the cursor reaches the bottom of the page, it will advance to the first line of the next page. When it reaches the last line of the last page, it advances to the first line of the first page (page zero).
Off	On	A linefeed causes the cursor to return to the top of the current page when it reaches the last line of the page.

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Table 4-7 Effects of Auto Page and Protect Mode on Reverse Linefeed Actions

Auto Page	Protect Mode	Description
On	Off or On	The cursor will move to the last line of the previous page when it reaches the first line of the current page. When the cursor reaches line one of page zero, it will not move further.
Off	On	The cursor does not move when on the first line.
Off	Off	The screen will scroll down one line when the cursor is on the first line.

4.16 CURSOR CONTROL CODES

All cursor controls may be performed using escape and control sequences sent from the computer.

The cursor control codes are summarized in Table 4-8.

Table 4-8 Cursor Control Commands

Cursor Control	Control Code	Auto Page	Protect Mode	Effect
Up	^K	Off/On	Off/On	Moves the cursor up one line until it encounters the top of the screen. If the cursor is not on the first line of the page, the display will roll down one line with each ^K until the cursor reaches the top of the page. Once it reaches the top of the page, receipt of further ^K codes has no effect.
Down	^V	Off/On	Off/On	Moves cursor down one line.
		Off	Off/On	If the cursor is on the bottom line of the page, the code has no effect.
Left	^H	Off/On	Off/On	Functions the same as BACKSPACE. Moves the cursor left to the next unprotected position on the page. If the cursor is currently in the first column of the line, it will move to the last column of the preceding line.
HOME	^^	Off	On	Moves cursor to the first unprotected space on the screen. If the cursor is currently at the home position or the first unprotected position on the page, the code has no effect.
		On	Off/On	If the cursor is at the home position or the first unprotected position on the page, the cursor will move to the end of the preceding page or to the last position of the last unprotected field of the preceding page. If the current page is page zero, the code has no effect.

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Table 4-8 continued

Cursor Control	Control Code	Auto Page	Protect Mode	Effect
Right	^L	Off/On	Off/On	Moves the cursor right one column. If the cursor is at column 80, it moves the cursor to the first column of the next line.
		Off	Off	Causes the screen to scroll one line if the cursor is at column 80 of the last line.
		On	Off/On	If the cursor is at the last unprotected position on the page, the cursor will move to the first unprotected position of the next page. If that page is the last page, the cursor will advance to the first unprotected position of the first page.
Carriage Return	^M	Off/On	Off	Moves the cursor left to column one of the current line.
		Off/On	On	Moves the cursor to the first unprotected position of the current cursor line.
New Line	^_ (underline)	Off/On	Off/On	Causes the terminal to perform a LF and a CR.

4.17 THE FUNCTION KEYS

The function keys (F1 through F11) send a user-defined or default code to the screen, to the computer, or to both, depending on whether the keys are set up for local or duplex communication mode. (For example, the user-defined code may be a frequently-used escape or control code sequence in a text editing application.)

4.17.1 Description

There are eleven function keys; using them in combination with SHIFT allows up to 22 sets of codes to be transmitted.

4.17.2 Default Messages

When the terminal is first turned on, the function keys are already programmed with default messages set to full duplex mode. If you do not program the function keys, the default values shown in Table 4-9 will be transmitted by each function key.

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Table 4-9 Default Function Key Values

Key	Unshifted Code	Shifted Code
F1	^A @ CR	^A \ CR
F2	^A A CR	^A a CR
F3	^A B CR	^A b CR
F4	^A C CR	^A c CR
F5	^A D CR	^A d CR
F6	^A E CR	^A e CR
F7	^A F CR	^A f CR
F8	^A G CR	^A g CR
F9	^A H CR	^A h CR
F10	^A I CR	^A i CR
F11	^A J CR	^A j CR

4.17.3 Programming the Function Keys

You may program the function keys (i.e., not use the default values listed in Table 4-9) following the procedure described in this section.

Enter the following code in the exact sequence shown:

```
ESC | p1 p2 message ^Y
```

where

p1 is the number of the function key. The values of p1 are as follows:

Key	Unshifted	Shifted
F1	1	<
F2	2	=
F3	3	>
F4	4	?
F5	5	@
F6	6	A
F7	7	B
F8	8	C
F9	9	D
F10	:	E
F11	;	F

The message can contain up to 63 bytes per key. (The total memory available for the function keys is 256 bytes total or 64 characters per key; however, one byte is added by the terminal processor for control purposes.)

p2 is one of the following values:

- 1 = Send to the computer (full duplex)
- 2 = Send to screen (local)
- 3 = Send to computer and to screen (half duplex)

^Y is the termination character

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Because control, escape, cursor position, and similar function keys are not normally stored, a ^P embedded in the text of the function key message may be used to store the next character entered.

For example, assume that the message desired for key F1 in local mode is:

TURN ON THE PRINTER

Precede this message with the following:

ESC |

The key number (1 for key F1)

The transmission mode (2 for local mode)

The entry will be:

ESC | 1 2 TURN ON THE PRINTER CR ^Y



Program the computer's input/output string routine to catch the entire string and then process it (unless you are using an interrupt-driven computer, in which case you should not need to worry about data being lost). If your computer cannot receive the message fast enough, enter a ^@ (null) sign between each character of the message.

4.17.4 Using Function Keys

To use one of the function keys in normal operation, press the function key for the first message, or press SHIFT and the key at the same time for the second message.

4.18 THE FUNCT KEY

Not to be confused with the function keys described in 4.17, the FUNCT key transmits a user-selected character (the ASCII code of the depressed key) bracketed by ^A (SOH) and a carriage return (CR). For example, if a ^A C CR sequence is required for a special operation in a text editing program, press FUNCT and C at the same time to transmit ^A C CR to the computer.



Program your computer's input/output string routine to catch the entire string and then process it (unless you are using an interrupt-driven computer, in which case you do not need to worry about data being lost).

4.19 ADDRESSING AND READING THE CURSOR POSITION

The computer can position the cursor (called *addressing* or *loading* the cursor) and determine the position of the cursor (*reading* the cursor).

To address the cursor, enter

ESC = r c

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or

ESC - p r c

where

r is the desired row (line). Refer to Table 4-2 to find the ASCII code representing the desired row.

c is the desired column. Refer to Table 4-2 to find the ASCII code representing the desired column.

p is the page number if the chip for additional pages of memory has been installed. Possible values are:

- 0 for page one
- 1 for page two
- 2 for page three
- 3 for page four



If your applications program inserts nulls between characters, loading the cursor will not function as described. Instead, the cursor will go to an unpredictable position.

For example, if you want the cursor to go to Row 9 of Column 50, enter

ESC = (Q

To read the cursor's row and column position (listed in Table 4-2), enter

ESC ?

To read the cursor's current page, row, and column, enter

ESC /

The page value will be

- 0 for page one
- 1 for page two
- 2 for page three
- 3 for page four

The row and column values sent (specified in Table 4-2) are followed by a carriage return.

4.20 LOADING AN INSERT CHARACTER

Several editing, erase, and clear functions (in addition to scroll and reverse scroll) cause certain areas of the page to be replaced with a predefined character. When the terminal is turned on, this insert character is defined as a space (ASCII 20 HEX).

During normal operation, the insert character may be redefined to be any ASCII character (e.g., a null or an underline) with the following escape sequence:

ESC e n

where n is the insert character.

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4.21 TAB PROGRAMMING

Two types of tabs are available:

Typewriter-style tabs

Field tabs (used when protect mode is on)

Table 4-10 summarizes all tab controls.

Table 4-10 Tab Controls

Action	Control Code	Auto Page	Protect Mode	Effect
Set tab ¹	ESC 1	Off/On	Off	Sets a typewriter-style column tab.
		Off/On	On	Generates a vertical column of half-intensity spaces from the cursor position down to the first write-protected character or to the end of the page, whichever is first.
Typewriter (Column) Tab	^I	Off/On	Off	Causes the cursor to advance to the next typewriter-style tab set. If no tabs are set, the code has no effect and the cursor will not move.
		Off	On	If there are no following unprotected fields, the cursor moves to the first character of the first unprotected field at the top of the page. If there are no characters on the page, the cursor will move to the home position.
		On	On	If no unprotected field follows, the cursor will advance to the first unprotected character on the next page. If no unprotected field exists on the next page, the cursor moves to home position on that page.
Field Tab	ESC i		Off	No effect.
			On	If there are no following unprotected fields, the cursor moves to the first character of the first unprotected field at the top of the page. If there are no unprotected characters on the page, the cursor will move to the home position.
Back Tab	ESC I	Off/On	Off	Causes the cursor to go back to the previous tab position set. If no tabs are set or if the cursor is on the first tab position on the page, this code moves the cursor to the first column on the line.
		Off	On	Moves the cursor back to the start of the first preceding unprotected field. If no preceding positions exist, the cursor will not move.

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Table 4-10 continued

Action	Control Code	Auto Page	Protect Mode	Effect
		On	On	If the cursor is at the first unprotected position on the page, it will move the cursor to the first unprotected character of the last unprotected field of the previous page. If no protected fields exist, home position is considered the start of an unprotected field. If the cursor is on the first unprotected position of the first page, this code has no effect.
Clear Typewriter Tab ²	ESC 2	Off/On	Off	Clears the typewriter tab where the cursor is located when this code is entered.
		Off/On	On	No effect.
Clear All Tabs ³	ESC 3	Off/On	Off/On	Clears all typewriter tabs regardless of the position of the cursor when the code is entered.

Notes

1. To set a tab, move the cursor to the column position where you want a tab. Be sure you enter a *numeral one*, not a lower case *L*.
2. Position the cursor at the tab to be cleared before entering the sequence.
3. The position of the cursor when this code is entered is not important.

4.22 COMMUNICATION MODES

Communication between the terminal and the computer can be controlled by escape sequences, switch settings, or the status line. Four modes are possible:

- Local
- Block
- Half duplex (conversational)
- Full duplex (conversational)

These are described in detail in 3.6.

4.22.1 Local

To operate in the local mode, enter

ESC c

4.22.2 Block

To operate in block mode, enter

ESC B

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4.22.3 Half Duplex

To operate in half duplex mode, enter

ESC DH

4.22.4 Full Duplex

To operate in full duplex mode, enter

ESC DF

4.22.5 Conversation

Half duplex and full duplex are both conversational modes. You can return to the previous conversational mode by entering

ESC C

For example, you were using full duplex before you changed to local mode. Now you want to return to full duplex. You can do so by entering either ESC C (conversational) or the command for full duplex (ESC FD).

4.23 EDIT KEYS

The edit modes which are described in this section can be selected either with the switches on the rear of the terminal or with control codes.

Two communication editing modes are available: local edit and duplex edit.

4.23.1 Local Edit

Using local edit enables you to change the text without transmitting the editing commands to the computer (i.e., all editing is in local mode).

In local edit mode, SEND, PRINT, and the edit keys (CLEARSPACE, BACKSPACE, ↑, ↓, →, ←, TAB, HOME, BACK TAB, LINE INSERT, LINE DELETE, CHARACTER INSERT, CHARACTER DELETE, LINE ERASE, and PAGE ERASE) and the changes caused by these keys are not transmitted to the computer.

To enter local edit mode, either change the status line or enter

ESC k

While local edit is on, all other keys will operate normally.

4.23.2 Duplex Edit

When duplex edit is selected, all editing commands are transmitted to the computer. To make editing changes which will be sent to the computer in the same manner as the alphanumeric keys (i.e., either half or full duplex), either change the status line or enter

ESC l (lower case "L")

For example, if the terminal is set for half-duplex operation, both the alphanumeric and edit keys will operate in half duplex mode.

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4.24 EDITING TEXT

Changing text can involve the following three actions:

Replacing (i.e., typing over) existing text; referred to here as *editing*

Inserting new text which pushes existing text to the right from the cursor position

Deleting existing text (by either character, line, or page) by moving that text backward toward the cursor

Editing, inserting, and deleting can occur within either the line on which the cursor is positioned or within the entire page of memory. Text which reaches the beginning or the end of a line or the page by these actions will, if moved *further*, be lost (i.e., “fall off”) that boundary (either line or page).

The four modes of operation available are:

Edit Page

Edit Line

Insert Page

Insert Line

These modes can be selected by any of the following methods:

Changing the status line (3.4)

Pressing some of the edit keys along with the SHIFT key (see Table 4-11)

Sending escape commands (see Table 4-11)

Table 4-11 summarizes the changes possible and the commands and keys which will cause those changes.

Table 4-11 Edit and Insert Modes

Change		Command	Press	Status Line Displays
From	To			
Edit (replace)	Insert	ESC q	Shifted Char Insert	INS
Insert	Edit (replace)	ESC r	Shifted Char Delete	EDT
Line	Page	ESC N	Shifted Line Insert	P
Page	Line	ESC O	Shifted Line Delete	L

The following sections describe in detail the effect of these modes.

Page Edit—When page edit is selected and characters are inserted, the remaining text moves forward to the next line as necessary. The *page* length is determined by the number of lines of memory for that page. For example, if you have the extra memory chips installed and have configured the memory to have one 96-line page, the text, of which you can see 24 lines at a time, would be able to flow forward within that 96-line area. When the end of the page is reached, however, text being pushed forward by the inserted text will be lost as it moves beyond column 80 of the last line of memory.

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When characters are deleted while page edit is in effect, the character in column one of each line will move to column 80 of the previous line (i.e., backward wraparound).

Page edit will be indicated by the presence of *EDTP* on the status line.

Line Edit—This is the default mode (i.e., the mode in effect when the terminal is turned on). Line edit allows you to insert or delete text only on the line on which the cursor presently rests. Characters will move forward or backward until column one or column 80 is reached. Text can be lost (i.e., “fall off”) either end of the line being edited.

Line edit will be indicated by the abbreviation *EDTL* on the status line.

Insert Line—Insert line allows you to insert or delete text only within the line on which the cursor presently rests.

Insert line will be indicated by the presence of *INSL* on the status line.

Insert Page—Insert page allows you to insert or delete text in the page of memory on which the cursor is resting. Characters will move forward or backward until column one of page one or column 80 of the last line is reached. Text can be lost (i.e., “fall off”) either end of the page of memory being edited.

Insert page will be indicated by the presence of *INSP* on the status line.

Table 4-12 summarizes the effects of the available editing commands in conjunction with page edit, line edit, and protect mode.

Table 4-12 *Editing Commands*

Edit Command	Escape Sequence	Edit Mode	Protect On/Off	Effect
Character Insert	ESC Q	–	–	Causes character at the cursor to move right one column position and enters an insert character at the cursor position.
		EDTP	–	The character at column 80 wraps to column one of the next line.
		EDTP	On	This control will turn off edit page. A character insert will insert from the cursor position to the end of the line or to the first protected field.
		EDTL	–	As characters are inserted, characters reaching column 80 are lost.
		EDTL	Off	Causes the character at the cursor to move right one column and enters an insert character at the cursor position. The character at column 80 is lost.
			On	Inserts from the cursor position to the end of the line or to the first protected field.

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Table 4-12 continued

Edit Command	Escape Sequence	Edit Mode	Protect On/Off	Effect
Character Delete	ESC W	EDTL	Off	Deletes the character at the cursor position and moves all following characters left one position. At the end of the delete function, an insert character is written into the last position on the line.
		EDTP	Off	Deletes the character at the cursor position and moves all following characters left one position. At the end of the delete function, an insert character is written into the last position on the page.
		EDTL	On	Operates only from the cursor position to the end of the unprotected field or line.
Line Insert	ESC E	-	Off	Inserts a line consisting of insert characters at the cursor position. This causes the cursor to move to the start of the new line and all following lines to move down one line, resulting in the loss of the last line on the page.
		-	On	No effect.
Line Delete	ESC R	-	Off	Deletes the line at the cursor position and all following lines move up one line. The cursor will move to column one of the line and insert characters will be loaded into the last line of the page.
		-	On	No effect.
Erase to End of Line	ESC T	-	Off	Erases all characters from the cursor to the end of the line and replaces them with insert characters. If half intensity is on, half-intensity insert characters will replace the erased characters.
		-	On	Erases all unprotected characters from the cursor to the end of the field and replaces them with insert characters. If half intensity is on, half-intensity insert characters will replace the erased characters.
Erase to End of Line with Nulls	ESC t	-	Off	Erases all characters from the cursor position to the end of the line and replaces them with null characters.
		-	On	Erases all characters from the cursor position to the end of an unprotected field and replaces them with null characters.

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Table 4-12 continued

Edit Command	Escape Sequence	Edit Mode	Protect On/Off	Effect
Erase to End of Page	ESC Y	-	On	Replaces unprotected characters from the cursor position to the end of the screen with insert characters. If half intensity is on, erased characters will be replaced with half-intensity insert characters.
Erase to End of Page with Nulls	ESC y	-	On	Erases all unprotected characters from the cursor position to the end of the page and replaces them with null characters.

4.25 CLEAR FUNCTION

The clear function is used in one of four ways to clear data from screen memory. Clear commands are summarized in Table 4-13.

Table 4-13 Clear Commands

Clear Command	Escape Sequence	Half Intensity	Protect	Effect
Clear Unprotected to Nulls	ESC :	Off/On	Off/On	Clears all unprotected data on the page to the null character or to the half intensity character if half intensity is on.
Clear Unprotected to Insert Characters	ESC ; ESC + ^Z	Off/On	Off/On	Clears all unprotected data on the page to insert characters. The default insert character is a space, but may be programmed to be another character. If half intensity is on, the screen will be cleared to half-intensity insert characters.
		On	Off	Clears screen to half-intensity spaces.
Clear Page to Half-Intensity Insert Characters	ESC ,	On	Off/On	Clears all unprotected data on the page to half-intensity insert characters.
Clear All Data to Nulls	ESC *	On/Off	On/Off	Clears all data on the page to nulls. Resets half intensity and protect modes.

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4.26 X-ON/X-OFF CONTROL

When the terminal's receive buffer is almost full (less than 32 characters), the terminal automatically transmits X-Off to the computer, requesting it to stop sending data. When the data in the buffer has been sent to the screen or the printer's buffer, the terminal transmits X-On to the computer, indicating that the computer may resume sending data to the terminal.

This X-On/X-Off feature may be enabled or disabled with the following control sequences:

Enable X-ON/X-Off	^O
Disable X-On/X-Off	^N

At power on, X-on/X-off is enabled. If X-On/X-Off is disabled, DTR control (4.27) is enabled.

4.27 DATA TERMINAL READY CONTROL

If you have disabled the X-on/X-off feature described above, the Data Terminal Ready feature is enabled (i.e., the DTR line is high). In that case, the DTR line will go low when the 256-byte receive buffer in the terminal has received 224 bytes from the computer—until the buffer is 20 percent empty again.

4.28 USER ROM

If you have installed your own programs in the ROM (as described in the Model 950 Customizing Manual), you can command the terminal to execute one of the programs with the command:

ESC z p

where

p is the optional parameter as defined in the ROM

If the user ROM has not been installed, the command will have no effect.

4.29 COMPUTER PORT PROGRAMMING

The default operating parameters of the RS232C computer port (terminal/computer interface) can be set using switch S1 on the terminal's rear panel. The terminal processor reads these parameters once when the terminal is turned on. These may, however, be changed with escape sequences after power up.

To change the parameters, enter

ESC { p1 p2 p3 p4

where

p1 is the baud rate (with values as shown in Table 4-14)

p2 is the number of stop bits (with values as shown in Table 4-15)

p3 is parity (with values as shown in Table 4-16)

p4 is the word length (with values as shown in Table 4-17)

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Table 4-14 Baud Rate Values

Value	Baud Rate
0	9600
1	50
2	75
3	110
4	135
5	150
6	300
7	600
8	1200
9	1800
:	2400
:	3600
<	4800
=	7200
>	9600
?	19200

Table 4-15 Stop Bit Values

Value	Stop Bits
0	1
1	2

Table 4-16 Parity Values

Value	Parity
0	Disabled/ignored
1	Odd (receive/transmit)
3	Even (receive/transmit)
5	Mark (transmit parity check disabled)
7	Space (transmit parity check disabled)

Table 4-17 Word Length Values

Value	Word Length
0	8 bits
1	7 bits

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You would select parameters of

- baud rate of 4800
- one stop bit
- even parity
- 7-bit word length

if you entered the following command sequence:

```
ESC { < 0 3 1
```

4.30 PRINTER PORT PROGRAMMING

Like the computer port, printer port default operating parameters are set with switch S1 on the rear of the terminal. The terminal processor reads these parameters once when the terminal is turned on. The parameters may, however, be changed after power up using escape sequences.

To change the parameters, use the following command sequence:

```
ESC } p1 p2 p3 p4
```

where the values for p1, p2, p3, and p4 are the same as those listed for programming the main port.

4.31 SEND FUNCTION

Once you have entered and edited data or text, you can transmit it to the computer by one of two methods:

1. Press the preprogrammed SEND key to transmit line or page data.
2. Enter a control sequence to send specific data.

4.31.1 Programming the SEND Key

To program the SEND key, enter the following code:

```
ESC 0 x y
```

where

- x is 1 to program the SEND key
- 2 to program the shifted SEND key
- y is 4 to program ESC 4
- 5 to program ESC 5
- 6 to program ESC 6
- 7 to program ESC 7
- S to program ESC S
- s to program ESC s

The SEND key operates both unshifted and shifted for transmittal of two-character escape sequences. Transmission of text by the SEND key may include embedded delimiters which define fields, end of line, and end of text.

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4.31.2 Delimiter Programming

To set the send delimiters, enter the following code in the exact sequence shown below:

ESC x n p1 p2

where

- n = 0 for delimit field code to p1 p2
- 1 for delimit line code to p1 p2
- 2 for delimit start protect field to p1 p2
- 3 for delimit end protect field to p1 p2
- 4 for delimit end of text to p1 p2

p1 = A standard ASCII or control character

p2 = A standard ASCII or control character

If no delimiter is desired, program p1 and p2 as nulls. For example, to eliminate the field delimiter during transmission, enter

ESC x O null null

The default delimiter values are shown in Table 4-18.

Table 4-18 Default Delimiter Values

Delimiter	Values	
	p1	p2
Field	FS	null
Line	US	null
Start protected field	ESC)
End protected field	ESC	(
End of text	Carriage return	null

To send specific data to the computer, use the commands shown in Table 4-19.

Table 4-19 Data Transmission Commands

Data Sent	Code	Effect
Unprotected line from start of line to cursor	ESC 4	Sends all unprotected data on the line from column one through the cursor position. Also sends an FS code (1C Hex) as field delimiters in place of each protected field and end-of-text characters at the end of the send transmission.
Unprotected page from home to cursor	ESC 5	Sends all unprotected data on the page from home through the cursor position. Sends an FS code (1C Hex) as field delimiters in place of each protected field. Sends line delimiters at the end of a line and an end-of-text at the end of the send transmission.

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Table 4-19 continued

Data	Code	Effect
Whole line from start of line to cursor	ESC 6	<p>Sends all data from the first column through the cursor position. Also sends ESC) at the beginning of each protected field and ESC (at the end of each protected field.</p> <p>If the character at the cursor position is protected, the terminal sends ESC ((end-protected field) to the computer. Sends the end-of-text characters at the end of the send transmission.</p> <p>If the data to be sent includes attribute characters, these will be sent also [the terminal will automatically include the suitable escape sequences (ESC Gn)].</p>
Send whole page	ESC 7	<p>Sends all data on the page from home through the cursor position. It also sends ESC) at the start of each protected field and ESC (at the end of each protected field.</p> <p>If the character at the cursor position is protected, the terminal sends an ESC (to the computer. This code also sends line delimiters at the end of each line and the end-of-text characters at the end of the send transmission.</p> <p>If the data to be sent includes attribute characters, these will be sent also [the terminal will automatically include the suitable escape sequences (ESC Gn)].</p>
Send unprotected message (STX to ETX)	ESC S	<p>Sends all unprotected data bracketed by the start of text (STX) and end of text (ETX) codes displayed on a page. After the data is sent, the terminal positions the cursor at the ETX code. If the page contains no STX codes, transmission begins from the home position. If the page contains no ETX code, the terminal sends to the end of the page and positions the cursor at home after the data is sent. If the page contains neither an STX nor an ETX code, the entire page will be sent.</p> <p>The code sends an FS code (1C Hex) as field delimiters in place of protected fields. It also sends line delimiters at the end of each line and an end-of-text delimiter at the end of the send transmission.</p>
Send whole message (STX to ETX)	ESC s	<p>Same as ESC S above except protected fields delimited by start-protected field ESC (and end-protected field ESC) are also transmitted.</p>

Data other than text may also be sent to the computer using control sequences. Pressing SEND will not send that data. The commands to transmit other-than-text data are shown in Table 4-20.

4. PROGRAMMING

Table 4-20 Transmit Commands

Data Transmitted	Code
Terminal identification ¹	ESC M
User line ²	ESC Z 0
Status line ²	ESC Z 1

Notes

1. The identification will include the software level and the number of lines in its memory, followed by a carriage return. The lines of memory will be indicated by the following values:

- 1 for a 24-line memory
- 2 for a 48-line memory
- 3 for a 96-line memory

For example, 2.0,2 CR would be sent for Level 2.0 firmware and 48 lines of memory.

2. Transmission is followed by a carriage return.

4.32 PRINT FUNCTION PROGRAMMING

The terminal's printer port may be set for one of five types of communication:

1. Extension (copy all): All data received by the terminal is displayed and sent to the printer. (See Figure 4-3.)
2. Transparent: All data transmitted from the computer to the terminal is printed without being displayed on the screen. (See Figure 4-3.)
3. Bidirectional: Two-way communication occurs between a KSR (keyboard send/receive) printer with a keyboard and the computer.
4. Formatted page print: All data between the home position and the cursor position is sent to the printer. Each line will be terminated with a CR, LF, and null.
5. Unformatted page print: All data between home position and the cursor position is sent to the printer. No line delimiters are sent.

Table 4-21 summarizes the print controls available.

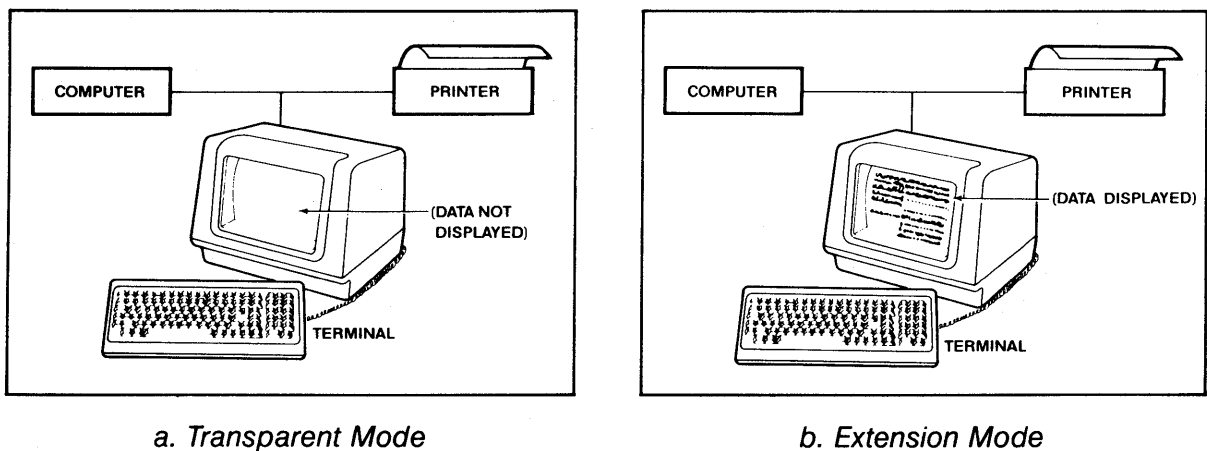


Figure 4-3 Print Modes

4. PROGRAMMING

Table 4-21 Print Controls

Name	Activated by	Prints	Status Line Shows	Buffer Action	Sends
Extension (copy all) print on	ESC @	All subsequent data received by the terminal goes to screen and continues on to the printer.	PRT 2	1	3
Extension print off	ESC A	Screen updating continues normally; any data remaining in the receive buffer continues to go to the printer until the buffer is empty.			
Buffered transparent on	ESC	All data goes through the terminal to the printer without going to the screen.	PRT 3	2	3
Buffered transparent off	ESC a	Printing continues only until receive and print buffers are empty. Data received goes to the screen.			
Formatted page print on	ESC P or PRINT key	Data from home to cursor (not limited by the screen display if optional lines of memory have been added). Nothing typed or received from the computer goes to printer until ESC P is entered or PRINT key is pressed. Advances screen to the next page.	PRT 0	6	4, 5
Unformatted page print on	ESC L or shifted PRINT key	Data from home to cursor (not limited by the screen display if optional lines of memory have been added). Advances screen to next page.	PRT 1	6	3, 4

Notes

1. When the terminal's receive buffer contains 224 characters, the terminal sends X-Off to the computer (or if X-Off has been disabled, toggles DTR low). When the receive buffer is 20 percent empty, the terminal sends X-On to the computer (or toggles DTR high if X-Off has been disabled).
2. Data goes first to the terminal's receive buffer and then to the terminal's print buffer. When the receive buffer contains 224 characters, the terminal transmits X-Off to the computer. If X-Off has been disabled, the terminal toggles DTR low instead. The terminal will send X-On when the receive buffer is 20 percent empty.
3. All control and escape characters are transmitted. Control characters are sent with the data.
4. An ACK will be sent to the computer, indicating that all print data has been output to the printer port.
5. Each 80-character line is followed by a CR, LF, and null.
6. If the printer sends X-Off to the terminal (or toggles the DTR line), the terminal will stop sending data to the printer until the printer sends X-On or toggles the DTR line. The status line will display PBSY, indicating that the printer is busy.

4. PROGRAMMING

Table 4-21 continued

Name	Activated by	Prints	Status Line Shows	Buffer Action	Sends
Enable bidirectional port	^R	Data from computer to printer passes through and is acted on by the terminal (i.e., keyboard lock enabled). Data can be sent from a KSR printer to the computer (passing through the terminal) but does not affect terminal (i.e., can't unlock the keyboard if it has been locked). PRINTER AND COMPUTER BAUD RATES MUST BE THE SAME.	BDIR		
Disable bidirectional port	^T	Data from computer to the terminal is not passed automatically to printer and no direct communication is possible between the computer and the device connected to the printer port.			

5. TROUBLESHOOTING AND SERVICE

This manual is written for the latest Model 950 firmware. Earlier firmware (i.e., 1.0) functions may not correspond to this manual.

5.1 CARE

Periodic cleaning and inspection will prolong the useful life of your terminal.

To clean the case:

1. Vacuum the keyboard with a soft brush or use a small soft brush.
2. Clean the housing with a soft, lint-free cloth and a commercial cleaner.



Do NOT use solvent-based or abrasive cleaners.

3. If you spill liquids on the keyboard, disassemble the keyboard and clean it with a soft cloth and water. Dry it thoroughly before re-using.

Inspect the cabinet and keyboard for damage or excessive wear periodically.

1. Inspect the cabinet for cracks or breaks. On customized units, check the bezel for paint damage (peeling, cracking, or severe scratches).
2. Check each key for free movement.
3. Inspect the cables and pin connectors twice a year for damage. Inspect the interface cable connectors for kinks or other signs of excessive stress (such as stretching).

Refer any damage to a qualified service technician.

5.2 TROUBLESHOOTING

The information provided in this section may enable you to resolve many operating problems without placing a service call.

You can run two self tests. If both tests run satisfactorily and you still have problems, consult Table 5-1.

Table 5-1 Troubleshooting Terminal Problems

Symptom	Possible Cause	Solution
Terminal dead (no beep; no cursor)	No AC power	Unplug power cord and plug in. Turn on power switch. Check power select switch.
	Fuse(s) blown	Check line and power supply fuses.
	Loose or defective line/power supply fuses	Turn power off and change fuses.

5. PREVENTIVE MAINTENANCE AND CARE

Table 5-1 continued

Symptom	Possible Cause	Solution
Terminal will not go on line	System is not "up"	Check system status.
	Loose, unconnected, or damaged cables	Re-attach all cables; check for damage.
		Check main port (P3) interface cables: Pins 5, 6, and 8 must be driven by +12 VDC or not connected Pins 1 and 7 must be grounded Pin 3 must be connected to the computer transmitter; Pin 2 must be connected to the computer receiver.
	Incorrect switch settings.	Check settings.
Cursor will not appear.	Modem not turned on, or defective, or phone handset upside down.	Turn on modem. Switch modems. Check handset.
	Defective contrast pot.	Place service call.
System does not respond while on line	Contrast set too light.	Adjust contrast.
	Incorrect parity, word structure, stop bits	Set parity to match system
Terminal does not respond to switch settings	Terminal not powered down after being reconfigured; software has not scanned new settings	Turn terminal off and back on
No keyboard response	Terminal set for on line and full duplex	Set to half duplex
	Keyboard unplugged	Check keyboard connector
Terminal locked up	Keyboard disabled	Enter ESC "
	Switches set incorrectly	Review all switch settings
Terminal prints correct data only part of the time	Incorrect parity settings	Check system parity needs
	Stop bits or word structure wrong	Change switch settings
Display is wavy	Hertz setting wrong	Change power switch to match local power frequency
Printer does not print what is typed	Incorrect print mode	Check print function
	Cable connector pins connected incorrectly	Refer to Table 2-3. Pins 4 and 20 must be driven by +12 VDC or not connected; 3 must be connected to printer data input; 2 must be connected to printer data output for operation with X-On/X-Off control.
	Printer set up incorrectly	Check printer switch settings Check other printer port device requirements.

5. PREVENTIVE MAINTENANCE AND CARE

Table 5-1 continued

Symptom	Possible Cause	Solution
Escape and control codes do not function as expected	Incorrect escape and control codes used	Make sure upper and lower case codes are used as required. Is a numeral one being used instead of lower case "L"?
	Keyboard locked in SHIFT (AUTO LOCK on) position	Put in lower case.
		Connect P3-2 to P3-3 and try in full duplex. Disconnect computer system.

5.2.1 Testing the Terminal (Self-Test 1)

You can test the terminal yourself to verify proper operation of the video display circuitry, the transmit and receive portions of the RS232C circuitry, the character generator, and the control processor. The test will display all displayable characters and all 16 video attributes (in both half and full duplex).

To activate the self-test, follow these steps:

1. Press SHIFT and SET-UP/NO SCROLL at the same time.
2. Press 1.
3. Verify that the screen appears as shown in Figure 5-1. It should contain twenty lines with all the characters and attributes displayed. All characters should appear, and all video attributes and half-intensity characters should appear as shown. Each character should be formed properly; you should not see any extra dots and no dots should be missing.
4. If any of the video attributes or display functions are inoperative, call a qualified service technician.
5. To stop the test, press SHIFT and SET-UP/NO SCROLL again at the same time.

5.2.2 Testing the Computer and Printer Port Communications (Self Test 2)

This self test checks communications of the computer and printer ports by running four test patterns. The test patterns are:

1. 55 (16) from P3 to P4
2. AA (16) from P3 to P4
3. 55 (16) from P4 to P3
4. 2A (16) from P4 to P3

5. PREVENTIVE MAINTENANCE AND CARE

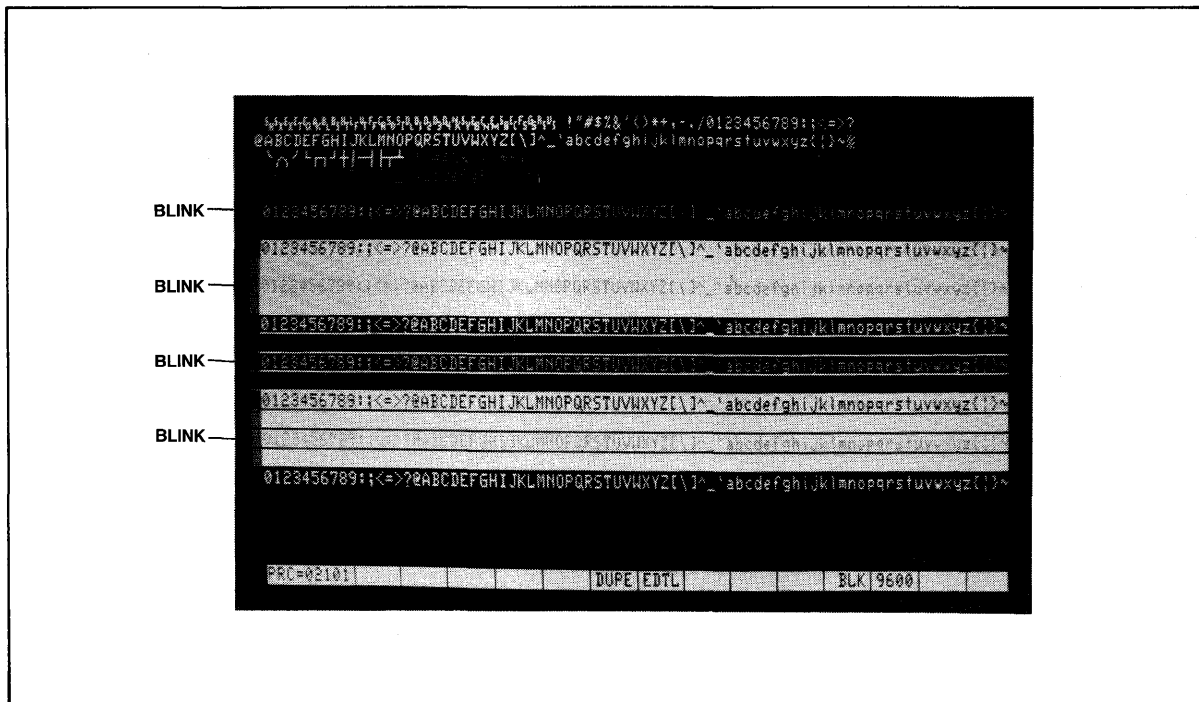


Figure 5-1 Normal Screen During Self Test 1



The terminal must be set for an 8-bit data word and full or half duplex or this self test will fail.

To run this self test, follow these steps:

1. Connect P3-2 to P4-2 and P3-3 to P4-3 on the rear panel. (If necessary, use a prefabricated test cable with RS232C 25-pin male connectors at either end.)
2. Set both ports to the same baud rate (see Table 2-4b).
3. Press SHIFT and SET-UP/NO SCROLL at the same time.
4. Press 2.
5. Wait while the test runs.
6. Look for a pass or fail indicator to appear in line one on the screen. The failure indicator is FAIL n where n is the number of test(s).
7. If any of the tests fail, recheck the cable connection and the baud rates, then run the test once again.
8. If the problem persists, call a qualified service technician.
9. To stop the test, press SHIFT/SET-UP once more.

5. PREVENTIVE MAINTENANCE AND CARE

5.3 REPAIR

Operator repair is limited to changing the line fuse and the two internal power supply fuses.

5.3.1 Changing the Line Fuse



To avoid electrical shock, disconnect the terminal power cord before changing the line fuse.

1. Remove the fuse holder (see Figure 2-3) by unscrewing it counterclockwise.
2. Remove the blown fuse and replace it with a 3AB, 1 amp "slow blow" 125 VAC or 0.5 amp, 250 VAC instantaneous "fast blow" fuse for 220 VAC applications.
3. Install the fuse in the reverse order of Steps 1 and 2.
4. Plug the power cord in again.

5.3.2 Changing the Power Supply Fuses

The two terminal power supply fuses are installed in fuse clips on the power supply assembly inside the terminal (see Fig. 2-6). To replace either of these fuses, follow these steps:



Hazardous voltages are exposed in the cabinet. Turn off the power switch and disconnect power BEFORE opening the terminal cabinet.

1. Disconnect the terminal power cord from primary power.
2. Remove the four Phillips screws that hold the cabinet cover on the base and remove the cover.
3. Remove the blown fuse from its fuse clip.
4. Replace the blown fuse with a 3AG, 3 amp, 125 VAC fuse.
5. Reinstall the terminal cover and screws. (Do not overtighten the screws.)

5.4 TECHNICAL ASSISTANCE

The Service Department is open from 7:00 a.m. until 5:00 p.m., Pacific Time, Monday through Friday, except holidays. Be specific when describing the problem and failure history. Have the terminal in question by the phone before calling. If the line is busy and your problem can wait, leave a message with the TeleVideo operator and your call will be returned at our first opportunity.

5. PREVENTIVE MAINTENANCE AND CARE

5.4.1 Vital Statistics

Enter here the serial number, date received, and switch settings. This will expedite any technical conversations about your terminal.

Serial Number _____ Date Received _____

Switch Settings Used:

	Up/Down		Up/Down
S1	1____	S2	1____
	2____		2____
	3____		3____
	4____		4____
	5____		5____
	6____		6____
	7____		7____
	8____		8____
	9____		9____
	10____		10____

5.5 RESHIPPING THE TERMINAL

Should you need to reship the terminal, follow these procedures:

1. Remove the four screws on the bottom of the terminal (Figure 2-1) and lift off the top portion of the cover.
2. Check the integrity of the cabling and security of internal mounting hardware.
3. Replace the cover, being careful not to overtighten the screws.
4. Repack the terminal in the original TeleVideo shipping container or other suitable materials.

APPENDIX A MODEL 950 SPECIFICATIONS

MONITOR	
Size	12 inches measured diagonally
Phosphor	P31 green nonglare read out
CHARACTER FONT	14 × 10 dot resolution with lower case descenders
DISPLAYED CHARACTER SET	128 displayable characters: 96 character ASCII upper/lower case alphabet 32 control characters 15 special graphics characters 24 lines (80 characters per line; 1920 characters per screen) Dual intensity with Protected fields Reverse video Underlined fields Blink Blank Half intensity (alone or in combination)
CURSOR ATTRIBUTES	Reverse block Blinking reverse block Undisplayed Underline Blinking underline
EDITING	Insert/delete character Insert/delete line Line/page edit Local/duplex edit
SPECIAL FEATURES	Smooth scroll/no scroll Line lock
CURSOR CONTROL	↑, ↓, ←, →, home, tab, back tab, return, line feed, backspace
REPEAT	20 cps auto repeat
PARITY	Even, odd, send, mark, space, or no
WORD STRUCTURE	7 or 8 data bits 10 or 11 bit word
BAUD RATES	15 switch-selectable: 50, 75, 110, 135, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600, 19,200
TRANSMISSION	Local Block Conversation: full or half duplex (keyboard selectable)
COMMUNICATION PROTOCOL	X-On/X-Off DTR
INTERFACES	Standard RS232C point-to-point (50 ft. maximum)
PRINTER PORT	RS232C bidirectional page print buffered transparent buffered with screen copy

APPENDIX A MODEL 950 SPECIFICATIONS

POWER

Requirements 115 VAC (60 Hertz) at 0.54 amps
 230 VAC (50 Hertz) at 0.27 amps
 65 watts

DIMENSIONS

Cabinet 16.50 inches (41.9 cm) wide
 14.00 inches (35.6 cm)
 14.25 inches (36.2 cm)

Keyboard 16.50 inches (41.9 cm)
 7.50 inches (29.0 cm)
 3.00 inches (7.6 cm)

WEIGHT

Net Cabinet 30 lbs. (13.6 kg)
 Keyboard 4.5 lbs. (2.3 kg)

Shipping 44 lbs.

ENVIRONMENT

Ventilation Requirements 4 inches minimum

Temperature Ambient operating 32°F (0°C) to 122°F (50°C)
 Storage -40°F (-40°C) to 149°F (65°C)

Relative humidity Operating 5 to 95 percent noncondensing
 Nonoperating no restrictions

APPENDIX B STATEMENT OF LIMITED WARRANTY

STATEMENT OF LIMITED WARRANTY

TeleVideo Systems, Inc. ("TeleVideo") warrants to its distributors, systems houses, end users, and OEMs ("Buyer"), that products manufactured by TeleVideo are free from defects in materials and workmanship. TeleVideo's obligations under this warranty are limited to repairing or replacing, at TeleVideo's option, the part or parts of the products which prove defective in material or workmanship within 15 months after shipment by TeleVideo. Buyer must pass along to its initial customer or user ("Customer") a minimum of 12 months' coverage within this 15-month warranty period, provided that Buyer gives TeleVideo prompt notice of any defect and satisfactory proof thereof.

Products may be returned by Buyer only after a Return Material Authorization number ("RMA") has been obtained from TeleVideo by telephone or in writing. Buyer will prepay all freight charges to return any products to the repair facility designated by TeleVideo and include the RMA number on the shipping container. TeleVideo will, at its option, either repair the defective products or parts or deliver replacements for defective products or parts on an exchange basis to Buyer, freight prepaid to the Buyer. Products returned to TeleVideo under this warranty will become the property of TeleVideo. With respect to any product or part thereof not manufactured by TeleVideo, only the warranty, if any, given by the manufacturer thereof, applies.

EXCLUSIONS

This limited warranty does not cover losses or damage which occurs in shipment to or from Buyer, or are due to, (1) improper installation or maintenance, misuse, neglect, or any cause other than ordinary commercial or industrial application, or (2) adjustment, repair, or modifications by other than TeleVideo-authorized personnel, or (3) improper environment, excessive or inadequate heating or air conditioning and electrical power failures, surges, or other irregularities, or (4) any statements made about TeleVideo's products by salesmen, dealers, distributors or agents, unless confirmed in writing by a TeleVideo officer.

If the firmware or hardware is altered or modified by the Buyer, this firmware and hardware is not covered within this limited warranty and the Buyer bears sole responsibility and liability for that firmware and hardware.

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APPENDIX C ASCII CODE CHART

KEY
 ESC 33 OCTAL
 27 DECIMAL
 1B HEX

BITS	7 6 5 4				0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1			
	4	3	2	1	Column		0		1		2		3		4		5		6		7	
				Row																		
0	0	0	0	0	0	NUL	000	DLE	20	SP	40	0	60	(	P	120	,	140	p	160	
0	0	0	1	1	1	SOH	001	DC1 (XON)	21	!	41	1	61	A	Q	121	a	141	q	161		
0	0	1	0	0	2	STX	010	DC2	22	"	42	2	62	B	R	122	b	142	r	162		
0	0	1	1	1	3	ETX	011	DC3 (XOFF)	23	#	43	3	63	C	S	123	c	143	s	163		
0	1	0	0	0	4	EOT	100	DC4	24	\$	44	4	64	D	T	124	d	144	t	164		
0	1	0	1	1	5	ENQ	101	NAK	25	%	45	5	65	E	U	125	e	145	u	165		
0	1	1	0	0	6	ACK	110	SYN	26	&	46	6	66	F	V	126	f	146	v	166		
0	1	1	1	1	7	BEL	111	ETB	27	'	47	7	67	G	W	127	g	147	w	167		
1	0	0	0	0	8	BS	100	CAN	30	(	50	8	70	H	X	130	h	150	x	170	
1	0	0	1	1	9	HT	101	EM	31	)	51	9	71	I	Y	131	i	151	y	171	
1	0	1	0	0	A(10)	LF	110	SUB	32	*	52	:	72	J	Z	132	j	152	z	172		
1	0	1	1	1	B(11)	VT	111	ESC	33	+	53	;	73	K	[	133	k	153	{	173	
1	1	0	0	0	C(12)	FF	100	FS	34	,	54	<	74	L	\	134	l	154	|	174		
1	1	0	1	1	D(13)	CR	101	GS	35	-	55	=	75	M	]	135	m	155	}	175	
1	1	1	0	0	E(14)	SO	110	RS	36	.	56	>	76	N	^	136	n	156	~	176		
1	1	1	1	1	F(15)	SI	111	US	37	/	57	?	77	O	_	137	o	157	DEL	177		

ASCII Code Table Abbreviations For Control Characters

NUL	null	FF	form feed	CAN	cancel
SOH	start of heading	CR	carriage return	EM	end of medium
STX	start of text	SO	shift out	SUB	substitute
ETX	end of text	SI	shift in	ESC	escape
EOT	end of transmission	DLE	data link escape	FS	file separator
ENQ	enquiry	DC1	device control 1	GS	group separator
ACK	acknowledge	DC2	device control 2	RS	record separator
BEL	bell	DC3	device control 3	US	unit separator
BS	backspace	DC4	device control 4	SP	space
HT	horizontal tabulation	NAK	negative acknowledge	DEL	delete
LF	linefeed	SYN	synchronous idle		
VT	vertical tabulation	ETB	end of transmission block		

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OPERATOR'S QUICK REFERENCE GUIDE

Function	Command	Function	Command
MONITOR (4.2)		VISUAL ATTRIBUTES (4.10)	
Monitor mode on (transmitted)	ESC U	Normal video (green on black)	ESC G 0
Monitor mode off (transmitted)	ESC X	Invisible normal	ESC G 1
	ESC u	Blink	ESC G 2
		Invisible blink	ESC G 3
		Reverse video (black on green)	ESC G 4
USER AND STATUS LINE (4.3)		Invisible reverse	ESC G 5
Display user line	ESC s	Reverse blink	ESC G 6
Load user line	ESC f (text) CR	Invisible reverse blink	ESC G 7
Display status line	ESC h	Underline	ESC G 8
		Invisible underline	ESC G 9
LINE LOCK (4.4)		Underline blink	ESC G :
Enable linelock	ESC ! 1	Invisible underline blink	ESC G ;
Disable linelock	ESC ! 2	Reverse blink underline	ESC G <
		Invisible reverse underline	ESC G =
DISABLE/ENABLE KEYBOARD (4.5)		Reverse blink underline	ESC G >
Disable keyboard	ESC #	Invisible reverse blink underline	ESC G ?
Enable keyboard	ESC "	Reverse screen background	ESC b
		Normal screen background	ESC d
CURSOR (4.6, 4.15, 4.16)		SPECIAL GRAPHICS (4.11)	
Home	^^	Special graphics on	ESC \$
New line (LF and CR)	^_	Special graphics off	ESC %
Carriage return	^M	SCREEN MEMORY (4.12)	
Linefeed/cursor down	^J or ^V	Set lines per page	ESC \ n
Cursor up	^K or ESC j	Advance page of memory	ESC K
Backspace/cursor left	^H	Print current page and view next page	ESC P
Cursor right	^L		ESC L
Cursor off	ESC . 0	View previous page	ESC J
Blinking block cursor	ESC . 1	AUTO PAGE (4.13)	
Steady block cursor	ESC . 2	Auto page on	ESC v
Blinking underline	ESC . 3	Auto page off	ESC w
Steady underline	ESC . 4	PROTECT MODE (4.14)	
		Half intensity (protected writing) on	ESC)
KEYCLICK AND BELL (4.7)		Half intensity (protected writing) off	ESC (
Keyclick on	ESC >	Protect on	ESC &
Keyclick off	ESC <	Protect off	ESC '
Ring bell	^G		
SMOOTH SCROLL (4.8)			
Enable smooth scroll	ESC 8		
Disable smooth scroll	ESC 9		
VIDEO DISPLAY (4.9)			
Screen display on	ESC n		
Screen display off	ESC o		

OPERATOR'S QUICK REFERENCE GUIDE

Function	Command	Function	Command
FUNCTION KEYS (4.17)		CLEAR (4.25)	
Program function key	ESC | p1 p2 (text) ^Y	Clear unprotected to insert characters	ESC + ^Z ESC ;
ADDRESS/READ CURSOR (4.19)		Clear all data to nulls	ESC *
Address cursor (column, row)	ESC = r c	Clear unprotected to nulls	ESC :
Address cursor (page, column, row)	ESC - p r c	Clear page to half-intensity insert characters	ESC ,
Read cursor (row, column)	ESC ?	X-ON/X-OFF	
Read cursor (page, row, column)	ESC /	Enable X-On/X-Off	^O
INSERT CHARACTER (4.20)		Disable X-On/X-Off	^N
Program insert character	ESC e n	DATA TERMINAL READY (4.27)	
TAB (4.21)		Enable DTR	^N
Set typewriter (column) tab	ESC 1	Disable DTR	^O
Typewriter tab	^I	USER ROM (4.28)	
Field tab	ESC i	Execute ROM program	ESC z p
Back tab	ESC I	COMPUTER AND PRINTER PORTS (4.29, 4.30)	
Clear typewriter tab	ESC 2	Configure computer port	ESC { p1 p2 p3 p4
Clear all tabs	ESC 3	Configure printer port	ESC } p1 p2 p3 p4
COMMUNICATION (4.22)		SEND KEY (4.31)	
Local on	ESC c	Load SEND key	ESC 0 x y
Block on	ESC B	Set send delimiters	ESC x n p1 p2
Half duplex on	ESC D H	Send unprotected line to cursor	ESC 4
Full duplex on	ESC D F	Send unprotected page to cursor	ESC 5
Return to previous conversational mode	ESC C	Send line to cursor	ESC 6
EDIT KEYS (4.23)		Send page to cursor	ESC 7
Local edit keys	ESC k	Send unprotected message	ESC S
Duplex edit keys	ESC I	Send entire message	ESC s
EDITING TEXT (4.24)		Send terminal identification	ESC M
Character insert	ESC Q	Send status line	ESC Z 1
Character delete	ESC W	Send user line	ESC Z 0
Line insert	ESC E	PRINT KEY (4.32)	
Line delete	ESC R	Extension print on	ESC @
Erase line to spaces	ESC T	Extension off	ESC A
Erase line to nulls	ESC t	Buffered transparent print on	ESC '
Erase screen to spaces	ESC Y	Buffered transparent print off	ESC a
Erase screen to nulls	ESC y	Formatted page print on	ESC P
Insert on	ESC q	Unformatted page print on	ESC L
Edit on	ESC r	Bidirectional printer port on	^R
Page on	ESC N	Bidirectional printer port off	^T
Line on	ESC O		

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