TeleVideo®

MODEL 910 *PLUS* TERMINAL
OPERATOR'S MANUAL

TELEVIDEO®
MODEL 910 *PLUS* TERMINAL OPERATOR'S MANUAL

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1. INTRODUCTION

This manual will explain how to install, operate, program, and troubleshoot your new 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 910 *PLUS* CRT terminal is a modular-design unit. Its nonglare green screen with high resolution characters reduces operator fatigue. Characters can be green on black or black on green.

The terminal includes many deluxe features. During installation you can change the terminal to one of four language character sets (English, Spanish, German, or French). Fifteen baud rates are available to fit your system requirements. An RS232C printer port allows you to connect an auxiliary printer of your choice. An optional current loop interface can be added, allowing the terminal to be installed up to 1,000 feet from your computer system.

You can select video attributes, transmission modes, and cursor appearance. Additional commands control protected fields, editing modes, monitor mode, handshaking protocol, and extension or copy print. Using a special "FUNCT" key plus an additional character allows you to quickly transmit a preprogrammed command sequence. Transmission can be conversational or block, editing can be local or duplex.

1.2 HOW TO USE THIS MANUAL

As you progress through the manual, you will find the following chapters:

2. INSTALLATION

Setting up your site for the terminal, the power requirements, unpacking and checking the terminal, setting switches to take advantage of the options available, configuring the terminal for your computer system and printer.

3. OPERATION

Turning on the terminal, a description of the keyboard and functions of the keys, using tabs, editing, sending data to the computer and the printer.

4. PROGRAMMING

Controlling the terminal through commands from your computer system: programming special functions, setting visual attributes, monitoring the program, loading and reading the cursor position, adding custom RAM and ROM, disabling the keyboard and printer.

5. TROUBLESHOOTING AND SERVICE

Periodic cleaning and inspection of the terminal, troubleshooting simple problems (using a table of symptoms, possible causes, and solutions), using self-test, service under warranty.

GLOSSARY

Explanation of terms commonly used in this manual.

APPENDICES

Specifications and reference tables.

INDEX

References to main subsections by subject.

OPERATOR'S QUICK REFERENCE GUIDE

Lists all control and escape commands.

Each section of the manual is numbered. To find a topic later, look in the index and find the appropriate section.

As you read the manual, you will notice some special symbols at the left margin of the text. These symbols call your attention to information of special importance. The symbols used are:

General note giving information to every operator.
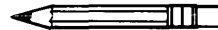
Programming note giving information of special significance to the programmer.

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

1.3 PROTECT YOURSELF!

When you install or test the terminal, observe standard safety precautions (as you would with any electrical or electronic equipment). Only qualified service personnel should open the terminal housing. Disconnect all power before performing any inspection or maintenance.

Beyond the normal precautions, you should be aware of two additional conditions:

1. If the CRT tube breaks, 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.

2. 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. INSTALLATION

2.1 INTRODUCTION

This chapter will tell you how to unpack and check your terminal for damage, check power and site requirements, and set the power and interface configurations. A brief checklist at the end will make sure you did not skip any part of the installation process.

Once your terminal is installed, you will be ready to operate the terminal. You will probably not need to refer to this chapter again unless you move the terminal, reship it, or use it with another computer system.

As you start the installation, you will want to have some information about your computer system and its configuration requirements.

2.2 UNPACKING AND INSPECTING THE TERMINAL

2.2.1 Shipping Damage Inspection

After the terminal is delivered to you, inspect the shipping container as well as the terminal (inside and out) for damage before taking it to your installation site. You should inspect the container for obvious damage before accepting delivery of the terminal. If damage is found, note it on the waybill and require the delivery agent to sign the waybill. Notify the transfer company immediately and submit a damage report to the carrier, your dealer, and to TeleVideo. If no exterior damage is found, unpack the terminal and inspect it for hidden damage.

2.2.2 Unpacking the Terminal

Carefully unpack the terminal from the shipping container. Avoid using sharp instruments to open the container. Save the packing container and material for possible use in reshipping the terminal.

2.2.3 Inspecting the Terminal

After you unpack the terminal, inspect it thoroughly for hidden damage and loose components or fittings. The inspection checklist is as follows:

1. Remove the terminal cover by removing the screws underneath the front bottom of the keyboard. Lift up the cover carefully.

The terminal will now be top heavy and will have a tendency to fall over backwards. Be sure there is sufficient table room.

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

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.

5. Tighten all loose hardware.

6. Clean loose debris from the cabinet interior.

7. Replace the cover. Do not overtighten the screws.
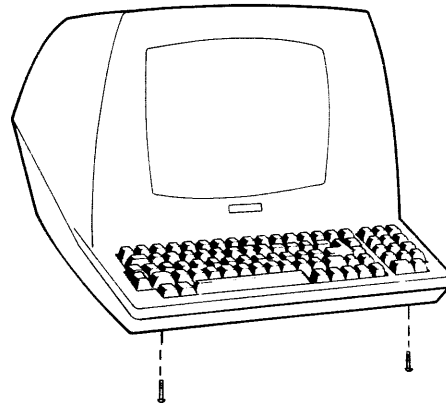
Figure 2–1 Location of Screws in the Terminal Cover

2.2.4 Reporting Damage

If hidden damage is found, immediately notify the transfer company of the damage. Save all packing materials for the transfer company's inspection, file a damage report with the carrier, and notify your dealer and TeleVideo of the damage. Since terms of sale for the terminal are FOB TeleVideo, Sunnyvale, California, TeleVideo is not responsible for any damage which occurred during shipment and will not repair this damage under warranty. **All repairs for shipping damage are billable.** Prompt notification of damage will ensure claim validity and expedite payment for necessary repairs by the transfer company or its insurance agent.

2.2.5 Reshipping the Terminal

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

1. Remove the two screws on the bottom front of the terminal and lift off the cover.

2. Check the integrity of the cabling and security of internal mounting hardware.

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

4. Repack the terminal in the original TeleVideo shipping container or other suitable materials.

2.3 PREPARING THE SITE

Before you proceed with the actual installation, make sure you are ready with the proper power and a large enough table.

2.3.1 Power Requirements

- 115 VAC 60 Hertz at 0.5 amp
           OR
  230 VAC 50 Hertz at 0.25 amp

- 55 watts

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

2.3.2 Physical Requirements

- Flat, level area

- Surface dimensions: 13¼ inches (33.66 cm) high
                        16⅛ inches (40.96 cm) wide
                        20¹⁄₁₆ inches (50.96 cm) deep

- Recommended ventilation clearance is 4 inches (10.2 cm) on all sides. Refer to Figure 2–2.

13¼"

20¹⁄₁₆"
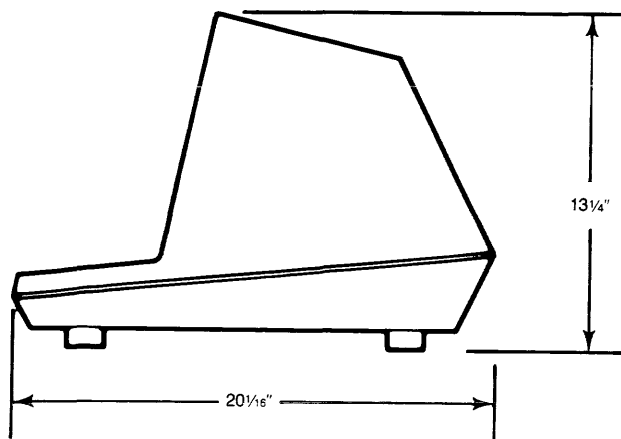
Figure 2–2 Dimensions

2.4 INSTALLATION

The actual installation and set-up consists of only three steps:

1. Configuring the terminal for either 115 or 230 VAC operation.

2. Connecting the terminal to the computer or a modem (and to a printer, if used).

3. Configuring the terminal by setting switches and installing jumper options.

2.4.1 Power Configuration

Depending on your location, the terminal can be configured to operate with either 115 VAC (United States) or 230 VAC (international).

115 VAC Configuration—Keep the three-prong plug which is provided with the terminal and make sure your outlet is grounded. If an adapter is used, ground with a pigtail.

230 VAC Configuration—If you are located outside the United States and use 230 VAC power, cut off the US-style three-prong plug provided and install a connector compatible with your local power receptacles. The power cord wires are color-coded as follows:

- Green   Earth ground

- Black   Primary power (hot)

- White   Primary power return (neutral)

Set the power select switch (located underneath the terminal) to either 115 or 230 V (Fig. 2–3). You will set Hertz to match your power frequency when you set switch S2.
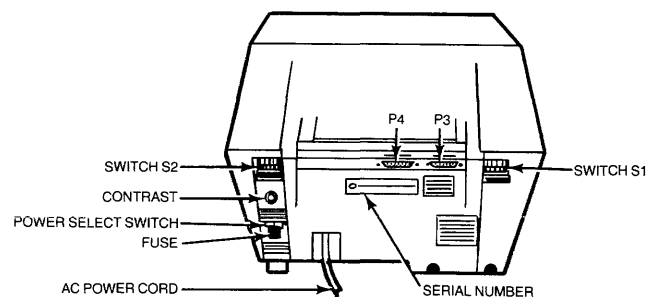
Figure 2–3 Rear Panel

2.4.2 Connecting the Terminal to a Computer System or Modem

You can connect the terminal directly to your computer system or use a modem. Table 2–1 points out pin connections which may be used.

3

The interface connection to the computer system (main) port is P3, located on the rear of the terminal. The connector configuration of P3 is given in Table 2–1.

Table 2–1
P3 (Computer Interface)
Pin Connections

Pin No.	Signal Name[1]
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 (opt.)
7	Signal Ground
8	Carrier Detect Input
12	Current Loop + , Receive
13	Current Loop − , Transmit
20	Data Terminal Ready Output
24	Current Loop − , Receive
25	Current Loop + , Transmit

Notes
1. Reference EIA Standard RS232 for Signal Definitions

2.4.3 Connecting the Terminal to a Printer

Your terminal can be connected to an auxiliary serial printer to make a permanent 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, including both character-by-character and buffered printers. The serial printer interface is a 25-pin connector, P4, located on the rear of the terminal. Table 2–2 defines the serial printer interface pin connections.

Table 2–2
P4 (Serial Printer Interface)
Pin Connections

Pin No.	Signal Name
1	Protect Ground
3	Transmit Data
6	Data Set Ready
7	Signal Ground
20	Data Terminal Ready

2.4.4 Configuring the Terminal for the Computer and Printer

Two switches (located on the rear of the terminal and shown in Fig. 2–2) allow you to configure the terminal to operate according to the requirements of your computer system and printer. This section describes these switch settings.

The optional conditions controlled by these switches are:

Baud Rates

You can select any of 15 baud rates according to the requirements of your computer system.

Character Sets

You can select English, French, German, or Spanish character sets.

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.

Signals

You can connect/disconnect Data Set Ready, Data Carrier Detect, and Data Terminal Ready.

Transmission

You can select half or full duplex (conversational mode) or block mode.

Set your printer's baud rate to match the computer's baud rate. (This rate is also used for switch S1 dipswitches 1 through 4 as described in Table 2–3b.)

Whenever you change any switches, press BREAK twice while holding down the SHIFT key. This allows the software to scan all new switch positions.

2.4.4.1 Character Sets—You can select any of four possible character sets. The standard set is English. To select another character set, refer to Table 2–5.
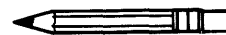
Character sets are resident in the character generator. You must reprogram the terminal system ROM for the particular keyboard layout desired.

Table 2–3a
External Switch Settings

Switch	Dipswitch	Open (Up)	Closed (Down)	Function
S1	1,2,3,4			Computer baud rate; see Table 2–3b
	5	x		Seven-bit word structure
			x	Eight-bit word structure
	6	x		Send parity
			x	No parity
	7	x		Even parity
			x	Odd parity
	8	x		Two stop bits
			x	One stop bit
	9	x		Autowrap on
			x	Autowrap off
	10	x		Performs CR/LF upon receipt of CR
			x	Performs CR upon receipt of CR
S2	1	x		Block
			x	Conversational
	2	x		Half duplex
			x	Full duplex
	3	x		50 Hertz[1]
			x	60 Hertz[1]
	4	x		Local edit
			x	Duplex edit
	5	x		Underline cursor
			x	Block cursor
	6	x		Cursor down key as in 912/920
			x	Cursor down key as in 925/950
	7	x		Green on black
			x	Black on green
	8	x		Data Set Ready disconnected
			x	Data Set Ready connected
	9	x		Data Carrier Detect disconnected
			x	Data Carrier Detect connected
	10	x		Data Terminal Ready disconnected
			x	Data Terminal Ready connected

NOTES
[1]Set to match powerline frequency to avoid screen flicker.

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Table 2–3b
Switch Settings for Computer Baud Rates

Switch	Position				Baud Rate Setting
S1	1	2	3	4	
	D	D	D	D	9600
	D	D	D	U	50
	D	D	U	D	75
	D	D	U	U	110
	D	U	D	D	135
	D	U	D	U	150
	D	U	U	D	300
	D	U	U	U	600
	U	D	D	D	1200
	U	D	D	U	1800
	U	D	U	D	2400
	U	D	U	U	3600
	U	U	D	D	4800
	U	U	D	U	7200
	U	U	U	D	9600
	U	U	U	U	19200

Legend: U = Up
D = Down

Table 2–4
Switch Settings of S1 for Common Word Structures
(Data Bits, Stop Bits, and Parity)

Position						
5	6	7	8	Data Bits	Parity	Stop Bits
U	D	X	D	7	None	1
U	D	X	U	7	None	2
U	U	D	D	7	Odd	1
U	U	D	U	7	Odd	2
U	U	U	D	7	Even	1
U	U	U	U	7	Even	2
D	D	X	D	8	None	1
D	D	X	U	8	None	2
D	U	D	D	8	Odd	1
D	U	U	D	8	Even	1

Legend: U = Up
D = Down
X = Either up or down

If word structure, parity, or stop bits are set incorrectly, the terminal will only display @ signs when it is turned on.

Conversational (down)
Half duplex (up)
60 Hertz (down)
Duplex edit (down)
Block cursor (down)
912/920 mode (up)
Black on green (down)
DSR connected (down)
DCD disconnected (up)
DTR connected (down)
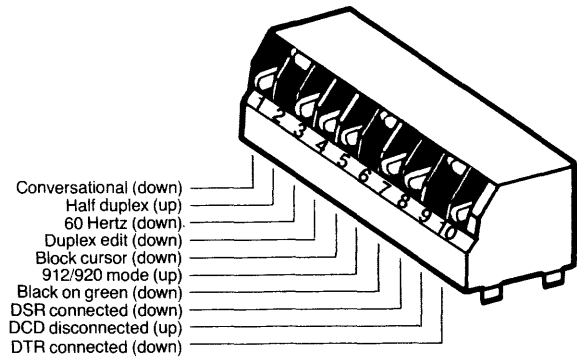
Figure 2–4 Switch Setting Example

Table 2–5
Character Set Jumper Options

French Cut trace between E4 and E5. Ensure that E6 and E7 are connected.

German Cut trace between E6 and E7. Ensure that E4 and E5 are connected.

Spanish Cut trace between E6 and E7 and E4 and E5.

2.4.4.2 Video Display—You can set the terminal display to be green on black (normal) or black on green (reverse) and cause the cursor to be an underline or a block, displayed as steady or blinking. (See Table 2–3a.)

2.4.4.3 Composite Video Jumper Option—To drive a monitor in addition to or other than the terminal monitor, modify the logic board (Fig. 2–5) by adding an Amphenol BNC connector (Part 227169–5) to the rear of the terminal case. (See Fig. 2–6 for recommended placement.)

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 E10 and E11. Install a jumper between E12 and E13.

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

2.4.4.4 Current Loop Option—Installing an optional current loop board enables you to operate the terminal up to 1,000 feet from your computer system.

Before you install the optional current loop board, inspect it for possible shipping damage (i.e., bent pins, cracked board, etc.).

Make cuts and jumpers on the current loop board (shown in Figure 2–7) according to the desired configuration. (Possible configurations are described in Table 2–6).

Remove the terminal cover by removing the two screws in the bottom of the case. (Figure 2–1 shows the location of these screws.)

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SOCKET (MODEM/CURRENT
LOOP CONNECTION)

POWER SUPPLY
CONNECTOR

S1

E8 E9

KEYBOARD ENCODER

KEYBOARD
CONNECTOR

E17 E18 E19

P3

UART

CRT
CONTROLLER

P4

CPU

PROGRAM EPROM

E14 E15 E16

S2

E10 E11
E12 E13

E4 E5   CHARACTER   MONITOR   P2 PIN 6 (COMPOSITE VIDEO)
E6 E7   GENERATOR   CONNECTOR

Figure 2–5 Logic Board

POWER SUPPLY

POWER SUPPLY
FUSES

MONITOR CARD

PLACEMENT OF
BNC CONNECTOR

P3   P4

S1

S2

P6

P7

P2

P5

P1
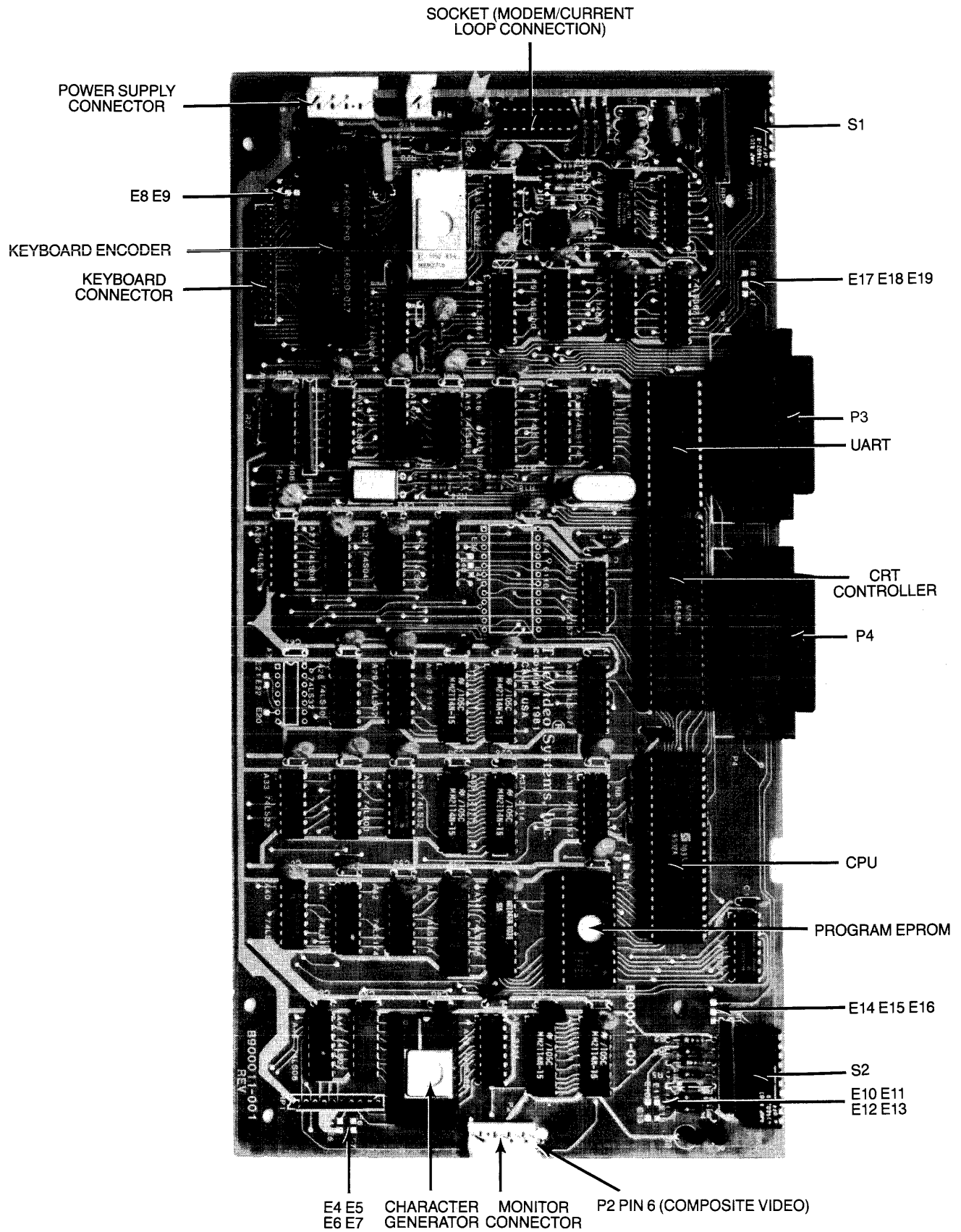
8

Figure 2–6 Interior of Terminal
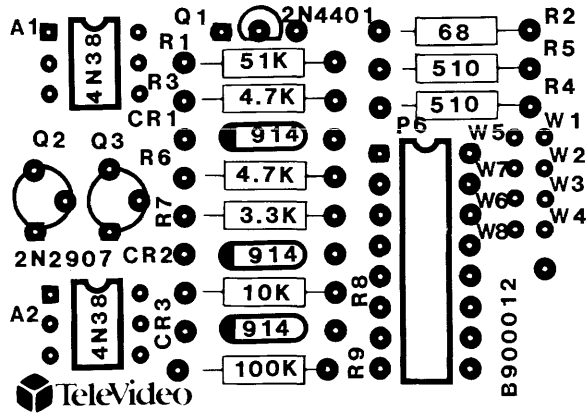
Figure 2–7 Current Loop Board
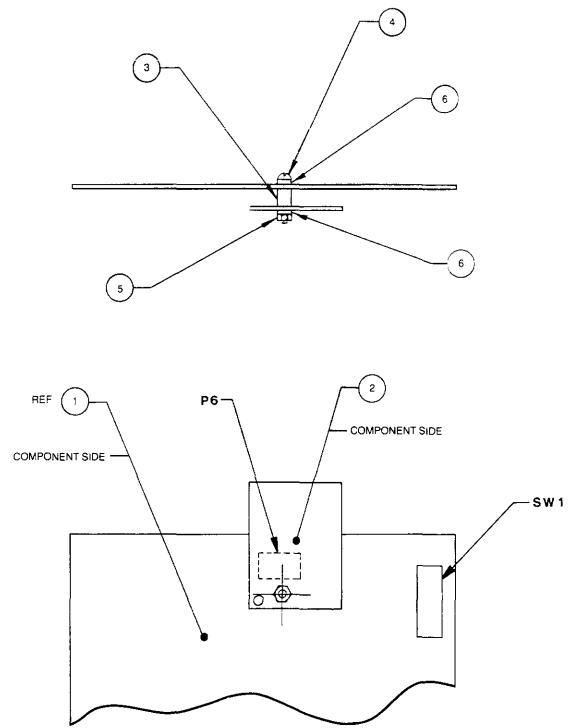
1.	B-900011–001	910 PLUS CONTROL BOARD
2.	B-900012–001	CURRENT LOOP BOARD
3.	M490022–002	NYLON SPACER
4.	M490013–006	SCREW
5.	M490019–001	HEX NUT
6.	M490014–003	NYLON WASHER

**Figure 2–8 Current Loop Board
in Relation to Logic Board**

**Table 2–6
Possible Current Loop Configurations**

Mode[1]	Transmit/ Receive	Cut	Jumper	P3 Pin No.
Full Duplex				
Active	Transmit	W2 to W3	W1 to W3 W3 to W4	Pin 25 − Pin 13 +
	Receive	W6 to W7	W5 to W6 W7 to W8	Pin 12 − Pin 24 +
Passive	Transmit	None	None	Pin 25 + Pin 13 −
	Receive	None	None	Pin 12 + Pin 24 −
Half Duplex				
Active	Transmit and Receive	W3 to W4	W1 to W2 P3–13 to P3–12	Pin 25 − Pin 24 +
Passive	Transmit and Receive	None	P3–13 to P3–12	Pin 25 + Pin 24 −

Notes
[1]Active = terminal supplies the current source; passive = computer supplies the current source.

Insert the current loop board into the 16-pin socket located on the terminal control board. Refer to Figure 2–3 for socket position; Figure 2–8 shows where to insert the screw, spacer, washer, and nut.

Replace the terminal cover using the screws you removed. Be careful not to overtighten the screws.

Connect your computer to the terminal, using a cable with pins as shown in the column labeled **P3 Pin No.** in Table 2–6.

2.4.4.5 Additional Modifications—Table 2–7 describes other jumper options which will change the terminal's interfaces.

Table 2–7
RS232C Terminal Interface Jumper Options

1. **Standard Set Up (no modifications to printed circuit board)**

   a. Data Carrier Detect (DCD), P3 pin 8, is used to monitor status of an external modem.

   b. Data Terminal Ready (DTR) output is sent to the computer when DTR from printer port is received.

2. **Jumper Options**

   a. Data Set Ready (DSR), P3 pin 6, can be used to monitor the external modem rather than DCD.

      To install: Cut the trace between E14 and E15. Add a jumper between E15 and E16.

   b. Use Request to Send (RTS) to send DTR to computer rather than DTR from printer.

      To install: Cut the trace between E18 and E19. Add a jumper between E17 and E19.

      (Refer to Figure 2–5)

2.5 INSTALLATION CHECKLIST

Before you proceed to the next chapter and turn on the terminal, check to be sure you installed the terminal correctly.

1. Did you install the correct power plug for your wall outlet?

2. Did you set the power selector switch to match your power requirements?

3. Is the main interface cable to the computer system properly wired and plugged in?

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
   * 50 or 60 Hertz (to match your powerline/frequency requirements)?
   * Full or half duplex?

If the answers are YES, then you are ready to proceed with actually using the terminal.

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:
(Enter U or D for Up or Down)

S1	**U/D**	**S2**	**U/D**
	1 ___		1 ___
	2 ___		2 ___
	3 ___		3 ___
	4 ___		4 ___
	5 ___		5 ___
	6 ___		6 ___
	7 ___		7 ___
	8 ___		8 ___
	9 ___		9 ___
	10 ___		10 ___

3. OPERATION

3.1 INTRODUCTION

This chapter will lead you step-by-step through the operation of the terminal. Even if you have never used a computer terminal before, you will be able to use the terminal easily if you read this chapter carefully. If you are a programmer, you will want to continue on to Chapter 4, which covers additional information for programming a computer to interface with your terminal.

In this chapter you will learn about:

- Turning on and adjusting the terminal's display screen

- Using the various keys on the keyboard

- Directing data to the computer system and the printer through send commands

- Setting tabs

- Communicating with your computer system

3.2 TURNING ON THE TERMINAL

Turn on the terminal as follows:

1. Make sure the ON/OFF switch at the back of the terminal (Figure 2–3) is OFF.

2. Plug the terminal cord into a grounded outlet (115 VAC in United States).

3. Push the end of the rocker power switch marked with a white dot. The terminal should beep within one second, indicating that power is on and the CPU has initialized the terminal. After another 10 to 15 seconds, the cursor should appear in the upper left corner of the screen (home).

4. If the cursor does not appear at the home position, press the home key on the keyboard. If the cursor

still does not appear, check the contrast control at the rear of the terminal (Figure 2–3).

5. Adjust the contrast control for the desired screen intensity.

6. Follow the sign-on protocol required by your computer system.

7. Refer to Chapter 5 if the installation does not proceed smoothly.

3.3 KEYBOARD CONTROLS

In addition to standard alphanumeric typewriter keys, your terminal has several keys which perform special operations. These special keys can be used in conjunction with your computer to allow:

- Modifying action on other keys

- Editing

- Entering preprogrammed data

Each key on the keyboard is actually a switch. Sometimes two keys can be used with any alpha or numeric keys to provide a totally different message to the computer. When used together, these keys control the generation of data sent to the computer system and the receipt and printing of information.

3.3.1 Keyboard Layout

Figure 3–1 illustrates the keyboard layout. The character keys highlighted in Figure 3–1a include all alphabetic characters (a through z), numbers (0 through 9), punctuation marks, and mathematical symbols.

3.3.2 Key Functions

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

Figure 3–1a Keyboard Layout
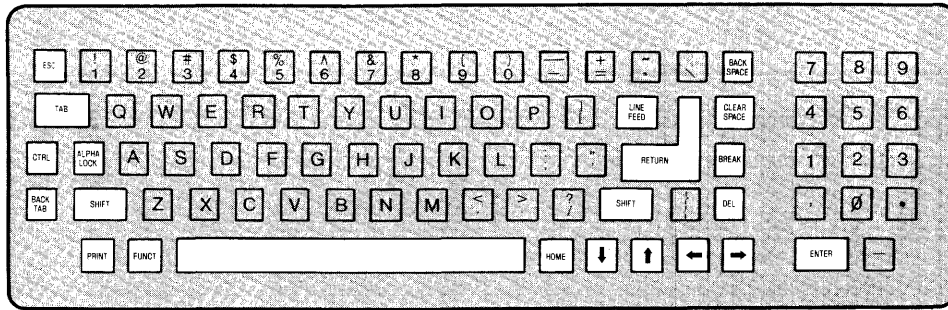
Figure 3–1b Keyboard Layout

Table 3–1
Function of Keys

Key Name	Transmitted? (Yes/No)	Repeat Action? (Yes/No)	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	(CTRL/I)—TAB moves the cursor forward to typewriter tabs (Protect mode off) or to the start of the next unprotected field (Protect mode on).
BACK TAB	Y	Y	(ESC I)—Moves cursor backward to typewriter tabs (Protect mode off) or to the previous start of an unprotected field (Protect mode on).
CTRL (Control)	N	N	Generates normally-nondisplayed ASCII control codes when used in conjunction with another key.

The CTRL key combinations are used for special action by the terminal and/or the application program in the computer.

The 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.) **The commands which require simultaneous depression of two keys are indicated by a slash separating the two key names.** |
| ESC (Escape) | Y | N | 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.

Another function of the ESC key causes the next control character entered to be displayed on the screen. This facilitates putting control characters on the screen without going into monitor mode. |

Table 3–1
Function of Keys

Key Name	Transmitted? (Yes/No)	Repeat Action? (Yes/No)	Description
			☀
			The ESC key is used in conjunction with one alphanumeric character in the command sequence; i.e., **the ESC key is pressed and released before the second key is pressed.**
			Although escape sequences appear here with a space before the alphanumeric character, this space is *not* to be entered as part of the sequence. It is included only for the sake of clarity.
RETURN/ ENTER	Y	N	(CTRL/M)—The RETURN and ENTER keys perform the same function. They send the ASCII code for a carriage return (CR) to the display or computer. The communication mode used causes the terminal to transmit a CR (or CR/LF) to the computer and/or the cursor to be moved to the first unprotected position.
			If the entire current line is protected, the code moves the cursor to the next unprotected position on the page.
			☀
			The terminal features an auto wraparound function which eliminates the need to manually enter a carriage return and a linefeed at the end of each 80-character line.
HOME	Y/N	N	(CTRL/ ∧)—Moves cursor to first unprotected character position on the page.
LINEFEED	Y	Y	(CTRL/J)—The LINEFEED key sends an 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 echoed by the computer in full duplex.
BACKSPACE ←	Y/N	Y	(CTRL/H)—Moves cursor one character to the left.
↑	Y/N	Y	(CTRL/K)—Moves cursor up one line.
↓	Y/N	Y	(CTRL/J or CTRL/V)—Moves cursor down one line. If the cursor is on the bottom line of the screen, the code has no effect. The code transmitted is determined by setting of switch S2.
→	Y/N	Y	(CTRL/L)—Moves cursor one character to the right.
DEL (Delete)	Y	Y	The DEL key sends an ASCII DEL character to the computer. This is usually interpreted by the computer as a character erase code.
BREAK	Y	N	Transmits a 250-millisecond break pulse to the computer.
Clear Space	Y/N	Y	Replaces all unprotected characters on the page with spaces. When pressed the same time as SHIFT (ESC *), it clears the entire page to nulls and turns off protect and half intensity modes.
PRINT	N	N	The PRINT key toggles the extension print mode on or off.
"FUNCT"	Y	N	The FUNCT key transmits a user-selected character bracketed by CTRL/A (SOH) and CR.

3.3.3 Cursor Control

The lighted rectangular block which appears on the screen indicates the entry spot for the following characters to be typed. It is called a "cursor." During typing, the cursor moves from left to right. As it reaches the end of a line, it "wraps around" to the beginning of the next line. If you place the cursor over a character which you have already typed, the character within the cursor will be changed into a reverse image within the cursor. (If the characters have been green on a black background, the cursor will appear as a green rectangle around a black character.)

The movement of the cursor is easy to control. To move the cursor, press one of the cursor control keys marked with an arrow. The cursor will move in the direction of the arrow until you release the key. To return the cursor quickly to the top left position on the screen, press HOME. The cursor will now be in column one, line one.

If you are in local edit mode, cursor movement will not be transmitted to the computer.

The cursor display may appear any one of five ways. See 4.11.

3.4 BASIC OPERATIONS

This section describes various options available to you as you use the terminal:

- Editing data

- Tab controls

- Communicating with your computer system

- Printing

3.4.1 Tab Controls

You can set regular typewriter-style tabs or (if you are using protect mode as described in 4.6) field tabs. Refer to 4.7 for complete instructions on setting, using, and clearing tabs.

3.4.2 Editing

Should you need to change text on the screen, you can delete a line (either partially or completely) or the display (either partially or completely). This will give you space to enter the correct text. Deletions will start with the column position of the cursor. The terminal can also modify screen data using character insert/delete and line insert/delete. These both start at the character position also. Commands for editing are described in 4.8.

You can select one of three transmission modes by switch settings or using escape sequences. The three modes

available are block, half duplex (conversation), and full duplex (conversation). The communications flow caused by these modes are illustrated in Figure 3-2.
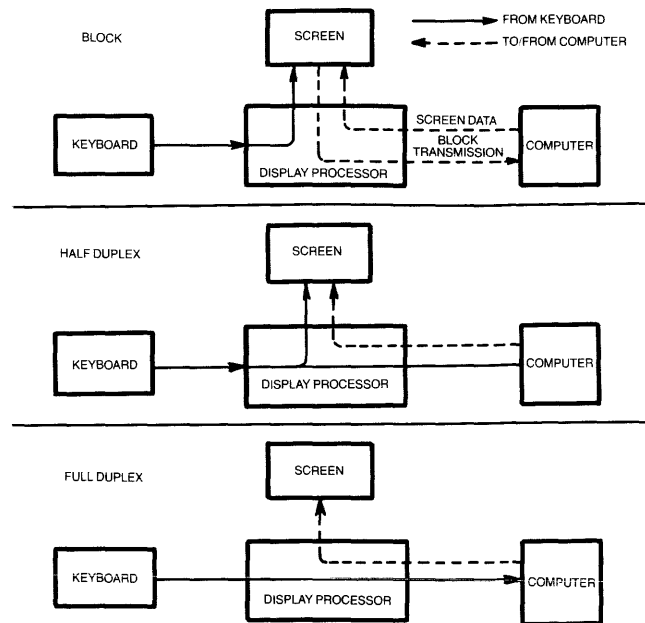
Figure 3-2 Communication Modes

3.4.2.1 Block Mode—Operating in the block mode generally consists of entering or changing text locally. In this mode, the terminal sends the results to the screen. When you are satisfied with the results of the data entry or change, you can enter an escape sequence to send the data to the computer. Block mode allows you to make all corrections before transmission.

To enter block mode, enter

ESC B

If switch S2 is set for block mode, the terminal will revert to conversation mode when an ESC C is received or entered.

3.4.2.2 Conversation Mode—In this mode, two-way transmission occurs continuously between the screen and the computer. You can either send the information to the computer *at the same time it is displayed on the screen,* or you can send it to the computer and the computer will echo back the information on the screen. (The time needed to echo back the information is so short it will *seem* to happen simultaneously.) Regardless of when you send data, the terminal can always receive information from the computer. When the information is displayed simultaneously with the transmission, it is called "half duplex." When the information is sent first to the computer and echoed back to the terminal, it is "full duplex." Refer to Figure 3-2 for a diagram of the information flow.

To enter conversation mode, enter

ESC C

The terminal is conversational in either half or full duplex modes.

Half Duplex Mode

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

Full Duplex Mode

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. For example, if the "A" is pressed on the keyboard, the computer will probably send the "A" back to the screen.

3.4.3 Sending Data to the Printer

When the printer is printing on a continuous basis, it is an extension of the line from the computer to the terminal—this mode of printing is thus called **extension** or **copy all.**

To start extension printing, either press the PRINT key or enter

ESC @

To stop printing, press PRINT again or enter

ESC A

You can also send information from the computer to the printer **without** displaying it on the screen. This is called **transparent** mode.

Section 4.15 describes commands used for transparent print.
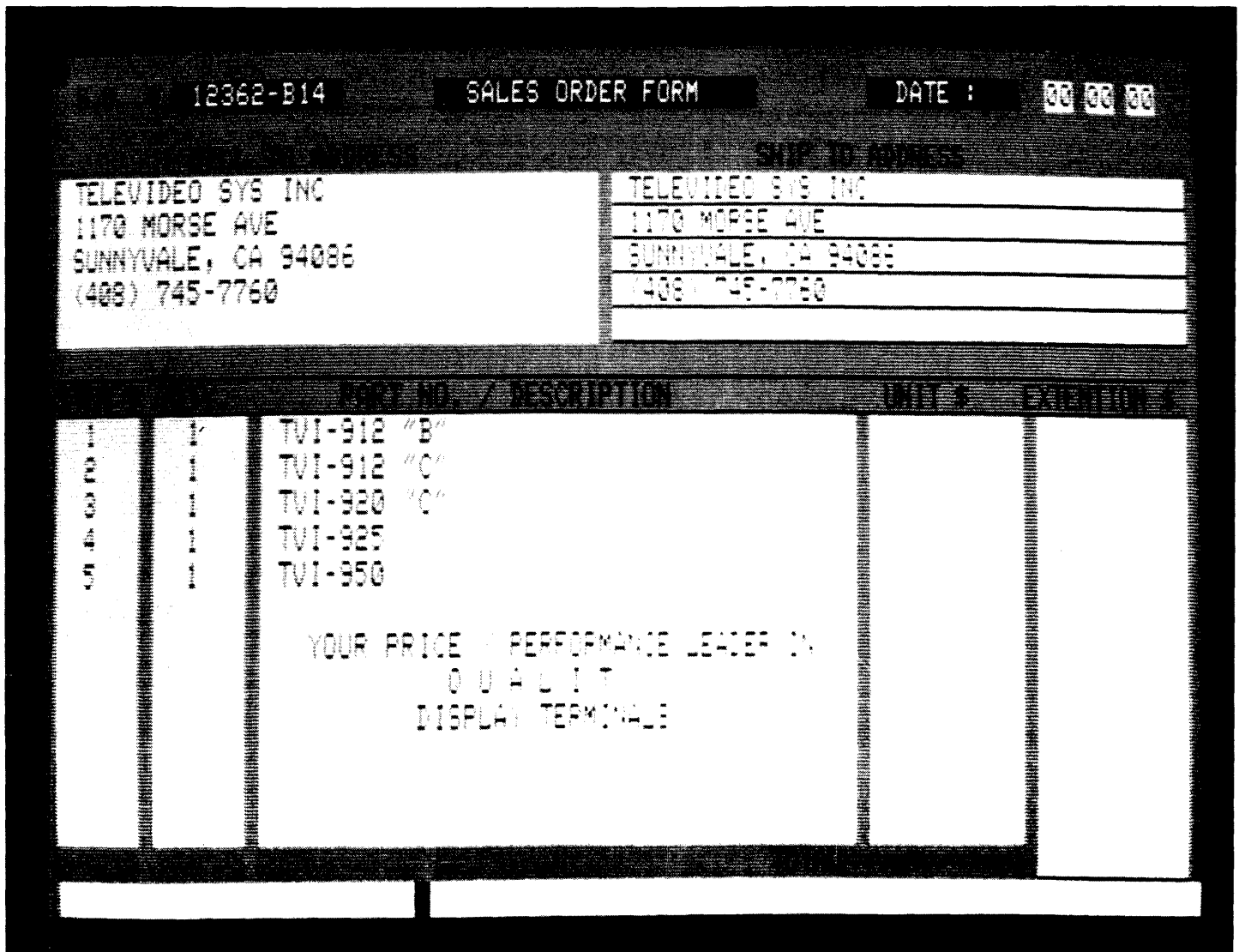
Figure 3– 3 Screen Display

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4. PROGRAMMING
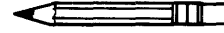
4.1 INTRODUCTION

Your computer program can completely control your terminal by transferring the appropriate ASCII codes. This chapter tells you how to translate keyboard functions into remote control functions.

Unless otherwise specified in the text, all control code sequences are transmitted to the terminal to elicit the response associated with the code.

4.2 MONITORING CONTROL COMMANDS

You can monitor control commands in several ways:

- Activate the monitor mode without transmitting the monitor mode code itself to the computer

- Transmit the monitor mode code to the computer

To enable monitor mode without transmitting that code to the computer, enter

CTRL/1

To terminate this mode, enter

CTRL/2

To enable monitor mode via the computer, enter

ESC U

This must be echoed by the computer or monitor mode will not be activated.

To terminate the display of the control commands, enter either

ESC u or ESC X

Figure 4–1 illustrates the monitor mode codes.

4.3 FUNCT KEY

Using the FUNCT (function) key in combination with any key enables you to quickly transmit a three-character sequence of commands.

To enter a function command, press the FUNCT key and *at the same time* press a key. The first code which is transmitted will always be

SOH (Control A)

The second code will be the ASCII code of the depressed key. The third code will always be a CR (Table 2–3).

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).

MONITOR MODE CODES
CHARACTER SETS
HALF INTENSITY
BLANK REVERSE
REVERSE

BLINK REVERSE

NORMAL VIDEO
BLANK NORMAL
BLINK NORMAL
BLANK BLINK
REVERSE UNDERLINE
BLANK REVERSE UNDERLINE
BLINK REVERSE UNDERLINE
BLANK BLINK REVERSE
NORMAL UNDERLINE
BLANK NORMAL UNDERLINE
BLINK NORMAL UNDERLINE

S1   S2
Xs DON'T CHANGE
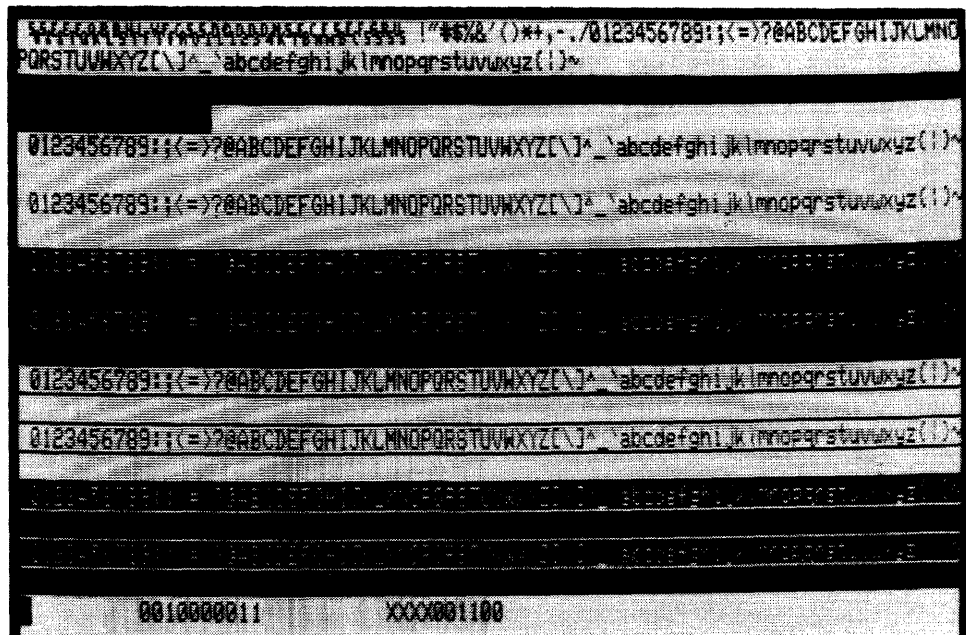
Figure 4–1 Video Attributes

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4.4 ADDRESSING AND READING THE CURSOR

The computer can tell the terminal where to position the cursor with a four-character escape sequence. This is called **addressing** or **loading** the cursor.

4.4.1 Addressing the Cursor

To address the cursor, enter

ESC =

Then enter two more characters to represent the absolute row or line and column where the cursor will rest. Using Table 4–1, find the ASCII code representing the desired row. Note that the line number can not be greater than 24. Enter the appropriate ASCII code. Next find the ASCII code corresponding to the desired column position (1 through 80 possible) and enter that code. For example, if you want to program the cursor to go to Row 9, Column 50, enter

ESC = (Q

4.4.2 Reading the Cursor

The computer can also **read** the cursor's row and column position. To read the cursor's position, enter

ESC ?

Following the cursor coordinates (row and column), the terminal will transmit a CR.

4.5 VISUAL ATTRIBUTES

You can define the appearance of each line on the screen (a whole line or only part of a line). Each line must be defined separately (except half intensity). Several attributes can be used on each line (i.e., blinking set at the beginning followed by underlining set later in the line).

Reverse Video Changes background of screen on that line to the reverse of that which appears on power ON. If screen is normally black with green characters, this line will now be green with black characters.[1]

Table 4–1
Cursor Coordinates

CURSOR POSITIONING

POSITION R or C[1]	ASCII CODE Transmitted	POSITION C	ASCII CODE Transmitted	POSITION C	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

Notes
1. Value of R can't be greater than 24.

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Half Intensity   Changes intensity to half of normal on a character-by-character basis.

Half intensity differs from other visual attributes in that once it is set, it affects all characters entered (regardless of cursor position) until it is turned off.

Underline   Creates a solid line below all characters on the line (including the line created by the underscore key).[1]

Blink   Causes all characters on the line to blink.[1]

Blank   All data entered on the line will be invisible to you but will print out and be transmitted to the computer. (A typical application might be payroll information.)[1]

Note

1. Attribute starts with cursor position and continues until another attribute or end of line is encountered.

Figure 4–1 illustrates the visual attributes.

4.5.1 Setting

To set a visual attribute, place the cursor one position *before* you want the attribute to start. Attributes occupy a character position. If you want the whole line changed, place the cursor at column one before entering the attribute command (ESC Gn).

Table 4–2
Escape Sequences for
Visual Attributes

Description	Escape Sequence
Normal video (green on black)	ESC G0
Blank (invisible normal video)	ESC G1
Blink	ESC G2
Blank (invisible blink)	ESC G3
Reverse video (black on green)	ESC G4
Blank (invisible reverse video)	ESC G5
Reverse and blink	ESC G6
Blank (invisible reverse blink)	ESC G7
Underline	ESC G8
Blank (invisible underline)	ESC G9
Underline and blink	ESC G:
Blank (invisible blink underline)	ESC G;
Underline and reverse	ESC G <
Blank (invisible underline reverse)	ESC G =
Underline and reverse and blink	ESC G >
Blank (invisible underline reverse blink)	ESC G?

4.6 PROTECT MODE

4.6.1 Application

Using protect mode during the creation of a page allows you to protect designated areas of the page from future change by the operator and control the transmission of those areas.

Using protect mode is actually a two-step process: input and protection.

A typical application would be the creation of a form, leaving blank spaces for later entry or 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.

4.6.2 Effect

Protected areas appear on the screen at half the regular intensity. The cursor is not able to enter a field which has been protected, but will instead advance across that area to the first unprotected field when the operator enters → or ←. Linefeed, ↑, or ↓ may, 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.

Protect mode affects cursor action during tabulating, editing, sending, and printing.

4.6.3 Procedure

4.6.3.1 Input—Individual areas (fields) which will be given blanket protection from later change are created using protected writing mode.
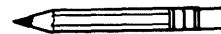
Information must be input using this procedure if it is to be protected later.

To start protected writing, position the cursor where the first protected character is to be located.

Enter

   ESC)

This turns on protected writing mode (also called **half intensity**). Until the mode is reset, each character entered is displayed at half intensity.

Enter the information for that area of the screen.

Proofread the entry and change if necessary.

End data entry in that area by entering

   ESC (

This turns off the protected writing mode (half intensity).

Move the cursor to the next area to be protected and repeat.

4.6.3.2 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.

To start protect mode, enter

ESC &

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

Protect mode protects all visual attribute codes within the defined protected area from overwriting or erasure. All data within protected areas is also protected.

To remove protect mode (protect off), enter

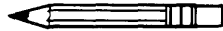ESC '

4.7 TAB PROGRAMMING

As briefly described in Chapter 3, the cursor may be moved on the screen to preset typewriter-style tabs or, if protect mode is on, to field tabs. This section describes how to set, use, and clear both types of tabs.

4.7.1 Setting a Tab

To set a tab, move the cursor to the column position where you want a tab. Enter

ESC 1

Be sure you enter a **numeral** one, not a lower case **L.**

When protect mode is on, this ESC 1 code 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.

When protect mode is off, the code sets a typewriter-style column tab.

4.7.2 Using Tabs

4.7.2.1 Typewriter Tabs (Protected and Unprotected)—When the protect mode is off, CTRL/I 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.

When the protect mode is on, the cursor is moved to the first unprotected character following the next protected field.

4.7.2.2 Field Tabs (Protected Only)—With protect mode on, ESC i causes the cursor to move to the first unprotected character following the next protected field.

With protect mode off, this code has no effect.

4.7.2.3 Back Tab—When protect mode is off, ESC I 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, this code moves the cursor to the first column on the line.

If protect mode is on, ESC I moves the cursor back to the start of the first preceding unprotected field. If no preceding positions exist, the cursor will not move.

If the cursor is at the first unprotected position on the page, the code has no effect. If no protected fields exist, home position is considered the start of an unprotected field.

4.7.3 Clearing Tabs

4.7.3.1 Typewriter Tabs—You can clear a typewriter tab by putting the cursor on the tab position you wish to clear and entering

ESC 2

This code has no effect when protect mode is on.

4.7.3.2 All Tabs—To clear **all** tabs, enter

ESC 3

The position of the cursor when this code is entered is not important.

4.8 EDITING CONTROLS

The editing control sequences and a description of their functions follow:

Use of the editing commands may result in the loss of data. Read the following explanations of the editing control functions carefully.

4.8.1 Edit Modes

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.

There are two edit modes available: local edit and duplex edit.

4.8.1.1 Local Edit Mode—Operating in local edit mode enables you to change the text using the edit keys (CLEARSPACE, BACKSPACE, ↑, ↓, →, ←, TAB, HOME, and BACK TAB) without transmitting these keys or any changes caused by these keys to the computer. To enter local edit mode, enter

ESC k

All other keys will operate normally while local edit is on.

4.8.1.2 Duplex Edit Mode—To set the edit keys described in 4.8.1.1 to operate in the mode set for the alphanumeric keys, 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.

4.8.2 Cursor Control

The cursor control key operation is described in 3.3.3. Escape and control sequences may be sent from the computer to perform the various cursor functions.

4.8.2.1 Cursor Control Codes—The cursor control codes and a description of their functions are described below.

Cursor Up. CTRL/K moves the cursor up one line

Cursor Down. Depending on the switch settings, CTRL/V or CTRL/J moves the cursor down one line. If the cursor is on the bottom line of the screen and switch 2 dipswitch 6 is down (925/950 mode), the code has no effect.

Cursor Left. CTRL/H is the same as BACKSPACE; it 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. If the cursor is currently at the first unprotected position on the screen, the code has no effect.

Cursor Right. CTRL/L 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. With protect mode off, it causes a scroll if the cursor is at column 80 of the last line. With protect mode on and the cursor at the last unprotected position on the page, the cursor will move to the first unprotected position.

Carriage Return. CTRL/M moves the cursor left to column 1 of the current line. If protect mode is on, it moves the cursor to the first unprotected position of the next unprotected field.

Cursor HOME. CTRL/∧ moves the cursor to the first unprotected character on the page.

New Line. CTRL/_ (underline) causes the terminal to perform a CR and a LF.

4.8.2.2 Linefeed—With protect mode off, CTRL/J or linefeed (LF) advances the cursor to the next line on the page. If the cursor is at the bottom of the screen, a LF 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 (shifts the cursor down). The new line contains spaces.

If the cursor is at the bottom of the screen with protect mode on, LF moves the cursor to the top of the screen at the current column position. If that position is protected, it then moves the cursor to the next unprotected position.

4.8.3 Editing Commands

4.8.3.1 Character Insert—ESC Q causes the character at the cursor to move right one column and enters a space character at the cursor position, The character at column 80 is lost. If protect mode is on, this control will insert from the cursor position to the end of the line or to the first protected field.

4.8.3.2 Character Delete—ESC W deletes the character at the cursor position and moves all following characters left one position. At the end of the delete function, a space character is written into the last position on the line. If protect mode is on, character delete operates only from the cursor position to the end of the unprotected field or line.

4.8.3.3 Line Insert—With protect mode off, ESC E inserts a line consisting of spaces 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 screen. If protect mode is on, a line insert command has no effect.

4.8.3.4 Line Delete—When protect mode is off, ESC R deletes the line at the cursor position and all following lines move up one line. The cursor will move to column 1 of the line and spaces will be loaded into the last line of the screen. When protect mode is on, this code has no effect.

4.8.3.5 Erase to End of Line—ESC T erases all unprotected characters from the cursor to the end of the line (or field, if protect mode is on) and replaces them with spaces. If half intensity is on, half-intensity spaces will replace the erased characters.

4.8.3.6 Erase to End of Line with Nulls—ESC t erases all characters from the cursor position to the end of the line or the end of an unprotected field and replaces them with null characters.

4.8.3.7 Erase to End of Screen—ESC Y replaces unprotected characters from the cursor position to the end of the screen with spaces. If half intensity is on, erased characters will be replaced with half-intensity spaces.

4.8.3.8 Erase to End of Screen with Nulls—ESC y erases all unprotected characters from the cursor position to the end of the screen and replaces them with null characters.

4.9 CLEAR FUNCTION

The clear function is used in one of four ways to clear data from screen memory and/or computer memory.

4.9.1 Clear Unprotected to Nulls

ESC : clears all unprotected data on the screen to the null character.

4.9.2 Clear Unprotected to Spaces

ESC ; or ESC + or CTRL/Z clears all unprotected data on the screen to spaces. If half intensity is on, the screen will be cleared to half-intensity spaces.

4.9.3 Clear Screen to Half-Intensity Spaces

ESC , clears all unprotected data on the screen to half-intensity spaces.

4.9.4 Clear All Data to Nulls

ESC * clears all data on the screen to nulls and resets the half intensity and protect modes.

4.10 DISABLING AND ENABLING THE KEYBOARD

You can disable all keyboard functions by remote commands from the computer. Once the keyboard is disabled, it can *only* be enabled once again by another remote command from the computer.

If your computer system echoes all codes, the keyboard may be accidentally disabled.

To disable the keyboard remotely, enter

    ESC #

While the keyboard is disabled, all keys are disabled except FUNCT, PRINT, BREAK, CTRL/1, and CTRL/2.

To subsequently enable the keyboard, the terminal must receive an ESC " or you must press BREAK twice while holding down the SHIFT key to reset the terminal completely.

4.11 CURSOR ATTRIBUTES

The cursor display may appear any one of five ways. To set the cursor display, enter the control code for the desired attribute. Type the code in the exact sequence shown below:

Attribute	Code
Not displayed	ESC.0
Blinking block	ESC.1
Steady block	ESC.2
Blinking underline	ESC.3
Steady underline	ESC.4

4.12 WORD STRUCTURE, PARITY SETTINGS, AND STOP BITS

Each computer system has its own method for checking the transmission of characters from the terminal to verify receipt. In Chapter 2 you were shown how to set the switches in the terminal to match the requirements of your computer system. Since these settings may be of importance in your programming, they are discussed in more detail here.

The first bit of the transmission is always used as a start bit to tell the computer that a character will be transmitted. (This is *not* part of the character code.) This start bit is always a one. A one may also be referred to as *true* or *mark* or *high*. A zero bit can also be called a *false, space,* or *low.*

Following the start bit, the terminal will now send either a 7- or 8-bit character code. These are *data bits.*

To verify correct receipt of the character code, computers may now require that the next bit received serve as a check on the transmission. This is called *parity.* Several methods are used, varying from system to system. The methods used are listed in Table 4–3.

Following any parity bit required, the terminal will also send (as set by the switch settings) either one or two stop bits to signal the end of the character code transmission. Stop bits are always ones.

Figure 4–2 shows the structure of a serial data word.

Table 4–3
Switch Settings for Parity and Data Bits

Switch S1 Dipswitch	Position Up	Down	Parity	Description
7		x	ODD	Requires that the total number of valid data bits be odd.
	x		EVEN	Terminal will add a one as necessary to make the total valid data bits sent even.
8	x[1]		One (or MARK or TRUE)	Requires that a one be sent in the parity position.
5		x[2]	ZERO (or SPACE or FALSE)	Requires that a zero be sent in the parity position.
6	x		SEND	Allows an odd or even parity to be sent.
		x	NONE (or NO)	Does not require a parity bit to be sent.
5	x			Causes 7 data bits to be sent.

NOTES

1. Selecting 2 stop bits on the terminal results in ONE parity.
2. Selecting 8 data bits on the terminal results in ZERO parity.
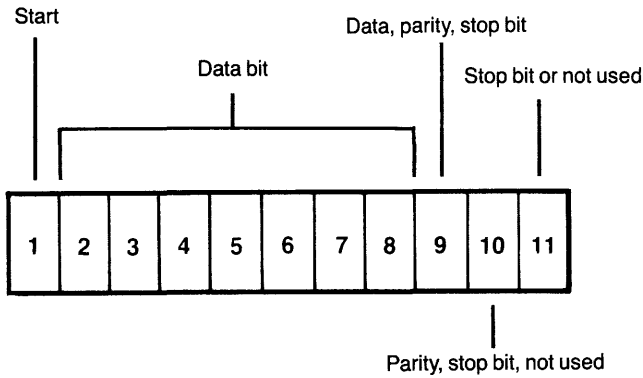
Figure 4–2 Bit Structure of a Serial Data Word

4.13 SEND FUNCTION

Once you have entered and edited data or text, you can transmit it to the computer by entering an escape sequence to send specific data.

4.13.1 Send Line Unprotected

ESC 4 sends all unprotected data on a line from column 1 through the cursor position. This code also sends an FS code (1C Hex) as a field delimiter in place of each protected field and an end-of-text character at the end of the send transmission.

4.13.2 Send Screen Unprotected

ESC 5 sends all unprotected data on the screen from home through the cursor position. It sends an FS code (1C Hex) as a field delimiter in place of each protected field. The code also sends a line delimiter at the end of a line and an end-of-text character at the end of the send transmission.

4.13.3 Send Line All

ESC 6 sends all data from the first column through the cursor position. It also sends ESC) at the beginning of each protected field and ESC (at the end of each protected field. If the character at the cursor position is protected, the terminal sends ESC (to the computer. The code sends an end-of-text character at the end of the send transmission.

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)].

4.13.4 Send Screen All

ESC 7 sends all data on the screen 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. If the character at the cursor position is protected, the terminal sends an ESC (to the computer. This code also sends a line delimiter at the end of each line and the end-of-text character at the end of the send transmission.

4.13.5 Send Unprotected Message

ESC S sends all unprotected data bracketed by the start of text (STX) and end of text (ETX) codes displayed on a screen. After the data is sent, the terminal positions the cursor at the ETX code. If the screen contains on STX codes, transmission begins from the home position. If the screen contains no ETX code, the terminal sends to the end of the screen and positions the cursor at home after the data is sent. If the screen contains neither an STX nor an ETX code, the entire screen will be sent. The code sends an FS code (1C Hex) as a field delimiter 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.

4.13.6 Send Entire Message

ESC s is similar in effect to an ESC S except that protected fields delimited by start-protected field (ESC () and end-protected field (ESC)) are also transmitted.

4.14 TERMINATION CHARACTER SELECTION

4.14.1 Page Terminator

At the completion of each send sequence, a CR is sent to the computer. This termination character may be changed to any ASCII code by entering

   ESC x4NN

where NN = any two ASCII characters. For NN, two characters must be entered. Use a NULL (CTRL/@) as a filter code.

For example, to change the termination character to ETX, enter

   CTRL/C (ETX)   CTRL/@ (NULL)

4.14.2 Line Terminator

At the end of each line, a US (1FH) is transmitted. To change the line termination character, enter

   ESC x1NN

where NN = any two ASCII characters.

4.15 PRINT FUNCTION PROGRAMMING

The terminal's printer port may be set to pass data received from the computer through to the printer. If the printer can not accept any more data during a print operation, the printer may signal the terminal to stop sending data by sending a Printer Busy signal (P4 pin 20 low). This sends an X-off character (DC3) or passes the DTR signal to the computer (if the DTR switch is selected). The printer may then request more data by sending a Printer Ready signal (P4 pin 20 high). This sends an X-on character (DC1) or passes the DTR signal to the computer.

As discussed in Chapter 3, there are two methods of print commands available: transparent and extension.

The protocol described above functions in either transparent or extension mode.
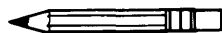
Ports P3 and P4 must both be set for the same baud rate.

4.15.1 Transparent Print

ESC ` allows all subsequent data received by the terminal (including control and escape characters) to be passed through to the printer. No screen updating occurs while this mode is active.

To stop transparent printing and return to extension printing, enter
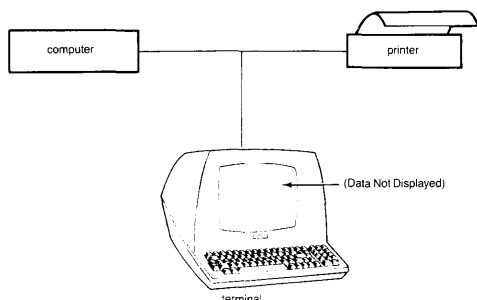
ESC @

To stop transparent printing but allow screen updating to continue, enter either
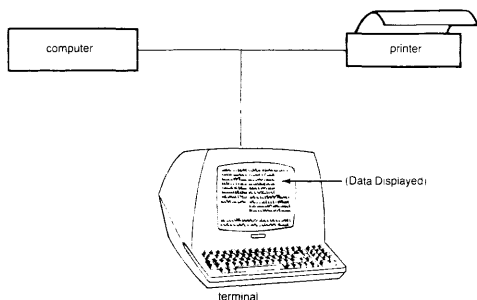
ESC a or ESC A

4.15.2 Extension (Copy) Print

ESC @ causes all subsequent data received by the terminal to be sent to the screen and passed to the printer.

ESC A turns off the extension mode. Screen updating continues normally.

a. Transparent Mode

b. Extension Mode

Figure 4–3 Print Modes

4.16 X-ON/X-OFF CONTROL

The terminal automatically transmits X-off to the computer (requesting it to stop sending data) when the 256-byte receive buffer is almost full (less than 16 characters).

This buffer is for data being sent to the terminal by the computer. It is not a buffer for data being sent to the printer.

When the data in the buffer has been sent to the screen, the terminal automatically transmits X-on to the computer, indicating that the computer may resume sending data to the terminal.

To turn this feature off (i.e., enable Data Terminal Ready control), enter

CTRL/N

To reenable this feature (i.e., disable Data Terminal Ready control), enter

CTRL/O

At power on, X-on/X-off is enabled.

4.17 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, when the 256-byte receive buffer in the terminal has received 240 bytes from the computer, the DTR line will go low until the buffer is 20 percent empty again.

You can turn the DTR feature on or off by changing switch S2 dipswitch 10 on the rear of the terminal. (Up disconnects DTR; down connects it.)

4.18 CUSTOM EPROM APPLICATIONS

You can replace the 2532 EPROM (supplied with the terminal) with your own special 2532 EPROM or (if more space is needed) your own 2564 EPROM. The 2564 EPROM will provide an additional 4K EPROM, giving you a total of 8K EPROM space for special application programs.

4.19 BELL

You can cause a short loud bell to sound by entering

CTR/G

5. TROUBLESHOOT-ING AND SERVICE

5.1 CARE

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

5.1.1 Cleaning

To clean the terminal exterior:

1. Vacuum the keyboard every three months with a soft brush attachment (or use a small soft brush).

2. Clean the housing with a soft, lint-free cloth and a commercial detergent every three months.

$$-\!\!\bigcirc\!\!-$$

DO NOT use solvent-based or abrasive cleaners.

5.1.2 Inspection

Description	Frequency
1. Inspect the terminal cabinet for cracks or breaks.	1/Yr.
2. Check each key for free movement.	1/Yr.
3. Check the cable connector (at the rear of the terminal cabinet) for damage.	1/Yr.

5.2 TROUBLESHOOTING

Your computer terminal is just one of several components in the computer system. A failure anywhere else in the system can cause the improper operation of the terminal. The computer system, memory systems, cables, modems, and operational procedures should be checked if there has been a malfunction. Table 5–1 will be helpful in determining the cause of a problem. If this table does not help locate the cause of the problem, run the self test or call a qualified service technician for assistance.

5.2.1 Testing the Terminal (Self Test)

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

To start the test, enter

   ESC V

$$-\!\!\bigcirc\!\!-$$

Switch S1 dipswitch 9 must be UP or the self test will fail.

The display screen should now look like that in Figure 4–1. Look at the display carefully to verify that all characters appear, all video attributes appear correctly, and all half intensity characters are shown. Each character should be formed properly and you should not be able to see any extra dots (and no dots should be missing).

Check the switch settings on the terminal against those on the display (see Fig. 4–1). The display will show the dipswitches as a 1 (up) or a 0 (down).

To stop the test, press BREAK twice while holding down the SHIFT key (to reset the terminal).

Should your display not appear as pictured in Figure 4–1, call qualifed service technician.

Table 5–1
Troubleshooting Terminal Problems

Symptom	Possible Cause	Solution
Terminal dead (no beep; no cursor)	No AC power	Plug in power cord. Turn on power switch. Check 115/230 power switch setting.
Terminal dead; cursor may appear	Loose or defective line or power supply fuses	Turn terminal power off and change fuses.
Terminal will not go on line	System is not "up"	Check status of system.
	Loose, unconnected, or damaged cables	Attach all cables and check for cable damage.
		Check main port (P3) interface cable pins:

Table 5-1
Troubleshooting Terminal Problems

Symptom	Possible Cause	Solution
		• 5, 6, and 8 must be driven by +12 VDC or not connected at all for normal operation. • 1 and 7 must be grounded. • 3 must be connected to the host transmitter. • 2 must be connected to the host receiver.
	Modem not turned on, defective, or phone handset on modem upside down	Turn on modem. Attach different modem. Check phone handset position.
Cursor will not appear	Defective contrast pot Contrast set too light	Refer to technical representative for adjustment of contrast settings.
System does not respond while on line	Incorrect parity switch setting, word structure, stop bits	Set parity switch to match system.
Terminal is not responding to settings	Terminal not powered down after being reconfigured; software has not scanned new settings	Power down terminal and turn back on.
Terminal "locked up"	System is not responding; communication link broken	Set to half duplex and try to type. If terminal will type, check cables, modem, phone lines, and computer system. Set to full duplex and perform self test.
	Terminal incorrectly set for on line and full duplex	Set to half duplex.
Terminal locked up	Keyboard disabled from computer	Enter ESC "
	Switches set incorrectly	Review Chapter 2 switch settings carefully and check all switch settings.
Terminal prints correct data only part of the time	Parity settings incorrect	Check parity settings with system requirements.
	Stop bits or word structure wrong	Change switch settings.
Display is wavy	Hertz setting incorrect; does not match local power frequency	Change switch setting.
Printer does not print what is typed	Correct print mode selected?	Refer to 3.4 and 4.15.
	Cable connector pins connected incorrectly	Refer to 2.4. Check printer port (P4) interface cable connector pins: • 20 must be driven by +12 VDC or

Table 5–1
Troubleshooting Terminal Problems

Symptom	Possible Cause	Solution
		not connected at all for normal operation • 3 must be connected to printer data input
		Check other printer port device requirements.
Escape and control codes to not function as specified	The escape and/or control codes being used are not correct	Check model number of terminal and code table for correct model of terminal being used.
		Makes sure upper and lower case codes are used. Is a numeral one required instead of lowercase "L"?
	Keyboard locked in SHIFT position (AUTO LOCK on)	Put in lower case. Connect P3–2 to P3–3 and try in full duplex. Disconnect computer system.
Terminal prints "garbage"	Improper baud rate setting	Set correct baud rate.
	Improper handshaking protocol	Check handshaking protocol requirements of system with terminal protocol.
	Defective modem	Replace modem.
	Noisy telephone lines	Check phone lines. Install dedicated phone lines.
Erroneous data sent to computer Scrambled output Terminal loses memory	Static electricity	1. Check operating environment for static problems. 2. Install antistatic floor mat. 3. Spray carpeting with antistatic spray. 4. Increase humidity.
	AC outlet not wired properly	Check for proper wiring and grounding.
Terminal does not print what is typed while on line	Duplex switch incorrectly set	Set duplex switch to match host system.
Terminal only prints @ characters	Word length switch set incorrectly	Set word length switch to match computer system.
	Parity switch set incorrectly	Set parity switch to match computer system.
	Stop bits set incorrectly	Set stop bit switch to match computer system.

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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 change the line fuse, proceed as follows:

🛑

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

1. Disconnect the terminal power cord from primary power.

2. Remove the fuse holder (see Figure 2–3) by unscrewing it counterclockwise.

3. Remove the blown fuse and replace it with a 3AG, 1 amp "slo blo" 125 VAC or 0.5 amp, 250V fuse for 220 VAC applications instantaneous (fast blow) fuse.

4. Install the fuse in the reverse order of Steps 1 through 3.

5.3.2 Changing the Power Supply Fuses

The terminal power supply fuses are installed in fuse clips on the power supply assembly inside the terminal (see Figure 2–6). To replace either of these fuses, proceed as follows:

🛑

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. Turn the terminal upside down and set it on a soft surface to prevent marring the cabinet. Remove the two Phillips screws that hold the cabinet cover on the terminal.

3. Turn the terminal right side up and lift off the cabinet cover.

☀

Make sure there is adequate table space for the open terminal. It is top heavy and could fall over.

4. Remove the blown fuse from its fuse clip (see Figure 2–6).

5. Replace the blown fuse with a 3AG, 3 amp, 125 VAC fuse.

6. Reinstall the terminal cover and secure it with the two screws. (Do not overtighten screws!)

5.4 TECHNICAL ASSISTANCE

The Service Department is open from 7:00 a.m. until 5:00 p.m., Pacific Standard Time, Monday through Friday (except holidays). Be specific when describing the problem and failure history. 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.

APPENDIX A
SPECIFICATIONS

Monitor

Size: 12 inches measured diagonally
Phosphor: P31 green nonglare read-out

Displayed Character Set

128 displayable characters
    (96 character ASCII upper/lower case alphabet with
    true descenders plus 32 control characters)
24 lines
80 characters per line
1920 characters per screen
Security (blank) fields
Reverse video
Underlined fields
Half intensity

Character Sets

English, French, German, Spanish

Character Font

7X8 dot matrix
8X10 resolution

Cursor Control

↑ , ↓ , ←, →, Home, Tab, Back Tab, Return, Line
Feed, Backspace

Editing

Line insert/delete
Character insert/delete

Repeat

20-cps auto-repeat

Parity

Even, Odd, Send, Mark, Space or No Parity

Transmission

Conversation mode: Full or half duplex (keyboard
selectable)
Block mode

Word Structure

7 or 8 data bits
10 or 11 bit word

Video Attributes

Blinking fields

Baud Rates

15 baud rates:

    50, 75, 110, 135, 150, 300, 600, 1200, 1800, 2400,
    3600, 4800, 7200, 9600, 19,200

Interfaces

Standard RS232C point-to-point (50 ft. max.)
20ma current loop (optional) (1000 ft. max.)
RS232C printer port (unidirectional)

Auxiliary Port

Printer RS232C, transparent, screen copy

Communication Protocol

X-ON/X-OFF, DTR

Dimensions

Height: 13¼"   (33.66 cm)
Width: 16⅛"   (40.96 cm)
Depth: 20¹⁄₁₆" (50.96 cm)

Ventilation Requirements

Minimum 4" (10.2 cm)

Weight

30 lbs. (13.95 kg)

Operating Environment

Ambient temperature range:
    0°C to 50°C (32°F to 122°F)

Maximum relative humidity (noncondensing): 95%
(Nonoperating: no restrictions)

Power Requirements

115 VAC at 0.5 amp
230 VAC at 0.25 amp
50/60 Hz, 65W

APPENDIX B
ASCII CODE CHART

b4 b3 b2 b1	Row	000 (0)	001 (1)	010 (2)	011 (3)	100 (4)	101 (5)	110 (6)	111 (7)
0 0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN↓	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS←	CAN	(	8	H	X	h	x
1 0 0 1	9	SKIP HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT↑	ESC	+	;	K	[	k	{
1 1 0 0	12	FF→	FS	,	<	L	\	l	¦
1 1 0 1	13	CR	GS	-	=	M	]	m	}
1 1 1 0	14	SO	HOME RS	.	>	N	^	n	~
1 1 1 1	15	SI	NEW LINE US	/	?	O	—	o	DEL RUB

GLOSSARY

ASCII

The acronym for American Standard Code for Information Interchange. This is a standardized code for the transmission of data within the United States. It is composed of 128 characters (upper and lower case letters, numerals, punctuation marks, symbols, and control characters) in a 7-bit binary format.

Asynchronous Communication

A method of communication where the time synchronization of the transmission of data between the sending and receiving stations is set by start and stop bits and the baud rate.

Baud

The rate of transmission of data. One baud equals one binary bit per second.

Bit

An abbreviation for binary digit. A bit is the smallest unit of data. ASCII codes are composed of seven bits.

BREAK

To break or interrupt communications. When the BREAK switch on the terminal is toggled, a 250-millisecond tone is sent to the computer to immediately halt communications.

Buffer

An electronic device within the terminal that allows for the temporary storage of incoming data should the transmission rate of the incoming data be faster than the terminal's printing speed.

Bug

An error in a computer program or in the operation of the computer.

Byte

A coded group of binary bits which represents a character (letter, numeral, symbol, command, etc.).

Code

A method of representing data by groups of binary digits.

Command

A code that will cause the terminal or computer to perform an electronic or mechanical action.

Computer

An electronic system which, in accordance with its programming, will store the process information and perform high-speed mathematical or logical operations.

Control Codes

Special nonprinting codes which cause the terminal or computer to perform specific electronic or mechanical actions (such as setting tabs, etc.).

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CPU

Central Processing Unit. The "brains" of a computer or computer terminal; that section where the logic and control functions are performed.

Default

Condition which exists from POWER ON or RESET if no instructions to the contrary are given to the terminal.

DEL

The ASCII DELETE code used in some instances to delete transmitted characters or to exit modes of operation.

Digit

One of the numerals in a number system.

Digital

Information in the form of individual parts—bits or digits.

EOT

An ASCII code that means "end of transmission" (EOT); used in the EOT/ACK handshaking protocol. The computer sends an EOT at the end of each transmission to the terminal. When the terminal is ready to receive more data, it transmits an acknowledge (ACK) back to the computer.

ESC

An ASCII code meaning "escape" which is used to control various electronic and mechanical functions of the terminal.

Full Duplex

In full duplex communication, the terminal can transmit and receive *simultaneously*. The transmitted data is not printed locally unless it is "echoed back" by the computer.

Half Duplex

In half duplex communication, the terminal transmits and receives data in separate, *consecutive operations*. Transmitted data is printed locally.

Handshaking

A communications protocol which is necessarily used when the transmitting speed of the computer is faster than the printing speed of the terminal. It consists of a set of commands, recognized by both stations, which control the flow of the data transmission from the computer.

Host

The computer system.

Interface

A communications channel which is typically used for external devices.

Main

The computer system.

Memory

That part of a computer system or terminal where information is stored.

Microprocessor

An electronic circuit on the surface of a small silicon chip which can be programmed to perform a wide variety of functions within the computer system or terminal.

Modem

An electronic device which converts (modulates) the serial communications between the computer and terminal into audible tones which can be transmitted over telephone lines. All received data is reconverted (demodulated) from the audible tones into serial information.

NUL

An ASCII code ("nothing") used as a fill character in some communications formats.

Parity

A method of checking for errors in data communications. An extra bit (either a "1" or "0"), called the parity bit, is added to the end of each ASCII character to make the final count of "1" bits in the character an even or odd number, according to a prearranged format. Some systems always use even parity, some always use odd parity, and some do not check for parity. Both terminal and system *must* be set for the same parity.

Protocol

All of the conventions which must be observed in order for the computer and terminal to communicate with each other.

Serial Communication

The standard method of ASCII character transmission where bits are sent, one at a time, in sequence. Each 7-bit ASCII character is preceded by a start bit (see Asynchronous Communication) and ended with a parity bit and stop bit.

Toggle

Activation or deactivation of function or mode key (either a receive key, command sequence, or manual keystroke.)

Wraparound

Movement of the cursor as it reaches the right edge of screen, disappears, and "wraps around" to the beginning of the next line.

X-ON/X-OFF

A handshaking protocol. When the terminal's buffer is nearly full, it transmits an X-OFF to the computer to stop transmission; when the buffer is almost empty, an X-ON is transmitted to the host to resume transmission.

INDEX

OPERATOR'S QUICK REFERENCE GUIDE

Function	Command
CURSOR	
Home	CTRL/ ^
New line	CTRL/__
Carriage return	CTRL/M
Linefeed/cursor down	CTRL/J
Cursor up	CTRL/K
Backspace/cursor left	CTRL/H
Cursor right	CTRL/L
Cursor off	ESC.0
TAB	
Set column tab	ESC1
Typewriter tab	CTRL/I
Field tab	ESCi
Back tab	ESCI
Clear typewriter tab	ESC2
Clear all tabs	ESC3
EDIT	
Local edit	ESCk
Duplex edit	ESCl
Character insert	ESCQ
Character delete	ESCW
Line insert	ESCE
Line delete	ESCR
Erase line to spaces	ESCT
Erase line to nulls	ESCt
Erase screen to spaces	ESCY
Erase screen to nulls	ESCy
Clear screen to spaces	ESC +
	CTRL/Z
	ESC;
Clear screen to nulls	ESC*
Clear unprotected to nulls	ESC:
Clear screen to half-intensity spaces	ESC,
PROGRAM	
Address cursor (row, column)	ESC =
Read cursor (row, column)	ESC?
Enable keyboard	ESC"
Disable keyboard	ESC#
Extension print on	ESC@
Stop printing	ESCA
Transparent print on	ESC`
Transparent print off (update on)	ESCa
Bell	CTRL/G
VIDEO	
Normal video (green on black)	ESCG0

Function	Command
Blank (invisible normal)	ESCG1
Blink	ESCG2
Blank (invisible blink)	ESCG3
Reverse video (black on green)	ESCG4
Blank (invisible reverse)	ESCG5
VIDEO continued	
Reverse blink	ESCG6
Blank (invisible reverse blink)	ESCG7
Underline	ESCG8
Blank (invisible underline)	ESCG9
Underline blink	ESCG:
Blank (invisible underline blink)	ESCG;
Reverse blink underline	ESCG<
Blank (invisible reverse underline)	ESCG =
Reverse blink underline	ESCG>
Blank (invisible reverse blink underline)	ESCG?
Half intensity (protected writing) on	ESC)
Half intensity (protected writing) off	ESC(
Protect on	ESC&
Protect off	ESC'
Cursor visible/invisible	ESC.
Blinking block cursor	ESC.1
Steady block cursor	ESC.2
Blinking underline	ESC.3
Steady underline	ESC.4
MONITOR	
Monitor mode on (not transmitted)	CTRL/1
Monitor mode off (not transmitted)	CTRL/2
Monitor mode on (transmitted)	ESCU
Monitor mode off (transmitted)	ESCu
	ESCX
SELF TEST	
Start self test	ESCV
SEND	
Send line unprotected	ESC4
Send screen unprotected	ESC5
Send line all	ESC6
Send entire screen	ESC7
Send unprotected message	ESCS
Send entire message	ESCs
Select screen terminator	ESCx4NN
Select line terminator	ESCx1NN
Data Terminal Ready on	CTRL/N
Data Terminal Ready off	CTRL/O

SWITCH SETTING REFERENCE CHART

Si

1	2	3	4	
DN	DN	DN	DN	9600
DN	DN	DN	UP	50
DN	DN	UP	DN	75
DN	DN	UP	UP	110
DN	UP	DN	DN	135
DN	UP	DN	UP	150
DN	UP	UP	DN	300
DN	UP	UP	UP	600
UP	DN	DN	DN	1200
UP	DN	DN	UP	1800
UP	DN	UP	DN	2400
UP	DN	UP	UP	3600
UP	UP	DN	DN	4800
UP	UP	DN	UP	7200
UP	UP	UP	DN	9600
UP	UP	UP	UP	19200

S1 (rt rear)

	1	2	3	4	5	6	7	8	9	10
	Baud rate				data bits	parity	parity	stop bits	auto wrap	CR causes
up	see chart				7	send	even	2	on	CR/LF
down					8	no	odd	1	off	CR

S2 (left rear)

	Trans	Dplx	Hz	Edit	Cursor	Cursor Down	Video	DSR	DCD	DTR
up	Block	Half	50	Local	Underln	912/920	G on Bl	off	off	off
down	Convs	Full	60	Dplx	Block	925/950	Bl on G	on	on	on

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