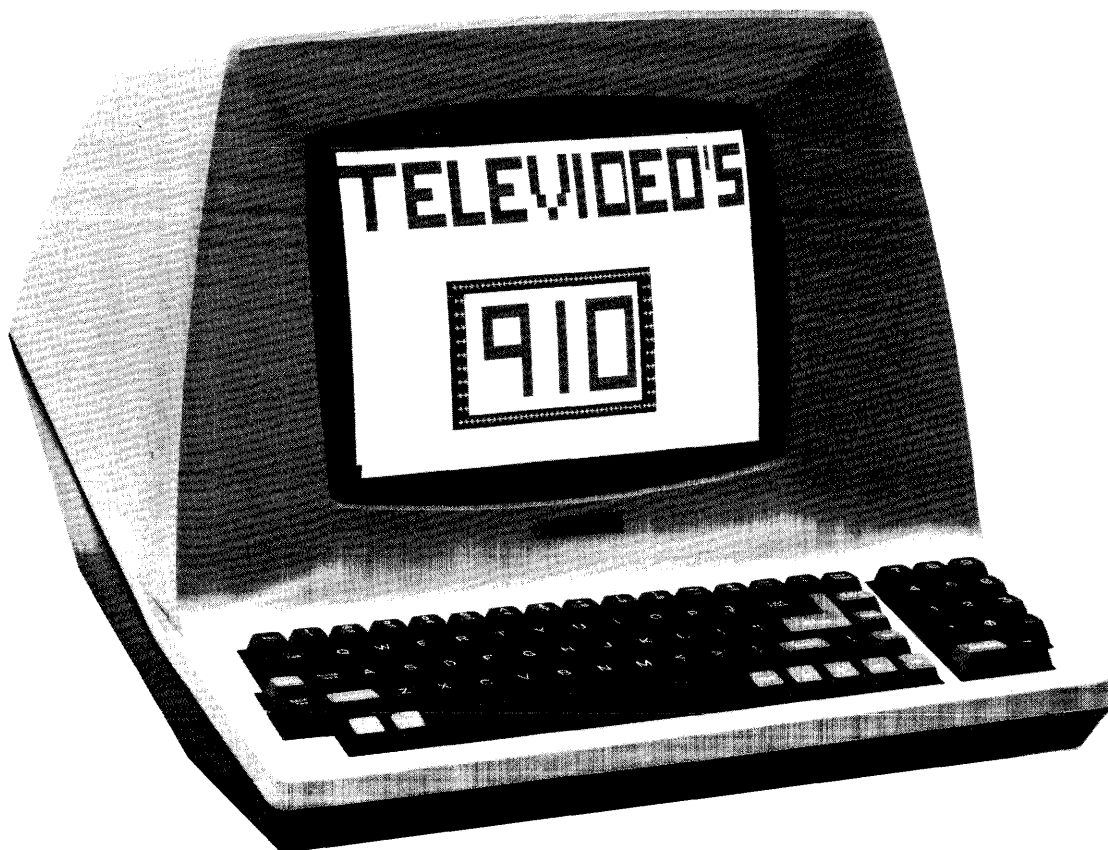# TeleVideo® Model 910 CRT Terminal Installation and User's Guide

Vital Statistics

When you receive your 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:

		U/D		U/D
(Enter U or D for Up or Down)	S1	1 __	S2	1 __
		2 __		2 __
		3 __		3 __
		4 __		4 __
		5 __		5 __
		6 __		6 __
		7 __		7 __
		8 __		8 __
		9 __		9 __
		10 __		10 __

MODEL 910 OPERATOR'S MANUAL

TeleVideo® No. 2002500 Revision D
Copyright TeleVideo Systems, Inc.
April 1983

STATEMENT OF LIMITED WARRANTY

TeleVideo Systems, Inc. ("TeleVideo") warrants to Buyer that products, except software, manufactured by TeleVideo will be free from defects in material and workmanship. TeleVideo's obligations under this warranty will be limted to repairing or replacing, at TeleVideo's option, the part or parts of the products which prove defective in material or workmanship within 90 days after shipment by TeleVideo, 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 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, will apply.

Exclusions

This limited warranty does *not* cover losses or damage which occurs in shipment to or from Buyer, or is 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.

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TELEVIDEO'S LIABILITY, WHETHER BASED ON CONTRACT, TORT, WARRANTY, STRICT LIABILITY OR ANY OTHER THEORY, SHALL NOT EXCEED THE PRICE OF THE INDIVIDUAL UNIT WHOSE DEFECT OR DAMAGE IS THE BASIS OF THE CLAIM. IN NO EVENT SHALL TELEVIDEO BE LIABLE FOR ANY LOSS OF PROFITS, LOSS OF USE OF FACILITIES OR EQUIPMENT, OR OTHER INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Service Out of Warranty

If your terminal is out of warranty when it needs service, you should follow the same procedure to receive an RMA. You will be responsible for all shipping costs.

Should your company require a purchase order for out-of-warranty repairs, let us know the purchase order number when you call in. One purchase order may cover several repairs but we will give each item its own individual RMA number. This allows us to return each item quickly and not hold up the entire purchase order because of one item.

Technical Assistance

The Service Department is normally open from 8:00 a.m. until 5:00 p.m., Pacific Time, Monday through Friday. If the line is busy and your problem can wait, leave a message with theTeleVideo operator and your call will be returned at our first opportunity.

Extended Warranty

TeleVideo offers an Extended Warranty Contract. To take advantage of this Extended Warranty, you must sign an Extended Warranty Contract and return it, together with full payment, to TeleVideo prior to the end of your normal warranty period. The extended warranty lasts for one year; the cost is $75.00. Call our Terminal Division Literature Department (408/745-7760) for a contract.

To renew the extended warranty for another year, the same procedure must followed.

Shipping charges are *not* included in the Extended Warranty. This is the only expense you incur.

SPECIFICATIONS

MONITOR

Size: 12″ measured diagonally
Phosphor: P31 nonglare display

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
Video attributes
    Blinking fields
    Security (blank) fields
    Reverse video
    Underlined fields
    Half intensity

CHARACTER SETS

English, French, German, Spanish

CHARACTER FONT

7 X 8 dot matrix
8 X 10 resolution

KEYBOARD FORMAT

Tab, Back Tab

REPEAT

20-cps auto-repeat

EDITING FEATURES

Typeover
Clear screen to space or null
Erase to end of page
Erase to end of line
Absolute cursor addressing

CURSOR CONTROLS

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

PARITY

Even, Odd, or No Parity

TRANSMISSION

Conversation mode: Full or half duplex

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
20ma current loop (optional)
RS232C printer port (unidirectional)

EMULATION

ADDS 25
Hazeltine 1410
Lear Siegler ADM-3A/5

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

35 lbs. (15.9 kg)

OPERATING ENVIRONMENT

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

Maximum relative humidity (noncondensing): 95%

POWER REQUIREMENTS

115 VAC at 0.5 amp
230 VAC at 0.25 amp
50/60 Hz, 45W

TABLE OF CONTENTS

1. INTRODUCTION

1 DESCRIPTION OF MANUAL

This manual will teach you 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. 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, using Auto Scroll, disabling the keyboard and printer.

5. Preventive Maintenance
Periodic cleaning and inspection of the terminal.

6. Troubleshooting and Repair
Troubleshooting simple problems (using a table of symptoms, possible causes, and solutions), using self-test.

Glossary
Explanation of terms commonly used in this manual.

Appendices
Reference tables.

Index
References to main subsections by subject.

1.2 HOW TO USE THIS MANUAL

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

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.
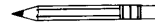
Programming note giving information of special significance to the programmer.

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!**

Emulation commands are given in Table A–1 and the Operator's Quick Reference Guide. The descriptive text of the manual **will only reference the 910 commands.**

On the back cover is the Operator's Quick Reference Guide, listing all control and escape commands for the terminal.

1.3 DESCRIPTION OF TERMINAL

A brief overview of the capabilities of your terminal will help you take advantage of its features as you use it. The Model 910 operates in a conversation mode with your computer system, in either half or full duplex. Baud rates can be set at any of 15 speeds, from 50 to 19,200.

Depending on switch settings, the 910 will emulate a Lear Siegler ADM-3A/5, a Hazeltine 1410, or an ADDS 25. Character sets can be changed to English, Spanish, German, or French. Visual attributes can be set a line at a time, either alone or in combination. You can set the display to monitor the computer program (to facilitate program debugging).

Printing is easily controlled with a special PRINT key. Using the FUNCT key with a numeric key allows you to quickly transmit one of ten special command code sequences. To create custom applications, you can easily substitute a ROM with twice as much space. Termination characters are switch selectable. The keyboard is a Selectric style and includes a ten-key pad for easy entry of numbers.

1.4 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 should be 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.

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.

1.5 PROTECT THE TERMINAL

Although the terminal is packaged in a durable housing, you can help protect it by observing two simple precautions:

1. Take care to keep foreign objects such as paper clips or liquids off the keyboard.

2. Use the terminal on a secure surface and don't drop the terminal or drop heavy objects onto it.

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 and you will probably not need to use this chapter again unless you need to 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 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.

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

- 45 watts

- NEMA standard 5-15R, 3-prong receptable (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 2–1.

.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. Configuring and connecting the terminal to the computer and printer connectors.

3. Setting up the terminal's operating switches and jumper options.

These procedures should only be performed by technically qualified personnel.

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)

Setting Power Select Switch—Set the power select switch on the bottom of the terminal to either 115V or 230V. (A on Figure 2–2). You will set Hertz to match your power frequency when you set S2 (Table 2–3).

2.4.2 Connecting the Terminal to Your Computer System

You can connect the terminal directly to your computer system or use a modem. Table 2–1 points out pin connections which are always used for either the computer connection or to a modem.

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

TABLE 2–1
P3 (COMPUTER INTERFACE) CONNECTOR

Minimum Communication Link

Computer	Modem	Pin No.	Signal Name
		1	Frame Ground
x	x	2	Transmit Data (OUTPUT)
x	x	3	Receive Data (INPUT)
		4	Request to Send (OUTPUT)
		5	Clear to Send (INPUT)
		6	Data Set Ready (INPUT)
x	x	7	Signal Ground
		8	Carrier Detect (INPUT)
	x	20	Data Terminal Ready (OUTPUT)

TABLE 2–2
SERIAL PRINTER INTERFACE (P4) PIN CONNECTIONS

Pin No.	Signal Functional Name
1	Frame Ground
3	Transmit Serial Data (RS232) OUTPUT
7	Signal Ground
20	Printer Ready INPUT
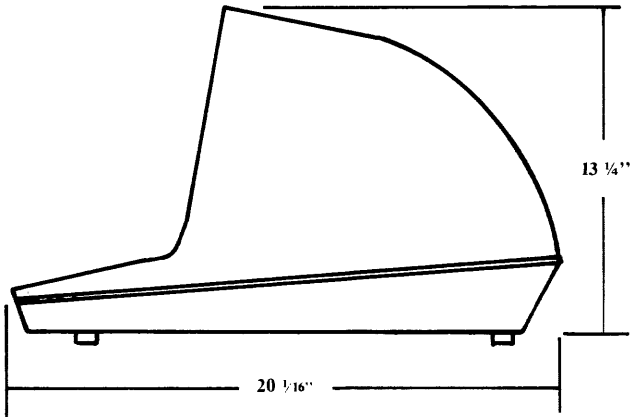
Figure 2–1 Model 910 Dimensions
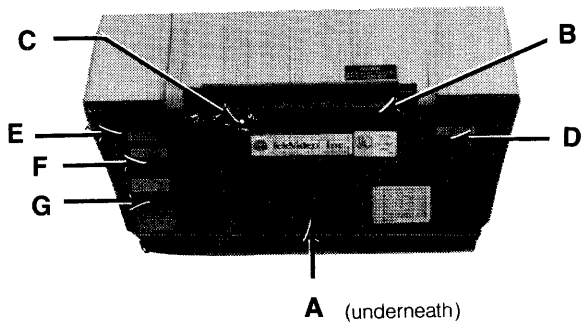
Figure 2–2 Rear Panel

TABLE 2–3
SWITCH SETTINGS FOR MODEL 910[1]

(Reference EIA Standard RS232 for Signal Definitions)

	Position				Baud Rate
Switch	1	2	3	4	Setting
S1	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

NOTES

1. After you set switches, complete the table on the inside front cover; this will provide a quick reference later.
2. Set to match powerline frequency to avoid screen flicker.

TABLE 2–3 Continued

Switch	Position	Toggle Setting Up	Down	Description
S1	5	x		7-bit word structure
			x	8-bit word structure
	6	x		Send parity
			x	No parity
	7	x		Even parity
			x	Odd parity
	8	x		2 stop bits
			x	1 stop bit
	9	x		Auto wraparound at the 80th character
			x	No wraparound. Cursor stays in 80th position.
	10	x		CR code performs CRLF
			x	CR code performs only a CR
S2	1		x	Standard 910
	2		x	
	1	x		Emulates ADM-3A/5
	2		x	
	1		x	Emulates ADDS 25
	2	x		
	1	x		Emulates Hazeltine 1410
	2	x		
	3		x	60 Hertz frequency[2]
		x		50 Hertz frequency[2]
	4		x	Blinking block cursor
	5		x	
	4		x	Blinking underline cursor
	5	x		
	4	x		Steady block cursor
	5		x	
	4	x		Steady underline cursor
	5	x		
	6	x		Full duplex
			x	Half duplex
	7	x		Green characters on black screen
			x	Black characters on green screen
	8	x		Data Set Ready disconnected (P3, pin 6)
			x	Data Set Ready connected
	9	x		Data Carrier Detect disconnected (P3, pin 8)
			x	Data Carrier Detect connected
	10		x	Data Terminal Ready connected
		x		Data Terminal Ready disconnected

4

SPEAKER
CONNECTOR (P7)

SOCKET (MODEM/CURRENT
LOOP CONNECTION, P6)

POWER SUPPLY
CONNECTOR (P5)

S1

E8 E9

KEYBOARD ENCODER

KEYBOARD
CONNECTOR (P1)

E17 E18 E19

P3

UART

CRT
CONTROLLER

P4

CPU

PROGRAM
EPROM

E14 E15 E16

S2

E4 E5
E6 E7

CHARACTER
GENERATOR

MONITOR
CONNECTOR (P2)
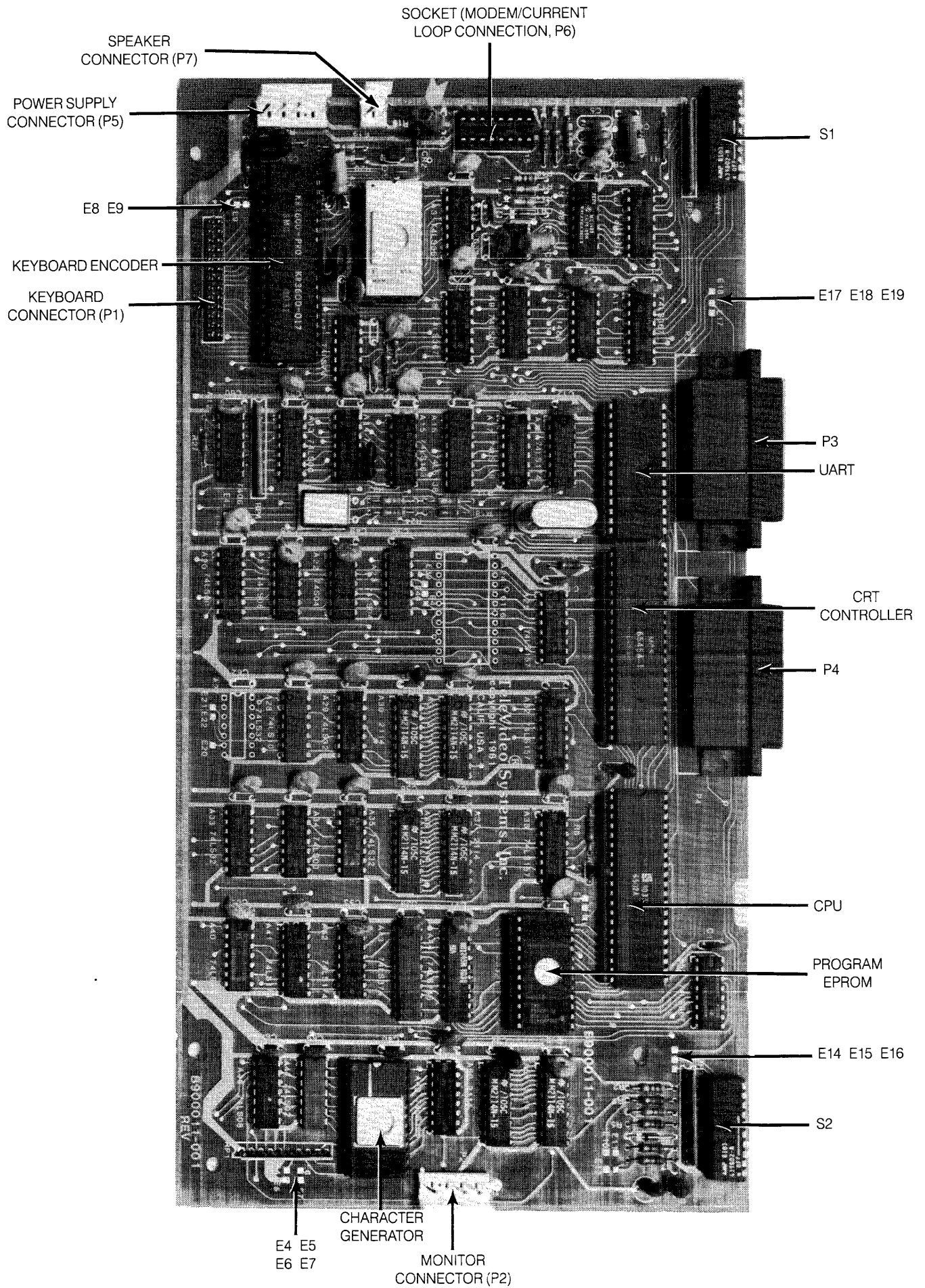
Figure 2–3 TTL Logic Board

SPEAKER
CONNECTOR (P7)

SOCKET (MODEM/CURRENT
LOOP CONNECTION, P6)

POWER SUPPLY
CONNECTOR (P5)

S1

KEYBOARD
ENCODER

KEYBOARD
CONNECTOR (P1)

UART

P3

CHARACTER
GENERATOR

P4

CRT
CONTROLLER

CPU

GATE ARRAY

SYSTEM EPROM

S2

MONITOR
CONNECTOR (P2)
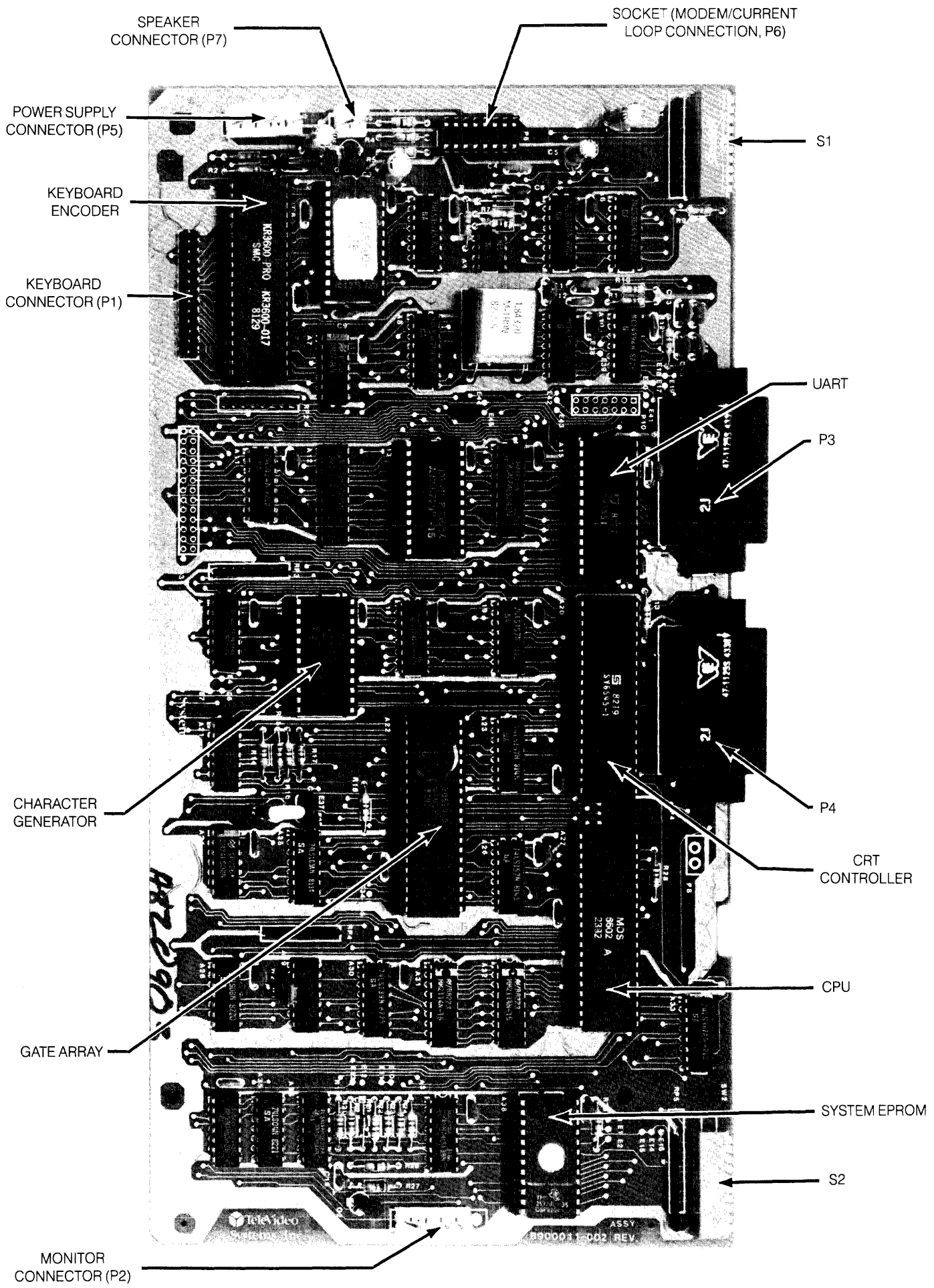
Figure 2–4 Gate Array Logic Board

TABLE 2-4
SWITCH SETTINGS OF S1 FOR COMMON WORD STRUCTURES

DIP Switch 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	U	D	D	8	Odd	1
D	U	U	D	8	Even	1

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

2.4.3 Interfacing 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. (See C in Figure 2-2.) Table 2-2 defines the printer interface pin connections.

2.4.4 Configuring the Terminal for the Computer and Printer

Several switches, located at the rear, allow you to configure the terminal to operate according to the requirements of your computer system and printer. This section lists all possible switch settings (in table form).

Setting the switches as shown in Table 2-3 allows you to preset the terminal to operate in any of several optional conditions:

Baud Rates

You can select any of 15 baud rates according to the requirements of your computer system. (Tables 2-3 and 2-4)

Character Sets

You can select English, French, German, or Spanish character sets (using jumper options). (Tables 2-3 and 2-6)

Conversation

You can select half or full duplex.

Emulations

You can set the terminal to emulate another brand of terminal (ADDS 25, Hazeltine 1410, or Lear Siegler ADM-3A/5. (Table 2-3)

DTR connected—DN
DCD disconnected—UP
DSR connected—DN
Green characters on black—DN
Full duplex—UP
Steady block cursor—DN/DN
50 Hertz frequency—UP
Standard 910—DN/DN
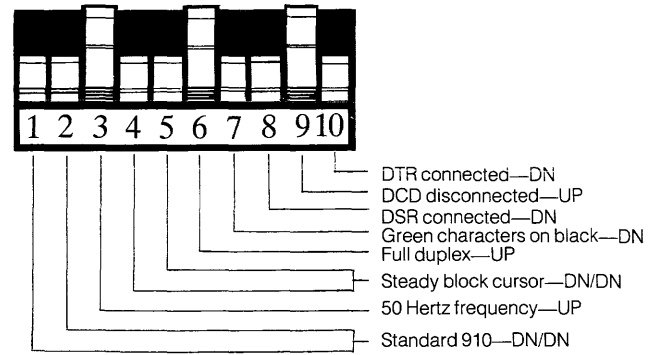
Figure 2-5 Switch Setting Examples

TABLE 2-5
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.

      Implementation: Cut trace between E14 and E15

      Add jumper from E16 to E15

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

      Implementation: Cut trace between E18 and E19

      Add jumper from E17 to E19

(Refer to Figure 2-3)

Hertz

You can set the Hertz switch to match your powerline frequency. (Table 2-3)

Parity
Stop Bits
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. (Tables 2-3 and 2-4)

Signals

You can connect/disconnect Data Set Ready, Data Carrier Detect, and Data Terminal Ready. (Tables 2-3 and 2-4)

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TABLE 2–6
CHARACTER SET JUMPER OPTIONS

English No changes required.

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.

TABLE 2–7
COMPOSITE VIDEO JUMPER OPTION

To drive a monitor in addition to the terminal monitor (i.e., add a composite video option), add an Amphenol BNC connector to the logic board. You can order this part (Amphenol Part 227169-5) from TeleVideo.

Drill a hole in the shroud for the connector. Connect the center lead of the BNC connector to P2 pin 6 and the BNC ground lead to P2 pin 3.

Cut trace between E10 and E11
Add jumper between E12 and E13

Video Display

You can set the display of the terminal to be green on black or black on green, with a steady or blinking cursor which is either an underline or a block. (Table 2–3)

Whenever you change any switches, reset the terminal by turning the power off and then back on or pressing BREAK twice while holding down the SHIFT key to allow the software to scan all of the new switch positions.

S1 and S2 are accessible from the rear of the terminal (see Fig. 2–3).

2.5 CHECKING YOUR INSTALLATION

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?

7. Did you plug the terminal in to the wall outlet?

If the answer to all of these steps is YES, then you are ready to proceed with actually using the terminal.

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.

During 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

* Setting tabs

* Changing visual attributes of the screen

* Communicating with your computer system

3.2 TURNING ON THE TERMINAL

3.2.1 Rear Controls

Several controls are located at the rear of the terminal.

* Baud rate switches (S1)   (D in Figure 2–2)
* Function switches (S2)   (E in Figure 2–2)

Set these prior to turning on power to the terminal (as explained in Chapter 2) and keep a permanent record of how you have set the switches.

The connectors to the main interface and printer ports are also located here.

Once these have been set during installation, they will seldom need to be changed unless the terminal is being used with several different computer systems.

3.2.2 Turning On and Adjusting the Terminal

Turn on the terminal as follows:

1. Make sure the ON/OFF switch at the back of the terminal (G in Figure 2–2) 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 (F in Figure 2–2).

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

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

7. See Chapter 6, Troubleshooting and Repair, for help 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 of other keys

- Editing

- Entering preprogrammed data

Each key on the keyboard is actually a switch. Sometimes two keys can be used together to provide a totally different message to the computer (CTRL or SHIFT). 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. Refer to Table 3–1, where each key's function is described in detail. This table is subdivided by types of functions and gives information on the effect of each key and commands. For detailed information, refer to Table A–1 in the Appendix.
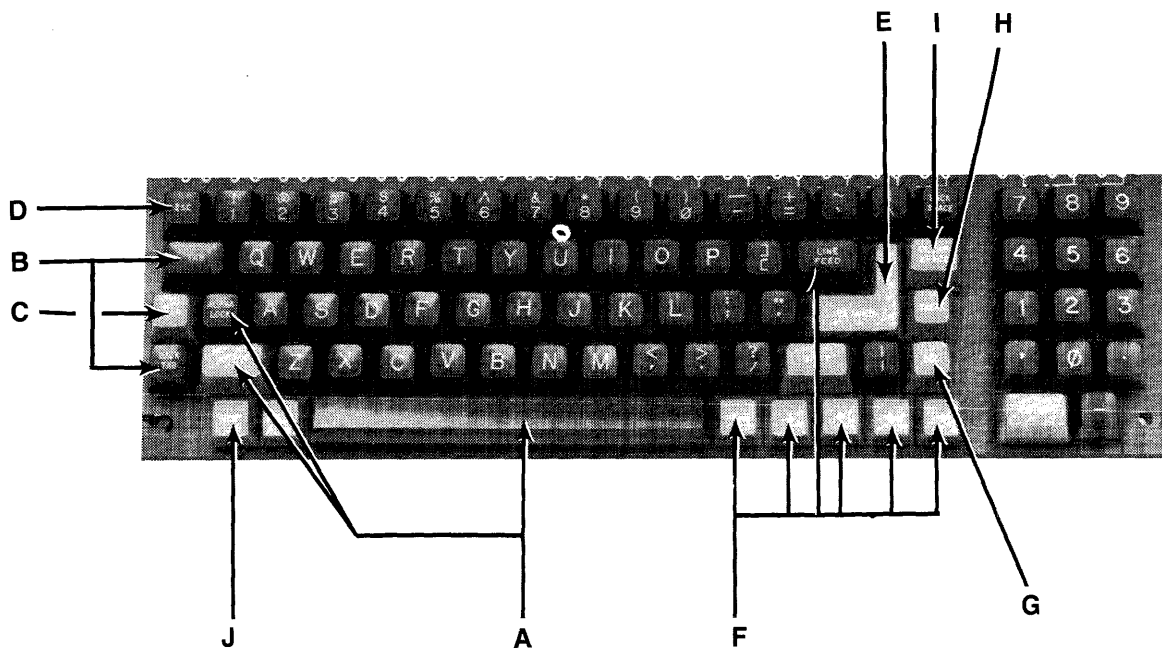

Figure 3–1 Model 910 Keyboard Layout

TABLE 3–1
FUNCTION OF KEYS[1]

Key Name	Area[2]	Transmitted? (Yes/No)	Repeat Action? (Yes/No)	General Function
Space Bar	A	Y	Y	Causes a blank space to appear on the display and transmits an ASCII space code.
SHIFT	A	N	N	Selects upper character indicated on another key and changes operation of special keys.
				Commands which require simultaneous depression of two keys are indicated by a slash.
ALPHA LOCK	A	N	N	Locks upper case for alpha characters only; has no effect on numeric or special keys. The key is pressed to lock and pressed again to release.
TAB	B	Y	Y	Moves cursor to next tab location if any are set.
BACK TAB	B	Y	Y	Moves cursor backward to last tab position.
CTRL (Control)	C	N	N	Generates nonprinting control codes when used in conjunction with other keys.
				The control key is always used simultaneously with the other characters in the command; i.e., the control key is pressed first and held down while the other keys are 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)	D	Y	N	The ESC key sends an ASCII code for escape to the computer processor. The key is generally used to momentarily leave (escape) an application program in order to use a special feature or function.
				The escape key is used in conjunction with one alphanumeric character in the command sequence; i.e., the escape 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	E	Y	N	Returns cursor to first character position of line in which the cursor is resting. If Auto Line Feed is on, CR code moves cursor to first character position of the next line.
HOME	F	Y	N	Moves cursor to first character position (Column One) of Line One.

TABLE 3–1 Continued
FUNCTION OF KEYS[1]

Key Name	Area[2]	Transmitted? (Yes/No)	Repeat Action? (Yes/No)	General Function
LINEFEED, ↓	F	Y	Y	Moves cursor down one line.
↑	F	Y	Y	Moves cursor up one line.
BACKSPACE, ←	F	Y	Y	Moves cursor one character to the left.
→	F	Y	Y	Moves cursor one character to the right.
DEL (Delete)	G	Y	Y	The DEL key sends an ASCII DEL character to the computer processor, and (depending on the terminal's communication mode) the computer program echoes the code back to the terminal to be performed. This is usually interpreted by the computer as a character erase code.
BREAK	H	Y	N	Transmits a 250-millisecond ASCII Break pulse to the computer.
CLEAR SPACE	I	Y	Y	Clears the screen to spaces and HOMES the cursor.
PRINT	J	N	N	Toggles printer port on/off.

NOTES
1. For Model 910 only. For emulations, see Table A–1.
2. Refer to Figure 3–1 for key location on keyboard.

3.3.2 Other Controls

Cursor—The lighted rectangular block (or underline) that appears on the screen indicates the entry spot for the following character 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 auto wraparound mode is on. Otherwise, the cursor stays at the end of the 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 emulating the ADDS 25, pressing HOME will move the cursor to the lower lefthand corner of the screen.

Any desired cursor position in the display area can be programmed using an absolute cursor address of R (line or row) and C (column). (See 4.5 and Tables B–1 and C–1.)

Auto Scroll—When the terminal is turned on, the Auto Scroll feature will be activated. This feature causes the terminal to automatically scroll as the original display becomes full, making more screen available to you. On the last line, ↓ or LINEFEED will cause the screen to scroll up.

With Auto Scroll off, the cursor will move downward as long as you press the ↓ or LINEFEED keys. When the cursor reaches the last line, it will wrap back up to Line One (remaining in the same column position). To control the Auto Scroll feature, refer to 4.6.

Bell—The terminal can sound a short, loud bell upon your command. To sound the bell, press down CTRL and G at the same time.

From now on, you will not be told to press CTRL and the other character at the same time. The command will be shown as CTRL/G instead.

Break—You can transmit a 250-millisecond break pulse (a break signal) to your computer system. The effect will depend on the operating program in your computer system. Usually it stops communication.

3.4 BASIC OPERATIONS

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

• Editing data

• Communicating with your computer system

• Printing

3.4.1 Tab Controls

You can set regular typewriter-style tabs on your terminal. Pressing the TAB key causes the cursor to stop whenever it reaches that column position, regardless of which line the cursor was on when the tab was set. Characters can be superimposed on the tab position. (At power ON, the terminal has tabs every eighth column position.)

Setting a Tab—To set a tab, move the cursor to the column position where you need a tab. Enter

ESC 1 (be sure you enter a *numeral* one, not a lower case "L")

Using the Tab Setting—When you want the cursor to go to the tab position, just press the TAB key. The cursor will move to the next tab setting in that line. When it reaches the last tab setting in that line, it will rest. To move the cursor to the previous tab setting, press BACK TAB.

Clearing Tabs—You can clear a specific tab by putting the cursor on the tab position you wish to clear and entering

ESC 2

To clear *all* tabs, enter

ESC 3 (cursor position is not important)

3.4.2 Editing

Should you need to change text on the screen, you can erase a line (either partially or completely) or the whole display (either partially or completely). This will give you space to enter the correct data. Erasures will start with the column position under the cursor. The commands for editing are found in Table A-1.

3.4.3 Sending Data to the Computer

As you input text at the terminal, it is sent to your computer system. 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 3–1 for a diagram of the information flow.

3.4.4 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." To toggle extension mode on, press the PRINT key. To stop extension mode, simply press PRINT again.
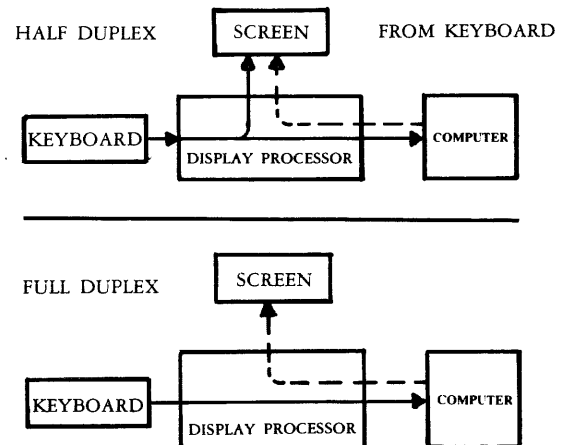
Figure 3–1 Model 910 Communications Flow

4. PROGRAMMING

4.1 INTRODUCTION

Your computer program can completely control the terminal by transferring the appropriate ASCII codes over the RS232C interface. This chapter tells you how to translate keyboard functions into remote control functions.

The escape sequences and control codes given in the body of this manual are for the 910 terminal. If you have set the terminal to emulate another terminal, refer to Table A–1 or the Quick Reference Chart on the back inside cover for the appropriate codes.

4.2 MONITORING CONTROL COMMANDS

You can monitor control commands in several ways:

- Activate the monitor mode command without transmitting them to the computer

- Transmit control codes to the computer and display them

- Display only a single control character

Using monitor mode will make program debugging easier.

To activate display of control commands without transmitting a code to the computer, enter

CTRL/1

To terminate this mode, enter

CTRL/2

To enable monitor mode via the computer, enter

ESC U

Unless you are using half duplex, 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

To display a single control character, enter

ESC Fn

where n is the control code to be displayed.

4.3 CONTROL FUNCTIONS

When the CONTROL key is used with an alpha or numeric key, bit 7 of the character which is typed is complemented (changed to the opposite), thus changing the code transmitted by that character. Example: If "M" alone is pressed, the code for M is sent. If "CTRL/M" are pressed, the code for a carriage return is sent.

4.4 FUNCT KEY

Using the FUNCT (function) key in combination with any one of the numeric keys enables you to quickly transmit a three- or four-character sequence of commands. Table 4-1 indicates the code which is transmitted by each of the numeric keys when used with the FUNCT key.

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

SOH (Control A)

The second will be determined by the numeric key depressed (see Table 4-1). The third code will always be a CR. (Table 2-3).

Program the 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).

To eliminate the need for long or hard-to-remember sequences, you can use the FUNCT key to trigger long functions or a chain of commands in the computer.

For ADM emulation, the FUNCT key sends STX plus numeric plus CR.

TABLE 4-1
FUNCTION KEY COMMANDS

Command	ASCII Code Transmitted
FUNCT/0	SOH @ + CR
FUNCT/1	SOH A + CR
FUNCT/2	SOH B + CR
FUNCT/3	SOH C + CR
FUNCT/4	SOH D + CR
FUNCT/5	SOH E + CR
FUNCT/6	SOH F + CR
FUNCT/7	SOH G + CR
FUNCT/8	SOH H + CR
FUNCT/9	SOH I + CR

4.5 ADDRESSING THE CURSOR

The computer can tell the terminal where to position the cursor with a four-character escape sequence. (See Table 4-1.) This is called "loading" the cursor.

To load the cursor, enter

ESC = RC

The R and C represent the absolute row or line (R) and column (C) where the cursor will rest. Using Table B-1, find the ASCII code representing the desired row. (If you are emulating ADDS, use Table C-1.) Note that the row 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

If your computer system inserts nulls between characters, loading the cursor will not function as described—instead the cursor will go to an unpredictable position.

To load only the column, enter

ESC]C

and to load only the row, enter

ESC [R

where R and C are the row and column values.

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 carriage return code.

4.6 AUTO SCROLL

You can program the terminal to automatically scroll to a new line as the original display becomes full. The escape sequence which controls this Auto Scroll feature toggles the feature on and off. To start or stop Auto Scroll, enter

ESC H

When the terminal is powered on, Auto Scroll is on.

(Refer also to 3.3.2 for a description of cursor movement when Auto Scroll is not used.)

4.7 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). The choices available are:

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.

Half Intensity   Changes intensity of the line to half of normal.

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   Fills that line with underlines.

Blink   Causes all characters on the line to blink.

Blank   All data entered on the line will be invisible to you but will print out and be transmitted to the computer.

Setting—To set a visual attribute, place the cursor one position *before* you want the attribute to start. Attribute 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	ESC G0
Blank (invisible normal video)	ESC G1
Blink	ESC G2
Blank (invisible blink)	ESC G3
Reverse video	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?

4.8 ENABLING/DISABLING THE PRINTER

To turn on the printer port and also simultaneously display data on the screen, either press PRINT or enter

ESC @

This turns extension and update modes on. Should you only want to activate the printer port and NOT update the display screen, enter

CTRL/R

This turns on transparent and extension modes.

To toggle the printer off (together with the transparent mode), press PRINT again or enter

ESC A

If you had the printer on *without* screen update (transparent) and want to update *and* print, enter

CTRL/T or ESC @

Thus using the PRINT key simply toggles the printer port on and off.

When the terminal is turned on, the default condition is printer port off and display update on.

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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 (displayed in reverse order, i.e. 10–1)
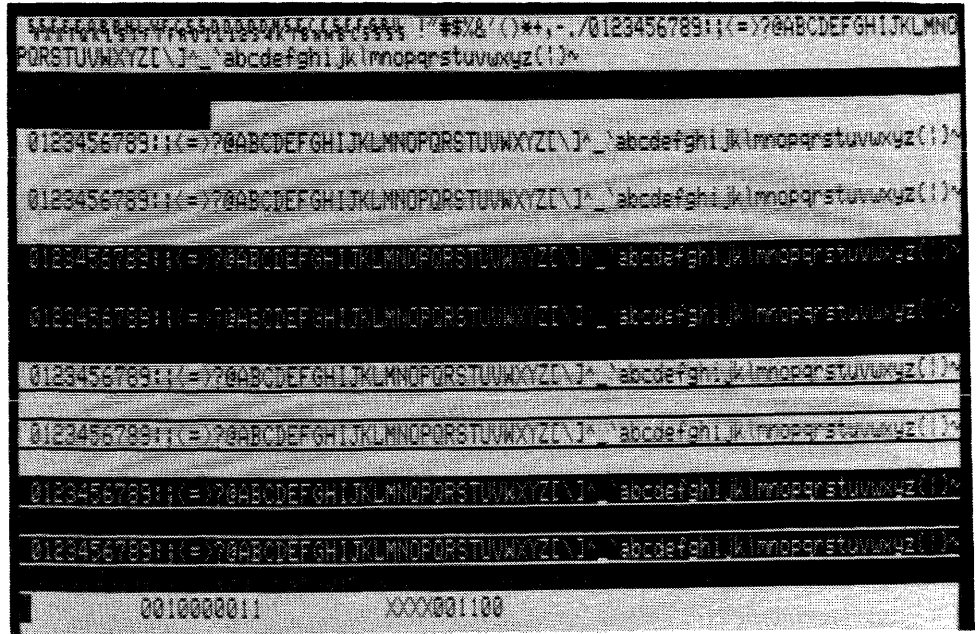X's DON'T CHANGE

Figure 4–1 Model 910 Video Attributes and Monitor Mode

4.8.1 DTR (Data Terminal Ready) Control and X-ON/X-OFF

DTR control (a voltage change on pin 20 of the RS232 connectors) and X-On/X-Off (ASCII characters) are prearranged signals that control data flow between the printer, terminal, and computer (or modem).

You determine which signals are sent with switch settings and commands. S2 DIP switch 10 determines whether DTR control is enabled. Setting this switch in the "down" position enables DTR control by physically connecting the DTR line. X-On/X-Off is enabled at power on. To disable X-On/X-Off, enter CTRL/N from the keyboard or computer. To reenable X-On/X-Off, enter CTRL/O.

If the terminal sends data faster than the printer can print it, the printer lowers DTR, triggering the terminal to send X-Off (or lower DTR) to the computer. In response, the computer should stop sending data. Once the printer can accept more data, it raises DTR. The terminal sends X-On (or raises DTR) to the computer, telling it to resume sending data.

4.9 DISABLING 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.

(STOP)

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 it, you must receive an ESC " or type a SHIFT/BREAK BREAK (reset) from the keyboard.

4.10 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. This section explains the meaning and importance of those settings.

The terminal communicates with the computer in a code called "American Standard Code for Information Interchange," usually abbreviated to ASCII (pronounced **ask**-key). The code consists of 128 characters in a 7-bit binary format (each bit is either a one or a zero).

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 zero. A one may also be referred to as *false* or *mark* or *low*. A zero bit can also be called a *true, space,* or *high.* (These signal levels and names are RS232 EIA standards.)

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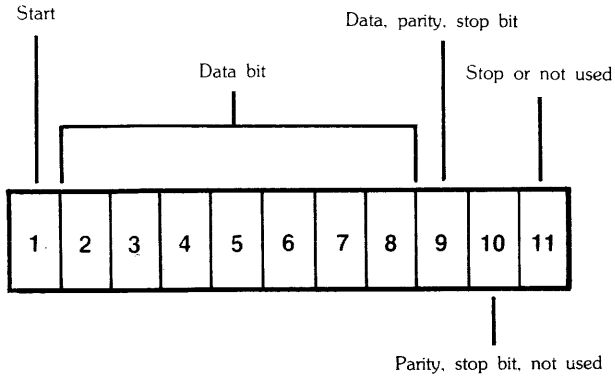
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Figure 4–2 shows the structure of a serial data word.

Figure 4–2 Bit Structure of a Serial Data Word

TABLE 4–3
SWITCH SETTINGS FOR PARITY
AND DATA BITS

S1 Switch Position	Setting Up	Down	Parity	Description
7	x	x	ODD EVEN	Requires that the total number of true data bits received be odd or even. Terminal will add a one or zero as necessary to make the total number of data bits sent either odd or even.
8	x[1]		MARK or FALSE	Requires that a one be sent in the parity position.
5		x[2]	SPACE or TRUE	Requires that a space be sent in the parity position.
6	x		SEND	Allows an odd or even parity bit 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 Model 910 results in MARK parity.
2. Selecting 8 data bits on the Model 910 results in SPACE parity.

4.11 CUSTOM RAM AND ROM APPLICATIONS

You can replace the 2532 ROM (supplied with the 910 terminal) with a 2564 ROM. This replacement will provide an additional 4K ROM, giving you a total of 8K ROM space for special application programs.

4.12 CURSOR APPEARANCE

You can change the appearance of the cursor with the following commands:

Cursor off	ESC .0
Blinking block cursor	ESC .1
Steady block cursor	ESC .2
Blinking underline	ESC .3
Steady underline	ESC .4

4.13 BELL

You can cause a short loud bell to sound by entering

CTRL/G

5. PREVENTIVE MAINTENANCE

5.1 CARE

Tender loving care will prolong the useful life of your terminal. Clean and inspect it periodically.

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.

(STOP)

DO NOT use solvent-based or abrasive cleaners.

5.1.2 Inspection

Check the cabinet and keyboard for damage or excessive wear.

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.

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6. TROUBLESHOOT-ING AND REPAIR

6.1 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 6–1 will be helpful in determining the cause of a problem. If this table does not help locate the cause of a problem, run the self test or call a qualified service technician for assistance.

6.1.1 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.

To start the test you must be in 910 mode and half duplex. Enter

ESC V

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 dip switches as a 1 (up) or a 0 (down).

To stop the test so you can type, type O (alpha, not zero) or press SHIFT/BREAK BREAK.

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

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

6.2 REPAIR

Model 910 operator repair is limited to changing the line fuse and the two internal power supply fuses.

6.2.1 Changing the Line Fuse

To change the line fuse, proceed as follows:

(STOP)

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 2–2) by unscrewing it counterclockwise.

3. Remove the blown fuse. For 110 volt applications, install a 3AG, 1 amp 125 volt fast blow fuse. For 220 volt AC applications, install a 0.5 amp 220 volt slow blow fuse.

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

6.2.2 Changing the Power Supply Fuses

The terminal power supply fuses are installed in fuse clips on the power supply assembly inside the terminal. To replace either of these fuses, proceed as follows:

(STOP)

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 2–4).

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

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

TABLE 6–1
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. Check for loose connections.
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: • 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 # or press SHIFT/BREAK BREAK.
	Switches set incorrectly	Review Chapter 2 switch settings carefully and check all switch settings.

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TABLE 6–1 Continued
TROUBLESHOOTING TERMINAL PROBLEMS

Symptom	Possible Cause	Solution
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 4.8.
	Cable connector pins connected incorrectly	Refer to 2.4 Check printer port (P4) interface cable connector pins: • 4 or 20 must be driven by + 12 VDC or 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 do 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. Make 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" or @ symbols	Improper baud rate setting Improper stop bit setting Improper word length setting Improper parity setting	Set correct switch settings
	Defective modem	Replace modem.
	Noisy telephone lines	Check phone lines. Install dedicated phone lines.
	Static electricity	Check operating environment for static.

TABLE 6–1 Continued
TROUBLESHOOTING TERMINAL PROBLEMS

Symptom	Possible Cause	Solution
	EIA and AC power cords intermingled	Separate cables. Keep EIA cable separate from power cord to prevent noise on data line.
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	Improper duplex switch setting Improper baud rate setting Improper stop bit setting Improper word length setting Improper parity setting	Set correct switch settings to match host system.

SUMMARY OF FUNCTIONAL COMMANDS

Function	Key	910	LS	Hzltn	ADDS	Description
				Command[1,2]		
MOVE CURSOR						
Home	HOME	CRTL/ ∧	CTRL/ ∧	ESC CTRL/R	CTRL/A	Moves cursor to Column One of Line One.
New line		CTRL/__	*CTRL/__		*CTRL/__	Moves cursor to Column One of next line.
Carriage return	RETURN ENTER	CTRL/M	CTRL/M	CTRL/M	CTRL/M	Returns cursor to Column One of line in which the cursor is resting.
Cursor down	↓ . LINEFEED	CTRL/J	CTRL/J	CTRL J	CTRL/J	Moves cursor down one line.
Cursor up	↑	CTRL/K	CTRL/K	*ESC CTRL/L	CTRL/Z	Moves cursor up one line.
Cursor left	← , BACKSPACE	CTRL/H	CTRL/H	CTRL/H	CTRL/H CTRL/U	Moves cursor one character position to the left.
Cursor right	→	CTRL/L	CTRL/L	CTRL/P	CTRL/F	Moves cursor one character position to the right.
CURSOR APPEARANCE						
Cursor off		ESC .0				Makes cursor disappear
Blinking block cursor		ESC .1				Makes cursor appear as blinking square
Steady block cursor		ESC .2				Makes cursor appear as steady square
Blinking underline		ESC .3				Makes cursor appear as blinking underline
Steady underline		ESC .4				Makes cursor appear as steady underline
TAB CONTROL						
Set column tab		ESC 1	*ESC 1	*ESC 1	*ESC 1	Sets typewriter-type tab for entire column (from top to bottom of screen) at cursor location.
Clear tab		ESC 2	*ESC 2	*ESC 2	*ESC 2	Clears tab at cursor location.
Clear all tabs		ESC 3	*ESC 3	*ESC 3		Clears all tabs on screen.
Back tab	BACK TAB	ESC I	*ESC I	*ESC I	*ESC I	Moves cursor back to previous tab position. If no previous tabs set, moves cursor to Column One of that line.
Move to tab	TAB	CTRL/I	CTRL/I	*CTRL/I CTRL/N	CTRL/I	Cursor moves to next tab location (if any). If there are no more tabs set, cursor does not move.
EDIT						
Erase line; change to spaces		ESC T	ESC T	*ESC CTRL/O	ESC K	Erases characters from cursor to end of line and replaces them with spaces.
Erase page; change to spaces		ESC Y	ESC Y	*ESC CTRL/X	ESC k	Erases characters from cursor to end of page and replaces them with spaces.
Clear screen; change to spaces	CLEAR	ESC + CTRL/Z	CTRL/Z	ESC CTRL \	CTRL/L	Clears entire screen and changes it to spaces. If half-intensity was on, replaces the page with half-intensity spaces.
Clear screen; change to nulls	SHIFT/CLEAR	ESC *	*ESC *		ESC *	Clears entire screen and changes it to nulls. Cursor position is not important. Sends cursor to HOME position.

Function	Key	910	LS	Hzltn	ADDS	Description
				Command[1,2]		
CURSOR ADDRESS						
Load cursor (line or row)		ESC [R	*ESC [R		CTRL/KR	Allows host to control cursor position within the row where R is absolute row. See Table B–1 for value of R (Table C–1 for ADDS emulation).
Load cursor (column)		ESC]C	*ESC]C		CTRL/PC	Allows host to control cursor position within column upon transmission of sequence where C is column. See Table B–1 (C–1 for ADDS emulation) for coordinate value.
Load cursor (row, column)		ESC = RC	ESC = RC		ESC YRC	Allows host to position cursor at row and column. See Table B–1 for coordinate values. (Table C–1 for ADDS emulation.)
Load cursor (column, row)				ESC CTRL/ QCR		Allows host to position cursor at row and column. See Table B–1 for coordinate values.
Read cursor (row, column)		ESC ?	*ESC ?		*ESC ?	Transmits row and column coordinates of cursor, followed by the terminator character, to the computer. (See Tables B–1, C–1.)
Read cursor (column, row)				ESC CTRL E		Transmits row and column position of cursor plus terminator character to the computer.
KEYBOARD						
Enable keyboard		ESC "	**ESC "	ESC CTRL/F	ESC 6	Enables keyboard to be used. Can only be caused by input from the computer.
Disable keyboard		ESC #	**ESC #	ESC CTRL/U	ESC 5	Disables keyboard.
PRINTER						
Enable printer port		ESC @	CTRL/N	*ESC/	CTRL/R	Enables printer to start printing; screen will display updated data.
Disable printer port		ESC A	CTRL/O	*ESC ?	CTRL/T	Disables printer port; leaves display update on.
Enable transparent print		CTRL/R	*ESC @	*ESC *	ESC 3	Enables transparent print mode; screen will not display updated data.
Disable transparent print		CTRL/T	*ESC A	*ESC /	ESC 4	Disables transparent print mode; screen will display updated data.
VISUAL ATTRIBUTES						
Normal video (same as set during installation)		ESC G0		*ESC CTRL/G0	ESC G0	
Invisible normal (blank)		ESC G 1		*ESC CTRL/G1	ESC G1	Characters transmitted but invisible on screen.

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Function	Key	910	LS	Hzltn	ADDS	Description
				Command[1,2]		
Blink		ESC G 2		*ESC CTRL/G2	ESC G2	Characters blink on/off beginning at cursor position.
Invisible blink (blank)		ESC G 3		*ESC CTRL/G3	*ESC G3	Characters transmitted but invisible on screen.
Reverse (opposite of that set during installation)		ESC G 4		*ESC CTRL/G4	*ESC G4	Black/green display (opposite of installation selection) beginning at cursor when set.
Invisible reverse (blank)		ESC G 5		*ESC CTRL/G5	*ESC G5	Characters transmitted but invisible on screen.
Reverse blink		ESC G 6		*ESC CTRL/G6	*ESC G6	Reverse video, blinking beginning where cursor was set.
Invisible blink reverse (blank)		ESC G 7		*ESC CTRL/G7	*ESC G7	Characters transmitted but invisible on screen.
Underline		ESC G 8		*ESC CTRL/G8	*ESC G8	Line is underlined, beginning where cursor is when set.
Invisible underline (blank)		ESC G 9		*ESC CTRL/G9	*ESC G9	Characters transmitted but invisible on screen.
Blink underline		ESC G :		*ESC CTRL/G:	*ESC G:	Blinking underline beginning where cursor is when set
Invisible blink underline (blank)		ESC G ;		*ESC CTRL/G;	*ESC G;	Characters transmitted but invisible on screen.
Reverse underline		ESC G <		*ESC CTRL/G <	*ESC G <	Line reverse video and underlined, beginning where cursor is when set.
Invisible reverse underline (blank)		ESC G =		*ESC CTRL/G =	*ESC G =	Characters transmitted but invisible on screen.
Reverse blink underline		ESC G >		*ESC CTRL/G >	*ESC G >	Line reversed, underlined, and blinking beginning where cursor is when set.
Invisible reverse blink underline (blank)		ESC G ?		*ESC CTRL/G ?	*ESC G ?	Characters transmitted but invisible on screen.
Half intensity on		ESC)	ESC)	*ESC CTRL/Y	*ESC G)	Changes screen to half intensity.
Half intensity off		ESC (	ESC (	*ESC CTRL/__	*ESC G (	Turns off half intensity.
Display normal/reverse			ESC G			Toggles normal display off and on (ADM-3A/5 only)
Cursor visible/invisible			*ESC.		*ESC.	Toggles cursor on/off.
MONITOR						
Display control character		ESC Fn	*ESC Fn		ESC Zn	Displays selected control character where "n" is character to be displayed.
Monitor off (local)		CTRL/2	*CTRL/2	*CTRL/2	*CTRL/2	Stops monitor mode.
Monitor on		ESC U	*ESC U			Transmits control codes to computer and displays them.
Monitor off		ESC u ESC X	*ESC u ESC X			Stops monitor mode.

TABLE A–1 Continued
SUMMARY OF FUNCTIONAL COMMANDS

Function	Key	910	LS	Hzltn	ADDS	Description
				Command[1],[2]		
MONITOR						
Monitor on (local)		CTRL/1	*CTRL/1	*CTRL/1	*CTRL/1	Displays control codes without transmitting them.
MISCELLANEOUS						
Self test on		ESC V	*ESC V	ESC CTRL/S	*ESC V	Starts self test
Auto scroll on/off		ESC H	*ESC H		*ESC H	Toggles Auto Scroll on/off. Auto Scroll permits another line when screen is full.
Bell		CTRL/G	CTRL/G	*CTRL/G	CTRL/G	

Legend

910 = TeleVideo 910; LS = Lear Siegler ADM-5/3A; Hzltn = Hazeltine 1410; ADDS = ADDS 25

NOTE

1. Slash means depress CTRL key at same time control character is pressed. ESC CTRL/ means press and release ESC key before pressing CTRL *and* other character. Do not add spaces. User upper and lower case characters as indicated.

2. For transmitted code sequences for each function, refer to the Command column.

 * Additional emulation codes.

** Differs from original code.

TABLE B–1
CURSOR COORDINATES

CURSOR POSITIONING

POSITION R or C*	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		
18	1	50	Q		
19	2	51	R		
20	3	52	S		
21	4	53	T		
22	5	54	U		
23	6	55	V		
24	7	56	W		
25	8	57	X		
26	9	58	Y		
27	:	59	Z		
28	;	60	[		
29	<	61	\		
30	=	62	]		
31	>	63	∧		
32	?	64	—		

 * Value of R can't be greater than 24.　　24

TABLE C–1
ADDS CURSOR COORDINATES

Row Position	ASCII Code Transmitted	Column Position	ASCII Code Transmitted	Column Position	ASCII Code Transmitted
1	@	1	CTRL/@	41	@
2	A	2	CTRL/A	42	A
3	B	3	CTRL/B	43	B
4	C	4	CTRL/C	44	C
5	D	5	CTRL/D	45	D
6	E	6	CTRL/E	46	E
7	F	7	CTRL/F	47	F
8	G	8	CTRL/G	48	G
9	H	9	CTRL/H	49	H
10	I	10	CTRL/I	50	I
11	J	11	CTRL/P	51	P
12	K	12	CTRL/Q	52	Q
13	L	13	CTRL/R	53	R
14	M	14	CTRL/S	54	S
15	N	15	CTRL/T	55	T
16	O	16	CTRL/U	56	U
17	P	17	CTRL/V	57	V
18	Q	18	CTRL/W	58	W
19	R	19	CTRL/X	59	X
20	S	20	CTRL/Y	60	Y
21	T	21	SP	61	/
22	U	22	!	62	a
23	V	23	"	63	b
24	W	24	#	64	c
		25	$	65	d
		26	%	66	e
		27	&	67	f
		28	'	68	g
		29	(	69	h
		30	)	70	i
		31	0	71	p
		32	1	72	q
		33	2	73	r
		34	3	74	s
		35	4	75	t
		36	5	76	u
		37	6	77	v
		38	7	78	w
		39	8	79	x
		40	9	80	y

TABLE D–1   ASCII Chart

$b_4 b_3 b_2 b_1$	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

INDEX

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 lowercase 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 and 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.).

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.

Hardware

The electronic components of a computer system or terminal.

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") which is 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).

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.

Wraparound

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

OPERATOR'S QUICK REFERENCE GUIDE

Note: In CTRL sequences, the CTRL key and key that follows the slash should be pressed together.
In ESC sequences, press the ESC key first, followed by the other key(s).

Function	910	Lear Siegler	Hazeltine	ADDS
CURSOR				
HOME	CTRL/ ∧	CTRL/ ∧	ESC CTRL/R	CTRL/A
New line	CTRL/__	CTRL/__		CTRL/__
Carriage return	CTRL/M	CTRL/M	CTRL/M	CTRL/M
Linefeed/ ↓	CTRL/J	CTRL/J	CTRL/J	CTRL/J
↑	CTRL/K	CTRL/K	ESC CTRL/L	CTRL/Z
Backspace/ ←	CTRL/H	CTRL/H	CTRL/H	CTRL/H
				CTRL/U
→	CTRL/L	CTRL/L	CTRL/P	CTRL/F
TAB				
Set column tab	ESC 1	ESC 1	ESC 1	ESC 1
Clear tab	ESC 2	ESC 2	ESC 2	ESC 2
Clear all tabs	ESC 3	ESC 3	ESC 3	
Back tab	ESC I	ESC I	ESC I	ESC I
Tab	CTRL/I	CTRL/I	CTRL/I	CTRL/I
			CTRL/N	
EDIT				
Erase line to spaces	ESC T	ESC T	ESC CTRL/O	ESC K
Erase page to spaces	ESC Y	ESC Y	ESC CTRL/X	ESC k
Clear screen to nulls	ESC *	ESC *		ESC *
Clear screen to spaces	ESC +	CTRL/Z	ESC CTRL \	CTRL/L
	CTRL/Z			
CURSOR				
Load cursor (row)	ESC[R	ESC[R		CTRL/K R
Load cursor (column)	ESC]C	ESC]C		CTRL/P C
Load cursor (row, column)	ESC = RC	ESC = RC		ESC Y R C
Load cursor (column, row)			ESC CTRL/Q C R	
Read cursor (row, column)	ESC ?	ESC ?		ESC ?
Read cursor (column, row)			ESC CTRL/E	
Cursor off	ESC .0			
Blinking block cursor	ESC .1			
Steady block cursor	ESC .2			
Blinking underline	ESC. 3			
Steady underline	ESC .4			
KEYBOARD				
Enable keyboard	ESC "	ESC "	ESC CTRL/F	ESC 6
Disable keyboard	ESC #	ESC #	ESC CTRL/U	ESC 5
PRINTER				
Enable printer port	ESC @	CTRL/N	ESC /	CTRL/R
Disable printer port	ESC A	CTRL O	ESC ?	CTRL/T
Enable transparent print	CTRL/R	ESC @	ESC *	ESC 3
Disable transparent print	CTRL/T	ESC A	ESC /	ESC 4
VIDEO				
Normal video	ESC G0		ESC CTRL/G0	ESC G0
Normal/reverse video		ESC G		
Blank normal	ESC G1		ESC CTRL/G1	ESC G1
Blink	ESC G2		ESC CTRL/G2	ESC G2
Blank (invisible blink)	ESC G3		ESC CTRL/G3	ESC G3
Reverse video	ESC G4		ESC CTRL/G4	ESC G4
Blank (invisible reverse)	ESC G5		ESC CTRL/G5	ESC G5
Reverse blink	ESC G6		ESC CTRL/G6	ESC G6

Function	910	Lear Siegler	Hazeltine	ADDS
Blank (invisible reverse blink)	ESC G7		ESC CTRL/G7	ESC G7
Underline	ESC G8		ESC CTRL/G8	ESC G8
Blank (invisible underline)	ESC G9		ESC CTRL/G9	ESC G9
Underline blink	ESC G:		ESC CTRL/G:	ESC G:
Blank (invisible underline blink)	ESC G;		ESC CTRL/G;	ESC G;
Reverse underline	ESC G<		ESC CTRL/G<	ESC G<
Blank (invisible reverse underline)	ESC G=		ESC CTRL/G=	ESC G=
Reverse blink underline	ESC G>		ESC CTRL/G>	ESC G>
Blank (invisible reverse blink underline)	ESC G?		ESC CTRL/G?	ESC G?
Half intensity on	ESC)	ESC)	ESC CTRL/Y	ESC On)
Half intensity off	ESC (	ESC (	ESC CTRL/__	ESC ON (
Cursor visible/invisible		ESC . (period)		ESC . (period)

MONITOR

Function	910	Lear Siegler	Hazeltine	ADDS
Monitor mode on (not transmitted)	CTRL/1	CTRL/1	CTRL/1	CTRL/1
Monitor mode off (not transmitted)	CTRL/2	CTRL/2	CTRL/2	CTRL/2
Monitor mode on (transmitted)	ESC U	ESC U		
Monitor mode off (transmitted)	ESC u ESC X	ESC u ESC X		
Display single control character (n = control character)	ESC Fn	ESC Fn		ESC Zn

MISCELLANEOUS

Function	910	Lear Siegler	Hazeltine	ADDS
Auto scroll on/off	ESC H	ESC H		ESC H
Bell	CTRL/G	CTRL/G	CTRL/G	CTRL/G

SELF TEST

Function	910	Lear Siegler	Hazeltine	ADDS
Self test on	ESC V	ESC V	ESC CTRL/S	ESC V

S1

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 (RIGHT REAR)

	1	2	3	4	5	6	7	8	9	10
	BAUD RATE BIT 3	BAUD RATE BIT 2	BAUD RATE BIT 1	BAUD RATE BIT 0	WORD LENGTH	NO PARITY	EVEN/ODD PARITY	STOP BITS	1AUTO (WRAP	CR/CRLF
UP		SEE CHART			7 BITS	SEND PARITY	EVEN	TWO BITS		SEE CHART BELOW
DN					8 BITS	NO PARITY	ODD	ONE BIT		

S2 (LEFT REAR)

	1	2	3	4	5	6	7	8	9	10
	EMULA-TION	EMULA-TION	50/60 HERTZ	CURSOR MODE	CURSOR MODE	FULL/HALF DUPLEX	VIDEO	DSR	DCD	ENABLE DTR
UP	SEE CHART BELOW		50 Hz	SEE CHART BELOW		FULL	GOB	DIS-CON	DIS-CON	DIS-CON
DN			60 Hz			HALF	BOG	CON	CON	ON W/ TERM

S1				S2 1 2		S2 4 5	
9	UP	AUTOWRAP		DN DN STD 910		DN DN BLOCK BLINK	
	DN	NO AUTOWRAP		DN UP ADDS 25		DN UP UNDERLINE BLINK	
10	UP	CR = CRLF		UP DN ADM - 5/3A		UP DN BLOCK STEADY	
	DN	CR = CR		UP UP HAZELTINE 1410		UP UP UNDERLINE STEADY	