HEWLETT PACKARD

HP-85A

PERSONAL COMPUTER

ASSEMBLY-LEVEL

SERVICE MANUAL

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General Information

1-1. INTRODUCTION

1-2. This manual provides information to help you in servicing the HP-85 computer.

1-3. This section describes the HP-85, outlines how to use this manual, lists tools recommended for servicing, and discusses safety considerations. The following sections tell you:

- How to isolate the cause of a problem to a part or assembly that you can replace without soldering: section II.
- How to disassemble and reassemble the computer: section III.
- How to troubleshoot and repair the keyboard assembly: section IV.
- How to make adjustments to the CRT assembly: section V.
- How to troubleshoot and repair the printer assembly: section VI.
- How to troubleshoot and repair the tape drive assembly: section VII.
- A description of the tests provided by the Service ROM: section VIII.
- A list of replaceable parts: section IX.

1-4. Before using this manual in an actual repair, first read all of section I to become familiar with the product and the organization of this service manual, then read through the rest of the manual to become familiar with the service procedures. Paragraph 1-16 outlines how to use this manual in servicing an HP-85.

1-5. Additional information related to service is included in appendix B of the HP-85 Owner's Manual and Programming Guide. This information includes:

- Illustrations and part numbers of power cords for use with the HP-85.
- Information concerning the fuses and the voltage selector switch on the back panel.
- Procedures for installing plug-in modules and plug-in ROM's.
- Recommendations for storing HP-85 printer paper.
- Procedures for loading printer paper.
- Procedures for inserting and removing a tape cartridge.
- Procedures for rethreading a tape cartridge.
- Recommendations for cleaning the top and bottom case.

1-6. PRODUCT DESCRIPTION

1-7. The HP-85 Personal Computer is an integrated system that features:

- Enhanced ANSI BASIC language.
- 16K read/write memory, expandable to 32K.
- CRT display.
- Bidirectional, thermal printer.
- Magnetic tape input/output.
- Typewriter keyboard and numeric keypad.
- Graphics capability standard.
- I/O capability for plug-in ROMs and peripheral devices.
- Programmable tone output.

1-8. For detailed specifications, refer to table 1-1.

Table 1-1. HP-85 Specifications

Size

- Width: 41.9 cm (16.5 in.).
- Depth: 45.2 cm (17.8 in.).
- Height: 15.9 cm (6.25 in.).

Weight: 9.06 kg (20 lb), including paper roll and power cord.

Power Requirements

- AC Line Voltage: 90 to 127, 200 to 254.
- Line Frequency: 50 to 60 Hz.
- Power Consumption: 25 watts (nominal).

Environmental Limits

- Operating Temperature: 5 to 40 degrees C (41 to 104 degrees F).
- Storage Temperature: -40 to 65 degrees C (-40 to 149 degrees F).
- Operating Humidity: 5% to 80% relative humidity at 40 degrees C (104 degrees F).

CRT Display

- Size: 12.7 cm (5 in.) diagonal width.
- Capacity: 16 lines, 32 characters per line (alphanumeric mode); 256 dots by 192 dots (graphics mode).
- Refresh Rate: 60 Hz.

Table 1-1. HP-85 Specifications (Continued)

Printer

- Line Width: 32 characters.
- Print Speed: 64 characters per second.
- Graphic printout using 192 by 256 dot matrix.
- Bidirectional printing in alphanumeric mode.

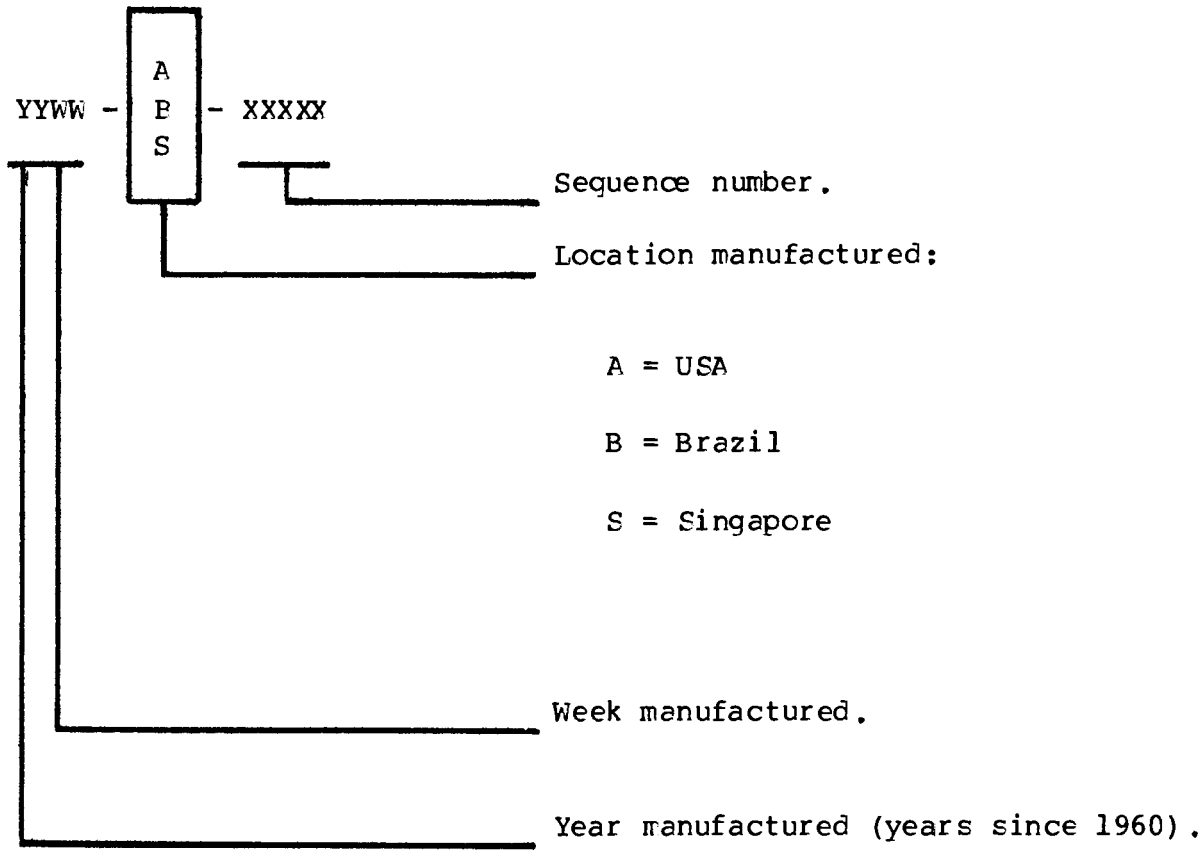
Tape Unit

- Tape Capacity (typical): 850 data records (210K bytes); 780 program records (195K bytes).
- Tape Directory Capacity: 42 files (directory entries).
- Number of Tracks: 2.
- Tape Length: 43 m (141 ft).
- Search Speed: 152.4 cm/s (60 in/s); 7,800 bytes/second (typical).
- Read/Write Speed: 25.4 cm/s (10 in/s); 650 bytes/second (typical).
- Rewind Time: 29 seconds.
- Initialization Time: 15 seconds.
- Tape Life: 50 to 100 hours (typical).

Keyboard

- 92 keys.
- Typewriter keyboard.
- Numeric keypad.
- Special function keys.

1-9. The serial number of the computer is used for identification and determination of warranty status. It is located at the top of the back panel, above the brightness control. Its format is shown below:



1-10. SERVICING THE HP-85

1-11. The HP-85 is designed to be easy to service. Most parts are included in the folowing assemblies (see figure 1-1):

- Logic PCA (printed-circuit assembly).
- CRT assembly.
- Printer assembly.
- Tape drive assembly.
- Keyboard assembly.
- Back panel assembly.
- Top case assembly.
- Bottom case assembly.

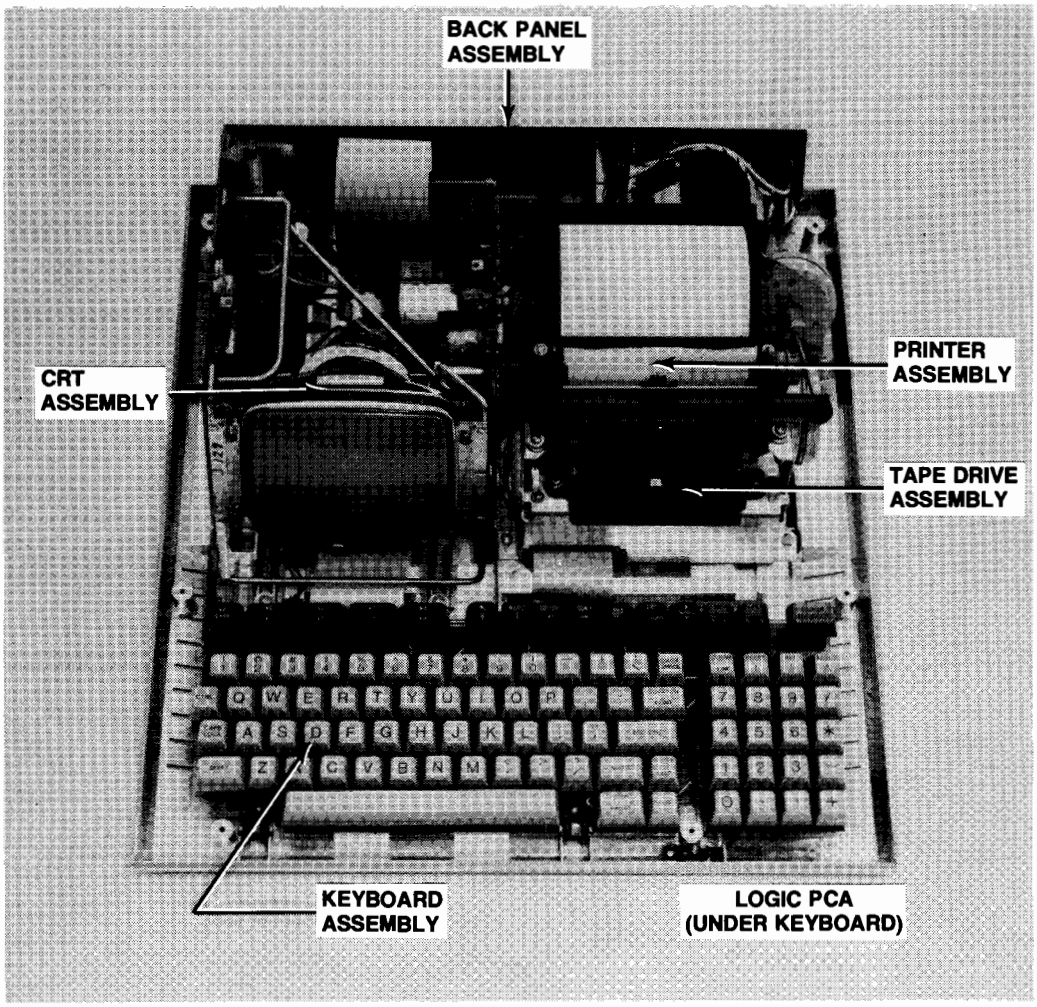


Figure 1-1. HP-85 Computer

1-12. To avoid the necessity of frequent unsoldering and soldering, all major ICs (23) are mounted in sockets. Most of these ICs are located on the logic PCA, which is readily accessible when the top case and keyboard assembly are removed. Five socketed ICs are included in the CRT assembly, and one each is included in the printer and tape drive assemblies.

1-13. Troubleshooting the HP-85 is greatly facilitated by the use of the Service ROM. Tests provided in this ROM tell you if a socketed IC is bad, check for proper operation of the tape drive assembly, and enable you to check for proper operation of the CRT and printer assemblies. (The tests provided in the Service ROM go much further than the self-test performed by the computer when power is switched on and when the [TEST] key is pressed. Refer to paragraphs 8-7 and 8-8 for more information about these tests. The tests provided by the Service ROM are described in section VIII.)

1-14. Also contributing to the ease of service are extender cables, which enable you to substitute a good assembly for one in the computer without removing it.

1-15. Table 1-2 lists the tools recommended for servicing the HP-85.

1-16. Here is an outline of how you would use this manual in servicing an HP-85:

a. Follow the procedures in section II. They will isolate a problem to one of the major HP-85 assemblies and refer you to the appropriate section in this manual that tells you how to repair that assembly.

b. If it is necessary to disassemble the computer in order to access a bad assembly, refer to the procedures in section III.

c. Follow the troubleshooting and repair procedures in the section applicable to the bad assembly.

d. If it is necessary to run one of the tests from the Service ROM, refer to section VIII for a description of the test and how to run it.

e. To order replacement parts or assemblies, obtain the HP part numbers from the list of replaceable parts in section IX.

Table 1-2. Recommended Tools

HP PART NUMBER	DESCRIPTION
HP 3465/3466	Digital voltmeter
HP 1220A	Oscilloscope
0960-0062	Continuity tester
8710-1355*	CRT alignment tool (GC #8606 or equivalent)
00085-60955*	CRT test pattern overlay
8120-3708*	Extender cable, 20-conductor (can trim to 17- and 11-conductor widths)
8500-0232	FREON TF
8650-0029	Gloves, nylon, small
8650-0030	Gloves, nylon, large
8710-0857*	Hex Key, 0.050 inch
8710-1254*	Key contact insertion tool
8720-0001	Nut driver, 3/16 inch
8720-0007	Nut driver, 1/2 inch
8710-1107	Pliers, long-nose, serrated tip
0470-0304	RTV 108 silicon rubber adhesive sealant
8710-1197*	Screwdriver, ballpoint hex, 7/64 inch
8710-0945	Screwdriver, holding
8710-0899	Screwdriver, Pozidriv, #1

Table 1-2. Recommended Tools (Continued)

HP PART NUMBER	DESCRIPTION
8710-0900	Screwdriver, Pozidriv, #2
8730-0008	Screwdriver, small flat-blade
00085-60952*	Service ROM
8520-0023	Swabs, cotton
HP 98200A	Tape cartridges, 5-pac
00085-90002	HP-85A Owner's Manual and Programming Guide
00085-90154	HP-85A Assembly-Level Service Manual
00085-60949	I/O Exerciser Tape

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* These tools are included in the Service Tool Kit (00085-83501).

1-17. PRINCIPLES OF OPERATION

1-18. Functional Overview

1-19. The HP-85 system (see figure 1-2) consists of:

- The CPU (central processing unit), an 8-bit parallel microprocessor.
- Read-only memory (ROM) containing microprogrammed instructions. The HP-85 has 32K bytes of ROM distributed among four ROM ICs.
- Random access memory (RAM) for storage of the user's programs and data and the BASIC operating system. The HP-85 has 16K bytes of RAM, which are distributed among eight RAM ICs and accessed through the RAM controller.* About 2K bytes of RAM are used for the BASIC operating system.
- A keyboard with 92 keys, which is controlled by the CPU through the keyboard controller. This IC also provides four timers for use by the operating system and the user.
- A CRT (cathode ray tube) display capable of displaying up to 32 characters on each of 16 lines, or graphics patterns using a matrix of 192 dots by 256 dots. The display is controlled by the CPU through the CRT controller and associated RAM (64K bits), analog drive circuitry, and a high-voltage power supply.
- A moving-head, bidirectional, thermal printer capable of printing up to 32 characters per line. The printer is controlled by the CPU through the printer controller and print-head and motor-drive transistor packs.
- Magnetic tape drive unit, controlled by the CPU through the tape controller, a read/write sense amp, and motor drivers.
- Four I/O (input/output) ports for plug-in modules that provide additoinal memory or functional capabilities, or for connecting peripheral devices such as printers, plotters, etc. An I/O buffer IC interfaces between the CPU and modules or devices plugged into the I/O ports.
- A 1 3/4-inch speaker, controlled by the CPU through the keyboard controller to produce audible tones ("beeps") of variable frequency and duration.
- An 8-bit bus that transfers instructions, addresses, and data between the CPU and the various controllers, the I/O buffer, and the ROMs.
- System timing circuitry, and power supply circuitry.

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*Each of the input/output units of the HP-85, as well as the RAM, is controlled by a separate IC. Throughout this manual, these ICs are referred to simply as "controllers."

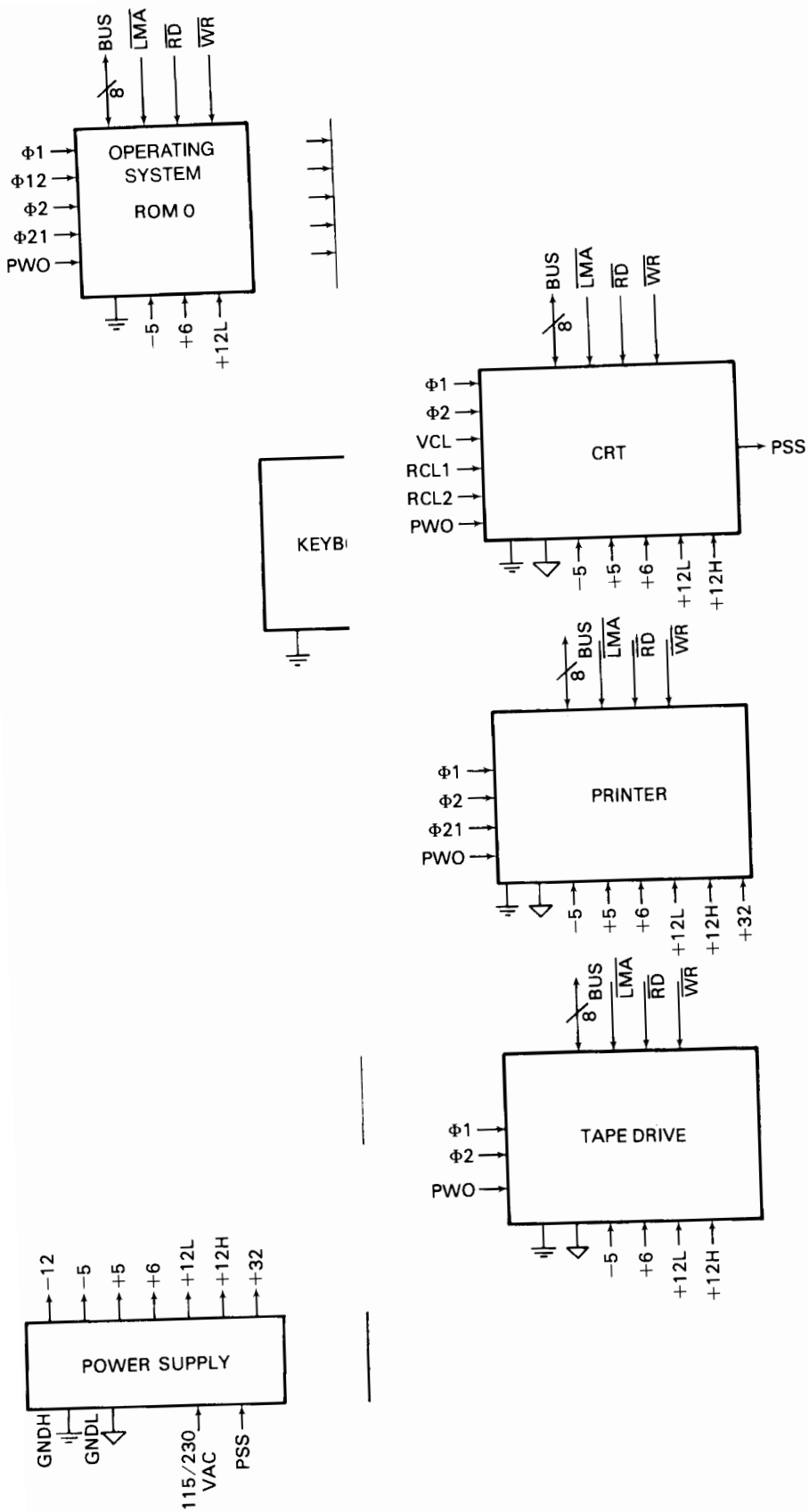


Figure 1-2. HP-85A Block Diagram

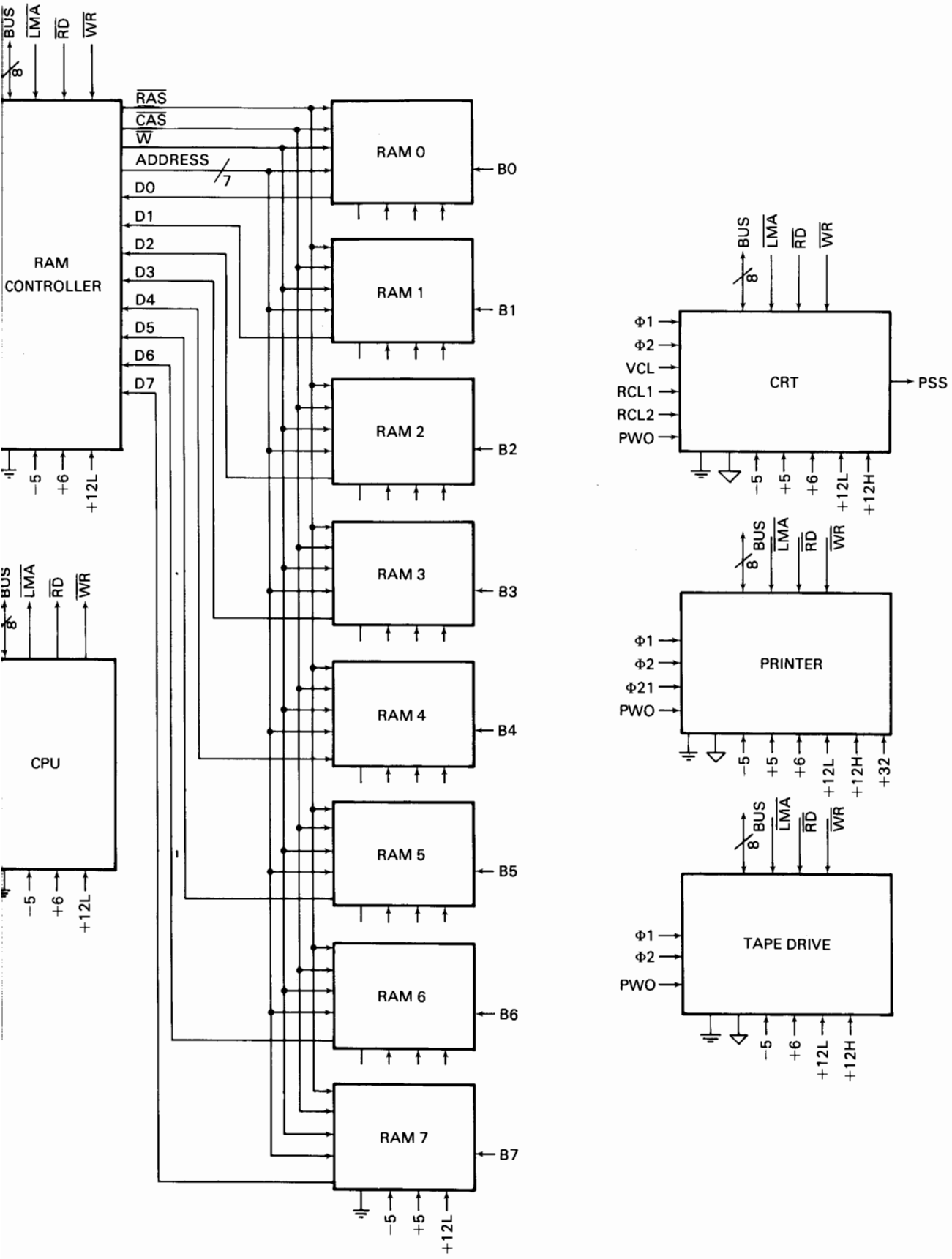
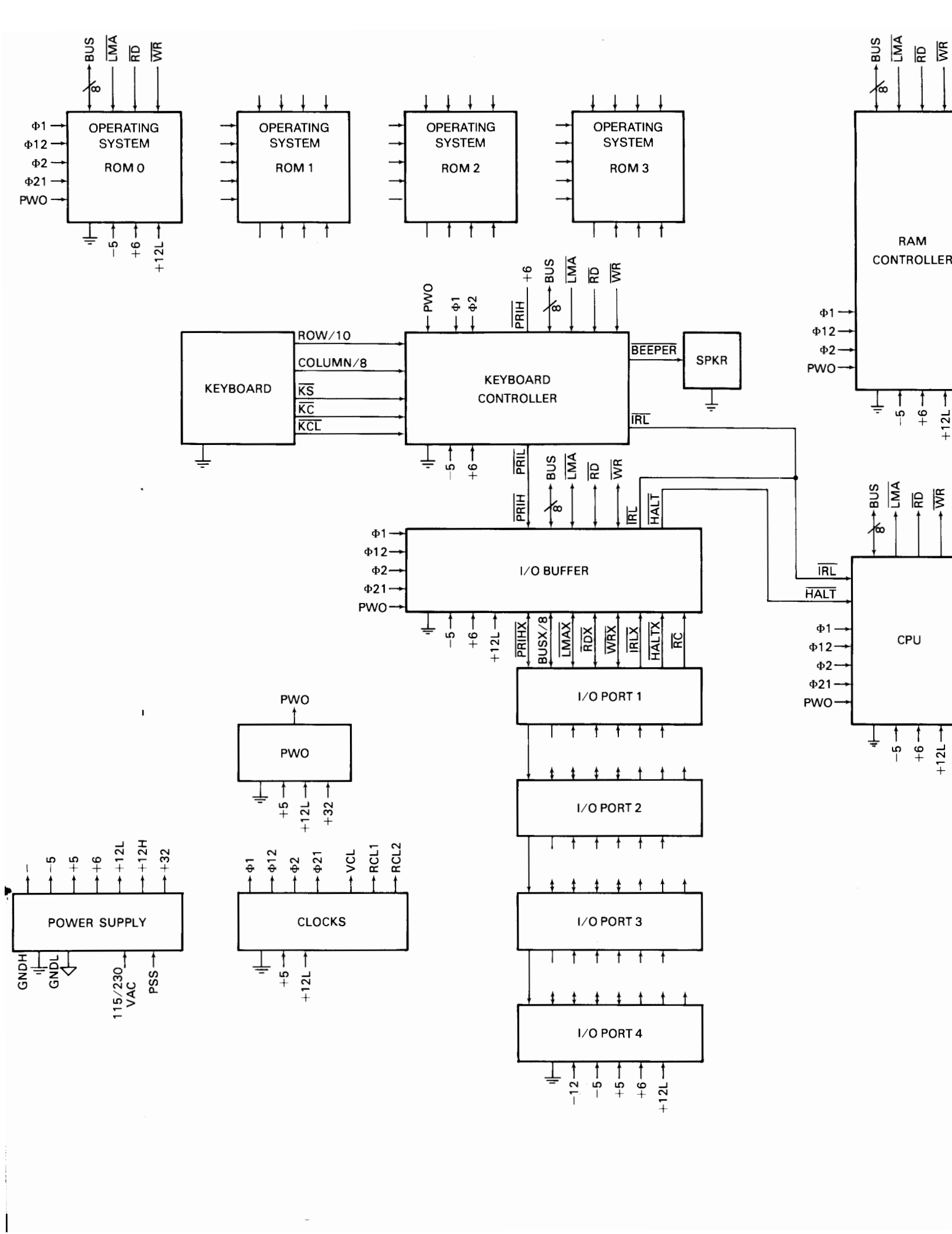


Figure 1-2. HP-85A Block Diagram


OPERATING SYSTEM ROM 0
OPERATING SYSTEM ROM 1
OPERATING SYSTEM ROM 2
OPERATING SYSTEM ROM 3
RAM CONTROLLER
KEYBOARD
KEYBOARD CONTROLLER
SPKR
I/O BUFFER
CPU
I/O PORT 1
I/O PORT 2
I/O PORT 3
I/O PORT 4
PWO
POWER SUPPLY
CLOCKS
BUS
LMA
RD
WR
Φ1
Φ12
Φ2
Φ21
PWO
ROW/10
COLUMN/8
KS
KC
KCL
BEEPER
IRL
HALT
PRIH
PRIL
PRIHX
BUSX/8
LMAX
RDX
WRX
IRLX
HALTX
RC
VCL
RCL1
RCL2
GNDH
GNDL
115/230 VAC
PSS

1-20. Power Supply

1-21. The power supply circuitry, which is located on the printer PCA, provides four regulated voltage supplies and one unregulated voltage supply (+32V) that are used throughout the computer. It also provides one regulated voltage supply (-12V) that is used only by certain peripheral devices. All of the regulated supplies are derived from switching regulator circuitry that provides the +12V supply.

1-22. One of the regulated voltages--the +12V supply--is sent over two separate lines. One line goes to parts that do not generate much noise on the line and cannot tolerate a high noise level; this line is called +12L. The other line goes to parts that either generate significant noise on the line or can tolerate a high noise level; this line is called +12H. Parts connected to each of these voltage supply lines are connected to one of two corresponding ground lines; GND/L for +12L, or GND/H for +12H. For proper operation, +12L should never be connected to +12H, and GND/L should never be connected to GND/H. (Of course, each of these pairs is connected on the printer PCA.)

1-23. Table 1-3 shows what parts and circuits require each of the power supply lines.

Table 1-3. Parts and Circuits Using Power Supply Lines

ASSEMBLY	PART OR CIRCUIT	POWER SUPPLY LINE						
		+12H	+12L	+6	+5	-5	-12	+32
Logic	CPU		X	X		X		
	RAM's		X		X	X		
	ROM's		X	X		X		
	RAM Controller		X	X		X		
	Keyboard Controller			X		X		
	I/O Buffer		X	X		X		

Table 1-3. Parts and Circuits Using Power Supply Lines (Continued)

ASSEMBLY	PART OR CIRCUIT	POWER SUPPLY LINE						
		+12H	+12L	+6	+5	-5	-12	+32
CRT	PWO		X		X			X
	Clocks		X		X			
	CRT Controller		X	X		X		
	CRT RAMs		X		X	X		
	Horizontal Drive	X			X			
	Phase Lock	X			X			
	Vertical Drive	X				X		
	Video Drive				X			
Printer	Printer Controller		X	X		X		
	Print Head	X						
	Motors	X						
	Print-Head Drivers				X			
	Motor Drivers				X			X

Table 1-3. Parts and Circuits Using Power Supply Lines (Continued)

ASSEMBLY	PART OR CIRCUIT	POWER SUPPLY LINE						
		+12H	+12L	+6	+5	-5	-12	+32
Tape Drive	Tape Controller		X	X		X		
	Motor	X						
	Sense Amplifier			X				
	Motor Driver	X		X				
	Motor Speed		X			X		
	Hole Detect		X			X		
Back Panel	I/O PCA		X	X	X	X	X	
Bottom Case	Speaker				X			
	Power Light				X			

1-24. Clocks

1-25. Seven clock signals, generated by circuitry on the CRT PCA, are used by various ICs for timing:

- Ø1, Ø12, Ø2, and Ø21 are the system clocks. Two or more of these clock signals are required by all socketed ICs except the RAMs and CRT RAMs. Table 1-4 indicates the clock signals that are required by each IC.
- RCL1, RCL2, and VCL are clock signals used only by the CRT controller.

Table 1-4. ICs Using System Clocks

IC	CLOCK SIGNAL			
	Ø1	Ø12	Ø2	Ø21
CPU	X	X	X	X
ROMs	X	X	X	X
RAM Controller	X	X	X	
Keyboard Controller	X		X	
I/O Buffer	X	X	X	X
CRT Controller	X		X	
Tape Controller	X		X	
Printer Controller	X		X	X

1-26. PWO

1-27. The PWO (power-on) signal, generated by circuitry on the CRT PCA, goes to the CPU, the controllers, and the ROMs. PWO ensures that these ICs are not enabled until all power supply voltages and system clocks have reached the proper states. In addition, it disables these ICs if the power line voltage (115V/230V) drops too low and enables the ICs again when the power line voltage has returned to an acceptable level.

1-28. Control and Bus Lines

1-29. The CPU controls the ROMs and the controllers using three control lines ($\overline{LMA}$, $\overline{RD}$, and $\overline{WR}$) and eight bus lines (B0 through B7).

1-30. The $\overline{LMA}$, $\overline{RD}$, and $\overline{WR}$ lines are control signals that define the information currently on the bus lines. $\overline{LMA}$ (load memory address) indicates that the bus contains an address; $\overline{RD}$ indicates that the information on the bus is to be read from the location addressed; and $\overline{WR}$ indicates that information is to be written into the location addressed.

1-31. The bus lines carry addresses, instructions, or data. Each line contains one bit of the information.

1-32. SAFETY CONSIDERATIONS

> **WARNING**
>
> Lethal voltages are exposed when the top case of the HP-85 is removed. At certain points these voltages are present not only while power is on, but also for up to several days after power has been turned off. Electrical and mechanical failures may cause dangerous voltages to be present at points that normally are safe. For your own safety, read and heed the safety guidelines listed below.

1-33. The dangerous voltages present in the HP-85 include not only the 115V or 230V ac line voltage, but also +32 Vdc used on the printer, CRT, and logic PCAs, and pulsed voltages of +28V, -48V, +120V, +800V, and +8 kV used in the CRT assembly. The high-voltage area on the CRT PCA is shown in figure 1-3.

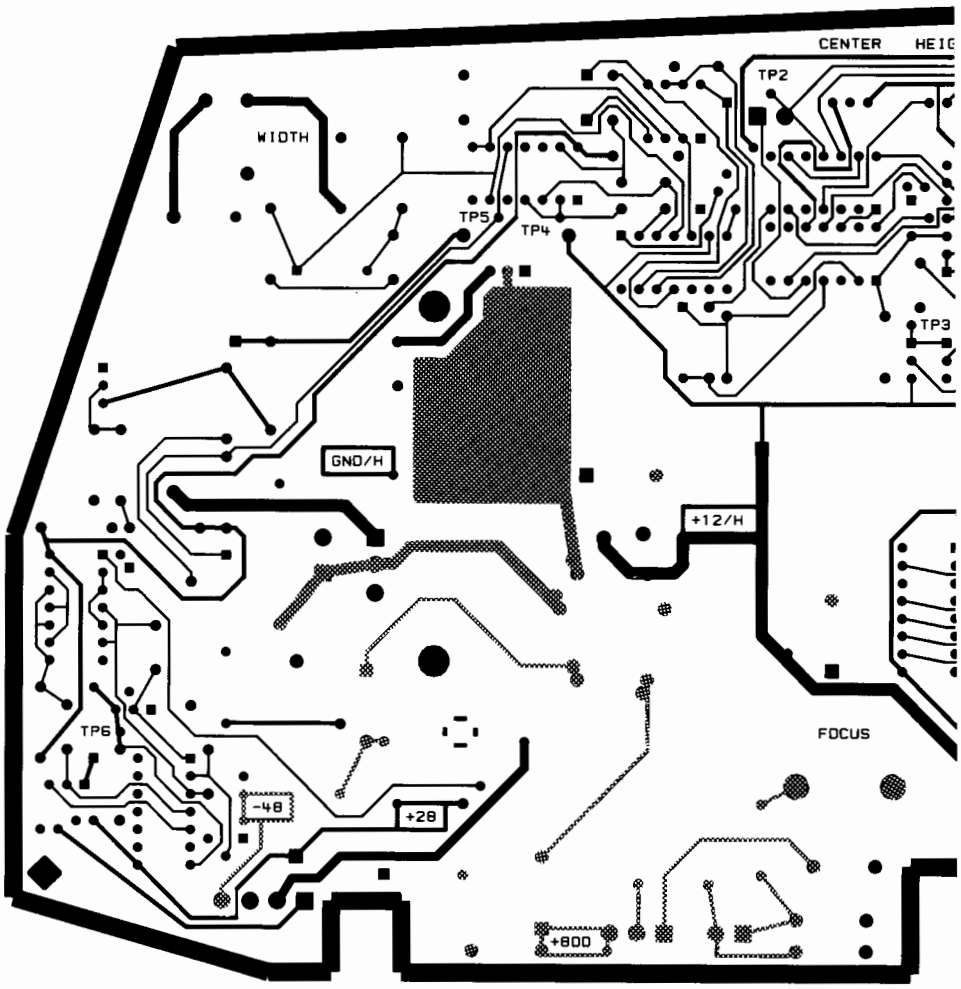


Figure 1-3. High-Voltage Area on CRT PCA

1-34. Observe the following safety guidlines while working on an HP-85:

- Do all possible operations with the computer turned off.
- NEVER WORK ALONE. Be familiar with the location of power switches in your service area and what they control. Know how to free another worker from contact with high voltage without endangering yourself.
- In case of an accident, know where to obtain respiratory resuscitation and/or cardiac pulmonary resuscitation (CPR).
- Have available and use approved warning signs in areas where high voltage testing is in progress.
- Keep your work area neat, free of any nonessential conducting material or sharp objects. Remember that reaction to an electrical shock can make you strike nearby objects, which could result in serious injury.
- Do not exceed the rated specifications of test instruments.
- Make sure the probe being used has insulation that is rated higher than the voltage being measured. Check all instrument wires and probes for cracked insulation and other defects. If you find any problems, don't risk your safety by using them.
- While measuring high voltages, keep one hand behind your back or in a pocket. This helps prevent you from touching a point that could close a high-voltage loop.
- Always be certain that the computer is turned off and all high voltages are discharged before touching or removing any electrical or mechanical part. Keep in mind while servicing that some circuits can be lethally charged if a component or connector is faulty or disconnected even after the computer has been turned off.
- Never reach around energized high voltage circuits. Develop a habit of turning the computer off and discharging the high voltage before reaching.
- Do not make measurements in a circuit where corona is present. Corona can be identified by a pale-blue color, by a buzzing sound emanating from sharp metal points in the circuit, or by the odor of ozone.
- Never leave your work area with high voltage circuits energized and exposed.
- Never do any service work while your hands, shoes, workbench, or the floor is wet. Avoid making measurments under humid, damp, or other environmental conditions that could affect the dielectric voltage tolerance of the test leads or instruments.

1-35. Associated with certain procedures throughout this manual you will see a warning. Enclosed within a box like the one following paragraph 1-32, these warnings caution you about possible dangers while you do these procedures. For your own safety, always read and heed all warnings.

1-36. ACCESSORIES

1-37. Standard and optional accessories for use with the HP-85 are listed in appendix A of the HP-85 Owner's Manual and Programming Guide. In addition, several peripheral devices are available that connect to the HP-85 through the I/O ports on the back panel. These devices are listed in the HP-85 Configuration Guide and System Summary. Service information for peripheral devices is not covered by this service manual; refer instead to the service literature applicable to the particular device.

1-38. Illustrations and part numbers of power cords for use with the HP-85 are included in appendix B of the HP-85 Owner's Manual and Programming Guide.

Assembly-Level Troubleshooting and Repair

2-1. INTRODUCTION

2-2. This section tells you how to isolate the cause of a problem to a part or assembly that you can replace without soldering.

2-3. Frequently a computer is received for repair with a message from the customer describing the problem. This information can be extremely valuable in troubleshooting. Nevertheless, because of the complexity of the HP-85, you should always begin troubleshooting any HP-85 problem using the procedures described in paragraph 2-16.

2-4. Every effort should be made to reproduce the customer's problem. In particular, if the customer returned a tape cartridge along with the computer, be sure to have it inserted during testing. It can be very difficult to determine the cause of tape drive problems. They can be caused by a bad tape drive assembly, a bad tape cartridge, or a misalignment between the tape drive assembly reading the tape and the one on which the tape was recorded.

> CAUTION
>
> Ensure that the bench setup for troubleshooting and repair has adequate electrostatic protection; otherwise, ICs may be damaged.

2-5. Safety Considerations

WARNING

Lethal voltages are exposed when the top case of the HP-85 is removed. At certain points these voltages are present not only while power is on, but also for up to several days after power is turned off. Electrical and mechanical failures may cause dangerous voltages to be present at points that normally are safe. For your own safety, read and heed the safety guidelines listed in section I.

When substituting a new CRT assembly for the one in the computer using extender cables, a spare brightness control must be connected to the new assembly before the computer is switched on. If this is not done, 800V will remain on pin 3 of the brightness control connector (J6) after the power is turned off. (This pin is the one toward the rear of the computer.) If this happens, discharge the 800V before reconnecting the plug by shorting the pin to the CRT frame with a well-insulated screwdriver. (See figure 2-1.)

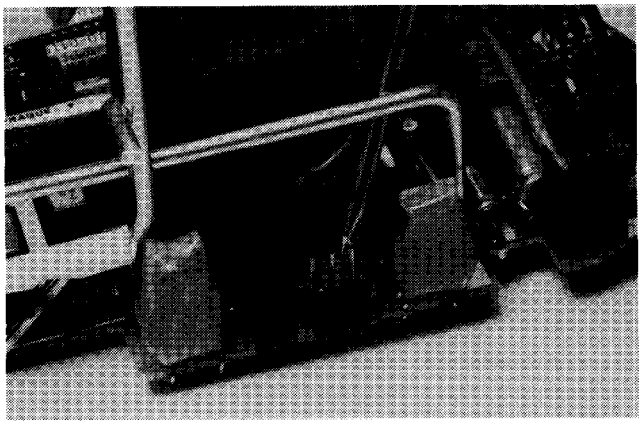


Figure 2-1. Discharging Brightness Control Connector

2-6. Troubleshooting Overview

2-7. Troubleshooting the HP-85 is greatly facilitated by the use of the Service ROM and the extender cables.

2-8. The Service ROM identifies bad ICs and enables you to further check the printer, CRT, tape drive, and keyboard assemblies. Section VIII describes the tests in the Service ROM and how to run them.

2-9. The extender cables enable you to substitute a good assembly for one in the computer without removing it. If such a substitution corrects a problem, the old assembly was malfunctioning and should be replaced.

2-10. To troubleshoot an HP-85:

a. Set up the computer as described in paragraph 2-16. If the computer does not turn on properly, troubleshoot it as described in paragraph 2-26.

b. Run the System Test from the Service ROM as described in paragraph 8-25.

c. Replace any bad ICs identified by the Service ROM. After replacing an IC, you need run only the individual test for that IC from the Service ROM to verify that the replacement has corrected the problem.

d. For some problems, the Service ROM will not identify a possible cause. In such cases, an IC may nevertheless be bad, or some other part of an assembly may be bad. If you observe a problem with the beeper, CRT, or printer, correct it as described in paragraph 2-36. After replacing any part or assembly, run the appropriate test from the Service ROM to verify that the replacement has corrected the problem.

e. After correcting all problems and installing the top case, run the entire System Test again to make sure that the computer is working properly before returning it to the customer.

f. If the customer reported an intermittent problem, you can attempt to reproduce it in either of two ways:

   - Run the Cycle Test. (Refer to paragraph 8-121.)

   - Write and run a BASIC program containing a continuous loop of a test or tests from the Service ROM. (For more information about running Service ROM tests under the control of the BASIC system, refer to paragraph 8-15; for assistance in programming, refer to the HP-85 Owner's Manual and Programming Guide.)

2-11. Troubleshooting Tips

CAUTION

Always switch the power off before disconnecting or connecting an assembly, ribbon cable, or IC. If power is on while this is done, ICs could be damaged.

Do not attempt to leave the keyboard PCA connected with its short ribbon cables while the keyboard hinge pins are disengaged from their retainers in the bottom case. If this is done, the strain on the ribbon cable connectors may open the connection between a connector pin and the keyboard PCA. If you want to access the logic PCA with the keyboard PCA connected, either use extender cables, or prop up the keyboard assembly as shown in figure 2-2.

When substituting a new CRT assembly for the one in the computer using extender cables (refer to the WARNING following paragraph 2-5), do not position the wires of the brightness control as they should be when the CRT assembly is installed in the computer. This might allow the terminals of the brightness control to short against the CRT PCA. Instead, position the three wires over the CRT frame, then place them in the slot in the bottom of the CRT printed-circuit board so that the brightness control is located on the trace-side of the CRT PCA. (See figure 2-3.)

If ribbon cables are not inserted properly into their connectors, components could be damaged. Refer to paragraph 3-11 for information about connecting cables.

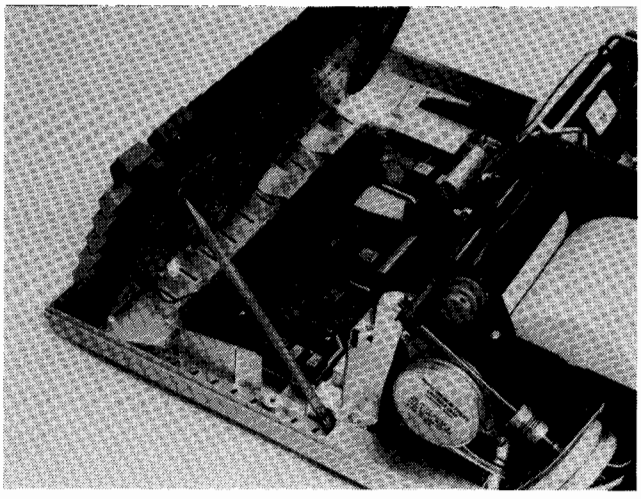


Figure 2-2. Keyboard Assembly Propped Up

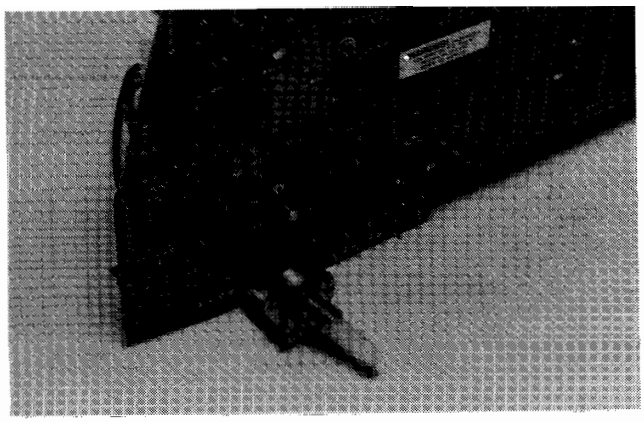


Figure 2-3. Positioning Brightness Control

- When a power supply, clock, bus, control, or PWO line is bad, or when the Service ROM indicates that the controller IC of an assembly is bad, check the assembly's ribbon cable connector to make sure that the contacts of the cable are properly aligned with the contacts of the connector. Figure 3-4 shows how a connector would look if the cable had shifted within the connector. Additional information about the ribbon cables, including recommended procedures for disconnecting and reconnecting them, is given in paragraph 3-8.

- The hole in each ribbon cable connector does not necessarily mean that the adjacent contact is pin 1.

- If the Service ROM indicates that an IC is bad but replacing it results in the same message, check that all power supplies, clocks, bus lines, control lines, etc., are present at the pins of the IC. If not, the line may be open or shorted between the socket and the source of the signal; in this situation, the bad printed-circuit assembly should be replaced. If an oscilloscope is not available and the IC indicated is a ROM, try exchanging its location with that of another ROM. If the Service ROM then indicates that the other ROM is bad, one of the lines to the socket is bad.

- If the computer won't turn on after you replace an IC identified by the Service ROM, make sure that no pin of the new IC was bent over and shorted against another pin when you inserted it. Recommended procedures for removing and inserting ICs are described in paragraph 2-12.

- If the -5V supply goes bad, it could damage the print head.

- Don't connect GND/H to GND/L.

2-12. Removing and Inserting Socketed ICs

2-13. The socketed ICs are held tightly in their sockets and cannot easily be removed with your fingers. Furthermore, unless you are careful you can bend the pins of an IC while inserting it into a socket. The recommended removal and insertion procedures are as follows.

2-14. To remove an IC from its socket:

a. Insert a small, flat-blade screwdriver between one end of the IC and the socket. (See figure 2-4.)

> CAUTION
>
> In the next step, do not insert the screwdriver more than about 2.5 millimeters (3/32 inch) between the IC and its socket. If you do so with certain sockets, the screwdriver could damage traces on the printed-circuit board.

b. Pry the end of the IC up by raising the handle of the screwdriver.

c. Raise the other end of the IC up either by prying it with the screwdriver, if possible, or by pushing the first end down so that the other end rocks up.

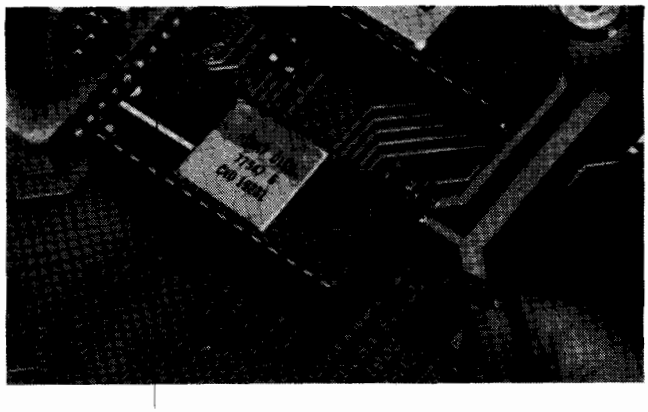


Figure 2-4. Removing IC From Socket

2-15. To insert an IC into its socket:

a. Position the IC over the socket so that the semicircle in the top end of the IC is pointing in the same direction as the semicircle in the socket. (See figure 2-5.)

b. Rest the IC on the socket.

c. Press down evenly along both sides of the IC until it snaps secured in the socket. (See figure 2-6.) When the IC is properly inserted, both sides of the IC should be the same height above the socket.

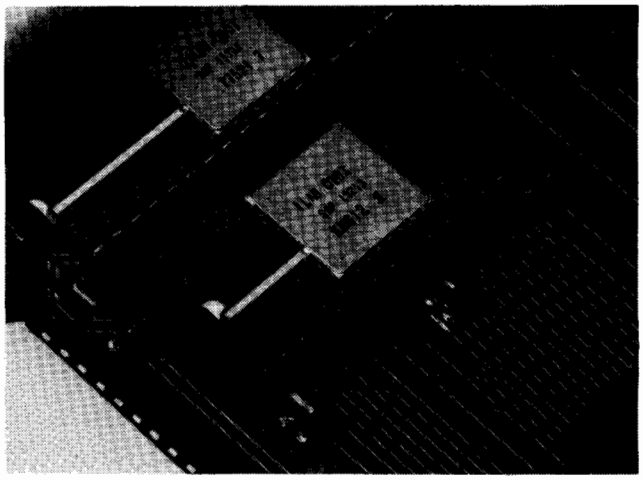


Figure 2-5. Positioning IC For Insertion

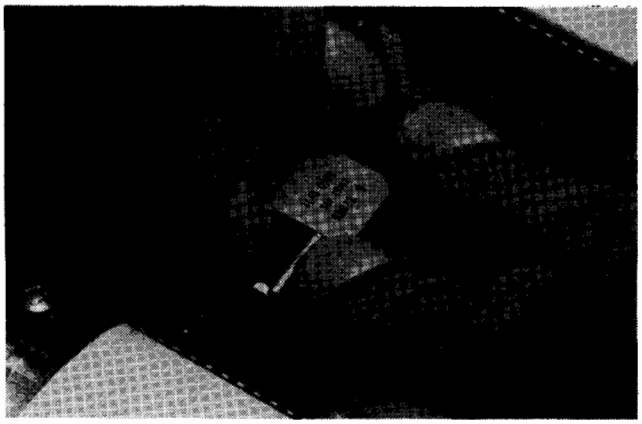


Figure 2-6. Pressing IC Into Socket

2-16. SETUP

2-17. To set up an HP-85 for checkout and troubleshooting:

a. Disconnect the power cord and ensure that the ON-OFF switch on the back panel is set to OFF.

b. Make sure that the line voltage selector switch on the back panel is set to the nominal line voltage in the customer's area.

> CAUTION
>
> The computer will be damaged if the switch is set to 115V and the computer is switched on while connected to a 230V supply.

c. Ensure that an intact fuse of the proper rating is installed in the fuse receptacle on the back panel. Use a 750 mA fuse for 115V operation; use a 400mA fuse for 230V operation.

d. Connect the power cord to its receptacle on the back panel. Plug the other end of the cord into an ac power source of the proper voltage.

> CAUTION
>
> The computer must be switched off when the ROM drawer (as well as any other plug-in module) is inserted into a module port. If the power were on, ICs could be damaged.

e. Install the Service ROM in a ROM drawer, and insert the ROM drawer into one of the module ports in the back panel assembly. The procedures for these installations are described in appendix B of the HP-85 Owner's Manual and Programming Guide.

f. Switch the computer on.

2-18. INITIAL TROUBLESHOOTING

2-19. Within 10 to 15 seconds after you switch the computer on, the following message should be displayed and printed:

{SERVICE ROM: SELECT TEST A-V}*

2-20. This message may be preceded by other messages identifying bad IC's; such messages will be repeated during the System Test (if the System Test can be run). Watch the display for these messages; they may not appear on the printer, and they may appear on the display only momentarily. The computer beeps once before each such message appears.

2-21. If the {SERVICE ROM} message appears correctly on either the CRT or the printer (or both), run the System Test from the Service ROM, as described in paragraph 8-25, to check out and troubleshoot the rest of the computer,then refer to System Test Diagnosis, paragraph 2-36. If a message preceding the {SERVICE ROM} message indicated a bad IC, you need not replace the IC before running the System Test.

Note: If the computer has a keyboard problem, the System Test may not be run. In this situation:

- If the message {NO KEY!} appears, refer to No Key Entry, paragraph 4-6.
- If the message {KEY STUCK!} appears, refer to Key Stuck, paragraph 4-13.
- If a Service ROM test other than the System Test is run, look up the key entered in table 8-1, then refer to paragraph 4-10.
- If only the message {RETURN TO BASIC SYSTEM} appears, refer to paragraph 4-11 if the character following the message is one of the first 32 characters listed in table 4-3; otherwise, refer to paragraph 4-10.
- If there is no response to pressing any key (that is, no test is run and no message appears), replace the keyboard controller.

---

*Throughout the rest of this manual, this message is referred to simply as "the {SERVICE ROM} message."

2-22. If no message appears within 15 seconds after you switch the computer on and the computer does not beep, the computer is not turning on properly; refer to paragraph 2-26.

2-23. If no message appears but the computer beeps once, watch the display while you switch the computer off and immediately on again. (This shortens the time required for the CRT to warm up.) If no message appears, replce the CPU. If still no message appears, the computer is not turning on properly; refer to paragraph 2-26.

2-24. If the {SERVICE ROM} message does not appear on either the display or the printer but a {CPU BAD!}, {RAM CONTROL BAD!}, {RAM n BAD!}, or {ROM n BAD!} message appears, replace the indicated IC. (Refer to table 2-6 for the reference designation of the IC identified by a Service ROM message.)

2-25. If the {SERVICE ROM} message does not appear on either the display or the printer but the message {CPU BAD! N OR RAM BAD!} appears, perform the following steps until the {SERVICE ROM} message appears:

a. If the character following the message is listed in table 2-1, replace the indicated RAM IC. Otherwise, look up the character in appendix C of the HP-85 Owner's Manual and Programming Guide in the table under HP-85 Character and Key Codes. The binary code corresponding to the character shown indicates which RAM IC is bad: the leftmost bit in the code represents RAM 7; the rightmost bit represents RAM 0. A 1 in a bit position indicates that the corresponding RAM IC is probably bad; a 0 in a bit position indicates that the corresponding RAM IC is probably OK. If the character following the message is underlined, RAM 7--as well as the RAM ICs indicated by the binary code in the table--is probably bad.

b. Check the power supply lines at the pins of the indicated RAM IC. (To determine the pin number for each line, see figure 2-9. Table 2-2 shows the acceptable values for the power supply lines.) If any line is bad, remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

c. Replace the RAM controller.

d. Replace the CPU.

e. Remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

Table 2-1. ICs Indicated by {CPU BAD! N OR RAM BAD!} Message

CHARACTER	RAM	REFERENCE DESIGNATION
⌂	0	U9
Ç	1	U10
α	2	U11
Δ	3	U12
Θ	4	U13
(blank)	5	U14
Φ	6	U15
Ω	7	U16

2-26. NO TURN-ON

2-27. If the computer does not beep and no messages appear when the computer is switched on with the Service ROM installed, the computer is not "turning on" properly. This condition could be caused by any of the following:

- The power supply, PWO, or clock circuitry is not operating properly.
- An output of one of these three circuits is being brought low by a failure on another assembly.
- The CPU is bad.
- One of the bus lines or control lines, which are generated by the CPU, is being brought low by a failure on another assembly.
- ROM 0 is bad. This IC is necessary for turn-on.
- The RAM controller or any of the RAM ICs is bad. A portion of RAM is used by the Service ROM.
- The I/O buffer is bad. This IC is necessary to interface between the Service ROM and the CPU.
- One of the power supply, PWO, clock, bus, or control lines to an IC is open.
- The connector on the I/O PCA is bad.
- The connection between the I/O PCA and the logic PCA is bad.
- The Service ROM itself is bad.

2-28. To isolate a no turn-on condition to a socketed IC or an assembly, perform the following steps until the computer turns on:

a. Check the power supply lines at the ribbon cable connectors on the printer PCA. Refer to table 2-2 for the test point and acceptable range for each supply line. If any line is out of range, refer to table 2-3.

b. Check the PWO line at pin 12 of J2 on the CRT PCA. Monitor the signal with an oscilloscope as you switch the power on. PWO should reach at least 4.4 Vdc a fraction of a second after you switch the power on, but not instantly. If PWO is bad, refer to paragraph 2-29.

c. Check the clock lines at the ribbon cable connectors on the CRT PCA. Refer to table 2-2 for the clock test points; they should look like the waveform shown in figure 2-7. If any clock line is bad, refer to paragraph 2-31.

d. Check the power supply, PWO, and clock lines at the socket of the CPU. (See figure 2-9 for the pin number for each line.) If any line is bad, remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

e. Replace the CPU.

f. Check the control and bus lines at the pins of the CPU with an oscilloscope. (See figure 2-9 for the pin number for each line.) Each line should be toggling between 0V and 6V. Since these lines are asynchronous (their waveforms do not have a period), with an ordinary oscilloscope you can verify only that they are toggling. If any line is bad, refer to paragraph 2-33.

g. Check the power supply, PWO, clock, control, and bus lines at the sockets of ROM 0 (U4), the RAM controller (U8), the RAM ICs (U9 through U16), and the I/O buffer (U1). (See figure 2-9 for the pin numbers for each line.) If any line is bad, remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

h. Replace (one at a time) ROM 0, the RAM controller, then each of the RAM ICs.

i. Replace the I/O buffer.

j. Check continuity between the pins under the ribbon cable on the logic PCA and those on the I/O PCA. Replace the cable(s) or the printed-circuit assembly that has the bad connector.

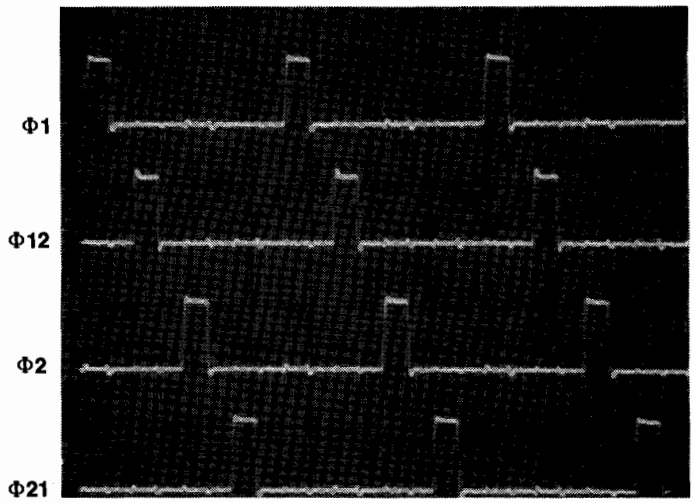
> CAUTION
>
> Do not install two Service ROMs (or two of any other plug-in ROM) in the computer at the same time. If this is done, the plug-in ROMs could be damaged.

k. Try a different Service ROM.

Table 2-2. Power Supply, PWO, and Clock Test Points

LINES	SOURCE	CHECK		ACCEPTABLE
		SIGNAL	PIN	
Power supply	Printer PCA	+12	J1-16,17	11.4V to 12.6V
		+6	J2-6	5.70V to 6.30V
		+5	J2-12	4.75V to 5.25V
		-12	J2-8	-10.8V to -13.2V
		-5	J2-4	-4.75V to -5.25V
PWO	CRT PCA	PWO	J2-12	At least 4.4 Vdc.*
Clocks	CRT PCA	Ø1	J2-16	See figure 2-7.
		Ø12	J2-20	
		Ø2	J1-19	
		Ø21	J1-17	

*Monitor the PWO signal with an oscilloscope as you switch the power on. PWO should reach at least 4.4 Vdc a fraction of a second after you switch the power on--but not instantly.



Time Base: 0.5 usec/div

Vertical Gain: 10V/div

Figure 2-7. Clock Waveforms

Table 2-3. Bad Power Supply Troubleshooting

STEP	ACTION	DIAGNOSIS/REPAIR	
		SUPPLIES OK	SUPPLIES BAD
1	Check fuse; replace if blown.		
2	Disconnect printer PCA from logic PCA. Check supplies.	Reconnect printer PCA to logic PCA and proceed with step 4.	Proceed with step 3.
3	Remove printer controller. Check supplies.	Install new controller in original printer PCA and reconnect original printer PCA to logic PCA.	Return original controller to original printer PCA, and install new printer PCA in computer. Check fuse and replace if blown.
4	Substitute new CRT assembly for original using extender cables. Check supplies.	Proceed with step 5.	Reconnect original CRT assembly to logic PCA and proceed with step 7.
5	Remove original CRT assembly and connect to logic PCA using extender cables.		
	Note: Do step 6 for the CRT controller followed, one at a time, by each of the CRT RAM ICs.		
6	Remove IC. Check supplies.	Install new IC in original CRT assembly, and install original assembly in computer.	Return original IC to original assembly and repeat step 5 for next IC. If all ICs checked, install new CRT assembly in computer.

Table 2-3. Bad Power Supply Troubleshooting (Continued)

STEP	ACTION	DIAGNOSIS/REPAIR	
		SUPPLIES OK	SUPPLIES BAD
7	Substitute new tape drive assembly for original using extender cables. Check supplies.	Proceed with step 8.	Reconnect original tape drive PCA to logic PCA and proceed with step 10.
8	Remove original tape drive assembly, and connect to logic PCA using extender cables.		
9	Remove original tape controller. Check supplies.	Install new IC in original assembly and install original assembly in computer.	Return original IC to original assembly and proceed with step 10.
	Note: Do step 10 for each of the ICs on the logic PCA, one at a time.		
10	Remove IC. Check supplies.	Install new IC on logic PCA; return any ICs previously removed from logic PCA.	Repeat step 10 for another IC. If all ICs removed, return to original logic PCA and install new logic PCA in computer.

2-29. PWO Failure Isolation

> Note: If the PWO circuitry on the CRT PCA is bad and you are doing assembly-level repair, replace the CRT assembly.

2-30. PWO should reach at least 4.4 Vdc a fraction of a second after you switch the power on, but not instantly.

- If PWO reaches at least 4.4 Vdc instantly, the PWO circuitry on the CRT PCA is bad.
- If PWO never reaches 4.4 Vdc, either the PWO circuitry on the CRT PCA is bad, an IC somewhere in the system is holding the line low, or the line is shorted somewhere in the system. To isolate the failure, refer to table 2-4.

2-31. Clock Failure Isolation

> Note: If the clock circuitry on the CRT PCA is bad, replace the CRT assembly.

2-32. All four clock waveforms should be pulse trains swinging between 0V and at least 10V, as shown in figure 2-7. A clock signal is bad if it does not reach 10V, its duty cycle is incorrect, or it is always constant.

- If the duty cycle of a clock is bad, the clock circuitry on the CRT PCA is bad.
- If a clock signal does not reach 10V or is always constant, either the clock circuitry on the CRT PCA is bad, an IC somewhere in the system is holding the line low or constant, or the line is shorted somewhere in the system. To isolate the failure, refer to table 2-4. Table 1-4 indicates the clock signals that are required by each IC.

Table 2-4. PWO or Clock Failure Isolation

STEP	ACTION	DIAGNOSIS/REPAIR	
		LINE OK	LINE BAD
1	Substitute new CRT assembly for original using extender cables. Check line.	Proceed with step 2.	Proceed with step 3.
2	Remove CRT controller from original assembly, and reconnect original assembly. Check line.	Install new CRT controller in original assembly, and install original assembly in computer.	Return original CRT controller to original assembly, and install new assembly in computer.
3	For PWO, check continuity at XU17 (on logic PCA) between pin 5 and each of the other pins except 7 and 8. If continuity bad, replace U17 or replace logic PCA.		
	Note: Do step 4 for each of the ICs on the logic PCA, one at a time.		
4	Remove IC. Check line.	Replace IC with new one, and return all ICs previously removed from logic PCA.	Return original IC to logic PCA and repeat step 4 for next IC. If all ICs checked, proceed with step 5.
5	Substitute new printer PCA for original using extender cables. Check line.	Proceed with step 6.	Proceed with step 7.

Table 2-4. PWO or Clock Failure Isolation (Continued)

STEP	ACTION	DIAGNOSIS/REPAIR	
		LINE OK	LINE BAD
6	Remove printer controller from original assembly, and reconnect assembly. Check line.	Install new printer controller in original printer PCA, and install original printer PCA in computer.	Return original printer controller to original printer PCA, and install new printer PCA in computer.
7	Substitute new tape drive assembly for original using extender cables. Check line.	Proceed with step 8.	Proceed with step 9.
8	Remove tape controller from original assembly, and reconnect original assembly. Check line.	Install new tape controller in original assembly and install original assembly in computer.	Return original tape controller to original assembly, and install new assembly in computer.
9	Substitute new logic PCA for original by connecting original CRT PCA and printer PCA to new logic PCA using extender cables. Check line.	Install new logic PCA in computer.	

2-33. Control and Bus Line Failure Isolation

2-34. The three control lines ($\overline{LMA}$, $\overline{RD}$, and $\overline{WR}$) and the eight bus lines (B0 through B7) should appear toggling between 0V and 6V. Since these lines are asynchronous (their waveforms do not have a period), with an ordinary oscilloscope you can verify only that they are toggling.

2-35. If the CPU is good and one of the bus or control lines is not toggling, either an IC is holding the line constant or the line is shorted somewhere in the system. To isolate the failure, refer to table 2-5.

Table 2-5. Control or Bus Line Failure Isolation

STEP	ACTION	DIAGNOSIS/REPAIR	
		LINE OK	LINE BAD
	Note: Do step 1 for each IC on the logic PCA, one at a time, checking the line after each removal.		
1	Remove IC. Check line.	Replace IC with new one, and return all ICs previously removed.	Proceed with step 2.
2	Substitute new CRT assembly for original using extender cables. Check line.	Proceed with step 3.	Proceed with step 4.
3	Remove CRT controller from original assembly, and reconnect original assembly. Check line.	Install new CRT controller in original assembly, and install original assembly in computer.	Return original CRT controller to original assembly, and install new assembly in computer.
4	Substitute new printer PCA for original using extender cables. Check line.	Proceed with step 5.	Proceed with step 6.

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Table 2-5. Control or Bus Line Failure Isolation (Continued)

STEP	ACTION	DIAGNOSIS/REPAIR	
		LINE OK	LINE BAD
5	Remove printer controller from printer PCA, and reconnect original assembly. Check line.	Install new printer controller in original printer PCA, and install original printer PCA in computer.	Return original printer controller to original printer PCA, and install new printer PCA in computer.
6	Substitute new tape drive assembly for original using extender cables. Check line.	Proceed with step 7.	Proceed with step 9.
7	Remove original tape drive assembly, and connect to logic PCA using extender cables.		
8	Remove tape controller from original assembly, and reconnect original assembly. Check line.	Install new tape controller in original assembly, and install original assembly in computer.	Return original tape controller to original assembly, and install new assembly in computer.
9	Substitute new logic PCA for original by connecting original CRT PCA and printer PCA to new logic PCA using extender cables. Check line.	Install new logic PCA in computer.	

2-36. SYSTEM TEST DIAGNOSIS

2-37. If the Service ROM finds a bad IC during the System Test, it displays and prints (if possible) a message identifying the IC, then it skips to the next test. To determine the reference designation of an IC identified in a Service ROM message, refer to table 2-6.

> Note: The Service ROM may indicate that more than one IC is bad. If so, replace the indicated ICs one at a time, running the System Test after each replacement, until the test can be run successfully.

2-38. If the message still appears after the IC is replaced, check the power supply, PWO, clock, control, and bus lines at the indicated IC. (See figure 2-8 or 2-9 for the pin number for each line. The acceptable values for the power supply, PWO, and clock lines are listed in table 2-2.) If any line is bad, remove all the socketed ICs from the printed-circuit assembly, install them on a new printed-circuit board, and install the new printed-circuit assembly in the computer.

2-39. If the computer appears to "die" during any test, refer to table 2-6 and look up the last IC for which a message appeared, then replace the next IC listed. The RAM ICs and CRT RAM ICs are each tested simultaneously as a group. Therefore, if the computer goes dead during their testing, try replacing each IC in the group, one at a time, until the computer no longer goes dead during the test.

2-40. For assistance in troubleshooting problems that the steps above do not correct, refer to paragraphs 2-41 through 2-59.

2-41. RAM Test Diagnosis

2-42. If the message {RAM n BAD!} still appears after you replace the indicated RAM IC, replace the RAM controller.

2-43. ROM Test Diagnosis

2-44. If the {ROM n BAD!} message is followed by the letter {C}, replace the following ICs on at a time, running the System Test after each replacment, until the test can be run successfully:

a. The ROM indicated in the message.

b. The next numbered ROM or (for a {ROM 3 BAD!} message) the RAM controller. For example, if replacing ROM 1 following a {ROM 1 BAD!} message results in the same message, replace ROM 2. Similarly, if replacing ROM 3 following a {ROM 3 BAD!} message results in the same message, replace the RAM controller.

2-45. Beeper Test Diagnosis

2-46. If the beeper is not operating properly, try replacing the keyboard controller. If this does not result in proper beeper operation, replace the speaker.

2-47. CRT Test Diagnosis

2-48. If the message {CRT RAM n BAD!} still appears after you replace the indicated IC, replace the CRT controller.

2-49. If any of the following occur, replace the CRT assembly.

- The CRT screen does not go blank at step d of the CRT Test.
- The CRT does not go entirely white at step e of the CRT Test.
- CRT test pattern 3 is not displayed as shown in figure 8-4.
- The lines in test pattern 3 are not straight. (Refer to paragraph 5-3.)

2-50. If any of the following occur (and the lines in CRT test pattern 3 are straight), make adjustments to the CRT assembly as described in section V:

- CRT test pattern 3 is skewed.
- Test pattern 3 is incorrectly centered horizontally or vertically.
- The height or width of test pattern 3 is incorrect.
- CRT test pattern 4 is not correctly focused.

2-51. If any character in CRT test pattern 5 is not displayed as shown in figure 8-5, replace the CRT controller.

2-52. Printer Test Diagnosis

2-53. Refer to section VI if any of the following occur:

- The test printout does not match the one shown in figure 8-6.
- The message {PRINTER OUT OF PAPER!} appears (and paper is in the printer).
- The printer is otherwise not operating properly.

2-54. Abbreviated Tape Test and Tape Write-Protect Test Diagnosis

2-55. If any of the following messages appear, refer to section VII.

- {END OF TAPE!}
- {TAPE ERROR!}
- {TAPE ERROR! GAP}
- {TAPE ERROR! HOLE}
- {TAPE ERROR! READ}
- {TAPE ERROR! SPEED}
- {TAPE ERROR! WRITE}
- {TAPE NOT REMOVED!}
- {TAPE OUT!}
- {TAPE PROTECTED!}
- {TAPE STALLED!}
- {TAPE UNPROTECTED!}

2-56. Timer Test Diagnosis

2-57. If the message {TIMER BAD!} appears, replace the keyboard controller.

2-58. Keyboard Test Diagnosis

2-59. If one of the following messages appears, refer to section IV:

- {NO KEY!}
- {KEY BAD!}
- {KEY STUCK!}

Table 2-6. Service ROM IC Messages

MESSAGE	REFERENCE DESIGNATION	PRINTED-CIRCUIT ASSEMBLY
{CPU BAD!}	U2	logic
{RAM CONTROL BAD!}	U8	logic
{RAM 0 BAD!}	U9	logic
{RAM 1 BAD!}	U10	logic
{RAM 2 BAD!}	U11	logic
{RAM 3 BAD!}	U12	logic
{RAM 4 BAD!}	U13	logic
{RAM 5 BAD!}	U14	logic
{RAM 6 BAD!}	U15	logic
{RAM 7 BAD!}	U16	logic
{ROM 0 BAD!}	U4	logic
{ROM 1 BAD!}	U5	logic
{ROM 2 BAD!}	U6	logic
{ROM 3 BAD!}	U7	logic
{CRT CONTROL BAD!}	U12	CRT
{CRT RAM 0 BAD!}	U13	CRT
{CRT RAM 1 BAD!}	U14	CRT
{CRT RAM 2 BAD!}	U15	CRT
{CRT RAM 3 BAD!}	U16	CRT

Table 2-6. Service ROM IC Messages (Continued)

MESSAGE	REFERENCE DESIGNATION	PRINTED-CIRCUIT ASSEMBLY
{PRT CONTROL BAD!}	U5	printer
{TAPE CONTROL BAD!}	U1	tape drive
{TIMER BAD!}	U3	logic
{KEY CONTROL BAD!}	U3	logic

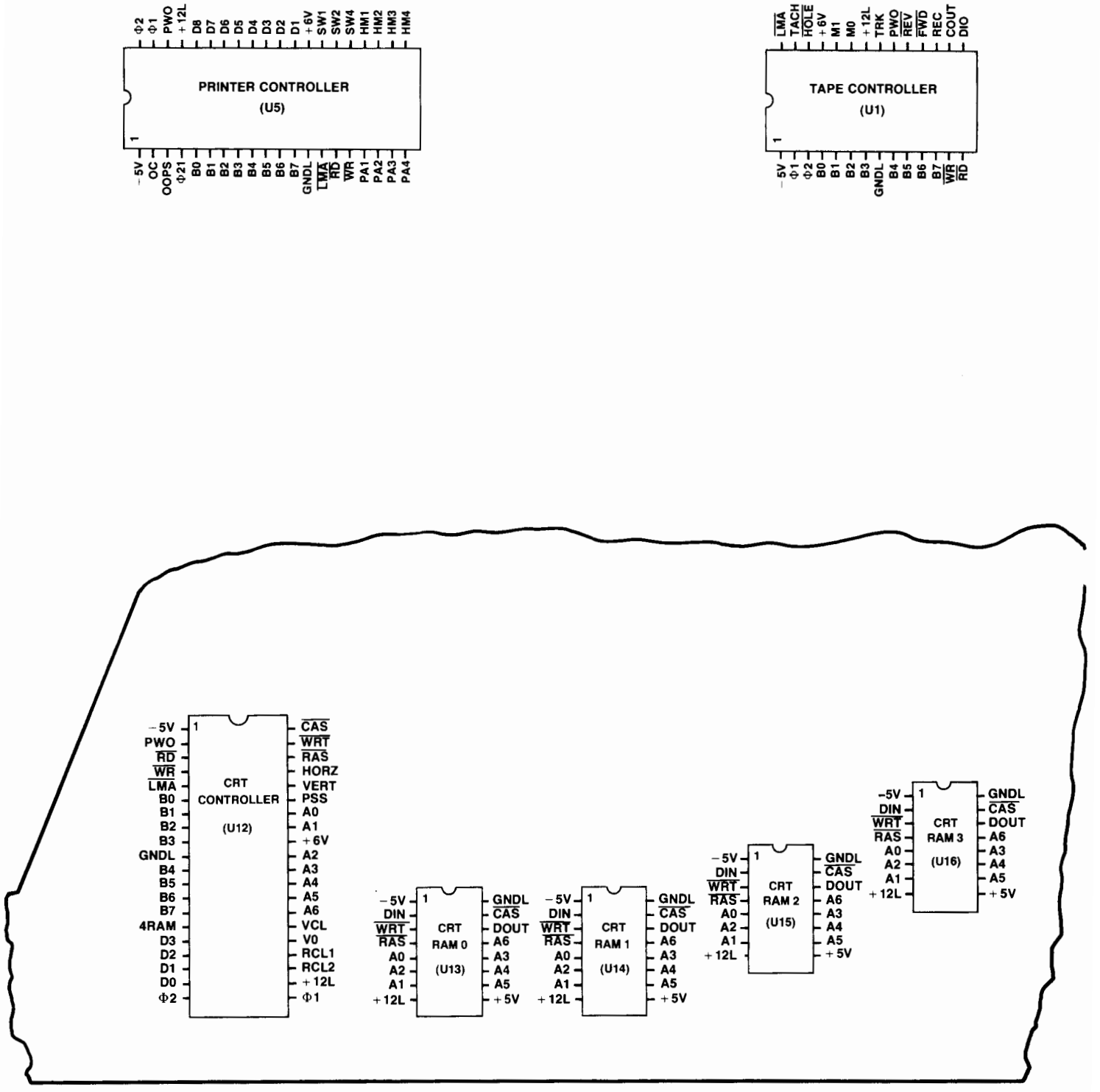


Figure 2-8. Socketed IC Location Diagram for Printer, CRT, and Tape Drive PCAs

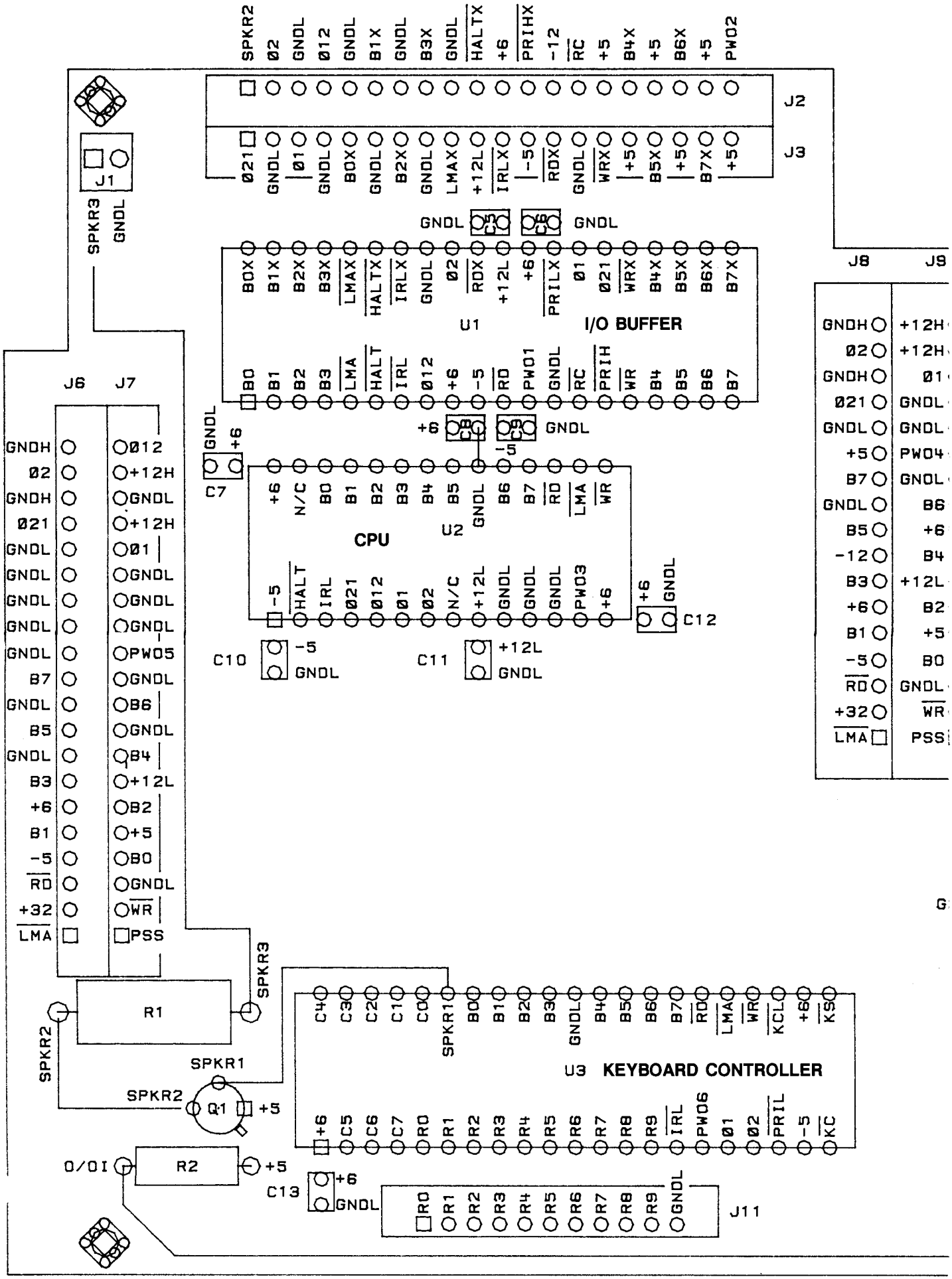
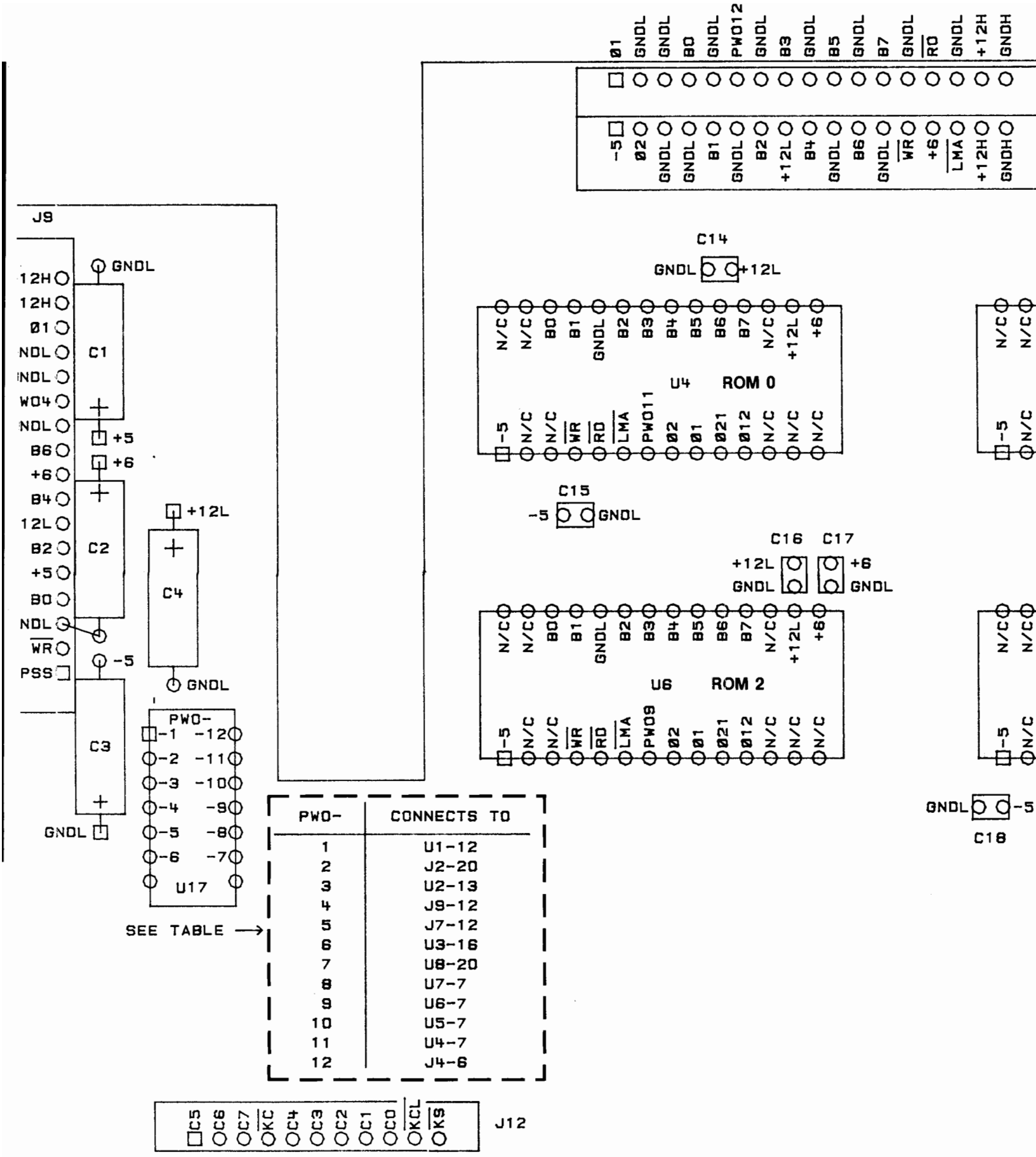
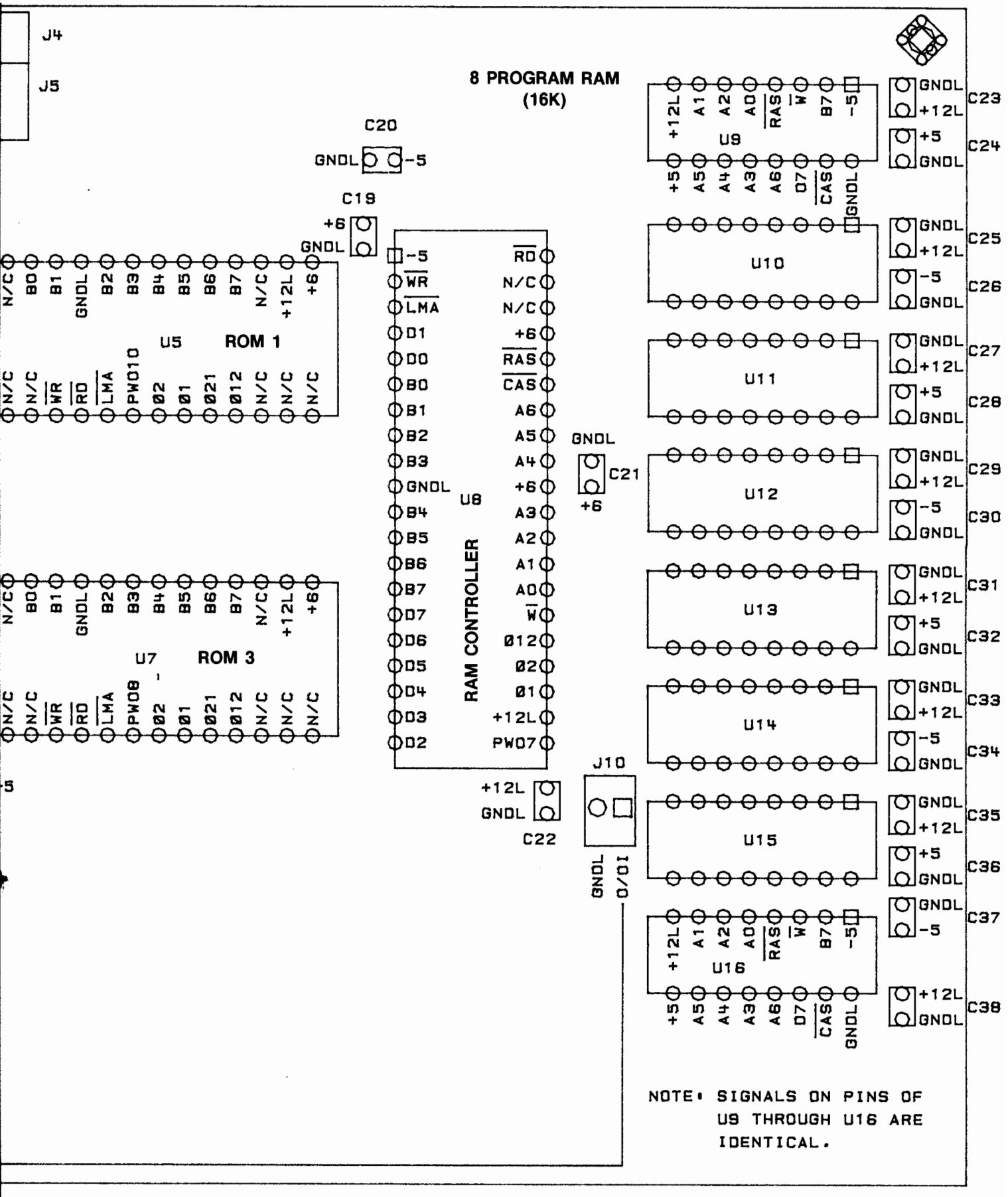


Figure 2-9. Logic PCA Component Location Diagram



PWO-	CONNECTS TO
1	U1-12
2	J2-20
3	U2-13
4	J9-12
5	J7-12
6	U3-16
7	U8-20
8	U7-7
9	U6-7
10	U5-7
11	U4-7
12	J4-6



NOTE: SIGNALS ON PINS OF U9 THROUGH U16 ARE IDENTICAL.

Disassembly and Reassembly

3-1. INTRODUCTION

3-2. This section describes--both in words and in pictures--how to access, remove, and replace the major assemblies of an HP-85 and the parts of the top and bottom cases. These assemblies are identified in figure 1-1--which shows the inside of an HP-85 with the top case removed--and in the exploded view in the Replaceable Parts section. The exploded view also identifies the parts of the top and bottom cases.

3-3. SAFETY CONSIDERATIONS

WARNING

Lethal voltages are exposed when the top case of the HP-85 is removed. At certain points these voltages are present not only while power is on, but also for up to several days after power has been turned off. Electrical and mechanical failures may cause dangerous voltages to be present at points that normally are safe. For your own safety, read and heed Safety Considerations in section 1.

Removing the top case can be dangerous if it is done while the power is on or if the brightness control has been disconnected or broken. The danger lies in accidentally touching a high voltage area on the CRT PCA while lifting the top case off of the bottom case. This area is shown shaded in figure 3-1.

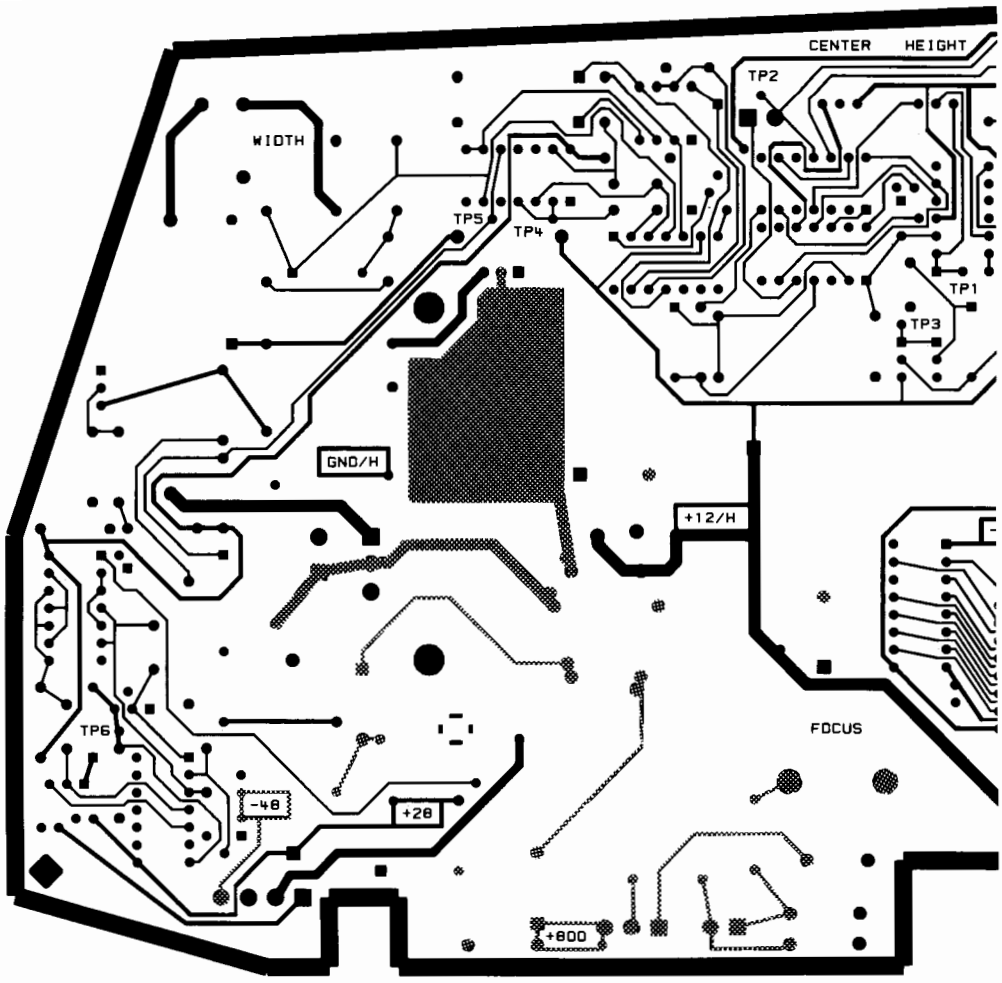


Figure 3-1. High-Voltage Area on CRT PCA

3-4. REMOVING AND TIGHTENING SCREWS

3-5. The main tools you will need to remove and replace the major HP-85 assemblies are two Pozidriv screwdrivers, #1 and #2. All screws used in the HP-85 have Pozidriv heads, not Phillips heads. Although Phillips screwdrivers will work, they can easily strip the screw heads. Because all the screws have Pozidriv heads, Phillips screwdrivers can easily "cam out" of the heads. Pozidrive screwdrivers require much less effort to remove and insert the screws.

3-6. Due to the nature of the plastic used in HP-85 parts--in particular, parts of the tape drive assembly--the threads in screw holes can easily be stripped if you overtighten the screws. All screws should be tightened only until they feel snug; if you strip the threads by overtightening the screws, you will have to replace the part. Also, try to engage screws--especially small screws--in the original threads; if a screw cuts new threads, they can easily be stripped.

3-7. CABLE INTERCONNECTIONS

3-8. The HP-85 assemblies are electrically connected with various lengths of ribbon cable. All connections are made with two cables between the logic PCA and the various other printed-circuit asemblies. Three widths of cables are used in the HP-85: 11-conductor, 17-conductor, and 20-conductor. Table 3-1 shows the widths and lengths of all ribbon cables, the assemblies they connect to the logic PCA, and their reference designations.

Table 3-1. Interconnecting Cables

ASSEMBLY CONNECTED	CONDUCTORS	LENGTH	REFERENCE DESIGNATION
Keyboard	11	5.7 cm (2.25 in.)	W9, 10
CRT	20	5.0 cm (1.95 in.)	W1
CRT	20	5.5 cm (2.15 in.)	W2
Printer	17	4.2 cm (1.65 in.)	W5
Printer	17	4.7 cm (1.85 in.)	W6
Tape	17	9.7 cm (3.80 in.)	W7
Tape	17	10.7 cm (4.20 in.)	W8
I/O PCA	20	44.5 cm (17.5 in.)	W3, 4

3-9. Note that the cables in each pair between the logic PCA and the CRT, printer, and tape PCA's are not the same length. The shorter cable in each of these pairs should be connected below the other cable. Also, one of the cables to the I/O PCA (W4) has additional insulation at one end to protect it from being damaged by the pins on the back of the I/O PCA. This cable should run beneath the other cable, and the end with the additional insulation should be connected to the I/O PCA.

3-10. The ribbon cables can be both connected and disconnected with your fingers; no special tool is needed. However, if you insert a cable into its connector without properly aligning it first, it will not make the proper electrical connection. Furthermore, it will be very difficult to remove it, and doing so may damage the cable.

3-11. Connecting a Cable

> Note: When the contacts of a cable are split, have come loose from their backing, or are otherwise deteriorated, use a new cable when reassembling the computer.

3-12. To connect a cable properly:

> CAUTION
> Ensure that the cables are properly aligned when they are installed in the connectors. If a cable is not properly aligned, the entire cable could be shorted, causing equipment damage.

a. Carefully align the contacts of the cable with the contacts of its connector, as shown in figure 3-2. The cable contacts must face the connector contacts.

b. Press the end of the cable into the connector gently but firmly.

c. Make sure that the cable contacts are properly aligned with the connector contacts and that neither edge of the cable is folded over. Figure 3-3 shows a cable connected properly. Figure 3-4 shows a cable connected misaligned, and figure 3-5 shows a cable connected with an edge folded over.

3-13. Removing a Trapped Cable

3-14. To remove an improperly connected cable from its connector:

a. Insert a spare cable of the same width into the connector between the trapped cable and the connector contacts. (See figure 3-6.) The contacts of the spare cable should face the contacts of the trapped cable, not the contacts of the connector.

b. Pull the two cables together out of the connector.

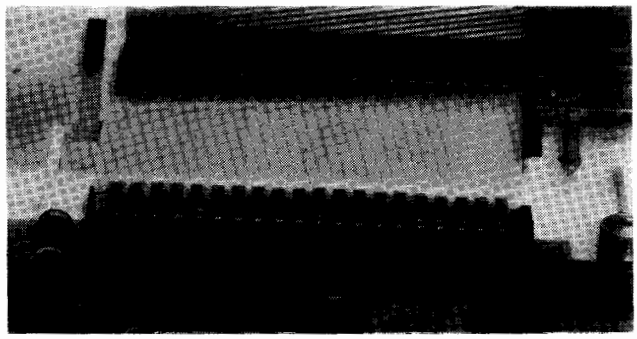


Figure 3-2. Aligning Cable Contacts

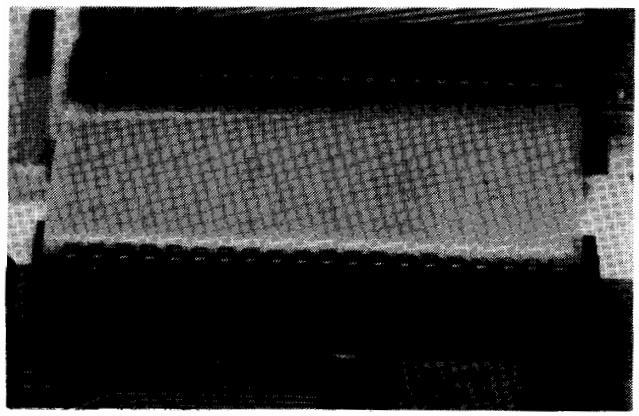


Figure 3-3. Cable Connected Properly

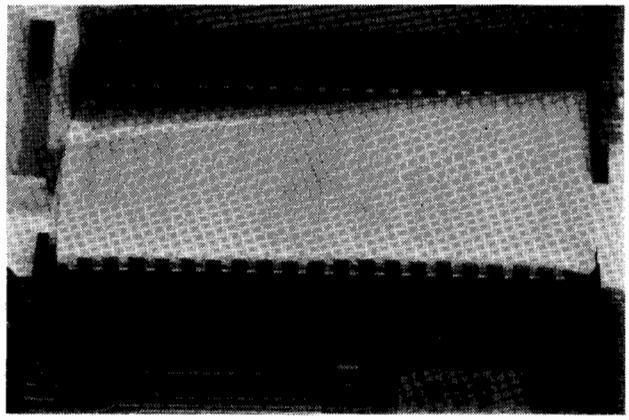


Figure 3-4. Cable Connected Misaligned

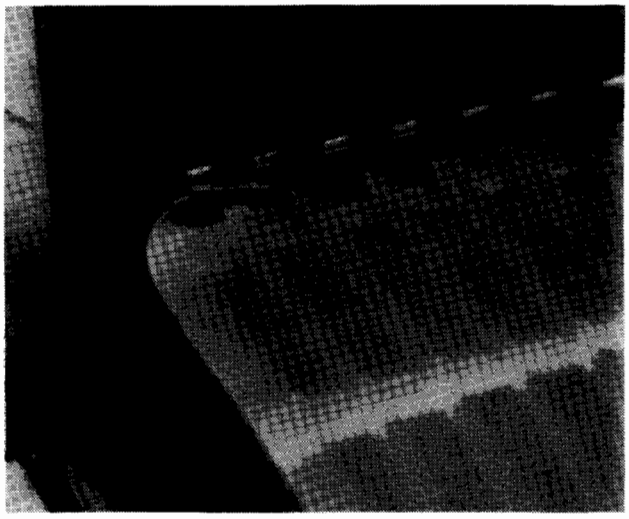


Figure 3-5. Cable Connected With Edge Folded Over

Figure 3-6. Removing Trapped Cable

3-15. REPLACING ASSEMBLIES AND CASE PARTS

3-16. The HP-85 is designed so that nearly every assembly can be accessed simply by removing the top case. (The only exception is that the keyboard assembly must be tilted forward to access the logic PCA.) The disassembly and reassembly procedures are grouped as follows:

1. Separating the top case from the bottom case.
2. Replacing the keyboard assembly.
3. Replacing the logic PCA.
4. Replacing the CRT assembly.
5. Replacing the printer assembly.
6. Replacing the tape drive assembly.
7. Replacing the back panel assembly.
8. Replacing parts of the top case assembly.
9. Replacing parts of the bottom case assembly.
10. Attaching the top case to the bottom case.

> WARNING
>
> Before working on the computer with the top off, remove objects from your shirt pocket that could fall out and strike the CRT. The CRT can implode if it is dropped, hit by a tool or other object, or subjected to stress exceeding the glass strength.

> CAUTION
>
> Avoid touching the metallized inside surface of the top and bottom cases with your fingers. Do not allow substances such as solder flux to touch the metallized surfaces. Contamination of these surfaces could degrade the EMI (electromagnetic interference) characteristics of the computer.

1. SEPARATING THE TOP CASE FROM THE BOTTOM CASE

> CAUTION
>
> If the power is on while the case is removed, the metallized inside surface of the top case could short traces on the CRT PCA. This could blow the fuse and/or damage other components.

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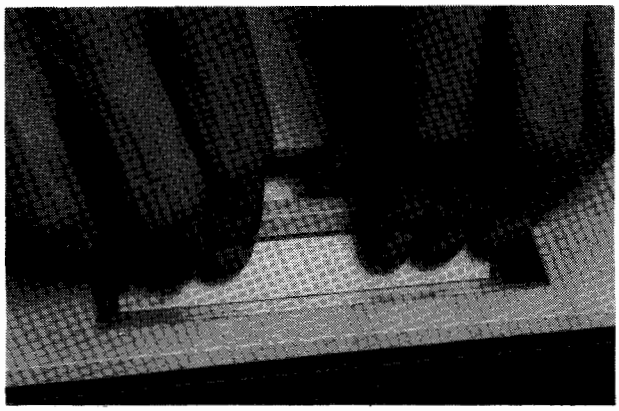
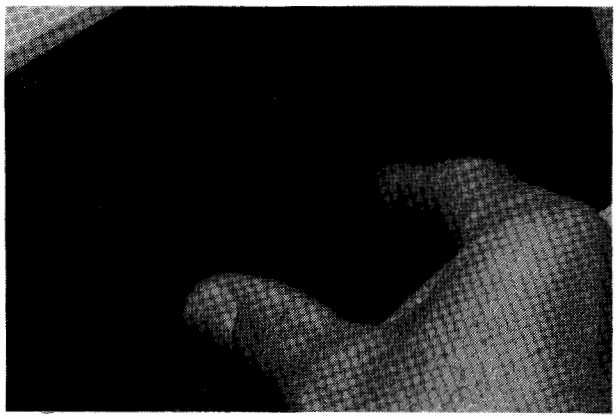
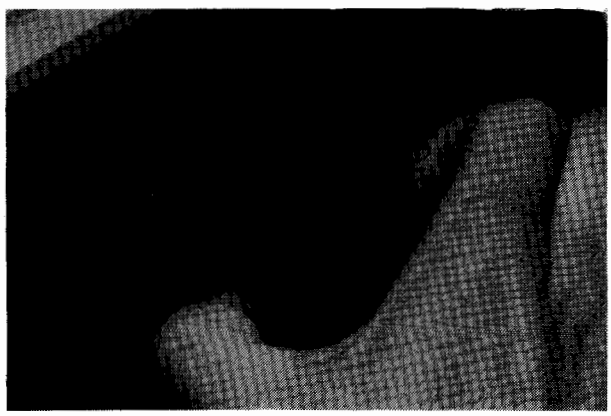
a. Disconnect the power cord from the back panel.

b. Lift out the printer tear bar by pulling up on its upper lip.



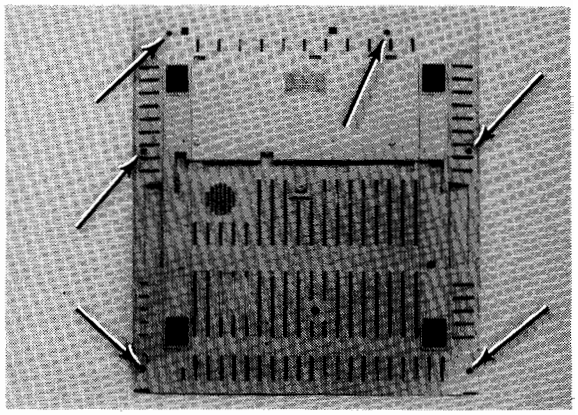
c. Pull out the tape ejector bar. To do so, place your thumb and forefinger on the corners of the bar. Rotate your thumb and forefinger around the ends of the bar while pulling outward. When the bar snaps into its extended position, grasp the ends firmly and pull the bar out.



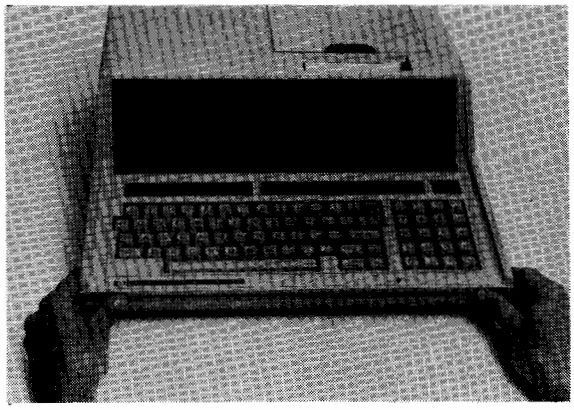


Note: While the next step is performed, the computer will be most stable resting on its back panel with the I/O port covers installed.

d. Loosen the six screws in the bottom case with a #1 Pozidriv screwdriver after tilting the computer onto its back panel.



e. Separate the front of the top case from the front of the bottom case. To do so, rotate the computer back down and place your thumbs on the front edge of the top case. Push upward until the cases separate slightly.

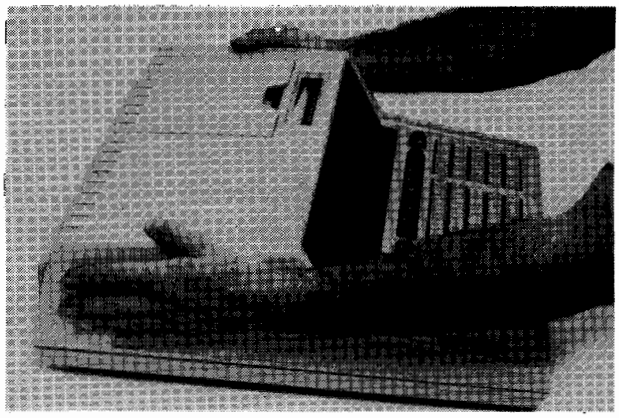


WARNING

In the next step, be careful not to allow the fingers of your left hand to curl under the top case. If they do, they could contact the high-voltage area on the CRT PCA. (This area is shown in figure 3-1.) If the brightness control is disconnected or broken, high voltage may be present there.

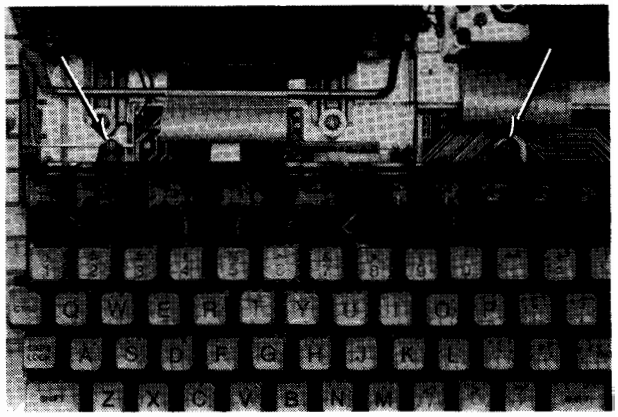
Also, be sure to lift the top case straight up. If you do not, the metallized inside surface of the top case could be scratched, thereby degrading the EMI characteristics, or it could contact the high-voltage area on the CRT PCA.

f. Lift the top case off of the computer. To do so, place your hands on the sides of the computer near the back. Press inward on the sides of the top case and lift it straight up.



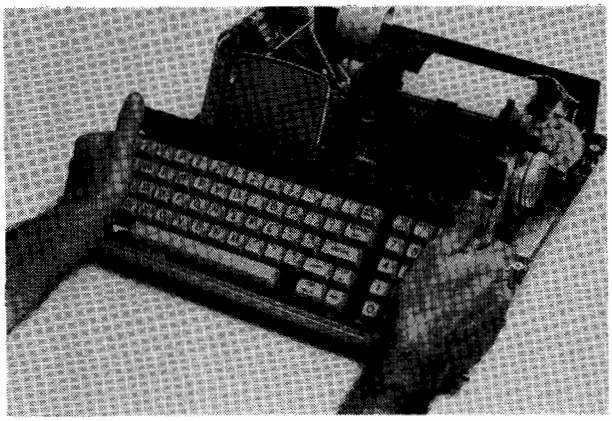
2. REPLACING THE KEYBOARD ASSEMBLY

a. Remove the two screws securing the keyboard to the bottom case with a #1 Pozidriv screwdriver.



b. Rotate the back of the keyboard forward.

c. Lift the keyboard out of the bottom case. To do so, grasp its ends and lift up and slightly forward until the keyboard hinge pins snap out of their retainers in the bottom case. With the keyboard still inclined, lift it straight up until the two cables disconnect from the logic PCA.



d. Disconnect the two cables from the old keyboard assembly, and connect them to the new keyboard assembly.

e. Connect the other ends of the cables to the logic PCA.

f. Snap the keyboard hinge pins into their retainers in the bottom case.

g. Rotate the back of the keyboard down.

h. Insert and tighten the two screws securing the keyboard to the bottom case with a #1 Pozidriv screwdriver.

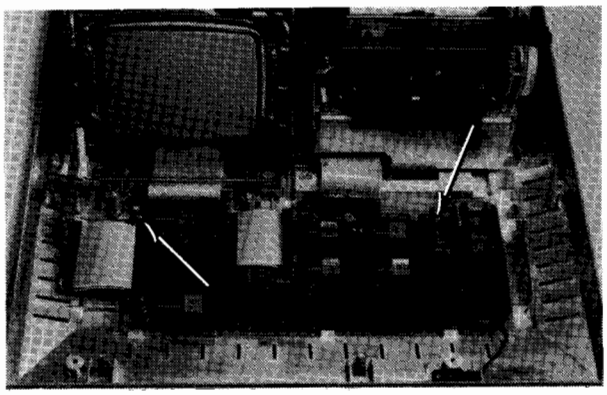
> Note: Be sure to run the System Test (or at least the Keyboard Test) from the Service ROM after installing the top case.

3. REPLACING THE LOGIC PCA

With the keyboard assembly removed (procedure 2):

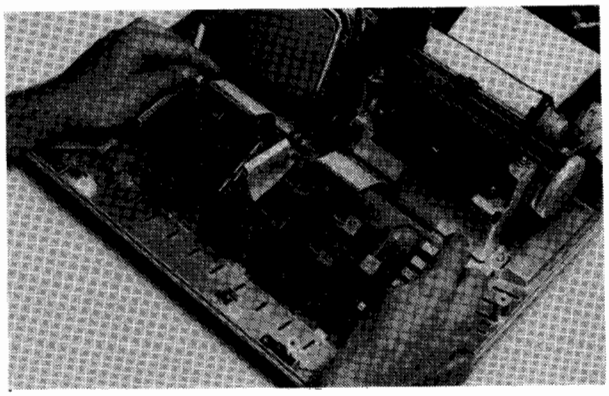
> Note: While disconnecting the cables from the tape drive PCA in step a, be careful to pull the cables straight up, not forward. Pulling the cables forward may disconnect them from the tape drive PCA; if this happens, you will have to remove the tape drive assembly to reconnect them.

a. Disconnect the cables from the logic PCA to the CRT PCA, I/O PCA, printer PCA, and tape drive PCA.



b. Disconnect the two small plugs from the logic PCA. One is at the upper left; the other is at the lower right.

c. Remove the two screws securing the logic PCA to the bottom case using a #1 Pozidriv screwdriver.



d. Lift the logic PCA out by rocking it forward.

e. Make sure the insulator is correctly positioned in the bottom case.

f. Place the new logic PCA in the bottom case. To do so, hook the front edge of the logic PCA under the hooks in the bottom case, then set the back down.

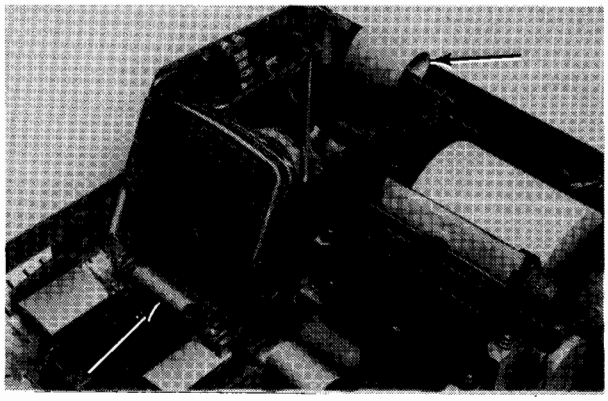
g. Insert and tighten the two screws securing the logic PCA to the bottom case using a #1 Pozidriv screwdriver.

h. Connect the two small plugs to the logic PCA. Be sure that the wires to the speaker pass under the CRT frame. Also, be sure that the plug from the power light is connected so that the wires come out of the plug toward the front of the computer. The power light will not turn on if the plug is connected backwards.

i. Arrange the power light wires down against the logic PCA and the bottom case.

j. Connect to the logic PCA the cables from the CRT PCA, I/O PCA, printer PCA, and tape drive PCA.

k. Arrange the cables to the I/O PCA so that the excess cable length is distributed evenly between the front and the back of the CRT assembly.

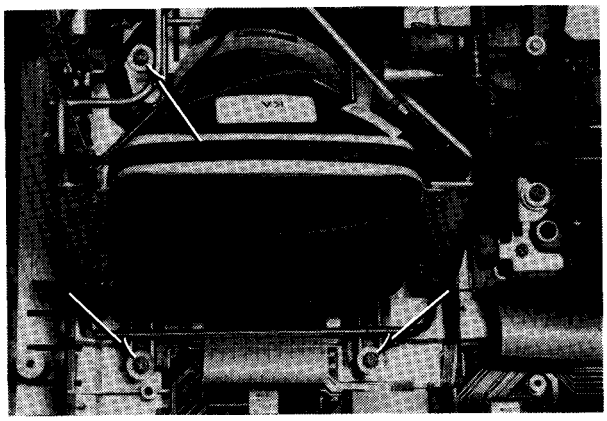


4. REPLACING THE CRT ASSEMBLY

a. Remove the keyboard assembly as described in procedure 2.

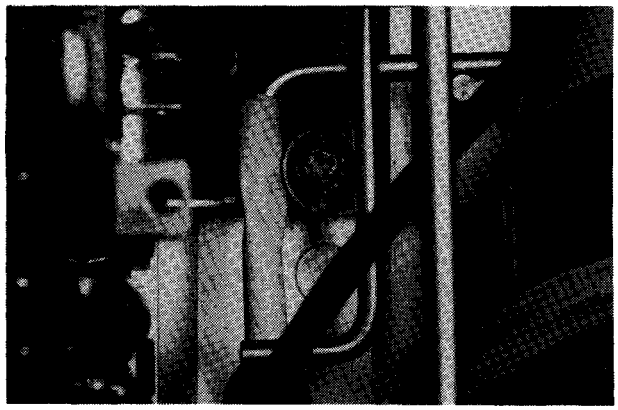
b. Disconnect the pair of cables connecting the CRT PCA to the logic PCA.

c. Remove the two screws and the washers securing the front of the CRT frame to the bottom case using a #2 Pozidriv screwdriver.



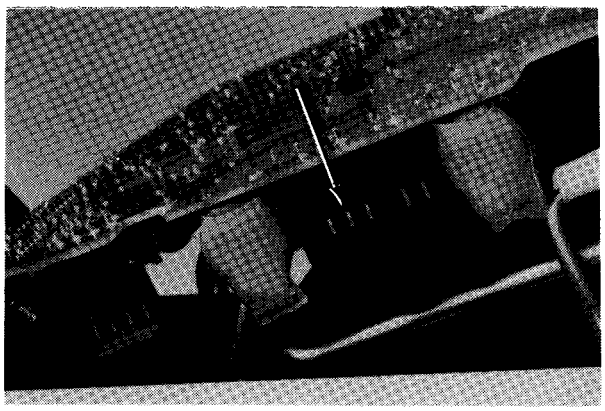
d. Loosen (but do not remove) the screw between the yoke and the CRT PCA that holds the frame against the bottom case.

e. Wiggle the CRT assembly until the frame is no longer held by the washer. You may need to loosen the screw further to do this.



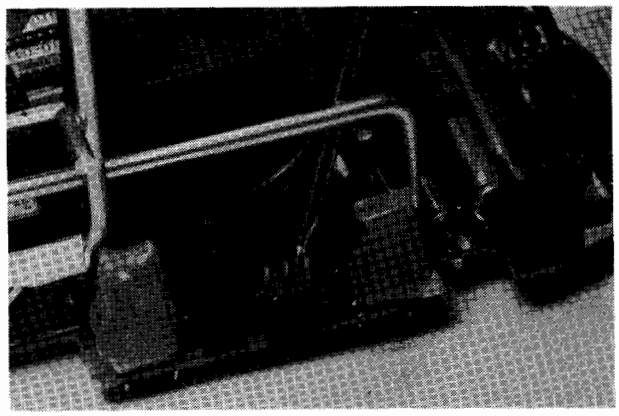
f. Disconnect the brightness control plug from its connector by lifting the CRT assembly up and pulling the plug out from below. This plug is the one with the three wires connected to it.

g. Lift out the CRT assembly.

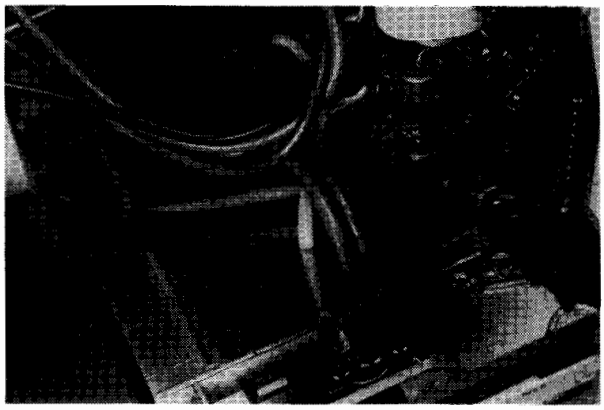


WARNING

If you turn on the computer without the brightness control connected, 800V will remain on pin 3 of the brightness control connector (J6) after the power is turned off. (This pin is the one toward the rear of the computer.) If this happens, discharge the 800V before reconnecting the plug by shorting the pin to the CRT frame with a well-insulated screwdriver.

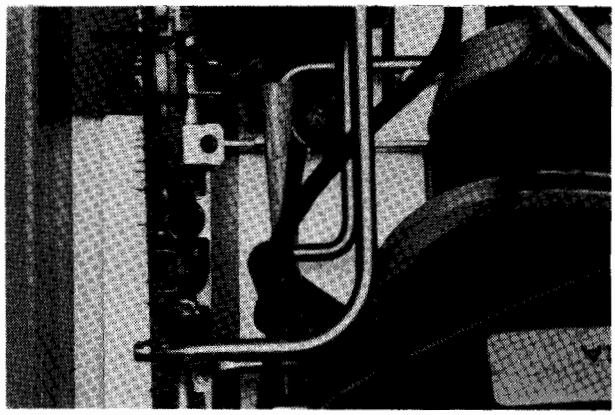


h. Connect the brightness control plug to the new CRT assembly. The three wires from the brightness control should pass over the CRT frame and the four wires to the socket on the CRT, but they should pass under the three wires to the CRT yoke. The plug should be connected so that its wires come up rather than down.



CAUTION

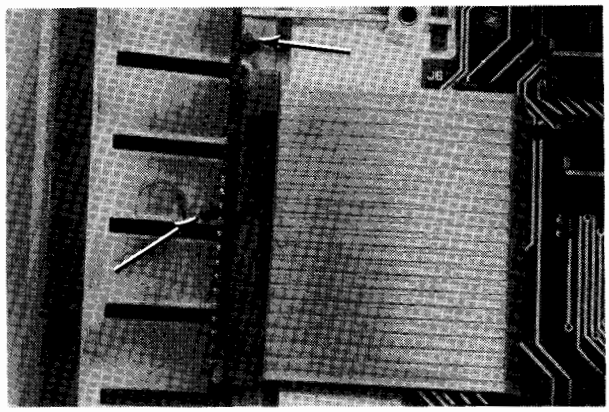
While positioning the CRT assembly in the bottom case, make sure that neither of the two neon bulbs at the lower rear of the CRT PCA are hit by the brightness control or its mounting post. If necessary, the bulbs may be bent to provide clearance.



i. Place the CRT assembly in the bottom case, lift up the washer using a long, flat-blade screwdriver, then wiggle the CRT assembly until its frame is under the washer.

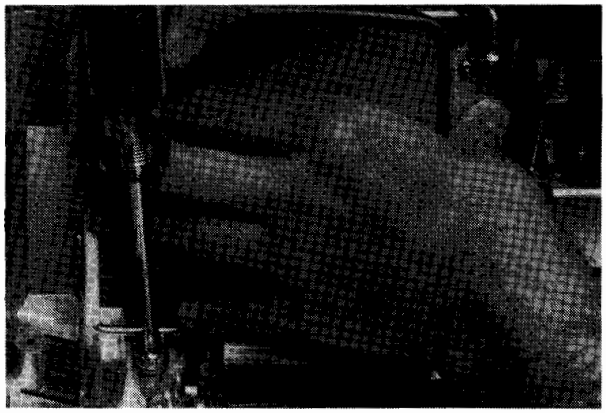
j. Make sure that the cables between the logic PCA and the I/O PCA are arranged so that the excess cable length is distributed between the front and the back of the CRT assembly.

k. Make sure that the front of the CRT PCA is positioned between the two pins on the bottom case.



l. Insert, but do not tighten, the front two screws and washers.

m. Push the CRT assembly back as far as it will go with your fingers on the sides of the CRT frame; do not press on the face of the CRT.



n. Holding the CRT assembly in position, tighten the two screws at the front of the frame.

o. Tighten the third screw securing the CRT frame to the bottom case.

p. Connect the two cables from the CRT PCA to the logic PCA.

5. REPLACING THE PRINTER ASSEMBLY

Note: The printer assembly consists of two separate replaceable assemblies: 1) the printer mechanism, and 2) the printer/power supply (PR/PS) PCA.

a. Remove the keyboard assembly as described in procedure 2.

b. Disconnect the power plug from the upper rear of the printer PCA.

c. Disconnect the pair of cables connecting the tape drive PCA to the logic PCA and the pair of cables connecting the printer PCA to the logic PCA.

d. Remove the two screws toward the rear of the printer that secure it to the bottom case. Use a #2 Pozidriv screwdriver.

e. Remove the two screws securing the tape drive support bracket to the bottom case. Disconnect the ground straps from the back panel and I/O PCA.

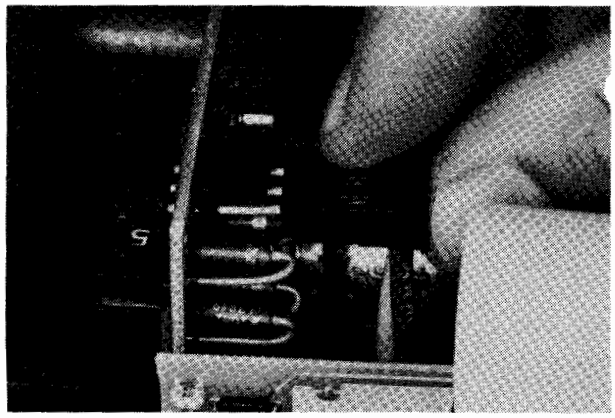
f. Lift the printer assembly, together with the tape drive support bracket and the tape drive assembly, straight up out of the bottom case.

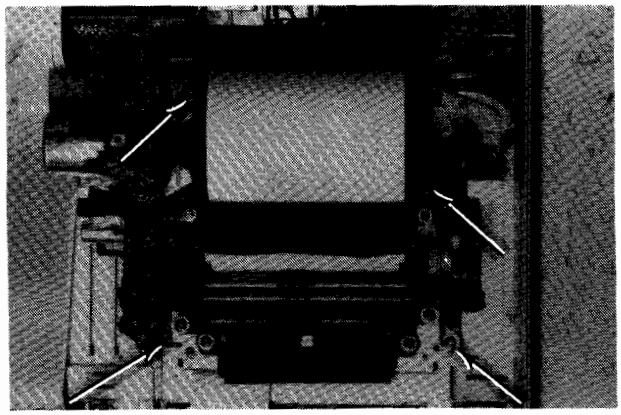
g. Remove the two screws securing the front of the printer to the tape drive support bracket, then separate the printer from the bracket.

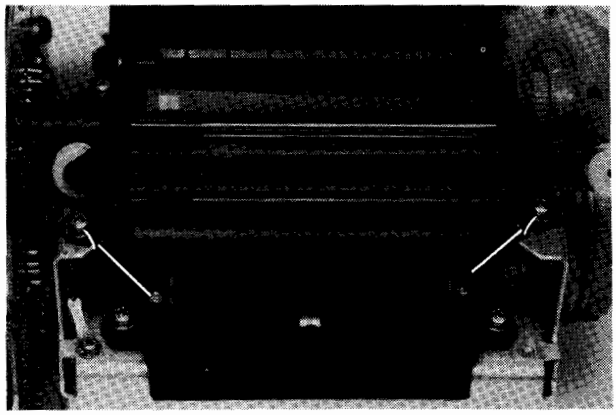
h. Remove the four screws securing the printer mechanism to the PR/PS PCA. Remove the two motor cables and the print-head cable. Replace the printer mechanism and/or PR/PS PCA as needed. Insert and tighten the four screws. Replace the cables.

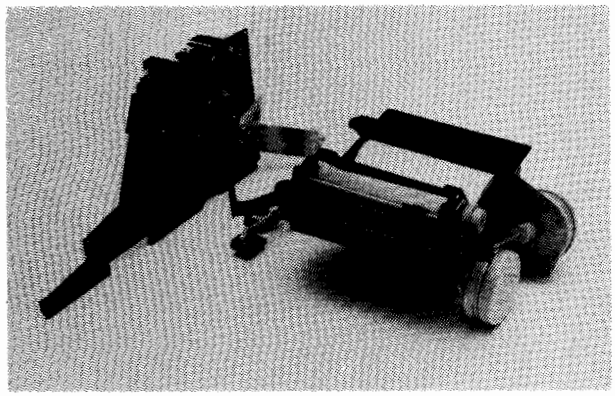
i. Position the new printer assembly over the tape drive assembly and support bracket, then insert and tighten the two screws.

j. Place the new printer assembly, together with the tape drive assembly and support bracket, in the bottom case.



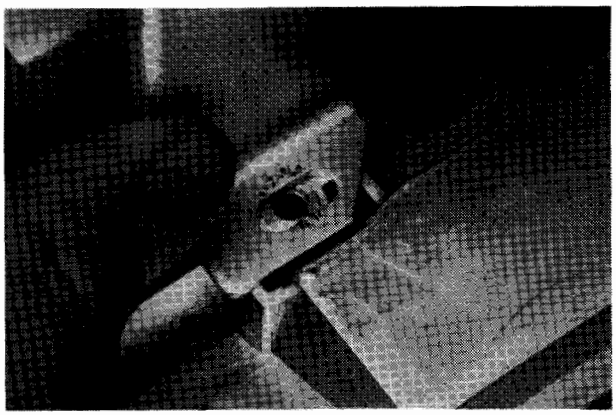






k. Insert and tighten the two screws securing the printer to the bottom case.

l. Position the bottom of the tape support bracket in its original position, which you can tell by the marks from the lockwashers.



m. Insert and tighten the screws securing the bracket to the bottom case while holding the bracket in position. Connect the ground straps (if present) to the back panel and I/O PCA.

n. Connect the pair of cables connecting the tape drive PCA to the logic PCA.

o. Connect the pair of cables connecting the printer PCA to the logic PCA.

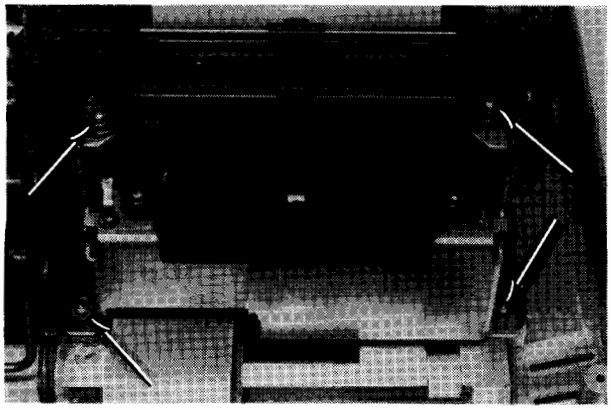
p. Connect the power plug to the printer PCA.

6. REPLACING THE TAPE DRIVE ASSEMBLY

a. Remove the keyboard assembly as described in procedure #2.

b. Disconnect the pair of cables from the tape drive PCA to the logic PCA.

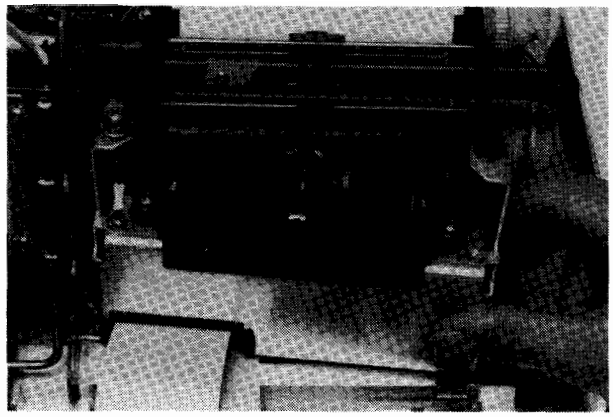
c. Remove the two screws securing the tape drive support bracket to the bottom case. Use a #2 Pozidriv screwdriver.



d. Remove the right screw securing the printer to the bracket.

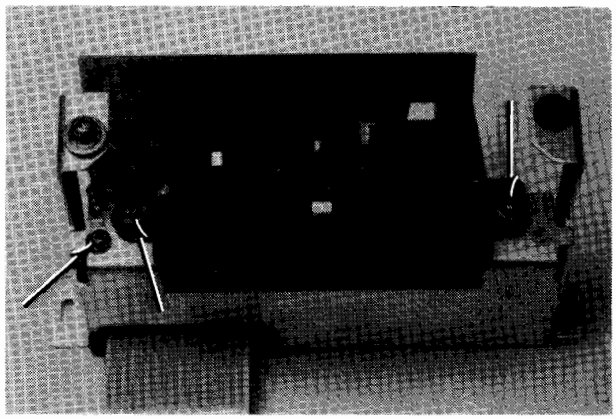
e. Loosen, but do not remove, the left screw.

f. Swing the right side of the support bracket forward, and push the bracket to the left until the screw clears the mounting stub on the printer.



g. Pull the support bracket forward while pressing up slightly on the front of the printer until the tape drive assembly clears the printer.

h. Disconnect the grounding wire from the support bracket. Use a #1 Pozidriv screwdriver.



i. Separate the tape drive assembly from its support bracket by removing the two screws holding them together. Use a #2 Pozidriv screwdriver.

j. Disconnect the pair of cables from the old tape drive assembly, and connect them to the new assembly.

k. Mount the new tape drive assembly on the support bracket. Insert the screws into themounting lugs, push the tape drive to the rear, then tighten the screws with the tape drive in this position.

> Note: The tape ejector bar may not slide freely through its slot in the top case after the top case is installed. If this happens, loosen the two screws, move the tape drive slightly forward on the support bracket, then tighten the screws.

l. Connect the grounding wire to the support bracket.

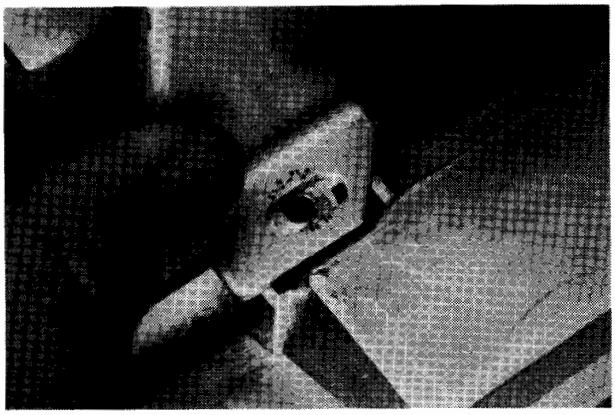
m. Lift the front of the printer up and push the tape drive assembly underneath.

n. Slide the mounting lug on the left of the printer under the screw and washer, then rotate the bracket into position.

o. Insert and tighten the right screw securing the printer to the bracket.

p. Tighten the left screw securing the printer to the bracket.

q. Position the bottom of the bracket in its original position, which you can tell by the marks from the lock-washers.



r. Insert and tighten the screws securing the bracket to the bottom case while holding the bracket in position.

s. Connect the pair of cables from the tape drive PCA to the logic PCA. PCA to the logic PCA.

7. REPLACING THE BACK PANEL ASSEMBLY

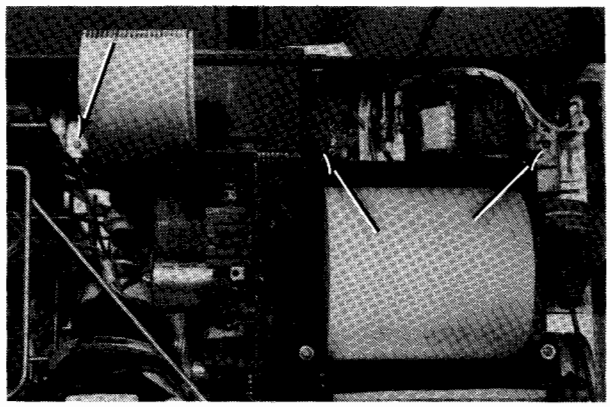
With the top case removed (procedure 1):

a. Turn the computer around so that the back panel is facing you.

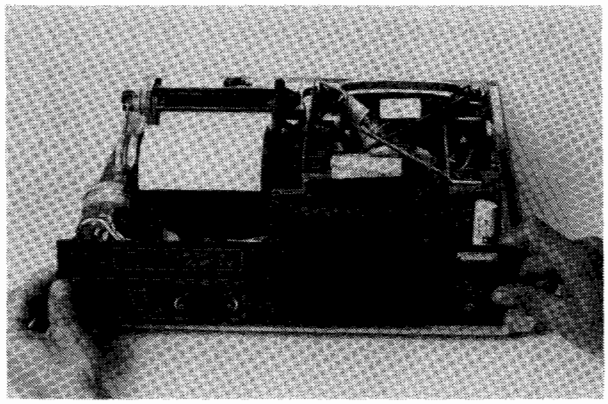
b. Disconnect the power plug from the printer PCA.

c. Disconnect the pair of cables to the I/O PCA.

d. Remove the three screws securing the back panel assembly to the bottom case. Use a #1 Pozidriv screwdriver. Disconnect the ground straps from the back panel and I/O PCA if present.

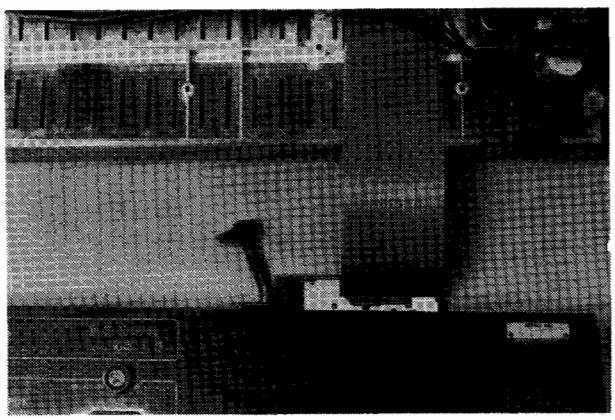


e. Lift the left side of the assembly up and pull the right side out until it clears the shaft of the brightness control.



f. Connect the pair of cables to the new I/O PCA. It's easiest to do this with the back panel face up.

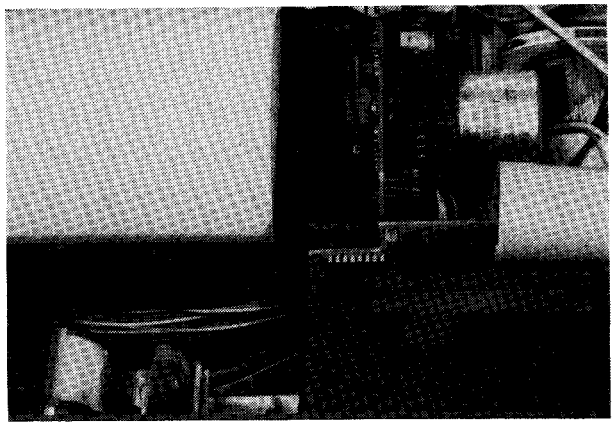
g. Place the right side of the assembly in position so that the shaft of the brightness control passes through the hole, then place the left side of the assembly in the bottom case.



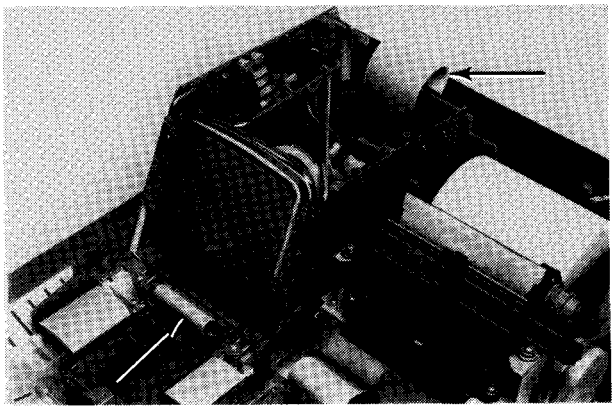
h. Insert and tighten the three screws securing the back panel assembly to the bottom case.

Computer Museum

i. Connect the power plug to the printer PCA. The wires going to the power plug should remain lower than the the mounting lug on the printer paper well. Also, be sure that the plug is connected so that the wires come down out of it rather than up.



j. Arrange the cables between the logic PCA and the I/O PCA so that the excess cable length is destributed evenly between the front and the back of the CRT assembly. Reconnect the grounding straps if present.



8. REPLACING THE I/O ASSEMBLY

a. Disconnect the ribbon cables.

b. Remove the screw connecting the grounding strap from the printer/power supply to the I/O PCA.

c. Remove the screws from inside the I/O box.

d. Pull the I/O PCA straight up and out of the back panel.

e. Insert a new I/O PCA. Insert and tighten screws, replacing the grounding strap and ribbon cables.

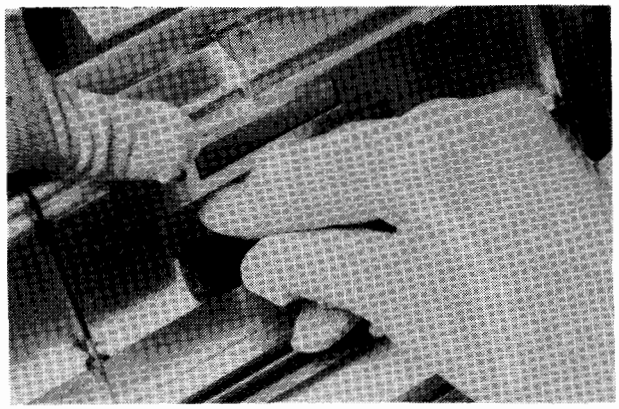
9. REPLACING PARTS OF THE TOP CASE ASSEMBLY

> CAUTION
>
> Wear white gloves while replacing parts of the top case assembly. If the metallized inside surface of the top case is contaminated with grease or dirt, the EMI (electromagnetic interference) characteristics of the computer may be degraded.

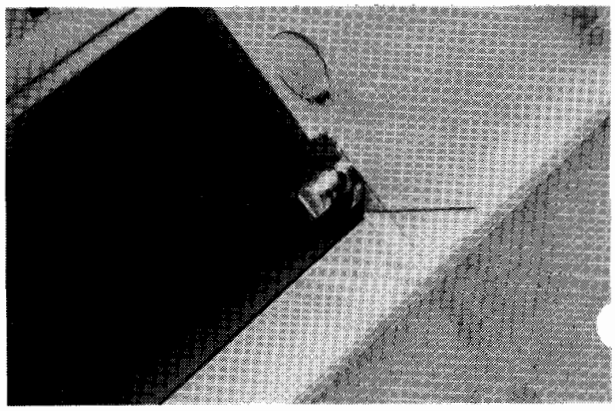
Note: Throughout this procedure, a number in parentheses following a reference to a part identifies that part in the HP-85 Exploded View.

- To replace the tape door (41) and/or tape door spring (44):

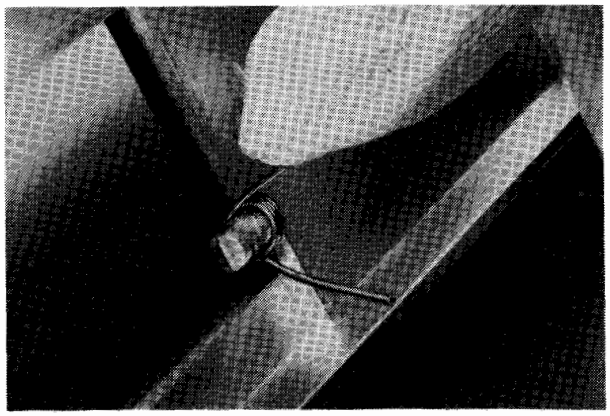
  a. Open the door and push it out from the inside.



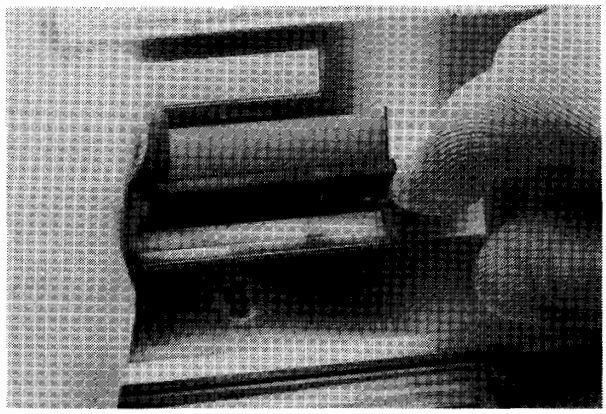
  b. Placed the new spring onto the bezel pin with the arms of the spring toward the top of the top case.



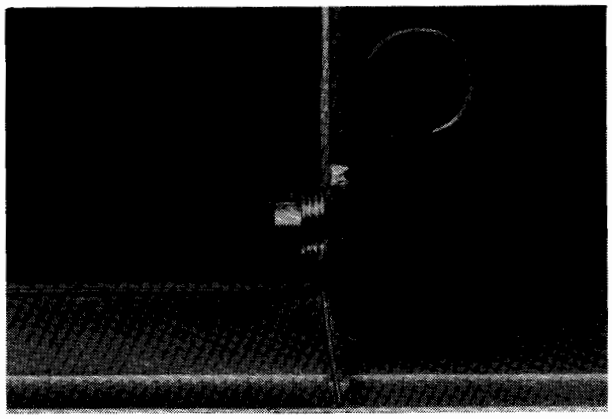
c. Bend the outer arm of the spring inward until it is about 60 to 90 degrees from the inner arm. Hold it there while inserting the tape door in the next step. The spring should be located at the base of the pin.



d. Insert the tape door from the inside, snap its hinge tabs over the bezel pins, then release the arm of the spring.

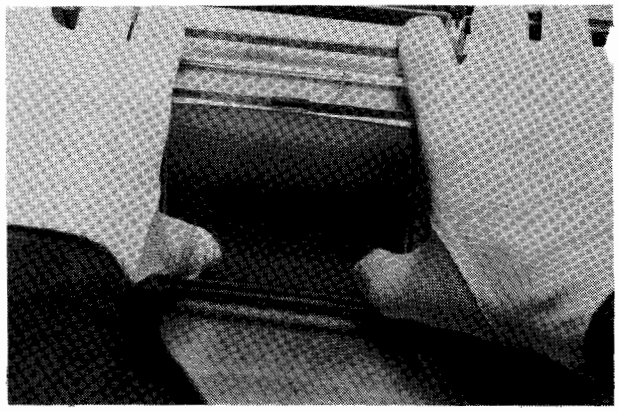


e. Make sure that the coil of the spring is positioned at the base of the pin, not under the hinge tab. Also, be sure that the spring arm that presses the door is located inside, not outside, the lip on the door.

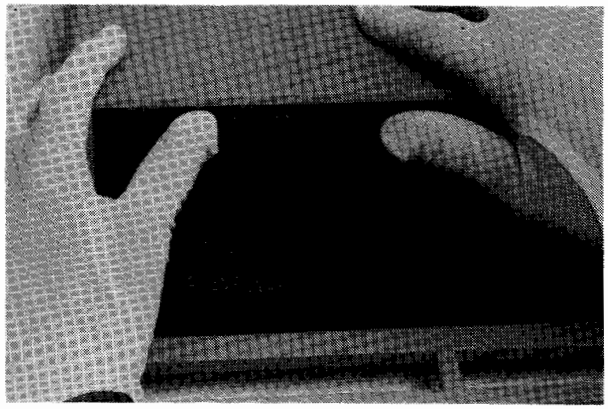


o To replace the CRT window (46):

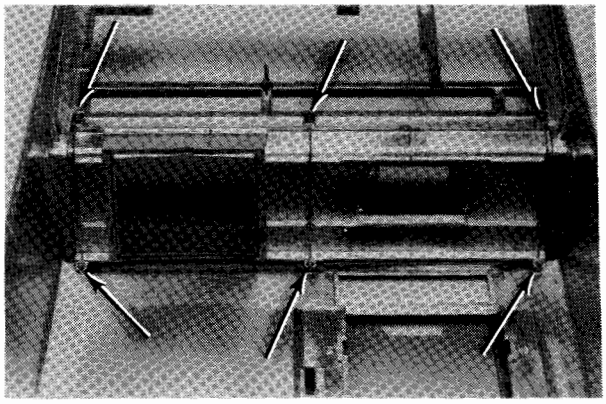
a. Press the top of the window out from the inside with your fingers in the top corners.



b. Place the wide lip of the window over the ledge at the bottom of the bezel, then press the top corners until the window snaps into place.



o To replace the bezel (38):



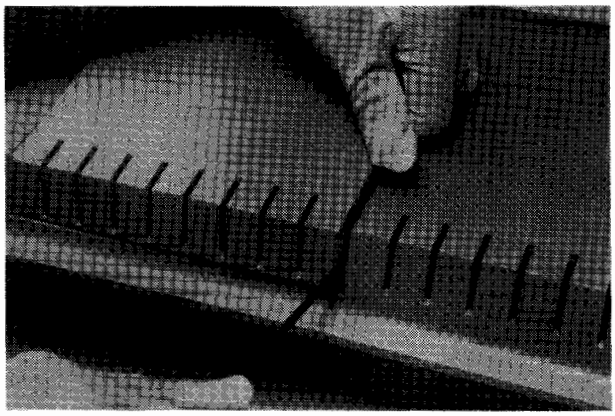
a. Remove the six screws securing the bezel to the cover (39) using a #1 Pozidriv screwdriver.

b. Remove the tape door, tape door spring, and CRT window from the old bezel, and insert them into the new bezel as described above.

c. Place the new bezel into the cover, then insert and tighten the six screws.

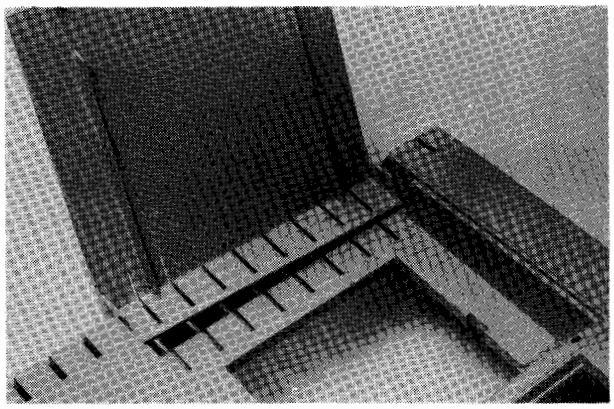
o To replace the paper door (40):

a. Insert a flat tool betwwen the door and the cover near the pin toward the computer's left. While doing this, let the door remain in its closed position.

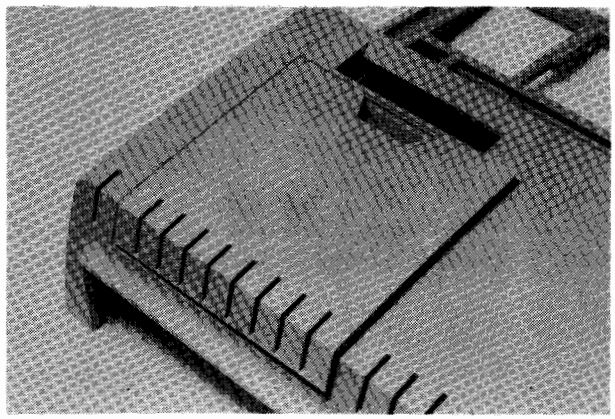


b. Carefully push the handle of the tool to the computer's right until the pin clears the hole and the door can be lifted free.

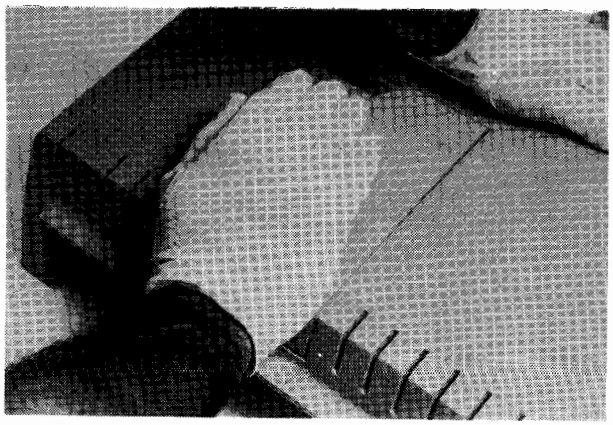
c. Place the right hinge of the new paper door over its pin.



d. Lay the door down in its closed position in the cover.



e. Press down on the left corner of the door until it snaps over the pin.



10. REPLACING PARTS OF THE BOTTOM CASE ASSEMBLY

> **CAUTION**
>
> Wear white gloves while replacing parts of the bottom case assembly. If the metallized inside surface of the bottom case is contaminated with grease or dirt, the EMI (electromagnetic interference) characteristics of the computer may be degraded.

Note: Throughout this procedure, a number in parentheses following a reference to a part identifies that part in the HP-85 Exploded View.

o To replace the speaker:

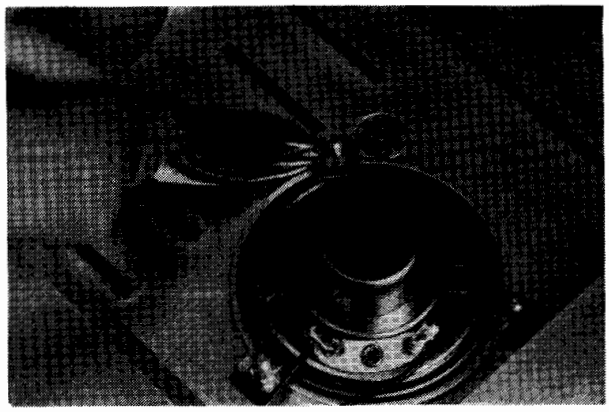
a. Disconnect the speaker plug from the logic PCA.

b. Remove the CRT assembly as described in procedure 4.

c. Disconnect the cables to the I/O PCA.

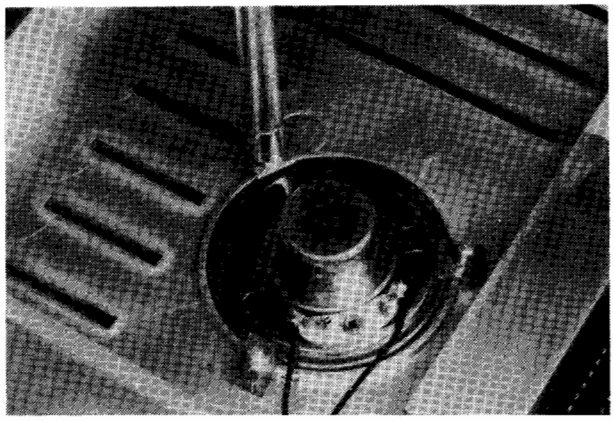
d. Break each of the three retaining clips (9) off of the pins using pliers or diagonal cutters, being careful not to break the pins.

e. Place the new speaker in the bottom case with the speaker's terminals toward the channel in the bottom case.



f. Insert a new retaining clip over each pin and press them all the way down using a small nutdriver.

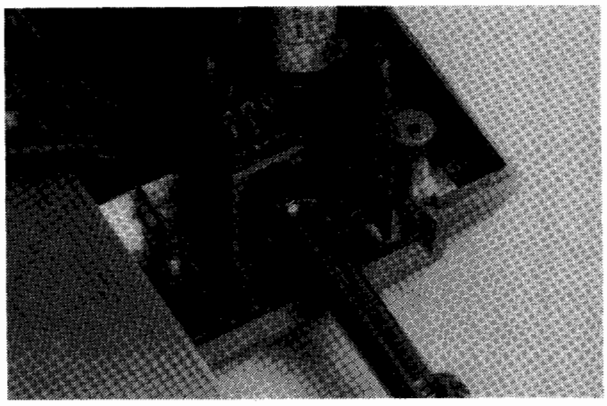
g. Connect the speaker plug to the logic PCA.



o To replace the brightness control (10):

a. Remove the back panel assembly as described in procedure 7.

b. Remove the nut securing the brightness control to its mounting post in the bottom case. Use a 1/2-inch nut driver.



> CAUTION
>
> In the next step, be careful not to damage the neon bulb when pushing on the control.

c. Push the shaft of the control through the hole in its mounting post.

d. Pull the control to the left until its plug comes off the connector.

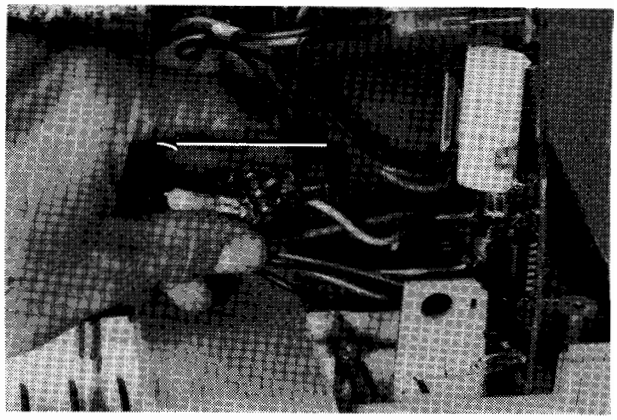
e. Insert the plug of the new control over the CRT frame.

f. Engage the tip of the connector pins into the plug, then press the plug onto the connector with your finger.

g. Insert the shaft of the new control into the hole in its mounting post. Be sure that the locating tab on the control enters the slot in the post.

h. Insert and tighten the nut securing the control to the post.

i. Install the back panel assembly in the bottom case as described in procedure 7.



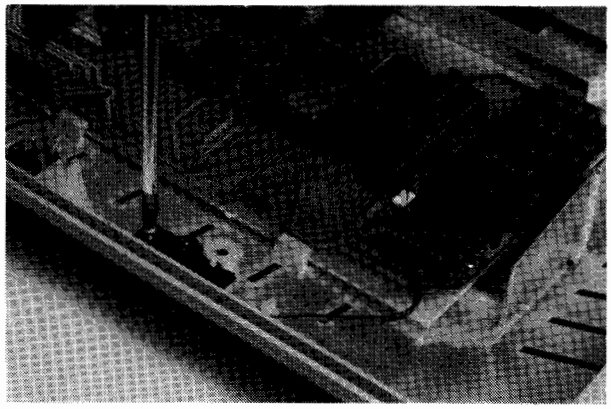
o To replace the power light:

a. Remove the keyboard assembly as described in procedure 2.

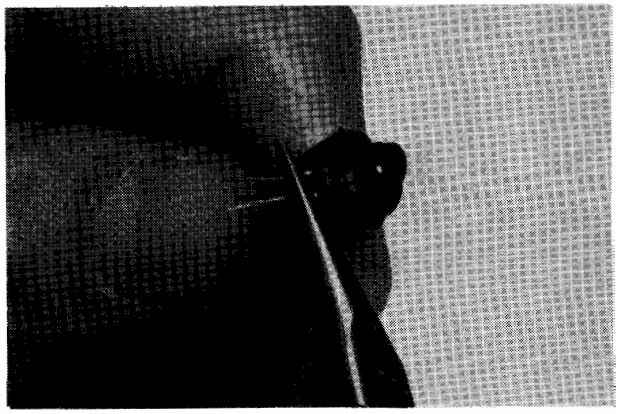
b. Disconnect the power light plug from the logic PCA.

c. Remove the screw securing the power light holder to the bottom case using a #1 Pozidriv screwdirver.

d. Lift out the power light holder, and pull the plug off the LED.

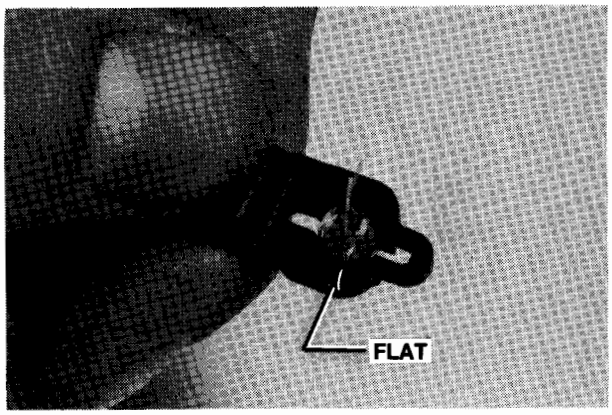


e. Pull the LED out of the holder using pliers.



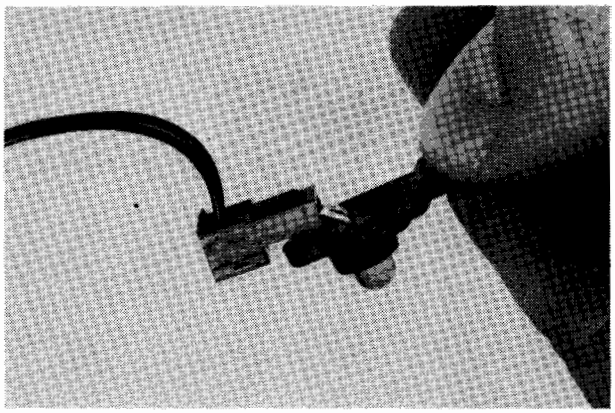
f. Insert a new LED into the holder. The flat on the LED should be aligned with the flat on the base of the holder.

g. Push the LED in until its base is flush with the base of its holder.



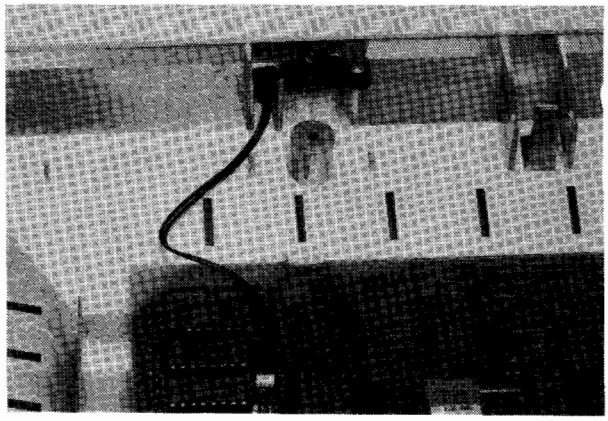
h. Insert about 3/4 of the length of the LED leads into either of the plugs. Bend the plug away from the screw hole in the holder. The plug should be positioned so that when the holder is in position the wires will come down out of the holder, not up.

i. Position the holder in the bottom case and insert the screw. Before tightening it, orient the holder so that the plug is positioned between the two ribs in the bottom case. Tighten the screw.

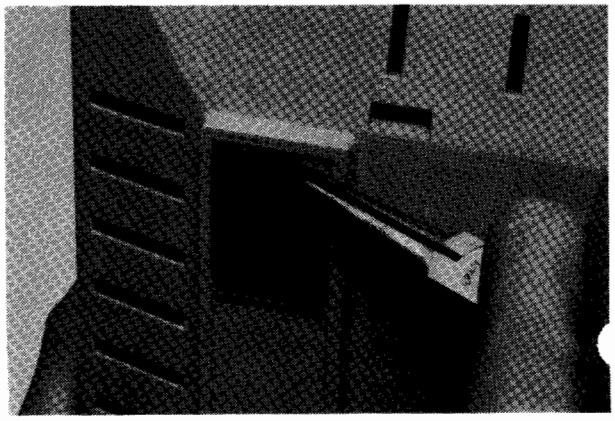


j. Connect the other plug to the logic PCA. The plug should be positioned so that the wires come out of the plug toward the front of the computer. The power light will not turn on if the plug is connected backwards.

k. Arrange the power light wires down against the logic PCA and the bottom case.



o To replace a foot: tilt the computer onto its back panel, peel off the old foot with needle nose pliers, then press a new one into place.



11. ATTACHING THE TOP CASE TO THE BOTTOM CASE

a. Make sure the power cord is disconnected from the back panel.

b. Make sure the grounding spring is correctly attached to the CRT assembly.

> CAUTION
>
> In the next step, be careful to lower the top case straight down onto the bottom case. If you do not, the metallized inside surface of the top case may be scratched, which might degrade the EMI characteristics of the computer.

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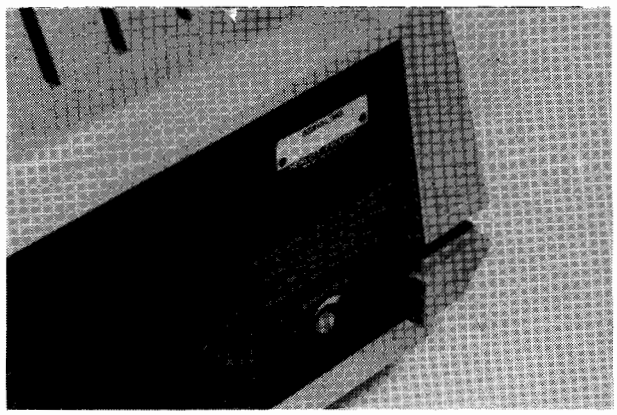
c. Place the top case in position on the bottom case. Make sure that the back panel is just inside the top case, not outside.

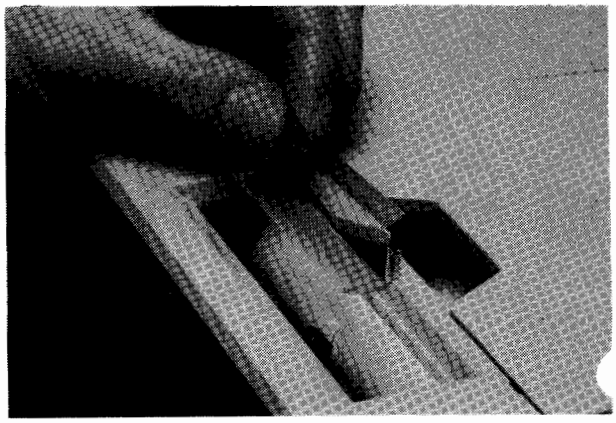
d. Wiggle the top case and gently press it down until the cases close together. When closed properly, there should be a gap of about 1.6 millimeters (1/16 inch) between the edges of the cases.



e. Insert the tape ejector bar into the slot in the bezel, and push it in until it is securely attached to the tape ejector mechanism. It probably will snap twice: the first snap is the tape ejector mechanism moving into its retracted position; the second snap is the ejector bar snapping onto the mechanism.

f. Insert and tighten the six screws in the bottom case after tilting the computer onto its back panel. Use a #1 Pozidriv screwdriver.

g. Insert the paper tear bar into the printer. The bar should be positioned with the beveled edge up and the ledge forward.



SECTION
IV

Keyboard Troubleshooting and Repair

4-1. INTRODUCTION

4-2. This section tells you how to troubleshoot and repair the keyboard assembly. Included are procedures for:

- o Isolating a keyboard problem to the keyboard controller, the logic PCA, the keyboard PCA, the key plunger, or the key contacts (paragraph 4-3).
- o Replacing parts of the keyboard assembly (paragraph 4-15).
- o Cleaning the key contacts (paragraph 4-16).

4-3. TROUBLESHOOTING

4-4. To help determine what may be wrong with the keyboard (if anything), run the System Test from the Service ROM. (Refer to paragraph 8-23.) It is essential that you run at least the CPU, RAM, and ROM Tests before running the Keyboard Test, since the Keyboard Test uses the computer's ROM and RAM. If one of those three tests indicates a bad IC, replace it and run the System Test again. After all three tests have been passed, you need run only the Keyboard Test to check whether replacing a part has corrected a keyboard problem.

6-5. If the keyboard is not working properly, one of the messages listed in table 4-1 will be displayed and printed when the computer is switched on (with the Service ROM installed) or during the Keyboard Test. For each message, the table shows the reason for the message and the recommended action to correct the problem. To determine the key(s) corresponding to the character entered following a {KEY STUCK!} or {KEY BAD!} message, refer to table 4-3. To determine the key expected from the mnemonic following certain other messages, refer to table 4-2.

> Note: Remember that a message showing a digit ({0}) through {9}), period ({.}), or comma ({,}) may indicate either a key on the numeric keypad (at the right of the keyboard) or a key elsewhere on the keyboard that shows the same character.

Table 4-1. Keyboard Test Diagnosis

MESSAGE	REASON	DIAGNOSIS/REPAIR
{KEY CONTROL BAD!}	Bad controller (U3).	Replace controller.
{PRESS KEY}	Service ROM does not recognize that you have pressed any key within 15 seconds after the prompting message.	Press the key again.
{NO KEY!}	Service ROM does not recognize that you have pressed any key within 15 seconds after the {PRESS KEY} message.	Refer to No Key Entry, paragraph 4-6.
{RELEASE KEY!}	Service ROM does not recognize that you have released a key within 15 seconds after you pressed it.	Release key.
{KEY STUCK! (character entered)}	Service ROM does not recognize that you have released a key within 15 seconds after the {RELEASE KEY} message.	Refer to Key Stuck, paragraph 4-13.
{(key expected)}	Character entered does not correspond to key expected.	1. Press expected key. If message appears again, refer to Wrong Character Entered, paragraph 4-8; if not, proceed with step 2 below.

Table 4-1. Keyboard Test Diagnosis (Continued)

MESSAGE	REASON	DIAGNOSIS/REPAIR
		2. Press next key in sequence. If message appears again, proceed with step 3 below; if not, continue with key sequence. 3. Press expected key twice. If no message appears, refer to No Key Entry, paragraph 4-6; if message appears indicating next key in sequence, press that key and continue with key sequence.
{SHIFT UP} {(key expected)}	[SHIFT] key appears to be down.	Press expected key again with [SHIFT] key up.
{SHIFT DOWN} {(key expected)}	[SHIFT] key appears to be up.	Press expected key again with [SHIFT] key down.
{CAPS UP} {(key expected)}	[CAPS LOCK] key appears to be down.	Press expected key again with [CAPS LOCK] key up.
{CAPS DOWN} {(key expected)}	[CAPS LOCK] key appears to be up.	Press expected key again with [CAPS LOCK] key down.

Table 4-1. Keyboard Test Diagnosis (Continued)

MESSAGE	REASON	DIAGNOSIS/REPAIR
{CTRL UP} {(key expected)}	[CTRL] key appears to be down.	Press expected key again with [CTRL] key up.
{CTRL DOWN} {(key expected)}	[CTRL] key appears to be up.	Press expected key again with [CTRL] key down.
{KEY BAD! (character entered)}	Character entered different from character expected.	If message occurred during key sequence test (step 8 or 9 of Keyboard Test; refer to table 8-2), refer to No Key Entry, paragraph 4-6; otherwise, refer to Wrong Character Entered, paragraph 4-8.

4-6. No Key Entry

4-7. To locate the problem when pressing a key has no effect:

a. Make sure that both ribbon cables are properly aligned in their connectors on the keyboard PCA. (Refer to paragraph 3-11.)

b. Prop the keyboard up so that you can access the keyboard controller. (See figure 4-1.) Do not remove the keyboard from the bottom case. Leave the original ribbon cables connected at both the logic PCA and the keyboard PCA; do not substitute extender cables.

c. Make sure that both ribbon cables are properly aligned in their connectors on the logic PCA.

d. Look up the row and column lines for the bad key in table 4-2.

e. With the key pressed, check for continuity between the row and column pins for the bad key at the keyboard controller. (See figure 4-2 to determine the pin locations of the row and column lines at the keyboard controller.) If continuity OK, replace the keyboard controller.

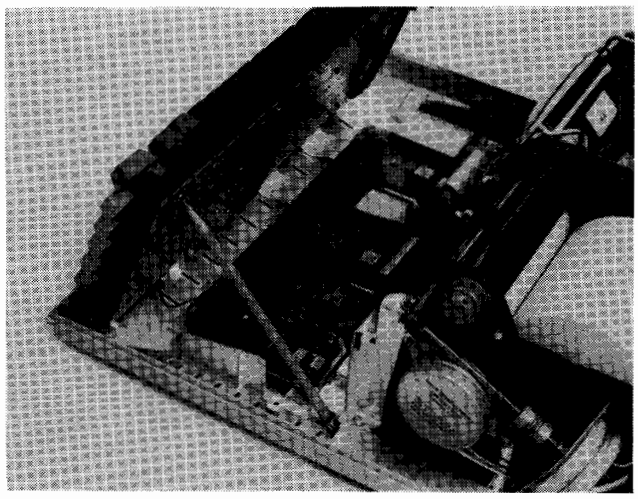


Figure 4-1. Keyboard Assembly Propped Up

f. Check for continuity along the row line for the bad key between the keyboard controller and the pins of J1 on the bottom of the keyboard PCA. (See figure 4-2 to determine the pin locations at the controller and at the connector.) Check for continuity along the column line for the bad key between the keyboard controller and the pins of J2 on the bottom of the keyboard PCA. If no continuity on either line, check the cable connectors on the keyboard PCA. If either is bad, replace the keyboard assembly; otherwise, remove all the IC's from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

Note: If the connectors have been bent, a connector pin may be broken or making intermittent contact.

g. Disconnect the keyboard PCA from the logic PCA and remove the keyboard assembly from the computer. Check for continuity between the key contact pins (on the back of the keyboard PCA) for the bad key while the key is pressed.

- If continuity OK, replace the keyboard assembly.
- If no continuity, remove the key cap (refer to paragraph 4-15), and inspect the key plunger and the key contacts.
  - If at least three of the four fingers of the slotted key contact appear to close against the solid key contact when the plunger is pressed, clean the key contacts. (Refer to paragraph 4-16.)
  - If the key contacts do not appear to close, or if cleaning the key contacts does not result in continuity between them, replace the plunger and/or the key contacts. (Refer to paragraph 4-15.)

4-8. Wrong Character Entered

> Note: If the [SHIFT}, [CAPS LOCK], and [CTRL] keys were not all released before step 1 of the Keyboard Test, the results of the test are not valid.

4-9. If pressing a key results in entering the wrong character:

- If a {KEY BAD!} message was preceded by a {SHIFT UP}, {CAPS UP}, or {CTRL UP} message, refer to paragraph 4-11.
- If a {KEY BAD!} message was preceded by a {SHIFT DOWN}, {CAPS DOWN}, or {CTRL DOWN} message, refer to paragraph 4-12.
- If a {KEY BAD!} message was preceded only by a mnemonic for the key expected, refer to paragraph 4-10.
- If only a {(key expected)} mnemonic appears, refer to paragraph 4-10.

4-10. Wrong Character Entered; [SHIFT], [CAPS LOCK], and [CTRL] OK. To locate the problem when pressing a key results in entering the wrong character:

a. Make sure that the ribbon cables are properly aligned in their connectors on the keyboard PCA and on the logic PCA. (Refer to paragraph 3-11.)

b. Try replacing the controller.

c. Try replacing the keyboard assembly.

d. Remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, then install the new logic PCA in the computer. (This solves the problem if it is caused by a bad connector or an open trace on the logic PCA.)

4-11. Wrong Character Entered; [SHIFT], [CAPS LOCK], or [CTRL] Apparently Down. To locate the problem when pressing a key results in entering the wrong character because the [SHIFT], [CAPS LOCK], or [CTRL] key appears to be down:

a. Make sure that both ribbon cables are properly aligned in their connectors on the keyboard PCA. (Refer to paragraph 3-11.)

b. Prop the keyboard up so that you can access the keyboard controller. (See figure 4-1.) Do not remove the keyboard from the bottom case. Leave the original ribbon cables connected at both the logic PCA and the keyboard PCA; do not substitute extender cables.

c. Make sure that both ribbon cables are properly aligned in their connectors on the logic PCA.

d. Remove the controller and check for continuity between pin 32 (GND) and pin 22 ($\overline{KS}$, [SHIFT]), pin 24 ($\overline{KCL}$, [CAPS LOCK]), or pin 21 ($\overline{KC}$, [CTRL]) of the keyboard controller socket. If no continuity, install a new controller; otherwise, return the original controller.

e. Disconnect the keyboard PCA from the logic PCA and check for a short between pin 11 of J1 (GND) on the bottom of the keyboard PCA and pin 11 ([SHIFT]), pin 10 ([CAPS LOCK]), or pin 4 ([CTRL]) of J2 on the bottom of the keyboard PCA. Figure 4-2 on page 4-20 shows pin locations. If not shorted, remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

f. Check for continuity between the key contact pins (on the back of the keyboard PCA) for the bad key.

Note: Remember that there are two [SHIFT] keys.

- If shorted, replace the key plunger and/or the key contacts. (Refer to paragraph 4-15.)
- If not shorted, replace the keyboard assembly.

4-12. Wrong Character Entered; [SHIFT], [CAPS LOCK], or [CTRL] Apparently Up. To locate the problem when pressing a key results in entering the wrong character because he [SHIFT], [CAPS LOCK], or [CTRL] key appears to be up:

a. Make sure that both ribbon cables are properly aligned in their connectors on the keyboard PCA. (Refer to paragraph 3-11.)

b. Prop the keyboard up so that you can access the keyboard controller. (See figure 4-1.) Do not remove the keyboard from the bottom case. Leave the original ribbon cables connected at both the logic PCA and the keyboard PCA; do not substitute extender cables.

c. Make sure that both ribbon cables are properly aligned in their connectors on the logic PCA.

d. With the key down, check for continuity at the controller between pin 32 (GND) and pin 22 ($\overline{KS}$, [SHIFT]), pin 24 ($\overline{KCL}$, [CAPS LOCK]), or pin 21 ($\overline{KC}$, [CTRL]). If continuity OK, replace the controller.

e. Check for continuity between the pin at the controller (refer to step b for the pin number) and pin 11 ([SHIFT]), pin 10 ([CAPS LOCK]), or pin 4 ([CTRL]) of J2 on the bottom of the keyboard PCA. If no continuity, check J1. If bad, replace the keyboard assembly; otherwise, remove all the IC's from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

f. Disconnect the keyboard PCA from the logic PCA and remove the keyboard assembly from the computer. With the key down, check for continuity between the key contact pins (on the back of the keyboard PCA) of the bad key.

- If continuity OK, replace the keyboard assembly.
- If no continuity, remove the key cap (refer to paragraph 4-15), and inspect the key plunger and key contacts.
  - If at least three of the four fingers of the slotted key contact appear to close against the solid key contact when the plunger is pressed, clean the key contacts as described in paragraph 4-16.
  - If the key contacts do not appear to close, or if cleaning the key contacts does not result in continuity between them, replace the plunger and/or the key contacts. (Refer to paragraph 4-15.

4-13. Key Stuck

4-14. To locate the problem when a key appears to be stuck:

a. Prop the keyboard up so that you can access the keyboard controller. (See figure 4-1.) Do not remove the keyboard from the bottom case. Leave the original ribbon cables connected at both the logic PCA and the keyboard PCA; do not substitute extender cables.

b. Remove the controller and check for continuity between the row and column pins for the bad key at the keyboard controller. (Refer to table 4-3, if necessary, to determine the key corresponding to the character entered; then refer to table 4-2 to determine the key's row and column lines. See figure 4-2 to determine the corresponding pin locations at the keyboard controller.) If no continuity, install a new controller; otherwise, return the original controller.

c. Disconnect the keyboard PCA from the logic PCA and check for a short between the pin of J1 (on the bottom of the keyboard PCA) for the row line of the bad key and the pin of J2 for the column line of the bad key. (See figure 4-2 to determine the pin locations at the connectors.) If not shorted, remove all the ICs from the logic PCA, install them on a new logic printed-circuit board, and install the new logic PCA in the computer.

d. Check for continuity between the key contact pins (on the back of the keyboard PCA) for the bad key.

   - If shorted, replace the key plunger and/or the key contacts. (Refer to paragraph 4-15.)

   - If not shorted, replace the keyboard assembly.

Table 4-2. Mnemonics and Key Lines for Keys Expected

SERVICE ROM MNEMONIC	KEY EXPECTED	ROW LINE	COLUMN LINE
{´}	[´ "]	R6	C2
{(}	[([]]	R7	C2
{(}	[(RESET]	R8	C6
{)}	[) INIT]	R7	C6
{)}	[)]]	R7	C3
{*}	[*]	R1	C0
{+}	[+]	R5	C5
{,}	[,] or [, <]	R5	C0
{-C}	[-CHAR DEL]	R9	C3
{-L}	[-LINE CLEAR]	R7	C5
{-}	[- _]	R8	C2
{-}	[-]	R5	C6
{.}	[.] or [. >]	R5	C1
{/}	[/ ?]	R5	C2
{/}	[/]	R6	C7
{0}	[0] or [0)]	R8	C1
{1}	[1] or [1 !]	R1	C7
{2}	[2] or [2 @]	R1	C6
{3}	[3] or [3 #]	R1	C5
{4}	[4] or [4 $]	R1	C4

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Table 4-2. Mnemonics and Key Lines for Keys Expected (Continued)

SERVICE ROM MNEMONIC	KEY EXPECTED	ROW LINE	COLUMN LINE
{5}	[5] or [5 %]	R1	C3
{6}	[6] or [6 ^]	R1	C2
{7}	[7] or [7 &]	R1	C1
{8}	[8] or [8 *]	R1	C0
{9}	[9] or [9 (]	R8	C0
{;}	[; :]	R6	C1
{=}	[= +]	R8	C3
{A}	[A]	R3	C7
{BS}	[BACK SPACE]	R8	C5
{B}	[B]	R4	C2
{C<}	[◄ GRAPH]	R9	C0
{C>}	[► COPY]	R9	C1
{CN}	[CONT]/[SCRATCH]	R7	C4
{C^}	[▲ ▶]	R0	C1
{Cv}	[▼ AUTO]	R0	C0
{C}	[C]	R4	C4
{D}	[D]	R3	C5
{EN}	[END LINE]	R6	C3
{E}	[E]	R2	C5
{F}	[F]	R3	C4

Table 4-2. Mnemonics and Key Lines for Keys Expected (Continued)

SERVICE ROM MNEMONIC	KEY EXPECTED	ROW LINE	COLUMN LINE
{G}	[G]	R3	C3
{H}	[H]	R3	C2
{I}	[I]	R2	C0
{J}	[J]	R3	C1
{K}	[K]	R3	C0
{LA}	[LABEL KEY]	R0	C6
{LI}	[LIST PLST]	R6	C4
{LO}	[LOAD REW]	R9	C5
{L}	[L]	R6	C0
{M}	[M]	R4	C0
{N}	[N]	R4	C1
{O}	[O]	R7	C0
{PA}	[PAPER ADVANCE]	R9	C7
{PS}	[PAUSE STEP]	R5	C3
{P}	[P]	R7	C1
{Q}	[Q]	R2	C7
{RP}	[RPL INS]	R9	C2
{RU}	[RUN]	R5	C4
{Rv}	[ROLL]	R9	C4
{R}	[R]	R2	C4

Table 4-2. Mnemonics and Key Lines for Keys Expected (Continued)

SERVICE ROM MNEMONIC	KEY EXPECTED	ROW LINE	COLUMN LINE
{ST}	[STORE TEST]	R9	C6
{S}	[S]	R3	C6
{T}	[T]	R2	C3
{U}	[U]	R2	C1
{V}	[V]	R4	C3
{W}	[W]	R2	C6
{X}	[X]	R4	C5
{Y}	[Y]	R2	C2
{Z}	[Z]	R4	C6
{\}	[\ |]	R8	C4
{^}	[^ RESLT]	R8	C7
(blank)	[(space bar)]	R4	C7
{k1}	[k1 k5]	R0	C5
{k2}	[k2 k6]	R0	C4
{k3}	[k3 k7]	R0	C3
{k4}	[k4 k8]	R0	C2

Table 4-3. Key(s) Corresponding to Character Entered

CHARACTER ENTERED	CORRESPONDING KEY(S)	CHARACTER ENTERED	CORRESPONDING KEY(S)
◀	[CTRL] [SHIFT] [2 @] or [CTRL] [SHIFT] [2]	A	[CTRL] [S]
		a	[CTRL] [T]
	[CTRL] [A]	A	[CTRL] [U]
	[CTRL] [B]	a	[CTRL] [V]
	[CTRL] [C]	O	[CTRL] [W]
	[CTRL] [D]	o	[CTRL] [X]
	[CTRL] [E]	O	[CTRL] [Y]
	[CTRL] [F]	u	[CTRL] [Z]
	[CTRL] [G]	Æ	[CTRL] [SHIFT] [([]
	[CTRL] [H]	æ	[CTRL] [\ |]
	[CTRL] [I]	ß	[CTRL] [SHIFT] [)]]
	[CTRL] [J]	£	[CTRL] [^ RESLT]
	[CTRL] [K]	±	[CTRL] [SHIFT] [- _]
	[CTRL] [L]	(blank)	[(space bar)]
(blank)	[CTRL] [M]	!	[SHIFT] [1 !] or [SHIFT] [1]
	[CTRL] [N]	"	[SHIFT] [' "]
	[CTRL] [O]	#	[SHIFT] [3 #] or [SHIFT] [3]
	[CTRL] [P]	$	[SHIFT] [4 $] or [SHIFT] [4]
	[CTRL] [Q]	%	[SHIFT] [5 %] or [SHIFT] [5]
	[CTRL] [R]	&	[SHIFT] [7 &] or [SHIFT] [7]

Table 4-3. Key(s) Corresponding to Character Entered (Continued)

CHARACTER ENTERED	CORRESPONDING KEY(S)	CHARACTER ENTERED	CORRESPONDING KEY(S)
'	[´ "]	6	[6 ^] or [6]
(	[SHIFT] [9 (] or [SHIFT] [9] or [(RESET]	7	[7 &] or [7]
		8	[8 *] or [8]
		9	[9 (] or [9]
)	[SHIFT] [0)] or [SHIFT] [0] or [) INIT]	:	[SHIFT] [; :]
		;	[; :]
*	[SHIFT [8 *] or [SHIFT] [8] or [*]	<	[SHIFT] [, <] or [SHIFT] [,]
		=	[=]
+	[SHIFT] [= +] or [+]	>	[SHIFT] [. >] or [SHIFT] [.]
,	[, <] or [,]	?	[SHIFT] [/ ?]
-	[- =] or [-]	@	[SHIFT] [2 @] or [SHIFT] [2]
.	[. >] or [.]	A	[A]
/	[/ ?] or [/]	B	[B]
0	[0)] or [0]	C	[C]
1	[1 !] or [1]	D	[D]
2	[2 @] or [2]	E	[E]
3	[3 #] or [3]	F	[G]
4	[4 $] or [4]	G	[G]
5	[5 %] or [5]	H	[H]
		I	[I]

Table 4-3. Key(s) Corresponding to Character Entered (Continued)

CHARACTER ENTERED	CORRESPONDING KEY(S)	CHARACTER ENTERED	CORRESPONDING KEY(S)
J	[J]	^	[^ RESLT]
K	[K]	_	[SHIFT] [- _]
L	[L]	`	[SHIFT] [KEY LABEL]
M	[M]	a	[SHIFT] [A]
N	[N]	b	[SHIFT] [B]
O	[O]	c	[SHIFT] [C]
P	[P]	d	[SHIFT] [D]
Q	[Q]	e	[SHIFT] [E]
R	[R]	f	[SHIFT] [F]
S	[S]	g	[SHIFT] [G]
T	[T]	h	[SHIFT] [H]
U	[U]	i	[SHIFT] [I]
V	[V]	j	[SHIFT] [J]
W	[W]	k	[SHIFT] [K]
X	[X]	l	[SHIFT] [L]
Y	[Y]	m	[SHIFT] [M]
Z	[Z]	n	[SHIFT] [N]
{	[SHIFT] [({]	o	[SHIFT] [O]
\	[\ |]	p	[SHIFT] [P]
}	[SHIFT] [) }]	q	[SHIFT] [Q]

Table 4-3. Key(s) Corresponding to Character Entered (Continued)

CHARACTER ENTERED	CORRESPONDING KEY(S)	CHARACTER ENTERED	CORRESPONDING KEY(S)
r	[SHIFT] [R]	C	[SHIFT] [k3 k7]
s	[SHIFT] [S]	D	[SHIFT] [k4 k8]
t	[SHIFT] [T]	A	[SHIFT] [LOAD REW]
u	[SHIFT] [U]	B	[SHIFT] [► COPY]
v	[SHIFT] [V]	T	[PAPER ADVANCE] or [SHIFT] [PAPER ADVANCE]
w	[SHIFT] [W]		
x	[SHIFT] [X]	H	[SHIFT] [(RESET]
y	[SHIFT] [Y]	U	[SHIFT] [) INIT]
z	[SHIFT] [Z]	_	[RUN] or [SHIFT] [RUN]
?	[SHIFT] [/]	I	[PAUSE STEP]
|	[SHIFT] [\ |]	K	[CONT]/[SCRATCH]
+	[SHIFT] [-]	P	[SHIFT] [PAUSE STEP]
*	[SHIFT] [*]	Q	[SHIFT] [STORE TEST]
+	[SHIFT] [+]	L	[SHIFT] [-LINE CLEAR]
1	[k1 k5]	G	[SHIFT] [◄ GRAPH]
2	[k2 k6]	J	[LIST PLIST]
3	[k3 k7]	M	[SHIFT] [LIST PLIST]
4	[k4 k8]	N	[KEY LABEL]
A	[SHIFT] [k1 k5]	O	[SPACE BACK]
B	[SHIFT] [k2 k6]	V	[END LINE] or [SHIFT][END LINE]

Table 4-3. Key(s) Corresponding to Character Entered (Continued)

CHARACTER ENTERED	CORRESPONDING KEY(S)	CHARACTER ENTERED	CORRESPONDING KEY(S)
£	[SHIFT] [SPACE BACK]	#	[RPL INS] or [SHIFT] [RPL INS]
¢	[◄ GRAPH]	$	[-CHAR DEL]
¤	[► COPY]	%	[SHIFT] [▲ ►]
¥	[SHIFT] [ROLL]	&	[SHIFT] [^ RESLT]
§	[ROLL]	'	[STORE TEST]
¬	[-LINE CLEAR]	(	[LOAD REW]
¡	[▲ ►]	)	[SHIFT] [▼ AUTO]
¨	[▼ AUTO]	=	[SHIFT] [CONT]/[SCRATCH]

*Two dot rows high on CRT.

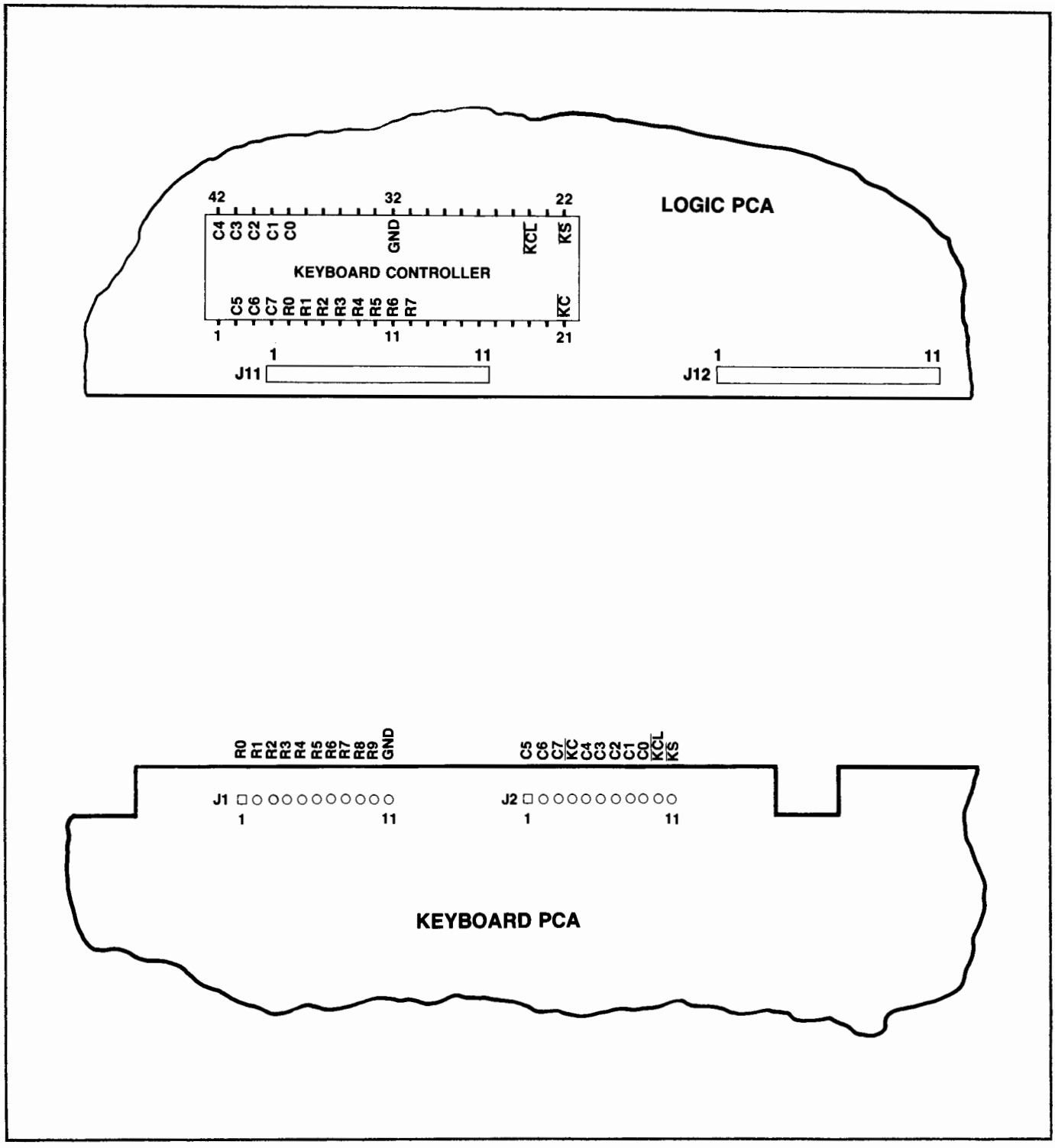


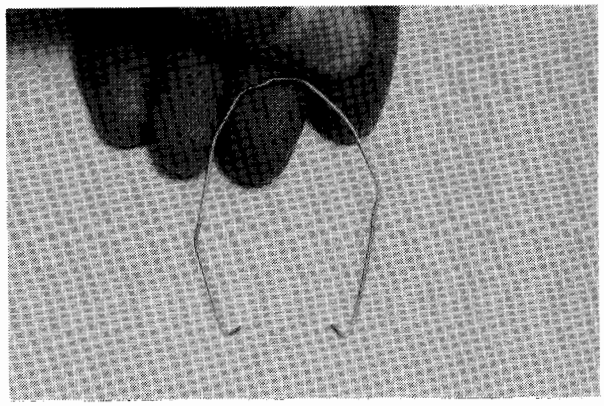
Figure 4-2. Row and Column Pins on Keyboard PCA and Keyboard Controller

4-15. REPLACING PARTS

Note: Throughout these procedures, a number in parentheses following a reference to a part identifies that part in the Keyboard Assembly Exploded View, figure 4-4.

REPLACING A KEY CAP

Note: Make a tool to remove key caps by bending a paper clip as shown in the photograph. (You can also use the Keycap Extractor Tool, part number 5040-7433.)

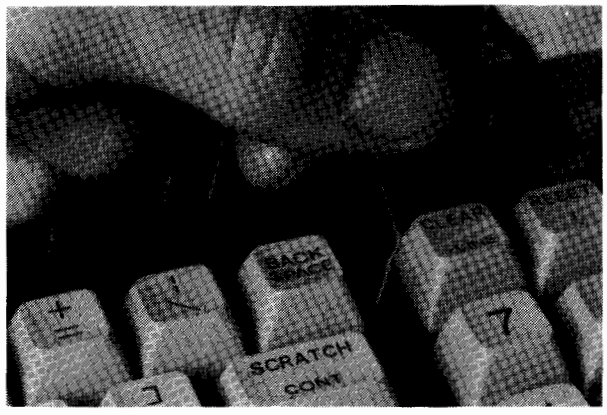


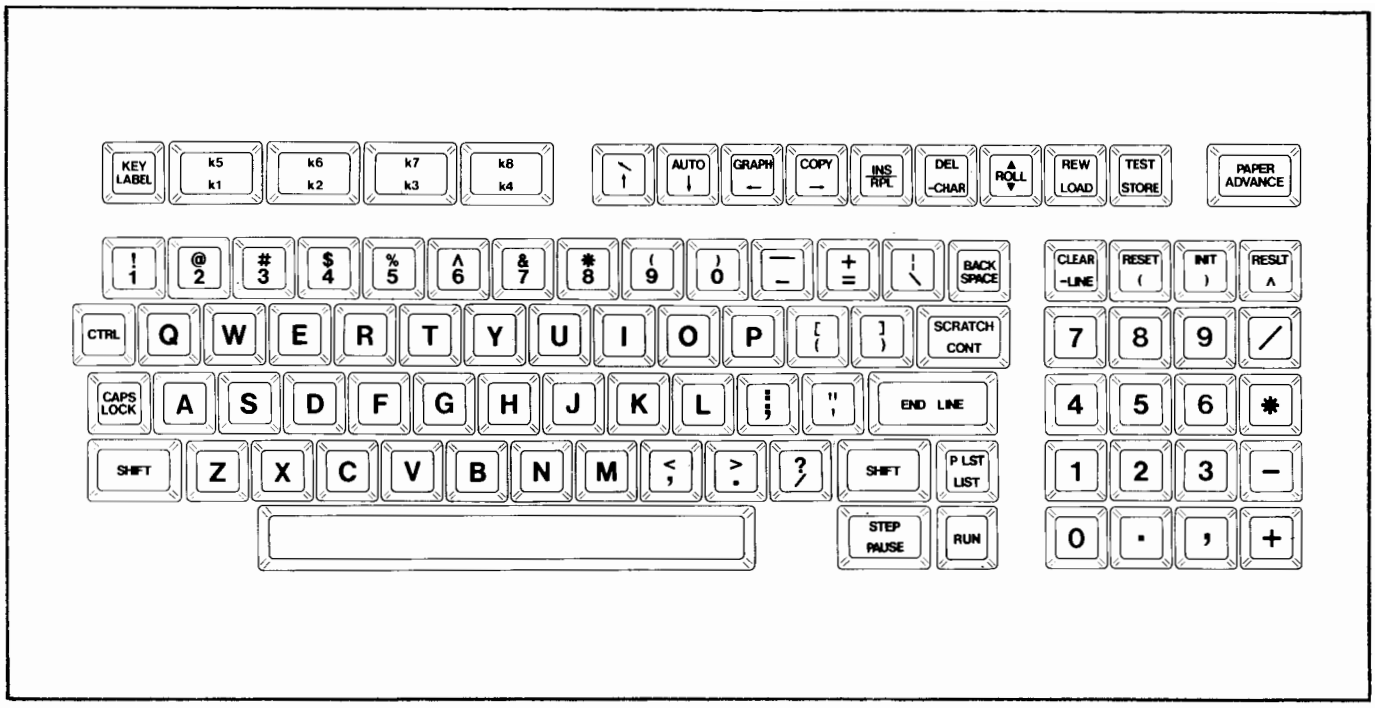
a. If the key cap to be removed is along the outside of the keyboard, remove the key caps between the one to be removed and the outside of the keyboard. This provides clearance for the paper clip, preventing the key cap from being scratched.

b. Insert the paper clip over the key hook the clip in the corners of the key cap.

c. Pull firmly upward to remove the key cap.

d. Install the new key cap by pressing it firmly into place. It is a press fit; it will not snap. If you have removed several key caps, see the drawing on the next page for the correct key positions.

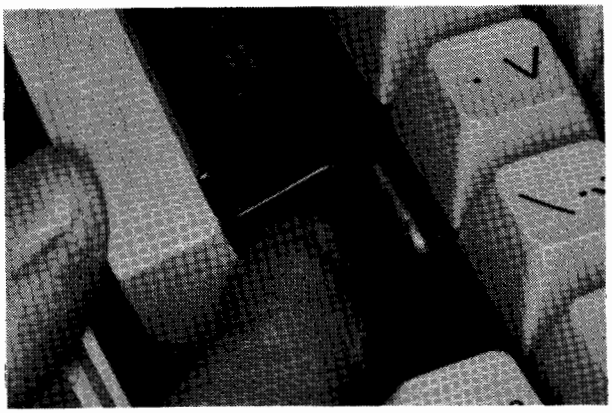




REPLACING THE SPACE BAR

a. Pull the space bar up, by hooking your thumbs under the ends of the bar, until the bar separates from its plunger.

b. Slide the bar along the hinge rod and gently press the bracket inward until it clears the rod.

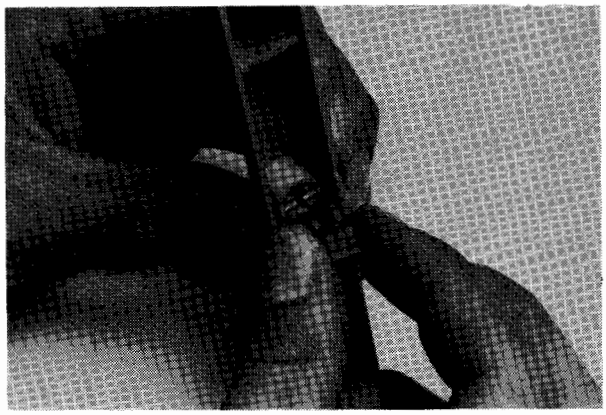


c. If the adapter (1) from the space bar remained in the plunger instead of in the space bar:

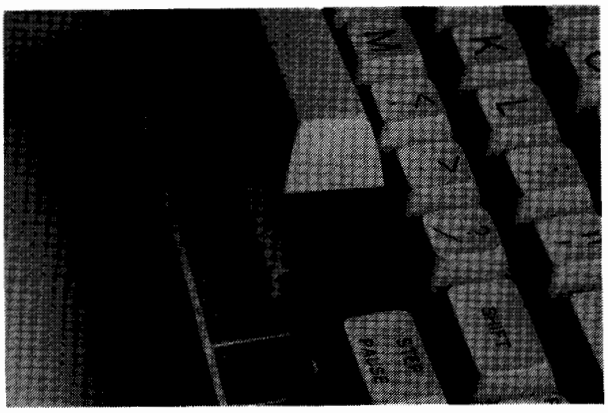
   (1) Pull the adapter out of the plunger with your fingers.

   (2) Insert the adapter into the boss in the space bar. The adapter should be positioned so that it angles toward the edge of the space bar away from the brackets.

   (3) Press the adapter firmly into place with your thumb.



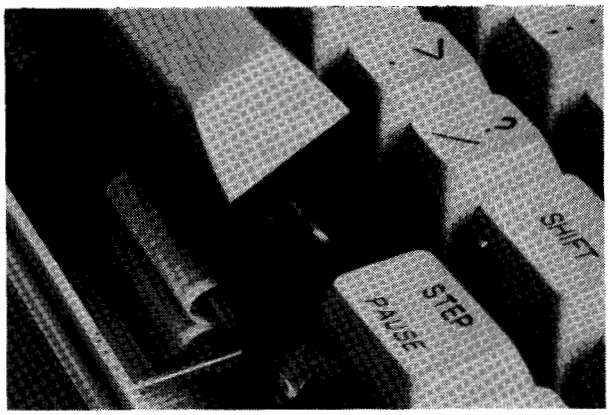
d. Position the space bar over the keyboard. It should be oriented with the brackets toward the front.



e. Hook one end of the hinge rod in the rear hole in the bracket.

f. Hook the other end in the rear hole of the bracket after sliding the bar along the rod.

g. Position the space bar with its adapter over its plunger, then press down on the center of the bar as far as it fill go. It is a press fit; it will not snap.

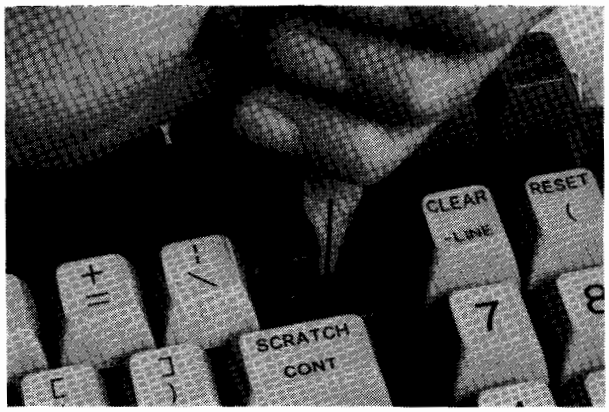


Note: After a plunger has been removed, it should not be reinserted. Discard it and install a new plunger.

This procedure does not apply to the plunger and spring for the [CAPS LOCK] key. To replace them, see the next procedure.

a. Remove the key cap or space bar as described above.

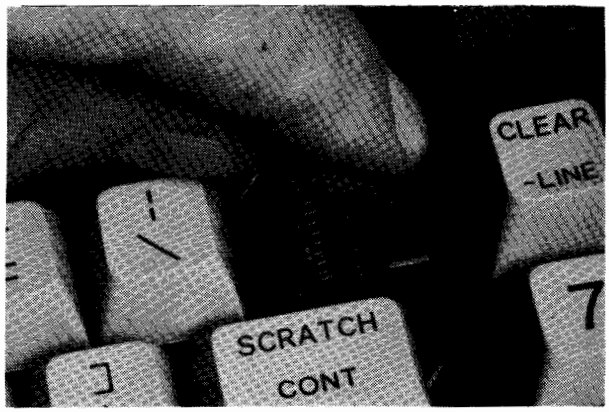
b. Grasp the plunger firmly using long-nose pliers with serrated tips.



> CAUTION
>
> In the next step, be sure to pull the plunger straight up. If you pull it up at an angle, the plunger housing could be damaged.

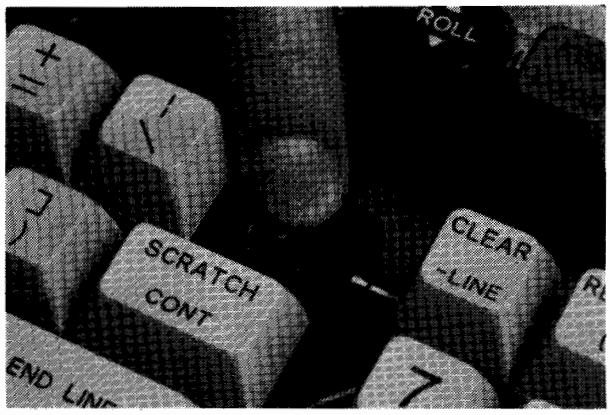
c. Pull up to remove the plunger.

d. Remove the old key spring and replace it with a new one. For all keys except the space bar and [CAPS LOCK] key, insert a short spring. For the space bar, insert a long spring. The exact lengths depend on the type of keyboard (refer to page 4-34 for details).



e. Place a new plunger over the spring. The plunger should be oriented such that the slots in its sides face the left and right of the keyboard and the bar inside points toward the front and back of the keyboard.

f. Press the plunger down with your finger until it snaps into place.



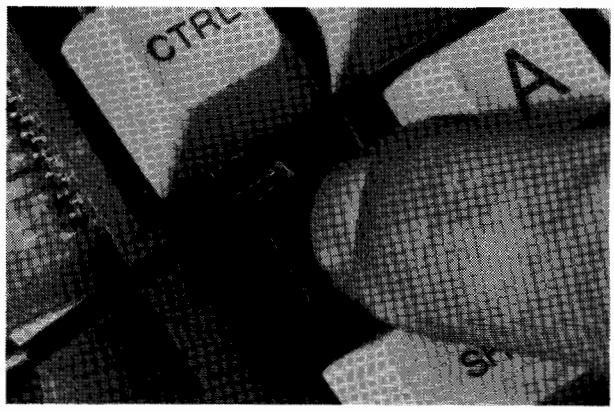
REPLACING THE [CAPS LOCK] KEY MECHANISM

Note: The plunger and spring used for the [CAPS LOCK] key are not the same as those used for the other keys. Refer to figure 4-4 and table 4-4 for the correct part number.

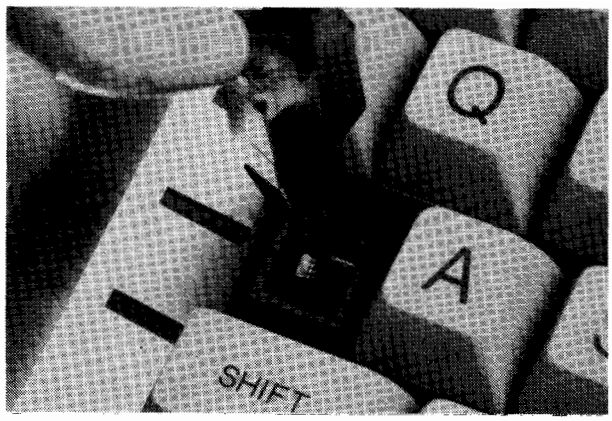
a. Remove the key cap as described above.

b. Place your finger over the plunger (6), and pry the wire (9) away from the plunger using a small, flat-blade screwdriver.

c. Lift off and discard the plunger and spring.

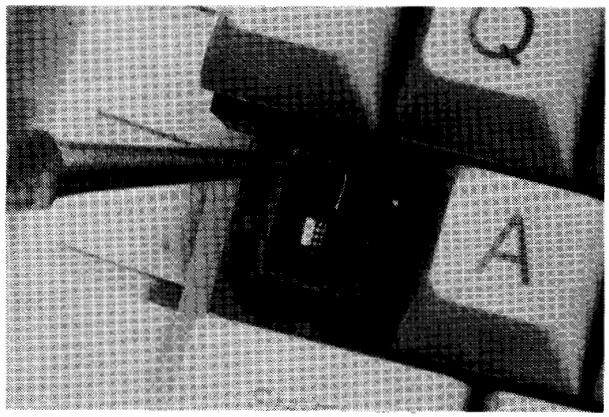


d. Remove the straight retaining wire (10) from the bottom of the plunger housing using needle-nose pliers. You may have to release the wire from beneath the plunger housing by prying it toward the rear of the keyboard.

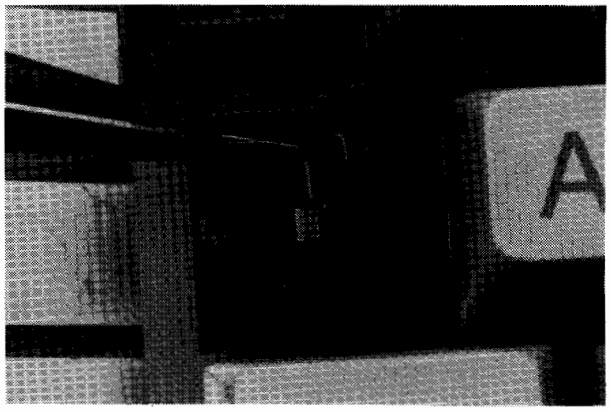


e. Remove the C-shaped wire from the plunger housing.

f. Insert a new C-shaped wire into the plunger housing. The long arm should be down and located in the shallow channel in the base of the plunger housing.

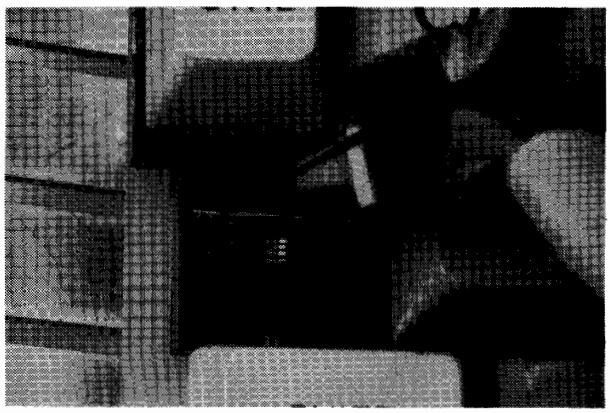


g. Insert a new straight retaining wire between the arms of the other wire, then release it so that it drops to the bottom of the plunger housing.

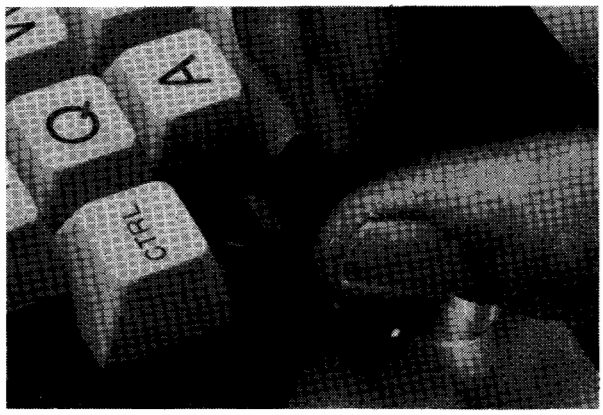


h. Pry both ends of the straight wire under the corners of the plunger housing.

i. Place a new, long spring (8) around the key contacts in the plunger housing.

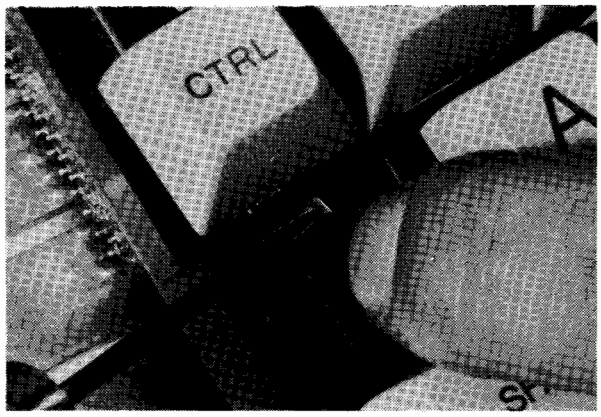


j. Place a new plunger over the spring. The plunger should be oriented such that the raised area on one of its sides faces the rear of the keyboard.



k. Press the plunger down into the housing while prying the C-shaped wire away from the plunger using a small, flat-blade screwdriver.

l. Release the wire so that it engages in the slot in the side of the plunger. Press down on the plunger a few times to make sure that the mechanism is working properly.

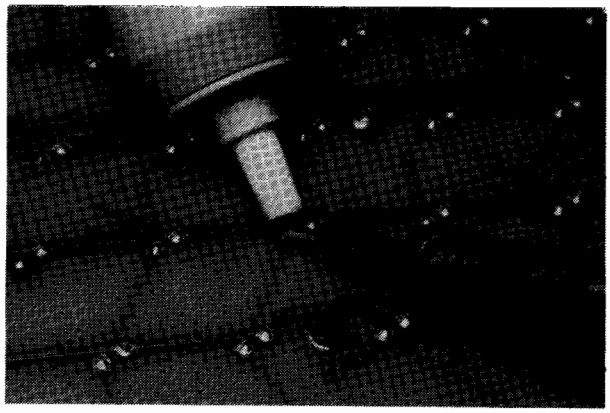


Computer Museum

REPLACING KEY CONTACTS

a. Remove the key cap, plunger, and spring as described above.

b. Unsolder the key contacts from the back of the keyboard PCA.



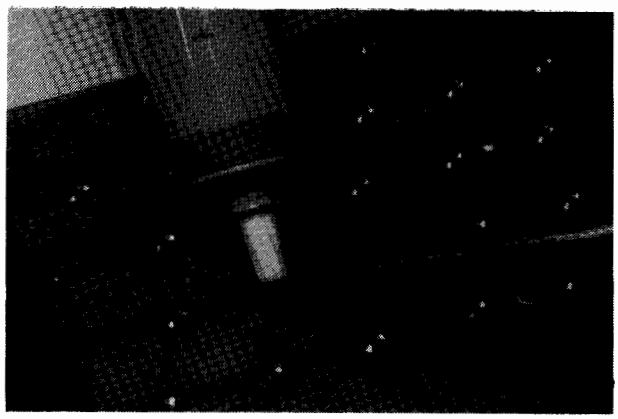
CAUTION

In the next step, be sure to pull the contacts straight up. If you pull them up at an angle, the plunger housing could be damaged.

c. Remove the key contacts, one at a time, by pulling them straight up using needle-nose pliers with serrated tips.

d. Remove all solder from the two holes in the keyboard PCA.

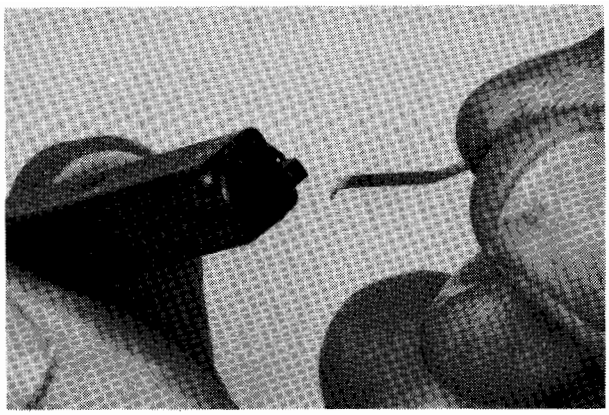
e. Remove any bits of plastic, loose solder, or other particles from the inside of the plunger housing.



CAUTION

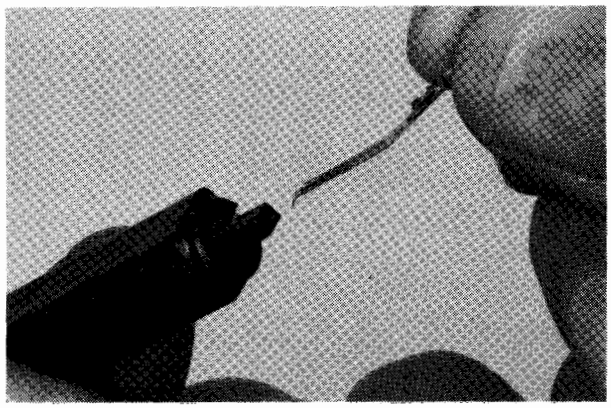
Wear white gloves while handling the key contacts in the next two steps. If key contacts are contaminated with dirt or oils, they might not make proper electrical contact when closed.

f. Insert a solid key contact into one of the rectangular holes next to the plunger in the bottom of the key contact insertion tool. The contact should be inserted so that it is bent toward the plunger in the tool.

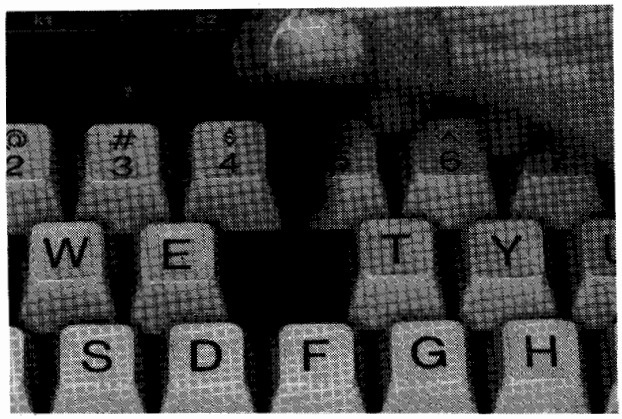


g. Push the contact into the tool as far as it will go. When fully inserted, the solder tail of the contact will reach the end of the plunger in the tool.

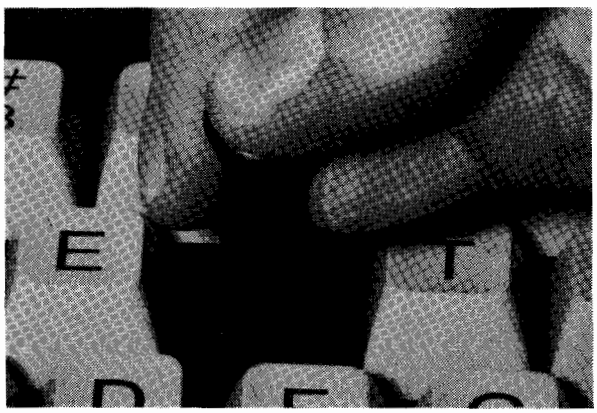
h. Insert a slotted key contact into the other rectangular hole in the tool. Again, the contact should be inserted so that it is bent toward the plunger. Push the contact into the tool as far as it will go.



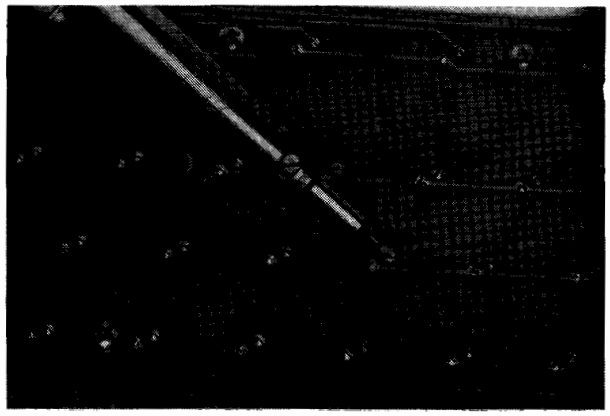
i. Insert the tool into the plunger housing. The tool should be oriented so that the contacts are facing the left and right of the keyboard, not the front and rear.



j. Press the tool down until it bottoms out in the plunger housing, then remove the tool.

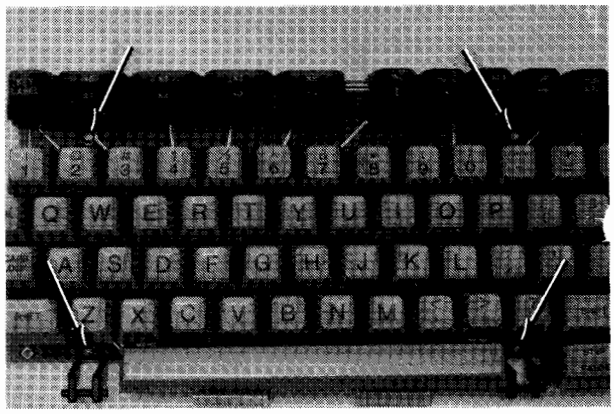


k. Solder the contacts to the keyboard PCA.



REPLACING A HINGE

a. Remove the two screws securing the hinge to the keyboard PCA using a #1 Pozidriv screwdriver.



b. Position a new hinge beneath the keyboard PCA. The pin in the middle of the hinge should be engaged in the hole in the keyboard PCA.

c. Insert and tighten the screws.

4-16. CLEANING KEY CONTACTS

4-17. To clean key contacts:

a. Remove the key cap, plunger, and spring as described in paragraph 4-15.

b. Dampen the corner of a thin cardboard sheet (such as a business card) with Freon TE, TF, or TMS PLUS.

c. Insert the dampened corner between the key contacts, and move it up and down between them a few times. (See figure 4-3.)

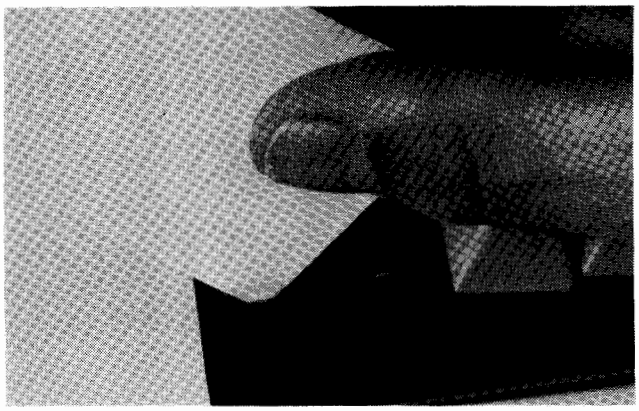


Figure 4-3. Cleaning Key Contacts

Table 4-4. Keyboard Assembly Replaceable Parts

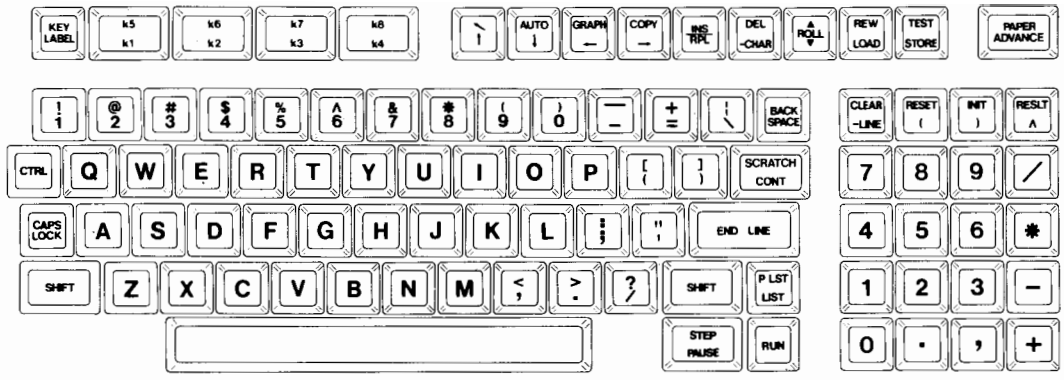
INDEX NUMBER, FIGURE 4-4	HP PART NUMBER	DESCRIPTION	QTY
	0371-0136	CAP, key, [LABEL KEY]	1
	0371-0149	CAP, key, [k1 k5]	1
	0371-0150	CAP, key, [k2 k6]	1
	0371-0151	CAP, key, [k3 k7]	1
	0371-0152	CAP, key, [k4 k8]	1
	0371-0092	CAP, key, [▲ ▶]	1
	0371-0093	CAP, key, [▼ AUTO]	1
	0371-0094	CAP, key, [◀ GRAPH]	1
	0371-0095	CAP, key, [▶ COPY]	1
	0371-0096	CAP, key, [RPL INS]	1
	0371-0098	CAP, key, [-CHAR DEL]	1
	0371-0137	CAP, key, [ROLL]	1
	0371-0138	CAP, key, [LOAD REW]	1
	0371-0139	CAP, key, [STORE TEST]	1
	0371-0144	CAP, key, [PAPER ADVANCE]	1
	0371-0119	CAP, key, [1 !]	1
	0371-0103	CAP, key, [2 @]	1
	0371-0104	CAP, key, [3 #]	1
	0371-0105	CAP, key, [4 $]	1
	0371-0106	CAP, key, [5 %]	1
	0371-0063	CAP, key, [6 ^]	1
	0371-0130	CAP, key, [7 &]	1
	0371-0070	CAP, key, [8 *]	1
	0371-0071	CAP, key, [9 (]	1
	0371-0072	CAP, key, [0)]	1
	0371-0073	CAP, key, [- _]	1
	0371-0074	CAP, key, [= +]	1
	0371-0075	CAP, key, [\ |]	1
	0371-0076	CAP, key, [BACK SPACE]	1
	0371-0069	CAP, key, [-LINE CLEAR]	1
	0371-0141	CAP, key, [(RESET]	1
	0371-0140	CAP, key, [) INIT]	1
	0371-0097	CAP, key, [RESLT]	1
	0371-0131	CAP, key, [CTRL]	1
	0371-0101	CAP, key, [Q]	1
	0371-0090	CAP, key, [W]	1
	0371-0120	CAP, key, [E]	1
	0371-0100	CAP, key, [R]	1

Table 4-4. Keyboard Assembly Replaceable Parts (Continued)

INDEX NUMBER, FIGURE 4-4	HP PART NUMBER	DESCRIPTION	QTY
	0371-0079	CAP, key, [T]	1
	0371-0108	CAP, key, [Y]	1
	0371-0080	CAP, key, [U]	1
	0371-0085	CAP, key, [I]	1
	0371-0125	CAP, key, [O]	1
	0371-0123	CAP, key, [P]	1
	0371-0143	CAP, key, [([]	1
	0371-0065	CAP, key, [)]]	1
	0371-0145	CAP, key, [CONT]/[SCRATCH]	1
	0371-0124	CAP, key, [7]	1
	0371-0117	CAP, key, [8]	1
	0371-0118	CAP, key, [9]	1
	0371-0078	CAP, key, [/]	1
	0371-0127	CAP, key, [CAPS LOCK]	1
	0371-0142	CAP, key, [A]	1
	0371-0099	CAP, key, [S]	1
	0371-0121	CAP, key, [D]	1
	0371-0088	CAP, key, [F]	1
	0371-0087	CAP, key, [G]	1
	0371-0086	CAP, key, [H]	1
	0371-0084	CAP, key, [J]	1
	0371-0083	CAP, key, [K]	1
	0371-0082	CAP, key, [L]	1
	0371-0132	CAP, key, [; :]	1
	0371-0128	CAP, key, [´ "]	1
	0371-0153	CAP, key, [END LINE]	1
	0371-0114	CAP, key, [4]	1
	0371-0115	CAP, key, [5]	1
	0371-0116	CAP, key, [6]	1
	0371-0077	CAP, key, [*]	1
	0371-0147	CAP, key, [SHIFT], right offset stem	1
	0371-0107	CAP, key, [Z]	1
	0371-0089	CAP, key, [X]	1
	0371-0122	CAP, key, [C]	1
	0371-0091	CAP, key, [V]	1
	0371-0064	CAP, key, [B]	1
	0371-0126	CAP, key, [N]	1
	0371-0081	CAP, key, [M]	1

Table 4-4. Keyboard Assembly Replaceable Parts (Continued)

INDEX NUMBER, FIGURE 4-4	HP PART NUMBER	DESCRIPTION	QTY
	0371-0066	CAP, key, [,<]	1
	0371-0067	CAP, key, [.>]	1
	0371-0068	CAP, key, [/?]	1
	0371-0146	CAP, key, [SHIFT], left offset stem	1
	0371-0134	CAP, key, [LIST PLST]	1
	0371-0111	CAP, key, [1]	1
	0371-0112	CAP, key, [2]	1
	0371-0113	CAP, key, [3]	1
	0371-0133	CAP, key, [-]	1
	0371-0154*	CAP, key, [SPACE BAR]	1
1		o ADAPTER	1
	0371-0148	CAP, key, [PAUSE STEP]	1
	0371-0135	CAP, key, [RUN]	1
	0371-0110	CAP, key, [0]	1
	0371-0129	CAP, key, [.]	1
	0371-0109	CAP, key, [,]	1
	0371-0102	CAP, key, [+]	1
2	1251-5794	CONNECTOR, ribbon cable, 11-pin	2
3	1535-4040*	CONTRACT, key, slotted	92
4	1535-4041*	CONTACT, key, solid	92
5	1535-4043*	PLUNGER, key	91
6	1535-4042*	PLUNGER, key, [CAPS LOCK]	1
7	1150-1415*	SPRING, key, 28 mm (1.1 in.)	90
8	1150-1416*	SPRING, key, 35 mm (1.4 in.)	2
9	1460-1782*	WIRE, cam, [CAPS LOCK] plunger	1
10	1460-1783*	WIRE, retaining, [CAPS LOCK] plunger	1
* Part numbers apply only to keyboard assemblies having white key plungers (HI TEK). For assemblies with yellow key plungers (STACKPOLE), use the following portion of the table:			
1	0371-2738	CAP, key, [SPACE BAR]	1
3 & 4	3131-0458	CONTACT, switch	184
5	4040-2021	PLUNGER, key	91
6	4040-2020	PLUNGER, key, [CAPS LOCK]	1
7	1460-2012	SPRING, key, 22 mm (0.89 in.)	90
8	1460-2014	SPRING, key, 26 mm (1.01 in.)	2
9	1460-2013	WIRE, cam [CAPS LOCK]	1
10	7155-0489	WIRE, lock, [CAPS LOCK]	1



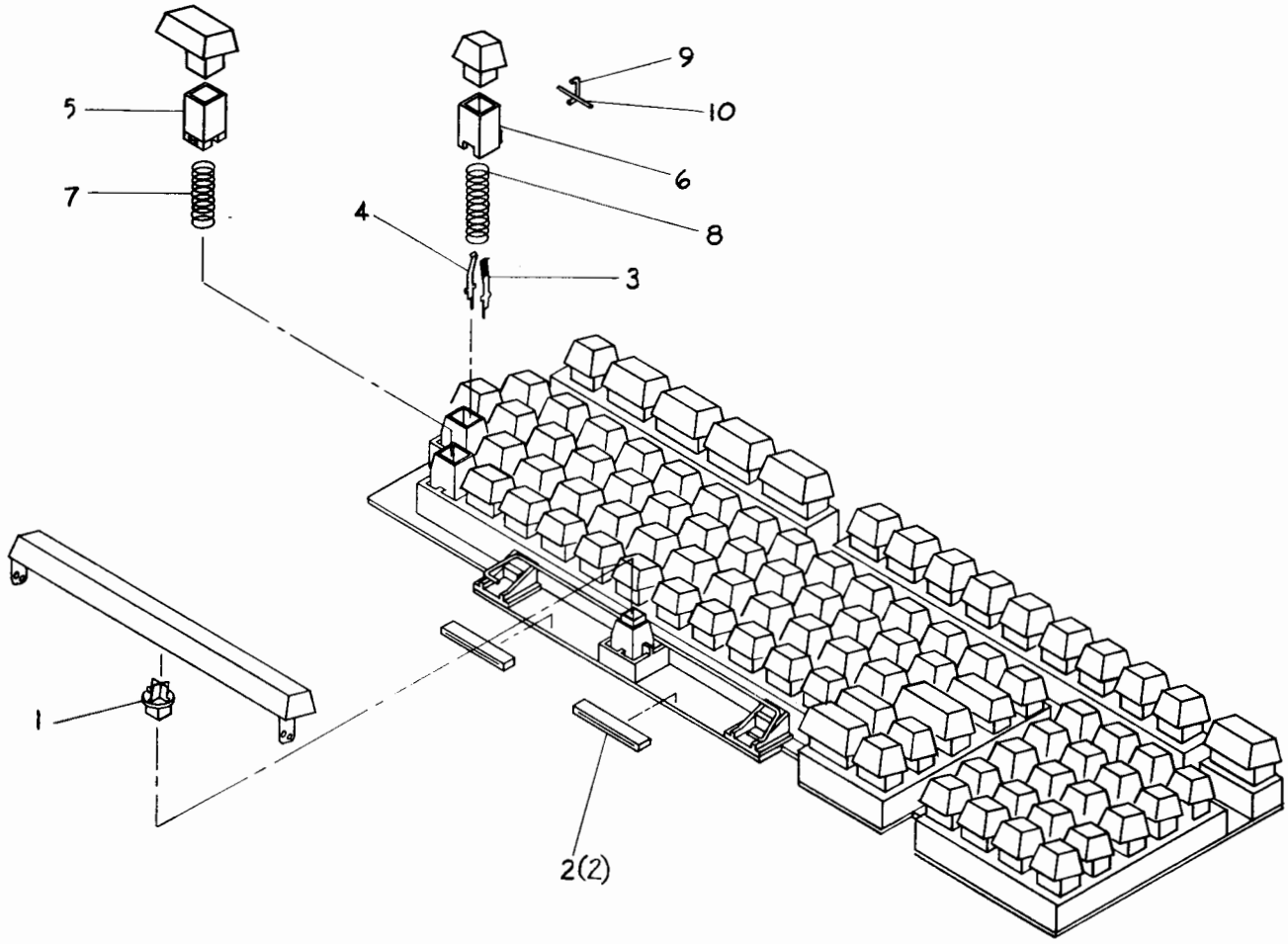


Figure 4-4. Keyboard Assembly Exploded View

SECTION
V

CRT Adjustments

5-1. INTRODUCTION

5-2. This section tells you how to correct certain conditions resulting from characteristics of the CRT circuitry drifting after long periods of use. These conditions include:

- Skew, adjusted by rotating the yoke around the CRT tube.
- Horizontal centering, adjusted by rotating the circular magnets around the CRT tube.
- Width, adjusted by the coil L1.
- Brightness, adjusted by the potentiometer normally accessible only through the back panel.
- Vertical centering, adjusted by the potentiometer R7.
- Height, adjusted by the potentiometer R6.
- Focus, adjusted by the potentiometer R19.

5-3. In addition to adjustments for the conditions listed above, a CRT assembly may also be pincushioned. This is a condition where straight lines, especially those at the edges of the display, are bowed inward or outward.* This condition can be corrected only by replacing the entire CRT assembly. To check whether the display is pincushioned, refer to paragraph 5-5.

*Strictly speaking, "pincushioning" refers to the condition where the lines of a displayed rectangle bow inward, like the sides of a pincushion; while "barreling" refers to the condition where the lines of a displayed rectangle bow outward, like the sides of a barrel. For simplicity, throughout this manual the term "pincushioning" is generally used to refer to both conditions.

5-4. The locations of the coil and all the potentiometers are shown in figure 5-1. The locations of the magnets adjusted for horizontal centering and the screw for adjusting the yoke are shown in photographs accompanying those steps.

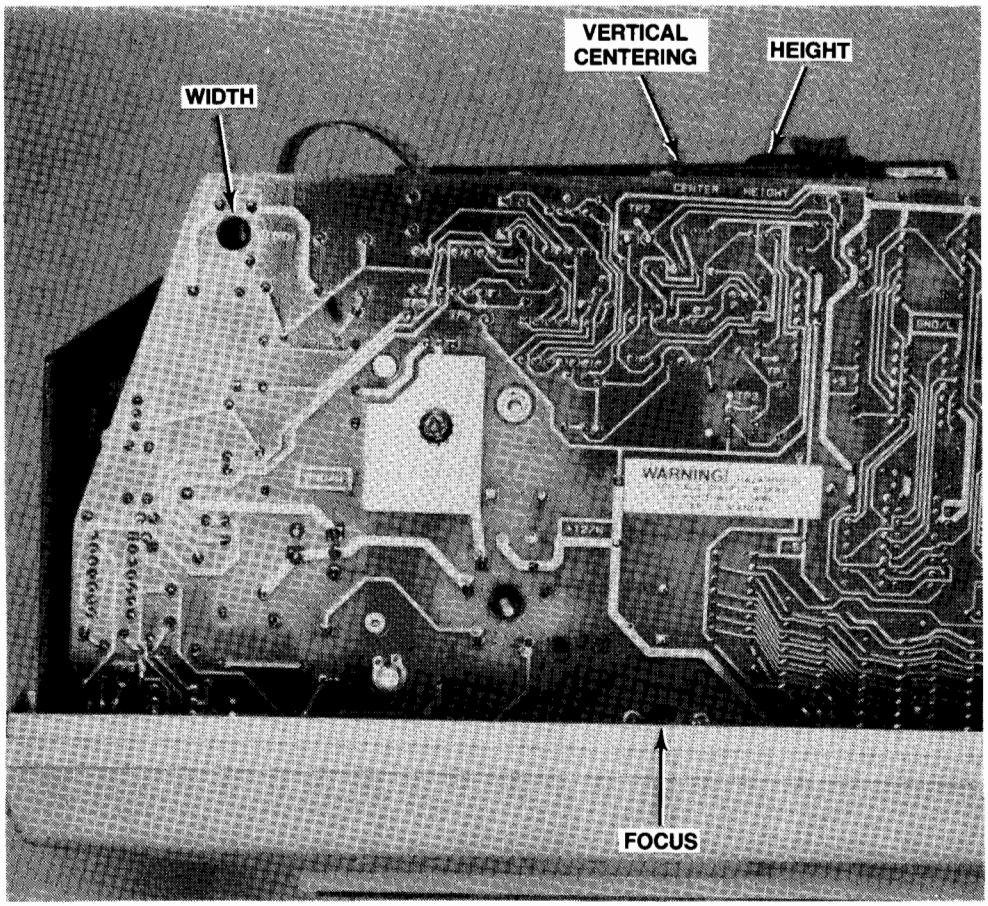


Figure 5-1. CPT Adjustments

WARNING

Lethal voltages may be present within and on the CPT assembly not only while power is on, but also for up to several days after power has been switched off. Electrical and mechanical failures may cause these voltages to be present at points that normally are safe. For your own safety, read and heed Safety Considerations in section I and the warning at the beginning of section II.

5-5. CHECKING WHETHER THE DISPLAY IS PINCUSHIONED

5-6. To check whether a display is pincushioned:

a. Place the CRT test pattern overlay on the CRT screen.

b. Adjust the position of the overlay until the wide outer lines are parallel to, and centered both horizontally and vertically between, the edges of the screen. The proper position is shown in figure 5-2.

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Figure 5-2. CRT Test Pattern Overlay in Position

Note: To avoid error due to parallax, when positioning the overlay you must sight on the overlay and screen with your eye along the center axis of the CRT tube, as shown in figure 5-3.

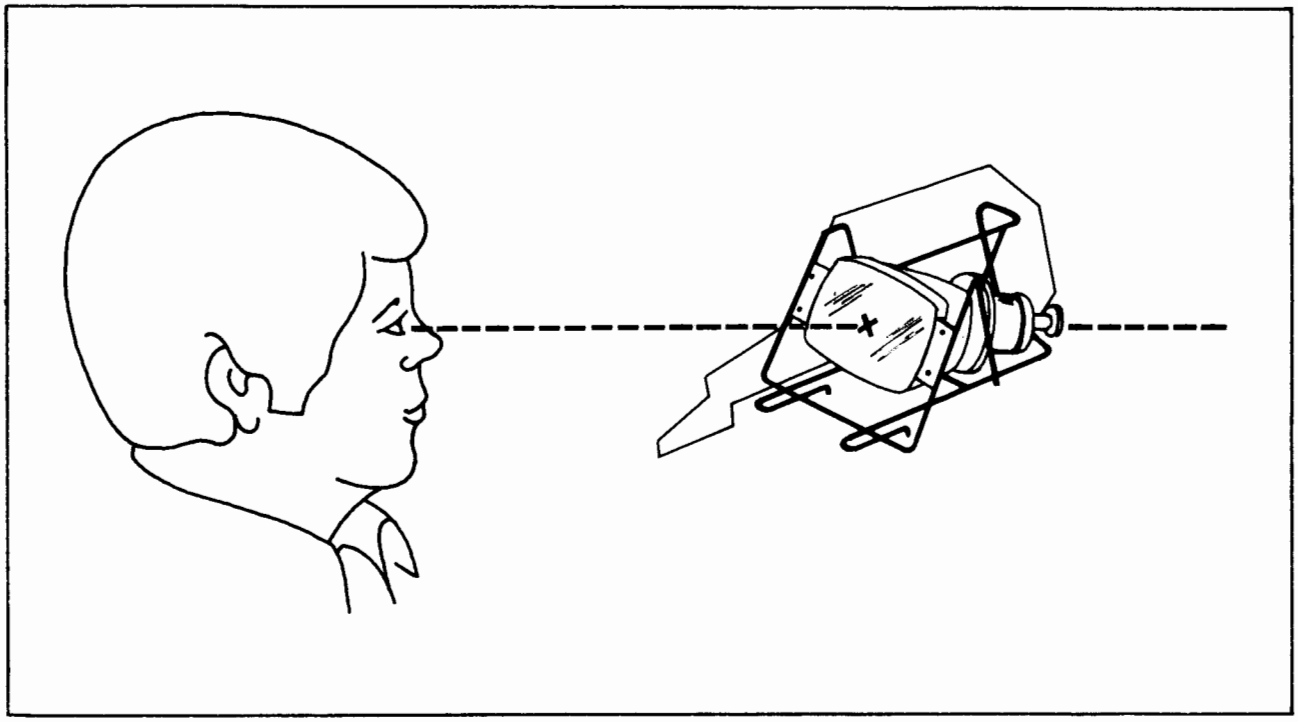


Figure 5-3. Sighting on CRT Screen and Test Pattern Overlay

c. Tape the overlay to the CRT tube with transparent tape.

d. Run the CRT test.

e. Keep CRT test pattern 3 (the pincushion test pattern) on the screen by pressing any key when it appears.

f. Check whether each of the four outside lines of the test pattern falls between the two parallel light lines on the overlay. You do not need to sight exactly along the axis of the CRT tube to check this, as you do when actually making an adjustment. If necessary, move your head to different positions for each line of the test pattern until you can see it between the overlay lines.

5-7. If any line is so curved that at no viewing position can you see all of it--namely, the middle and both ends--between the overlay lines, then the CRT assembly is pincushioned. (Figure 5-4 shows a pincushioned display; figure 5-5 shows a normal display.) Replace the entire CRT assembly.

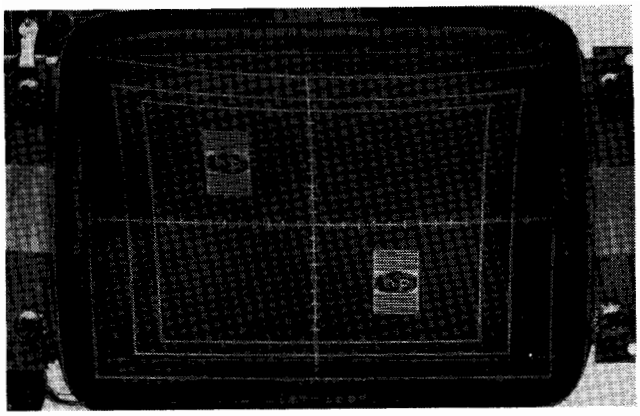


Figure 5-4. Pincushioned Display

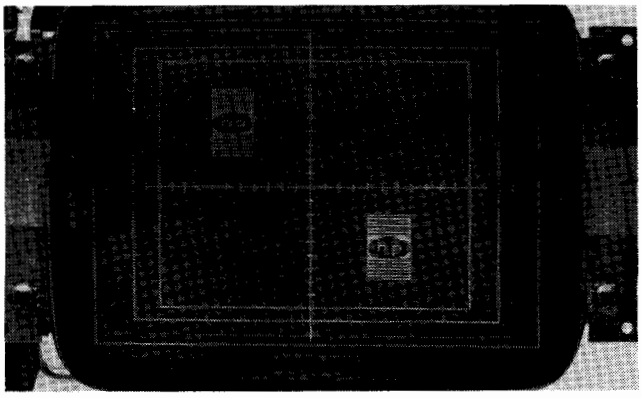


Figure 5-5. Normal Display

5-8. ADJUSTMENT PROCEDURES

5-9. To set up the CRT assembly for adjustments, attach the CRT test pattern overlay to the screen as described in paragraph 5-5, run the CRT test from the Service ROM, and halt it with CRT test pattern 3 in the display.

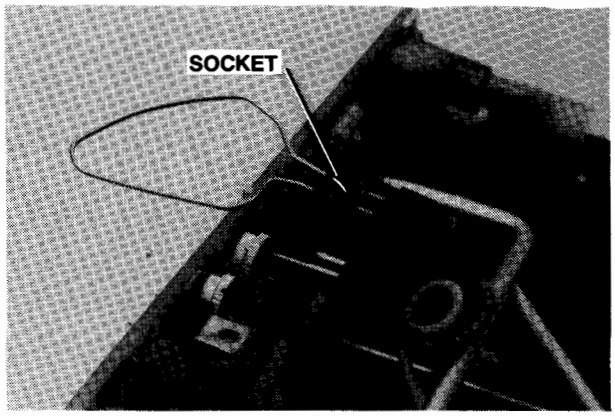
SKEW

1. Turn the brightness control fully counterclockwise. This should make the display blank. (If it does not, the control is connected or wired incorrectly; refer to step 4h of paragraph 3-15.)

2. Remove the socket connecting the vertical yoke to the CRT PCA.

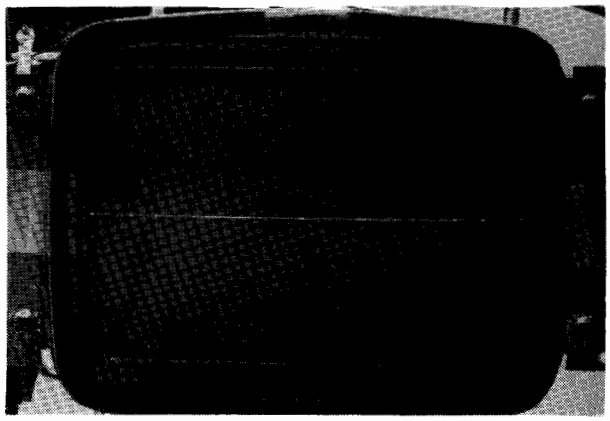
3. Short the vertical yoke by inserting into the socket a shorting plug. Construct a shorting plug by using a two-pin connector, p/n 1251-5732, along with some wire and heat shrink tubing. See also Service Note 85-01.

Note: Instead of using a paper clip as shown in this photograph, use the shorting plug described in Service Note 85-01.



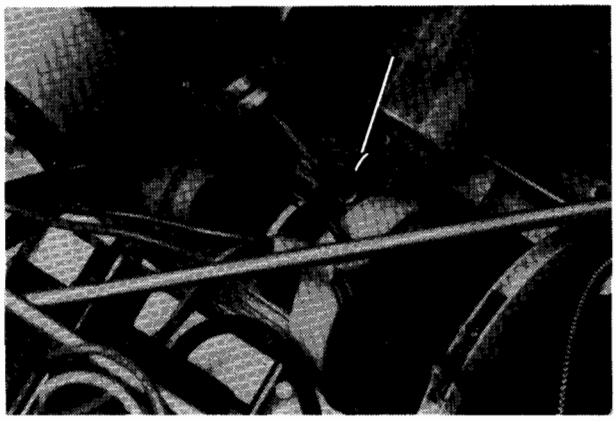
> **CAUTION**
>
> Do not turn the brightness up too far in the next step. Excessive brightness can permanently damage the CRT tube.

4. Turn the brightness control clockwise until you can clearly see the full width of the displayed horizontal line. You should see a dot at the end of each line.

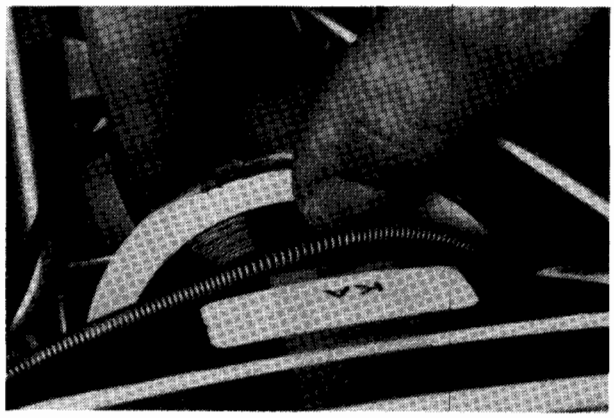


4. Check for skew in the line. It should be parallel to the short, parallel, horizontal lines at the sides of the overlay. (Disregard the vertical position and width of the line at this time.) If not:

   a. Loosen the screw in the yoke clamp with a flat-blade screwdriver.



   b. Rotate the yoke around the neck of the CRT tube until the displayed line is properly positioned beneath the overlay.



   c. Tighten the screw in the yoke clamp. Do not overtighten the clamp; it should be only tight enough that you cannot easily rotate the yoke with your fingers.

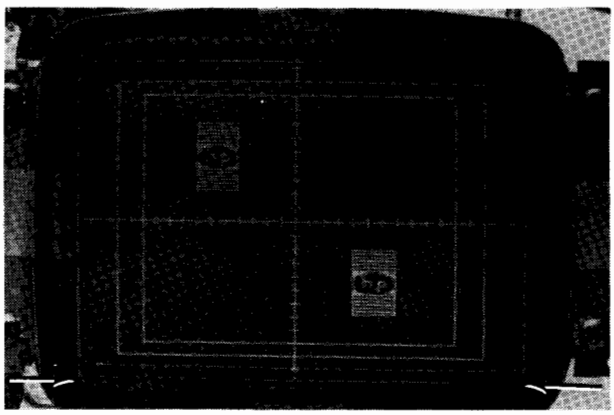
   d. Recheck the skew in the line; tightening the screw can rotate the yoke slightly.

   e. Remove the wire shorting the vertical yoke, and reconnect the plug to the CRT PCA. Readjust the brightness control for normal viewing intensity.

HORIZONTAL CENTERING

The left and right vertical lines in CRT test pattern 3 should be centered horizontally with respect to the vertical reference lines on the overlay. If not, adjust their position using both circular magnets as follows:

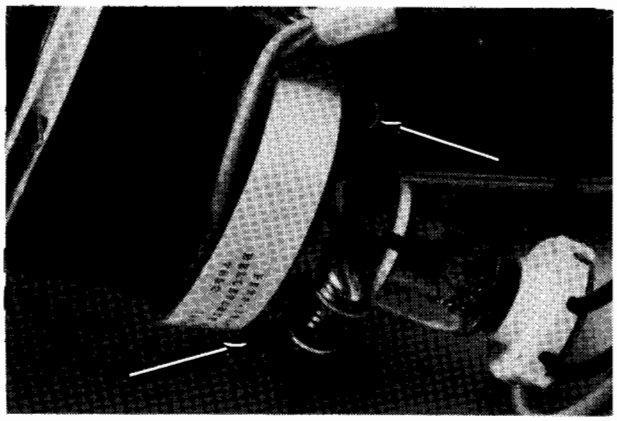
1. Adjust the vertical centering control (R7) until the top or bottom line of the test pattern falls under one of the horizontal reference lines on the overlay.



2. Move the magnet whose tab is furthest from up or down until the test pattern is centered horizontally.

3. Move the other magnet until the line in the test pattern again falls under the reference line on the overlay.

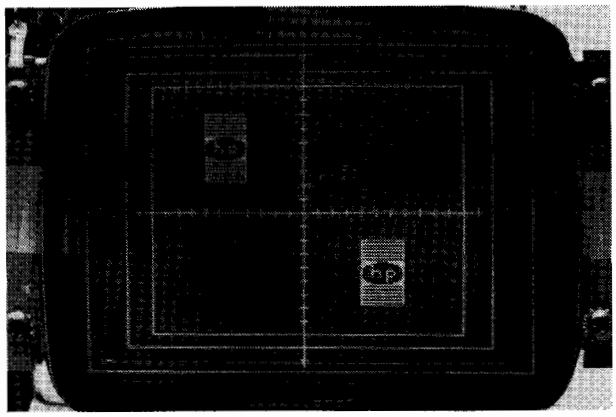
4. Repeat steps 2 and 3 until the test pattern is centered horizontally and the line falls under the reference line on the overlay.



WIDTH

The left and right vertical lines in CRT test pattern 3 should fall between the two pairs of narrow vertical lines at the sides of the overlay. If not, make sure the display is centered horizontally as described above, then adjust coil L1.

VERTICAL CENTERING AND HEIGHT



The top and bottom lines of CRT test pattern 3 should fall between the two pairs of narrow horizontal reference lines on the overlay. If not, adjust their position as follows:

1. Adjust the vertical centering control (R7; the rear potentiometer at the top of the CRT PCA) until the top line of the test pattern falls between the two narrow horizontal lines at the top of the overlay.

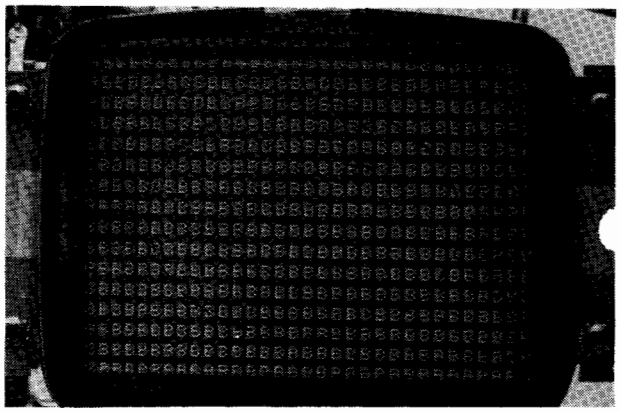
2. Adjust the height control (R6; the the front potentiometer at the top of the CRT PCA) until the bottom line of the test pattern falls between the two narrow horizontal lines at the bottom of the overlay.

3. Repeat steps 1 and 2, if necessary, until both the top and the bottom lines of the test pattern are properly located.

1. With CRT test pattern 3 in the display, press any key twice to get test pattern 4 (all {B}'s) onto the screen.

> WARNING
>
> In the following step, be careful not to touch either of the pins alongside the focus control. The voltage on these pins can vary up to 220V.

2. Adjust the focus control (R19, the potentiometer at the bottom of the CRT PCA) until the {B}'s in the area one inch from the top of the screen and one inch from the left-hand edge of the screen are in focus rather than the central region of the screen shown.



6-1. INTRODUCTION

6-2. This section tells you how to troubleshoot and repair the electrical and mechanical portions of the printer assembly. Included are procedures for:

o Determining the cause of a printer problem (paragraph 6-3).

o Making adjustments for proper operation (paragraph 6-7).

o Replacing the platen and the print-head assembly (paragraph 6-18).

6-3. TROUBLESHOOTING

6-4. To help determine what may be wrong with the printer (if anything), run the System Test from the Service ROM. (Refer to paragraph 8-23.) It is essential that you run at least the CPU, RAM, and ROM Tests before running the Printer Test, since many printer problems may be caused by a failure in one of these components rather than in the printer assembly. If one of those three tests indicates a bad IC, replace it and run the System Test again. After all three tests have been passed, you need run only the Printer Test to check whether replacing a part of the printer assembly has corrected a printer problem.

6-5. The Printer Test checks part of the printer controller and also gives you a test printout. By evaluating this printout and by observing the printer operating, you can identify symptoms of printer malfunctioning. Table 6-1 lists most symptoms you are likely to encounter, together with possible causes for each symptom and the recommended diagnosis/repair procedure.

6-6. To fix the problem, you may need to replace certain parts and/or make certain adjustments. The disassembly procedures referred to in table 6-1 are described in paragraph 6-18; the adjustment procedures are described in paragraph 6-7.

Table 6-1. Printer Troubleshooting Guide

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
No response from printer.	Bad controller (U5).	Replace controller.
Print head moves, but no printout.	Platen is not correctly positioned.	Check and adjust if necessary.
	Printer paper is not HP thermal paper.	Check by replacing paper roll.
	Thermal paper inserted backwards.	Check and reinsert if necessary.
	Print head is dirty.	Clean with a pink pencil eraser.
	Spring in print-head assembly broken or missing.	Replace spring.
	Bad connection between print-head flex-cable and printer PCA.	Remove flex-cable from connector. Inspect cable contacts, and check continuity between connector contacts and printer PCA. Replace print-head assembly or printer PCA* if necessary.
	Bad controller (U5).	Try new controller.
	Bad print-head assembly.	Try new print-head assembly.
	Bad printer PCA.	Replace printer PCA.*
Print head doesn't move, and paper under print head turns blue.	Bad controller (U5).	Try new controller.
	Bad print-head motor.	Try new print-head motor.** (Be sure to set the home position of the print head as described in paragraph 6-8.)

Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
	Bad printer PCA.	Replace printer PCA*
	Flexible coupling on print-head drive shaft loose.	Position print head and tighten coupling.** (Refer to Setting the Print-Head Home Position, paragraph 6-8.)
	Print-head drive belt too tight.	Adjust tension on belt.** (Refer to Adjusting the Print-Head Drive Belt, paragraph 6-12.)
Printed lines not correctly aligned vertically.	Bad controller (U5).	Try replacing controller.
	Print-head drive belt too loose or too tight.	Adjust tension on belt.** (Refer to Adjusting the Print-Head Drive Belt, paragraph 6-12.)
	Flexible coupling on print-head drive shaft loose, or coupling tightened with print head not in home position.	Position print head and tighten coupling.** (Refer to Setting the Print-Head Home Position, paragraph 6-8.)
	Guide shaft(s) dirty.	Clean with isopropyl alcohol or contact cleaner.
	Jumper wire (W37) connected.	Disconnect jumper wire.
Paper advances too little, not at all, or erratically.	Paper roll cocked or jammed.	Check whether paper roll turns freely in paper well.
	Paper jammed in printer.	Remove paper, check for jam, then reinsert paper. Be sure that paper is HP thermal printer paper.

Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
	Bad controller (U5).	Try new controller.
	Bad paper-advance motor.	Try new motor. (Be sure to adjust tension on paper-advance drive belt as described in paragraph 6-16.)
	Paper-advance drive belt too loose or too tight.	Adjust tension on belt. (Refer to Adjusting the Paper-Advance Belt, paragraph 6-15.)
	Bad springs on lower paper guide.	Check and replace springs if necessary.
	Paper-advance shaft not turning freely.	Check and replace shaft if necessary.
	Bad printer PCA.	Replace printer PCA.*
	Dirt or other objects caught in printer.	Check and clean.
Dots missing in printout.	Bad print-head assembly.	Disconnect print-head flex-cable from printer PCA and check resistance between the wide contact and each remaining contact. If each resistance is not 45 to 55 ohms, replace print-head assembly.
	Print head is dirty.	Clean with a pink pencil eraser.
	Bad controller (U5).	Try replacing controller.
	Bad printer PCA.	Replace printer PCA.*

Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
Extra dots printed.	Bad controller (U5).	Try replacing controller.
	Bad print-head assembly.	Disconnect print-head flex-cable from printer PCA and check resistance between flex-cable contact for extra dot and remaining contacts. If any are shorted, replace print-head assembly.
	Bad printer PCA.	Replace printer PCA.*
Printer prints incorrect characters ("garbage").	Bad controller (U5).	Replace controller.
Characters compressed across line.	Print-head drive belt too tight.	Adjust tension on belt.** (Refer to Adjusting the Print-Head Drive Belt, paragraph 6-12.)
First few or last few characters in each line compressed.	Flexible coupling on print-head drive shaft tightened with print head not in home position.	Position print head and tighten coupling.** (Refer to Setting the Print-Head Home Position, paragraph 6-8.)
	Print-head drive belt too tight (or too loose).	Adjust tension on belt.** (Refer to Adjusting the Print-Head Drive Belt, paragraph 6-12.)

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Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
Incomplete lines printed.	Bad print-head assembly.	Move print head to right side of printer, and inspect flex-cable where it joins print-head holder. If cracks are visible, replace print-head assembly.
	Bad controller (U5).	Replace controller.
	Flexible coupling on print-head drive shaft tightened with print head not in home position.	Position print head and tighten coupling.** (Refer to Setting the Print-Head Home Position, paragraph 6-8.)
	Print-head drive belt too tight (or too loose).	Adjust tension on belt.** (Refer to Adjusting the Print-Head Drive Belt, para-6-12.)
Vertical streaks printed on all lines.	Bad platen.	Replace platen.
Streak(s) printed across lines.	Bad spring in print-head assembly.	Check spring and replace if necesary.
	Print head is dirty.	Clean with a pink pencil eraser.
	Bad print-head assembly.	Check for sharp corners on print head; replace if neces-sary.
Printout too light (even with print intensity switch set to 7).	Blue discoloration on print head.	If present, clean with a pink pencil eraser.
	Bad spring in print-head assembly.	Check spring and replace if necessary.

Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
	Bad print-head assembly.	Try new print-head assembly.
	Bad controller (U5).	Replace controller.
	Bad printer PCA.	Replace printer PCA.*
	Printer paper is not HP thermal paper.	Check by replacing paper roll.
Intensity of printout varies across lines.	Bad platen.	Try new platen.
	Bad printer PCA. (If regulation of 12V power supply line bad, character width may also vary across line.)	Replace printer PCA.*
Intensity of printout varies between lines.	Bad print-head assembly.	Try new print-head assembly.
	Bad platen.	Replace platen.
Print-head movement slow or erratic. Note: Slow print-head movement can destroy print-head resistors.	Bad controller (U5).	Try new controller.
	Print-head drive belt too tight.	Adjust tension on belt.** (Refer to Adjusting the Print-Head Drive Belt, paragraph 6-12.)
	Bad print-head motor.	Try new motor.**
	Guide rod(s) dirty, worn, or damaged.	Clean or replace.
	Bad printer PCA.	Replace printer PCA.*
	Printer paper is not HP thermal paper.	Check by replacing paper roll.

Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
Prints without paper. CAUTION Do not loosen the screw securing the paper sensor to the lower paper guide. This assembly is precision-adjusted at the factory.***	Bad controller (U5). Bad paper sensor (on lower paper guide).*** Bad printer PCA.	1. Disconnect out-of-paper sensor plug from connectors (J5 and J8) on printer PCA.*** 2. Enter characters into display, then press [SHIFT] [COPY]. 3. If still prints without paper, replace controller; otherwise, replace printer mechanical assembly. 4. If replacing the controller or the lower paper guide does not correct the problem, replace the printer PCA.*
Displays out-of-paper message with paper in printer.*** CAUTION Do not loosen the screw securing the paper sensor to the lower paper guide. This assembly is precision-adjusted at the factory.***	Bad controller (U5). Bad paper sensor (on lower paper guide).*** Bad printer PCA.	1. Short together pins 1 and 2 of J5. 2. Enter characters into display, then press [SHIFT] [COPY]. 3. If message still appears, replace controller; otherwise, replace printer mechanical assembly. 4. If replacing the controller or the lower paper guide does not correct the problem, replace the printer PCA.*

Table 6-1. Printer Troubleshooting Guide (Continued)

SYMPTOM	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
Excessive noise. Note: Before the first print operation after power-on, the print-head moves to the left and bangs against the printer wall, establishing the print-head home position. This banging does not damage the printer mechanism in any way, and the noise generated by the banging is normal.	Guide rod(s) dirty, worn, or damaged.	Clean or replace.**
	Belt or pulley worn or damaged.	Replace.**

*If this assembly is replaced, remove the jumper wire (W37) from the printer PCA if the wire on the old assembly was removed. (W37 is located near pins 1 and 40 of the printer controller, U5.)

**After doing this, check the printout for a vertical misalignment. (See figure 6-4.) If printed lines are not correctly aligned, remove the jumper wire (W37) from the printer PCA if installed, or install one if not.

***The out-of-paper sensor (OOPS) is only present on older HP-85A computers. This sensor was removed on later units to improve the reliability of the HP-85A. See Service Note 85A-08 for further details.

6-7. ADJUSTMENTS

6-8. Setting the Print-Head Home Position

6-9. The "home" position of the print head is the position of the print head at the left end of a printed line. The home position must be set so that the printout is approximately centered across the paper and the print head carriage does not bang into the rubber bumper on either end of the guide rod. Just before the first print operation after power-on, the controller establishes the home position by moving the print head all the way to the left, then back about 0.045 inch to the right. To ensure that the same home position is established each time, the rotational position of the print-head motor must be fixed with respect to the position of the print head when the print head is in its home position. The necessary procedure is described below.

6-11. This procedure is necessary whenever:

- o The print-head assembly has been removed from its drive belt.
- o The print-head motor has been disconnected from the print-head drive shaft.
- o The setscrew in the flexible coupling on the print-head drive shaft has been loosened.
- o Certain symptoms listed in table 6-1 are observed.

> Note: If any part of the print-head drive mechanism--such as the print-head motor, drive belt, or the setscrew in the coupling--is adjusted or replaced, check the printout for a vertical misalignment after setting the print-head home position. (See figure 6-4.) If printed lines are not now correctly aligned, remove the jumper wire (W37) from the printer PCA if installed, or install one if not. (W37 is located near pins 1 and 40 of the printer controller, U5.)

6-12. To fix the position of the print head with respect to the print-head motor:

a. Ensure that the print-head drive belt is inserted in the print-head carriage.

b. Loosen the setscrew in the flexible coupling nearest the print-head motor using a 0.050-inch hex key. (See figure 6-1.)

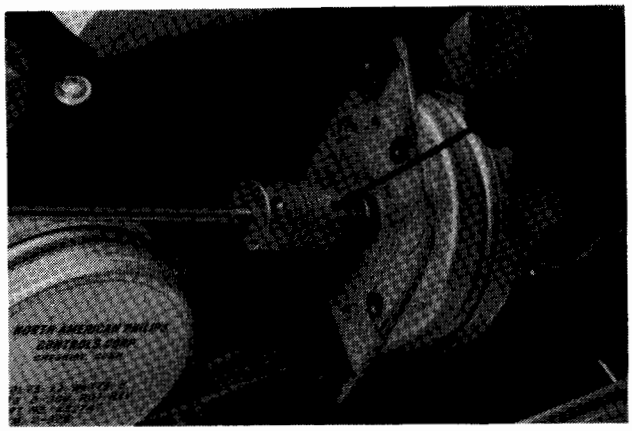


Figure 6-1. Setscrew for Setting Print-Head Home Position

c. Push the print head carriage to the left until it is about 0.045 inch (3/64 inch or 1.15 millimeters) from the rubber bumper at the left end of the guide rod. (See figure 6-2.)

d. If the computer is already on, switch it off and then on again.

e. Type {PRINT ""} [END LINE].

f. Move the cursor up one line, then press [END LINE] again. This second print operation brings the print-head motor into the correct rotational position (that is, a "home" position for the motor).

g. Tighten the setscrew in the coupling, being careful not to rotate the print-head drive shaft.

h. Enter the BASIC command shown in figure 6-3 into the display, then press [END LINE]. (You may type in any character between the quotation marks.)

i. Make sure there is space between the print-head carriage and the rubber bumper at the right end of the guide rod. The exact amount of space is not critical. If there is space there, proceed with step j; otherwise, repeat this procedure, positioning the print-head carriage somewhat closer to the rubber bumper at step c.

j. Move the cursor up one line, then press [END LINE] again.

k. Make sure there is space between the print-head carriage and the rubber bumper at the left end of the guide rod. At this step, the exact amount of space is not critical, but it should be about the same as in step c. If there is space there, proceed with step l; otherwise, repeat this procedure, positioning the print-head carriage somewhat closer to the rubber bumper in step c.

l. Switch the computer off, then on again.

m. Type {PRINT ""} [END LINE] twice, then check the position of the print-head carriage as in step k. If the space there is about the same as in step i, you are finished; otherwise, repeat this procedure, positioning the print-head carriage somewhat closer to the rubber bumper at step c.

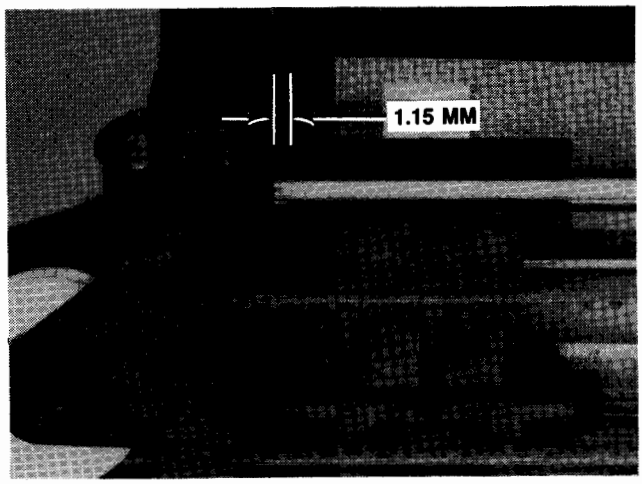


Figure 6-2. Clearance Between Print-Head Carriage and Bumpers

```
PRINT "BBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
BBBBBBE"
```

Figure 6-3. BASIC Command for Printing Full Line

6-12. Adjusting the Print-Head Drive Belt

6-13. The print-head drive belt must be adjusted whenever:

o The print-head drive belt is removed or replaced.

o Certain symptoms in table 6-1 are observed.

> Note: If adjusting the print-head drive belt does not correct a vertical misalignment between printed lines (see figure 6-4), remove the jumper wire (W37) from the printer PCA if installed, or install one if not. (W37 is located near pins 1 and 40 of the printer controller, U5.)

6-14. To adjust the print-head drive belt:

a. Set the print intensity to 4.

b. Type in: 10 PRINT "H"; @ GO TO 10 [END LINE].

c. Press [RUN] and wait for at least ten lines to be printed.

d. Check the middle five columns in the printout.

> Note: In step e, the belt will be adjusted until it is too tight; in step f, the belt will be adjusted until it is too loose. In both conditions, there will be an offset between the characters on one line and the characters on the next. (See figure 6-4.) However, if the belt is too loose, it will be visibly slack near the right pulley while the print head is moving from right to left. When the belt is adjusted to the proper tension, the offset from line to line should be no greater than 2/3 the width of a printed dot.

e. If the belt is not yet too tight:

   (1) Insert a 7/64-inch ballpoint hex screwdriver into the cap screw at the right side of the printer. (See figure 6-5.)

   (2) Turn the screwdriver clockwise 1/6 of a revolution.

   (3) Repeat steps c and d.

   (4) If the belt is not yet too tight, repeat steps (1) through (3).

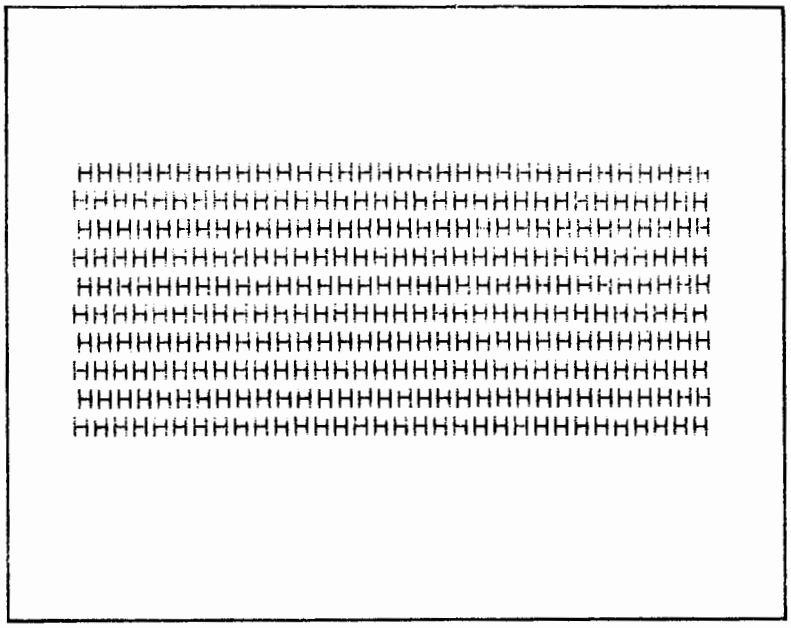


Figure 6-4. Printed Lines Not Correctly Aligned Vertically

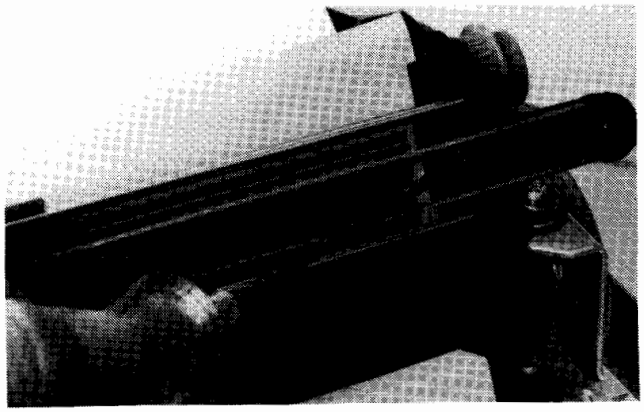


Figure 6-5. Adjusting Print-Head Drive Belt

f. If the belt is not too loose:

(1) Insert the screwdriver and turn it counterclockwise 1/6 of a revolution.

(2) Repeat steps c and d.

(3) If the belt is not yet too loose, repeat steps (1) and (2), counting the number of revolutions you turn the screw counterclockwise.

g. Turn the screw clockwise 1/3 to 1/2 the number of revolutions you turned it counterclockwise.

6-15. Adjusting the Paper-Advance Belt

6-16. The paper-advance belt must be adjusted whenever:

o The paper-advance motor is removed.

o Certain symptoms listed in table 6-1 are observed.

6-17. To adjust the paper advance belt:

a. Loosen the two screws securing the paper-advance motor to the printer, using a #1 Pozidriv screwdriver. (See figure 6-6.)

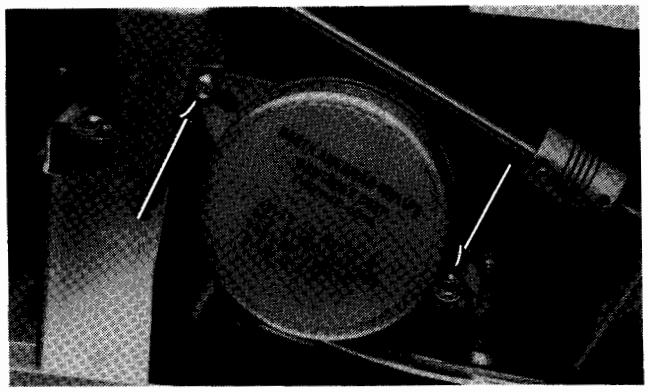


Figure 6-6. Paper-Advance Motor Screws

b. Slide the motor until the belt deflects 1/4 +- 1/64 inch (6.35 +- 0.4 millimeters) when you press midway on the rear portion of the belt. (See figure 6-7.)

c. Tighten the two screws while holding the motor in place.

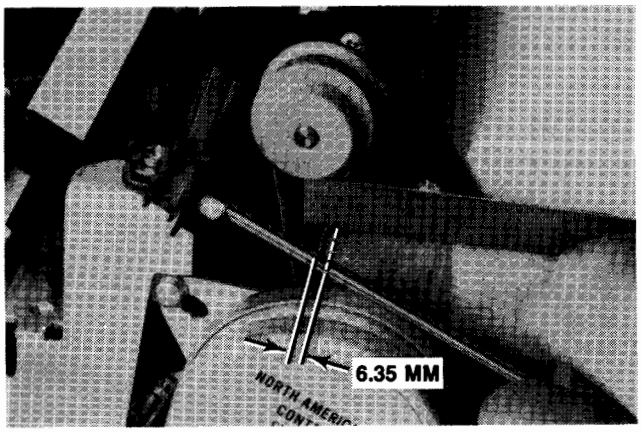


Figure 6-7. Adjusting Paper-Advance Belt

6-18. REPLACING PARTS

6-19. Described below are detailed replacement procedures for the print-head assembly, which is the most likely part of the printer to fail, and the platen, which must be removed in order to replace the print-head assembly.

> Note: Replacing certain printer parts may require that you make one or more of the adjustments described in paragraph 6-7.

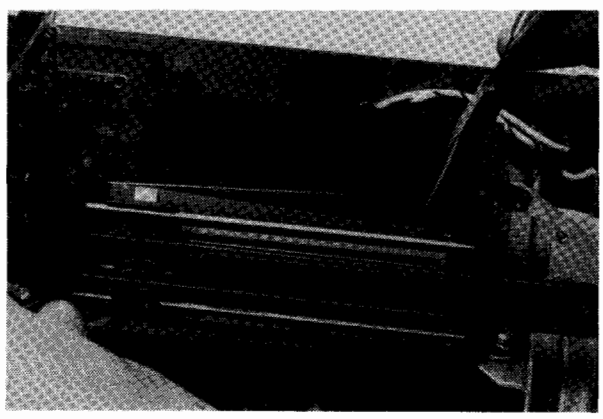
REPLACING THE PLATEN

a. Lift out the tear bar (if not already removed).

b. Lift the paper roll out of the printer, tear the paper between the roll and the printer, then pull the remaining paper forward through the paper advance mechanism until it is free of the printer.

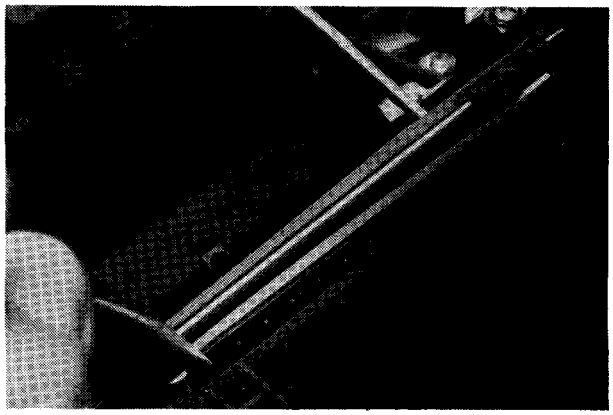
c. Insert the tip of a small, flat-blade screwdriver through the rectangular hole in the print-head carriage until it rests on the bottom of the print-head holder. Grasp the platen with long-nose pliers.

d. Press the handle of the screwdriver down so that the print head moves away from the platen, then lift the platen out.



e. Position the platen so that the bumps on the back face the rear of the computer, then insert the platen between the flap and the platen holder.

f. Release the print head. Be sure that the bumps on the back of the platen are seated in the groove in the platen holder.

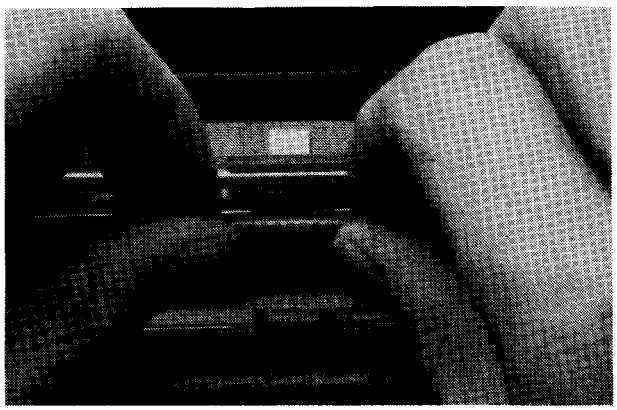


REPLACING THE PRINT-HEAD ASSEMBLY

a. Remove the platen as described above.

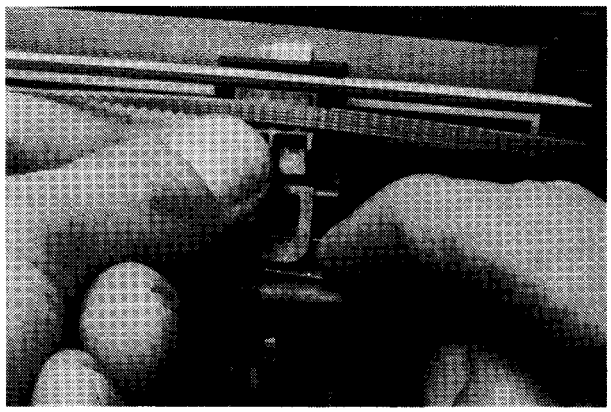
b. Position the print head at the middle of the printer by pushing it with your finger.

c. Pull the print-head drive belt out of the print-head carriage.

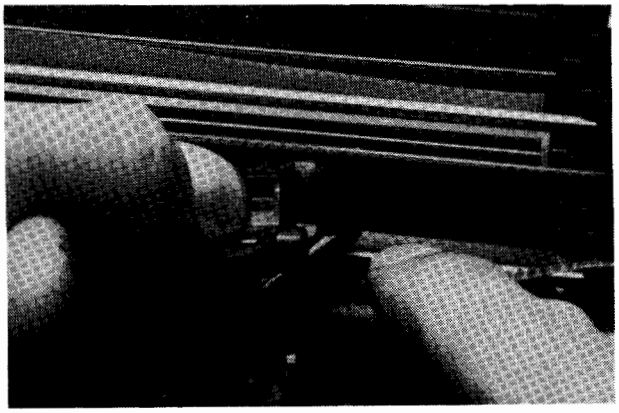


d. Press the lower portion of the belt downward, with the forefinger of your right hand, until it clears the bottom of the print-head assembly.

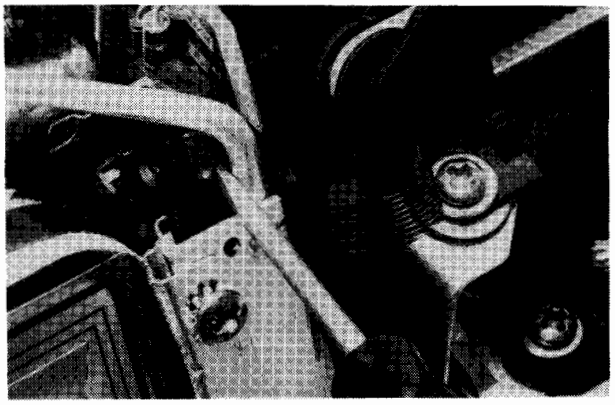
e. Compress the print-head holder with the foreginger of your left hand inserted between the belts.



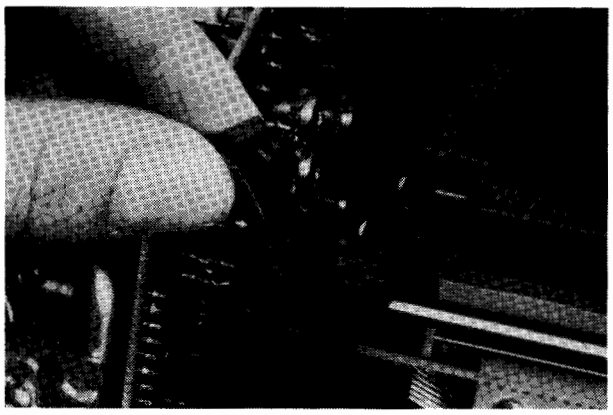
f. Rotate the print-head assembly down and out of the printer between the two portions of the belt.



g. Pry the lid of the flex-cable connector away from the board with a small, flat-blade screwdriver. Pull the cable out of the connector.

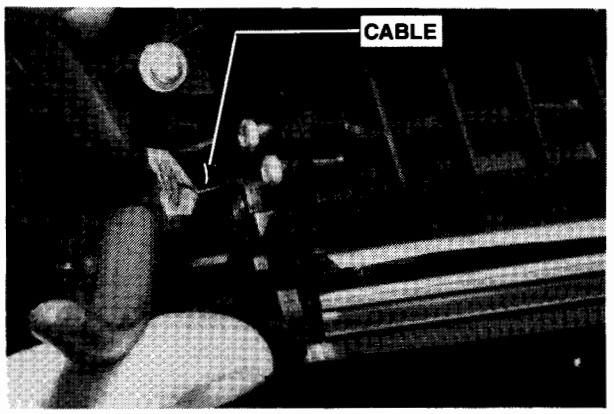


h. Fold--but do not crease--the contact-end of the flex-cable in the middle. The contact-side of the cable should be folded inside. Temporarily tape the ends together.



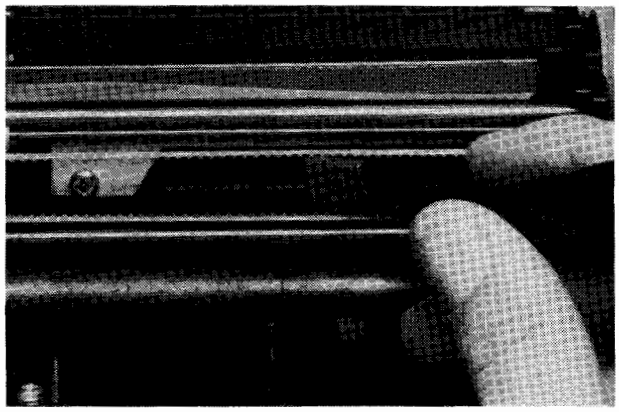
i. Pass the flex-cable through the slot in the printer side plate.

j. Pull the flex-cable out between the belts.



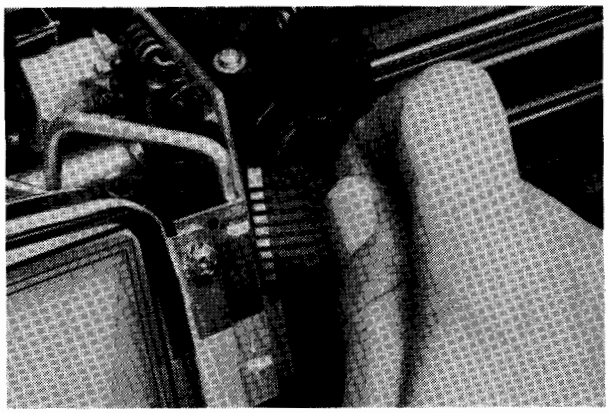
k. Fold the new flex-cable as in step h, tape it closed, then insert it between the belts.

l. Pass the flex-cable through the slot in the printer side plate.



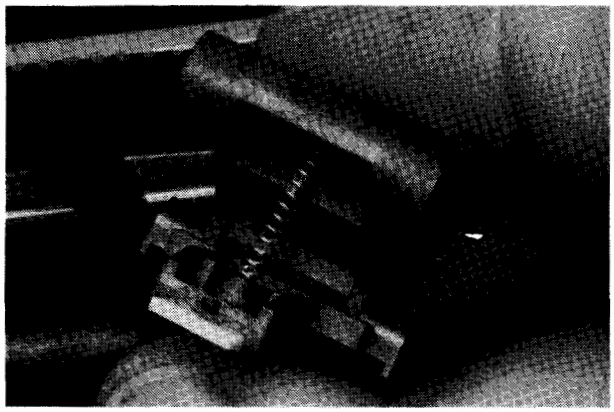
m. Insert the flex-cable into its connector on the printer PCA as far as it will go. The wide contact should be at the top of the connector.

n. Press the lid of the connector until it closes.



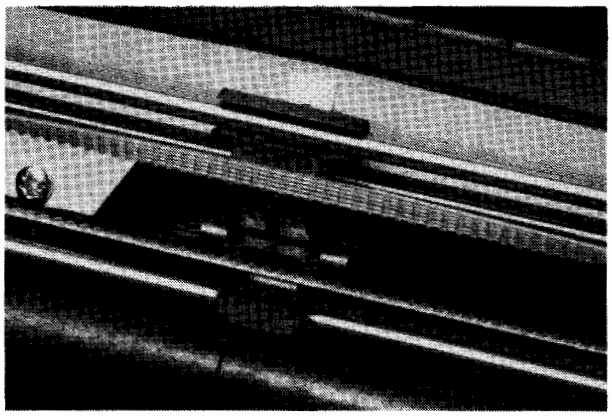
o. Check the spring in the print-head assembly to make sure that it is not broken or overly compressed or extended. One end of the spring should be seated in the hole in the print-head holder, and the other end should be seated over the peg.

p. Compress the print-head assembly, push the lower portion of the print-head drive belt downward, and insert the top of the print-head assembly between the belts.



q. Rotate the print-head assembly until its chnnel engages the upper guide rod.

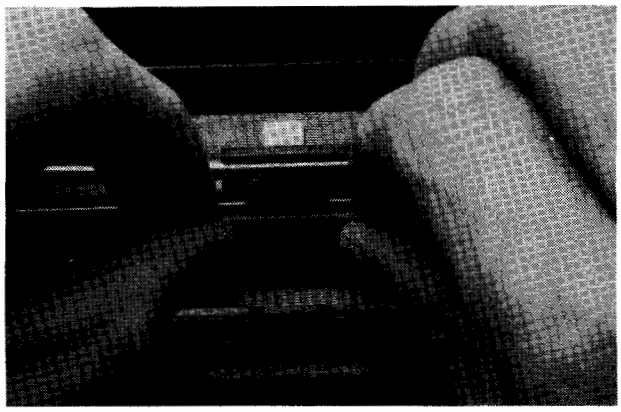
r. Continue rotating the bottom of the print-head assembly until it clears the belt and rests on the outside (not the inside) of the lower guide rod.



s. Insert the belt into the print-head carriage.

t. Replace the platen.

u. Set the home position of the print head as described in paragraph 6-8.



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SECTION
VII

Tape Drive Assembly-Level Troubleshooting and Repair

7-1. INTRODUCTION

7-2. This section tells you how to troubleshoot and repair the tape drive assembly to the assembly level. Included are procedures for:

- o Isolating a tape drive problem to the customer's tape cartridge, the tape controller, the motor/capstan assembly, the baseplate leaf spring, or the rest of the tape drive assembly (paragraph 7-3).
- o Replacing the motor/capstan subassembly of the tape drive assembly (paragraph 7-8).
- o Cleaning the tape head and capstan (paragraph 7-9).
- o Demagnetizing the tape head (paragraph 7-14).
- o Conditioning a tape cartridge (paragraph 7-17).

7-3. TROUBLESHOOTING

7-4. To help determine what may be wrong with the tape drive assembly (if anything), run the System Test from the Service ROM. (Refer to paragraph 8-23.) It is essential that you run at least the CPU, RAM, and ROM Tests before running the Abbreviated Tape Test, since many tape drive problems may be caused by a failure in one of these components rather than in the tape drive assembly. If one of those three tests indicates a bad IC, replace it and run the System Test again. After all three tests have been passed, you need only run the Abbreviated Tape Test to check whether replacing a part has corrected a tape drive problem.

7-5. Frequently a computer is received for repair with a message from the customer describing the problem. You need not attempt to reproduce the customer's problem by setting up the situation described; the System Test will either indicate a bad IC that is causing the problem or will reproduce the problem (except for the one described in paragraph 7-6). However, if the customer returned a tape cartridge along with the computer, be sure to have it inserted during testing. Some problems are caused by a bad tape cartridge rather than by a bad tape drive assembly.

7-6. If the customer's computer can read tape cartridges that were recorded on the same computer but cannot read cartridges that were recorded on another computer, the tape head may be out of alignment. To correct this problem, replace the tape drive assembly. Be sure to inform the customer that the computer may no longer be able to read tapes previously recorded on that computer.

7-7. Table 7-1 lists the possible causes and diagnostic/repair procedures for messages that may appear during the Abbreviated Tape Test, the Tape Write-Protect Test, and the other individual tests in the Full Tape Test.

Table 7-1. Tape Drive Troubleshooting

SERVICE ROM MESSAGE	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
{TAPE CONTROL BAD!}	Bad controller (U1).	Replace controller.
{TAPE ERROR! A}*	Bad tape drive assembly.	Replace tape drive assembly.
{TAPE ERROR! B}		
{TAPE ERROR! C}		
{TAPE ERROR! D}		
{TAPE ERROR! E}		
{TAPE ERROR! F}		
{TAPE ERROR! H}		
{TAPE ERROR! J}		
{TAPE ERROR! WRITE C}		
{TAPE ERROR! WRITE F}		
{TAPE ERROR! WRITE I}		
{TAPE ERROR! WRITE L}		

*If this message appears, make sure that both ribbon cables are inserted properly into their connectors on the logic PCA and the tape drive PCA before replacing the controller.

Table 7-1. Tape Drive Troubleshooting (Continued)

SERVICE ROM MESSAGE	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
{TAPE ERROR! GAP}	Bad controller (U1).	Try replacing controller.
{TAPE ERROR! SPEED}	Bad motor/capstan assembly.	Try replacing motor/capstan assembly.*
{TAPE STALLED!}	Bad tape drive assembly.	Replace tape drive assembly.
	Tape circuit out of adjustment.	Try adjustment paragraph 7-8 (i-n).
{TAPE ERROR! HOLE}	Customer's tape cartridge bad (light	Remove customer's tape cartridge and run Hole-Detect
{END OF TAPE!}	path obscured).	Test again with a good cartridge. If this message does not appear, customer's tape cartridge is bad.
	Bad controller (U1).	Try replacing controller.
	Bad tape drive assembly.	Replace tape drive assembly.
{TAPE NOT REMOVED!}	Bad controller (U1).	Try replacing controller.
{TAPE OUT!}	Bad tape drive assembly.	Replace tape drive assembly.
{TAPE PROTECTED!}		

* If an oscilloscope is not available, replace the entire tape drive assembly instead of just the motor/capstan assembly. If an oscilloscope is available, check TP4 to determine whether adjustments are necessary to match the motor/capstan assembly to the tape drive PCA. (Refer to paragraph 7-8. On older units, R7 may need to be connected or removed.)

Table 7-1. Tape Drive Troubleshooting (Continued)

SERVICE ROM MESSAGE	POSSIBLE CAUSE	DIAGNOSIS/REPAIR
{TAPE ERROR! READ} {TAPE ERROR! WRITE} (unless followed by {C}, {F}, {I}, or {L})	Customer's tape cartridge bad.	Run Abbreviated Tape Test with other tape cartridges. If {TAPE ERROR!} message does not appear, customer's tape cartridge is bad.
	Cartridge not seating properly: dirt in mechanism, leaf spring bad, or grounding strap bad.	Inspect mechanism and remove dirt. Check whether cartridge is parallel to baseplate; if not, replace leaf spring. Inspect grounding strap; replace if damaged.
	Tape head dirty.	Clean head. (Refer to paragraph 7-12.)
	Tape capstan dirty.	Clean capstan. (Refer to paragraph 7-13.)
	Bad controller (U1).	Try replacing controller.
	Bad motor/capstan assembly.	Try replacing motor/capstan assembly.*
	Bad tape drive assembly.	Replace tape drive assembly.
{TAPE UNPROTECTED!}	Bad controller (U1) (unless Abbreviated Tape Test or Tape Status Test has been passed).	Run Tape Status Test (refer to paragraph 8-97), and replace controller if {TAPE CONTROL BAD!} message appears.
{TAPE UNPROTECTED!}	Bad tape drive assembly.	Replace tape drive assembly.

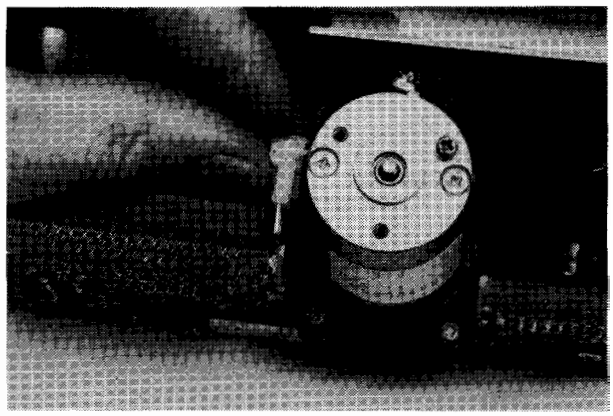
* If an oscilloscope is not available, replace the entire tape drive assembly instead of just the motor/capstan assembly. If an oscilloscope is available, check TP4 to determine whether adjustments are necessary to match the motor/capstan assembly to the tape drive PCA. (Refer to paragraph 7-8. On older units, R7 may need to be connected or removed.)

7-8. REPLACING THE MOTOR/CAPSTAN ASSEMBLY

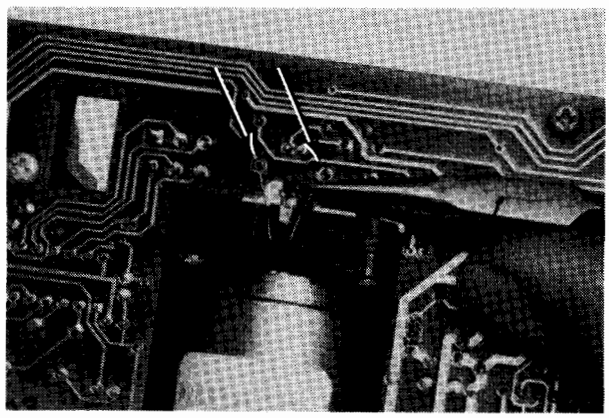
Note: The circuitry on the tape drive PCA is matched to the individual motor/capstan assembly. (On older units connecting or omitting resistor R7 accomplishes this.) For all units the adjustment described in step o applies. After installing a new motor/capstan assembly, be sure to check whether adjustments are necessary as directed in steps i through n below. If you do not have an oscilloscope to make this check, replace the entire tape drive assembly instead of just the motor/capstan assembly.

a. Remove the tape drive assembly from the computer, and disconnect the pair of cables to the logic PCA.

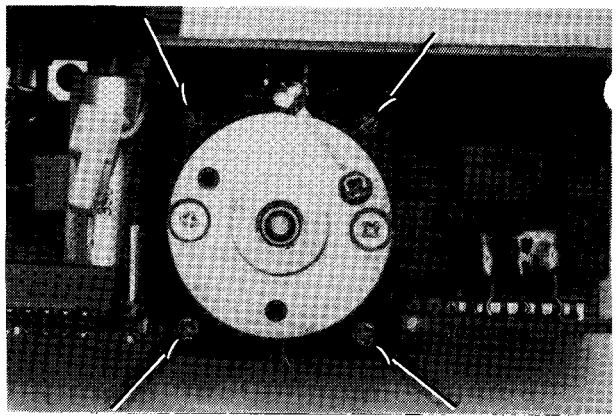
b. Disconnect the plug with the three motor leads from the component-side of the tape drive PCA near the ribbon cable connector.



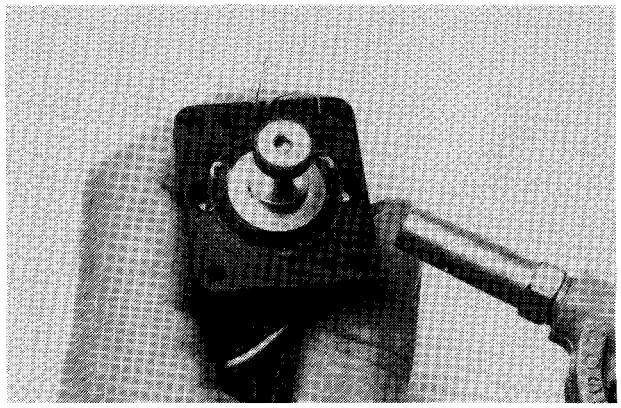
c. Disconnect the two motor-speed lamp leads from the trace-side of the tape drive PCA near the base of the motor/capstan assembly. The wires can be removed simply by pulling them out with pliers; they are not soldered.



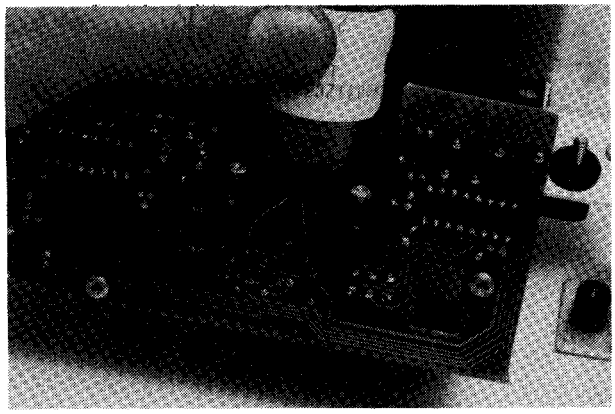
d. Remove the four screws securing the motor/capstan assembly to the baseplate of the tape drive assembly. Use a #1 Pozidriv screwdriver. (You may first need to pull back the cartridge-eject mechanism to provide clearance.) Remove the motor/capstan assembly.



e. Gently blow both faces of the disk on the shaft of the new motor/capstan assembly with compressed air to remove any dust. (Your breath is OK).



f. Insert the screws into the new motor/capstan assembly, then position it over the tape drive assembly with the motor-speed lamp leads next to the tape drive PCA. Seat the motor/capstan assembly onto the tape drive assembly baseplate.



CAUTION

Do not overtighten the screws securing the motor/capstan assembly to the tape drive assembly. To do so could strip the threads in the assembly baseplate.

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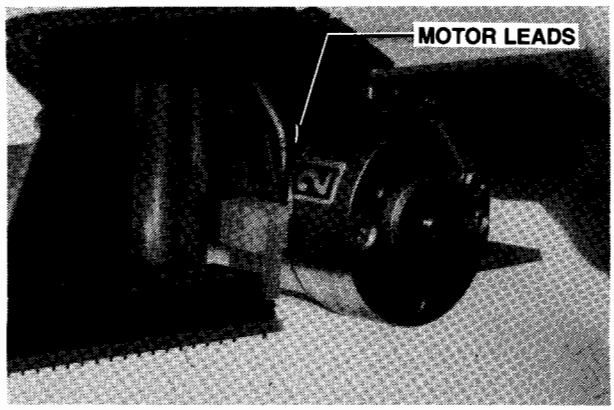
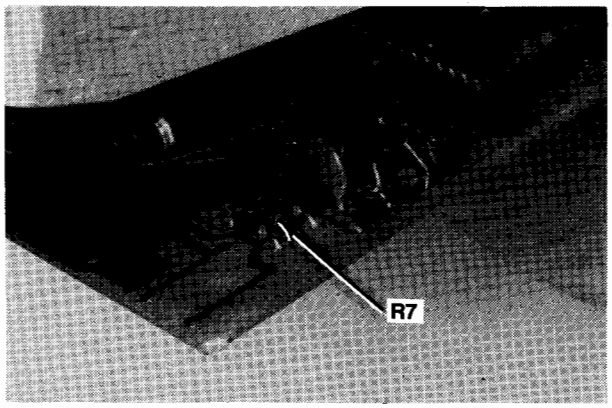
g. Tighten the four screws securing the motor/capstan assembly to the tape drive assembly baseplate. Use a #1 Pozidriv screwdriver.

h. Connect the plug with the three motor leads, and connect the two motor-speed lamp leads, to the tape drive PCA. The plug with the motor leads should be connected so that the leads come out of the plug toward the motor/capstan assembly.



i. Connect the tape drive assembly to the computer using extender cables.

j. Without a cartridge inserted, run the Tape Speed Test from the Service ROM. If the message {TAPE STALLED!} appears, proceed with step k to reposition the phototransistor. If resistor R7 is present (older units only), connecting or disconnecting it may solve the problem.

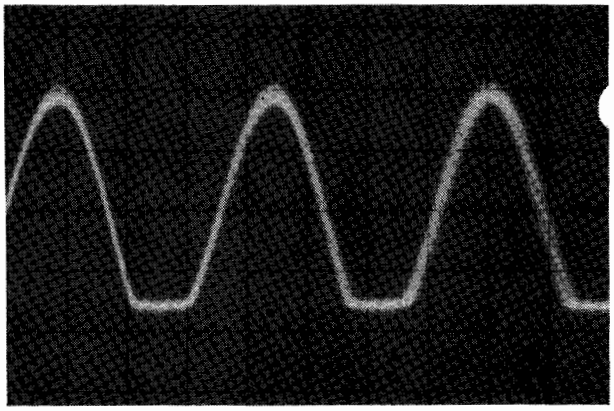


k. Set the time base on an oscilloscope to 10 microseconds/division.

l. Set the coupling on the oscilloscope to AC.

m. Adjust the position of the trace so that it falls under the center line on the oscilloscope graticule.

n. Check TP4 during the fast-forward phase of the Tape Speed Test. (TP4 is the uppermost of the three test points at the lower left corner of the tape drive PCA.) The positive peak of the waveform should be at least 2.5V above the center line; the negative peak should be at least 2.0V below the center line. If the waveform does not satisfy either of these conditions, proceed to step o.



Test Point: TP4
Time Base: 10 usec/div
Vertical Gain: 2V/div

o. Reposition phototransistor CR1 until the desired waveform is obtained. The phototransistor looks like a clear LED and is shown in the lower picture on page 7-5 of this manual (near the tip of the pliers). The phototransistor should only be repositioned using a nonconducting tool. Otherwise damage may occur by shorting to one of the two motor-speed lamp leads. Adjust the position with respect to the hole above the phototransistor in the motor/capstan assembly (left, right, up or down).

p. If repositioning does not eliminate the failure, then the entire tape drive assembly (00085-69009) should be replaced.

7-9. CLEANING THE TAPE HEAD AND CAPSTAN

7-10. Both the tape head and capstan should be cleaned whenever {READ} errors occur.

7-11. Furthermore, the tape head should be cleaned whenever dust--probably light tan in color--can be seen on the surface of the head; and the capstan should be cleaned whenever a dark band can be seen around the capstan.

7-12. To clean the tape head:

a. Dip a cotton swab in isopropyl alcohol.

b. Wipe the surface of the tape head in the left-and-right direction, not the up-and-down direction. (See figure 7-1.)

c. Using a dry, clean cotton swab, wipe the surface again. Be sure to wipe left-and-right, not up-and-down.

d. Repeat step c, using a new and clean swab, until no dirt is visible on the swab.

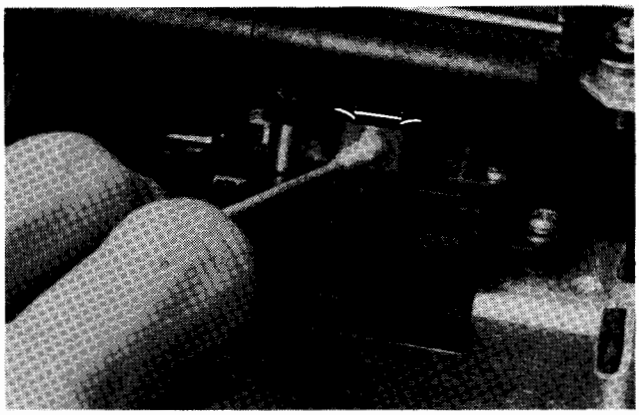


Figure 7-1. Cleaning the Tape Head

7-13. To clean the capstan:

a. Without a cartridge inserted, run the Tape Speed Test from the Service ROM.

c. Dip a clean cotton swab in isopropyl alcohol.

d. Hold the swab at the left of the rotating capstan during the fast-forward phase of the Speed Test. (See figure 7-2.)

e. After the capstan looks as clean as possible, allow the capstan to continue rotating until it is dry.

> Note: If the surface of the capstan appears pitted after being cleaned, the motor/capstan assembly should be replaced. Such deterioration in the capstan can also cause {READ} errors.

Figure 7-2. Cleaning the Capstan

7-14. DEMAGNETIZING THE TAPE HEAD

7-15. The tape head in the HP-85--unlike an audio head--normally should not require demagnetizing (degaussing). If, however, it is suspected that the tape head has been accidentally exposed to a high magnetic field, you should demagnetize the head using an HP Handheld Degausser (HP part number 9160-0023) or equivalent. Follow the procedures below:

> CAUTION
>
> Remove all tape cartridges from the vicinity of the degausser. Information on the tape can be lost if exposed to a high magnetic field.
>
> Make sure that the tip of the degausser is clean and free of small bits of metal or dirt that could could scratch the tape head.
>
> Do not leave the degausser energized, either next to the tape head or away, for more than 5 minutes at a time. If this is done, the degausser could be permanently damaged.

a. Connect the degausser to an ac power source.

b. Starting from at least 1 meter (3 feet) away, point the tip of the degausser toward the center of the tape head.

c. Slowly move the degausser toward the tape head until its tip touches the center of the head.

d. Slowly move the degausser to a distance of at least 1 meter (3 feet) from the tape head.

e. Disconnect the degausser from the power source.

7-16. TAPE CARTRIDGE MAINTENANCE

7-17. Tape Conditioning

7-18. Conditioning a tape restores proper tape tension by running the tape forward and backward at high speed. It is advised whenever:

- o {Read} errors occur with a particular tape cartridge but not others.
- o A tape cartridge has been rethreaded. (Refer to paragraph 7-20.)
- o A tape cartridge has been subjected to sudden environmental changes, such as being transported by air.
- o A tape cartridge has been left in the tape transport when not in use. This does not affect the tape tension; in this case the conditioning process helps to remove a slight flat impressed onto the capstan by the catridge drive pulley.

7-19. To condition a tape cartridge:

a. Insert the cartridge into the tape drive.

b. Type {CTAPE} [ENDLINE].

7-20. Tape Cartridge Rethreading

7-21. If the tape runs off of a cartridge hub, either the light path in the cartridge is obstructed or the tape drive assembly is malfunctioning. (Refer to paragraph 7-3.) Rethreading a tape is difficult to do successfully and is not recommended unless the information recorded on the tape must be recovered. Procedures for rethreading are given in appendix B of the HP-85 Owner's Manual and Programming Guide.

SECTION
VIII

The Service ROM

8-1. INTRODUCTION

8-2. This section describes the tests provided by the Service ROM. Included are:

a. Complete procedures for running the tests.

b. Messages and other results that should be obtained if all components and assemblies are operating properly.

c. Messages that are obtained if components or assemblies are not operating properly.

8-3. The various tests in the Service ROM enable you to:

- Check all socketed IC's.
- Generate test patterns for checking the operation of the beeper, CRT, and printer.
- Check for proper key entry in normal, shifted, and control modes.
- Check the HP 82903A 16K Memory Module.
- Check all enhancement ROM's in the ROM drawer plug-in module.
- Cycle any test or tests indefinitely in order to reproduce intermittent failures or stimulate failures in new components.
- Check for proper operation of the tape drive assembly.

8-4. Although any of the tests in the Service ROM can be run individually, most of the tests can be run automatically as a group. The two automatic group tests are the System Test and the Full Tape Test.

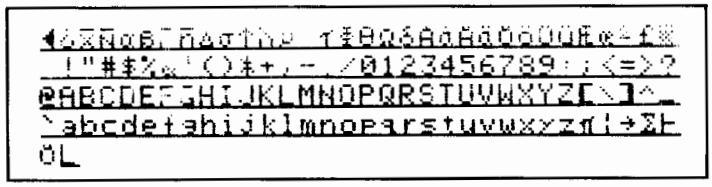
8-5. The System Test, which incorporates 10 individual tests, is the basic test you should use to begin assembly-level troubleshooting of an entire computer. Even when you know that there is a problem in a particular assembly checked by an individual test, you should first run the entire System Test. The first few tests in the System Test check components that could cause operating problems in the assemblies checked by subsequent tests. You may run an individual test alone in either of the following cases:

- You have replaced a component or assembly that the System Test indicated was bad, and you want to verify that the problem has been corrected.

- You are servicing only an assembly, received for repair from a dealer.

8-6. The Full Tape Test incorporates seven individual tests. It is provided primarily for use during production testing of the tape drive assembly. For service testing and troubleshooting, problems with the tape drive assembly are identified by the Abbreviated Tape Test, which is included in the System Test. Troubleshooting procedures may then direct you to use one or more of the individual tests included in the Full Tape Test.

8-7. The HP-85 system performs a self-test each time the computer is switched on. This test--which checks considerably less than the System Test--does a simplified version of the ROM Test and a portion of the RAM, Printer, Abbreviated Tape, and Keyboard Tests. The CPU, CRT, and timers are not checked. If the computer is switched on with the Service ROM installed, the ROM takes control immediately, and the self-test is not done until the Service ROM returns control to the BASIC system. At that time--if a problem is found--the computer beeps twice, and the message {Error 23: SELF TEST} is displayed. Only a cursor appears on the display for a successful self-test. Pressing the [TEST] key performs the same test, displaying and printing the dot matrix characters shown in the upper part of figure 8-1 at the end. The two characters on the last line vary.



Number Obtained by Pressing {ERRL} and [END LINE]	Location of Problem Causing {ERROR 23: SELF TEST}
0	RAM
1	ROM 0
2	ROM 1
3	ROM 2
4	ROM 3
5	Printer Status or Data Line
6	Printer ROM
7	Tape
8	Keyboard
9	RAM Refresh

Figure 8-1. System Self-Test Results

8-8. If {ERROR 23: SELF TEST} is displayed, you may be able to further isolate the problem by typing ERRL and then pressing [END LINE]. The number displayed on the CRT indicates the location of the error, as shown in the bottom part of figure 8-1.

8-9. RUNNING A TEST

8-10. When an HP-85 with the Service ROM installed is turned on, control is passed to the Service ROM. The following message should be displayed and printed:

{SERVICE ROM: SELECT TEST A-V}

8-11. If you press one of the keys [A] through [V] within 17 seconds after the message appears, the Service ROM should perform the corresponding test listed in table 8-1.

> Note: Refer to paragraph 2-18 for troubleshooting procedures in any of the following circumstances:
>
> - The {SERVICE ROM} message does not appear within 17 seconds after the computer is switched on.
> - A {NO KEY!} or {KEY STUCK!} message appears 17 seconds after the {SERVICE ROM} message appears.
> - Pressing a key has no result within 17 seconds after the {SERVICE ROM} message appears.
> - Pressing a key results in the wrong test.

8-12. When the selected test is completed, the {SERVICE ROM} message appears again, and you can then run any Service ROM test by pressing the corresponding key.

> Note: If you press [W] within 17 seconds after the {SERVICE ROM} message appears, the computer will wait indefinitely for you to press another key.

8-13. If you press any key other than [A] through [W], control will be passed to the BASIC system. (The space bar is a convenient key to press if you want to return to the BASIC system.) When this happens, the message {RETURN TO BASIC SYSTEM} is printed and momentarily displayed, then a cursor appears in the display. The message is followed by a character that indicates which key was entered. The cursor signifies that the BASIC system is in control.

8-14. If no key is pressed within 17 seconds after the {SERVICE ROM} message appears, the computer will beep, the messages {NO KEY!} and {RETURN TO BASIC SYSTEM} are printed and momentarily displayed, then the cursor appears in the display. If a key is not released (or a key is stuck) within 17 seconds after the {SERVICE ROM} message appears, the messages {KEY STUCK!} and {RETURN TO BASIC SYSTEM} are printed and momentarily displayed, then the cursor appears in the display.

8-15. Whenever the BASIC system is in control (as signified by the presence of the cursor on the CRT), you can select any test by typing in the corresponding BASIC command listed in table 8-1, followed by [END LINE]. This capability enables you to write and run a BASIC program that automatically runs and repeats a test or group of tests from the Service ROM. For normal testing and troubleshooting it is more convenient to run the test under the direct control of the Service ROM.

8-16. With two exceptions, the tests run under the control of the BASIC system are identical to the tests run under the direct control of the Service ROM. Under direct control, the RAM and External RAM Tests check somewhat more of the corresponding RAM controller than the same tests run under the control of the BASIC system.

8-17. Running a BASIC program--including a program that contains BASIC commands from the Service ROM--requires that the CPU, ROM, and RAM are OK. Therefore, do not run a test using a BASIC command until you have checked out these components by running the System Test under direct control of the Service ROM.

8-18. If you want to run a BASIC program that automatically runs and repeats a test or group of tests from the Service ROM, do not include the Tape Write-Protect Test or the Keyboard Test (or the System Test, which incorporates these tests) in your program. These tests require interaction from the user. Also, if your program runs the Abbreviated Tape Test, the Full Tape Test, or the Tape Hole-Detect Test, be sure to rewind the tape before the test by including a {REWIND} statment before the test command.

8-19. If you write a program that runs a test from the Service ROM, you may want to have the program beep, halt, or take other appropriate action in the event that the test finds a problem. To do so, use the BASIC {ERRN} function statement to check for error number 224. (For more information, refer to section 13 of the HP-85 Owner's Manual and Programming Guide.)

Table 8-1. Service ROM Tests

TEST	KEY	COMMAND	PARAGRAPH NUMBER
System	[A]	{SYSTEM}	8-23
CPU	[B]	{CPU}	8-27
RAM	[C]	{RAM}	8-31
ROM	[D]	{ROM}	8-36
Beeper	[E]	{BEEPER}	8-40
CRT	[F]	{DISPLAY}	8-44
Printer	[G]	{PRT}	8-49
Tape (Abbreviated)	[H]	{ATAPE}	8-54
Tape Write-Protect	[I]	{TPROT}	8-58
Timer	[J]	{TIMER}	8-62
Keyboard	[K]	{KBD}	8-67
External RAM	[L]	{XRAM}	8-76
External ROM	[M]	{XROM}	8-81
Heat	[N]	{HEAT}	8-86
Tape (Full)	[O]	{TAPE}	8-91
Status	[P]	{TSTAT}	8-97
Speed	[Q]	{TSPEED}	8-101
Hole-Detect	[R]	{THOLE}	8-105
Write	[S]	{TWRITE}	8-109
Read	[T]	{TREAD}	8-113
Record	[U]	{TREC}	8-117
Cycle	[V]	{CYCLE}	8-121

8-20. SERVICE ROM TESTS

8-21. The following paragraphs describe how to run tests from the Service ROM and what messages and other results may be obtained.

8-22. Most messages that result when a component or assembly is not operating properly are followed on the same line by a letter designating the nature of the failure. For many such messages, the letter indicates the nature of the failure within an IC, and is useful information only for quality control purposes at the factory. Throughout this manual, some of these messages appear with a letter following, and some do not. If an actual message on a computer under repair is followed by one of the letters shown next to the message in a troubleshooting procedure, proceed as directed in the procedure; otherwise, ignore the letter.

8-23. System Test

8-24. What It Does. The System Test automatically runs the following tests from the Service ROM:

a. CPU Test (described in paragraph 8-27).

b. RAM Test (described in paragraph 8-31).

c. ROM Test (described in paragraph 8-36).

d. Beeper Test (described in paragraph 8-40).

e. CRT Test (described in paragraph 8-44).

f. Printer Test (described in paragraph 8-49).

g. Abbreviated Tape Test (described in paragraph 8-54).

h. Tape Write-Protect Test (described in paragraph 8-58).

i. Timer Test (described in paragraph 8-62).

j. Keyboard Test (described in paragraph 8-67).

8-25. How to Run It. To run the System Test:

a. Insert a rewound tape cartridge, with its RECORD tab in the unprotected position (the direction of the arrow), into the tape drive.

Notes:

Any information on the tape will be erased by the Abbreviated Tape Test.

If the customer returned a tape cartridge along with the computer, be sure to use it during testing.

The tape should be rewound on a good computer before each time the System Test is run. If the tape is not rewound, running the Abbreviated Tape Test included in the System Test may either run the tape off of the cartridge hub or result in a message indicating a failure. Remember to rewind the tape when you are repeating the System Test after replacing a component or assembly.

If the RECORD tab is not set to its unprotected position, only a portion of the Abbreviated Tape Test can be run.

b. Press [A] if the Service ROM is in control, or type in {SYSTEM} if the BASIC system is in control.

8-26. Results.

o The message {SYSTEM TEST BEGINS} is displayed and printed, then the 10 individual tests are run in the order listed in paragraph 8-24.

o If a problem is found during any of the tests within the System Test, the appropriate message appears, the individual test is terminated, and the next test is begun.

o The message {SYSTEM TEST ENDS} appears after all the tests have been run.

8-27. CPU Test

8-28. What It Does. The CPU Test checks the CPU by performing microprogrammed instructions and comparing the results to what they should be. Note that since most of the CPU must be OK in order to obtain the {SERVICE ROM} message, in effect the CPU Test checks only a portion of the CPU.

8-29. How to Run It. To run the System Test, press [B] if the Service ROM is in control, or type in {CPU} if the BASIC system is in control.

8-30. Results. One of the following messages appears:

o {CPU OK} indicates that the CPU is probably OK.

o {CPU BAD!} indicates that the CPU is probably bad.

o {CPU BAD! N OR RAM BAD! (character)} indicates that a failure has been found during an attempt by the CPU to store data into RAM. When this message appears, either the CPU, the RAM controller, or a RAM IC may be bad. The character at the end of the message is a code that indicates which RAM IC may be bad. Refer to paragraph 2-25 to interpret the code.

8-31. RAM Test

8-32. What It Does. The RAM Test checks the RAM controller IC and the RAM ICs by filling the RAM ICs with alternate 1's and 0's and reading back the result to see if the contents have been changed. If an error is found in one bit or only a few bits at a particular address, the message will indicate that the corresponding RAM IC is bad. If an error is found in all eight bits at a particular address, the message will indicate that the RAM controller is bad.

8-33. When run under the control of the Service ROM, this test checks the address register in the RAM controller. When run under the control of the BASIC system, the address register is not checked since doing so would not allow you to continue using the BASIC system.

8-34. How to Run It. To run the RAM Test, press [C] if the Service ROM is in control, or type in {RAM} if the BASIC system is in control.

8-35. Results. Any of the following messages may appear:

o {RAM OK} indicates that the RAM controller and the RAM ICs are probably OK.

o {RAM CONTROL BAD!} indicates that the RAM controller is probably bad. When this message appears, the individual RAM ICs are not checked any further. Therefore, the RAM test should be run again, after replacing the RAM controller, to check for possible bad RAM ICs.

o {RAM n BAD!} indicates that the RAM IC designated by the number n is probably bad.

8-36. ROM Test

8-37. What It Does. The ROM Test checks the ROM IC's by performing a signature analysis on their contents. This means that the contents are treated as data; the test manipulates this data and checks whether the correct results are obtained.

8-38. How to Run It. To run the ROM Test, press [D] if the Service ROM is in control, or type in {ROM} if the BASIC system is in control.

8-39. Results. For each of the four ROM IC's, one of the following messages will be displayed and printed:

{ROM n OK} or {ROM n BAD!}

The particular ROM IC checked is designated by the number n.

> Note: If the message {RAM BAD! ROM TEST ABORTED!} appears, the ROM Test has been aborted because the RAM controller or a RAM IC is bad. To run the ROM Test, run the RAM Test first and replace the IC indicated.

8-40. Beeper Test

8-41. What It Does. The Beeper Test causes the beeper to sound three short tones of the same frequency followed by a scale of eight longer tones of increasing frequency. The test performs no internal checks.

8-42. How to Run It. To run the Beeper Test, press [E] if the Service ROM is in control, or type in {BEEPER} if the BASIC system is in control.

8-43. Results. After sounding the three short tones and the scale, the message {BEEPER TEST ENDS} appears.

8-44. CRT Test

8-45. What It Does. The CRT test is a combined test: it checks the CRT controller IC and the CRT RAM ICs, and also causes the CRT to display various test patterns. By checking whether each pattern is displayed correctly, you can determine whether the rest of the circuitry is operating properly. The test patterns are also used for making adjustments to the CRT assembly.

8-46. How to Run It. To run the CRT Test, press [F] if the Service ROM is in control, or type in {DISPLAY} if the BASIC system is in control.

8-47. Results. The CRT should display the following patterns:

> Note: While the patterns of steps e, f, and g are in the display, you can cause the pattern to remain there indefinitely by pressing any key. Pressing any key again will cause the next pattern to appear.

a. Vertical bars (CRT test pattern 1), as shown in figure 8-2. These bars remain on the screen for about 13 seconds.

> Note: If you are repeating the CRT Test, you may briefly see test pattern 3 on the CRT before the bars come down.

b. A new set of vertical bars, shifted from the previous bars. These bars also remain on the screen for about 13 seconds.

c. The pattern (CRT test pattern 2) shown in figure 8-3. This pattern remains on the screen for about 16 seconds.

d. Blank screen (signaled by a beep). This remains for about 1 second.

e. Entirely white screen (signaled by a beep). This remains for about 3 seconds.

f. The "pincushion" test pattern (CRT test pattern 3) shown in figure 8-4. This remains for about 3 seconds.

g. A screen filled with the character {B} (CRT test pattern 4). This remains for about 3 seconds.

h. Eight lines containing two copies of the HP-85 character set (CRT test pattern 5), as shown in figure 8-5. The first four lines contain the 128 characters without underscores; the second four lines contain the same 128 characters underscored. The lines of {B}'s "roll" up off the top of the screen as the eight lines of characters roll up in the bottom of the screen.

> Note: You can return the screenful of {B}'s to the display by pressing the [ROLL] key. Also, you can return CRT test pattern 3 to the display by pressing [GRAPH].

8-48. If no problems are found during the CRT Test, the message {CRT TEST ENDS} appears. Otherwise, one of the following messages is printed and (possibly) displayed:

- {CRT CONTROL BAD!} indicates that the CRT controller is probably bad.
- {CRT RAM n BAD!} indicates that the CRT RAM designated by the number n is probably bad.

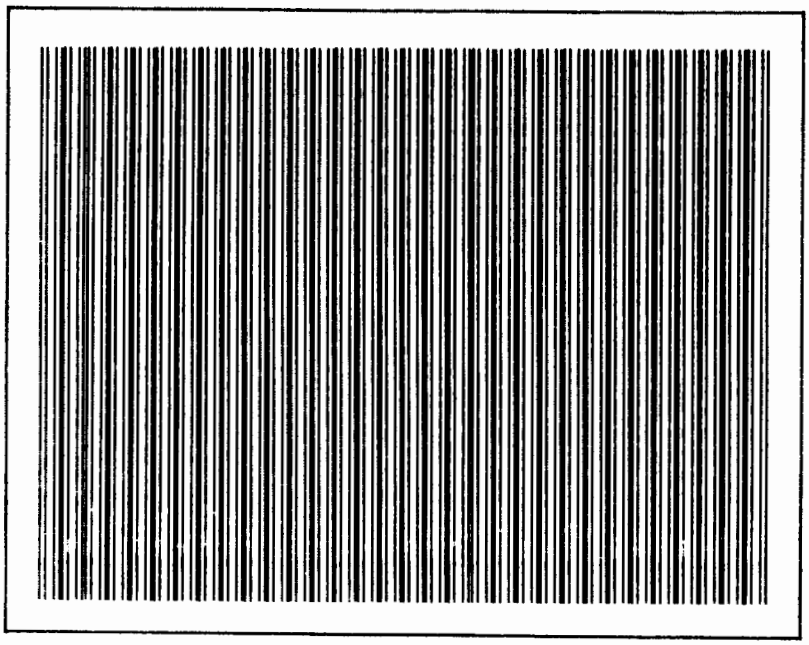


Figure 8-2. CRT Test Pattern 1

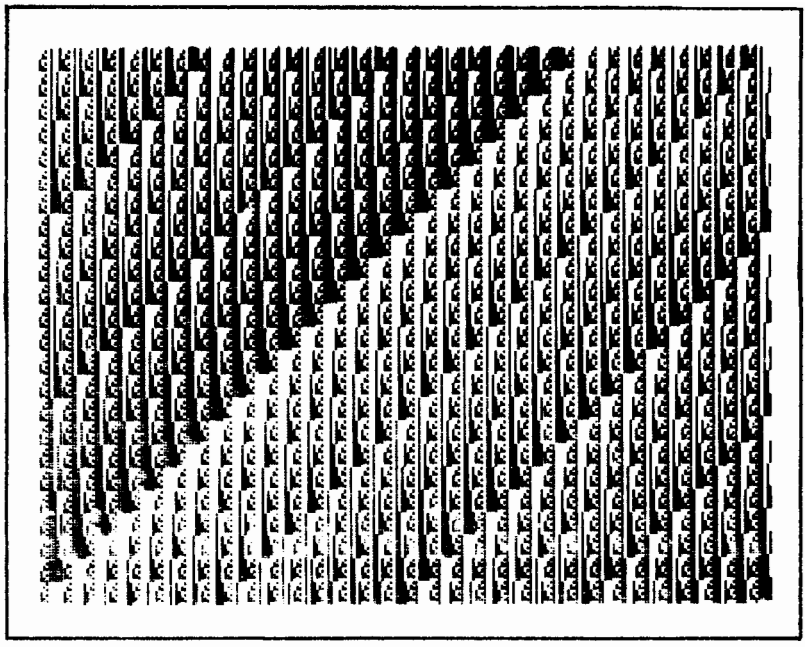


Figure 8-3. CRT Test Pattern 2

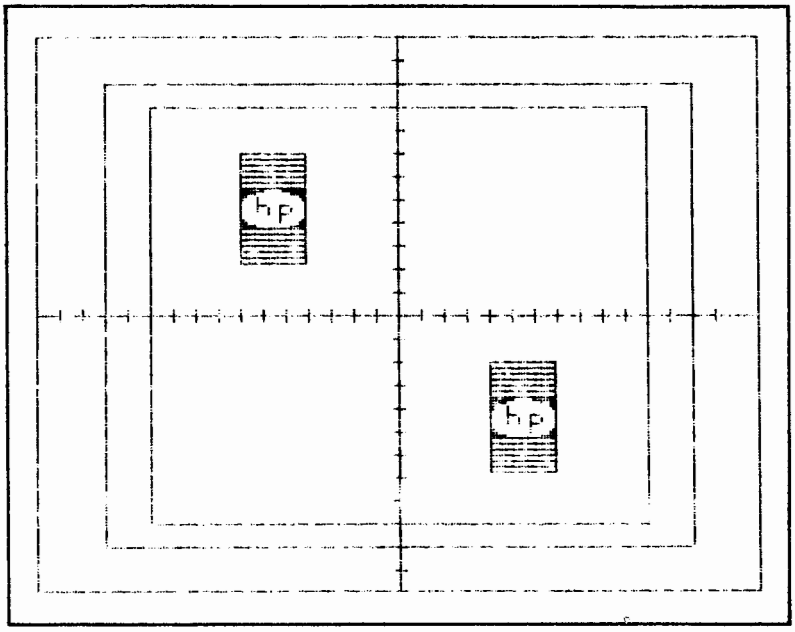


Figure 8-4. CRT Test Pattern 3

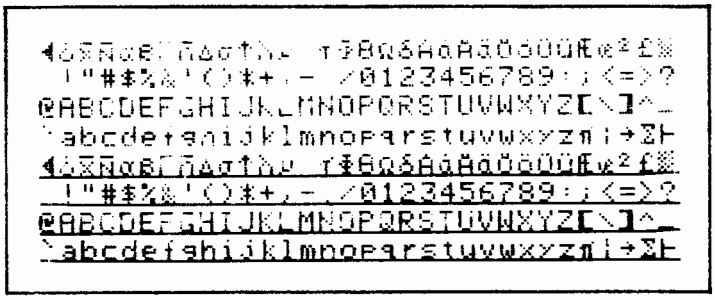


Figure 8-5. CRT Test Pattern 5

8-49. Printer Test

8-50. What It Does. The Printer Test, like the CRT Test, is a combined test: it checks the printer controller and also causes the computer to give you a test printout. By inspecting the printout, you can determine whether the printer mechanism and the rest of the printer circuitry are operating properly.

8-51. How to Run It. To run the Printer Test, first make sure that there is paper in the printer. (The procedures for loading paper into the printer are given in appendix B of the HP-85 Owner's Manual and Programming Guide.) Then, press [G] if the Service ROM is in control, or type in {PRT} if the BASIC system is in control.

8-52. Results. If no problems are found during the Printer Test, the test printout is generated and the message {PRINTER TEST ENDS} appears. Otherwise:

- If it appears to the Service ROM that there is no paper in the printer, the message {PRINTER OUT OF PAPER!} is displayed and the test printout is not generated. This should only occur on older units with an out-of-paper sensor (OOPS). See note at the bottom of page 6-9.
- If any other problems are found, the message {PRINTER CONTROL BAD!} is displayed.

8-53. The test printout should match the one shown in figure 8-6.

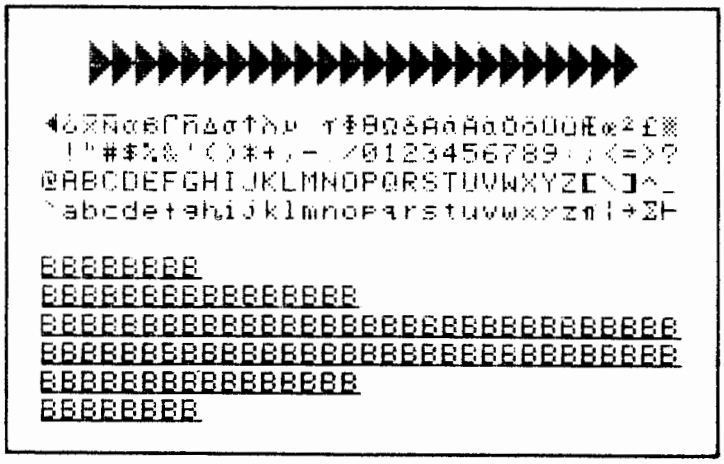


Figure 8-6. Printer Test Printout

8-54. Abbreviated Tape Test

8-55. What It Does. The Abbreviated Tape Test includes a number of operations that check the tape controller, the rest of the tape drive circuitry, and the tape transport mechanism. The test does the following:

a. Checks the status bits in the tape controller.

b. Checks the tape speed while running it at:

(1) Fast speed, forward direction for approximately one half second.

(2) Slow speed, reverse direction for approximately one half second.

c. Runs the Tape Hole-Detect Test (refer to paragraph 8-105), except that:

- In step b, the tape is moved in the reverse direction for 30 inches instead of 4 inches.
- In step c, the tape is moved in the forward direction for 36 inches instead of 24 inches.
- In step d, the tape is moved in the reverse direction for 36 inches instead of 30 inches.

d. Runs the Tape Record Test. (Refer to paragraph 8-117.)

8-56. How to Run It. To run the Abbreviated Tape Test:

a. Insert a rewound tape cartridge, with its RECORD tab in the unprotected position (the direction of the arrow), into the tape drive.

Notes:

Any information on the tape will be erased by this test.

If the customer returned a tape cartridge along with the computer, be sure to use it during testing.

The tape should be rewound on a good computer before each time the Abbreviated Tape Test is run. If the tape is not rewound, running the test may either run the tape off of the cartridge hub or may result in a message indicating a failure. Remember to rewind the tape when you are repeating the test after replacing a component or assembly.

If the RECORD tab is not set to its unprotected position, only a portion of the test can be run.

b. Press {H} if the Service ROM is in control, or type in {ATAPE} if the BASIC system is in control.

c. Press any key (after a rewound, unprotected tape cartridge has been loaded).

Notes:

If you have not pressed a key within 17 seconds after the message {LOAD REWOUND UNPROTECTED TAPE} appears, the test will begin at that time.

Do not insert a cartridge after the tape drive LED is on.

If a tape cartridge is not inserted, or if the RECORD tab is not in its unprotected position, only a portion of the Abbreviated Tape Test will be run.

8-57. Results. If no problems are found, the message {OK} appears. If a problem is found, the test is terminated and one of the following messages appears:

- {END OF TAPE!}
- {TAPE CONTROL BAD!}
- {TAPE ERROR!}
- {TAPE ERROR! GAP}
- {TAPE ERROR! HOLE}
- {TAPE ERROR! READ}
- {TAPE ERROR! SPEED}
- {TAPE ERROR! WPITE}
- {TAPE OUT!}
- {TAPE PROTECTED!}
- {TAPE STALLED!}

8-58. Tape Write-Protect Test

8-59. What It Does. The Tape Write-Protect Test does the following:

a. Checks whether a tape cartridge has been removed.

b. Checks whether a cartridge is now inserted.

c. Rewinds the tape.

d. Checks whether the inserted cartridge is write-protected.

> Note: If the Tape Write-Protect Test is being run as part of the System Test, it is skipped if the Abbreviated Tape Test is not completed successfully.

8-60. How To Run It. To run the Tape Write-Protect Test:

a. Press [I] if the Service ROM is in control, or type in {TPROT} if the BASIC system is in control.

b. Within 17 seconds after the message {REMOVE, PROTECT, LOAD TAPE} appears:

   (1) If a cartridge is inserted, remove it.

   (2) Slide the RECORD tab on the cartridge to the left.

   (3) Insert the cartridge.

   (4) Press any key.

> Note: If you have not pressed a key within 17 seconds after the message appears, the test will begin at that time.

8-61. Results. If no problems are found, the message {OK} appears. Otherwise, one of the following messages appears:

- {END OF TAPE!}
- {TAPE NOT REMOVED!}
- {TAPE OUT!}
- {TAPE STALLED!}
- {TAPE UNPROTECTED!}

8-62. Timer Test

8-63. What It Does. The Timer Test activates the test mode in the keyboard controller, which contains the four timers.

8-64. How to Run It. To run the Timer Test, press [J] if the Service ROM is in control, or type in {TIMER} if the BASIC system is in control. Since the Timer Test uses the computer's ROM and RAM, do not run the Timer Test alone unless the computer has already passed the CPU, ROM, and RAM Tests. If the Timer Test is run with a bad ROM or RAM IC, the computer may appear to "die" during the test.

8-65. In test mode, the keyboard controller uses the keyboard scan to run the timers. Because of this, pressing a key during the Timer Test aborts the test. The Timer Test is begun about 3 seconds after it is selected--that is, after you press [J] (if the Service ROM is in control) or [END LINE] (if the BASIC system is in control). Therefore, be sure that all keys are released by that time.

8-66. Results. One of the following messages appears:

Computer Museum

- {TIMER OK} indicates that the timer is probably OK.
- {TIMER BAD!} indicates that the timer is probably bad.
- {TIMER TEST ABORTED!} indicates that a key was apparently pressed during the Timer Test.

8-67. Keyboard Test

8-68. What It Does. The Keyboard Test checks the keyboard controller and also verifies key entry for every key on the keyboard.

8-69. How to Run It. The Keyboard Test requires you to press certain keys. In particular, at certain times you will press and hold the [CTRL] or [SHIFT] key while the next key or keys are pressed. The same is true for the [CAPS LOCK] key, except that you need not hold it down, since it locks in position. To release the [CAPS LOCK] key, press it again. The Service ROM will prompt you with messages indicating whether these keys are to be down or up while pressing the next key or keys.

8-70. Since the Keyboard Test uses the computer's ROM and RAM, do not run the Keyboard Test alone unless the computer has already passed the CPU, ROM, and RAM Tests. If the Keyboard Test is run with a bad ROM or RAM IC, the computer may appear to "go dead" during the test.

8-71. To begin the Keyboard Test, press [K] if the Service ROM is in control, or type in {KBD} if the BASIC system is in control. The keys to be pressed are indicated next to their prompting messages in table 8-2.

> Note: At the beginning of the test, make sure that the [CTRL] and [SHIFT] keys are not pressed and that the [CAPS LOCK] key is released to the same level as the other keys. If this is not done, the results of the test will be invalid.

8-72. In steps 4 through 7 and 9, each key is entered when it is pressed. In steps 1 through 3 and 8, each key is entered when it is released.

8-73. Results.

8-74. The following messages appear if no problem is found:

- {OK} following steps 2 through 8 and 11 indicates that the keys expected have been entered.
- {KEY TEST ENDS} indicates that the Keyboard Test has been completed.

8-75. If a problem is found, the test is terminated and one of the following messages appears:

- {KEY CONTROL BAD!} indicates that the keyboard controller is probably bad.
- {NO KEY!} indicates that no key has been entered. This message appears about 30 seconds after the key is first expected.
- {KEY STUCK!} indicates that a key appears to be stuck in the pressed position. This message appears about 30 seconds after the key is pressed.
- {KEY BAD!} indicates that the key entered is not the key expected. This message appears after an incorrect key has been entered eight times.

Table 8-2. Keyboard Test

STEP	PROMPTING MESSAGE	ACTION
1	{KEY TEST:} {CTRL, CAPS, SHIFT UP; PRESS A}	Until otherwise indicated in a subsequent prompting message, the [CTRL] and [SHIFT] keys should not be pressed, and the [CAPS LOCK] key should be released to the same level as the other keys. Press [A].
2	{PRESS A K1}	Press [A] [K1].
3	{PRESS A K1}	Press [A] [K1] again.
4	{CAPS DOWN; PRESS A K1}	Press and lock the [CAPS LOCK] key, then press [A] [K1].
5	{CAPS UP; PRESS A K1}	Press and unlock the [CAPS LOCK] key,
6	{CTRL DOWN; PRESS A K1}	While holding down the [CTRL] key, press [A] [K1].
7	{CTRL UP; PRESS A K1}	Release the [CTRL] key, then press [A] [K1] again.
8	{SHIFT DOWN; PRESS KEYS}	While holding down the [SHIFT] key, press each of the keys in the order shown in figure 8-7. Do not press the [CTRL] or [CAPS LOCK] key during this sequence test.
9	{SHIFT UP; PRESS KEYS}	Release the [SHIFT] key, then again press each of the keys in the order shown in figure 8-7. Do not press the [CTRL], [CAPS LOCK], or [SHIFT] key during this sequence test.

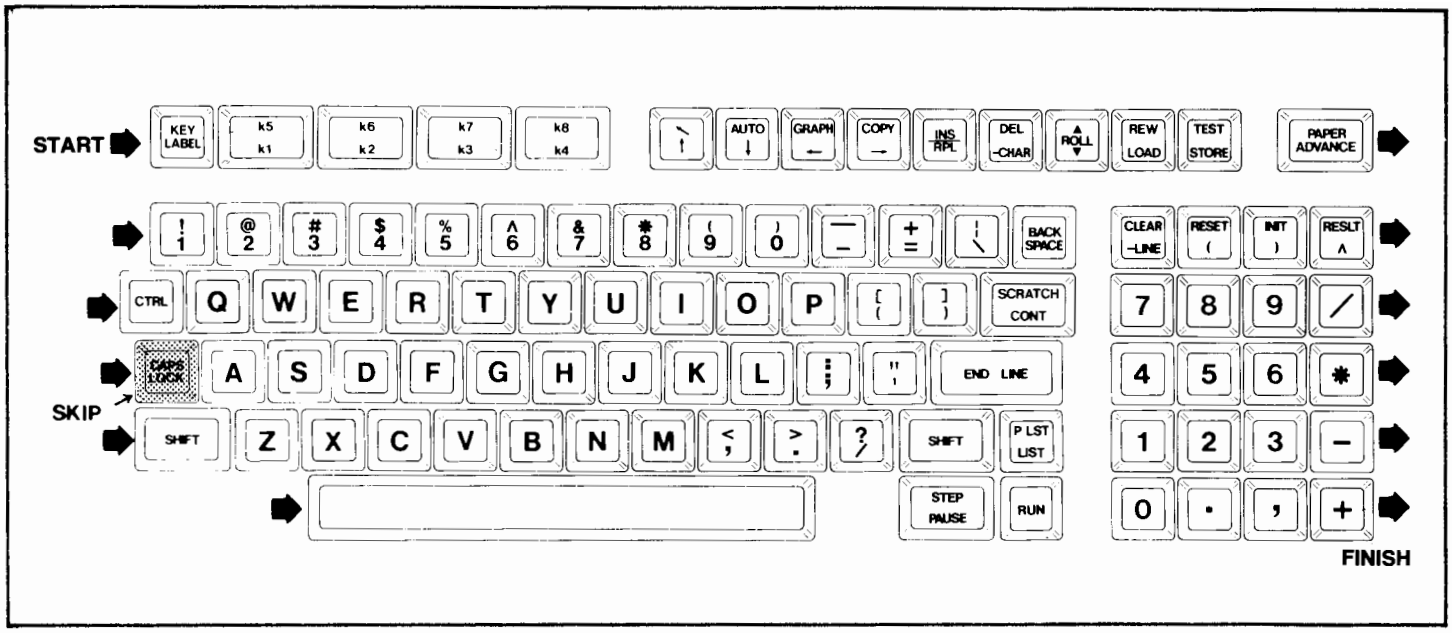


Figure 8-7. Key Sequence for Keyboard Test

8-76. External RAM Test

8-77. What It Does. The External RAM Test checks the RAM controller IC and the RAM ICs in the HP 82903A 16K Memory Module. The check is performed in the same way that the RAM Test checks the internal RAM controller and ICs. (Refer to paragraph 8-31.)

8-78. When run under the control of the Service ROM, this test checks the address register in the RAM controller. When run under the control of the BASIC system, the address register is not checked. Therefore, running the External RAM Test under the control of the Service ROM provides a more complete check than running the test under the control of the BASIC system.

8-79. How to Run It. To run the External RAM Test:

a. With the power to the computer off, insert the HP 82903A 16K Memory Module into one of the module ports in the back panel. (The procedures for installing plug-in modules are described in appendix B of the HP-85 Owner's Manual and Programming Guide.)

b. Switch the computer on.

c. When the {SERVICE ROM} message appears, press [L]. If the BASIC system is in control, you can run the External RAM Test by typing in {XRAM}.

8-80. Results. Any of the following messages may appear:

- {XRAM OK} indicates that the RAM controller and the RAM ICs in the Memory Module are probably OK.

- {NO XRAM OR XRAM BAD!} indicates one of the following conditions:

  - No Memory Module is plugged in a module port, or the Service ROM does not recognize that one is plugged in. If plugging the Memory Module into a different module port results in the message {XRAM OK}, replace the I/O PCA.

  - The RAM controller in the Memory Module is bad.

- {XRAM CONTROL BAD!} indicates that the RAM controller in the Memory Module is probably bad.

- {XRAM n BAD!} indicates that the RAM IC (in the Memory Module) designated by the number n is probably bad.

8-81. External ROM Test

8-82. What It Does. The External ROM Test checks plug-in enhancement ROMs by performing a signature analysis on their contents. This check is performed in the same way that the ROM Test checks the internal ROMs. (Refer to paragraph 8-36.)

8-83. Since the External ROM Test uses the computer's RAM, run the System Test (or at least the RAM Test) before running the External ROM Test to make sure that the RAM is OK.

8-84. How to Run It. To run the External ROM Test:

a. With the power to the computer off, install the ROM or ROMs to be tested in the ROM drawer, and insert the ROM drawer into one of the module ports in the back panel.

b. Switch the computer on.

c. When the {SERVICE ROM} message appears, press [M]. If the BASIC system is already in control, you can run the External ROM Test by typing in {XROM}.

8-85. Results. One of the messages shown below will appear for each external ROM present in the ROM drawer. The number {nnn} appearing in the message designates which external ROM has been checked. To identify the particular external ROM from the code, refer to table 8-3.

- {XROM nnn OK} indicates that the designated external ROM is probably OK.
- {XROM nnn BAD!} indicates that the designated external ROM is probably bad.

> Note: If the message {RAM BAD! XROM TEST ABORTED!} appears, the External ROM Test has been aborted because the RAM controller or a RAM IC is bad. To run the External ROM Test, run the RAM Test first and replace the IC indicated.

Table 8-3. Plug-In ROM Codes

CODE (DECIMAL)	ROM	HP PART NUMBER
008	9915 Program Development ROM	98151A
040	Assembler	00085-15007
176	Matrix ROM	00085-15004
192	I/O ROM	00085-15003
208	Mass Storage ROM	00085-15001
224	Service ROM	00085-60952
232	Advanced Programming ROM	00085-15005
240	Plotter/Printer ROM	00085-15002

8-86. Heat Test

8-87. What It Does. The Heat Test turns the CRT on full so that the entire screen is white, and simultaneously runs a continuous and repeating series of IC checks.

8-88. The capability of turning on the CRT is provided for production, so that new CRT's can be "burned in." The IC checks include the following:

a. The CPU Test.

b. The status bits in the CRT printer, tape, and keyboard controller ICs.

c. The RAM Test.

d. A checksum of the ROM ICs. (The checksum is a simplified signature analysis; this check is not the ROM Test.)

8-89. How to Run It. To run the Heat Test, press [N] if the Service ROM is in control, or type in {HEAT} if the BASIC system is in control. To terminate the test, press any key.

8-90. Results.

- When the Heat Test is begun, the message {HEAT TEST BEGINS} is printed and the CRT is turned on full.
- Each time one cycle of the test is completed (about every 25 seconds), the CRT momentarily goes blank.
- Every hour the elapsed time of the test is printed in the form {nnn HR}.
- If a problem is found in any IC during the test, the CRT goes blank, the appropriate message indicating the bad IC is printed, and the test is terminated.
- If no problem is found, the Heat Test runs until you terminate it. To do so, press any key; the message {HEAT TEST ENDS} will be displayed and printed within 21 seconds after you press the key.

8-91. Full Tape Test

8-92. What It Does. The Full Tape Test automatically runs the following tests from the Service ROM:

a. Status Test (described in paragraph 8-97).

b. Speed Test (described in paragraph 8-101).

c. Hole-Detect Test (described in paragraph 8-105).

d. Write Test (described in paragraph 8-109).

e. Read Test (described in paragraph 8-113).

f. Record Test (described in paragraph 8-117).

g. Write-Protect Test (described in paragraph 8-58).

8-93. How to Run It. To run the Full Tape Test:

a. Press [O] if the Service ROM is in control, or type in {TAPE} if the BASIC system is in control.

b. For each of the tests listed in paragraph 8-92 (and in that order), the message {(name of test)? Y, N, OR R} will appear. If you respond by pressing:

- [Y] (yes), the test is run.
- [N] (no), the test is skipped and the message for the next test appears.
- [R] (repeat), the test is not run and the message for the previous test appears.
- Any other key, the Full Tape Test is terminated and the message {TAPE TEST ENDS} appears.

8-94. Results.

8-95. The message {TAPE TEST BEGINS] is displayed and printed, then the seven individual tests are run in the order listed in paragraph 8-92. For each of these tests:

- If the test is completed successfully, the message {OK} appears.
- If a problem is found, the appropriate message appears, the individual test is terminated, and the message for the next test appears.

8-96. After the Write-Protect Test is run, the message {TAPE TEST ENDS} appears.

8-97. Tape Status Test

8-98. What It Does. The Tape Status Test does the following:

a. Checks status bits in the tape controller.

b. Checks the speed of the tape during:

   (1) Fast speed, forward direction.

   (2) Slow speed, reverse direction.

8-99. How to Run It. To run the Tape Status Test:

a. Press [P] if the Service ROM is in control, or type in {TSTAT} if the BASIC system is in control.

b. When the message {REMOVE TAPE, PRESS KEY} appears, remove the tape cartridge if one is inserted, then press any key.

8-100. Results. If the test is completed successfully, the message {OK} appears. If not, one of the following messages appears:

- {TAPE CONTROL BAD!}
- {TAPE ERROR!}
- {TAPE ERROR! SPEED}
- {TAPE NOT REMOVED!}
- {TAPE STALLED!}

8-101. Tape Speed Test

8-102. What It Does. The Tape Speed Test enables you to make electrical measurements on the tape motor-drive circuitry. It does the following:

a. Checks whether a cartridge is inserted.

b. If a cartridge is inserted:

(1) Runs the tape at fast speed in the forward direction until the end of the tape, rewinds, then repeats until a key is pressed.

(2) Rewinds the tape.

(3) Runs the tape at slow speed in the forward direction until the end of the tape, rewinds, then repeats until a key is pressed.

(4) Rewinds the tape.

c. If a cartridge is not inserted:

(1) Runs the tape motor at fast speed in the forward direction until a key is pressed.

(2) Runs the tape motor at fast speed in the reverse direction until a key is pressed.

(3) Runs the tape motor at slow speed in the forward direction until a key is pressed.

(4) Runs the tape motor at slow speed in the reverse direction until a key is pressed.

8-103. How to Run It. To run the Tape Speed Test:

a. Press [Q] if the Service ROM is in control, or type in {TSPEED} if the BASIC system is in control.

b. When the message {FAST? PRESS KEY} appears, press any key. If you want to run the Tape Speed Test with a cartridge inserted, insert the cartridge before pressing the key.

c. If a cartridge is inserted, press any key to terminate the fast-speed running. If a cartridge is not inserted, press any key to terminate the fast-speed running in the forward direction or the fast-speed running in the reverse direction.

d. When the message {SLOW? PRESS KEY} appears, press any key.

e. If a cartridge is inserted, press any key to terminate the slow-speed running. If a cartridge is not inserted, press any key to terminate the slow-speed running in the forward direction or the slow-speed running in the reverse direction.

8-104. Results. If the test is completed successfully, the message {OK} appears when the last key is pressed. If not, one of the following messages appears:

- {END OF TAPE!}
- {TAPE OUT!}
- {TAPE STALLED!}

8-105. Tape Hole-Detect Test

8-106. What It Does. The Tape Hole-Detect Test does the following:

a. Checks whether a tape cartridge is inserted.

b. Runs the tape at slow speed in the reverse direction for 4 inches, checking for a hole.

c. Runs the tape at slow speed in the forward direction for 24 inches, checking for a hole.

d. Runs the tape at fast speed in the reverse direction for 30 inches, checking for a hole.

e. Rewinds the tape.

8-107. How to Run It. To run the Tape Hole-Detect Test:

a. Press [R] if the Service ROM is in control, or type in {THOLE} if the BASIC system is in control.

b. When the message {LOAD REWOUND TAPE, PRESS KEY} appears, insert a rewound tape cartridge into the tape drive.

> Notes:
>
> If the customer returned a tape cartridge along with the computer, be sure to use it during testing.
>
> The tape should be rewound on a good computer before each time the Hole-Detect Test is run. If the tape is not rewound, running the Hole-Detect Test may either run the tape off of the cartridge hub or result in a message indicating a failure. Remember to rewind the tape when you are repeating the Hole-Detect Test after replacing a component or assembly.

8-108. Results. If the test is completed successfully, the message {OK} appears. If not, one of the following messages appears:

- {END OF TAPE!}
- {TAPE OUT!}
- {TAPE ERROR! HOLE}
- {TAPE STALLED!}

8-109. Tape Write Test

8-110. What It Does. The Tape Write Test generates a test tape for use in the Tape Read Test. It does the following:

> Note: If the key pressed in response to the prompting message (refer to paragraph 8-111) is a [1], 1's are written by this test. If any other key is pressed, 0's are written.

a. Checks whether a tape cartridge is inserted.

b. If a cartridge is inserted:

(1) Checks whether the cartridge is write-protected.

(2) Rewinds the tape.

(3) Writes continuous 0's (or 1's) on track A in the forward direction until the end of the tape, rewinds, then repeats until a key is pressed.

(4) Rewinds the tape.

(5) Writes continuous 0's (or 1's) on track B in the forward direction until the end of the tape, rewinds, then repeats until a key is pressed.

(6) Rewinds the tape.

c. If a cartridge is not inserted:

(1) Writes continuous 0's (or 1's) on track A forward until a key is pressed.

(2) Writes continuous 0's (or 1's) on track A backward until a key is pressed.

(3) Writes continuous 0's (or 1's) on track B forward until a key is pressed.

(4) Writes continuous 0's or (1's) on track B backward until a key is pressed.

8-111. How to Run It. To run the Tape Write Test:

a. Insert a tape cartridge--with its RECORD tab in the unprotected position (the direction of the arrow)--into the tape drive.

Notes:

Any information on the tape will be erased by this test.

If the customer returned a tape cartridge along with the computer, be sure to use it during testing.

The Tape Write Test can also be run without a tape cartridge inserted.

b. Press [S] if the Service ROM is in control, or type in {TWRITE} if the BASIC system is in control.

c. When the message {WRITE TRACK A? PRESS KEY} appears (which occurs after the cartridge is rewound), press a key to start the test.

d. If a cartrige is inserted, press any key to terminate the continuous write on track A. If a cartridge is not inserted, press any key to terminate the continuous write forward or the continuous write backward on track A.

d. When the message {WRITE TRACK B? PRESS KEY} appears, press a key.

e. If a cartridge is inserted, press any key to terminate the continuous write on track B. If a cartridge is not inserted, press any key to terminate the continuous write forward or the continuous write backward on track B.

8-112. Results. If no problem is found, the message {OK} appears when the last key is pressed. Otherwise, one of the following messages appears:

- {END OF TAPE!}
- {TAPE OUT!}
- {TAPE PROTECTED!}
- {TAPE STALLED!}

8-113. Tape Read Test

8-114. What It Does. The Tape Read Test checks the read circuitry and also enables you to make measurements on the circuitry. It does the following:

a. Checks whether a tape cartridge is inserted.

b. If a cartridge is inserted:

(1) Rewinds the tape.

(2) Reads track A in the forward direction until the end of the tape, rewinds, then repeats until a key is pressed.

(3) Reads track B in the forward direction until the end of the tape, rewinds, then repeats until a key is pressed.

(4) Rewinds the tape.

c. If a cartridge is not inserted:

(1) Reads track A continuously in the forward direction until a key is pressed.

(2) Reads track A continuously in the reverse directin until a key is pressed.

(3) Reads track B continuously in the forward direction until a key is pressed.

(4) Reads track B continuously in the reverse direction until a key is pressed.

8-115. How to Run It. To run the Tape Read Test:

a. Insert a tape cartridge into the tape drive.

> Note: You may use either the tape written by the Write Test or the tape from the HP-85 Standard Pac. However, if you are running the Read Test so that you can troubleshoot the read/write circuitry, it may be advantageous to use the tape written by the Write Test. This test writes a known signal onto the tape--all 0's or (if you start the test by pressing [1]) all 1's. (Refer to paragraph 8-109.) The Tape Read Test can also be run without any tape cartridge inserted.

b. Press [T] if the Service ROM is in control, or type in {TREAD} if the BASIC system is in control.

b. When the message {READ TRACK A? PRESS KEY} appears (which occurs after the cartridge is rewound), press any key to start the test.

c. If a cartrige is inserted, press any key to terminate the continuous read on track A. If a cartridge is not inserted, press any key to terminate the continuous read forward or the continuous read backward on track A.

d. When the message {READ TRACK B? PRESS KEY} appears, press any key.

e. If a cartridge is inserted, press any key to terminate the continuous read on track B. If a cartridge is not inserted, press any key to terminate the continuous read forward or the continuous reade backward on track B.

8-116. Results. If no problem is found, the message {OK} appears when the last key is pressed. Otherwise, one of the following messages appears:

- {END OF TAPE!}
- {TAPE OUT!}
- {TAPE STALLED!}

8-117. Tape Record Test

8-118. What It Does. The Tape Record Test does the following:

a. Checks whether a tape cartridge is inserted.

b. Rewinds the tape.

c. Checks whether the tape is write-protected.

d. Writes a 25-inch gap on track A in the forward direction.

e. Writes a 25-inch gap on track B in the reverse direction.

f. Rewinds the tape.

g. Moves the tape, at slow speed, 12.5 inches forward.

h. Writes a 1-inch gap on track A in the forward direction.

i. Writes a record of 256 bytes on track A in the forward direction.

j. Writes another 1-inch gap on track A in the forward direction.

k. Writes another record of 256 bytes on track A in the forward direction.

l. Writes another 1-inch gap on track A in the forward direction.

m. Writes a 1-inch gap on track B in the reverse direction.

n. Writes a record of 256 bytes on track B in the reverse direction.

o. Writes another 1-inch gap on track B in the reverse direction.

p. Writes another record of 256 bytes on track B in the reverse direction.

q. Writes another 1-inch gap on track B in the reverse direction.

r. Reads the first two gaps and the two records on track A in the forward direction.

s. Reads the first two gaps and the two records on track B in the reverse direction.

t. Rewrite on track B in the forward direction.

u. Rewrite on track A in the reverse direction.

v. Reads the rewritten three gaps and two records on track B in the forward direction.

w. Reads the rewritten three gaps and two records on track A in the reverse direction.

x. Rewinds the tape.

y. Runs the tape at fast speed in the forward direction until the three gaps and two records on track A have been read.

z. Rewinds the tape.

aa. Runs the tape at fast speed in the forward direction until the three gaps and two records on track B have been read.

bb. Rewinds the tape.

8-119. How to Run It. To run the Tape Record Test:

a. Press [U] if the Service ROM is in control, or type in {TREC} if the BASIC system is in control.

b. When the message {LOAD UNPROTECTED TAPE,PRESS KEY} appears, insert a tape cartridge--with its RECORD tab set to the right--into the tape drive, then press any key.

Notes:

Any information on the tape will be erased by this test.

If the customer returned a tape cartridge along with the computer, be sure to use it during testing.

8-120. Results. If the test is completed successfully, the message {OK} appears. If not, one of the following message appears:

- {END OF TAPE!}
- {TAPE ERROR! GAP}
- {TAPE ERROR! READ}
- {TAPE ERROR! WRITE}
- {TAPE OUT!}
- {TAPE PROTECTED!}
- {TAPE STALLED!}

8-121. Cycle Test

8-122. What It Does. The Cycle Test runs and automatically repeats the System Test (refer to paragraph 8-23) continuously.

8-123. How to Run It. To run the Cycle Test,

a. Insert a rewound tape cartridge, with its RECORD tab set to the right, into the tape drive.

> Notes:
>
> Any information on the tape will be erased by this test.
>
> If the customer returned tape cartridge along with the computer, be sure to use it during testing.

b. Press [V] if the Service ROM is in control, or type in {CYCLE} if the BASIC system is in control.

c. To terminate the Cycle Test, press any key within 3 seconds after the message {SYSTEM TEST ENDS} appears.

8-124. Results. The results of the Cycle Test are the same as the results of the System Test (refer to paragraph 8-26), but any messages are repeated until the test is terminated.

> Note: If you do not respond to the prompting messages during the Tape Write-Protect Test and the Keyboard Test, error messages will appear. Furthermore, if any messages (except {TAPE OUT!}) appear during the Abbreviated Tape Test, the Cycle Test will be terminated after the Keyboard Test ends.

Replaceable Parts

9-1. This section lists the replaceable parts and assemblies of the HP-85A. Replaceable parts of the keyboard assembly are listed in table 4-4, next to the Keyboard Assembly Exploded View.

9-2. Assemblies or parts listed without an HP part number are identified for reference only and cannot be ordered as named. Such items either are supplied as part of the assemblies under which they are listed, or can be obtained by ordering the indicated parts included in the assembly.

Table 9-1. HP-85A Replaceable Parts

FIGURE & INDEX NUMBER	HP PART NUMBER	DESCRIPTION	QTY
9-1-			
1	00085-69004	**ASSEMBLY, CRT**	1
2	8120-3706	CABLE, ribbon (W1)	1
3	8120-3707	CABLE, ribbon (W2)	1
	1MA5-0101	INTEGRATED CIRCUIT, CRT controller (U12)	1
	1818-1396	INTEGRATED CIRCUIT, CRT RAM (U13 thru U16)	4
	8160-0359	EMI Gasket	1
4	00085-60967	**ASSEMBLY, back panel (refer to table 9-2)**	1
		ASSEMBLY, base	1
5	00085-60025	ASSEMBLY, power light	1
6	00085-40019	o HOLDER	1
7	1990-0524	o LED	1
8	4040-1840	CASE, bottom	1
9	0510-0062	CLIP, retaining	3
10	00085-60027	CONTROL, brightness	1
11	0403-0291	FOOT	4
12	2950-0001	NUT, hex, 3/8-32	1
13	0624-0289	SCREW, tapping, 2-28 x 0.312 inch	1
14	00085-60925	SPEAKER	1
15	2190-0016	WASHER, lock, internal tooth, 3/8 inch	1
16	00085-60924	**ASSEMBLY, I/O PC**	1

Table 9-1. HP-85A Replaceable Parts (Continued)

FIGURE & INDEX NUMBER	HP PART NUMBER	DESCRIPTION	QTY
9-1-			
		ASSEMBLY, keyboard with hinges and cables	1
17	00085-60919	ASSEMBLY, keyboard (refer to table 4-4)	1
52	8120-3713	CABLE, ribbon (W9, 10)	1
56	00085-40031	HINGE, keyboard	2
64	0624-0314	SCREW, tapping, 4-20 x 0.375 inch	4
18	00085-60918	**ASSEMBLY, logic PC**	1
	00085-60910	BOARD, logic PC	1
	1MA8-0101	INTEGRATED CIRCUIT, I/O buffer (U1)	1
	1MB1-0001	INTEGRATED CIRCUIT, CPU (U2)	1
	1MB2-0001	INTEGRATED CIRCUIT, keyboard controller (U3)	1
	1MA7-0060	INTEGRATED CIRCUIT, ROM 0 (U4)	1
	1MA7-0068	INTEGRATED CIRCUIT, ROM 1 (U5)	1
	1MA7-0066	INTEGRATED CIRCUIT, ROM 2 (U6)	1
	1MA7-0063	INTEGRATED CIRCUIT, ROM 3 (U7)	1
	1MA2-0002	INTEGRATED CIRCUIT, RAM controller (U8)	1
	1818-1396	INTEGRATED CIRCUIT, RAM (U9 through U19)	1
		ASSEMBLY, printer	1
19	00085-60038	ASSEMBLY, motor, paper advance	1
20	00085-60028	ASSEMBLY, motor, print head	1
21	00085-60055	ASSEMBLY, paper roll insert	2
22	00085-60908	ASSEMBLY, printer mechanical	1
23	00085-60020	o ASSEMBLY, platen	1
	00085-60056	o ASSEMBLY, platen holder	1
24	00085-60923	o ASSEMBLY, print-head	1
	1460-2016	o SPRING, print-head	1
	00085-40017	o BEARING, steady, (print-head belt tension)	1
	1500-0572	o BELT, paper advance	1
	1500-0529	o BELT, print-head	1
25	0590-0787	o NUT, square, no chamfer, 4-40	2
26	2200-0589	o SCREW, machine, 4-40 x 0.312 inch	2
27	0624-0314	o SCREW, tapping, 4-20 x 0.375 inch	2
	1460-1732	o SPRING, print-head belt tension	1
28	2190-0891	o WASHER, flat metallic, #4	4
29	00085-69002	**ASSEMBLY, printer/power supply**	1
	1MA9-0101	o IC, printer controller (U5)	1
30	8120-3709	CABLE, ribbon (W5)	1
31	8120-3710	CABLE, ribbon (W6)	1
32	0624-0394	SCREW, tapping, 10-32 x 0.375 inch	4

Table 9-1. HP-85A Replaceable Parts (Continued)

FIGURE & INDEX NUMBER	HP PART NUMBER	DESCRIPTION	QTY
9-1-			
33	00085-69009	**ASSEMBLY, tape drive**	1
34	00085-60907	ASSEMBLY, motor/capstan	1
35	8120-3711	CABLE, ribbon (W7)	1
36	8120-3712	CABLE, ribbon (W8)	1
	1MA6-0001	IC, tape controller (U1)	1
	0683-4735	o RESISTOR (R7), 47K, 5%, 0.25W	1
37	0624-0324	o SCREW, tapping, 4-20 x 0.312 inch	4
		ASSEMBLY, top case	1
38	4040-1634	BEZEL	1
39	4040-1999	COVER	1
	1400-1087	STIFFENER	1
40	4040-1625	DOOR, paper	1
41	00085-40008	DOOR, tape	1
42	7120-8171	LABEL, nameplate	1
43	0624-0289	SCREW, tapping, 2-28 x 0.312 inch	6
44	1460-1726	SPRING, tape door	1
45	3050-0098	WASHER, flat metallic, #2	6
46	00085-40007	LENS, CRT	1
47	00085-40016	WINDOW, paper tear	1
48	00085-40020	BAR, tape ejector	1
49	1600-0924	BRACKET, tape drive support	1
50	8120-3708	CABLE, ribbon, I/O (W3)	1
51	8120-3714	CABLE, ribbon, I/O (W4)	1
53	00085-40011	COVER, I/O port	4
	2110-0063	FUSE, (115V), 0.75A	1
54	00085-60088	FUSE with fuseholder cap, 115V	1
	2110-0620	FUSE, (230V), 0.40A	1
54	00085-60087	FUSE with fuseholder cap, 230V	1
55	0400-0214	GROMMET, channel	3 inches
57	0340-0929	INSULATOR	1
58	7120-8599	LABEL, caution	1
59	1520-0067	MOUNT, shock	6
60	82931A	PAPER, thermal (two rolls), blue	1/2
60	82954A	PAPER, thermal (two rolls), black	1/2
61	2200-0147	SCREW, machine, 4-40 x 0.625 inch	6
62	2200-0103	SCREW, machine, 4-40 x 0.25 inch	1
63	2360-0205	SCREW, machine, 6-32 x 0.75 inch	6
64	0624-0314	SCREW, tapping, 4-20 x 0.375 inch	7
65	0624-0403	SCREW, tapping, 6-19 x 0.375 inch	2
66	0624-0446	SCREW, tapping, 6-19 x 0.625 inch	5
67	2190-0142	WASHER, flat metallic, #6	3
68	3050-0399	WASHER, flat metallic, #6	6
69	2190-0563	WASHER, lock, external tooth, #6	5

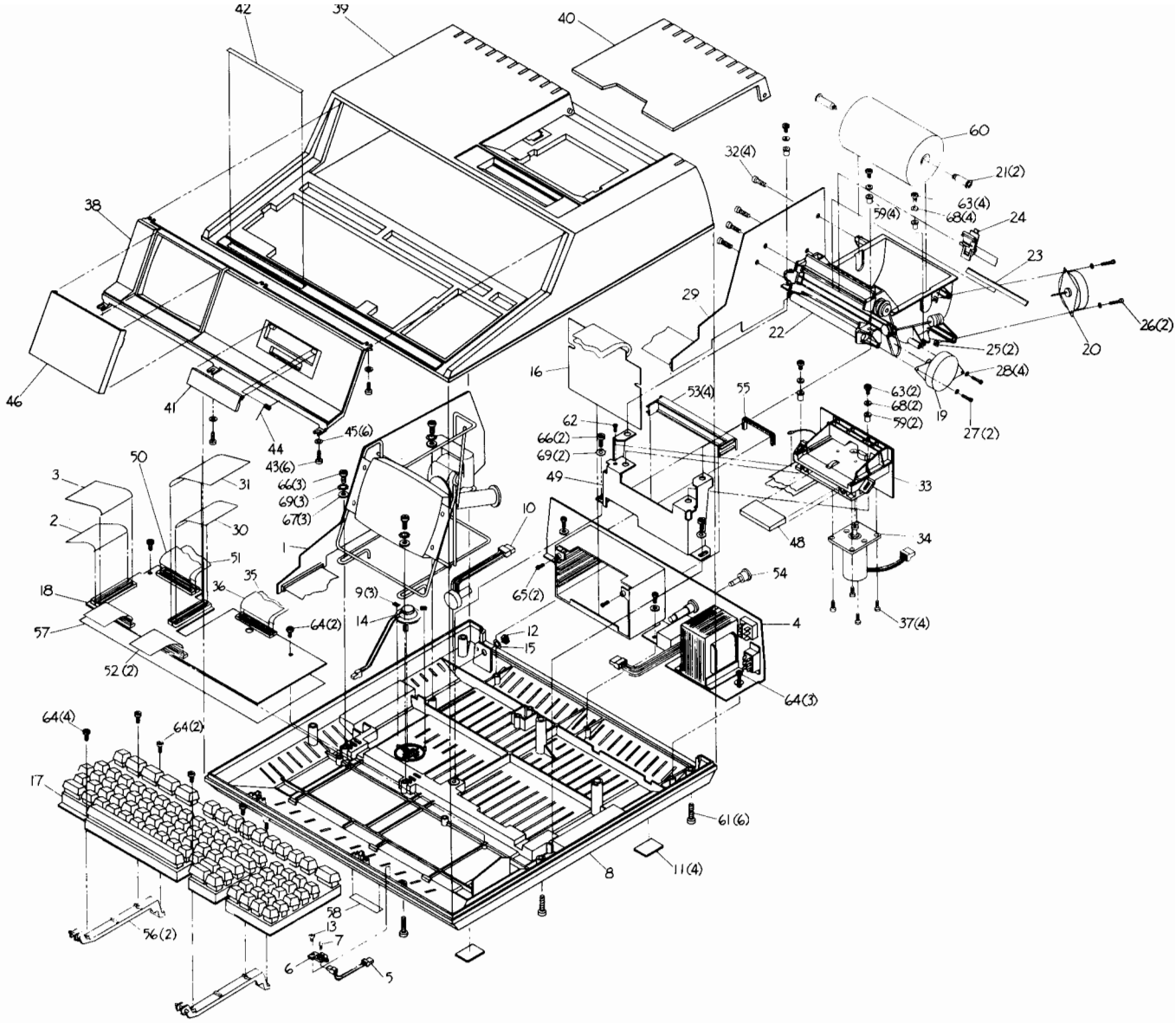


Figure 9-1. HP-85 Exploded View

Table 9-2. Back Panel Assembly Replaceable Parts

FIGURE & INDEX NUMBER	HP PART NUMBER	DESCRIPTION	QTY
9-2-			
1	00085-60920	ASSEMBLY, back panel with filter and switch	1
2	00085-60067	ASSEMBLY, connector, fuse to ON/OFF switch	1
3	00085-60066	ASSEMBLY, connector, filter to ON/OFF switch	1
	0362-0554	o CONNECTOR, single contact	1
4	00085-60017	ASSEMBLY, power transformer	1
5	00085-60065	ASSEMBLY, line filter ground	1
6	00085-60064	ASSEMBLY, transformer ground	1
7	1600-0805	BRACKET, transformer	2
8	1400-0249	CABLE TIE	1
9	2110-0610	FUSEHOLDER	1
10	2110-0569	NUT, fuseholder	1
11	2260-0001	NUT, hex, 4-40	3
12	0590-0305	NUT, hex, 6-32, with lockwasher	2
13	00085-40010	RECEPTACLE, I/O	1
14	2200-0608	SCREW, machine, 4-40 x 2 inches	3
15	2360-0481	SCREW, machine, black, 6-32 x 0.375 inch	4
16	2360-0195	SCREW, machine, 6-32 x 0.312 inch	4
17	1600-0923	SPRING, grounding	1
18	3101-0402	SWITCH, ON/OFF	1
19	0890-1357	TUBING, heat shrinkable	1
20	3050-0399	WASHER, flat metallic, #6	2
21	2190-0411	WASHER, lock, external tooth, #4	6
22	2190-0563	WASHER, lock, external tooth, #6	5
	8160-0360	EMI GASKET	1

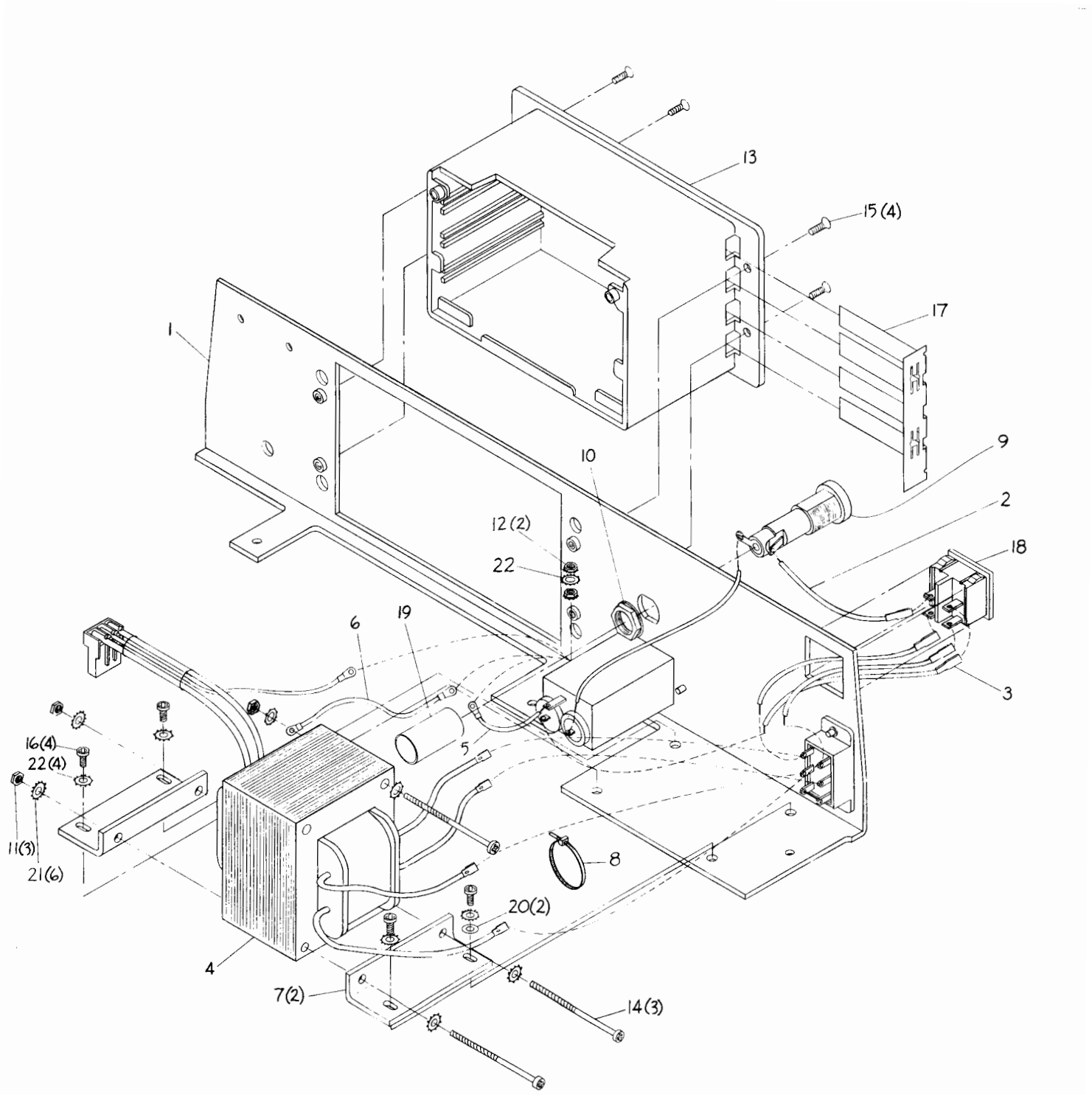
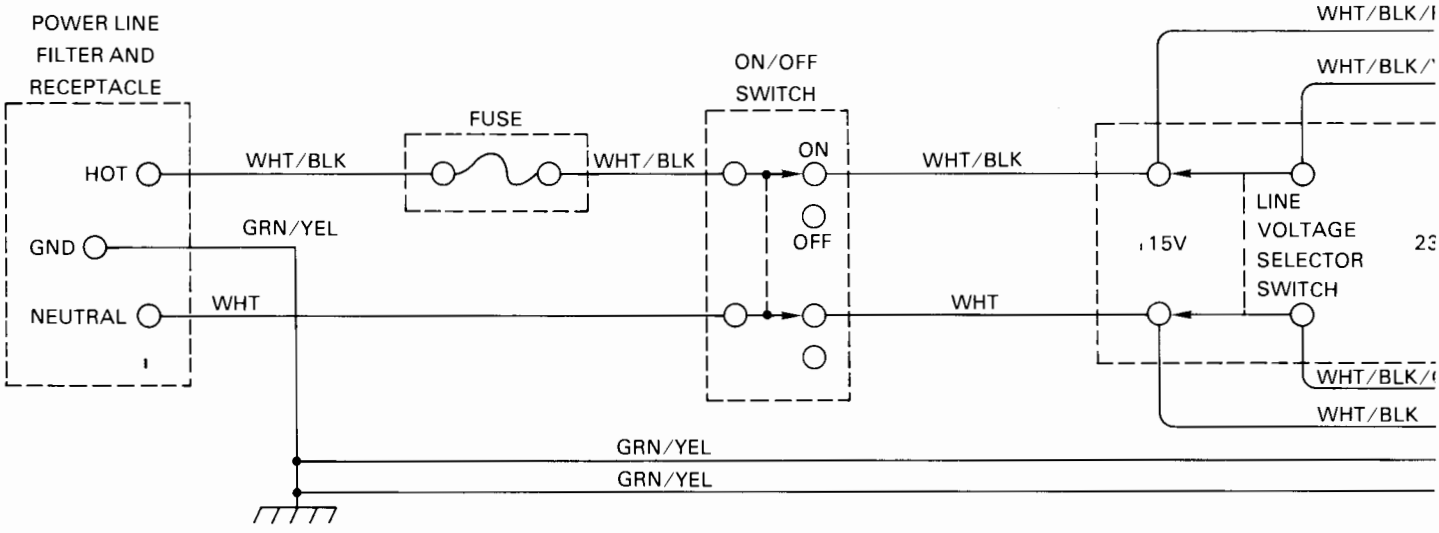


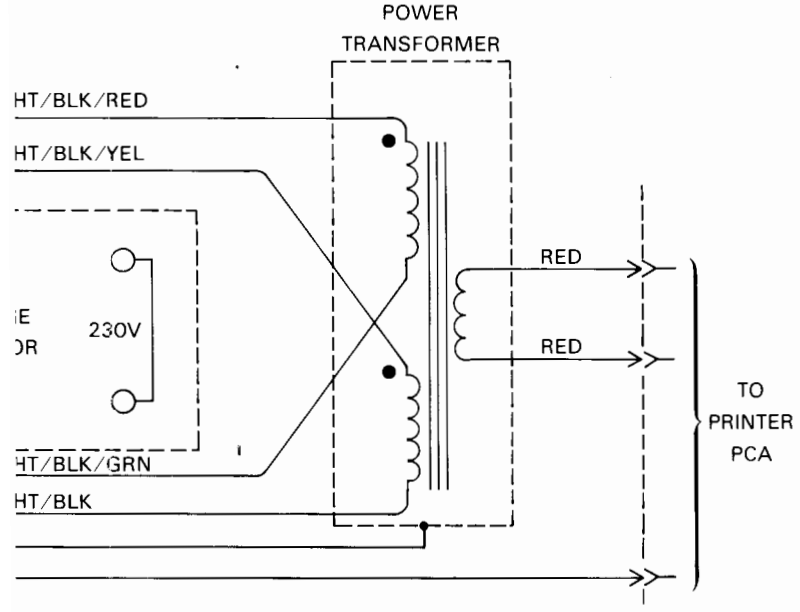
Figure 9-2. Back Panel Assembly Exploded View



NOTES:

1. POWER LINE FILTER AND RECEPTACLE TERMINALS ARE IDENTIFIED AS FOLLOWS:
   HOT — BROWN DOT
   NEUTRAL — BLUE DOT
   GROUND — SOLDERED TO CASE.
2. TRANSFORMER CORE MUST BE GROUNDED VIA 18 AWG WIRE CONNECTED TO SAME GROUND LUG AS GROUND ON LINE FILTER.

Figure 9-3. Back Panel Assembly Schematic Diagram


POWER
TRANSFORMER
HT/BLK/RED
HT/BLK/YEL
E
OR
230V
HT/BLK/GRN
HT/BLK
RED
RED
TO
PRINTER
PCA

SECTION
X

Reference Diagrams

This section includes reference diagrams for the HP-85A Personal Computer. Although Hewlett-Packard Company does not support component-level repair of the HP-85, these diagrams have been included in this manual due to popular request. Many of the PCAs have undergone one or more revisions, so these diagrams are not representative of all units.

This section contains both schematic and component location diagrams for each PCA. Since the Logic PCA component location diagram is shown in figure 2-9, it is not included in this section.

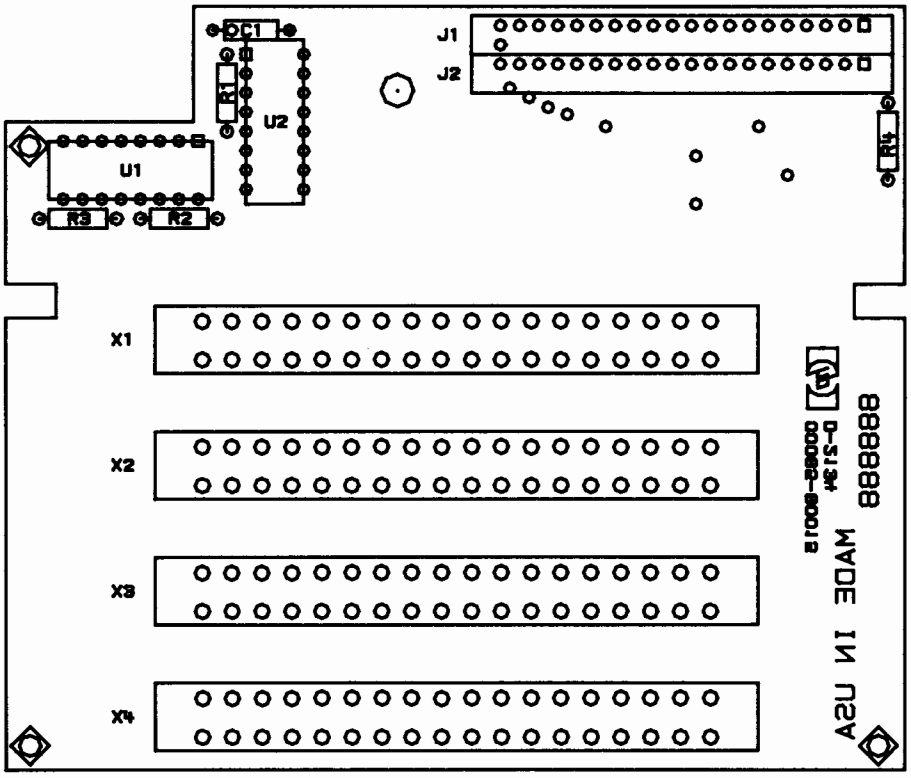
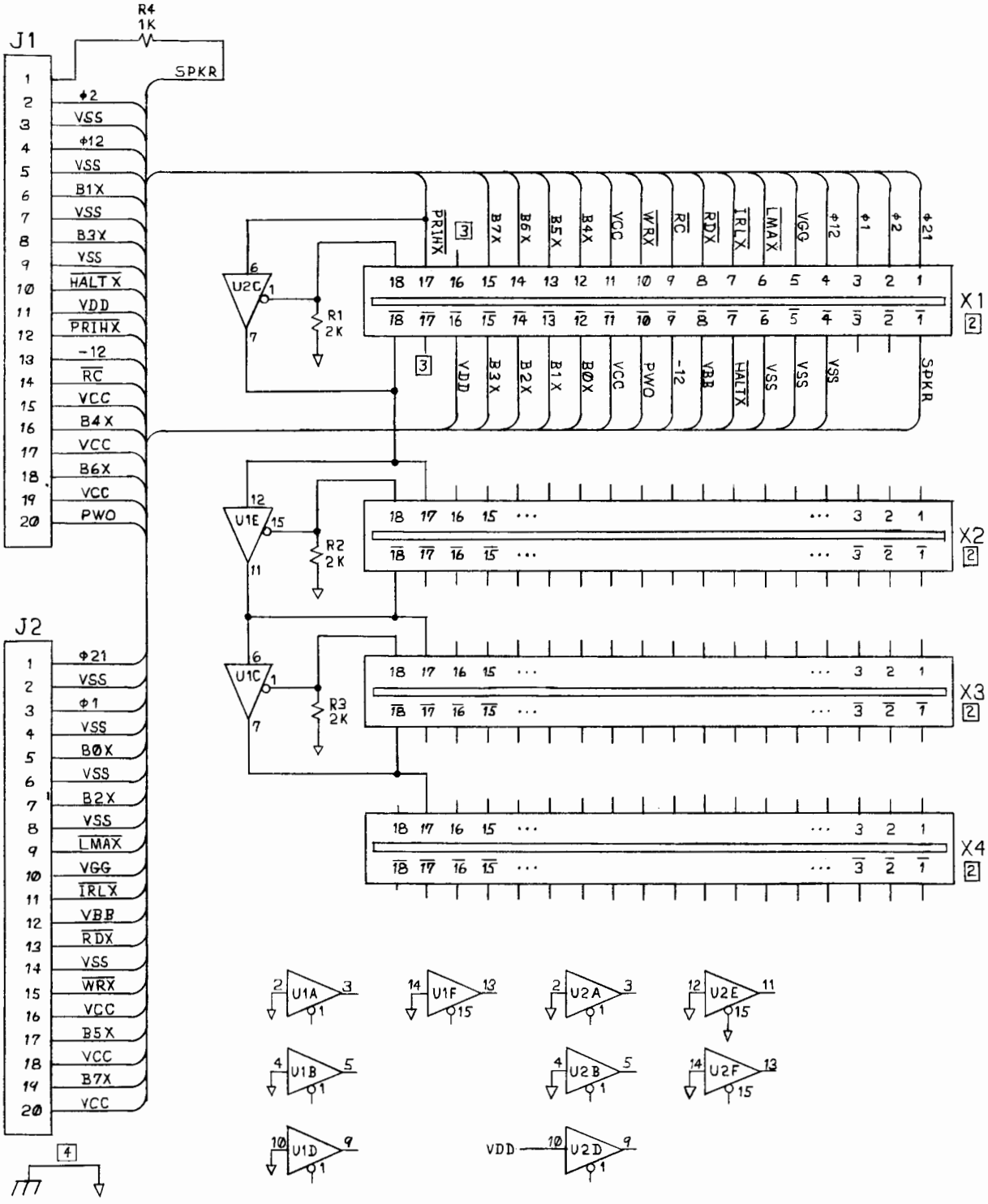


Figure 10-1. I/O PCA Component Location Diagram



NOTES:

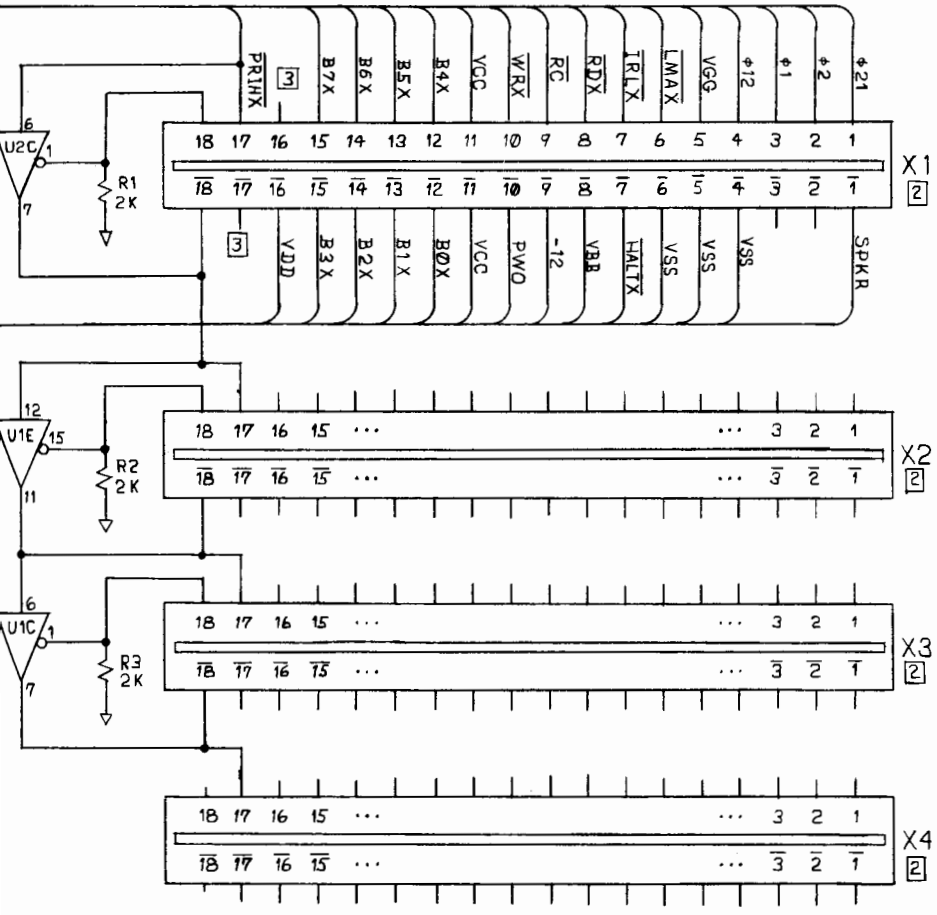
1. ⏚ = VS
2. X1 TH PARALLE PINS 1
3. PINS ARE CO
4. FRAME
5. INSERT X4 SHO

	POWER VDD
U1	16
U2	16

CAPACITOR

C1

Figure 10-2. I/O PCA Sche



NOTES:

1. ⏚ = VSS.
2. X1 THRU X4 ARE CONNECTED IN PARALLEL AT PINS 1 THRU 16 AND PINS $\overline{1}$ THRU $\overline{17}$.
3. PINS 16 AND $\overline{17}$ OF X1 THRU X4 ARE CONNECTED TOGETHER.
4. FRAME GROUND IS CONNECTED TO VSS.
5. INSERTION SIDE VIEW OF X1 THRU X4 SHOWN.

	POWER PINS VDD	VSS
U1	16	8
U2	16	8

CAPACITOR	+	-	DECOUPLES
C1	VDD	VSS	U1, U2

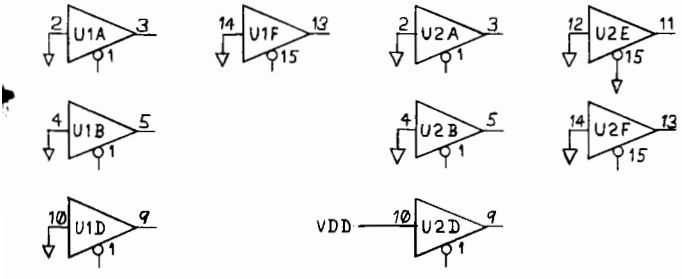
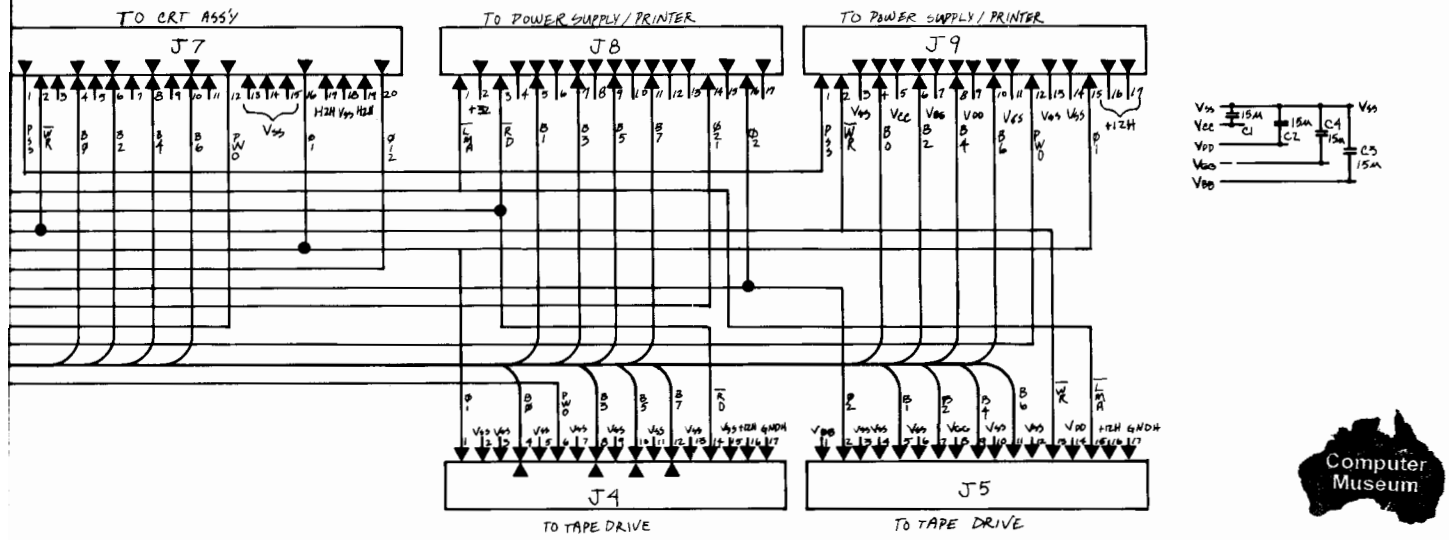
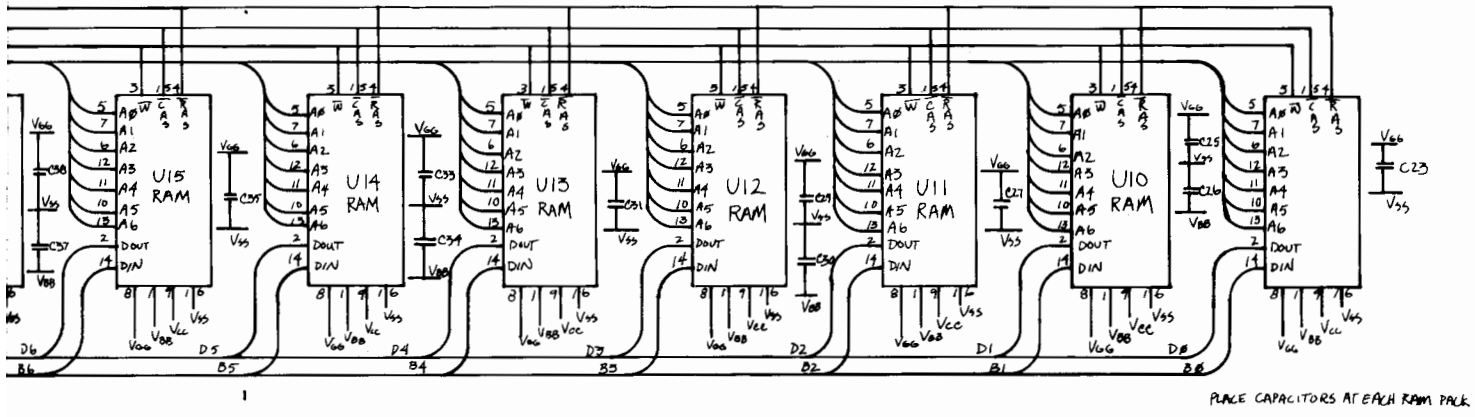


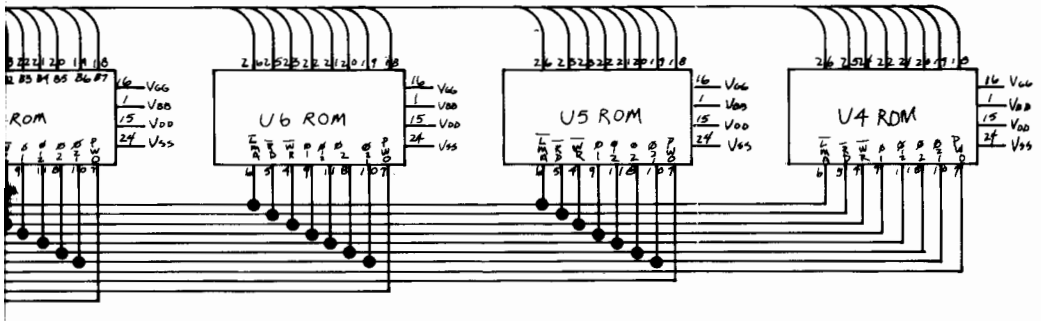
Figure 10-2. I/O PCA Schematic Diagram





PLACE CAPACITORS AT EACH RAM PACK

C36 0.1uf FOR WHOLE GROUP OF RAMS



C17 AT U5/U7 & U4/U6

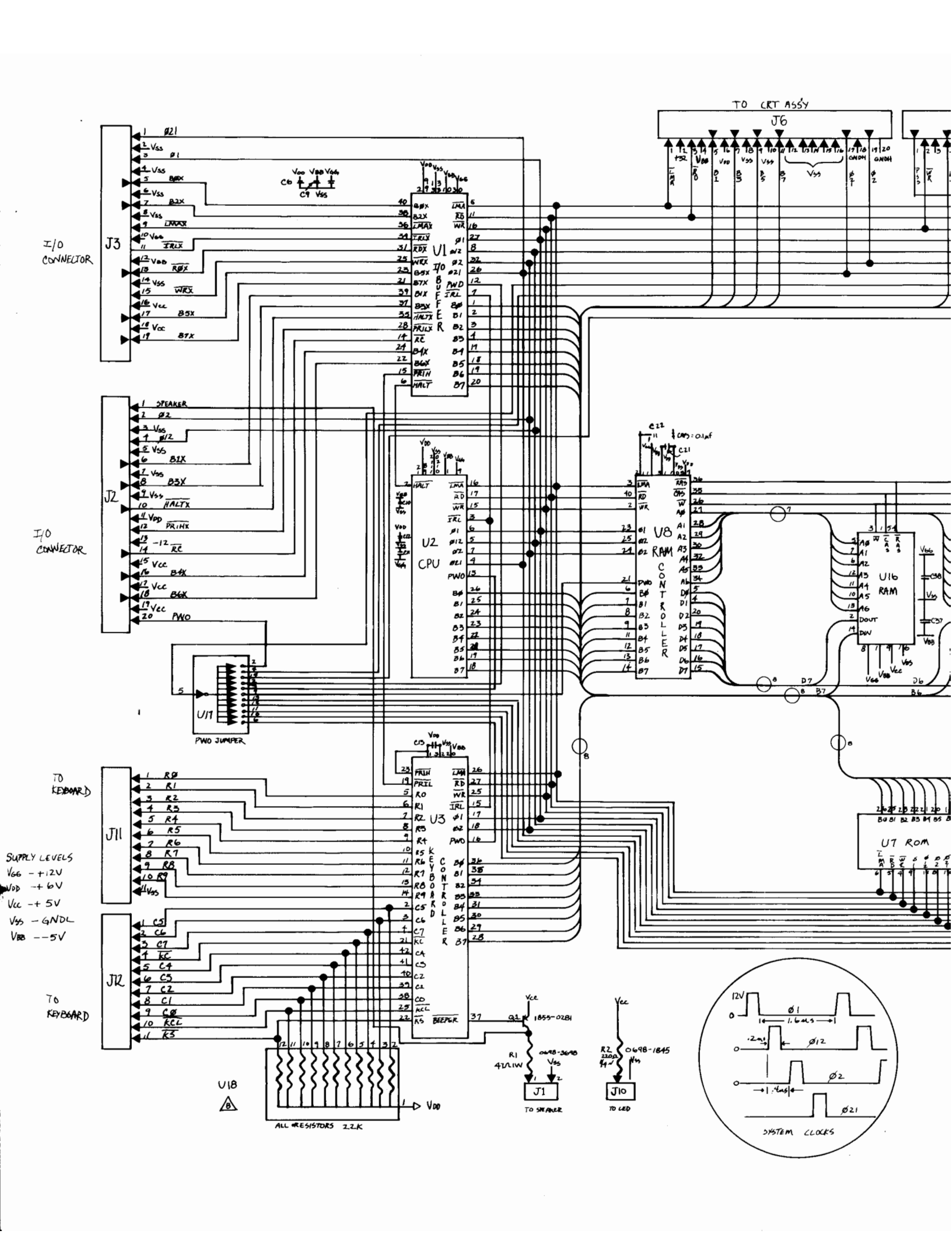
C16 AT U4 & U6

C15 AT U4/U6

C18 AT U5/U7

NOTE: ALL CAPACITORS .1UF UNLESS MARKED OTHERWISE.

Figure 10-3. Logic PCA Schematic Diagram


TO CRT ASSY
J6
I/O CONNECTOR
J3
J2
I/O CONNECTOR
U1
I/O BUFFER
U2
CPU
U8
RAM CONTROLLER
U16
RAM
U7 ROM
U17
PWO JUMPER
U3
KEYBOARD CONTROLLER
TO KEYBOARD
J11
TO KEYBOARD
J12
SUPPLY LEVELS
VGG - +12V
VDD - +6V
Vcc - +5V
Vss - GNDL
VBB - -5V
U18
ALL RESISTORS 22K
Q1
1855-0281
R1
470Ω 1W
0698-3648
J1
TO SPEAKER
R2
220Ω
0698-1845
J10
TO LED
12V
Ø1
1.6 uS
.2uS
Ø12
Ø2
1.4uS
Ø21
SYSTEM CLOCKS

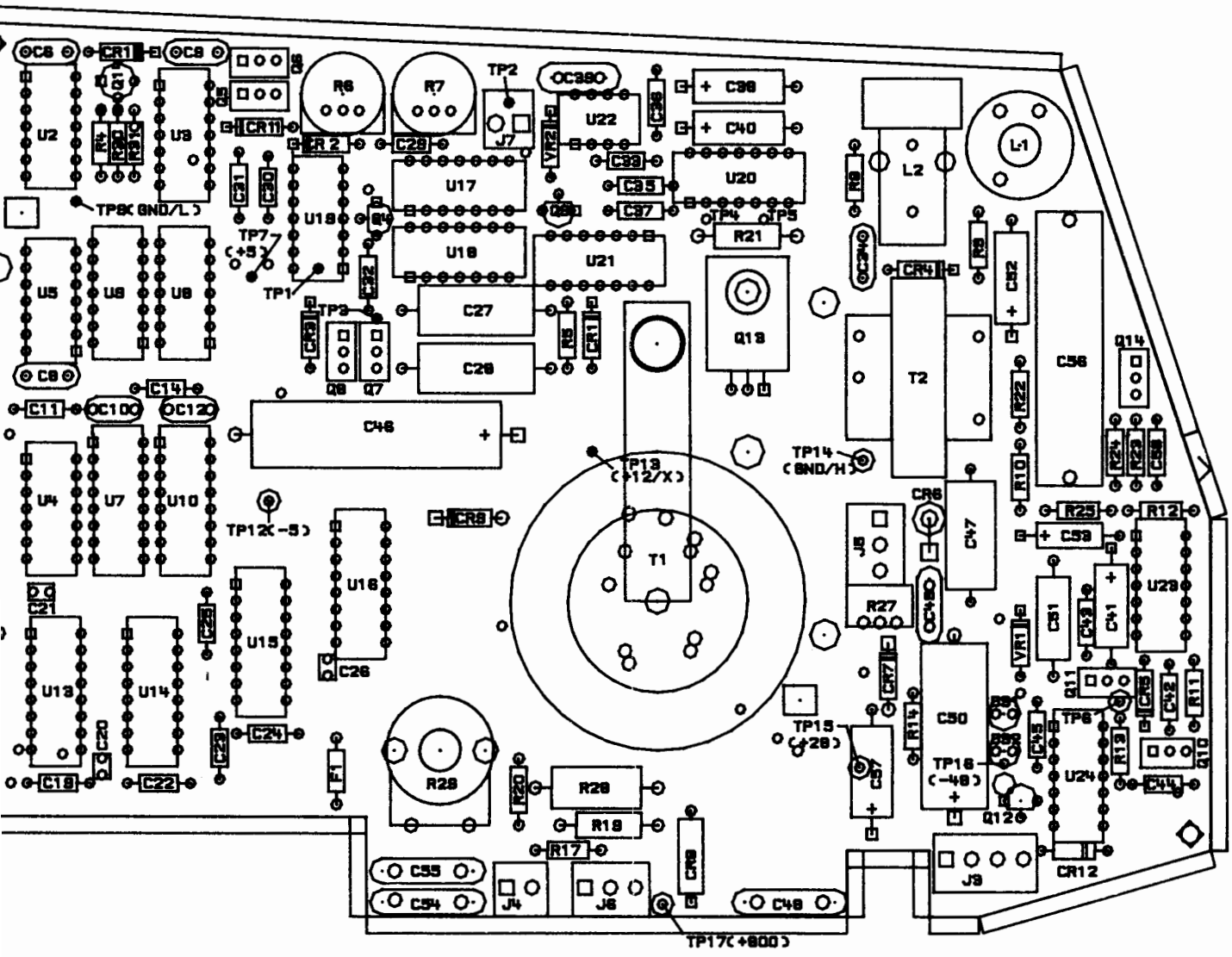
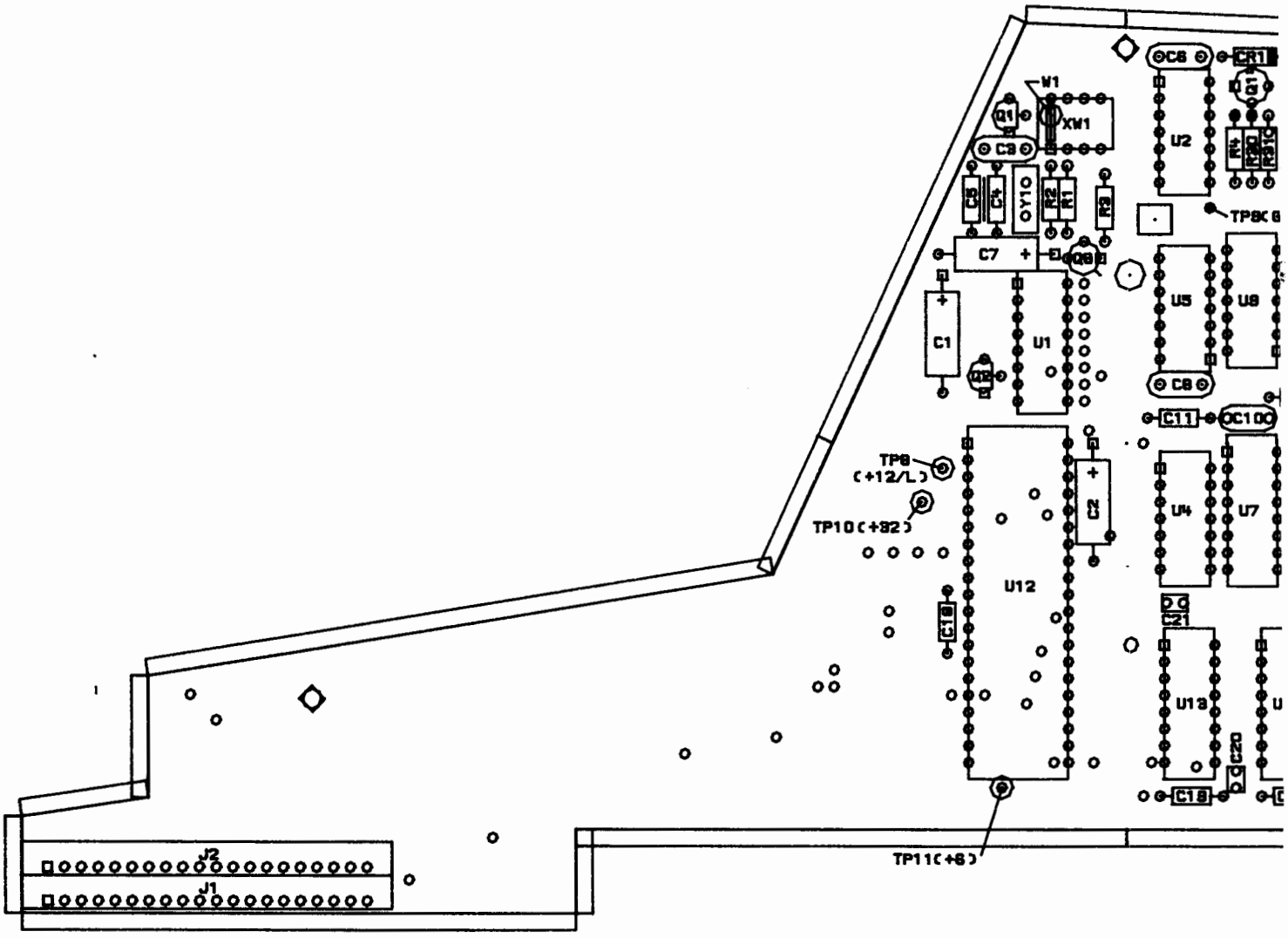


Figure 10-4. CRT PCA
Component Location Diagram


W1
XW1
C8
CR1
Q1
U2
C3
C5
C4
OY1O
R2
R1
R3
TP8(G
C7
Q8
C1
U1
U5
U8
Q2
C8
C11
C10
TP8
(+12/L)
TP10(+82)
U4
U7
C2
U12
C19
C21
U13
C20
C18
TP11(+8)
J2
J1

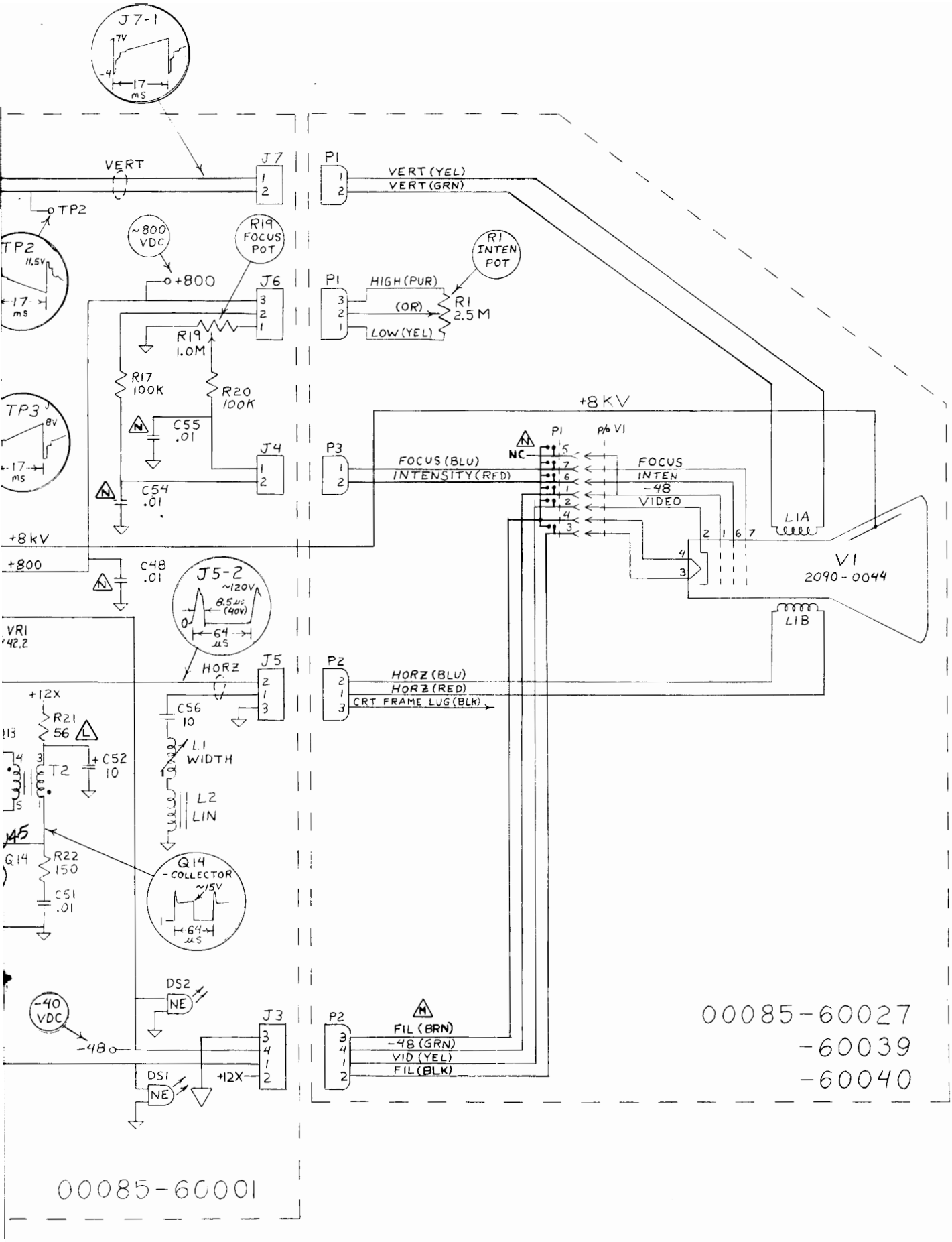
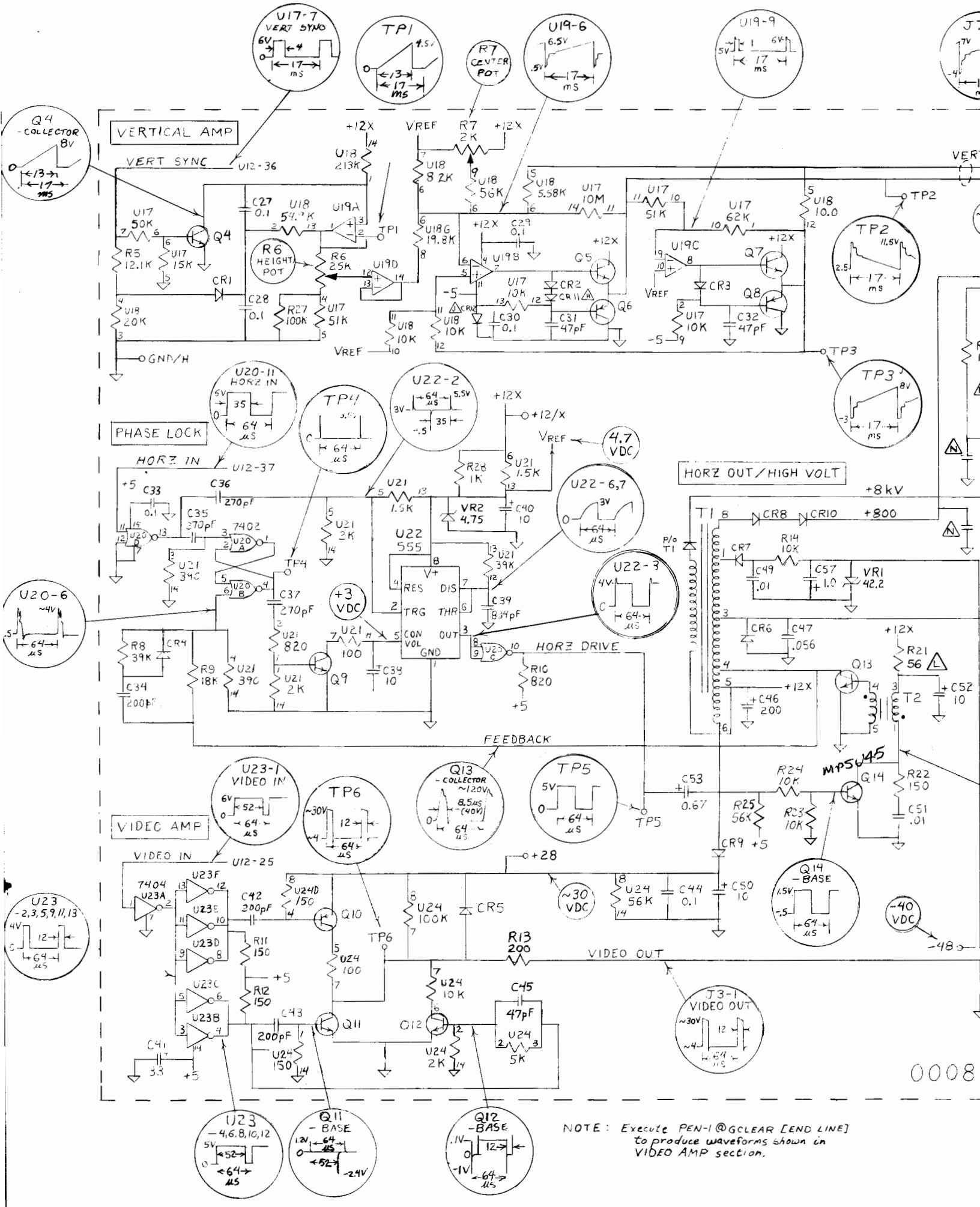


Figure 10-6.

CRT PCA Schematic Diagram (Page 2)


VERTICAL AMP
VERT SYNC
U12-36
PHASE LOCK
HORZ IN
U12-37
VIDEO AMP
VIDEO IN
U12-25
HORZ OUT/HIGH VOLT
HORZ DRIVE
FEEDBACK
VIDEO OUT
J3-1
VIDEO OUT
+12X
VREF
+5
+28
GND/H
+8kV
+800
+3 VDC
4.7 VDC
~30 VDC
-40 VDC
-48
-5
R7 CENTER POT
R6 HEIGHT POT
TP1
TP2
TP3
TP4
TP5
TP6
U17-7 VERT SYNC
U19-6
U19-9
Q4 - COLLECTOR
U20-11 HORZ IN
U22-2
U22-6,7
U22-3
U20-6
U23-1 VIDEO IN
Q13 - COLLECTOR
U23 -2,3,5,9,11,13
U23 -4,6,8,10,12
Q11 - BASE
Q12 -BASE
Q14 - BASE
U22 555
T1
T2
P/O T1
MPS U45
NOTE : Execute PEN-1 @GCLEAR [END LINE] to produce waveforms shown in VIDEO AMP section.
0008

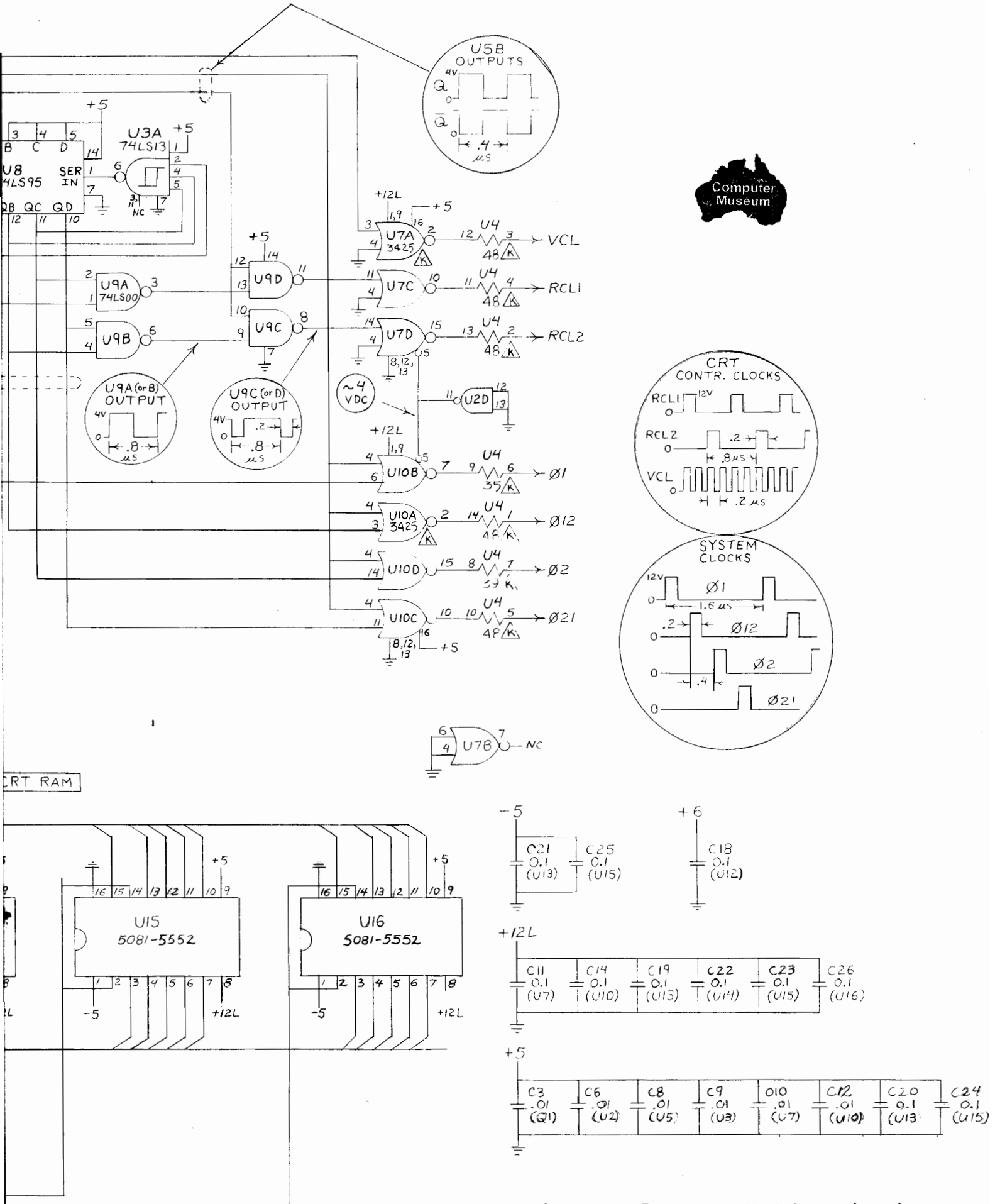
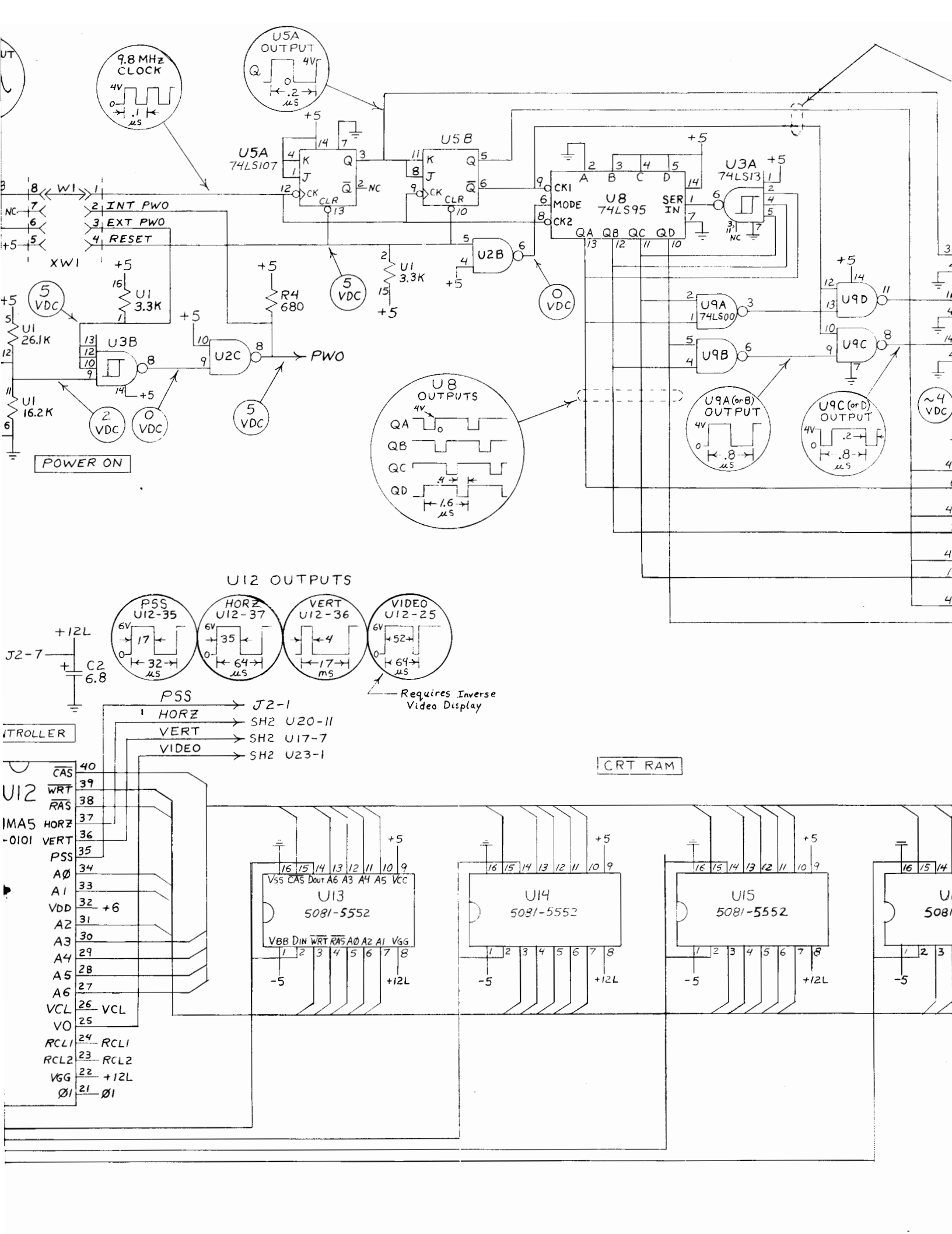
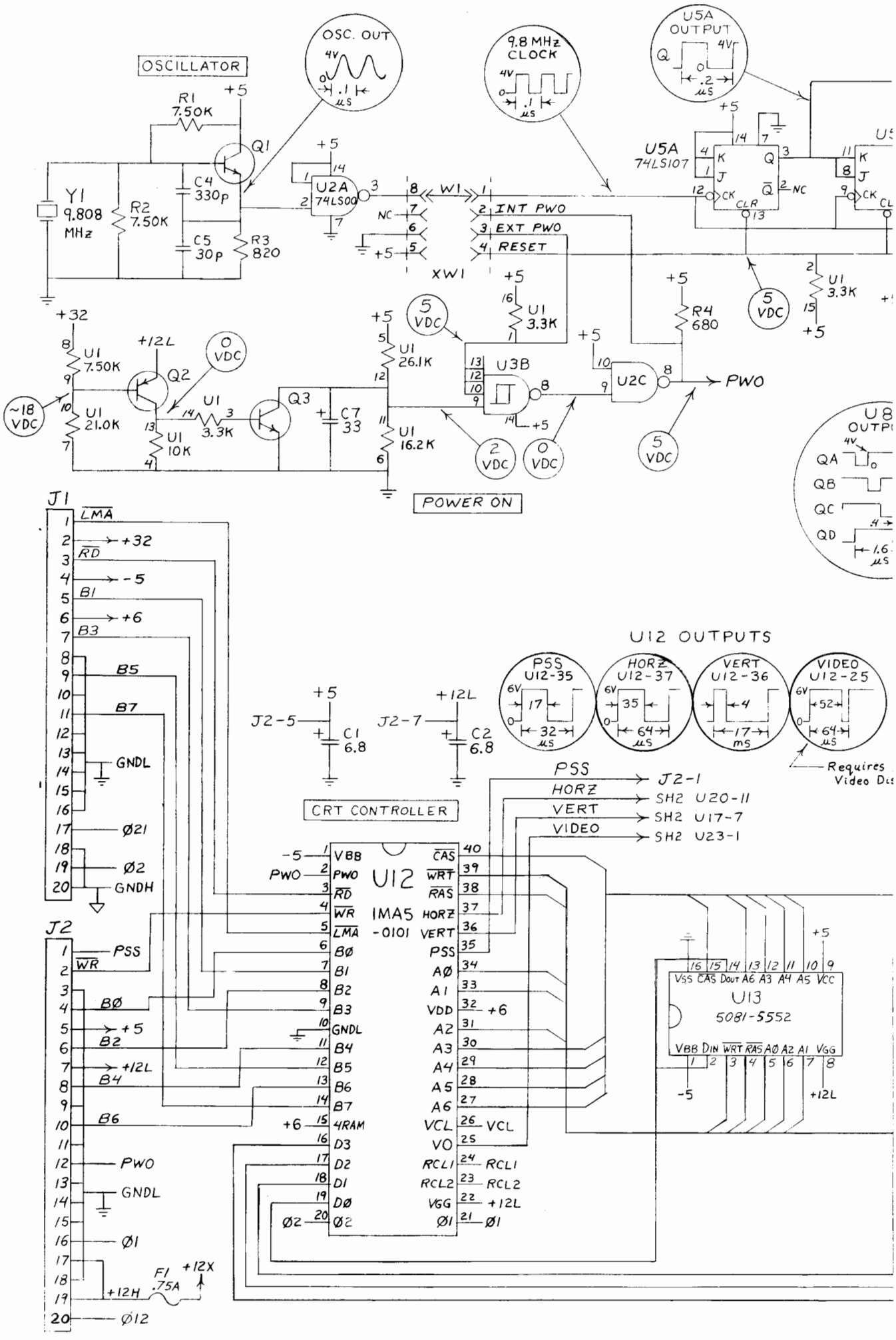


Figure 10-5. CRT PCA Schematic Diagram


9.8 MHz CLOCK
U5A OUTPUT
U5A 74LS107
U5B
U8 74LS95
U3A 74LS13
U9A 74LS00
U9B
U9C
U9D
W1
INT PWO
EXT PWO
RESET
XW1
U1 3.3K
U1 26.1K
U1 16.2K
R4 680
U2B
U2C
U3B
PWO
POWER ON
U8 OUTPUTS
QA
QB
QC
QD
U9A (or B) OUTPUT
U9C (or D) OUTPUT
U12 OUTPUTS
PSS U12-35
HORZ U12-37
VERT U12-36
VIDEO U12-25
Requires Inverse Video Display
+12L
J2-7
C2 6.8
PSS → J2-1
HORZ → SH2 U20-11
VERT → SH2 U17-7
VIDEO → SH2 U23-1
CRT RAM
U12
U13 5081-5552
U14 5081-5552
U15 5081-5552
CAS
WRT
RAS
HORZ
VERT
PSS
A0
A1
VDD
A2
A3
A4
A5
A6
VCL
VO
RCL1
RCL2
VGG
Ø1


OSCILLATOR
OSC. OUT
9.8 MHz CLOCK
U5A OUTPUT
R1 7.50K
Q1
Y1 9.808 MHz
R2 7.50K
C4 330p
C5 30p
R3 820
U2A 74LS00
W1
INT PWO
EXT PWO
RESET
XW1
U5A 74LS107
U1 3.3K
R4 680
U1 7.50K
Q2
U1 21.0K
U1 10K
U1 3.3K
Q3
C7 33
U1 26.1K
U1 16.2K
U3B
U2C
PWO
~18 VDC
5 VDC
0 VDC
2 VDC
POWER ON
J1
LMA
RD
WR
B1
B3
B5
B7
GNDL
Ø21
Ø2
GNDH
J2
PSS
BØ
B2
B4
B6
PWO
Ø1
Ø12
+12H
F1 .75A
+12X
C1 6.8
C2 6.8
J2-5
J2-7
CRT CONTROLLER
U12
IMA5 -0101
U12 OUTPUTS
PSS U12-35
HORZ U12-37
VERT U12-36
VIDEO U12-25
PSS → J2-1
HORZ → SH2 U20-11
VERT → SH2 U17-7
VIDEO → SH2 U23-1
U13 5081-5552

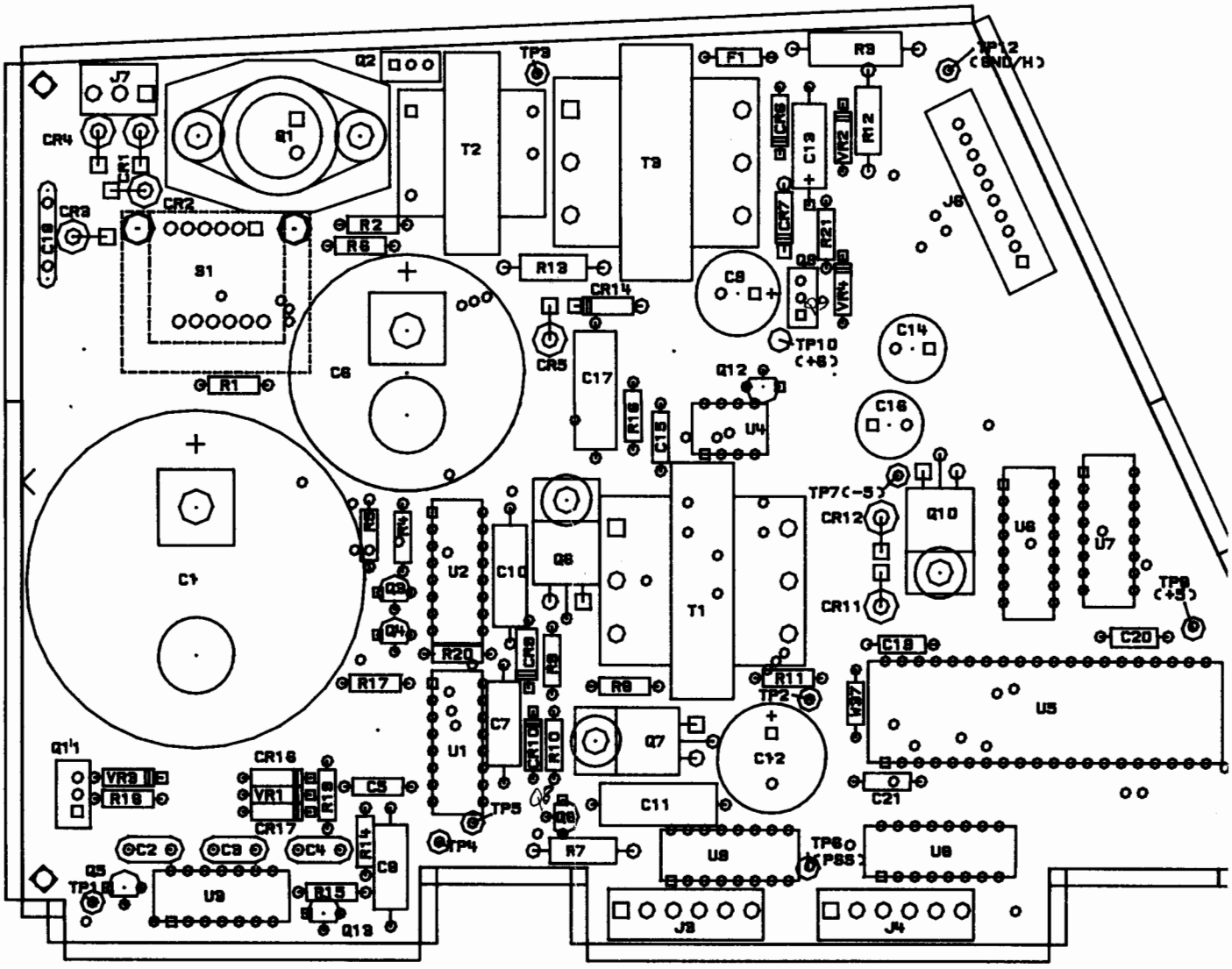
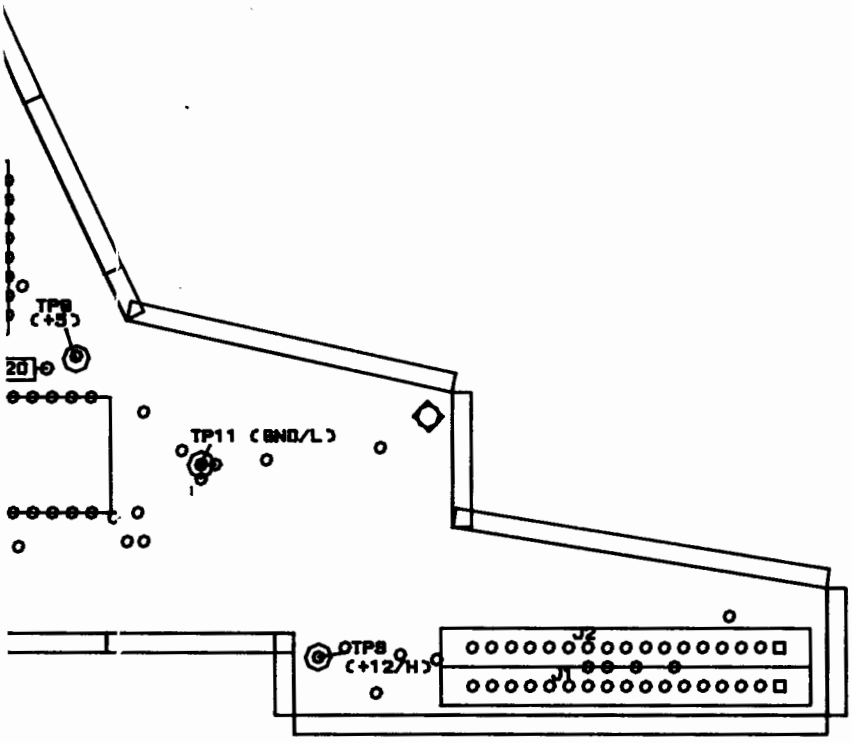
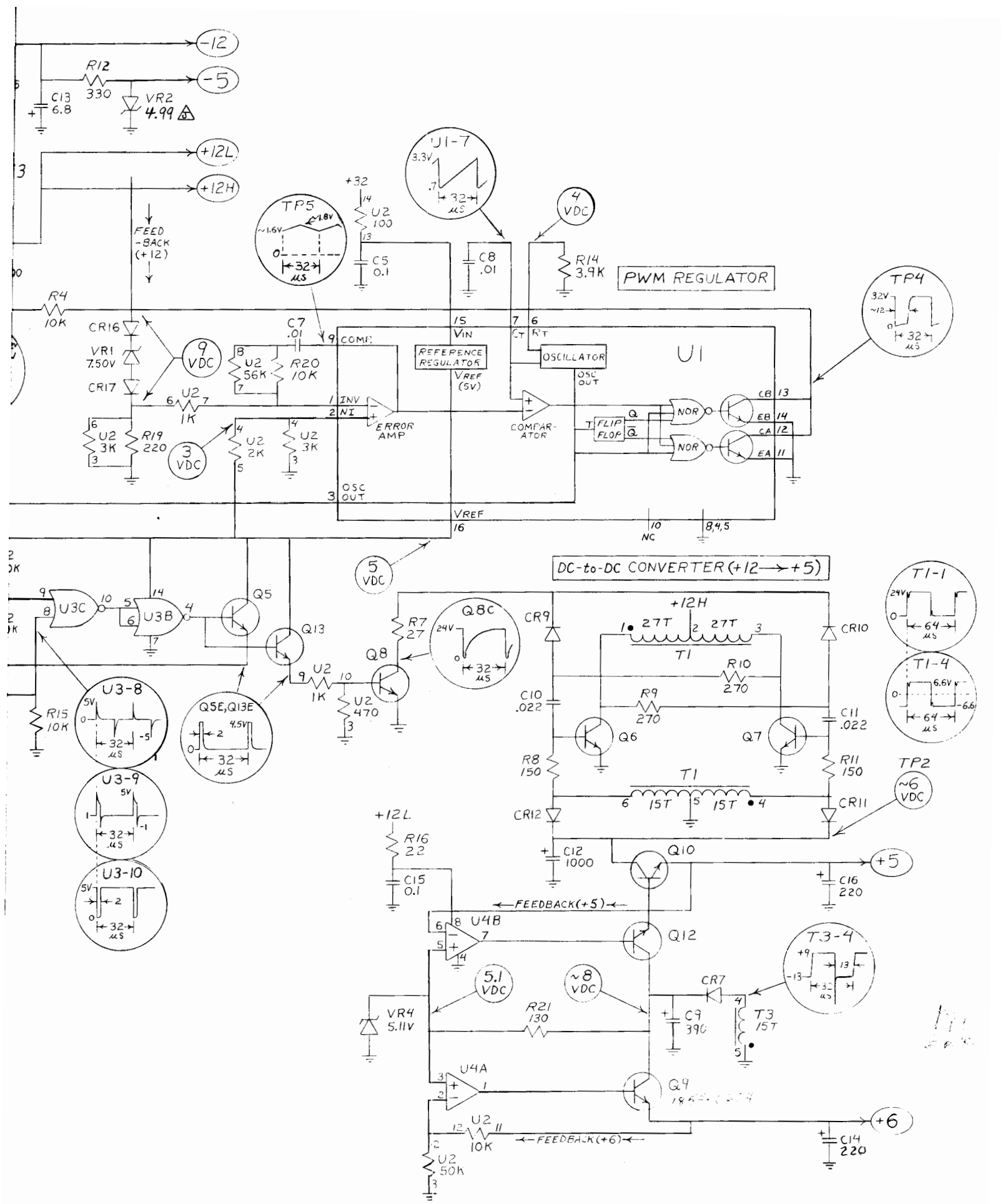


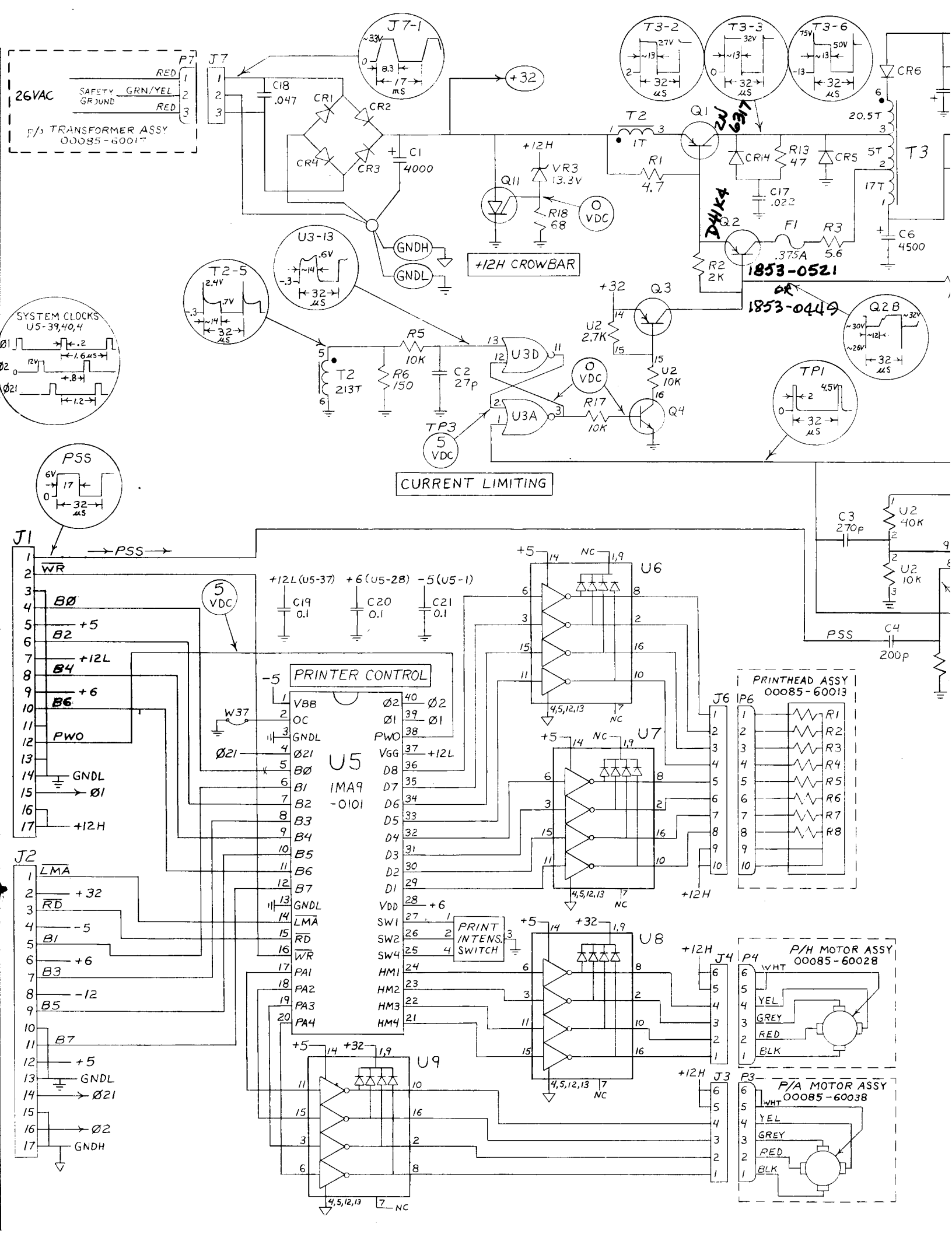
Figure 10-7. Printer/Power Supply Component Location Diagram

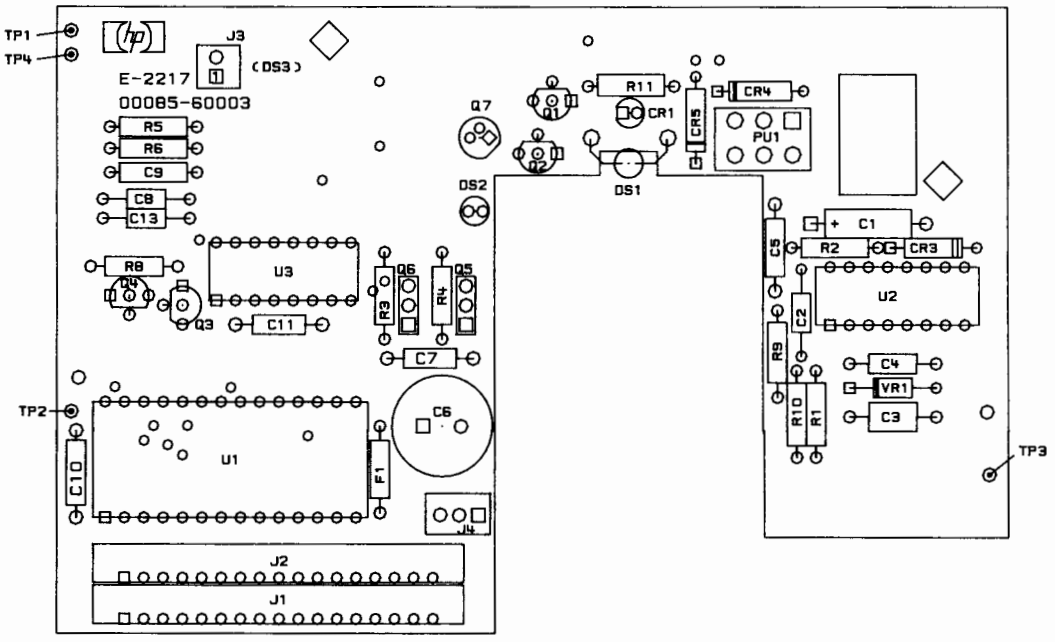

TP8
(+5)
20
TP11 (GND/L)
TP9
(+12/H)
J1



H	USED ON
	00085-60082
	00085-60083
K	00085-60112

Figure 10-8.
Printer/Power Supply Schematic Diagram

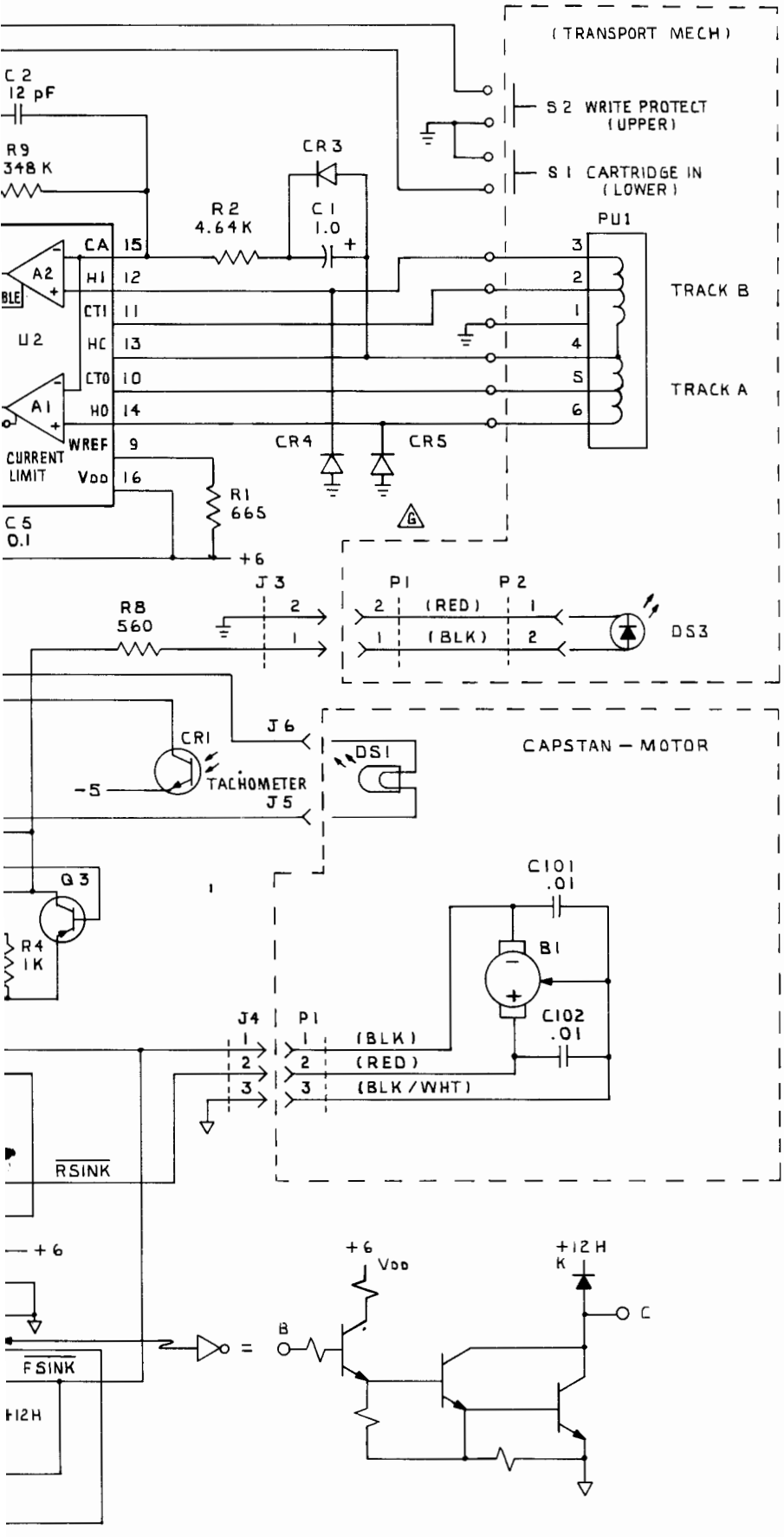

26VAC
SAFETY GROUND
GRN/YEL
RED
P/S TRANSFORMER ASSY 00085-60017
P7
J7
J7-1
C18 .047
CR1
CR2
CR3
CR4
C1 4000
+32
T3-2
T3-3
T3-6
T2
Q1
2N6317
CR6
20.5T
T3
CR14
R13 47
CR5
5T
17T
C17 .022
R1 4.7
+12H
VR3 13.2V
Q11
R18 68
0 VDC
GNDH
GNDL
+12H CROWBAR
Q2
D44K4
F1 .375A
R3 5.6
C6 4500
R2 2K
1853-0521
OR
1853-0449
Q2B
U3-13
T2-5
SYSTEM CLOCKS U5-39,40,4
Ø1
Ø2
Ø21
+32
Q3
U2 2.7K
U2 10K
R5 10K
T2 213T
R6 150
C2 27p
U3D
U3A
R17 10K
Q4
TP3
5 VDC
TP1
4.5V
CURRENT LIMITING
PSS
C4 200p
C3 270p
U2 40K
U2 10K
J1
WR
B0
+5
B2
+12L
B4
+6
B6
PW0
GNDL
Ø1
+12H
+12L(U5-37)
+6(U5-28)
-5(U5-1)
C19 0.1
C20 0.1
C21 0.1
PRINTER CONTROL
U5
1MA9-0101
W37
Ø21
VBB
OC
GNDL
B0
B1
B2
B3
B4
B5
B6
B7
PA1
PA2
PA3
PA4
Ø2
Ø1
PW0
VGG +12L
D8
D7
D6
D5
D4
D3
D2
D1
VDD +6
SW1
SW2
SW4
HM1
HM2
HM3
HM4
PRINT INTENS. SWITCH
U6
U7
U8
U9
J6
PRINTHEAD ASSY 00085-60013
P6
R1
R2
R3
R4
R5
R6
R7
R8
J4
P4
P/H MOTOR ASSY 00085-60028
WHT
YEL
GREY
RED
BLK
J3
P3
P/A MOTOR ASSY 00085-60038
J2
LMA
+32
RD
-5
B1
+6
B3
-12
B5
B7
+5
GNDL
Ø21
Ø2
GNDH

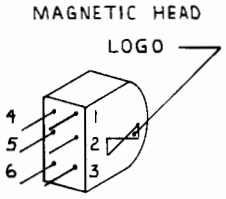


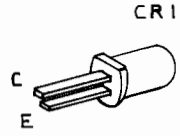
NOTES:

1. DS1 IS ON ASSEMBLY 00085-60046 AND IS SHOWN ON THIS DRAWING FOR CLARITY ONLY.

Figure 10-9. Tape Transport Component Location Diagram







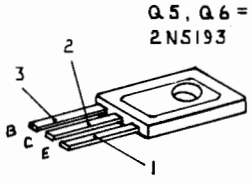
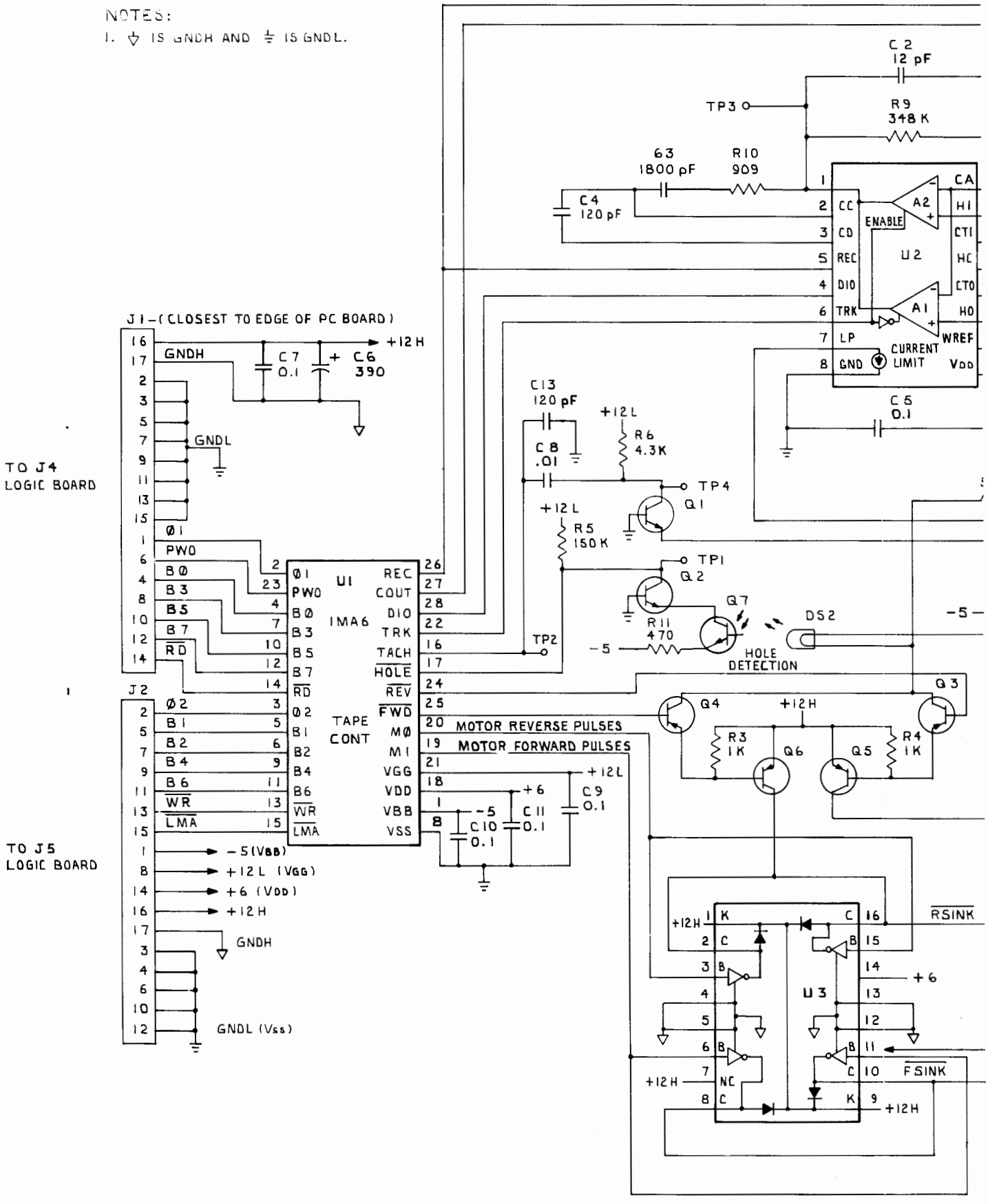


Figure 10-10.

Tape Transport Diagram

NOTES:

1. ⏚ IS GNDH AND ⏚ IS GNDL.