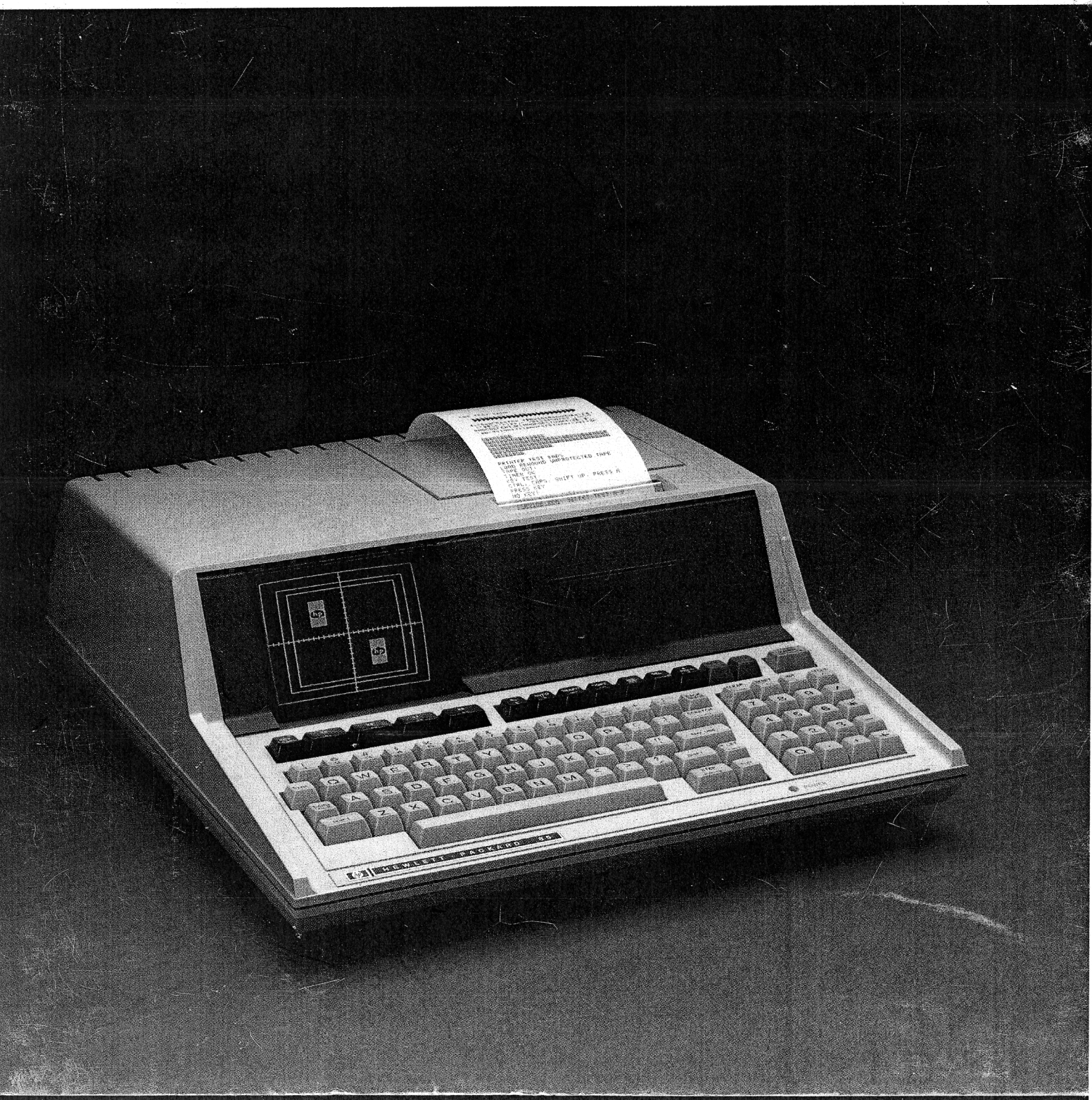
HP 85A/B Personal Computer

HEWLETT PACKARD

Self-Paced Learning Guide



HP 85A/B Personal Computer
Self-Paced Learning Guide

First Edition, 1983

PRINTING HISTORY

New editions of this manual will incorporate all material updated since the previous edition. Update packages may be issued between editions and contain replacement and additional pages to be merged into the manual by the user. Each update will be indicated by a revised date at the bottom of the page. Note that pages which are rearranged due to changes on a previous page are not considered revised.

The manual printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates which are incorporated at reprint do not cause the date to change.)

First Edition ..... August 1983

NOTICE

Contents

Before You Begin This Course

The *HP 85 Personal Computer Self-Paced Learning Guide* is designed to teach repair technicians how to service the HP 85A and HP 85B Personal Computers. Lessons 1 through 6 describe the service procedures for the HP 85A. These procedures are used to service the HP 85B except for the differences noted in lesson 8. After you have learned to service the HP 85A, the differences in the HP 85B should be easy to absorb.

At the completion of this guide, the technician should have the knowledge to troubleshoot, repair, and maintain HP 85 computers to the assembly and socketed component level.

To successfully complete this program you should have:

1. A good understanding of digital electronics.
2. At least one year of experience in digital electronic repair or direct supervision of each course lesson by a person with more than one year of experience in repairing electronic instruments.
3. A working HP 85A Personal Computer, an HP 82936A ROM Drawer, and an HP 85 Service ROM (HP part number 00085-60953).
4. The HP 85 Self-Paced Learning Package, which includes this document.
5. The required and standard repair tools listed in this section.

Materials Needed to Take This Course

1. The HP 85 Self-Paced Learning Package, which includes:
   a. This *HP 85 Self-Paced Learning Guide* (35106-90011).
   b. The *HP 85A Assembly-Level Service Manual* (00085-90154) and the *HP 85B Assembly-Level Service Manual* (00085-90988).
   c. Service ROM (00085-60952).
   e. Keycap extractor tool (5040-7433).
   d. Blank cartridge tape (9162-0061).
   f. Final review envelope (give to supervisor or administrator before beginning the course).
2. Standard repair tools (numbers after tool names are HP part numbers):
   a. #1 Pozidriv screwdriver (8710-0899).*
   b. #2 Pozidriv screwdriver (8710-0900).*
   c. Long-nose pliers (8710-1107).*
   d. Contact inserter (8710-1254).*
   e. Alignment tool (8710-1355).*
   f. Brightness control assembly (00085-60027).*
   g. CRT test pattern overlay (00085-60955).*
   h. 2 pin-156 connector (1251-5752).*
   i. Ribbon cable (8120-3708).*
   j. Static wrist strap (9300-0791).*
   k. ¼-inch nut driver (8720-0002).
   l. ½-inch nut driver (8720-0007).
   m. HP 85 Personal Computer.
   n. HP 82936A ROM Drawer.
   o. DC voltmeter, (HP 3465/3466 or equivalent)
   p. Cotton swabs
   q. Isopropyl alcohol

*Contained in the OEM Maintenance Kit (00085-83501)

3. Other useful items not required to complete the course:
   a. Oscilloscope.
   b. HP 85B Personal Computer.

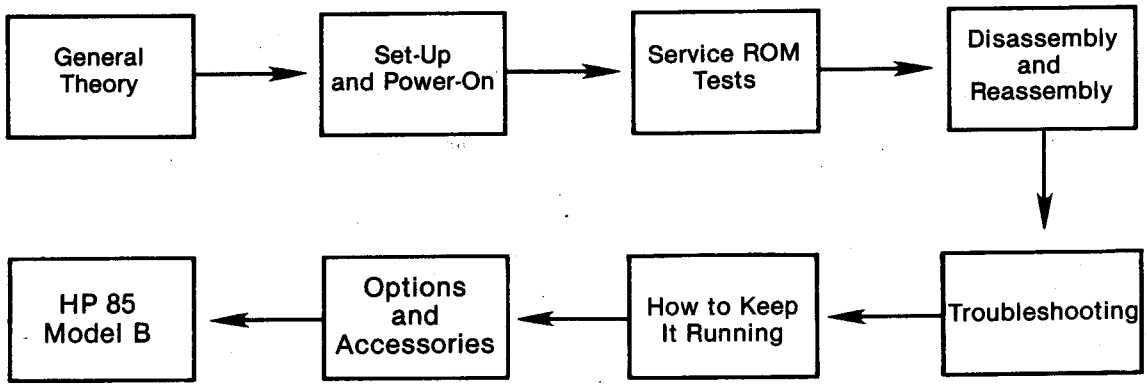
Course Description

How to Take This Course

1. Read each lesson in sequence. Use the *HP 85A Assembly-Level Service Manual* for Lessons 1 through 6. Lesson 8 requires that you use the *HP 85B Assembly-Level Service Manual.*
2. Read and observe all ***CAUTIONS, WARNINGS,*** and safety guidelines.
3. Follow the instructional program as presented in each lesson. That includes taking each quiz and completing each lab project. If you correctly answer 80 percent of the questions in a quiz, proceed with the course; otherwise, review the lesson and then take the quiz again. The quiz answers are located in Appendix E.
4. Keep a record of your progress using the Course Completion Checklist on page vi.
5. After completing the course, take the Final Review examination. If you incorrectly answer more than 20 percent of the questions, review those lessons where you were weakest. Then, retake the final examination.
6. Appendix G contains a Glossary and Bibliography. Refer to them as necessary.

Course Structure

The following flowchart illustrates the organization of the technical material in this course:



WARNING!

Always remove AC power before removing the top case. If servicing requires that power be on while the top case is removed, proceed only with extreme caution not to touch exposed areas. Failure to do so can result in serious injury. Heed all warnings and safety guidelines.

Course Objectives

- The primary goal of this self-paced guide is to *train* an individual to *repair* the products covered in the most direct and efficient manner through logical troubleshooting to the modular level.
- To teach efficient troubleshooting techniques.
- To enhance technical knowledge of the products covered.
- To train engineers or technicians to service the HP 85 through hands-on testing and experimenting.
- This guide will enhance the repair person's technical knowledge and enable the individual to reap greater benefits from Product Training and/or System Training classes. These classes are designed for more complex hands-on classroom instruction.

NOTICE!

This guide is intended for use by qualified service personnel only. Normal safety precautions must be observed at all times while servicing electronic equipment.

Many Hewlett-Packard products are designed to be easily repaired to the modular level. Hewlett-Packard has used this approach in designing the HP 85 product and accessories.

This self-paced learning guide supplies the basic information for modular repair of a stand-alone computer. Operator errors, installation configuration problems, program coding procedures, and data communications problems are areas not covered in detail and are part of other training programs available from HP through Customer Training. Consult your local training catalog for more information.

All the material and information needed to repair the standard product is included in this guide. Please note that variations, options, and accessories to the standard HP 85 are covered in Lesson 7 of this guide.

A reference list to supplemental information is included at the end of this guide in the Bibliography section, Appendix G.

Course Completion Checklist

HP 85 Self-Paced Learning Package

Lesson Title	Date Completed	Time Required	Supervisor's Initials
1. General Theory	_____	_____	_____
2. Initial Set-up	_____	_____	_____
3. Test Procedures	_____	_____	_____
4. Disassembly/Reassembly	_____	_____	_____
5. Troubleshooting	_____	_____	_____
6. How to Keep It Running	_____	_____	_____
7. Options and Accessories	_____	_____	_____
8. The HP 85 Model B Computer	_____	_____	_____

Program Completion Date _____

Student's Signature _____

Company Name _____

Address _____

_____

_____

Final Review Administered By: _____ Date: _____

General Theory

Lesson 1

Overview

This lesson is an introduction to the mechanical and electronic hardware design of the HP 85A. The general theory of operation will be explained by identifying and describing the main functional components and assemblies.

Learning Objectives

After completing Lesson 1, you should be able to:

- Identify the mechanical and basic electronic components of the HP 85A.
- Describe the function of each component.
- Group the components into the computer major assemblies.

The Basic Block Diagram (A-2, located in Appendix A) illustrates how the components are functionally interconnected. Fold out that diagram now and keep it open for the remainder of this lesson.

Product Description

The HP 85A is an integrated system containing the following components:

- Enhanced ANSI BASIC language.
- 80K bytes of read/write memory for storing data, programs, and display information.
- CRT display capable of displaying both alpha and graphics information.
- Bidirectional thermal printer.
- Typewriter keyboard and numeric keypad.
- Input/output ports for installing plug-in enhancements.
- A speaker for producing audible programmed tones.

Introduction to Hardware Design

The HP 85A consists of the following components, or modules:

- The CPU (central processing unit), an 8-bit microprocessor.
- "Controller" ICs that allow the CPU to control input/output (I/O) operations. The HP 85 has six controller ICs (RAM, keyboard, CRT, printer, tape) and an I/O buffer IC.
- Read-only memory (ROM) in the form of microprogrammed instructions contained in four ROM ICs. The HP 85 has 32K bytes of ROM.
- Random access memory (RAM) used to store user programs and data and the computer operating system. The HP 85 contains 16K bytes of RAM available for storing programs and data, distributed among eight RAM ICs. The RAM ICs are accessed through the RAM controller. The operating system uses approximately 2K bytes.
- The 92-key keyboard, which is controlled by the CPU through the keyboard controller. This IC also provides four timers.
- A CRT (cathode ray tube) display capable of displaying sixteen, 32-character lines, or graphics 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 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 ports for plug-in modules. 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. The speaker produces audible tones of variable frequency and duration.
- An 8-bit bus that transfers instructions, addresses, and data between the CPU and the various controller ICs, the I/O buffer, and the ROMs.
- System timing and power supply circuitry.

The CPU, RAM, timing, and power supply circuitry are described in greater detail later in this section. Specifications for the HP 85 are listed on page 1-3 of the HP 85 Assembly-Level Service Manual.

HP 85 Assemblies

The HP 85 components are grouped mechanically and electrically into eight major assemblies:

- The keyboard assembly consists of the HP 85 keyboard and the keyboard PCA (printed circuit assembly).
- The printer/power assembly (referred to as the printer assembly), includes the printer mechanism and the printer PCA. The printer mechanism contains the print-head and the print-head and paper advance motors. The printer PCA contains the computer power supply and the printer controller IC. Power is supplied to other assemblies by a cable from the printer assembly to the logic PCA and by cables from the logic PCA to the other assemblies.
- The logic PCA, located underneath the keyboard assembly, contains the CPU, the four ROM ICs, eight RAM ICs, the keyboard controller IC, the I/O (input/output) buffer IC, and the RAM controller IC. Cables connect the logic PCA to the CRT, printer, tape, keyboard, and back panel assemblies.
- The CRT assembly, which is mounted on the bottom case, consists of the CRT and the CRT PCA. The CRT PCA contains the CRT controller IC and four CRT RAM ICs.
- The tape drive assembly consists of the tape drive, the tape drive motor, and the tape drive PCA. The tape drive PCA contains the tape controller IC, the read/write circuitry, and the motor-drive circuitry.
- The back panel assembly includes the I/O PCA, the I/O receptacles for plugging in enhancement modules, the computer power switch, fuse, and power transformer. The four I/O ports are located on the I/O PCA.
- The bottom case assembly includes the case and speaker and power lights.
- The top case assembly includes the case, the tape door, the CRT window, the bezel, and the paper door.

The Central Processing Unit

The HP 85 CPU is an 8-bit microprocessor containing an 8-bit arithmetic logic unit, registers for performing arithmetic and addressing operations, bus lines, and clock drivers. The LMA, RD, and WR lines are control signals output from the CPU to the ROMs and controller ICs. The PWO (power-on) line carries a signal that is input to the CPU, ROMs, and controller ICs from circuitry on the CRT PCA. The signal remains low until the power supply voltages and system clocks have reached their proper states. While PWO is low, the CPU inhibits bus activity.

The Interrupt Request Line (IRL) carries a signal from the keyboard controller or I/O buffer to the CPU. A low state indicates that a key has been pressed or that a peripheral device requires attention. The HALT line, which carries a signal to the CPU from the I/O buffer, becomes low when a peripheral device is controlling the system; the CPU enters an idle state until the line becomes high.

Bus lines B0 through B7 connect the CPU and the controller, ROM, and I/O buffer ICs. All data, instructions, and addresses are transmitted eight bits at a time over these lines.

Computer RAM

The computer contains eight 16K dynamic RAM ICs. Information is written into RAM from the CPU via the bus lines B0 through B7. Information read from RAM is transmitted to the CPU over data lines D0 through D7. The 14-bit addresses of locations in RAM are transmitted from the RAM controller to the RAM ICs over seven address lines, A0 through A6.

Clock Circuitry

System activity is synchronized by seven system clocks generated by circuitry on the CRT PCA. Clock signals Φ1, Φ12, Φ2, and Φ21 are used throughout the entire HP 85 system. Clock signals VCL, RCL1, and RCL2 are used only by the CRT controller. All clock signals are derived from a quartz-crystal oscillator. See Appendix B-3 for addtional information on system clocks.

PWO Circuitry

The PWO circuitry, located on the CRT PCA, ensures that the CPU, controller ICs, and ROMs are not enabled until all power supply voltages and system clocks have reached their proper states. The PWO circuitry disables the ROMs and controllers when the line voltage drops too low; the ICs are enabled again when the power line voltage returns to an acceptable level.

Power Supply Circuitry

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

The regulated +12V supply is sent over two separate lines. One line (+12L) goes to parts that neither generate nor tolerate much noise on the line. The other line (+12H) goes to parts that either generate or can tolerate high noise levels. Parts connected to either of these voltage supply lines are connected to one of two corresponding ground lines—GND/L or GND/H.

Appendix B-3 and B-4 list the lines supplying power to various parts of computer.

STOP!

Complete Quiz 1 now—General Theory.

Quiz 1

General Theory

(Five points per correct answer, total = 100)

1. The HP-85 A has _____ bytes of read/write memory, abbreviated _____, for programs and data. An additional _____ bits are available for use by the CRT.

2. List the five controller ICs.

   _____ _____ _____

   _____ _____

3. Read-only memory (ROM) is contained in _____ (how many?) ROM ICs.

4. System activity is synchronized by _____.

5. List the eight major assemblies.

   _____ _____ _____ _____

   _____ _____ _____ _____

6. Information is written into read/write memory via eight _____ lines.
   Information is read from read/write memory via eight _____ lines.

Correct Quiz 1 now using Appendix E.

Initial Set-Up

Lesson 2

Overview

This lesson provides instructions for setting up the HP 85 for testing and servicing. If the service problem involves a configuration of the HP 85 that includes enhancement modules and/or peripheral devices, refer to the documentation accompanying those devices for additional information.

Learning Objectives

After completing this lesson, you should be able to:

- Use set-up procedures that ensure both your safety and the safety of the computer system.
- Install the HP 85 Service ROM.

Safety Guidelines

WARNINGS are provided to prevent personal injury during set-up and servicing. *CAUTIONS* inform you of procedures which, if not performed properly, could damage equipment. Read all *CAUTIONS* and *WARNINGS* thoroughly, and strictly observe them.

To obtain an overview of the installation procedure, you should read through this entire lesson before you start to set up an HP 85. Then, follow the instructions carefully as you perform Lab Project 1.

Set-Up Procedures

1. Disconnect the power cord and make sure the computer ON/OFF switch located on the rear panel is set to OFF (position **0**).
2. Make sure the voltage selector switch located on the rear panel is set to the line voltage to be used during servicing. If it is necessary to change the setting, insert the tip of a small screwdriver into the slot on the switch. Slide the switch so that the proper voltage designation is visible.

CAUTION!

Before applying power, check to see that the voltage selector switch has been set to the correct voltage. The computer will be damaged if the switch is set to 115V and the computer is switched on while connected to 230V.

WARNING!

Before installing a fuse, be sure that the computer is disconnected from any AC power source. Otherwise, a chance of electrical shock to personnel exists, and the new fuse might be immediately overloaded.

3. Make sure 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. To install a fuse, place the proper fuse in the fuse cap holder. Then, install the fuse and fuse cap into the fuse receptacle by pressing the cap inward and turning it clockwise until it is locked in place.
4. Connect the power cord to the power input receptacle on the back of the computer. Plug the other end of the cord into the AC power outlet.

CAUTION!

The computer must be switched off when a plug-in module, such as the ROM drawer, is installed into an I/O port. Failure to ensure that the power is off could result in damage to ICs.

5. Install the HP 85 Service ROM into the ROM drawer. Then, install the ROM drawer into an I/O port. Never install more than one Service ROM in the HP 85.

Safety Guidelines

Observe the following safety guidelines while you are taking this course and whenever you are servicing and troubleshooting 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. Know how to free another worker from contact with high voltage without endangering yourself. Know where to obtain respiratory and/or cardiac pulmonary resuscitation.
- Post appropriate warning signs in areas where high-voltage testing is in progress. Keep your work area neat and free of nonessential conducting materials.
- Do not exceed the rated specifications of test instruments.
- Make sure the probe being used has insulation rated higher than the voltage being measured. Check all instrument wires and probes for defective insulation.
- While measuring high voltages, keep one hand away from the work area to prevent you from touching a point that could close a high-voltage loop. Never leave your work area with high voltage circuits energized and exposed.
- Always turn the computer off and discharge all high voltages before touching or removing any electrical or mechanical part. Keep in mind that some circuits can be lethally charged if a component or connector is faulty or disconnected, even after the computer has been turned off.
- Turn the computer off and discharge all high voltages before reaching around high-voltage circuits.
- Do not make measurements in a circuit where a corona is present. A corona may include a pale-blue color, buzzing emanating from sharp metal points in the circuit, or an ozone odor.
- Never perform service work while your hands, shoes, workbench, or the floor is wet. Avoid making measurements under humid, damp, or other conditions that could affect the dielectric voltage tolerance of the test leads or instruments.

STOP!

When you have finished reading this lesson, do Lab Project 1. Then, take Quiz 2 to test your knowledge of the set-up procedure.

Lab Project 1

Initial Set-Up

In this lab project, you will perform the preliminary set-up procedures necessary before you can begin product testing. Check off each step as you complete it.

____ 1. Locate the power switch on the back panel and set it to OFF. Disconnect the power cord.

____ 2. Locate the voltage selector switch. If necessary, set it to match the line voltage you will be using for computer operation.

____ 3. Make sure the proper fuse is installed. If necessary, install the correct fuse for the line voltage you will be using.

____ 4. Connect the computer to an AC power source. However, leave the power switch set to OFF.

____ 5. Install the service ROM into the ROM drawer.

____ 6. Install the ROM drawer into one of the I/O ports.

____ 7. Turn the power switch to ON. The computer should display and print the message: SERVICE ROM: SELECT TEST A-V.

Quiz 2

Initial Set-Up

(10 points per correct answer, total = 100)

1. Describe the first step in the set-up procedure.

2. Describe the difference between cautions and warnings.

3. True ____ or False ____? The computer can be damaged if 230V are applied while the voltage selector switch is set to 115V.

4. True ____ or False ____? The same specification fuse can be used for 115V and 230V operation.

5. True ____ or False ____? The ROM drawer must be installed in port #1 (the top port).

6. Describe the three indications of a corona.

_____ _____

_____

7. Why must you be cautious in working with circuits which are not designed to carry high voltages?

8. True ____ or False ____? You can install more than one service ROM into the computer as long as each ROM is in a separate ROM drawer.

Correct Quiz 2 now using Appendix E.

Product Test Procedures

Lesson 3

Overview

This lesson explains the tests provided by the service ROM. In order to run service ROM tests and/or the computer self-test, the computer must power-up properly. Failure to power-up properly can be caused by a variety of malfunctions. Lesson 5 includes the procedures to follow to isolate the problem causing the failure to power-up.

The self-test, performed by the HP 85 computer automatically at power-on and when the [TEST] key is pressed, is not covered in this course. For additional information refer to paragraphs 8-7 and 8-8 of the HP 85 service manual.

After you've read about the tests provided by the Service ROM, Lab Project 2 will give you the opportunity to run several of the tests.

Learning Objectives

When you've completed Lesson 3, you should be able to:

- Verify that the computer is operating properly using the computer self-test and the Service ROM tests.
- Identify malfunctions that must be corrected before the Service ROM tests can be run.
- Understand the messages that are obtained during the Service ROM tests if components or assemblies are not operating properly.

The top case of the computer should not be removed until Lesson 4, "Product Disassembly and Assembly." You should not attempt to fix any problems you discover until you've completed Lesson 4.

Failure to Power-Up Properly

A number of service problems prevent proper operation of the service ROM. These problems must be corrected before any of the tests explained in this lesson can be run.

The following malfunctions must be isolated and repaired before running service ROM tests.

- A keyboard key is stuck or fails to respond when pressed.
- The keyboard controller, RAM controller, or CPU is bad.
- The power supply, PWO, or clock circuitry is not operating properly, or output from any of these circuits is being brought low by a failure on another assembly.
- ROM 0, any RAM IC, or the I/O buffer is bad.
- A bus or control line is being brought low by a failure on another assembly, or a power supply, PWO, clock, bus, or control line to an IC is open.
- The connector on the I/O PCA is bad, or the connection between the I/O PCA and the logic PCA is bad.
- The service ROM is bad.

Isolating the problem causing non-turn-on is discussed in Lesson 5.

CAUTION!

Never install more than one Service ROM into the ROM drawer. The Service ROM will not function properly if more than one is installed, and equipment could be damaged.

General Description Of the Service ROM

The various tests in the Service ROM enable you to:

- Check all socketed ICs.
- 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 external RAM provided by the HP 82903A 16K Memory Module.
- Check external ROM provided by any enhancement ROMs present in the ROM drawer.
- Cycle any test or sequence of test indefinitely to reproduce intermittent failures.
- Check for proper operation of the tape drive assembly.

Each of the tests in the Service ROM can be run individually. However, most of the tests can also be run as part of one of two "group" tests. Examine the lists of tests below.

System "Group" Test	(Full) Tape "Group" Test	Other Tests
CPU	Status	External ROM
RAM	Speed	External RAM
ROM	Hole-Detect	Heat
Beeper	Write	Cycle
CRT	Read	
Printer	Record	
Tape (abbreviated)	Write-Protect	
Tape Write-Protect		
Timer		
Keyboard		

The System Test is the first test you should use to begin assembly-level troubleshooting of the computer. Even when you know there is a problem in a component or assembly, you should first run the entire System Test. The individual tests that make up the System Test can also be run alone to verify that replacing a part has corrected the problem.

The Full Tape Test is used primarily during production testing of the tape drive assembly. For servicing and troubleshooting, problems with the tape drive assembly are identified by the Abbreviated Tape Test in the System Test. Troubleshooting procedures may then direct you to one or more of the individual tests included in the Full Tape test.

The four tests not included in either of the group tests must be run individually.

Selecting Service ROM Tests

With the Service ROM installed, switch the computer on. Within 15 seconds, the following message (the "Service ROM message") should be displayed and printed:

SERVICE ROM: SELECT TEST A-V

Control has now been passed to the Service ROM. Pressing keys [A] through [V] within 17 seconds causes the ROM to run a particular test on the computer components. Appendix B-2 itemizes the tests and keys used to access them. Pressing the [W] key causes the Service ROM to wait indefinitely for you to select a test.

NOTICE!

If a message preceding the Service ROM message indicates a bad IC, you need not replace the IC before running Service ROM tests.

If no key is pressed within 17 seconds or if the keyboard is not functioning properly, the computer displays NO KEY or KEY STUCK and informs you that control has been passed back to the BASIC system by displaying:

RETURN TO BASIC SYSTEM

Pressing any key other than [A] through [W] causes the service ROM to pass control back to the HP 85 BASIC system. When the BASIC system is in control, tests can be selected by typing in the BASIC commands shown in Appendix B-2. The tests run under control of the BASIC system (with the Service ROM installed) are almost identical to those run under control of the ROM. However, the CPU, ROM, and RAM ICs must be operating properly in order to run tests under control of the BASIC system. Therefore, you must make sure the computer passes those tests (CPU, ROM, and RAM tests) before attempting to run a program that uses BASIC commands from the Service ROM.

If you receive a KEY STUCK or NO KEY message after pressing a key, or if the wrong test for that key is run, the keyboard malfunction must be repaired before any tests can be run. Keyboard troubleshooting is covered in Lesson 5.

Service ROM Messages

If a part is not operating properly, the Service ROM displays and prints an appropriate message. By looking up the message in the troubleshooting table for that assembly, you can determine the source of the problem and the repair procedure. Troubleshooting is covered in Lesson 5.

Most messages are followed on the same line by a letter designating the cause of the failure. In some cases, these letters appear in the troubleshooting table to differentiate two problems that return the same message. Follow the procedure corresponding to the correct letter.

For many of the messages, the letter indicates the nature of the failue within a component and is used for quality-control purposes at the factory. If the troubleshooting table does not include any letters after a message, the letters can be ignored.

Running the System Test (Key [A])

Rewind a tape cartridge using a computer you know to be operating properly. (If the customer returned a tape cartridge along with the computer, use it during the test.) Keep in mind that any information on the tape will be erased during testing.

The RECORD tab must be set to the unprotected position in order for the entire Abbreviated Tape Test to be run. Make sure you rewind the tape cartridge before repeating the System Test. Otherwise, the test could run the tape off the cartridge hub.

Make sure there is paper in the printer.

If the Service ROM is in control, pressing the [A] key starts the System Test. If the BASIC system is in control (RETURN TO BASIC SYSTEM has been displayed), typing SYSTEM and pressing [END LINE] starts the test. When the test is started, the computer displays and prints SYSTEM TEST BEGINS. The individual tests are then run in the order in which they are listed in Appendix B-2.

If a test finds a problem, a message is displayed and printed. Then, the individual test is terminated and the next test is begun. When all the tests included in the System Test have been run, the message SYSTEM TEST ENDS appears.

A Description of the System Test

Each of the system tests is described below. Remember that each test can also be run individually under control of the Service ROM by pressing the appropriate key, or under control of the BASIC system by executing the command shown in Appendix B-2. Lesson 5 covers how to use these messages to isolate and repair a malfunction.

CPU Test (Key [B])

The CPU Test checks the portion of the CPU that is not required for the computer to power-up properly. The test returns one of three messages:

- CPU OK indicates that the test found no problem.
- CPU BAD! indicates that the CPU is probably bad and should be replaced.
- CPU BAD! N OR RAM BAD (character) indicates that the CPU failed to properly store data into RAM. The problem may be the CPU, the RAM controller, or any of the RAM ICs. The (character) indicates which RAM IC is bad (refer to Appendix C-10).

RAM Test (Key [C])

The RAM test detects problems in any of the eight RAM ICs and the RAM controller. The RAM test can generate any of the following messages:

- RAM OK indicates that no problem was found in the RAM ICs or RAM controller.
- RAM CONTROL BAD! indicates that the RAM controller should be replaced. After you've replaced the RAM controller, run the RAM test again to check the RAM ICs.
- RAM N BAD! indicates that RAM IC N should be replaced.

ROM Test (Key [D])

The ROM test checks the contents of the four internal ROMs. For each ROM, one of the following messages appears:

- ROM N OK indicates that no problem was detected.
- ROM N BAD! indicates that ROM N should be replaced.
- RAM BAD! ROM TEST ABORTED! informs you that the ROM test was aborted due to a problem in the RAM controller or a RAM IC. You must run the RAM test and correct the problem before rerunning the ROM test.

Beeper Test (Key [E])

The beeper test causes the beeper to sound three short tones of the same frequency followed by an ascending scale of eight longer tones. At the conclusion of the test, the message BEEPER TEST ENDS appears.

STOP!

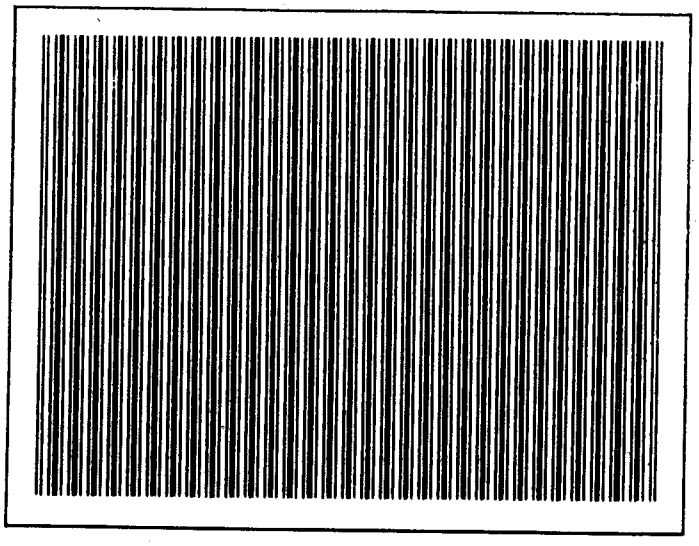
Stop now and take Quiz 3 (next page). When you've passed the quiz, continue on with Lesson 3 (Return to CRT Test (Key [F]).

CRT Test (Key [F])

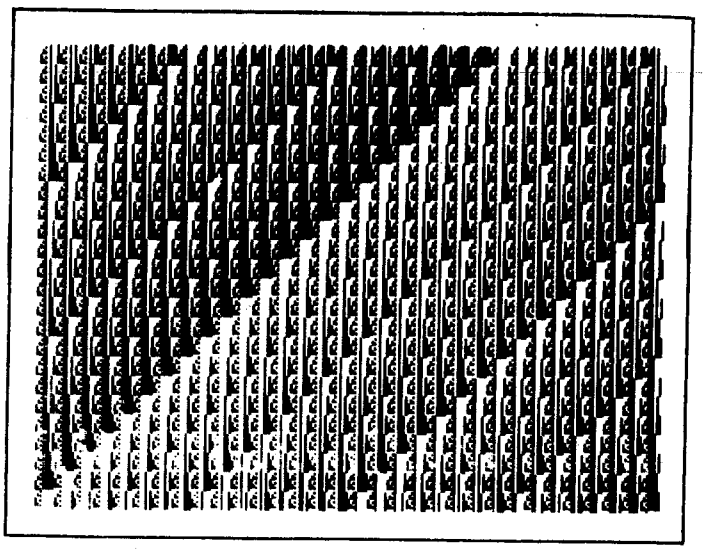
The CRT Test checks the CRT controller and the CRT RAM ICs, and also displays a series of test patterns. The test patterns inform you whether the CRT circuitry is operating properly and are used to make adjustments to the CRT assembly.

The CRT Test displays the following test patterns:

1. Vertical bars that remain on the screen for 13 seconds.



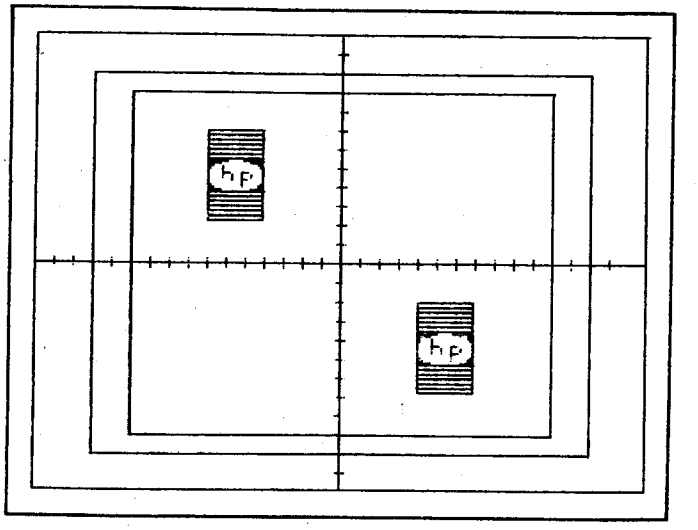
2. A new set of vertical bars, displaced from the previous set, remaining on the screen for 13 seconds.
3. The following test pattern, remaining on the screen for 16 seconds.



4. A blank screen for 1 second, signaled by a beep.

The test can be paused at steps 5, 6, and 7 by pressing any key. To resume the test, press any key again.

5. A white screen for 3 seconds, signaled by a beep.
6. The "pincushion" test pattern below remains on the screen for 3 seconds.



Quiz 3

Service ROM Sequence Tests

(10 points per correct answer, total = 100)

1. Check the three conditions in the following list that might prevent you from running the System Test.
   ____ a. The CRT controller is bad.
   ____ b. A RAM IC is bad.
   ____ c. The beeper is malfunctioning.
   ____ d. The power supply is bad.
   ____ e. The printer incorrectly senses itself out of paper.
   ____ f. The tape drive controller is bad.
   ____ g. The CRT is pincushioned.
   ____ h. The keyboard controller is bad.

2. True ____ or False ____? Obtaining the Service ROM message means the keyboard assembly is functioning properly.

3. Describe two ways to start the System Test.

   _____

   _____

4. True ____ or False ____? A protected tape cartridge should be inserted before running the System Test.

5. True ____ or False ____? If the System Test finds a problem in an assembly, the individual test is terminated and the next test starts.

6. List two of the three possible causes for failing the CPU Test.

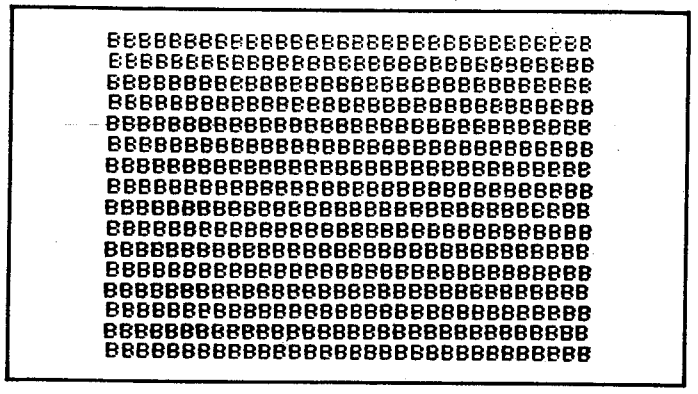
   _____

   _____

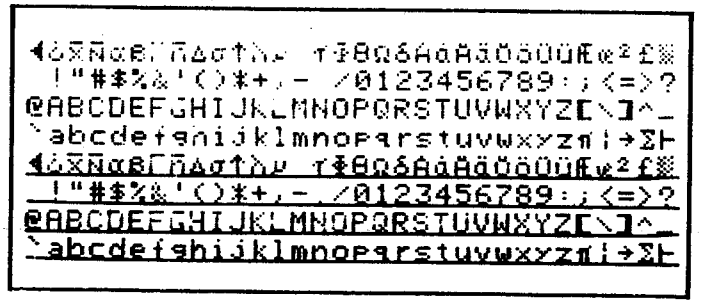
Correct Quiz 3 now using Appendix E.

Now return to previous page.

7. A screen filled with Bs remaining for 3 seconds.



8. Eight lines containing the HP 85 character set.



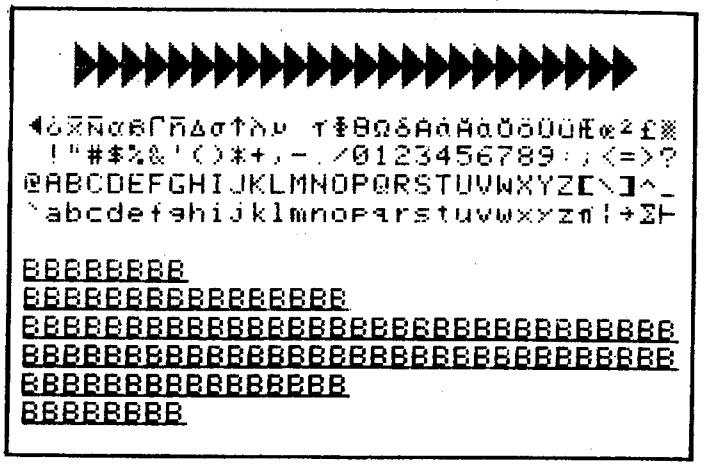
If the test discovers no problems, the message CRT TEST ENDS appears. If a problem is discovered, one of the following messages is printed and displayed.

- CRT CONTROL BAD! indicates that the CRT controller should be replaced.
- CRT RAM n BAD! indicates that CRT RAM n should be replaced.

Printer Test (Key [G])

The Printer Test generates one of three messages:

- If no problems are found, the test printout is printed on the printer paper along with the message PRINTER TEST ENDS displayed on the CRT.



- If the Service ROM determines that there is no paper in the printer, the message PRINTER OUT OF PAPER! may be generated. This happens only in units in which an Out of Paper Sensor is present.
- If any other problems are found, the message PRINTER CONTROL BAD! appears.

Abbreviated Tape Test (Key [H])

The Abbreviated Tape Test checks the tape controller, the tape drive circuitry, and the tape transport mechanism. The test checks the tape speed in both forward and reverse directions. Then, a version of the Tape Hole-Detect Test is run to check for holes in the tape. Finally, the Tape Record Test is run to check operation of the tape controller and tape assembly during read/write operations. A rewound, unprotected tape cartridge must be inserted during the Abbreviated Tape Test. If the customer returned a tape cartridge along with the computer, use it. The test erases any previous information on the tape. The tape cartridge is inserted into the drive when the message LOAD REWOUND UNPROTECTED TAPE appears.

If the Abbreviated Tape Test finds no problem, the message OK appears. If a problem is found, the test is terminated and an apropriate message appears. If the Abbreviated Tape Test is not passed, the Tape Write-Protect Test is skipped.

Tape Write-Protect Test

The Tape Write-Protect Test checks whether the tape cartridge is write-protected. The test displays and prints the message REMOVE, PROTECT, LOAD TAPE. Within seven seconds, remove the tape cartridge and write-protect it by sliding the plastic RECORD tab away from the corner of the cartridge. Then, press any key to resume the test.

If no problems are found, the message OK appears. If a problem is found, an appropriate message appears.

Timer Test (Key [J])

The Timer Test checks the portion of the keyboard controller that contains the four timers. Pressing any key during the Timer Test aborts the test.

The Timer Test generates one of the following messages:

- TIMER OK indicates that no problem has been detected.
- TIMER BAD! indicates that the timer is not functioning properly.
- TIMER TEST ABORTED! indicates that a key was pressed during the test.

Keyboard Test (Key [K])

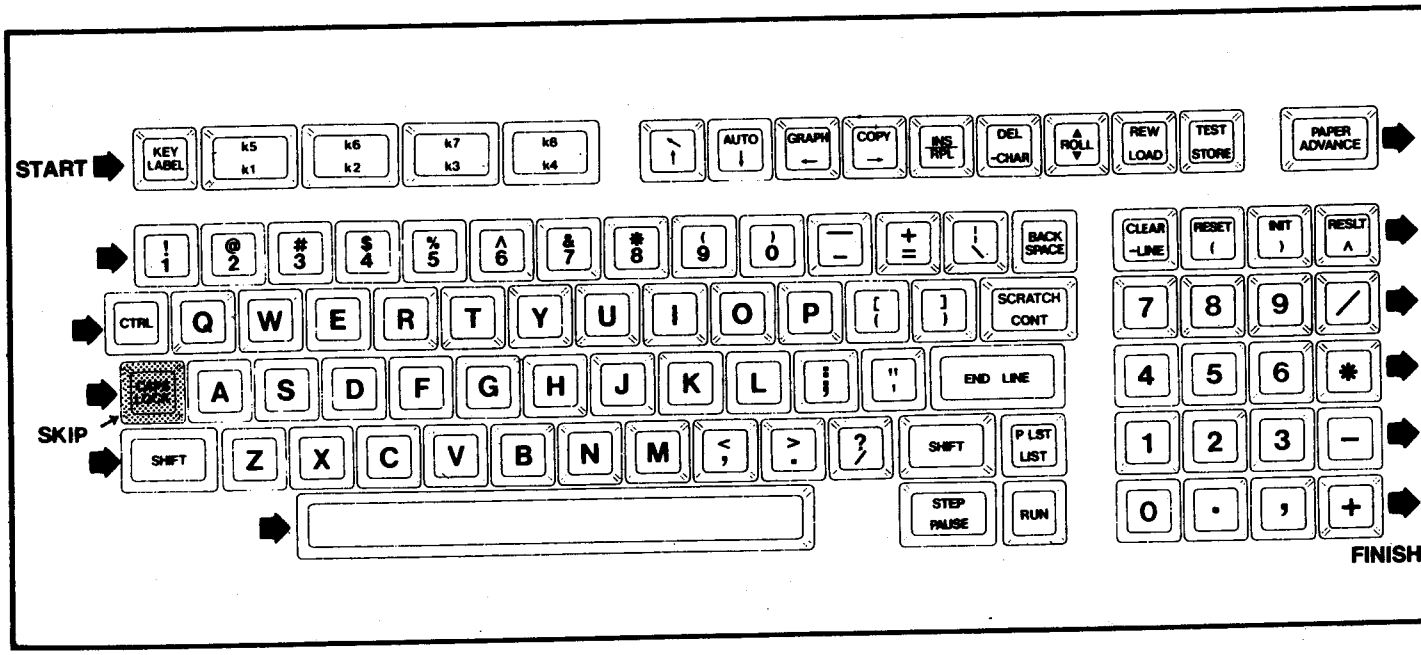
The keyboard test checks the keyboard controller and also verifies key entry for every key on the keyboard. The computer must pass the CPU, ROM, and RAM tests before the Keyboard Test can be run.

The test has nine steps; each step requires you to press a certain key or sequence of keys. While you are performing the test, pay particular attention to the instructions regarding the [CTRL], [SHIFT], and [CAPS LOCK] keys.

At the beginning of the test, the [CTRL], [SHIFT] and [CAPS LOCK] keys must be up. Perform steps 1 through 9 as described in the messages displayed and printed. The nine steps are described in more detail on the next page. The order in which keys are pressed during steps 8 and 9 is shown in the diagram below.

The Keyboard Test produces the following messages:

- OK following steps 2 through 8 and 11 indicates that the keys have functioned correctly.
- KEY TEST ENDS appears when the test is completed.
- KEY CONTROL BAD! indicates that the keyboard controller should be replaced.
- NO KEY! appearing 30 seconds after the key is pressed indicates the key is not operating properly.
- KEY STUCK! appearing 30 seconds after the key is pressed indicates that a key is stuck in the pressed position.
- KEY BAD! indicates that the key entered does not correspond to the key pressed. The message appears when an incorrect key has been entered eight times.



Key Sequence for 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 on page 3-7. 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 th order shown on page 3-7. Do not press the [CTRL], [CAPS LOCK], or [SHIFT] key during this sequence test.

Tests Not Included In the System Test

The External RAM Test and the External ROM Test are used to test those accessories. For servicing information, refer to Lesson 7.

External RAM Test (Key [L])

The External RAM Test checks the RAM controller and the RAM ICs contained in the HP 82903A 16K Memory Module.

To run the test:

1. Turn off the computer.
2. Install a memory module into one of the module ports.
3. Turn the computer on.
4. When the Service ROM message appears, type [L]. (The test can be run from the BASIC system by typing XRAM [ENDLINE]).

The External RAM test generates one of the following messages:

- XRAM OK indicates that no problem was found.
- NO XRAM OR XRAM BAD! indicates that the system is unaware of the presence of the module or that the RAM controller in the module is bad. If repeating the test procedure with the module installed in a different port corrects the problem, then the I/O PCA must be replaced. If the problem persists, the RAM controller in the module must be replaced.
- XRAM CONTROL BAD! indicates that the RAM controller must be replaced.
- XRAM n BAD! indicates that RAM IC n in the memory module must be replaced.

External ROM Test (Key [M])

The External ROM Test checks plug-in ROMs installed in the ROM drawer. The computer must be able to pass the (internal) RAM test before this test can be performed.

To perform the test:

1. Turn off the computer.
2. Remove the ROM drawer, install any ROMs to be tested, and then install the ROM drawer.
3. Switch the computer on.
4. When the Service ROM message appears, type [M]. (If the BASIC system is in control, type XROM [ENDLINE]).

One of the following messages will appear for each installed plug-in ROM. The number "nnn" corresponds ot the ROM number listed in Appendix B-7.

- XROM nnn OK indicates that no problem was found.
- XROM nnn BAD! XROM TEST ABORTED! indicates that the test was aborted because of a malfunction in internal RAM.
- RAM BAD! XROM TEST ABORTED! indicates that the test was aborted because of a malfunction in internal RAM.

Heat Test (Key [N])

The Heat Test runs a continuous, repeating series of IC tests and also turns the screen fully on (white). Each time one cycle of the test is completed (every 25 seconds), the screen momentarily goes blank. Every hour, the elapsed time of the test is printed. If a problem is found during the test, the CRT goes blank, a message is printed, and the test is terminated. If no problem is found, the test continues to run until it is terminated by pressing any key. After you terminate the test, the message HEAT TEST ENDS appears within 21 seconds.

Full Tape Test (Key [O])

Paragraph 8-91 of the *HP 85A Assembly-Level Service Manual* has details of the six tests comprising the Full Tape Test. This course does not cover the information given there.

Cycle Test (Key [V])

The Cycle Test automatically repeats the System Test continuously. A rewound, unprotected tape cartridge must be inserted in the tape drive before the test begins. Any information on the tape is erased during testing.

The test is terminated by pressing any key within three seconds after the message SYSTEM TEST END$ appears. The test continues until terminated by you, or until an error is detected during the Abbreviated Tape Test (other than the TAPE OUT error). Error messages appear if you do not respond to prompts issued by the Keyboard and Write-Protect Tests, but these errors do not terminate the test.

STOP!

Take Quiz 4 now. When you've passed the quiz, do Lab Project 2.

Quiz 4

Service ROM Sequence Tests

(10 points per correct answer, total = 100)

1. Describe the causes of the following messages during the keyboard test:

   NO KEY! _____

   KEY STUCK! _____

   KEY BAD! _____

2. Where is the timer circuitry located? _____

   _____

3. Match the part with the test that checks it:

____ a. CRT RAM	(1) Printer Test
____ b. Numeric keypad	(2) Abbreviated Tape Test
____ c. 16K Memory Module	(3) RAM Test
____ d. [CTRL] key	(4) Keyboard Test
____ e. Tape transport mechanism	(5) CRT Test
____ f. Tape drive controller	(6) External RAM Test
	(7) Tape Write-Protect Test

Correct Quiz 4 now using Appendix E.

Now do Lab Project 2.

Lab Project 2

Service ROM Tests

In this lab project, you will conduct several tests from the Service ROM. If any of the tests return a message indicating that a part or assembly is not operating properly, do not attempt any repairs. You will have the opportunity to isolate and repair computer malfunctions in Lesson 5.

____ 1. Have page 3-8 handy. It describes keys to be pressed during the Keyboard Test portion of the System Test.

____ 2. Obtain a blank tape cartridge. Place the write-protect tab in the record position.

____ 3. Turn on the computer. DO NOT press any keys. When the message RETURN TO BASIC SYSTEM appears, insert the tape cartridge in the drive and press [REW] to rewind the tape. When the tape is rewound, remove the tape cartridge and turn off the computer.

____ 4. Turn the computer on. When the Service ROM message appears, press [A].

____ 5. When the CRT pincushion test pattern (page 3-4) appears, pause the test. Then, resume the test.

____ 6. Follow the instructions for performing the Keyboard Test. However, at Step 9 (as described on page 3-8, [SHIFT] up; press keys), purposely skip the [T] key. When the message "T" appears, press [T] and continue with the test.

____ 7. In response to the message from the Tape Write-Protect Test, remove the tape cartridge, set the write-protect tab to the protected position, and insert the cartridge in the drive.

____ 8. When the message SYSTEM TEST ends, allow the computer to RETURN TO BASIC SYSTEM (press Space Bar key).

____ 9. Run the Heat Test by typing HEAT [END LINE]. Press any key to stop the test (usually the Space Bar key).

Continue if you feel confident in doing this Project. If not, review the last lesson and also the Service ROM section in the service manual. Then continue.

Product Disassembly/ Assembly

Lesson 4

Overview

This lesson explains the correct procedures for disassembling and assembling the computer. The lesson presents step-by-step instructions for each major assembly, accompanied by clarifying photographs. The lesson is divided into sections that cover the disassembly and reassembly of:

1. The top case from the bottom case.
2. The keyboard assembly.
3. The logic PCA.
4. The CRT assembly.
5. The printer assembly.
6. The tape drive assembly.
7. The back panel.
8. Parts of the top case and bottom case assemblies (tape door, CRT window, and brightness control).

Lab Projects 3, 4, 5, and 6 provide you with the opportunity to remove several assemblies, to disassemble some of their mechanical parts, and to reassemble those parts. As you do Lesson 4, read through disassembly/assembly instructions, but don't perform any of those procedures until you are directed to do a particular lab project. Then, follow the instructions in the lab project; in some cases, you may be told to skip a certain procedure.

Learning Objectives

After completing Lesson 4, you should be able to:

- Properly remove and insert ICs.
- Properly disconnect and connect ribbon cables.
- Safely access, remove, and replace the computer major assemblies.
- Replace parts of the top case, bottom case, keyboard, and printer.

WARNING!

Hazardous voltages are present inside the computer. Always remove AC power before working inside the computer. Procedures outlined in this lesson should be performed only by qualified service technicians.

Lesson 4 contains all the information you'll need to do the lab projects included in the lesson. However, certain disassembly procedures are not covered in this manual. You will need to refer to the *HP 85 Assembly Level Service Manual* when you are repairing a customer's unit.

Removing and Tightening Screws

The main tools needed to replace the major assemblies are two Pozidriv screwdrivers—#1 and #2. All screws used in the HP 85 have Pozidriv heads. The threads in screw holes can easily be stripped if the screws are overtightened. Tighten screws only until they feel snug.

Removing the Top Case

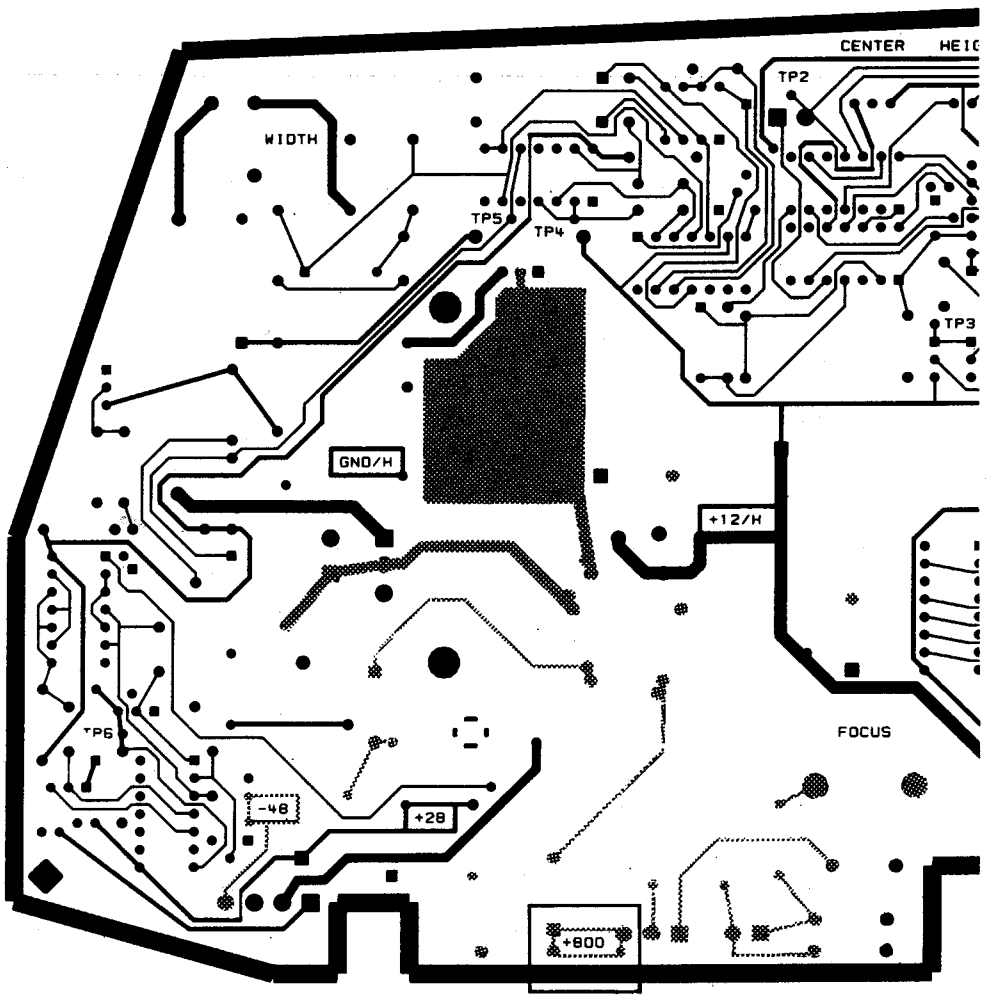
WARNING!

Lethal voltages are exposed when the top case of the HP 85 is removed. At certain locations, these voltages remain present for up to several days after the computer has been turned off. In addition, electrical and mechanical failures may cause dangerous voltages to be present at points that are normally safe.

Do not remove the top case with the power on. Be aware that high voltages may be present on the CRT PCA if the brightness control is disconnected or broken. Make sure you do not accidentally touch the high-voltage area on the CRT PCA (see figure below) in the process of removing the top case.

CAUTION!

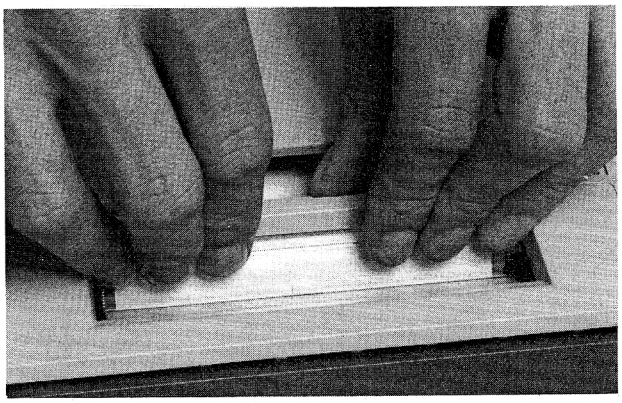
To preserve the EMI (electromagnetic interference) properties of the computer, avoid contaminating the metalized inside surface of the top and bottom cases with fingerprints, solder flux, or other substances.



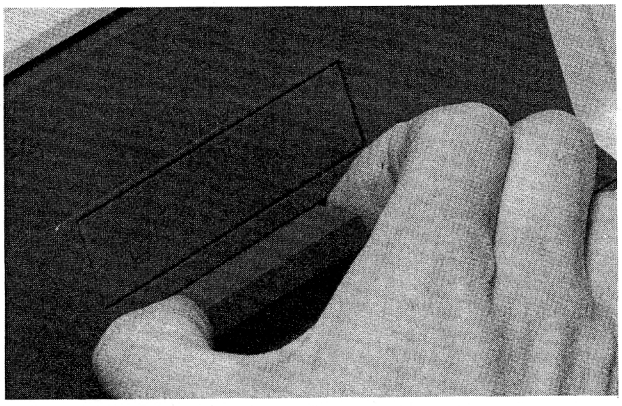
High-Voltage Area on CRT PCA Located on Left Rear Inside of Top Cover

To separate the top case from the bottom case:

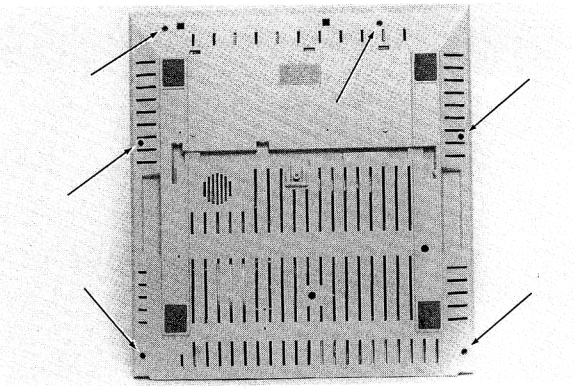
1. Disconnect the power cord from the back panel.
2. Lift out the printer tear bar by pulling up on its upper lip.



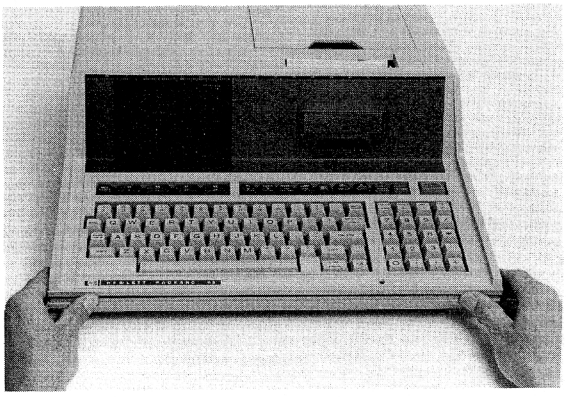
3. Pull out the tape ejector bar.



4. Rest the computer on its back panel with the I/O port covers installed. Loosen the six screws in the bottom case with a #1 Pozidriv screwdriver. Prepare a tabletop area to allow the screws to fall out and not be lost with other items on the table.



5. Return the computer to its original position. Separate the front of the top case from the front of the bottom case.

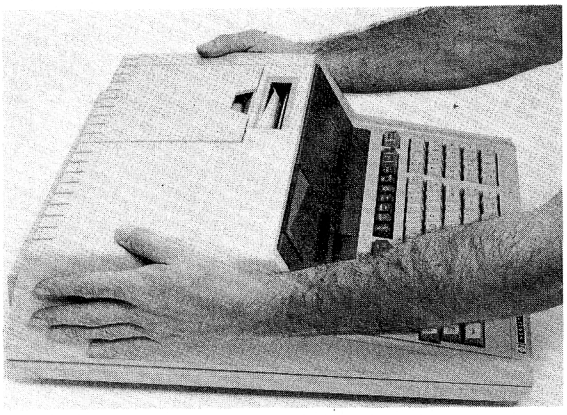


WARNING!

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. 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.

6. 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.



WARNING!

Before working on the computer, ensure that no objects can fall from your shirt pocket or work area onto the CRT. The CRT can implode if dropped or hit by an object.

Cable Interconnections

The HP 85 assemblies are electrically connected by ribbon cables described below.

Assembly Connect	Conductors	Length
Keyboard	11	5.7cm (2.25 in.)
CRT	20	5.0cm (1.95 in.)
CRT	20	5.5cm (2.15 in.)
Printer	17	4.2cm (1.65 in.)
Printer	17	4.7cm (1.85 in.)
Tape	17	9.7cm (3.80 in.)
Tape	17	10.7cm (4.20 in.)
I/O PCA	20	44.5cm (17.5 in.)

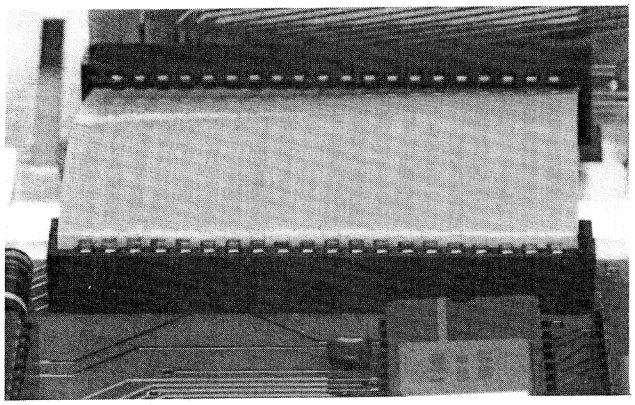
In cases where the two cables connecting an assembly have different lengths, the shorter cable is always connected below the longer cable. No tools are required to connect and disconnect cables. Cables must be properly aligned in order to ensure proper electrical connections and to prevent damage to the cable, ICs, and/or major assemblies in the computer.

To properly remove a cable from a cable connector:

1. Grasp the cable on both sides close to the cable connector.
2. Pull the cable straight up out of the connector.

To reconnect a cable:

1. Align the contacts of the cable with the contacts of the connector, making sure the contacts on the cable and connector face one another.
2. Press the end of the cable into the connector gently but firmly.
3. Make sure the cable contacts are properly aligned.



CAUTION!

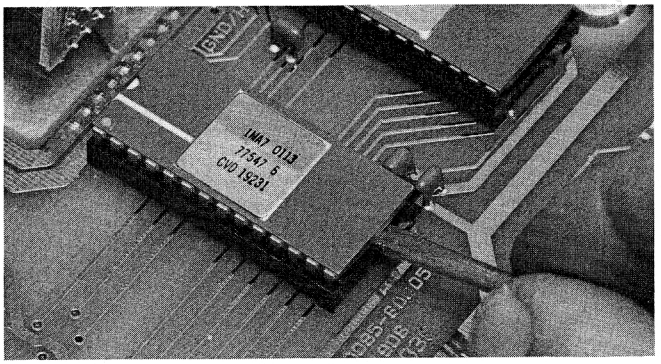
Connector tab *MUST* line up on cable tab. Failure to make this alignment will destroy the computer components.

If a cable must be removed because it was improperly aligned when inserted, insert a spare cable of the same width into the connector between the improperly aligned cable and the connector contacts. The contacts of the spare cable should face the contacts of the misaligned cable. Then, grasp both cables and pull them from the connector.

Removing and Inserting Socketed ICs

Socketed ICs are held tightly in their sockets. Whenever possible, use an IC extractor tool to remove ICs. If one is not available, use the following procedure.

1. Insert a small, flat-blade screwdriver between one end of the IC and the socket.



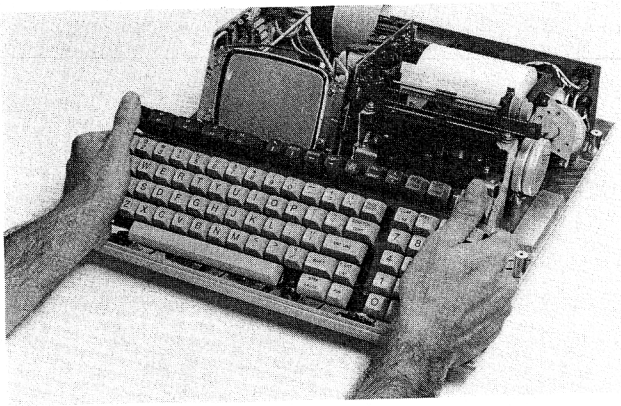
CAUTION!

In step 2, do not insert the screwdriver more than 2.5mm between the IC and its socket. Inserting the screwdriver too far could damage traces on the printed circuit board.

2. Pry the end of the IC up.
3. Raise the other end of the IC up either by prying it with the screwdriver or by pushing the first end down until the other end lifts up.

To insert an IC in its socket:

1. Position the IC over the socket so that the pins are lined up properly.



2. Rest the IC on the socket. Then, press down along both sides of the IC until it snaps securely into the socket. Make sure you are not bending any pins as you are pressing the IC into place. When the IC is properly inserted, both sides of the IC should be the same height above the socket and no pins should be bent inwards or outwards.

CAUTION!

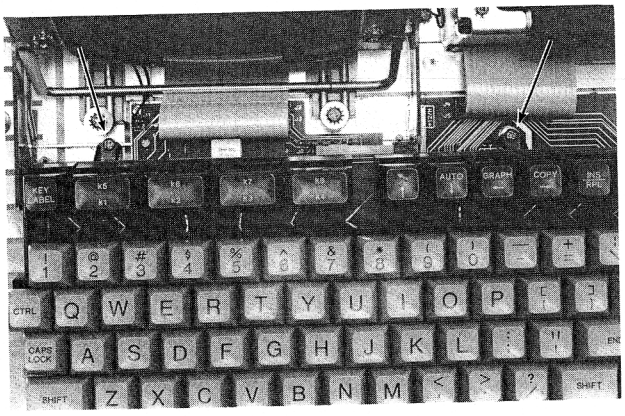
It is possible to insert ICs into the sockets in the wrong direction. Special care must be taken. (See service manual component location diagrams for IC polarity before insertion.)

Removing the Keyboard Assembly

The keyboard assembly must be removed before the logic PCA and the printer, tape, and CRT assemblies can be disassembled.

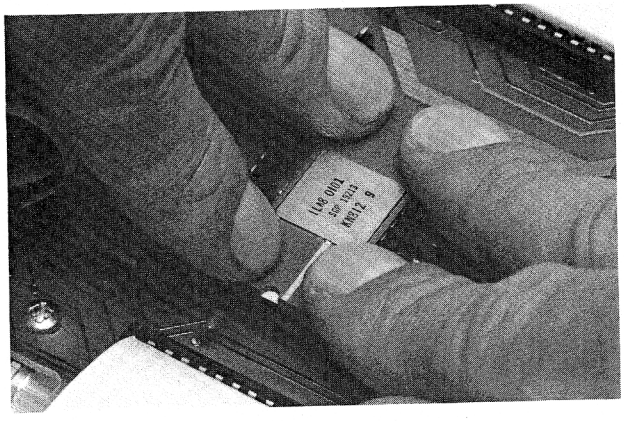
To remove the keyboard assembly:

1. Remove the two screws securing the keyboard to the bottom case.



2. Rotate the back of the keyboard forward.
3. Lift the keyboard out of the bottom case by grasping its ends and lifting 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.

Note the 45° angle the keyboard is held in. This angle is important. You *must* also lift straight up while holding the keyboard at 45°.



STOP!

Stop now and take Quiz 5. Continue on when you've passed the quiz.

Quiz 5

Disassembly

(10 points per correct answer, total = 100)

1. Screws should be removed and tightened using a _____ screwdriver.
2. You should not remove the top case if _____. When removing the top case, exercise extreme caution if _____.
3. Why must you not touch the inside surface of the top case and bottom case?

   _____

   _____
4. On which assembly could lethal voltages be present which might be contacted while the top case is being removed? _____
5. True ____ or False ____? All ribbon cables in the HP 85 are interchangeable with one another.
6. The keyboard assembly must be removed before the _____, _____, _____, and _____ assemblies can be removed.

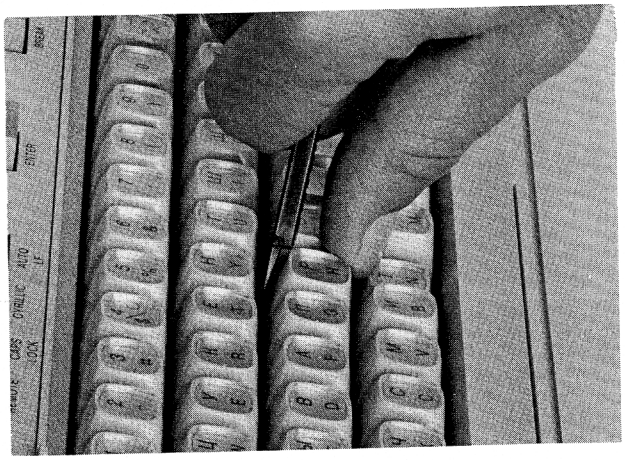
Correct Quiz 5 now using Appendix E.

Replacing Parts of the Keyboard

This section covers replacing key caps, the space bar, and the keyboard hinge. Instructions for replacing the key plunger and spring, the key contacts, and the [CAPS LOCK] key mechanism are included in the *HP 85 Assembly Level Service Manual.*

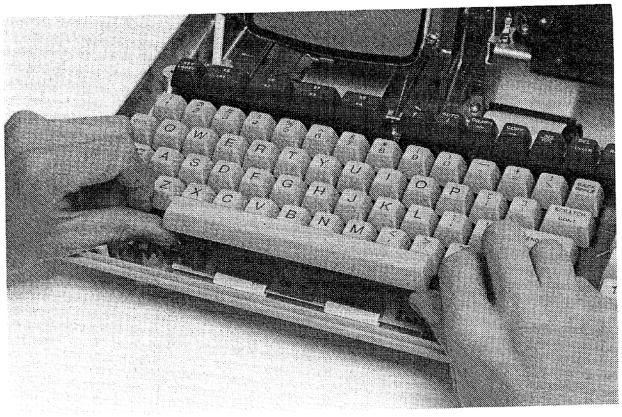
Replacing a Key Cap

Use the key cap extractor tool to remove key caps. Install a new key by pressing it firmly into place. It is a press fit; it will not snap.

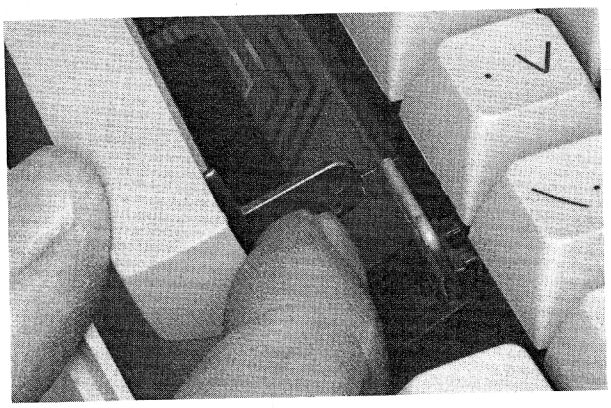


Replacing the Space Bar

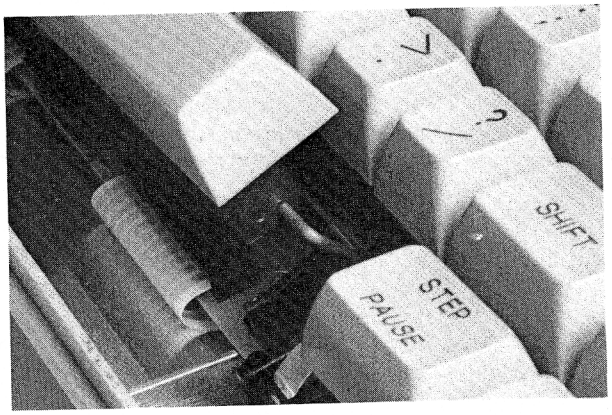
1. Hook your thumbs under the ends of the bar and pull upwards until the bar separates from the plunger. Slide the bar along the hinge rod and gently press the bracket inwards until it clears the rod. If the adapter from the space bar remained in the plunger, pull the adapter out and insert it into the boss in the space bar. The adapter should be positioned so that it angles towards the edge of the space bar away from the brackets.



2. To replace the space bar, position it over the keyboard oriented with the brackets toward the front. Hook one end at a time into the rear hole in the bracket.

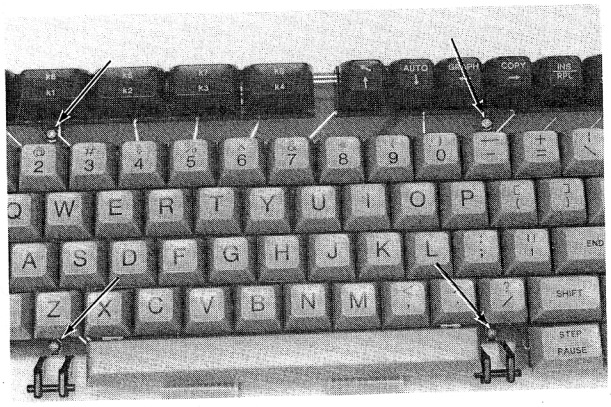


3. Position the space bar with its adapter over the plunger and press into place.



Replacing a Hinge

1. Remove the two screws securing the hinge to the keyboard PCA.



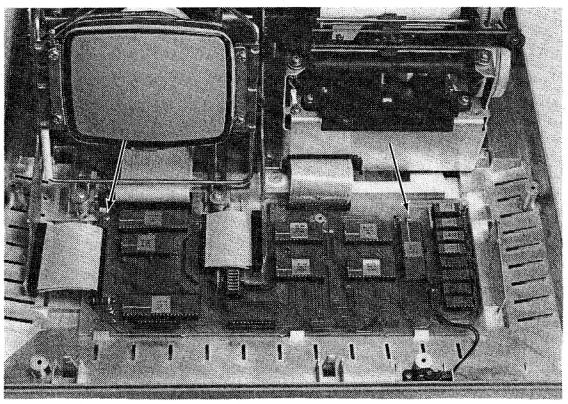
2. Position a new hinge beneath the keyboard PCA. The hinge locating pins should be engaged in the holes in the keyboard PCA. (In older units, the keyboard may not have holes for the hinge locating pins; the pins must be removed from the hinge.)
3. Insert and tighten the screws after testing top cover clearance by key caps.

Replacing the Logic PCA

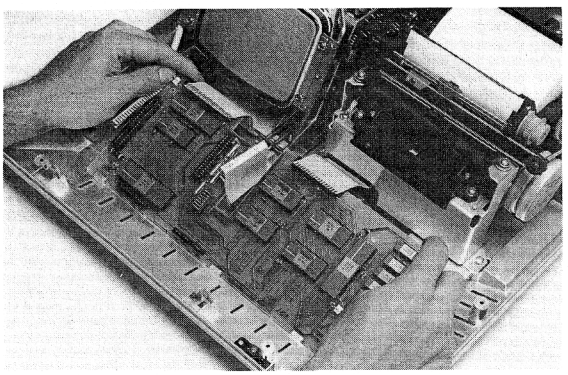
The keyboard assembly must be removed before the logic PCA can be removed.

To remove the logic PCA:

1. Disconnect the cables from the logic PCA to the CRT PCA, I/O PCA, printer/power supply PCA, and tape drive PCA.
2. Disconnect the two small plugs to the power light (lower right) and speaker (upper left).



3. Remove the two screws securing the logic PCA to the bottom case and lift the logic PCA out.



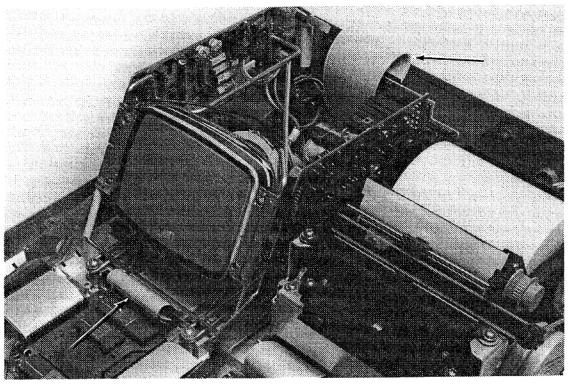
To install the logic PCA:

1. Make sure the insulator is correctly positioned in the bottom case.
2. 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.
3. Insert and tighten the two screws securing the logic PCA to the bottom case.
4. 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. Arrange the power light wires down against the logic PCA and the bottom case.

NOTICE!

Do not perform steps 5 and 6 if you will be continuing on with the disassembly procedures in Lesson 4. Leaving the cables to the logic PCA disconnected will save you time later as you disassemble the other computer assemblies.

5. Connect to the logic PCA the cables from the CRT PCA, I/O PCA, printer PCA, and tape drive PCA.
6. 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.



STOP!

Stop now and do Lab Project 3. When you've completed it, continue on with Lesson 4.

Lab Project 3

Disassembly

In this lab project, you will perform some of the disassembly procedures described in the preceding pages. When you've completed the project, leave the computer in its partially disassembled state. You will be continuing from where you left off later in Lab Project 4.

____ 1. Read the disassembly/assembly instructions up to this page.

____ 2. Turn off the computer and disconnect the power cord from the back panel.

____ 3. Return to the appropriate discussions as you perform the following procedures:

- ____ a. Remove the top case.
- ____ b. Remove the key cap for the [RUN] key. Remove the space bar.
- ____ c. Install the [RUN] key cap and the space bar.
- ____ d. Remove the keyboard assembly.
- ____ e. Use the Logic PCA Component Location Diagram (Appendix A-4) and the Table of Service ROM IC Messages (Appendix C-1) to identify (by reference designation) and locate the following socketed ICs (fill in the reference designation for each one):

  _____ I/O buffer _____ _____ RAM controller _____

  _____ CPU _____ _____ RAM 4 _____

  _____ Keyboard controller _____ _____ ROM 0 _____

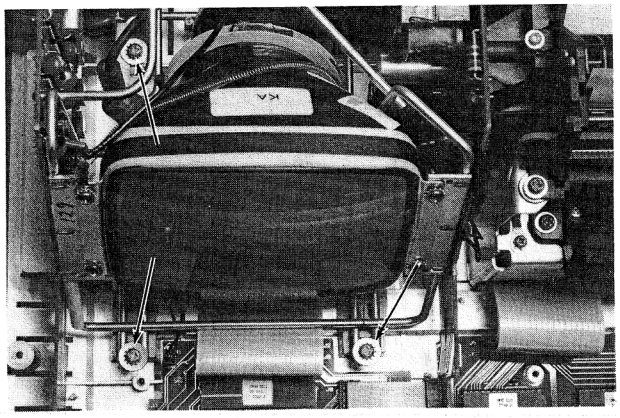
- ____ f. Remove ROM 0.
- ____ g. Replace ROM 0.
- ____ h. Remove the logic PCA.
- ____ i. Install the logic PCA. However, do not perform steps 5 and 6 in the instructions.

Replacing the CRT Assembly

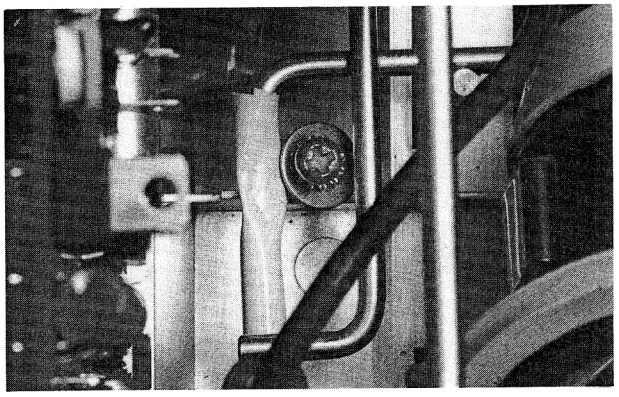
The keyboard assembly must be removed before the CRT assembly can be removed.

To remove the CRT assembly:

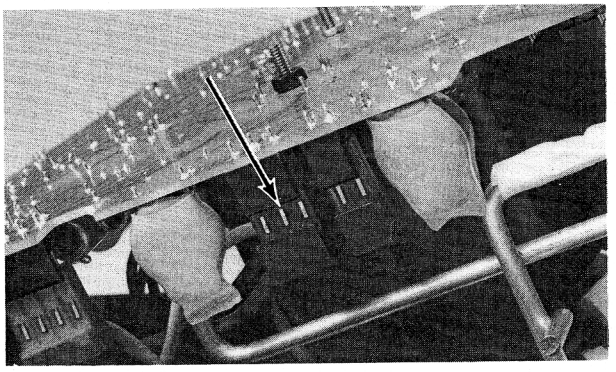
1. Disconnect the pair of cables connecting the CRT PCA to the logic PCA.
2. Remove the two screws and the washers securing the front of the CRT frame to the bottom case.



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



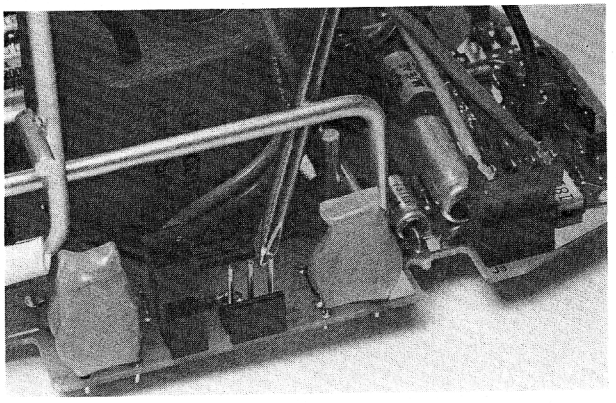
4. Wiggle the CRT assembly until the frame is no longer held by the washer.
5. Disconnect the brightness control plug from its connector by lifting the CRT assembly up and pulling the plug out from below. This plug is the one with the three wires (orange, red, and yellow) connected to it.
6. Disconnect the EMI apron from CRT PCA (85B only).



7. Lift out the CRT assembly.

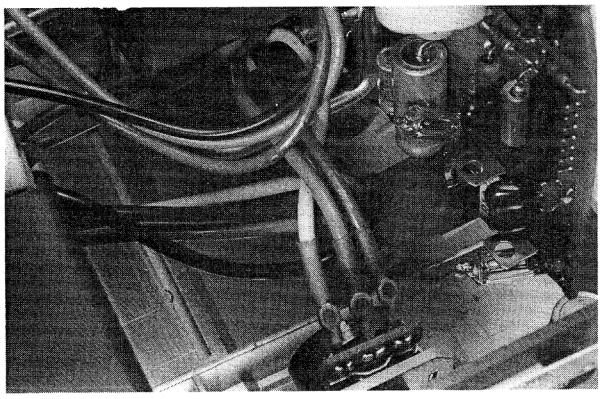
WARNING!

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 towards 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.



To install a CRT assembly:

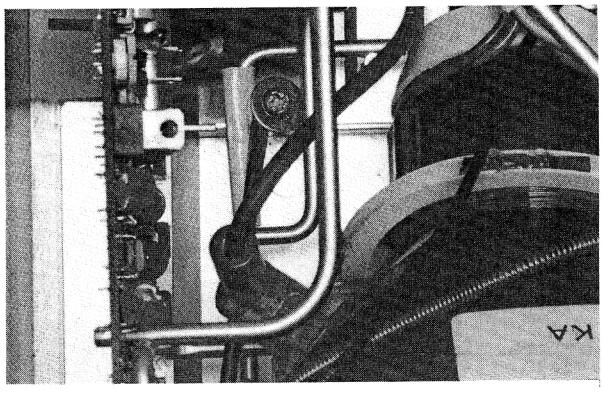
1. Connect the brightness control plug to the CRT assembly. The three wires from the brightness control should pass over the CRT frame and the four wires to the socket on the CRT, but they should pass under the three wires to the CRT yoke. The plug should be connected so that its wires come up rather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

2. 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.



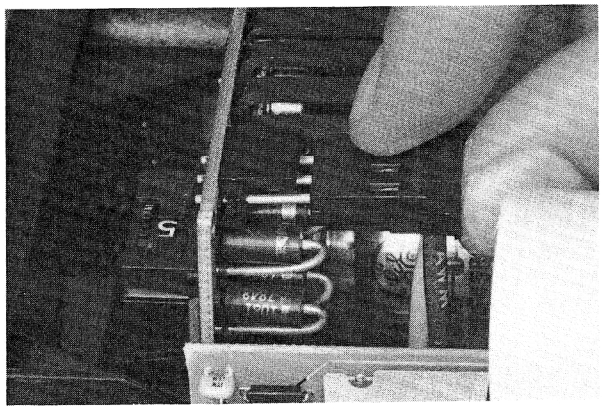
3. Make sure that the cables between the logic PCA and the I/O PCA are arranged so that the excess cable length is distributed between the front and the back of the CRT assembly. Make sure that the front of the CRT PCA is positioned between the two pins on the bottom case.
4. Insert, but do not tighten, the front two screws and washers.
5. 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. Holding the CRT assembly in position, tighten the two screws at the front of the frame. Tighten the third screw securing the CRT frame to the bottom case.
6. Connect the two cables running from the CRT PCA to the logic PCA.

Replacing the Printer Assembly

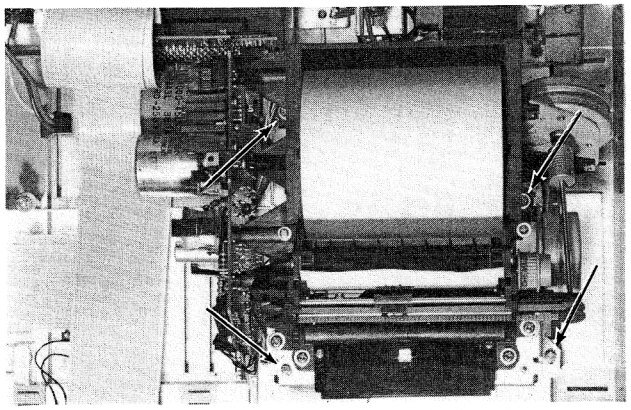
The printer assembly consists of the printer mechanism and the printer/power supply (PRNT/PS) PCA. To replace the printer assembly, both the printer assembly and tape drive assembly are removed from the bottom case as one unit. The tape drive assembly is then separated from the printer assembly. The printer assembly is separated into its two major parts—the printer mechanism and the printer/power supply PCA.

To remove the printer assembly and tape drive assembly:

1. Remove the keyboard assembly.
2. Disconnect the power plug from the upper rear of the printer PCA.
3. Disconnect the pair of cables connecting the tape drive PCA to the logic PCA. Disconnect the pair of cables connecting the printer/PS PCA to the logic PCA.

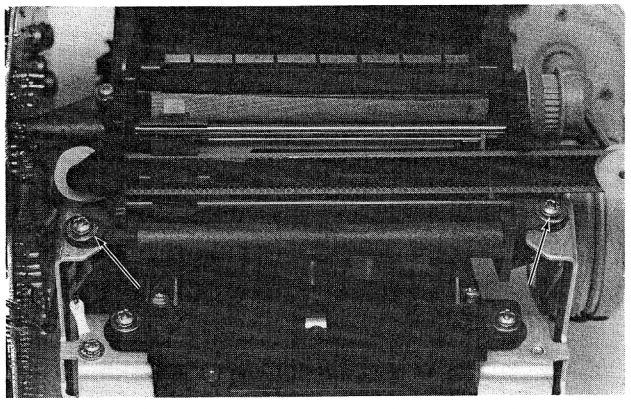


4. Remove the two screws toward the rear of the printer that secure it to the bottom case. Remove the two screws securing the tape drive support bracket to the bottom case.



5. Remove the screw securing the grounding strap(s) that connect the printer/PS PCA to the back panel (and I/O PCA). Older units may not have a grounding strap from the printer/PS PCA to the I/O PCA.
6. Lift the printer assembly, together with the tape drive support bracket and tape drive assembly, straight up out of the bottom case.

7. To separate the printer assembly from the tape drive assembly, remove the two screws securing the front of the printer to the tape drive support bracket. Then, separate the printer assembly from the bracket.



8. To remove the printer/PS PCA from the printer mechanism:
   a. Disconnect the two plugs that connect the printer stepper motors to the printer/PS PCA. These plugs are identical; therefore, label them to ensure proper reconnection.
   b. Disconnect the cable connecting the printer/PS PCA to the print-head assembly.
   c. Remove the four screws securing the printer/PS PCA to the print-head assembly. Lift the printer/PS PCA away from the printer mechanism.

To reassemble the printer assembly:

1. Attach the printer/PS PCA to the printer mechanism using the following procedure:
   a. Position the printer/PS PCA against the printer mechanism. Insert and tighten the four screws securing the printer/PS PCA to the printer mechanism.
   b. Connect the two plugs from the printer stepper motors to the printer/PS PCA.
   c. Connect the print-head cable from the printer mechanism to the printer/PS PCA.
2. Position the printer assembly over the tape drive assembly and support bracket. Insert and tighten the two screws.
3. Place the assembly in the bottom case. Connect the grounding strap(s) from the printer/PS PCA to the back panel (and the I/O PCA) by inserting and tightening the screw. Insert and tighten the two screws securing the printer to the bottom case.
4. Position the bottom of the tape support bracket in its original position. Insert and tighten the screws securing the bracket to the bottom case.
5. Connect the pair of cables connecting the tape drive PCA to the logic PCA. Connect the pair of cables connecting the printer/PS PCA to the logic PCA. Connect the power plug to the printer/PS PCA.

STOP!

Stop now and do Lab Project 4. When you've completed the lab, continue on with Lesson 4.

Lab Project 4

Disassembly/Assembly (Continued)

In this lab, you will disassemble the CRT and printer assemblies.

____ 1. Read the disassembly instructions up to this page.

____ 2. Return to the appropriate instructions as you perform the following procedures:

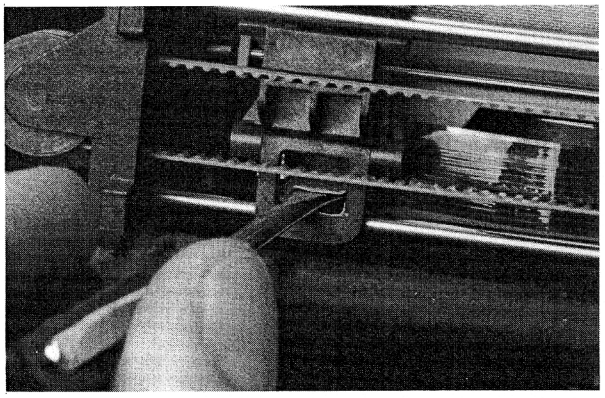
- ____ a. Remove the CRT assembly.
- ____ b. Remove the printer/tape drive assembly.
- ____ c. Separate the tape drive assembly from the printer assembly.
- ____ d. Separate the printer/PS PCA from the printer mechanism.
- ____ e. Reassemble the printer assembly:
  - ____ Attach the printer/PS PCA to the printer mechanism.
  - ____ Attach the tape drive assembly to the printer assembly.
- ____ f. Install the printer/tape assembly into the bottom case.
- ____ g. Locate pin 3 of the brightness control connector (J6). This is the pin that must be shorted to the CRT frame if the computer is turned on without the brightness control connected.
- ____ h. Identify and locate the CRT controller (reference designation _____) and the four CRT RAM ICs on the CRT PCA.
- ____ i. Identify and locate the printer controller (reference designation _____) on the printer/PS PCA.
- ____ j. Install the CRT assembly.

Replacing the Platen and Print-Head Assembly

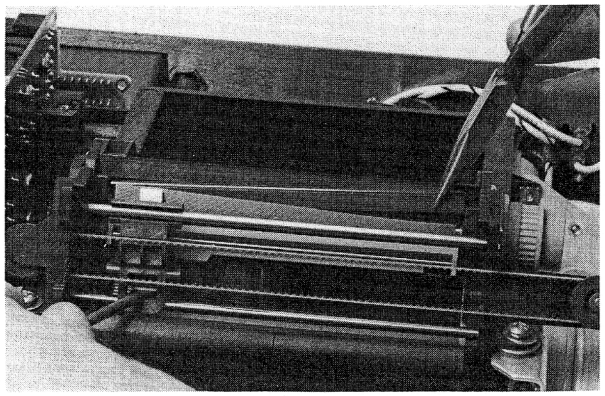
If the troubleshooting isolates the malfunction to the print-head assembly, use the following procedure to replace it. It is not necessary to remove the printer assembly from the computer in order to replace the print-head assembly.

Replacing the Platen

1. Lift out the tear bar.
2. Lift the paper roll out of the printer, tear the paper between the roll and printer, and then pull the remaining paper forward until it is free of the printer.
3. 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.



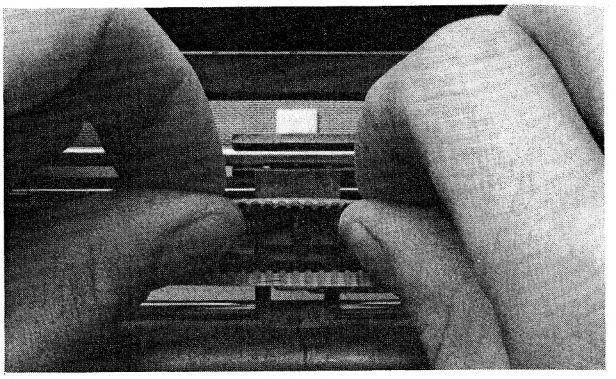
4. Press the handle of the screwdriver down until the print-head moves away from the platen. Lift the platen out.



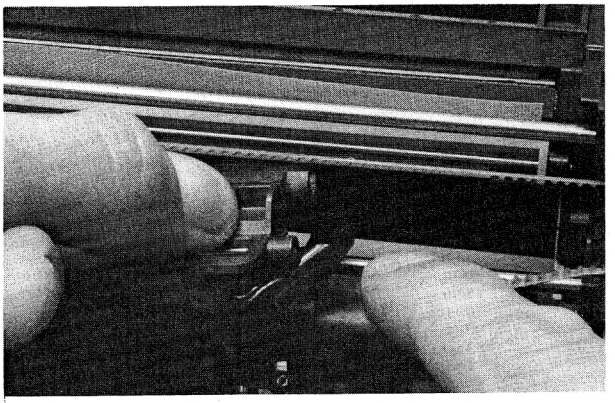
5. Insert the new platen so that the smooth side faces the front of the computer. Release the print-head and make sure the platen is seated properly.

Replacing the Print-Head Assembly

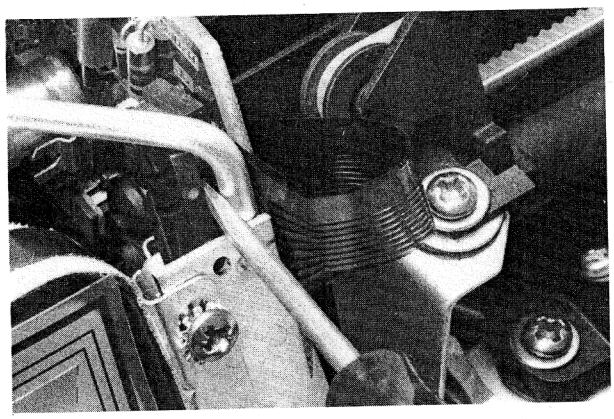
1. Remove the platen. Push the print head to the middle of the printer.
2. Pull the print-head drive belt out of the print-head carriage. Press the lower portion of the belt down until it clears the bottom of the print-head assembly.



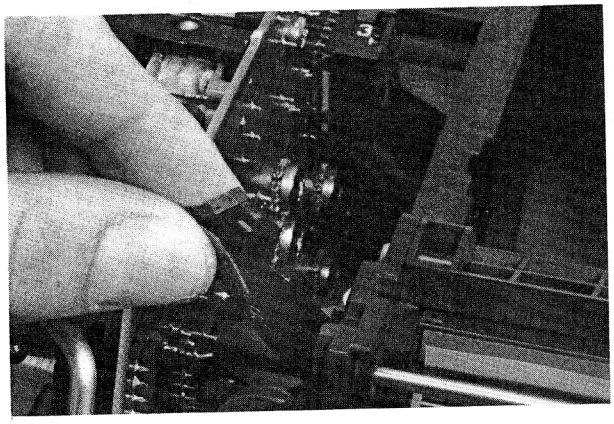
3. Compress the print-head holder. Rotate the print-head assembly down and out of the printer between the upper and lower portions of the belt.



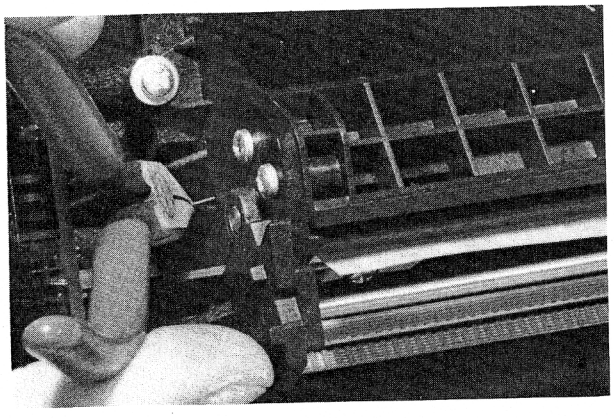
4. Pry the lid of the flex-cable connector (if present) away from the board with a small, flat-blade screwdriver. Pull the cable out of the connector.



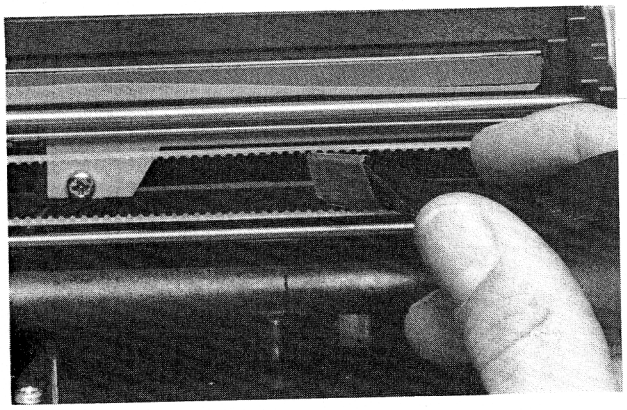
Fold (DO NOT CREASE) the contact end of the flex-cable in the middle, with the contact folded inside. Temporarily tape the ends together.



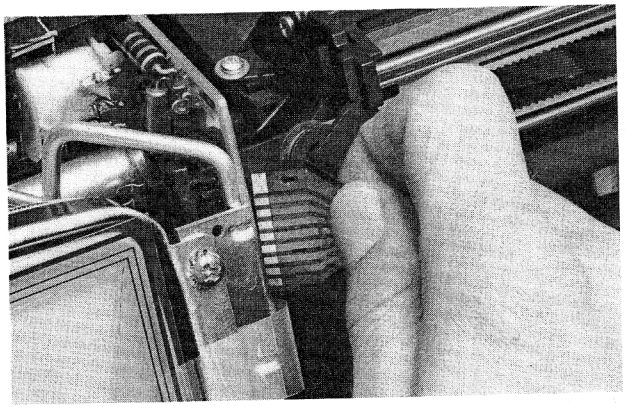
5. Pass the flex-cable through the slot in the printer side plate and pull it out between the belts.



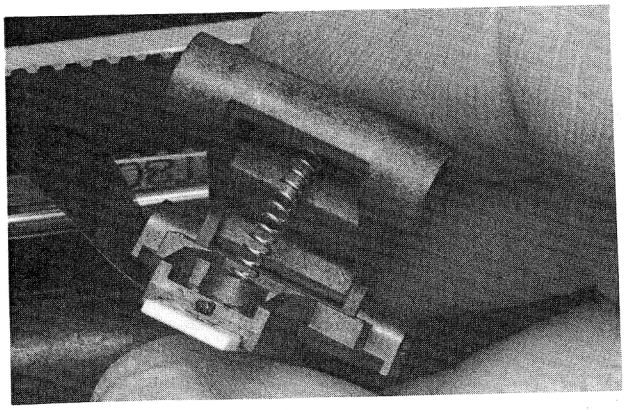
6. Fold (DO NOT CREASE) the new flex-cable, tape it closed, and insert it between the belts. Pass it through the slot in the printer side plate.



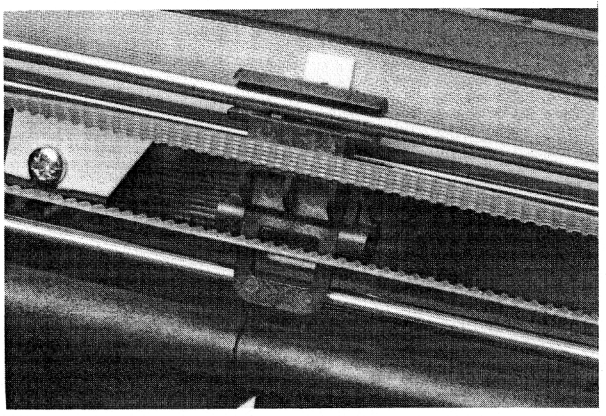
7. Insert the flex-cable into its connector on the printer/PS PCA as far as it will go. The wide contact should be at the top of the connector. Press the lid of the connector (if present) until it closes.



8. Check the spring in the print-head assembly to ensure that it is not broken or bent. Make sure it is seated properly in the print-head holder and peg.



9. Compress the print-head assembly, push the drive belt downwards, and insert the top of the print-head assembly between the belts. Rotate the print-head assembly until its channel engages the upper guide rod.



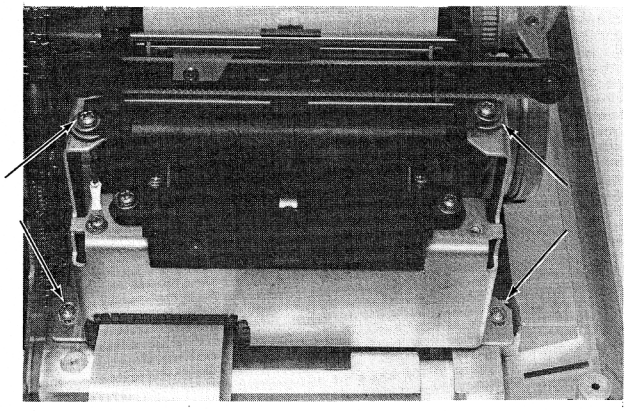
10. Rotate the bottom of the print-head assembly until it clears the belt and rests on the outside of the lower guide.
11. Press the belt into the print-head carriage.
12. Replace the platen and set home position of the print-head (covered in Lesson 5).

Replacing the Tape Drive Assembly

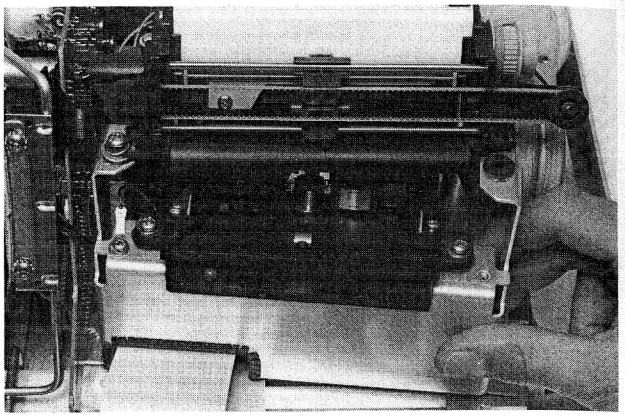
The keyboard assembly must be removed before the tape drvie assembly can be removed.

To remove the tape drive assembly:

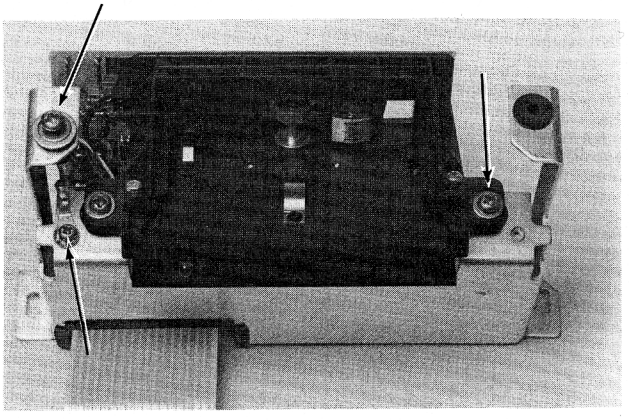
1. Disconnect the pair of cables running from the tape drive PCA to the logic PCA.
2. Remove the two screws securing the tape drive support bracket to the bottom case. Remove the right screw securing the printer mechanism to the bracket. Loosen, but do not remove, the left screw.



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



4. Disconnect the grounding wire from the support bracket. Separate the tape drive assembly from its support bracket by removing the two screws.



To replace the tape drive assembly:

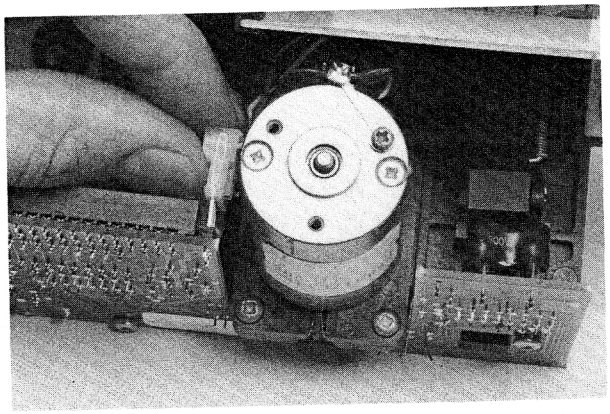
1. If a new assembly is to be installed, disconnect the pair of cables from the old tape drive assembly and connect them to the new assembly.
2. Mount the tape drive assembly on the support bracket. Insert the screws into the mounting lugs, push the tape drive to the rear, and then tighten the screws. Connect the grounding wire to the support bracket.
3. Push the tape drive assembly underneath the printer. Slide the mounting lug on the left of the printer under the screw washer and rotate the bracket into position. Insert and tighten the right screw securing the printer to the bracket. Tighten the left screw.
4. Position the bottom of the bracket in its original position and insert and tighten the two screws.
5. Connect the pair of cables from the tape drive PCA to the logic PCA.

Replacing the Motor/Capstan Assembly

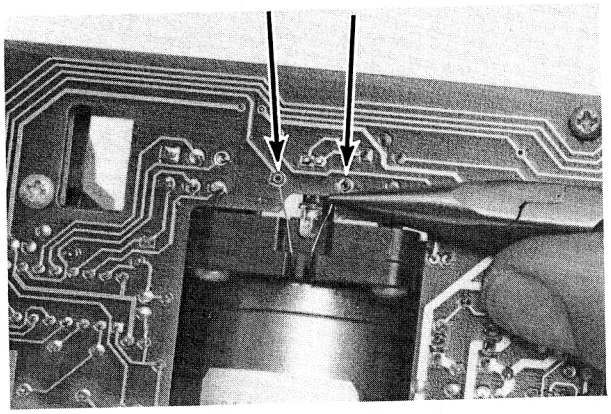
Because the circuitry on the tape drive PCA must be adjusted to the individual motor/capstan assembly, you must have an oscilloscope available in order to perform this procedure. If no oscilloscope is available, the entire tape drive assembly must be replaced instead.

The circuitry adjustment is covered in Lesson 5.

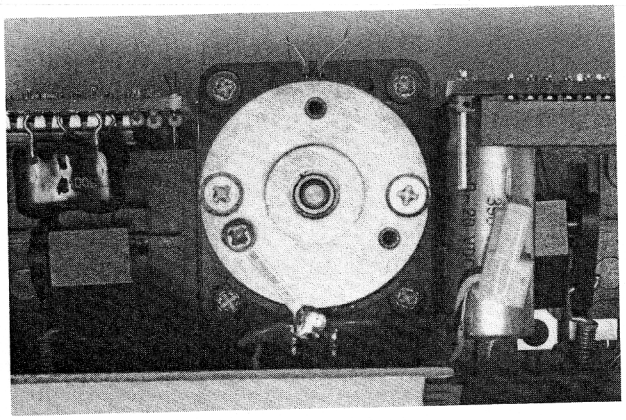
1. Remove the tape drive assembly.
2. Disconnect the plug with the three leads from the component-side of the tape drive PCA near the ribbon cable connector.



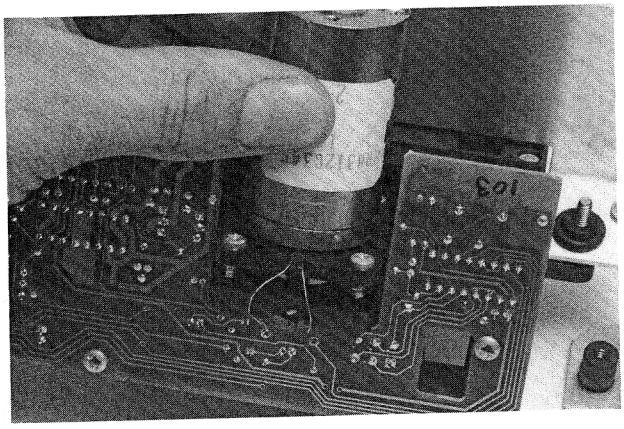
3. Disconnect the two motor-speed lamp leads from the trace-side of the tape drive PCA near the base of the motor/capstan assembly by pulling them out with pliers (they are not soldered).



4. Remove the four screws securing the motor/capstan assembly to the baseplate of the tape drive assembly (if necessary, pull back the tape eject mechanism to provide clearance). Remove the motor/capstan assembly. Gently blow both faces of the disk on the shaft of the new motor/capstan assembly with air to remove dust.



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



CAUTION!

In Step 6, do not overtighten the screws. Otherwise, the threads in the baseplate could be stripped.

6. Tighten the four screws securing the motor/capstan assembly to the tape drive assembly baseplate.
7. Connect the plug with the three motor leads, and the two motor-speed lamp leads, to the tape drive PCA. The plug with the motor leads should be oriented so that the leads come out of the plug towards the motor/capstan assembly.
8. Connect the tape drive assembly to the computer using extender cables. Without a cartridge inserted, run the Tape Speed Test from the service ROM. If the message TAPE STALLED! appears, photo-transistor CR1 must be repositioned. CR1 is located on the tape PCA and resembles a clear LED. In the photograph accompanying step 3 at the bottom of page 4-17, CR1 is located at the tip of the pliers. The proper position is determined by checking test point TP4 during the fast forward portion of the Tape Speed Test. Adjusting phototransistor CR1 is covered in Lesson 5. If the extender cables are too wide, slit the ends at the correct width and fold back out of the way the extra lines.

STOP!

Stop now and do Lab Project 5. When you've completed the lab, continue with Lesson 4.

Lab Project 5

Disassembly/Assembly (Continued)

In this lab project, you will disassemble and reassemble parts of the printer and tape drive assemblies.

____ 1. Read the preceding pages covering replacing parts of the printer and tape drive assemblies.

____ 2. Remove the printer platen.

____ 3. Remove the print-head assembly.

____ 4. Replace the print-head assembly and platen.

____ 5. Remove the tape drive assembly without removing the printer assembly.

____ 6. Identify (reference designation _____) and locate the tape controller on the tape drive PCA.

____ 7. Remove the tape drive motor/capstan assembly.

____ 8. Locate phototransistor CR1 and test point TP4 on the tape drive PCA. (The location of TP4 varies with model and date of manufacture.)

____ 9. Replace the motor/capstan assembly.

____ 10. Replace the tape drive assembly.

Replacing the I/O PCA

You do not need to remove the back panel assembly in order to remove the I/O PCA.

To remove the I/O PCA:

1. Disconnect the two ribbon cables from their connectors on the I/O PCA.
2. Disconnect the grounding strap (if present; older units may not have a ground strap from the Printer/PS PCA to the I/O PCA).
3. Remove the two screws located at the upper left and upper right of the I/O receptacle. Slide the I/O PCA upwards out of the slot in the I/O receptacle.

To replace the I/O PCA:

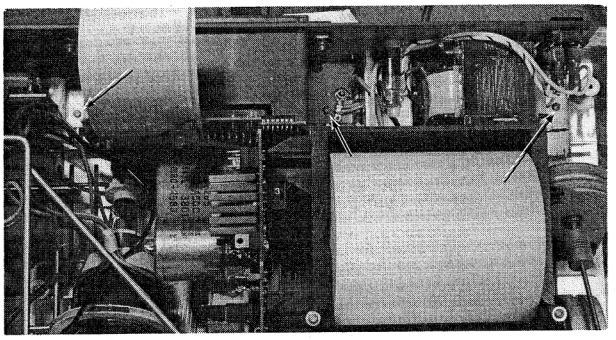
1. Slide the I/O PCA into the slot in the I/O receptacle.
2. Insert and tighten the two screws.
3. If a ground strap is present, reconnect it. Place the machine screw and lock washer through the I/O PCA from the component side. Place the spacer on the end of the screw that protrudes through the board, and then place the ground strap on the screw with the copper side towards the spacer. Secure the strap with the star washer and hex nut.
4. Reconnect the ribbon cables running from the logic PCA to the I/O PCA.

Replacing the Back Panel Assembly and I/O PCA

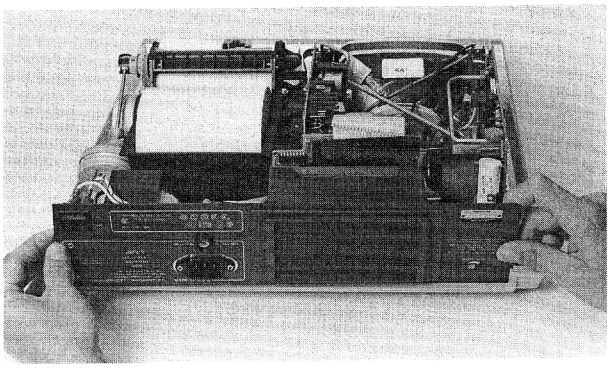
The back panel assembly includes the computer back panel and the I/O receptacle.

To remove the back panel assembly:

1. Disconnect the power plug from the printer PCA. Disconnect the pair of ribbon cables from the I/O PCA. Disconnect the grounding strap(s) connecting the Printer/PS PCA to the back panel assembly (and to the I/O PCA).
2. Remove the three screws securing the back panel assembly to the bottom case. Loosen, but do not remove, the three screws securing the CRT assembly to the bottom case. Slide the CRT assembly as far forward as possible.



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



4. Remove the I/O PCA according to the instructions in the previous discussion.

To replace the back panel assembly:

1. 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. Slide the CRT assembly back to its proper position and tighten the two screws that secure the assembly to the bottom case. Insert and tighten the three screws securing the back panel to the bottom case.
2. Connect the power plug to the printer PCA. The wires to the power plug should pass underneath the mounting lug on the printer paper well. Fasten the ground strap from the Printer/PS PCA to the back panel assembly.
3. Replace the I/O PCA and the ground strap (if present) according to the previous instructions.
4. Reconnect the cables connecting the I/O PCA and the Logic PCA and arrange them so that the excess cable is distributed evenly between the front and back of the CRT assembly.

Replacing the Keyboard Assembly

1. Connect the keyboard cables to the Logic PCA.
2. Snap the keyboard hinge pins into their retainers in the bottom case. Rotate the back of the keyboard down. Insert and tighten the two screws securing the keyboard to the bottom case.

Replacing Parts of the Top Case

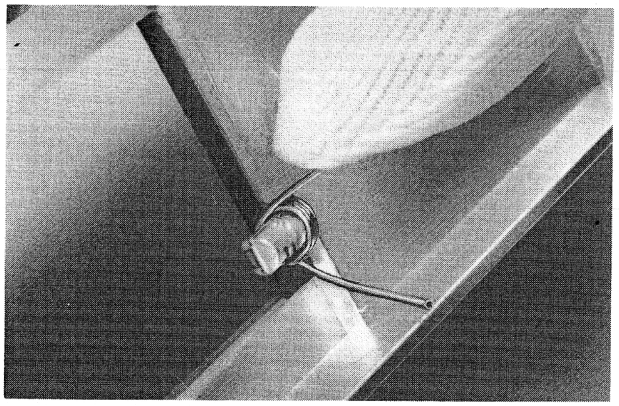
This section covers replacing the tape door and CRT window. Replacing the bezel and paper door are covered in the *HP 85 Assembly Level Service Manual.*

CAUTION!

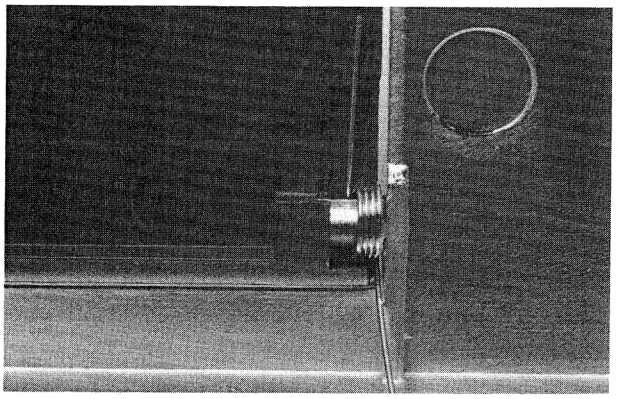
Wear clean gloves while replacing parts of the top case and bottom case assemblies. If the metallized inside surface of the top case is contaminated with grease or dirt, the EMI (electromagnetic interference) characteristics of the computer may be degraded.

To replace the tape door and/or tape door spring:

1. Open the door and push it out from the inside.
2. Place the new spring onto the bezel pin with the arms of the spring toward the top of the top case. Bend the outer arm of the spring inward until it is about 60 degrees 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.



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



To replace the CRT window:

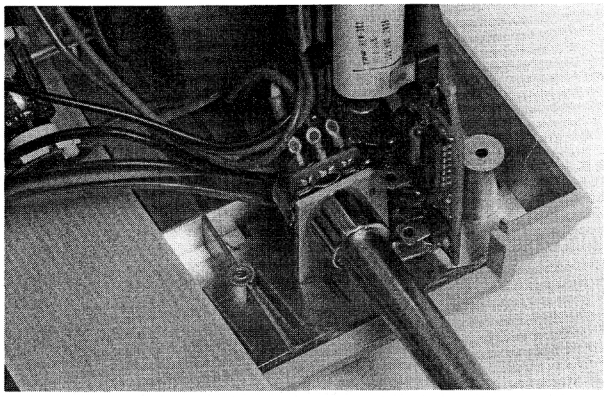
1. Press the top of the window out from the inside with your fingers in the top corners.
2. Place the wide lip of the new window over the ledge at the bottom of the bezel and press the top corners until the window snaps into place.

Replacing Parts of the Bottom Case

This section covers replacing the brightness control. Replacing the power light and speaker is covered in the *HP 85 Assembly Level Service Manual.*

To replace the brightness control:

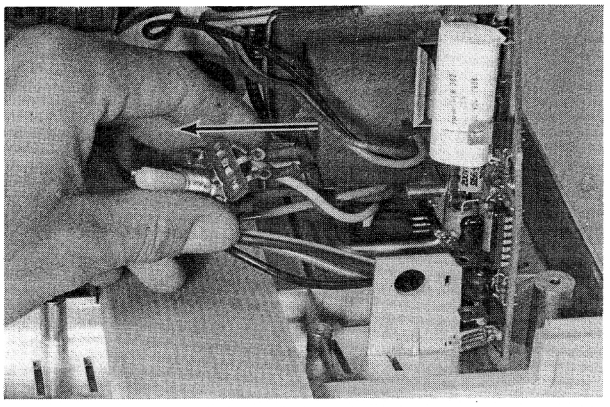
1. Remove the back panel assembly.
2. Remove the nut securing the brightness control to its mounting post in the bottom case. Use a ½-inch nut driver.



CAUTION!

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

3. Push the shaft of the control through the hole in its mounting post. Pull the control to the left until its plug comes off the connector.



4. Insert the plug of the new control over the CRT frame. Engage the top of the connector pins into the plug, then press the plug onto the connector with your finger.
5. Insert the shaft of the new control into the hold in its mounting post. Be sure that the locating tab on the control enters the slot in the post. Insert and tighten the nut securing the control to the post.

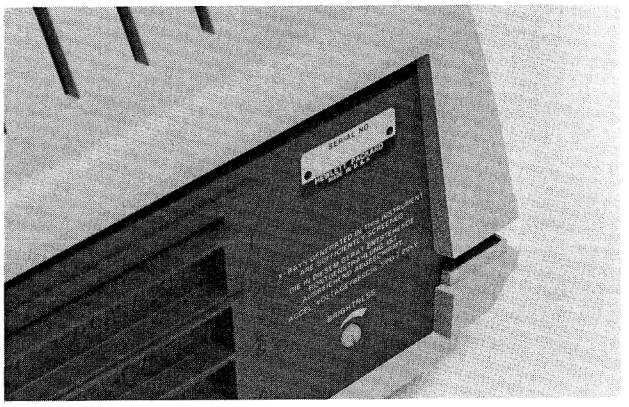
Attaching the Top Case to the Bottom Case

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

2. Place the top case in position on the bottom case with the back panel just inside the top case. Wiggle the top case and gently press it down until the cases close together.



3. Replace the tape ejector bar.
4. Insert and tighten the six screws in the bottom case.
5. Insert the paper tear bar into the printer positioned with the beveled edge up and the ledge forward.
6. Run the Keyboard Test from the service ROM to ensure that the keyboard is aligned properly. If a key catches on the top case, loosen the four screws securing the keyboard hinges to the keyboard PCA and adjust the position of the keyboard.

STOP!

Stop now and take Quiz 6. When you've passed the quiz, do Lab Project 6. Then, proceed to Lesson 5.

Quiz 6

Disassembly/Assembly

(10 points per correct answer unless otherwise indicated, total = 100)

1. List the five assemblies connected to the logic PCA by ribbon cables. (5 points per answer)

   a. _____ c. _____

   b. _____ d. _____

   e. _____

2. True ____ or False ____? The printer assembly must be removed in order to remove the tape drive assembly.

3. Two parts of the printer mechanism that can be replaced separately are _____ and _____.

4. (5 points) If the motor/capstan assembly is replaced, a/an _____ is needed to check the circuitry on the tape drive PCA.

5. If necessary, phototransistor _____ is adjusted by checking test point _____ on the tape drive PCA during the _____ portion of the Tape Speed Test.

6. The _____ Test should be run after the top case is replaced.

Correct Quiz 6 now using Appendix E.

Then proceed to Lab Project 6.

Lab Project 6

Disassembly/Assembly

In this lab project, you will disassemble the I/O PCA, the back panel assembly, and parts of the top case and bottom case. Then you will reassemble the computer.

____ 1. Read the preceding pages.

____ 2. Remove the I/O PCA.

____ 3. Remove the back panel assembly.

____ 4. Install the back panel assembly.

____ 5. Install the I/O PCA.

____ 6. Ensure that all ribbon cables are properly inserted in the appropriate connectors.

____ 7. Replace the keyboard assembly.

____ 8. Install the top case over the bottom case.* However, don't fasten the screws that hold them together, since you'll be removing the top case again in Lesson 5.

____ 9. Run the Keyboard Test from the Service ROM.

*At this point, you shouldn't have any parts left over. If you do, someone goofed—either you or the author!

Troubleshooting

Lesson 5

Overview

This lesson teaches you how to isolate a problem to an assembly or subassembly that can be replaced without soldering. During this lesson, you will learn to apply the results of the Service ROM tests and observed failures to isolating the cause of a failure.

Lesson 5 refers to a number of tables in the *HP 85 Assembly Level Service Manual* and in Appendix C of this manual. You will be using information in these tables in a series of lab projects that provide you with hands-on troubleshooting experience. You will also have the opportunity to install bugs or failures into the system so that you can observe the symptoms.

Learning Objectives

After completing Lesson 5, you should be able to:

- Perform assembly level repairs on the computer.
- Identify assembly failures by observation of the service ROM tests and malfunctions.
- Isolate and repair certain subassembly failures.

Learning Activities

So far, you have learned how to run the Service ROM tests and to dismantle and reassemble the computer. If you are not comfortable yet at performing these tasks, review lessons 3 and 4 before proceeding. You will probably need to refer to the procedures outlined in those lessons as you perform the labs. However, a familiarity with the testing and disassembly/assembly instructions presented in those lessons will guide you to the portion of the material containing the details you need.

Each of the 23 major ICs is mounted in a socket to avoid the need for soldering. Most of these ICs are located on the logic PCA; five are located on the CRT PCA, and one each is located on the printer/PS and tape drive PCA. Having completed Lesson 4, you should be able to identify and locate all computer ICs. If necessary, review Lesson 4 or refer to Appendix A-2 and A-4 and to Appendix C-1 or D-2.

As you proceed through Lesson 5, perform all troubleshooting lab projects and run the applicable tests to verify proper computer operation. Follow the instructions for installing the bugs into the computer and use the service ROM tests to record the symptoms and isolate the problem. Finally, if possible, have another qualified technician install bugs found in the troubleshooting tables so that you can repair those "unknown" bugs.

At times, you'll be referred to the *HP 85 Assembly Level Service Manual* for additional information. Feel free to consult that manual at other times too as you work on the lab projects. A familiarity with the contents and organization of the Service Manual will be invaluable to you later on.

CAUTION!

Make sure that the bench set up for troubleshooting and repair has adequate electrostatic protection; otherwise, ICs could be damaged.

An Overview of Troubleshooting

In general, troubleshooting includes the following procedures:

1. Set up the computer as described in Lesson 2. If the computer does not power-up properly (if no service ROM message appears), the cause of the failure must be isolated before the System Test can be run. Certain keyboard failures also must be isolated and repaired prior to running the System Test.
2. When the Service ROM message appears, run the System Test.
3. Replace any bad ICs identified by the service ROM. After replacing an IC, run the individual service ROM test for that IC to verify that the replacement has corrected the problem. If the computer won't turn on after you replace an IC, make sure that the new IC was inserted properly.
4. 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, and the PCA should be replaced.
5. For some problems, the Service ROM will not identify a cause. However, an IC or part of an assembly may need to be replaced. This lesson will cover how to isolate those problems.
6. When a power supply, clock, bus, control, or PWO line is bad, or when the Service ROM indicates that a controller IC is bad, check the assembly's ribbon cable to make sure that the cable is properly inserted in the connector.
7. If the computer has an intermittent problem, attempt to reproduce it by running the Cycle Test or by writing and running a BASIC program containing a loop of one or more tests.
8. After you've corrected all problems and have reassembled the computer, run the System Test.

Troubleshooting Tips

The following list of hints should be helpful to you in troubleshooting the HP 85:

- Never connect GND/H to GND/L. (True only for the HP-85A.)
- If the −5V power supply goes bad, it could damage the print-head.
- The hole in each ribbon cable connector does not necessarily mean that the adjacent hole is pin 1.
- After running a unit for a time, touch the ICs with your finger. Any ICs that are excessively hot to the touch should be suspected as the possible cause of the failure. Try replacing those ICs one at a time and see if the replacement solves the problem.
- When removing or replacing a PCA, always perform a quick examination of it, looking for cracks or hairline fractures, chipped or damaged components, evidence of heat damage (charring, boiled or melted resin), and loose solder connections. If any of these conditions exist, replace the PCA.
- Check for socketed ICs with bent pins.
- Troubleshooting is facilitated by using extender cables to substitute a good assembly for the one in the computer without removing it. If the substitution solves the problem, replace the entire assembly or the part of the assembly to which you isolate the problem.

WARNING!

When substituting a new CRT assembly 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, toward the rear of the computer) after the power is turned off. If this happens, discharge the 800V before reconnecting the plug by shorting the pin to the CRT frame with a well-insulated screwdriver.

- Frequently, a computer is received for repair with a message from the customer describing the problem. Whenever possible, use this information to narrow down the possible cause of the failure.

STOP!

Stop now and take Quiz 7. Continue on with Lesson 7 when you've passed the quiz.

Quiz 7

Troubleshooting

(10 points per correct answer unless indicated otherwise, total = 100)

1. True ____ or False ____? GND/H should be connected to GND/L.

2. What part of the printer could be damaged if the −5V power supply is defective?

   _____

3. (5 points each). Whenever a PCA is removed or replaced, you should make a quick examination. List four things you should look for.

   a. _____

   b. _____

   c. _____

   d. _____

4. List two types of failures which must be isolated before the System Test can be run.

   a. _____

   b. _____

5. (5 points each). If the service ROM indicates that an IC is bad, but replacing it results in the same message, you should check that all _____, _____, _____, and _____ are present at the IC pins.

6. Describe a method that can be used after a unit has been on for some time for identifying bad ICs.

   _____

   _____

7. (5 points each). List two methods for reproducing an intermittent problem.

   a. _____

   b. _____

Correct Quiz 7 now using Appendix E.

Keyboard Problems

If the keyboard is not functioning properly, you may not be able to run the System Test from the Service ROM. If any of the following occur while attempting to start the System Test, refer to the discussion of Keyboard Test Diagnosis in this lesson:

- The message RETURN TO BASIC SYSTEM appears.
- The message KEY STUCK appears.
- The message NO KEY appears.
- There is no response to pressing any key.
- The wrong Service ROM test is performed when you press a key.

When you've performed the repair procedure, power up the computer again and, upon receiving the Service ROM message, proceed with the System Test.

Failure to Power-Up

If no Service ROM message appears within 15 seconds after power-on, the computer is not powering up properly.

- If the computer beeps once, watch the display while you switch the computer off and immediately on again. If no message appears this time, replace the CPU.
- If the message CPU BAD!, RAM CONTROL BAD!, RAM n BAD!, or ROM n BAD! appears, replace the specified IC. Refer to Appendix C-1 for the reference designation of the IC identified by the message.
- If the message CPU BAD! n OR RAM BAD! appears, refer to paragraph 2-25 of the *HP 85 Assembly Level Service Manual* for instructions on isolating the problem. Lab Project 7 covers RAM failures.
- If the computer does not beep and no messages appear, the computer is not powering on properly. This problem could be caused by any of the conditions listed on page 3-1 of this manual. To troubleshoot this type of failure, use the procedure detailed in Lab Project 8. If necessary, refer to the following discussions in the *HP 85 Assembly Level Service Manual:*

  PWO Failure Isolation—paragraphs 2-29 and 2-30

  Clock Failure Isolation—paragraphs 2-31 and 2-32

  Control and Bus Line Failure Isolation—paragraphs 2-33 through 2-35

STOP!

Stop now and do lab projects 7 and 8.

Lab Project 7

Troubleshooting

In this lab project, you will purposely cause RAM failures and observe the resulting error messages.

____ 1. Turn off the computer. Install the Service ROM.

____ 2. Remove the top case. Remove the screws holding the keyboard assembly in place. Tilt the keyboard forward and prop it in position with a pencil so that you have access to the logic PCA.

____ 3. Locate and remove RAM IC 0. Turn on the computer. What error message appears?

_____

The character following the message indicates which RAM IC is bad. Refer to Appendix C-10.

____ 4. Turn off the computer. Locate and remove RAM IC 7. Turn on the computer. Indicate the character following the error message.

_____

If the character following the message is underlined, both RAM 7 and the RAM IC indicated by Appendix C-10 are probably bad.

____ 5. Turn off the computer. Locate and remove RAM IC 1. Turn on the computer. Indicate the character following the error message.

_____

Look up the character in Appendix B-1. The binary code corresponding to the character shown indicates which RAM IC is bad. The leftmost bit 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 RAM IC is probably OK.

____ 6. Turn off the computer. Replace all RAM ICs. Note the proper orientation of each IC before you insert it in the socket.

____ 7. If you will NOT be doing Lab Project 8, reassemble the keyboard and top case. Otherwise, continue on to Lab Project 8.

Lab Project 8

Troubleshooting

In this lab, you will perform procedures for troubleshooting a no turn-on failure. These are the steps you follow if you encounter this type of failure in a customer's unit.

___ 1. Remove the top case. Remove the keyboard assembly and Service ROM.

___ 2. Remove the ribbon cables and check the power supply lines at the ribbon cable connectors of the printer/PS PCA (J1, J2). Refer to Appendix B-5 for the test point and acceptable range for each power supply line. (Pin 1 is at the narrow tip of the printer/PS PCA.) Record your actual measured values.

+12V _____ +6V _____ +5V _____

−12V _____ −5V _____

If any line is out of range, refer to Table 2-3 in the *HP 85 Assembly Level Service Manual* and replace the ribbon cable.

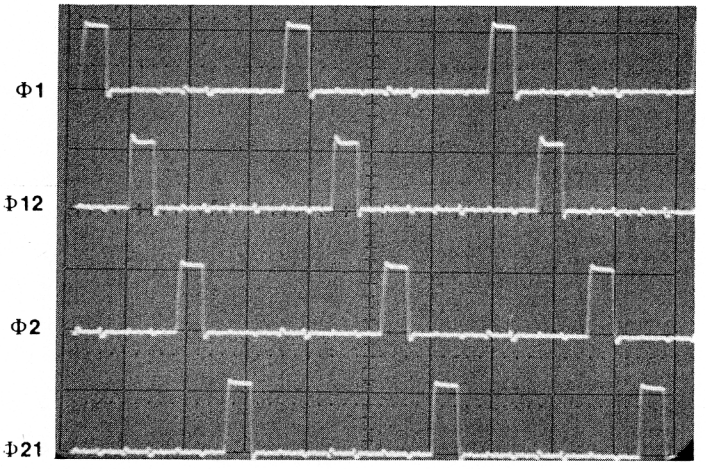
Optional

___ 3. 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 and Table 2-4 in the *HP-85 Assembly Level Service Manual.*

Optional

___ 4. Check the clock lines at the ribbon cable connectors on the CRT PCA. Refer to Appendix B-5 for the clock test points; they should look like the waveform in figure below.

If any clock line is bad, refer to paragraph 2-31 in the *HP 85 Assembly Level Service Manual.*



Time Base = 0.5 μsec/div.

Vertical Gain = 10V/div.

___ 5. Check power supply, PWO, and clock lines at the socket of the CPU. See Appendix A-4 for pinout.

Vdc	Pin Number(s)	Measurement
+12V		
+6V		
−5V		

If any lines are bad, you must remove all the ICs from the logic PCA and install them into a new logic PCA, which is then installed into the computer. If the problem persists, replace the CPU.

Optional

____ 6. Use an oscilloscope to check the control and bus lines at the pins of the CPU. See Appendix A-4 for pinout of LMA, RD, WR, and B0 through B7. Each line should be toggling between 0V and 6V. With the oscilloscope, you can verify only that they are toggling, since the lines are asynchronous. If any line is bad, refer to paragraph 2-33 in the *HP 85 Assembly Level Service Manual.*

Optional

____ 7. 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 Appendix A-4 for the pin numbers for each line. If a line is bad, remove all ICs from the logic PCA, install them on a new circuit board, and install the new logic PCA into the computer.

READ STEPS 8 THROUGH 11. HOWEVER, DO NOT DO THEM UNLESS YOU ARE TROUBLESHOOTING AN ACTUAL NO TURN-ON PROBLEM.

____ 8. Replace (one at a time) ROM 0, the RAM controller, then each RAM IC.

____ 9. Replace the I/O buffer IC.

____ 10. 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 PCA that has the bad connector.

____ 11. Remove the Service ROM and try a different service ROM.

Troubleshooting with the System Test

If the System Test finds a bad IC, it issues a message identifying the IC and skips to the next test. To determine the reference designation of the IC, refer to Appendix C-1. If the test indicates that more than one IC is bad, replace the indicated ICs one at a time, running the System Test after each replacement until the test can be run successfully.

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 Appendix A-2 or A-4 for the pin number for each line. The acceptable values for the power supply, PWO, and clock lines are listed in Appendix B-5.) If any line is bad, remove all the socketed ICs from the PCA, install them on a new circuit board, and install the new PCA into the computer.

If the computer appears to "die" during any test, use Appendix C-1 to determine the last IC for which a message appeared. Replace the next IC listed. The RAM ICs and CRT RAM ICs are tested simultaneously as a group. If the computer goes dead during RAM tests, replace each IC in the group one at a time until the computer passes that test.

ROM and RAM Test Diagnosis (HP 85A only)

If the message RAM n BAD! still appears after you replace the indicated RAM IC, replace the RAM controller.

If the ROM n BAD! message is followed by the letter C, replace the following ICs one at a time, running the System Test after each replacement, until the test is passed:

- The ROM indicated in the message.
- The next numbered ROM (for a ROM 3 BAD! message, the RAM controller).

Beeper Test Diagnosis

If the beeper is not operating properly, try replacing the keyboard controller. If this does not correct the problem, replace the speaker.

CRT Test Diagnosis

If the message CRT RAM N BAD! still appears after you replace the indicated IC, or if any character in the CRT test pattern is not displayed correctly, replace the CRT controller. Replace the CRT assembly if any of the following occur:

- The CRT screen does not go blank at Step 4 of the CRT Test.
- The CRT does not go entirely white at Step 5 of the CRT Test.
- The CRT pincushion test pattern is not displayed, or if the display is pincushioned (discussed below). If the lines in the pincushion test pattern are straight, but the pattern is skewed, incorrectly centered, or distorted horizontally or vertically, or if the screen of Bs is out of focus, refer to "CRT Adjustments" section in this lesson.

  To check whether the display is pincushioned, position the CRT test pattern overlay on the screen so that the overlay is centered on the screen. Use transparent tape to attach the overlay to the CRT. When the pincushion test pattern appears, pause the test by pressing any key. Check whether the four outside lines of the test pattern fall between the two parallel light lines on the overlay. If any line is so curved that you can't see all of it between the overlay lines in any viewing position, then the CRT assembly is pincushioned and should be replaced.

If any of the following occur (and the lines in the pincushion test pattern are straight), make the appropriate adjustments to the CRT assembly, described in "CRT Adjustments" section in this lesson.

- The CRT pincushion test pattern is skewed.
- The pincushion test pattern is incorrectly centered horizontally or vertically.
- The height or width of the pincushion test pattern is incorrect.
- The CRT test pattern consisting of a screen filled with B's is not focused correctly.

STOP!

Stop now and do Lab Project 9. Continue on with lesson 5 when you've completed the lab.

Lab Project 9

Troubleshooting

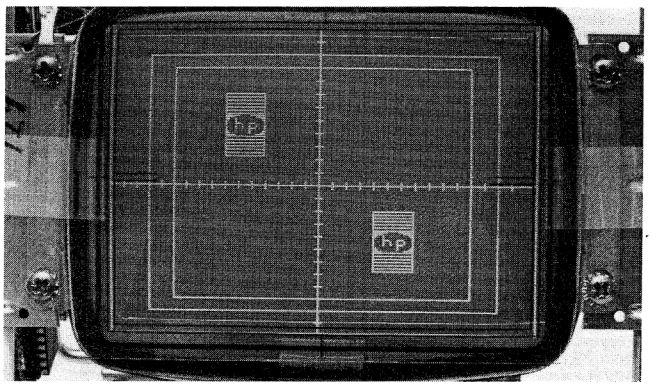
In this lab project, you will perform the procedure to check for CRT pincushioning.

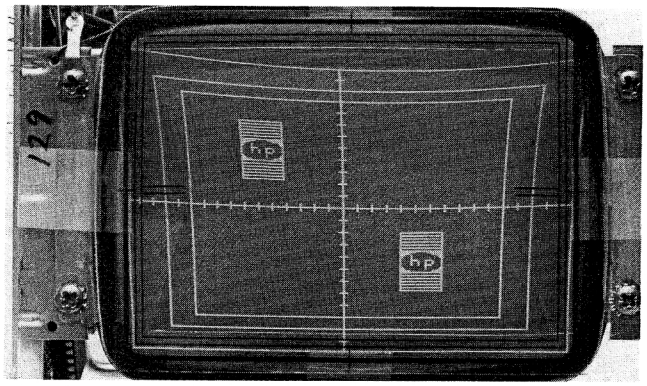
____ 1. Turn off the computer. Install the Service ROM. Remove the top case.

____ 2. Place the CRT test pattern overlay on the CRT screen so that it is centered. Use transparent tape to attach the overlay to the screen.

____ 3. Run the CRT test. When the pincushion test pattern appears, pause the test by pressing any key.

____ 4. Check whether the four outside lines of the test pattern fall between the two parallel light lines on the overlay. If any line is so curved that you can't see all of it between the overlay lines, then the CRT assembly has a pincushioning problem (as in the right-hand photo below) and must be replaced.





Printer Test Diagnosis

The computer must pass the CPU, RAM, and ROM Tests before the Printer Test can be run. If any of these 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 Printer Test.

The Printer Test checks part of the printer controller and provides a test printout. You can identify symptoms of printer malfunctions by observing the printout and the printer in operation. Appendix C-4 to 8 lists troubleshooting procedures for the symptoms you are most likely to encounter. You can use that table, together with the discussion of printer adjustments later in this lesson, to identify and repair malfunctions.

Abbreviated Tape Test and Tape Write-Protect Test Diagnosis

If any of the following messages appear, you will need to troubleshoot the tape drive assembly:

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

It is essential that the computer pass the CPU, RAM, and ROM Tests before you run the Abbreviated Tape Test, since a tape drive problem could be caused by a failure of one of these components. When all three tests have been passed, you need only run the Abbreviated Tape Test to determine whether your repairs have corrected the tape drive failure. If the computer can read tape cartridges recorded on that computer but cannot read cartridges recorded on other computers, the tape head may be misaligned. In this case, the tape drive assembly must be replaced.

Appendix C-9/10 lists possible causes and repair procedures for messages that appear during the Abbreviated Tape Test, the Tape Write-Protect Test, and the individual tests in the Full Tape Test.

Instructions for cleaning the tape head and capstan are included later in this lesson. Refer to the *HP 85 Assembly Level Service Manual* for instructions on demagnetizing the tape head.

Timer Test Diagnosis

If the message TIMER BAD! appears, replace the keyboard controller on the HP 85A or the Logic PCA on the HP 85B.

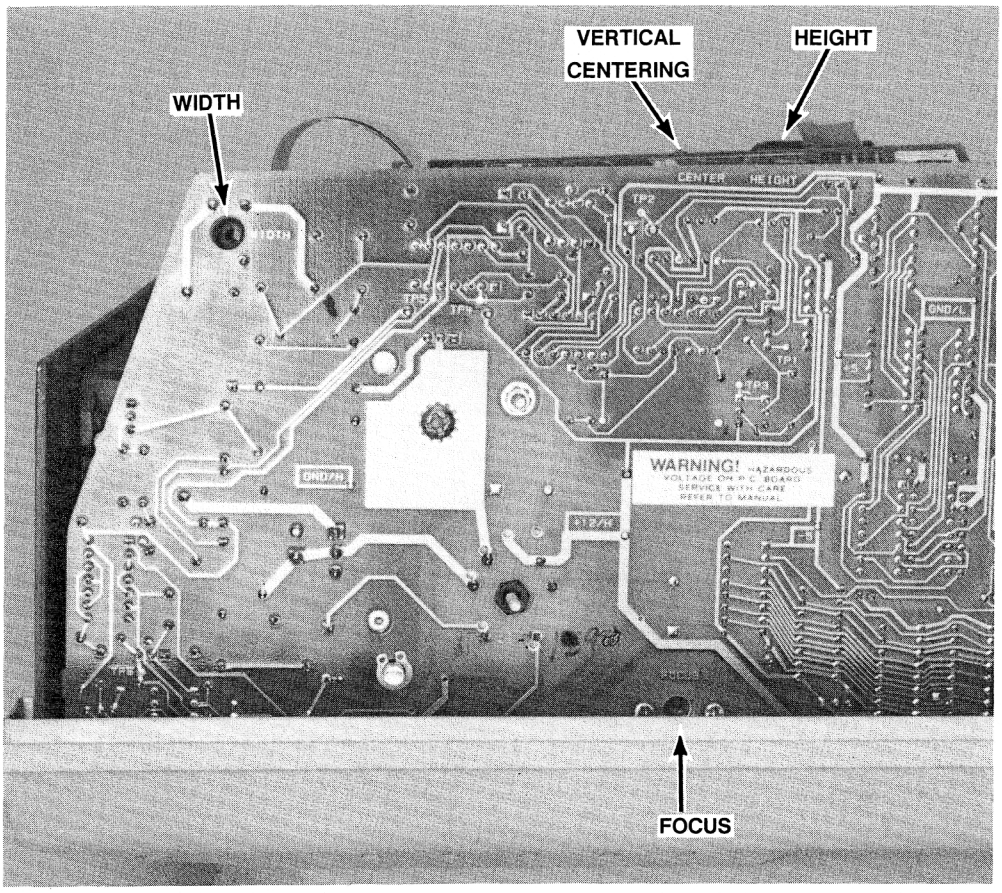
Keyboard Test Diagnosis

The computer must pass the CPU, RAM and ROM Tests before the Keyboard Test can be run. After those three tests have been passed, you need run only the Keyboard Test to check whether replacing a part has corrected a keyboard problem.

The keyboard test isolates a keyboard problem to the keyboard controller, the logic PCA, the keyboard PCA, the key plunger, or the key contacts. If the keyboard is not operating properly, one of the messages listed in Appendix C-2/3 appears at power-on or during the Keyboard Test. Refer to that table for troubleshooting procedures. To determine the key corresponding to the character entered following a KEY STUCK! or KEY BAD! message, refer to Appendix B-7. To determine the key expected from the mnemonic following certain other messages, refer to Appendix B-5/6. Keep in mind that a message showing a digit, period, or comma may indicate a key on the typewriter keyboard *or* on the numeric keypad.

Appendix C-2/3 provides detailed troubleshooting procedures. The following steps are a scaled-down procedure suitable for quick repairs in the field:

1. Make sure the ribbon cables from the keyboard PCA to the logic PCA are properly aligned in their connectors.
2. Try replacing the keyboard controller.
3. Try replacing the keyboard assembly.
4. Try removing all ICs from the logic PCA and installing them into a new board, which is then installed into the computer.



CRT Adjustments

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, horizontal and vertical centering, width, brightness, height and focus. The locations of the coil and the potentiometers used for CRT adjustments are shown above. The locations of the magnets which are adjusted for horizontal centering and the screw for adjusting the yoke are shown in photographs accompanying those steps.

WARNING!

Lethal voltages may be present on the CRT assembly while power is on and 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.

To set up the CRT assembly for adjustments, attach the CRT test pattern overlay to the screen, run the CRT test from the service ROM, and pause it with the pincushion test pattern on the display.

To correct skew:

1. Turn the brightness control fully counterclockwise to make the display blank.
2. Remove the socket connecting the vertical yoke to the CRT PCA. Short the vertical yoke as described in paragraph 5-9 of the service manual.

CAUTION!

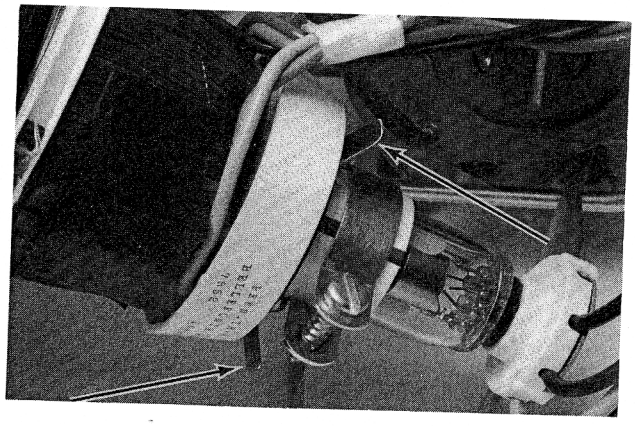
Do not turn the brightness up too far in the next step. Excessive brightness can permanently damage the CRT tube.

3. Turn the brightness control clockwise until you can clearly see the full width of the horizontal line and a dot at each end. Check for skew in the line. It should be parallel to the short, parallel, horizontal lines at the sides of the overlay. 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 line is properly positioned.
   c. Tighten the screw in the yoke clamp until you cannot easily rotate the yoke with your fingers. Check for skew in the line.
   d. Remove the wire shorting the vertical yoke, reconnect the plug to the CRT PCA, and adjust the brightness control for normal viewing.

To adjust horizontal centering:

Determine whether the left and right vertical lines in the test pattern are centered with respect to the vertical lines on the overlay. If not, adjust their position 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.

To adjust the width:

Check whether the left and right vertical lines in the test pattern fall between the pairs of narrow vertical lines at the sides of the overlay. If not, make sure the display is centered horizontally, and then adjust coil L1.

To check vertical centering and height:

Check whether the top and bottom lines of the test pattern fall between the two pairs of narrow horizontal lines on the overlay. If not, adjust their position as follows:

1. Adjust the vertical centering control until the top line of the test pattern falls betwen the two narrow horizontal lines at the top of the overlay.
2. Adjust the height control 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.

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.

To adjust the focus:

Obtain the test pattern with all B's. Adjust the focus control until the B's in the center of the screen are sharp.

STOP!

Stop now and do Lab Project 10. When you've completed that lab, continue on with Lesson 5.

Lab Project 10

Troubleshooting

In this lab, you will make CRT adjustments. During steps 3 through 7, vary the settings for each adjustment and then make the appropriate corrections.

____ 1. Read the previous discussion of CRT adjustments. Return to the appropriate discussion as you make adjustments.

____ 2. Attach the CRT test pattern overlay to the screen, run the CRT Test from the service ROM, and pause it with the pincushion pattern on the display.

____ 3. Adjust skew.

____ 4. Adjust horizontal centering.

____ 5. Adjust width.

____ 6. Adjust vertical centering and height.

____ 7. Adjust focus.

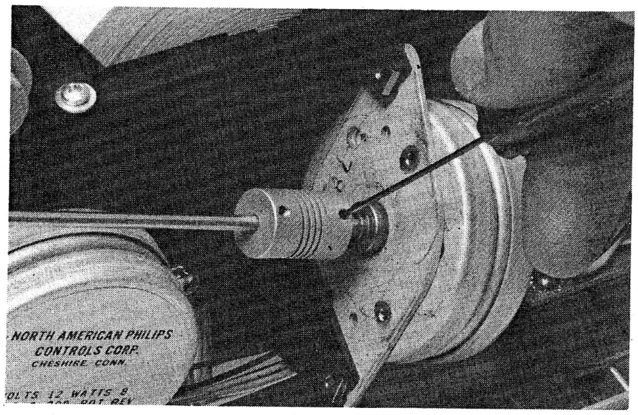
____ 8. Turn off the computer and remove the CRT test pattern overlay.

Printer Adjustments

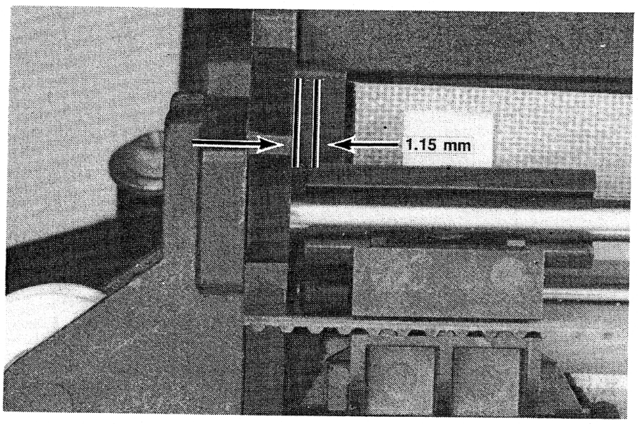
This discussion includes instructions for setting the print-head home position and adjusting the drive belt and paper advance belt. "Home" position is the position of the print-head at the left end of a printed line. Setting home position is necessary when the troubleshooting table indicates this is the case, or whenever the print-head has been removed from the drive belt, the print-head motor has been disconnected from the print-head drive shaft, or when the setscrew in the flexible coupling on the drive shaft has been loosened.

To set home position:

1. Turn off the computer.
2. Ensure that the print-head drive belt is inserted in the print-head carriage.
3. Loosen the setscrew in the flexible coupling nearest the print-head motor using a 0.050-inch hex key.



4. Push the print-head carriage to the left until it is 1.15mm (about 0.05 inch) from the rubber bumper on the guide rod. Turn the computer on.



5. Type PRINT "" [END LINE]. Move the cursor up one line and press [END LINE] again. The print-head should be in home position.
6. Tighten the setscrew in the coupling without rotating the drive shaft.
7. Type:

   PRINT "BBBBBBBBBBBBBBBBBBBBBBBBB BBBBBBB" [END LINE]

   There should be space between the print-head carriage and the right rubber bumper. If the carriage is touching the bumper, repeat the procedure from Step 4.
8. Move the cursor up one line and press [END LINE]. Make sure there is space between the carriage and the left bumper. If the carriage is touching the bumper, return to Step 4.
9. Switch the computer off, then on. Type PRINT "" [END LINE] twice, checking the position of the carriage each time. If the carriage touches the bumper, return to Step 4.

The drive belt must be adjusted whenever troubleshooting indicates this is the case, or whenever the belt is removed or replaced.

To adjust the print-head drive belt:

1. Set the printer intensity to 4.
2. Type:

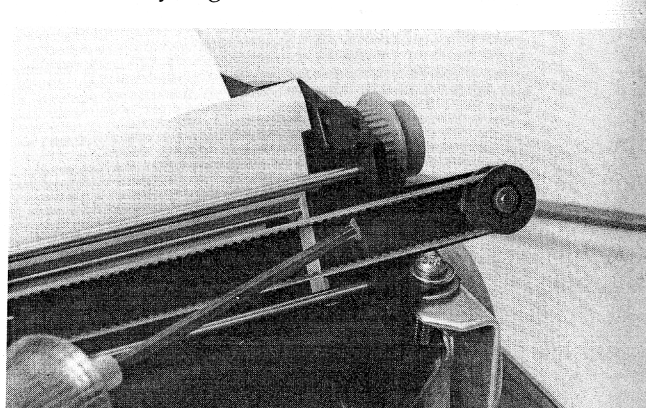
   10 PRINT "H"; @ GOTO 10 [END LINE] [RUN]

   Watch the right pully to see if slack is visible when the print-head is moving from right to left. Visible slack indicates the belt is too loose.

   When approximately 10 lines have been printed, press [PAUSE].
3. Check the middle 5 columns of printout. When the belt is properly adjusted, the offset from line to line is less than 2/3 the width of a printed dot. If the belt is too loose (offset with visible slack), it is first tightened until it is too tight, and then loosened to its proper tension. If the belt is too tight, it is loosened.

If the belt is too loose, tighten it:

a. Insert a 7/64-inch ballpoint hex screwdriver into the cap screw at the right side of the printer.
b. Turn the screwdiver clockwise 1/6 of a revolution.
c. Press [CONT] and observe the tension. If necessary, tighten the belt further.



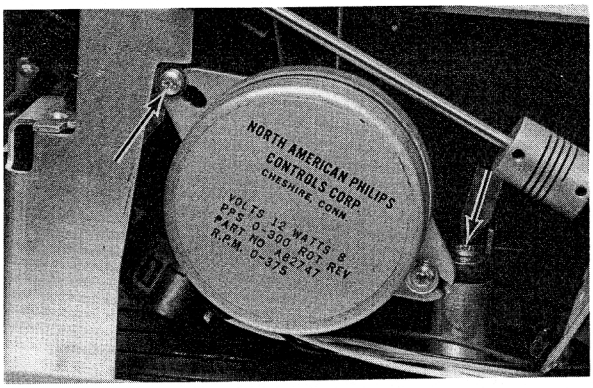
When the belt is too tight:

a. Insert the screwdriver and turn it counterclockwise 1/6 of a revolution.
b. Press [CONT] and observe the tension.
c. Repeat steps a and b until the belt is too loose, counting the number of revolutions of the screw. When the belt is too loose, turn the screw clockwise 1/3 to 1/2 the number of revolutions you turned it counterclockwise.

The paper advance belt must be adjusted whenever troubleshooting indicates this is the case or whenever the paper-advance motor is removed.

To adjust the paper-advance belt:

1. Loosen the two screws securing the paper-advance motor to the printer.



2. Slide the motor until the belt deflects approximately 1/4 inch when you press midway on the rear portion of the belt.
3. Tighten the two screws while holding the motor in place.

Tape Drive Adjustments

This section covers:

- Cleaning the tape-head and capstan. The tape-head and capstan should be cleaned whenever a READ error occurs or when they appear dirty.
- Adjusting phototransistor CR1 on the tape drive PCA. This adjustment must be made whenever the motor/capstan assembly is replaced.

Cleaning the Tape-Head and Capstan

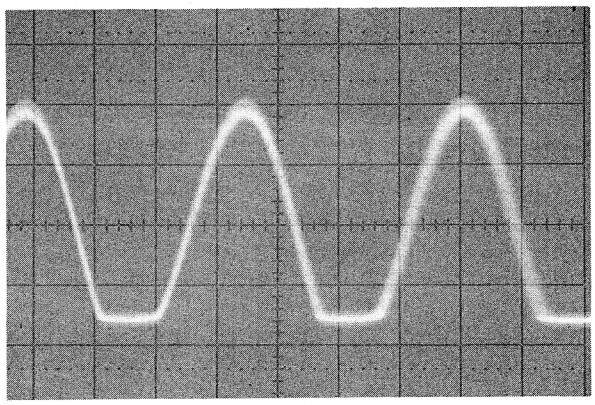
To clean the tape-head, wipe the surface of the tape-head in the left and right direction (not up and down) with a cotton swab moistened with isopropyl alcohol. Use the same motion to dry the head with a dry swab.

To clean the capstan, moisten a cotton swab with isopropyl alcohol. Run the Tape Speed Test with no cartridge inserted. Hold the swab at the left of the rotating capstan during the fast-forward phase. Allow the capstan to continue rotating until it is dry. If the surface appears pitted, the motor/capstan assembly should be replaced.

Adjusting Phototransistor CR1

Perform the following procedure whenever the motor/capstan assembly has been replaced.

1. Connect the tape drive assembly to the computer using extender cables.
2. Without a tape cartridge installed, run the Tape Speed Test. If the message TAPE STALLED appears, phototransistor CR1 must be adjusted.
3. Set the time base on an oscilloscope to 10 microseconds/division. Set the vertical gain to 2V/division and the coupling to AC. Adjust one position of the trace so that it falls under the center line on the oscilloscope graticule.
4. Check TP4 (uppermost of the three test points at the lower left corner of the tape drive PCA) during the fast-forward portion of the Tape Speed Test. 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, reposition phototransistor CR1 using a non-conducting tool. Adjust the position of CR1 with respect to the hole above CR1 in the motor/capstan assembly (left or right, up or down).



5. If repositioning CR1 does not eliminate the error, replace the entire tape drive assembly.

STOP!

Stop now and do Lab Project 11. When you've completed that lab, go on to Lesson 6.

Lab Project 11

Troubleshooting

In this lab, you will make adjustments to the printer and tape drive.

____ 1. Read the printer adjustment procedures in this lesson and return to the appropriate discussions as you do steps 2 through 4.

____ 2. Set home position.

____ 3. Adjust the print-head drive belt.

____ 4. Adjust the paper-advance belt.

____ 5. Read the tape drive adjustment procedures in this lesson and return to the appropriate discussions as you do steps 6 and 7.

____ 6. Locate and identify the tape-head and capstan.

Optional

____ 7. Adjust phototransistor CR1.

How to Keep It Running

Lesson 6

Maintenance of the HP 85 consists of keeping it clean. Dirt on the tape-head or capstan can cause errors in recording information onto tape. The top case, bottom case, keyboard and CRT should be kept clean for cosmetic reasons.

Additional care information is covered in the *HP 85 Owner's Manual and Programming Guide.*

WARNING!

Do not spill water inside the computer. The water could cause a shock hazard.

CAUTION!

Never use solvents of any kind on the top case, bottom case, keys, or CRT screen.

General Cleaning

The top case, bottom case, CRT screen and keyboard should be cleaned periodically with a soft cloth dampened with water or a solution of water and mild detergent. Do not use an excessively damp cloth, and do not let any water spill inside the computer. Do not use abrasive cleaners or solvents.

Printer

The printer mechanism does not require lubrication. It is recommended that the printer intensity dial be set to 4 or less to extend printer life. The paper well should be kept free of dust by cleaning it with a small, oil-free soft bristle brush and dust cloth each time the paper is replaced.

The printer platen and print-head should be examined and cleaned whenever the computer is serviced. To clean the platen, remove it according to the instructions in Lesson 4. Replace the platen if it is damaged. Otherwise, clean the platen by wiping the rubber surface with a clean cloth.

To clean the print head, remove the print-head assembly as described in lesson 4. Use a cotton swab to apply acetone to the print head; wipe the print head with a soft, clean cloth before the acetone has evaporated. Finally, set home position according to the directions in lesson 5.

Tape Drive

The tape-head and capstan should be cleaned after each eight hours of cumulative tape use. In dirty environments, more frequent cleaning may be necessary. Cleaning the tape head and capstan are discussed in Lesson 5.

Tape cartridges should be removed from the drive when the computer is not in use. If a cartridge is left in the drive too long, a flat spot may develop on the rubber wheel of the capstan, causing errors. The dent is temporary and can be corrected by conditioning the tape.

Tapes should be conditioned after every six to eight hours of use, or whenever the cartridge has been subjected to sudden environmental changes. A tape is conditioned by running it forward to the end of the tape and then backward to the beginning of the tape. To condition a tape cartridge, type:

```
CTAPE [END LINE]
```

Planning for Success

Preventive maintenance is also an important element of any support program, but how much is necessary? What type? When should it be scheduled? When should it be performed on an "as needed" basis? How much can the user do? These questions you must consider for your particular application and needs if you are to be successful in applying your new skills.

Up to this point in the training program you have focused on understanding and repairing the 85. Your progress through this program has been measured on your ability to understand the material presented and your troubleshooting expertise. While these are important aspects of product repair, they are only a single link in the overall repair and support process. Your true success can only be measured in the overall results of how well you keep the equipment running, not how well you understand the product or how fast you find the problem. Take, for example, the case of a defective fuse—isolating the problem quickly is of little value if you do not have a spare fuse. Having a large quantity of the wrong fuse neither increases the utilization of the equipment, nor helps you fix it faster. What then is a support program and how do you use it for your success?

Elements of a Support Program

A successful support program involves four (4) major elements:

1. Definition of the needs/requirements and expectations of the user.
2. Evaluation of the support resources available to meet the needs of the user.
3. Effective allocation of resources.
4. A mutually agreeable measurement system to record results.

The first element, "Definition of the needs," establishes the goals of the user. None of the key points can be addressed properly until the product application and need of the user is defined.

For instance, is the application one of monitoring on-line manufacturing processes, as in a production line system, or a less critical application in an engineering or research environment? These applications can require very different levels of support and resources. Further, the expectations of the users can vary dramatically.

Determining Need

To identify needs you should find answers to the following questions for each site or user you will support.

- What is the application of the product?
  Know how it is currently used and any new applications planned. These sometimes change the support requirements.
- What type of equipment is being used?
  Different products require more maintenance or interaction with other areas.
- How many hours/day is the equipment expected to be used?
  Will the system be expected to function 24 hours/day or something less?
  What about after hours?
- Are some times more critical than others?
  Most operations have critical times either daily, weekly or monthly when the operation must run. Find out!
- How long can the users or process be inoperable?
  It is important to establish alternate plans for critical times. Suggest alternatives for the user. Backup procedures, etc.

The User Requirements Worksheet on page 6-5 will help answer some of these questions and should be completed for each site and product that you will support.

For this program select one site you will support and answer the questions the way you feel the user would answer. (If you wish to use the worksheet for other sites you should make several copies before you complete the form.)

STOP!

Complete Steps 1 through 6 of the User's Requirements Worksheet located page 6-5.

Evaluating Resources

With steps 1 through 6 completed in the User Requirements Worksheet, you can begin to identify the resources required to meet the users needs in the areas of Response Time, Repair Time, and Planned Maintenance. These three key areas impact the overall system utilization. You should have a good understanding of each of these areas for your organization for normal working hours, after hours, weekends and holidays.

Response Time

Response time is a measure of the efficiency of the dispatching process. It is an issue that varies with each organization and location. Consider the effect of the following areas on response time for your organization.

Communication
Communication is important in any interaction with people. In response time it can mean long delays in responding to service requests or worse, missed service requests.

- How are requests for service received?
- Who received them?
- How are service personnel notified?
- What about after hours, weekends or holdiays?

Manpower Availability
Manpower is a difficult issue in any organization and it is not the intent of this program to suggest a simple solution. You must, however, understand what procedures are in place in your organization for available manpower. For example:

- How are service requests assigned?
- Can you leave immediately?
- What happens if you can't go immediately?
- Do you have a backup plan?
- What happens after hours?
- Weekends and holidays?

Parts/Tools Availability
This area is the most overlooked area of response time, but perhaps the most critical. If you don't have the proper parts and tools you must get them from somewhere before you can respond. Will they be carried by service personnel, stored in a central location, or will they be available once you arrive? What about access during normal working hours? After hours? Weekends/holidays? This can waste valuable time if parts are stored miles away from your current location.

User's Location
The user's location can definitely affect your ability to respond.

- Distance from support personnel.
- Geographic territory (mountains etc.).
- Travel time consideration (traffic etc.).
- Travel method (airplanes etc.).
- Security issues.

Check your situations! How does your organization handle each of these? What is your estimate of the time required for you to receive a service request? What do you feel your response time will be?

STOP!

Complete Section I of the Resource Analysis Worksheet on page 6-7.

Repair Time

Repair time is mainly a function of your ability to locate and solve the problem once you have arrived at the user's site. Other areas that impact your ability to repair the product are:

Product availability — Can you begin work on the system immediately once you arrive on site?
Parts availability — How do you get the part you need when you find the failing assembly?
Consulting Assistance — What about the times you can't isolate the problem? Who is your technical back-up?

STOP!

Complete Section II of the Resource Analysis Worksheet on page 6-11.

Planned Maintenance

The first portion of this lesson described the preventive maintenance (PM) procedures for the 85. You should understand that planned maintenance is a means to an end. Performing PMs 100% of the time would result in the equipment being utilized 0%. No PMs may cause unnecessary failures during critical operations. This raises several questions concerning preventive maintenance. What is a proper PM? How often should they be performed? The answer is dependent on three major factors:

- Product design.
- Environment.
- Equipment usage.

Any successful maintenance program must constantly evaluate each of these major areas to establish a Planned Maintenance program to fit the user's needs.

Product Design
The Hewlett-Packard 85 has been designed as a high-reliability, minimum-maintenance product. Under normal conditions it requires no scheduled maintenence. Still, you should evaluate the user's particular environment and usage situation to determine preventive measures for optimum product usage.

User Environment
What type of environment is the equipment subjected to. Is it a manufacturing facility? Computer room environment or office area? Is it subjected to high/low temperature extremes? Power fluctuation? Dirt? Caustic atmosphere, etc.? All of these affect the equipment utilization and should be monitored on a continuing basis.

Equipment Usage
Equipment usage involves the amount of time the specified product is used, i.e., 2 hrs/day, 10 hrs/day or 24 hrs/day, etc. Generally, the more the equipment is used the higher the probability that mechanical components may wear.

STOP!

Complete Section III of the Resource Analysis Worksheet on page 6-13.

With the Resource Analysis Worksheet completed, compare your capabilities to those identified in the User's Requirements Worksheet. What do you feel the measurement criteria should be?

Establishing a Measurement Program

One of the easiest and most comprehensive methods of measuring your results is equipment utilization or uptime. The uptime measurement allows an easy way to set user expectations and graphically identify potential problems or reduced performance.

Uptime Calculations
Many definitions and calculations exist for uptime. It is not important that only one definition or formula is correct. It is, however, important that once the criterion have been established that they not be changed.

The general formula for Uptime calculations is:

$$\text{Uptime \%} = \frac{\text{PPM-Downtime}}{\text{PPM}} \times 100$$

PPM = Principal Period of Maintenance per month determined by the number of hours service is provided.

Downtime = the amount of downtime during the covered period.

Table 6-1 shows PPM for typical applications.

Table 6-1

Hours of Service Coverage/day	# of days covered/week 5	6	7
8	174	208	242
12	261	312	363
16	348	416	484
24	522	624	728

Example:
Assume you provide support for a particular system or product for 8 hours/day, 5 days/week. (8:00 a.m. to 4:00 p.m. Monday through Friday.) Downtime is 6 hours total for the month of January.

$$\text{Monthly Uptime \%} = \frac{\text{PPM-Downtime}}{\text{PPM}} \times 100$$

$$\text{Monthly Uptime \%} = \frac{174-6}{174} \times 100$$

$$\text{Monthly Uptime \%} = 96.6$$

The uptime graph provided on page 6-14 and 6-15 can be used to record graphically the uptime results for both the site and service person.

STOP!

Complete Steps 7 through 11 of the User's Requirements Worksheet on pages 6-5 and 6-6.

User Requirements Worksheet

Date: _____ Prepared by: _____

1. a) User's description of application: (Name, purpose, etc: _____

_____

_____

Site Name: _____ Installation Location: _____

Contact Name: _____ Telephone Number: _____

b) Used in production of process control? Yes ____ No ____

c) As part of Network System? Yes ____ No ____

2. HP System Configuration: System Model _____ Memory Size_____

# of Discs _____ Model _____

# of Mag Tapes _____ Model _____

# of Line Printers _____ Model _____

# of CRTs _____ Model _____

Other Equipment _____

Types of modems: Manufacturer _____ SYNC _____ ASYNC _____ Model _____

3. Software used: HP _____ O.E.M. _____ Other _____

4. System Usage:

Hours:

_____5 days/week: 8 to 5 _____ 12 hours/day _____ 16 hours/day _____ 24 hours/day _____

_____7 days/week Other _____

5. Critical Periods: Days: (Circle appropriate days M T W TH F S S)

Hours: From: _____ to: _____ Days of Month: _____ Months of the year: _____

Other: _____

6. Maximum Down Time/Day:

_____Less than 1 hour _____4 hours _____10 hours _____12 hours Other _____

7. What service coverage is required to meet the System usage?

5 days/week _____ 7 days/week _____ Other _____

8 hrs/day _____ 12 hrs/day _____ 24 hrs/day _____ Other _____

8. What response time is required to meet the users requirements?

_____4 hours _____10 hours _____12 hours _____24 hours Other _____

9. Do you have a service contract with HP? _____No _____Yes

   Contract Number _____

   Type Contract(s):

   _____ Hardware _____ Software _____Cooperative

10. Service Information:

Location providing: _____	HP location providing: _____
Service Telephone # _____	HP Service Phone # _____
After Hrs Phone #: _____	HP After Hrs Phone # _____
Site Manager: _____	HP District CE Manager: _____
Trained Service Personnel: _____	HP Account CE: _____

11. Special Considerations:

_____

_____

_____

_____

_____

_____

Resource Analysis Worksheet

Section I

Response Time Analysis

Communication System

A. Normal Working Hours

1. How are service requests received/recorded?
   ☐ Central location ☐ Other _____
2. Requests are recorded by: ☐ Secretary ☐ Dispatcher
   ☐ Service Personnel ☐ Other _____
3. How are service personnel notified? ☐ Pager ☐ Phone Message
   ☐ Wait for call in ☐ Other _____
4. Estimated average amount of time required to notify service personnel of a pending service request:
   _____ hours

B. After Hours

1. How are service requests received/recorded?
   ☐ Central location ☐ Other _____
2. Requests are recorded by: ☐ Secretary ☐ Dispatcher
   ☐ Service Personnel ☐ Other _____
3. How are service personnel notified? ☐ Pager ☐ Phone Message
   ☐ Wait for call in ☐ Other _____
4. Estimated average amount of time required to notify service personnel of a pending service request:
   _____ hours

C. Weekends/Holidays

1. How are service requests received/recorded?
   ☐ Central location ☐ Other _____
2. Requests are recorded by: ☐ Secretary ☐ Dispatcher
   ☐ Service Personnel ☐ Other _____
3. How are service personnel notified? ☐ Pager ☐ Phone Message
   ☐ Wait for call in ☐ Other _____
4. Estimated average amount of time required to notify service personnel of a pending service request:
   _____ hours

Manpower Availability

A. Normal Working Hours

1. How are service requests assigned? ☐ Designated Service Personnel
   ☐ Next Available Service Person ☐ Other _____

2. Can you respond immediately? ☐ Yes ☐ No

   If no, what happens? _____

3. Do you have a backup plan? ☐ No ☐ Yes: What is it?

   _____

4. Estimated average amount of time before service person is available: _____ hours

B. After Hours

1. How are service requests assigned? ☐ Designated Service Personnel

   ☐ Next Available Service Person ☐ Other _____

2. Can you respond immediately? ☐ Yes ☐ No

   If no, what happens? _____

3. Do you have a backup plan? ☐ No ☐ Yes: What is it?

   _____

4. Estimated average amount of time before service person is available: _____ hours

C. Weekends/Holidays

1. How are service requests assigned? ☐ Designated Service Personnel

   ☐ Next Available Service Person ☐ Other _____

2. Can you respond immediately? ☐ Yes ☐ No

   If no, what happens? _____

3. Do you have a backup plan? ☐ No ☐ Yes: What is it?

   _____

4. Estimated average amount of time before service person is available: _____ hours

Parts/Tools Availability

A. Normal Hours

Parts Availability

Parts Available: ☐ On-Site ☐ Carried by Service Personnel

☐ Other _____

Tool Availability

Standard Tools: ☐ On-Site ☐ Carried by Service Personnel

☐ Other _____

Estimated average amount of time required to pick-up parts and tools per call: _____ hours

B. After Hours

Parts Availability

Parts Available: ☐ On-Site ☐ Carried by Service Personnel

☐ Other _____

Tool Availability

Standard Tools: ☐ On-Site ☐ Carried by Service Personnel

☐ Other _____

Estimated average amount of time required to pick-up parts and tools per call: _____ hours

C. Weekends/Holidays

Parts Availability

Parts Available: ☐ On-Site ☐ Carried by Service Personnel

☐ Other _____

Tool Availability

Standard Tools: ☐ On-Site ☐ Carried by Service Personnel

☐ Other _____

Estimated average amount of time required to pick-up parts and tools per call: _____ hours

User's Location

A. General

1. Estimated distance to user's site: _____ miles
2. Geographic territory: ☐ City ☐ Mountainous ☐ Rural ☐ Other _____

B. Normal Working Hours

1. Travel method used: ☐ Car ☐ Walk ☐ Airplane ☐ Van ☐ Other _____
2. Estimated travel time: _____ hours
3. What type of security clearance is necessary? ☐ None ☐ Pass
   ☐ Special ☐ Other _____
4. Estimated time delay for acquiring security access to site: _____ hours

C. After Hours

1. Travel method used: ☐ Car ☐ Walk ☐ Airplane ☐ Van ☐ Other _____
2. Estimated travel time: _____ hours
3. What type of security clearance is necessary? ☐ None ☐ Pass
   ☐ Special ☐ Other _____
4. Estimated time delay for acquiring security access to site: _____ hours

D. Weekends/Holidays

1. Travel method used: ☐ Car ☐ Walk ☐ Airplane ☐ Van ☐ Other _____
2. Estimated travel time: _____ hours
3. What type of security clearance is necessary? ☐ None ☐ Pass
   ☐ Special ☐ Other _____
4. Estimated time delay for acquiring security access to site: _____ hours

Response Time Analysis Summary

A. Normal Working Hours

Estimated average amount of time required to notify service personnel:	_____ hours
Estimated amount of time before service person is available:	_____ hours
Estimated amount of time to pick-up parts and tools:	_____ hours
Estimated travel time:	_____ hours
Estimated time delay for security access to site:	_____ hours
Total Response Hours:	_____ **hours**

B. After Hours

Estimated average amount of time required to notify service personnel:	_____ hours
Estimated amount of time before service person is available:	_____ hours
Estimated amount of time to pick-up parts and tools:	_____ hours
Estimated travel time:	_____ hours
Estimated time delay for security access to site:	_____ hours
Total Response Hours:	_____ **hours**

C. Weekends/Holidays

Estimated average amount of time required to notify service personnel:	_____ hours
Estimated amount of time before service person is available:	_____ hours
Estimated amount of time to pick-up parts and tools:	_____ hours
Estimated travel time:	_____ hours
Estimated time delay for security access to site:	_____ hours
Total Response Hours:	_____ **hours**

Resource Analysis Worksheet

Section II

Repair Time Analysis

A. Normal Working Hours

1. Product Availability

a. Is the product or system available to use when you arrive on-site? ☐ Yes ☐ No

b. How long must you normally wait? _____ hours

c. What can you do while you wait? _____

_____

d. What can the user do before you arrive? _____

_____

2. Parts Availability

a. What are the procedures for obtaining a part? _____

_____

b. Estimated average time to receive part: _____ hours

3. Consulting Assistance

a. Is technical assistance available? ☐ Yes ☐ No

Name _____

Location _____

Phone No. _____

b. Estimated amount of time to contact technical backup: _____ hours

c. Is management assistance available? ☐ Yes ☐ No

Name _____

Location _____

Phone No. _____

B. After Hours

1. Product Availability

a. Is the product or system available to use when you arrive on-site? ☐ Yes ☐ No

b. How long must you normally wait? _____ hours

c. What can you do while you wait? _____

_____

d. What can the user do before you arrive? _____

_____

2. Parts Availability

a. What are the procedures for obtaining a part? _____

_____

b. Estimated average time to receive part: _____ hours

3. **Consulting Assistance**

a. Is technical assistance available? ☐ Yes ☐ No

Name _____

Location _____

Phone No. _____

b. Estimated amount of time to contact technical backup: _____ hours

c. Is management assistance available? ☐ Yes ☐ No

Name _____

Location _____

Phone No. _____

. **Weekends/Holidays**

1. **Product Availability**

a. Is the product or system available to use when you arrive on-site? ☐ Yes ☐ No

b. How long must you normally wait? _____ hours

c. What can you do while you wait? _____

_____

d. What can the user do before you arrive? _____

_____

2. **Parts Availability**

a What are the procedures for obtaining a part? _____

_____

b. Estimated average time to receive part: _____ hours

3. **Consulting Assistance**

a. Is technical assistance available? ☐ Yes ☐ No

Name _____

Location _____

Phone No. _____

b. Estimated amount of time to contact technical backup: _____ hours

c. Is management assistance available? ☐ Yes ☐ No

Name _____

Location _____

Phone No. _____

Resource Analysis Worksheet

Section III
Planned Maintenance

A. Product Design

1. What is the recommended interval for preventive maintenance? _____ months
2. Who can best perform the maintenance procedures? ☐ Service Personnel ☐ User ☐ Other _____

B. User Environment

1. What type of environment is the equipment subjected? ☐ Industrial Manufacturing ☐ Office Area ☐ Computer Room ☐ Other _____
2. What temperatures will equipment operate in? ☐ High ☐ Low ☐ Moderate ☐ Other _____
3. What types of humidity? ☐ High ☐ Low ☐ Moderate ☐ Other _____
4. What type of atmosphere? ☐ Caustic ☐ Dirt Laden ☐ Other (please describe) _____
5. What power setup is available? ☐ Line Conditioned ☐ Line Filtered ☐ Other _____
6. What is the voltage range? _____ Volts to _____ Volts

C. Equipment Usage

1. The equipment is in constant use for approximately: ☐ 2 hours/day ☐ 4 hours/day ☐ 8 hours/day ☐ 16 hours/day ☐ Other _____

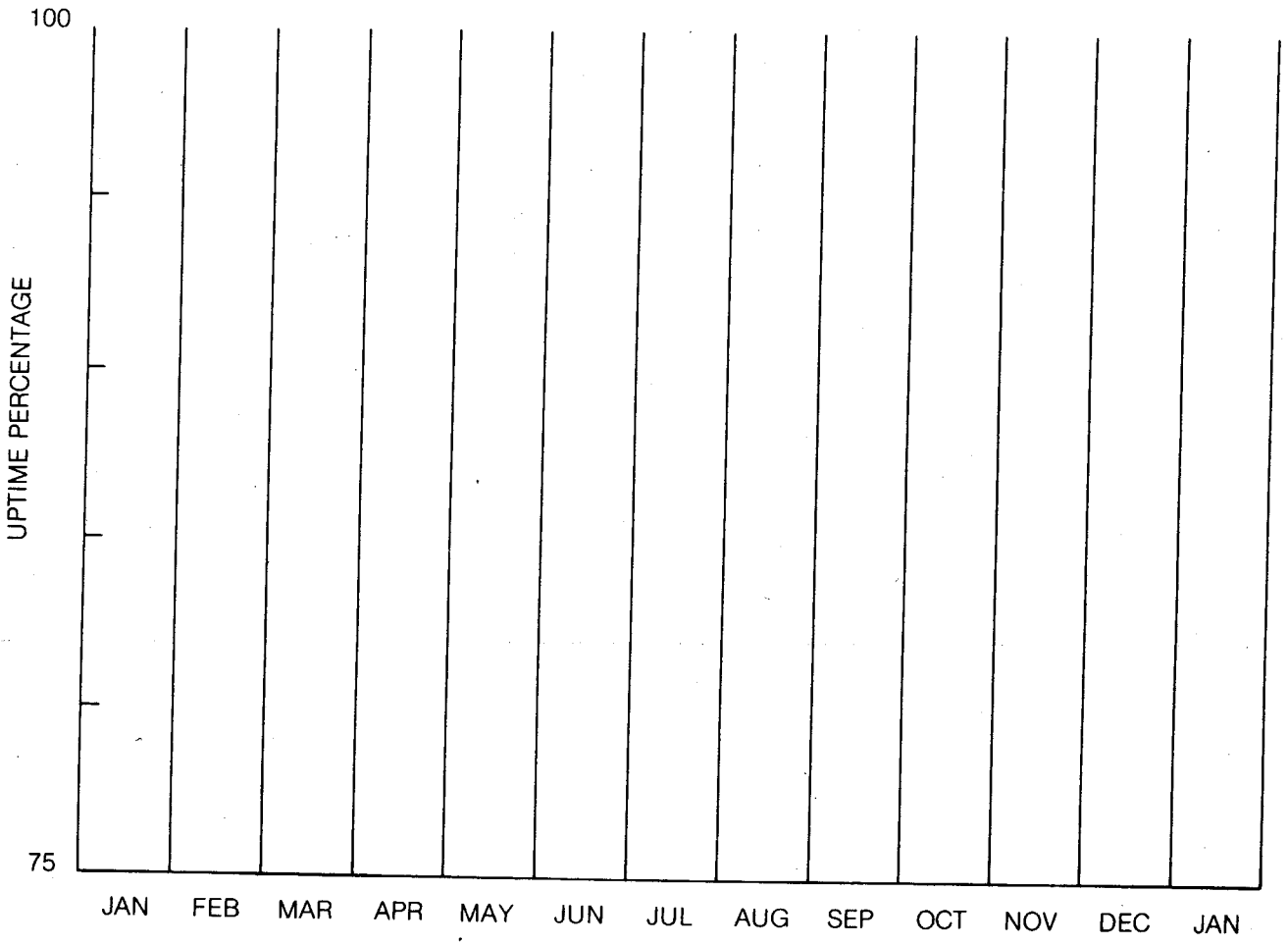
Uptime Graph

Service Person _____

Name _____

Number of Products _____

Product Types _____



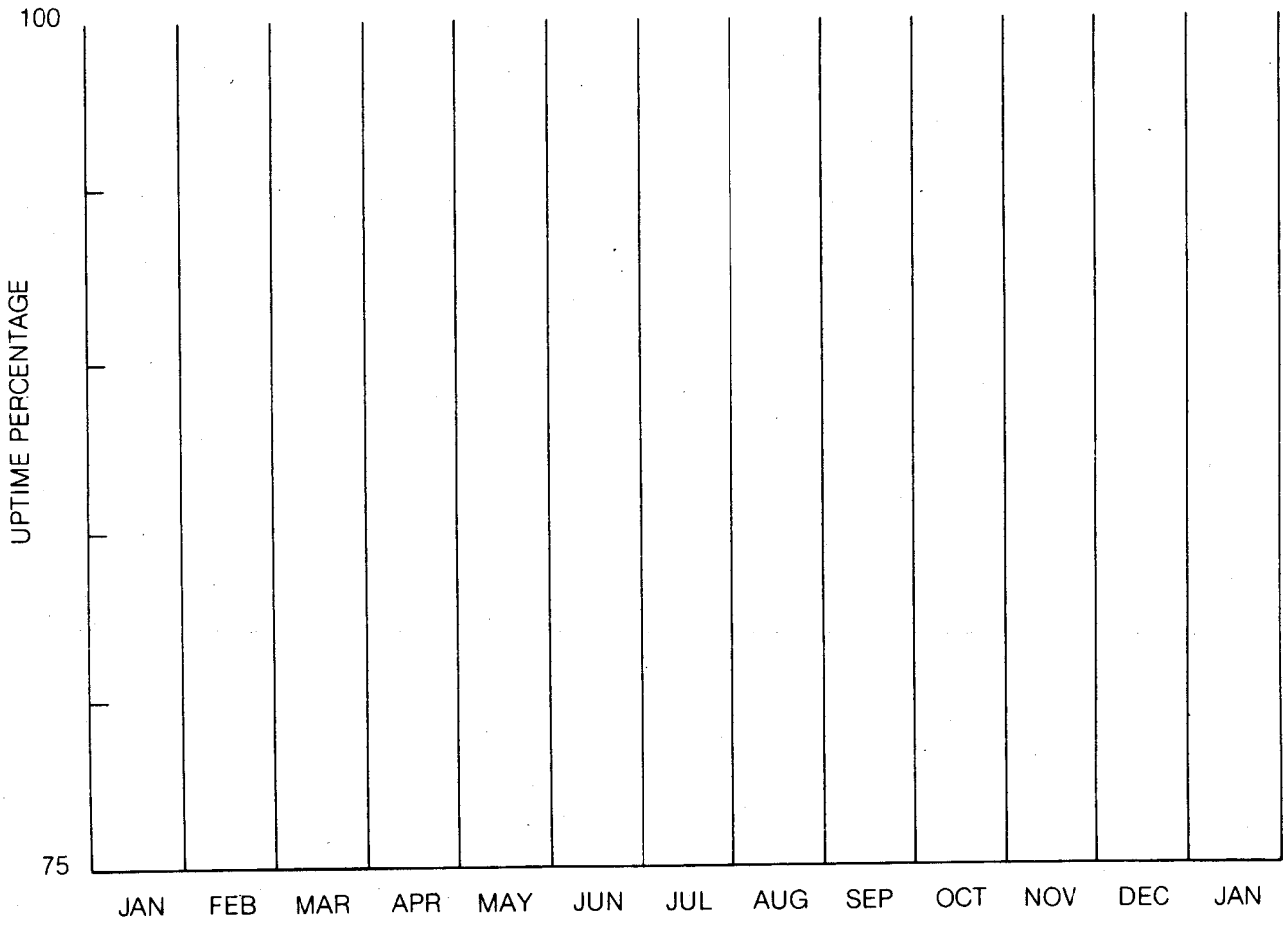
Uptime Graph

User Name _____

Product Type _____

Serial # _____

Service Person: _____



Options and Accessories

Lesson 7

Overview

This lesson covers the accessory modules that are available for use with the HP 85. Each of the modules will be briefly described. You'll also have the opportunity to perform a testing procedure for one of these accessories—the HP-IB Interface.

Learning Objectives

After completing Lesson 7, you will be able to:

- Describe the accessory modules that can be added to the HP 85 to enhance its capabilities.
- Use the Service Manual for any particular module to troubleshoot failures.

General Concepts

The accessory modules available for the HP-85 are listed on the next page. (Columns 3 and 4 of the table pertain to testing procedures described later in this lesson.) All accessories except the ROMs are compatible with the entire line of Series 80 Personal Computers. Nine of these modules (the seven interfaces, the modem, and the Speech Syntheses Module) use internal switches to set the module select code. The select code is used by the computer to differentiate the modules and to route input/output operations to the appropriate device.

Lesson 7 will concentrate on the repair strategy for these nine modules. To troubleshoot each module you will need an HP 82936A ROM Drawer and an HP 85 I/O ROM to run the diagnostic test programs.

The following general concepts apply to servicing these modules:

- Safety Precautions.
- General Description.
- Troubleshooting and Testing Guidelines.
- Recommended Tools, Equipment, and Test Connectors.
- Disassembly and Reassembly.
- Setting Internal Switches and Jumpers.
- Running the Diagnostic Test Program.

Lesson 7 covers each of these topics as they apply generally to all the interfaces. Then, you'll do a lab using the HP-IB Interface. Finally, you'll read some descriptive information about each Series 80 interface and enhancement module.

Accessories For the HP 85

Module Part Number	Product	Test Connector Part Number	Reference Interface Required?
82937A	HP-IB Interface	none	yes
82938A	HP-IL Interface	none	no
	Serial Interface (RS-232C):		
82939A	Female Connector	82944-60001	no
82939A Opt 001	Male Connector	82944-60001	no
82939A Opt 002	Current Loop	82947-60001	no
82940A	GPIO (16-bit) Interface	82945-69901	no
82941A	BCD Interface	82946-69901	no
82949A	Parallel Printer Interface	82949-60002	no
82966A	Data Link Interface		
	short test	82966-60902	no
	extended test	82966-60902	yes
82950A	Modem	none	yes
82967A	Speech Synthesis	Require external 8-ohm speaker	no
82929A	Programmable ROM Module	Programmable ROM Module and EPROMS (HP part number 82929-60903) required for testing.	
82928A	System Monitor		
82936A	Series 80 ROM Drawer	Tested Using Service ROM	
	HP 85 ROMs		
82903A	16K Memory Module (HP 85A only)	XRAM Test	

Required Tools and Equipment

To troubleshoot accessory modules, you need:

- A #1 Pozidriv screwdriver.
- 1/4-inch nut driver.
- An HP 85.
- An HP 82936A ROM Drawer.
- An HP 85 I/O ROM (HP part number 00085-15003).
- An HP 00085-60949 HP 85 I/O Exerciser Tape.
- An HP 00085-60958 Port Extender.
- An HP 0960-0062 Continuity Tester or a multimeter such as the HP 3449B Multimeter.
- The test connector for the interface being serviced (see above).
- A "yes" entry in column 4 above indicates that testing requires a known-good reference module of the same type. For instance, testing the HP-IB interface requires that you have both the interface to be tested and an additional HP-IB interface that you know is working properly.
- The programmable ROM module and system monitor each require an EPROM to be installed (see above for the part number).

Safety Precautions

WARNING!

To avoid personal injury and equipment damage, read and understand all the safety guidelines pertaining to installing and removing modules.

Follow these guidelines when installing or removing an enhancement module or interface:

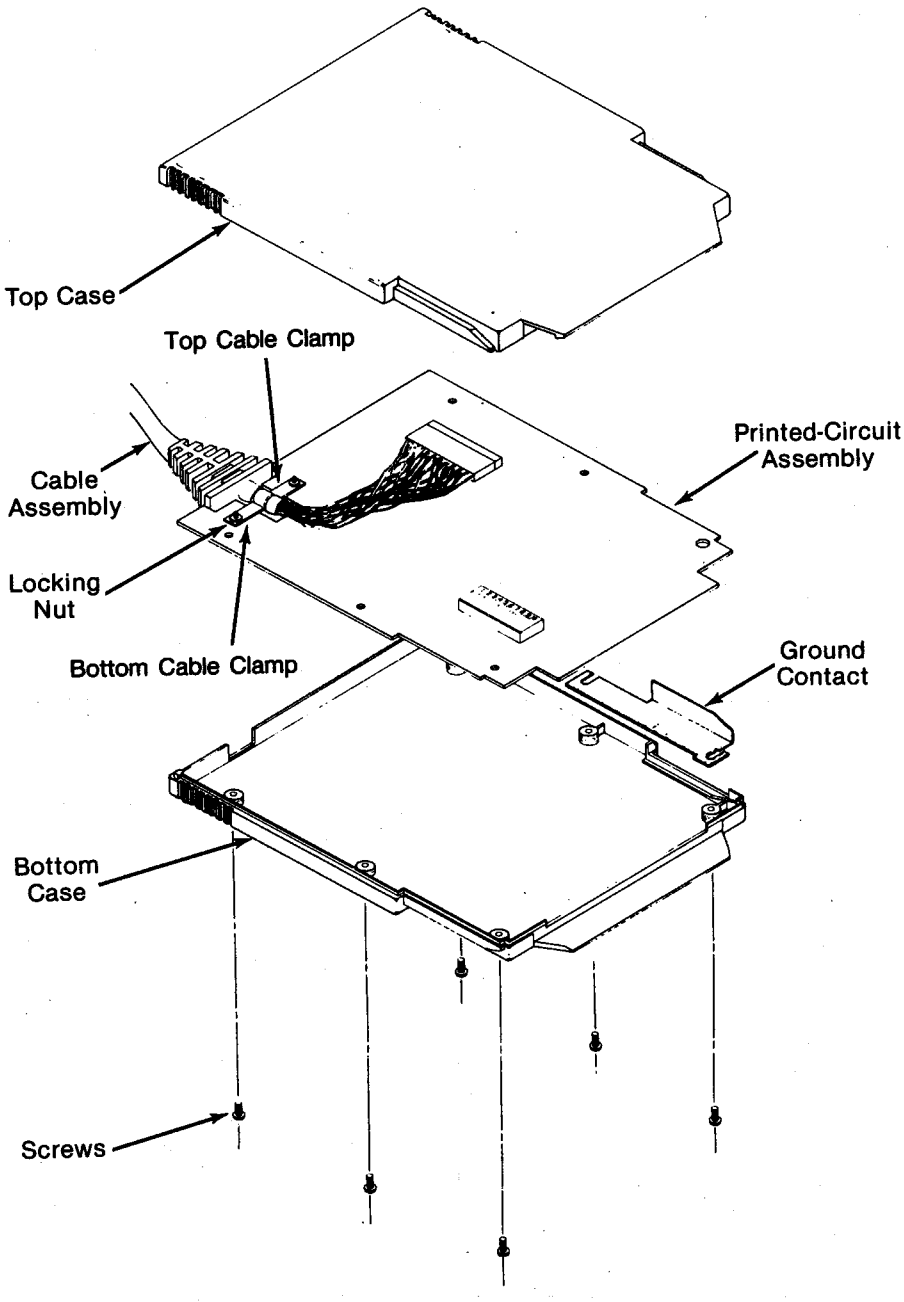
- Always turn off the computer and all peripherals before installing or removing the module.
- Be sure the computer is plugged into a grounded (three-wire) outlet.
- Turn on the computer only after all connections are made.

General Description of Modules

All of the Series 80 modules have similar design characteristics: each interface has a top and bottom case, a logic PCA, and one or two cable assemblies (or cable connectors). Repairing an interface usually involves isolating the problem and replacing either the module PCA or the cable assembly.

The figure below illustrates the replaceable parts of an HP-IB interface, listed below:

- Cable assembly.
- Printed-circuit assembly.
- Top case, and bottom case.
- Bottom cable clamp.
- Top cable clamp.
- Ground contact.
- Locking nut.
- Screws.



Disassembly

Troubleshooting Guidelines

The I/O Exerciser Tape enables you to use the HP 85 to test the modules. The diagnostic programs output commands and data to the module and then read back the new status of the module to see if the expected result has occurred. If not, the interface needs repair.

To provide for looping signals back to the computer, test connectors have been designed to fit in place of the cable assemblies on most modules. No test connectors are used for testing the HP-IB and HP-IL interfaces or for the modem.

Briefly, troubleshooting includes the following steps:

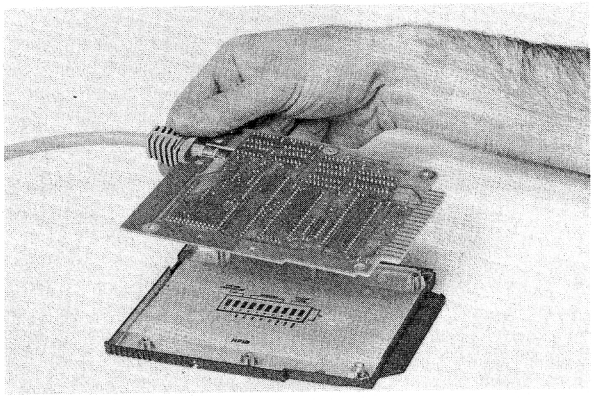
1. Note the customer's concern. If the module is an interface, determine whether the customer has changed the wiring configuration of the interface cable assembly. If the customer has rewired the cable, substitute a cable that is wired in the factory-built configuration.
2. Disassemble the interface module. Record the customer's switch settings. Set the switches as required by the testing procedure.
3. Attach the test connector and test cables. (For the HP-IB Interface, the data link interface, and the modem, install a known good reference interface into an I/O port.)
4. Insert the test interface into a port extender. (For the HP-IB interface, the Data Link Interface, and the modem, connect the test interface to the reference interface.)
5. Install the port extender/test interface into an I/O port.
6. Install the ROM Drawer with the HP 85 I/O ROM.
7. Insert the I/O Exerciser Tape into the tape drive. Load and run the main program.
8. Select the appropriate diagnostic test and run it one or more times.
9. Locate any error message in the error table in the Service Manual and follow the recommended repair procedure—either replace the cable assembly, the logic PCA, or the entire unit.
10. Reset any switches to the customer's setting.
11. Reassemble the module.

Disassembly and Reassembly of Modules

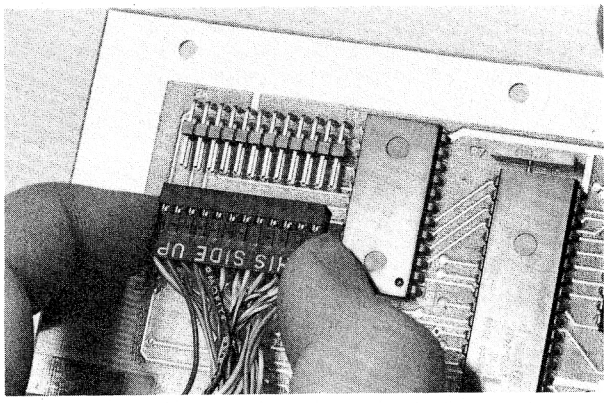
Because of the common construction of all modules, the following basic techniques apply to disassembling and reassembling modules:

To disassemble a module:

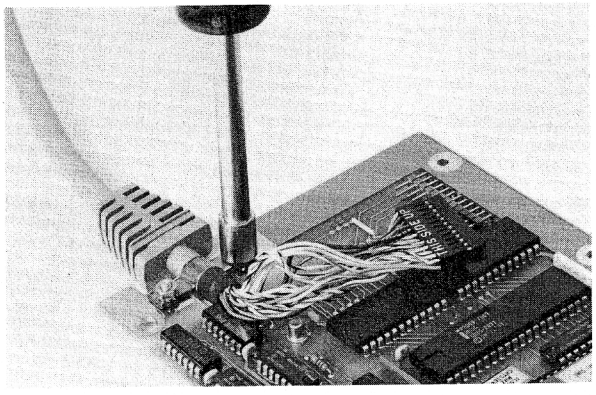
1. Remove the screws holding the top and bottom case together.
2. Lift off the bottom case.
3. Lift the logic PCA and ground contact out of the top case.
4. Unplug the cable socket from the cable plug on the logic PCA. (If there is a second cable assembly on the PCA, do steps 4 through 7 twice.)
5. Remove the locknuts from the cable clamp using a 1/4-inch nut driver.
6. Remove the top clamp.
7. Separate the PCA and cable assembly.



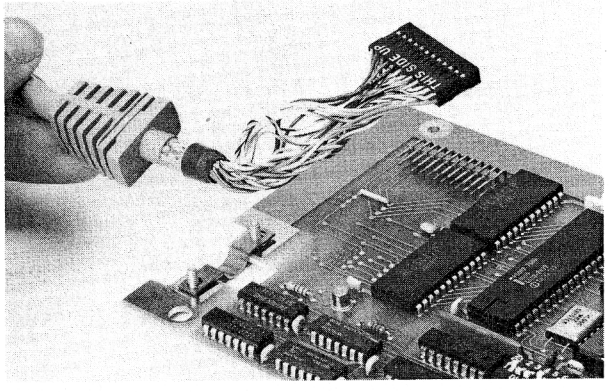
Step#3



Step #4



Step #5



Step #7

To reassemble a module:

1. Ensure that the bottom cable clamp is in place on the PCA. (The bottom clamp has a larger loop than the top clamp.)
2. Place the cable assembly onto the bottom clamp. Keep the insulation cutout facing away from (but aligned with) the bottom clamp.
3. Fasten the cable in place using the top cable clamp and two locknuts. (The top clamp has a smaller loop than the bottom clamp.) The top clamp fits into the insulation cutout and contacts the cable shield.

CAUTION!

Be sure the printed label on the cable socket faces up. Otherwise, components may be damaged.

4. Plug the cable socket into the connector on the PCA. Be sure the label faces up.
5. Check the labels inside the case halves. These labels serve as electrical insulators. If either label is damaged, replace the case.
6. Place the PCA into the top case. Keep the edge of the case between the first and second ribs of the strain relief. Be sure the larger screw holes in the PCA fit around the posts. The components should face into the top case.
7. Place the ground contact onto the edge of the PCA. The contact should lie along the outside edge of the top case.
8. Place the bottom case onto the top case and PCA.
9. Install the screws. Be sure that the ground contact remains snug against the side of the top case.

Setting Internal Switches

Every interface must have a distinct select code to differentiate it from other interfaces. The following list summarizes the factory preset default select codes for the Series 80 interfaces. Each interface has at least 3 switch segments dedicated to setting the select code. For more information about how to set switches, refer to the service manual or to the interface owner's manual.

Factory Preset Select Codes

Interface	Factory Preset Select Code
HP-IL	9
BCD	3
GPIO	4
Parallel Printer	8
Data Link	10
HP-IB	7
Serial	10
Modem	10
Speech Synthesis	10

There are additional switches in the BCD, GPIO, data link, HP-IB, and serial interfaces used to control default parameters such as Baud rate for the serial interface and 8-bit/16-bit operation for the GPIO interface. Most of the diagnostic programs require these switches to be set to specific values. Read the test procedures in the service manuals for information on setting both the select code and the default switches.

Running the Diagnostic Test Programs

Troubleshooting and testing uses the diagnostic programs on the I/O Exerciser Tape. These programs were designed at the factory for component level repair of each interface. If you are doing assembly level repair, then you need not concern yourself with the details provided by the error messages, other than to recognize when to replace the PCA or the cable or to conduct further tests.

The following diagnostic routines are available on the I/O Exerciser Tape:

- HP 82937A HP-IB Exerciser
- HP 82938A HP-IL Exerciser
- HP 82939A Serial Exerciser
- HP 82940A GPIO Exerciser
- HP 82941A BCD Exerciser
- HP 82949A Parallel Printer Interface Exerciser
- HP 82950A Modem Exerciser
- HP 82966A Data Link Exerciser
- HP 82967A Speech Card Exerciser

To use the diagnostic programs:

1. Prepare the computer and interface for testing.
2. Insert the exerciser tape into the tape drive.
3. Turn on the computer to autostart ("Autost") the supervisor program.
4. Press the softkey to select the diagnostic program for the module being tested.
5. Compare the error message, if any, to the table in the module Service Manual. Replace the PCA or perform further testing as necessary.

The disassembly, set-up, and test procedures particular to each module are described in the service manual for that module. Lab Project 12 gives you the opportunity to test the HP-IB interface.

The HP-IB Interface

The HP 82937A HP-IB Interface Module permits bidirectional, asynchronous communication among a wide variety of instruments and peripherals. It implements the IEEE 488-1978 Standard Digital Interface for Programmable Instrumentation, and allows the computer to communicate with as many as 14 devices per interface.

STOP!

To learn more about the HP-IB interface and to acquire repair skills that apply to all the interfaces, do Lab Project 12.

Optional
Lab Project 12
The HP-IB Interface

In this lab, you will learn disassembly, assembly, and testing techniques, how to set interface switches, and how to test for continuity in the HP-IB cable.

____ 1. Gather together the following equipment:
- ____ HP 85.
- ____ ROM Drawer and HP 85 I/O ROM.
- ____ Two HP 82937A HP-IB Interface Modules. Label one GOOD, the other TEST.
- ____ Port extender.
- ____ #1 Pozidriv screwdriver.
- ____ 1/4-inch nut driver.
- ____ Ohmmeter and small probes.

____ 2. Use the following procedure to prepare the GOOD interface for the tests that follow:
- ____ a. Perform steps 1, 2, and 3 of the disassembly instructions on page 7-5.
- ____ b. The operation of the interface depends upon the settings of switch S1. This 10-segment switch is located on the PCA. Set the switch segments of the GOOD interface to non-controller, talk/listen address 20, and select code 6 (segments 2 through 10 set to 010100011). If the switch is the slide type, the slides should be pushed toward the 0 or 1 printed on the PC board next to the switch. If the switch is the rocker type, the rockers should be pressed down at the end toward the desired setting.
- ____ c. The HP-IB interface responds to a parallel poll command by polling one of the DIO lines low. The line is selected by a jumper wire on the PCA. The jumper is initially installed between E1 and E2 and selects DI01 as the response line.

  What is the parallel poll jumper set to for this card?

  _____

  Although the S1 switch must be set as described above in order to run the HP-IB interface test programs, it does not matter how the parallel poll jumper has been set.
- ____ d. Perform steps 6 through 9 of the reassembly instructions on page 7-6.

____ 3. Separate the case of the TEST interface by removing the screws.

____ 4. Separate the cable assembly from the PCA as follows:
- ____ a. Unplug the cable plug from the cable connector on the PCA connector by prying them apart. Do not pull on the wires.
- ____ b. Remove the two locknuts from the cable clamp using a 1/4-inch nut driver.
- ____ c. Separate the PCA and cable assembly. Leave the bottom cable clamp in place on the PCA; the bottom clamp has a larger loop than the top clamp.

___ 5. Check for continuity from the HP-IB connector to the J1 connector:

HP-IB Signal	HP-IB Connector	J1 Connector	Continuity?
DI01	1	22	
DI02	2	23	
DI03	3	1	
DI04	4	24	
EOI	5	21	
DAV	6	11	
NRFD	7	10	
NDAC	8	12	
IFC	9	9	
SRQ	10	7	
ATN	11	6	
SHEILD	SHEILD	20	
DI05	13	2	
DI06	14	3	
DI07	15	4	
DI08	16	5	
REN	17	8	
GRND	18	14	
GRND	19	15	
GRND	20	13	
GRND	21	16	
GRND	22	18	
GRND	23	19	
GRND	24	17	

___ 6. Reassemble the cable assembly:

___ a. Place the cable assembly onto the bottom cable clamp. Keep the insulation facing away from, but aligned with, the bottom clamp.

___ b. Fasten the cable in place using the top cable clamp and two locknuts; the top clamp has a smaller loop than the bottom clamp.

CAUTION!

Be sure the printed label THIS SIDE UP on the cable connector faces up. Otherwise components may be damaged.

___ c. Plug the socket into the connector on the PCA. Be sure the label faces up.

___ 7. Record the setting of the HP-IB switch in the TEST interface:

_____

Set the switch to active controller, talk/listen address 21, and select code 7. Set segments 2 through 10 to 110101101.

___ 8. Turn off the HP 85 and all peripherals. Be sure to observe the safety guidelines when installing the HP-IB interfaces.

___ 9. Use a port extender (00085-60958) to install the TEST HP-IB Interface into any I/O port. (If no port extender is available, reassemble the TEST interface and install it into an I/O port.) The upper port is recommended so that the port extender can be easily used.

___ 10. Install the known-good HP-IB Interface into any other I/O port.

__ 11. Install an HP 85 I/O ROM and ROM drawer into any other I/O port.

__ 12. Connect the two HP-IB cables together.

__ 13. Insert the tape containing the test programs into the tape drive. Power on the computer. Wait for the system to autostart the I/O exerciser supervisor program.

__ 14. Press the softkey that selects the HP-IB diagnostic test. Select the short test. If you receive an immediate error message to the effect that the HP-IB switches are not set correctly, go back to steps 2 and 7 and check the S1 switch settings of both interfaces.

__ 17. What two messages are displayed for the short test? (This test cycles two times.)

_____

_____

__ 18. Run the long test. What further messages are displayed? Attach a printout if you'd like. (This test also cycles two times.)

_____

_____

_____

_____

_____

__ 19. Disconnect the two HP-IB cables and run the short test again. What error messages are displayed? Run the long test. What error messages are displayed? Assuming the cables were actually connected, what is your diagnosis? How would you repair this interface?

_____

_____

_____

_____

__ 20. Turn off the computer, pull out the port extender, and reassemble the TEST module:

____ a. Check the labels inside the case halves. These labels serve as electrical insulators. If either label is damaged, replace the case.

____ b. Reset the S1 switch to the setting recorded at Step 7.

____ c. Place the PCA into the top case. Keep the edge of the case between the first and second ribs of the strain relief. Be sure the larger screw holes in the PCA fit around the posts. The components should face into the top case.

____ d. Perform steps 6 through 9 of the reassembly instructions on previous page.

__ 21. Install the assembled TEST interface and rerun the test programs to verify that the interface is working properly.

Other Modules and Enhancements

HP 82939A Serial Interface (RS-232-C)

The HP 82939A Serial Interface provides bit-serial, asynchronous data communications between the Series 80 computers and terminals or printers. The serial interface is also used in applications where two computers are communicating, such as remote data acquisition. This interface supports operation with the Series 80 mainframe acting as the computer or as the peripheral; an I/O ROM is required.

The serial interface can be ordered with one of three options: a female connector (standard), male connector (option 1), or the current loop option (option 2).

Since customers frequently adapt the serial interface cable for their own applications, you must make sure that you run the diagnostic test using a cable wired with the factory-built configuration.

HP 82940A GPIO Interface

The HP 82940A GPIO Interface connects the computer to a variety of peripheral devices. It is a general-purpose interface which provides 16-bit or dual 8-bit data exchange between the computer and a peripheral device. The interface can transfer data in a Half-Duplex mode, which requires either an input or output handshake. The hardware and software characteristics of the interface are very flexible. Data exchange timing and logic can be configured to meet a wide variety of peripheral requirements; an I/O ROM is required.

Since customers frequently adapt the GPIO interface cable for their own applications, you must make sure that you run the diagnostic test using a cable wired with the factory-built configuration.

HP 82941A BCD Interface

The HP 82941A BCD Interface supports interfacing with BCD (Binary Coded Decimal) instrumentation. These BCD instruments present all the digits of their operation at one time on a set of parallel lines. Common instruments with a BCD interface include voltmeters, multimeters, medical equipment, and weighing systems; an I/O ROM is required. The hardware and software characteristics of the interface are very flexible.

Since customers frequently adapt the BCD interface cable for their own applications, you must make sure that you run the diagnostic test using a cable wired with the factory-built configuration.

HP 82949A Parallel Printer Interface

The HP 82949A Parallel Printer Interface connects Series 80 computers to a printer requiring a standard parallel printer interface. The interface provides uni-directional communication from the HP 85 to the printer. One printer at a time can be connected to the computer via the interface.

The HP 85 Plotter/Printer ROM or the HP 85 I/O ROM is required to use the interface.

HP 82938A HP-IL Interface

The HP 82938A HP-IL Interface connects Series 80 computers to a number of low-power instruments, some battery-powered. Up to 30 devices can be connected on one loop. Connectors on the interface accept the cables required to form the interface loop.

HP 82950A Modem

The HP 82950A Modem provides HP Series 80 computers with the ability to use the public telephone network for data communications operations. It features:

- Standard baud rate of 300—other baud rates are software selectable.
- Bell 103/113 compatible.
- Full-duplex, asynchronous operation.
- Automatic or manual originate and answer.
- Automatic dialing of voice calls.
- Direct connection to the public telephone network.

The modem is larger in vertical profile than any of the other plug-in modules. When inserted into a port, it partially blocks the port above it. However, the modem can be inserted in the top port, or modules that have no cable attachments (for instance, the ROM drawer and memory module) can be placed in the port above the modem.

HP 82967A Speech Synthesis Module

The HP 82967A Speech Synthesis Module provides speech generation for Series 80 computers. The system uses a parametric coding scheme known as LPC (linear predictive coding) to generate high-quality speech at moderately low data transfer rates. It is exclusively a voice synthesis system; it is not capable of performing voice recognition.

System requirements include an HP 82903A 16K Memory Module and headphones or an 8-ohm speaker with either a male standard 1/4-inch phono-jack connector or an RCA® phono-jack connector.

HP 82966A Data Link Interface

The HP 82966A Data Link Interface allows Series 80 Personal Computers to function effectively in data communications networks hosted by HP 1000 and HP 3000 computers. The interface uses the I/O ROM and handles data link protocol. An HP 3074A Data Link Adapter is required to make the electrical connection to the link.

The interface is designed to be used as part of a Distributed Systems Network/Data Link (DSN/DL), consisting of several computer systems interconnected by one or more data communications lines.

HP 82903A 16K Memory Module

The 16K memory module adds approximately 16K bytes of RAM to the HP 85. When the module is installed, the additional memory automatically becomes accessible for storing data and BASIC programs. Only one 16K memory module can be installed at a time.

The External RAM Test included in the Service ROM provides for testing the memory module.

HP 82928A System Monitor

The HP 82928A System Monitor simplifies developing and debugging of assembly language programs for Series 80 Personal Computers by allowing the user to set breakpoints and to single-step through programs. When the system monitor is used with the HP 85 Assembler ROM, programs can be executed in real time and halted at predetermined points. While the program is halted, the user can modify register and memory locations, select a new breakpoint, and continue execution until the next breakpoint. Registers and memory locations can also be modified during single-stepping.

HP 82929A Programmmable ROM Module

The 82929A Programmable ROM Module allows standard ROMs to be used with Series 80 Personal Computers. Assembly language programs developed using the HP 85 Assembler ROM and HP 82928A System Monitor can be used to program standard EPROMs, which are installed into the computer using the programmable ROM module.

HP 82936A ROM Drawer and Enhancement ROMs

The HP 82936A ROM Drawer contains six slots for enhancement ROMs. Enhancement ROMs expand the capabilities of the HP 85 by providing additional BASIC statements, functions, and commands. ROMs are installed into the ROM drawer, which in turn is inserted into an I/O port.

The following ROMs are available for the HP 85:

HP 85 ROMs

ROM	Part Number
HP 85 Matrix ROM	00085-15004
HP 85 Plotter/Printer ROM	00085-15002
HP 85 I/O ROM	00085-15003
HP 85 Mass Storage ROM	00085-15001
HP 85 Advanced Programming ROM	00085-15005
HP 85 Assembler ROM	00085-15007

The External ROM Test included in the Service ROM provides for testing these ROMs. The ROMs are not serviceable.

The HP 85 Model B Personal Computer

Lesson 8

Overview

This lesson contains information concomitant to previous lessons necessary for servicing the HP 85B Personal Computer. The HP 85B is similar to the HP 85A in many respects, and the procedures you have already learned apply to the HP 85B (with a few exceptions). When you understand the hardware differences between the two models, you will readily see the implications they have on the service procedures.

When you are using this guide to test or repair the HP 85B, all references to the HP 85 Assembly-Level Service Manual refer to the *HP 85B Assembly-Level Service Manual* (part number 00085-90988).

Learning Objectives

After completing lesson 8, you will be able to:

- Describe the functional differences between Models A and B.
- List the major assemblies that are different on Models A and B.
- Enumerate the diagnostic procedures that are unique to the HP 85B.
- Identify the additional disassembly/assembly procedures required for the HP 85B.

Functional Differences

The HP 85B has these features that distinguish it from the HP 85A:

- 32K bytes of read/write memory built in. The HP 82903A 16K Memory Module is not used in the HP 85B Personal Computer.

CAUTION!

DO NOT install a 16K Memory Module in the HP 85B. Doing so may damage the module or the computer.

- Built-in electronic disc for high speed storage—32K bytes standard, expandable to 544K bytes with HP 86/87 Memory Modules (model numbers 82907A, 82908A, 82909A).
- Built-in Electronic Disc and Mass Storage ROMs. Other ROMs, such as the I/O ROM, can also be built-in (that is, installed in sockets on the Logic PCA). The Mass Storage ROM (part number 00085-15001) is not used with the HP 85B.

CAUTION!

If you install a ROM Drawer in the back of the HP 85B, be certain that it contains no ROMs that are already built-in on the Logic PCA. Otherwise ICs may be damaged.

Hardware Differences

Of the eight major assemblies described in lesson 1, four have been changed in the HP 85B version of the computer. These assemblies and their salient changes are listed here:

- The printer/power supply assembly on the HP 85B differs slightly from the HP 85A. As a result, when the power supply lines need to be checked, a 22-ohm resistor must be connected to the PCA. Also, potentiometer R23 can be adjusted on the HP 85B. These procedures are discussed in detail on page 2-14 of the HP 85B service manual.
- The logic PCA, located underneath the keyboard assembly, contains the CPU, the ROM ICs, eight RAM ICs, the keyboard controller IC, the I/O (input/output) buffer IC, and the RAM controller IC. On the HP 85A logic PCA, all ICs are socketed and can be replaced. On the HP 85B, only the Mass Storage ROM, Electronic Disc ROM, and any custom ROMs are socketed and can be replaced. Also, a grounding apron for EMI is attached to the logic PCA by a threaded fastener on the PCA. (Appendix A contains Logic PCA component layout diagrams for both models.)
- The CRT assembly on the HP 85B also has the grounding apron for EMI attached with a threaded fastener to the CRT PCA. The HP 85A has no such apron. The apron connects the GND/H line to the GND/L line.
- The back panel assembly on the HP 85B has a box-shaped shield around the I/O ports that is fastened to the I/O PCA with two screws. The HP 85A has no such shield. (The grounding apron is also attached to this assembly.)

Unique replaceable parts for the HP 85B are listed in appendix D of this guide.

Service Differences

Service for the HP 85B should be performed using the *HP 85B Assembly-Level Service Manual.* If you understand the service procedures for the HP 85A, you should have no trouble servicing the HP 85B. Several of the procedures are simpler. When servicing an HP 85B, follow these procedures:

Troubleshooting and Diagnostic Procedures

1. Follow carefully the setup procedures listed on page 2-8 of the *HP 85B Assembly-Level Service Manual.* A safe way to avoid damage to the equipment is to install only a ROM drawer with the Service ROM into the computer. Ensure that no 16K Memory Module is plugged in to the computer. (HP 86/87 Memory Modules of 32, 64, and 128K can be installed, however.)
2. Power up the computer. If a no turn-on condition exists, follow the procedures beginning on page 2-12 of the *HP 85B Assembly-Level Service Manual* to isolate the cause. Since the printer/power supply assembly is different on the HP 85B, you should follow these procedures carefully, including the use of the 22-ohm load when checking the lines. If potentiometer R23 needs adjustment, use the plastic CRT alignment tool or a screwdriver. (This adjustment is easier if the CRT assembly is removed first.)
3. Power up the computer and run the System Test as described on page 8-6 of the service manual. Since there are an additional 16K bytes of RAM built-in to the computer, you must also run the External RAM Test described on page 8-21. If a problem is indicated at this point that requires the replacement of an IC on the Logic PCA, the entire Logic PCA must be replaced. This is necessary, since none of the ICs tested thus far on the HP 85B logic board is socketed for replacement. See Disassembly Procedures below to replace this PCA.
4. After the System Test and External RAM Tests have been passed, run the External ROM Test (described on page 8-22 in the service manual) to test the Mass Storage ROM, the Electronic Disc ROM, and any other built-in enhancement ROMs. These ROMs are socketed and can be replaced. Refer to page 8-23 of the service manual for the identities of the ROM numbers listed in the test. (This is an easy way to determine what ROMs are installed on the Logic PCA.) Replace any bad ROMs.

5. Now it is necessary to test the read/write memory that is used as an electronic disc. After you successfully perform steps 1 through 4 above, power down the computer and install any HP 82907A/8A/9A Memory Modules being used in the HP 85B for additional electronic disc capacity. Install the I/O Exerciser tape (00085-60949 Revision E) into the tape drive and switch on the computer. The "Autost" program has a special function key labeled [LDRAM]. Press this key to test the 32K bytes of built-in RAM designated as electronic disc and any HP 82907A/8A/9A Memory Modules being used in the HP 85B for additional electronic disc capacity. If the test indicates that the built-in RAM is bad, replace the logic PCA. If the test indicates that a module is bad, and more than one are installed in the computer, you must switch off the comptuer and remove all but one module. Then repeat the procedure for each module in an attempt to isolate the bad unit or units.

Disassembly Procedures

The hardware differences listed earlier in this lesson require that the disassembly procedures be altered somewhat when applied to the HP 85B.

1. When removing the I/O PCA from the HP 85B, in addition to the procedures on page 4-20 of this guide, you must remove the two screws holding the EMI box to the I/O PCA. One of these screws also holds the EMI apron on the PCA. Then you can slide the I/O PCA upward and out of the slot in the I/O receptacle. Conversely, when replacing the I/O PCA, you must also connect the EMI apron to the PCA and replace these screws.
2. When removing the CRT Assembly, refer to "Replacing the CRT Assembly," page 3-15 of the service manual. After disconnecting the pair of cables from the CRT PCA, remove the nut holding the EMI apron to the front of the CRT PCA. Then continue with the rest of the procedure. To replace the CRT Assembly, follow the steps listed, which include reconnecting the EMI apron to the PCA.

3. When removing the Logic PCA, refer to page 3-13 in the HP 85B service manual. You should use a ¼-inch nut driver to remove the nut holding the EMI apron to the Logic PCA. This fastener is located near the center of the PCA. When replacing the Logic PCA, reconnect the EMI apron to the PCA.

Conclusion

The HP 85B Personal Computer is similar to the HP 85A. The major differences you should keep in mind when servicing the HP 85B are the built-in ROMs, the additional memory and electronic disc, and the addition of the EMI apron. The apron is connected to the logic PCA, the CRT PCA, and the back panel assembly. There is also an EMI shield surrounding the I/O ports. For a no turn-on condition, the printer/power supply PCA requires the addition of a 22-ohm load to test the lines when disconnected from the logic PCA. Whenever the service diagnostics indicate that an IC is bad, replace the IC if it is socketed. If it is soldered to the PCA, you should replace the PCA.

STOP!

To learn more about the HP 85B, do Lab Project 13. Then take Quiz 8.

Lab Project 13 (Optional)

HP 85B Testing

In this lab you will perform those tests required to test the HP 85B mainframe. This lab project is optional; if you do not have an HP 85B, simply read through the following instructions. Then go on to Quiz 8.

____ 1. Reread the diagnostic procedures in this lesson and return to the appropriate discussions as you do steps 2 through 5.

____ 2. Properly install a Service ROM into one of the I/O ports of the HP 85B.

____ 3. Power up and run the System Test.

____ 4. Run the External RAM Test.

____ 5. Run the External ROM Test. Using table 8-3 on page 8-23 of the HP 85B Assembly-Level Service Manual, identify the ROMs that are built in to the computer.

Quiz 8

HP 85B Personal Computer

(10 points per correct answer, total = 100)

1. True _____ or False _____ ? On the HP 85B, GND/H is connected to GND/L.

2. True _____ or False _____ ? The service procedures for both HP 85A and HP 85B Personal Computers are described in one service manual.

3. (5 points each). What two HP products used with the HP 85A should never be installed in the I/O ports of the HP 85B?

   a. _____

   b. _____

4. List the three major assemblies that are connected to the EMI apron.

   a. _____

   b. _____

   c. _____

5. In addition to the System Test in the Service ROM, what other tests should you always perform when troubleshooting the HP 85B Personal Computer?

   a. _____

   b. _____

   c. _____

6. If diagnostics indicate that the RAM is bad on the HP 85B Logic PCA, what is the standard repair procedure?

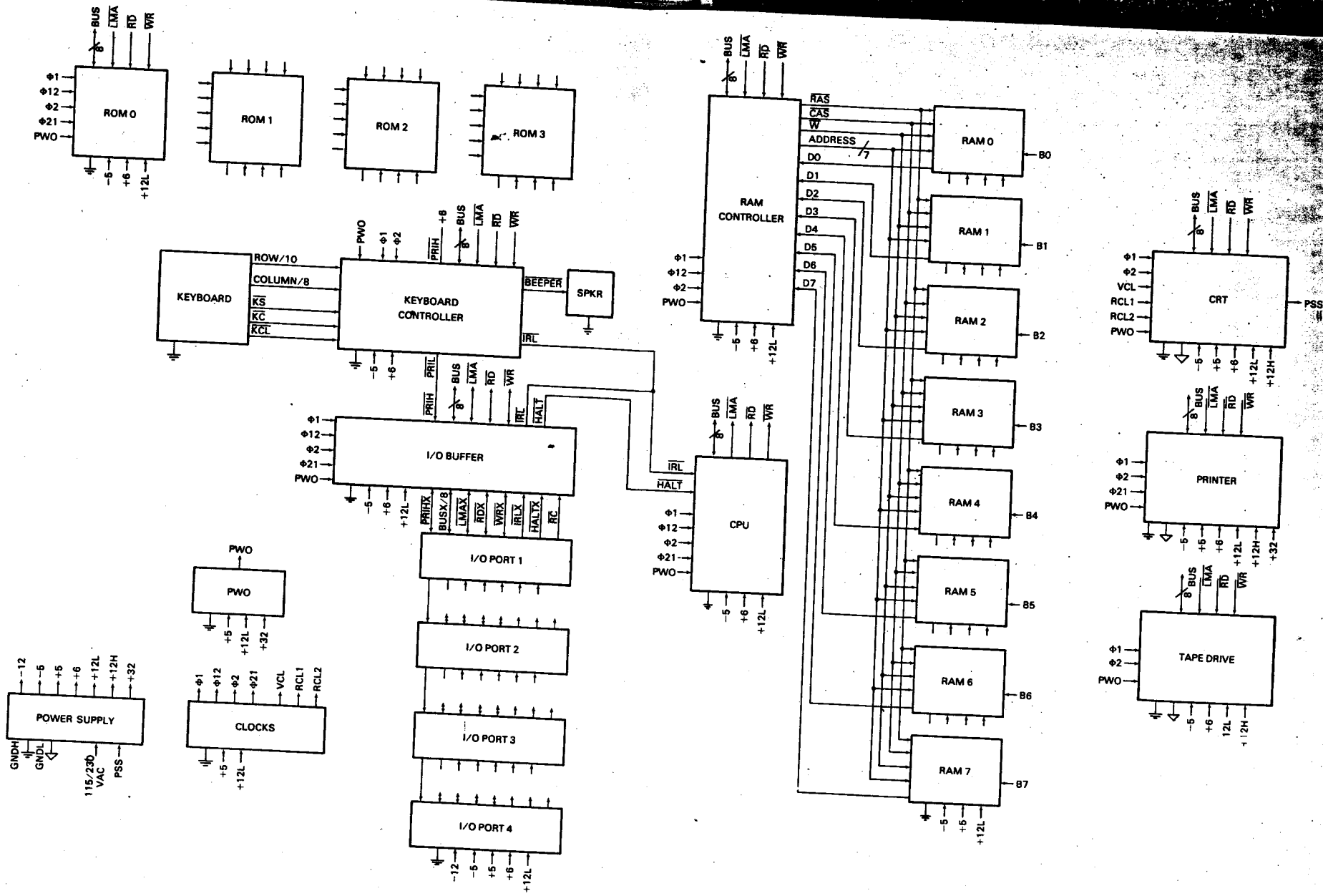
   _____

   _____

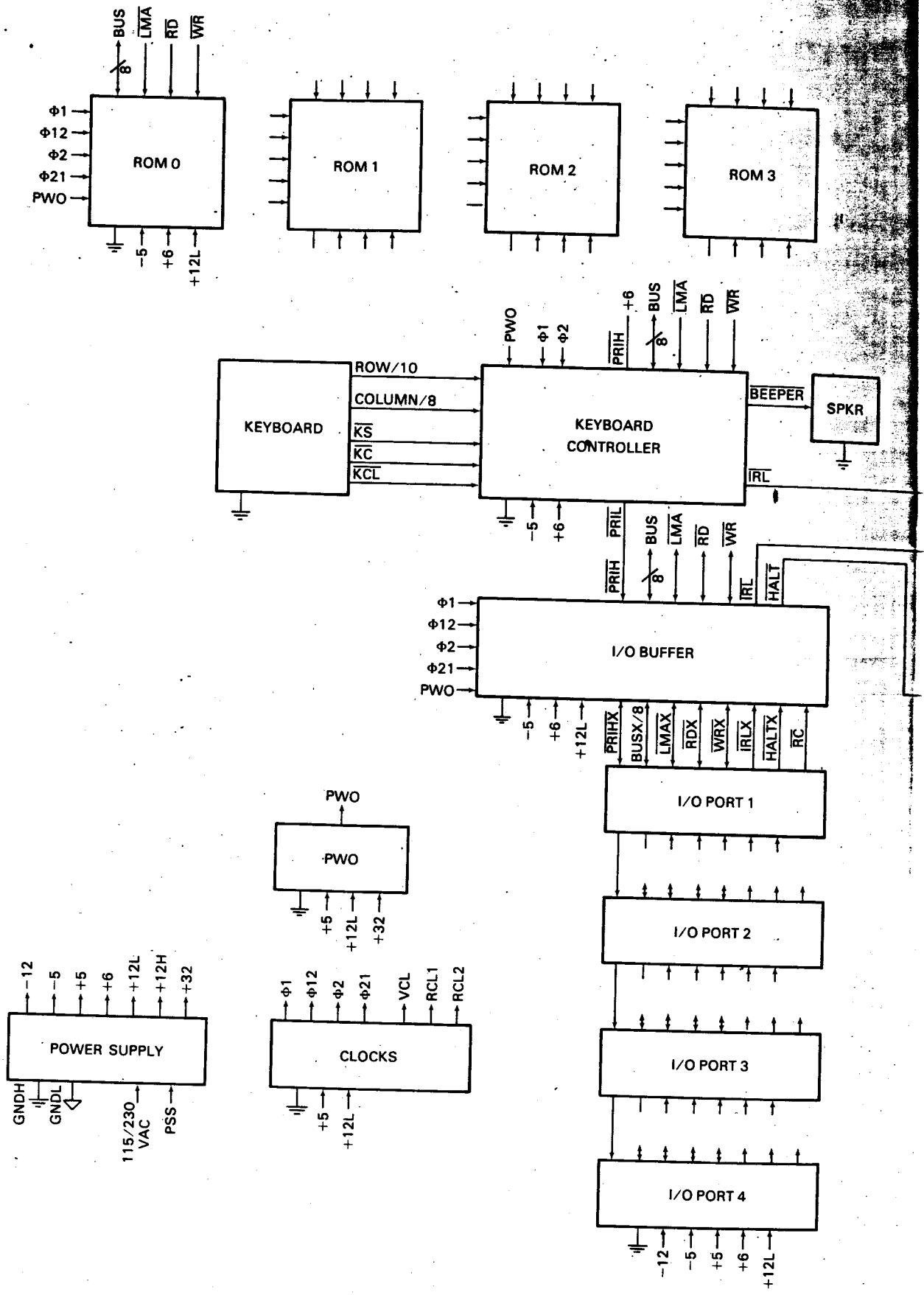
   _____

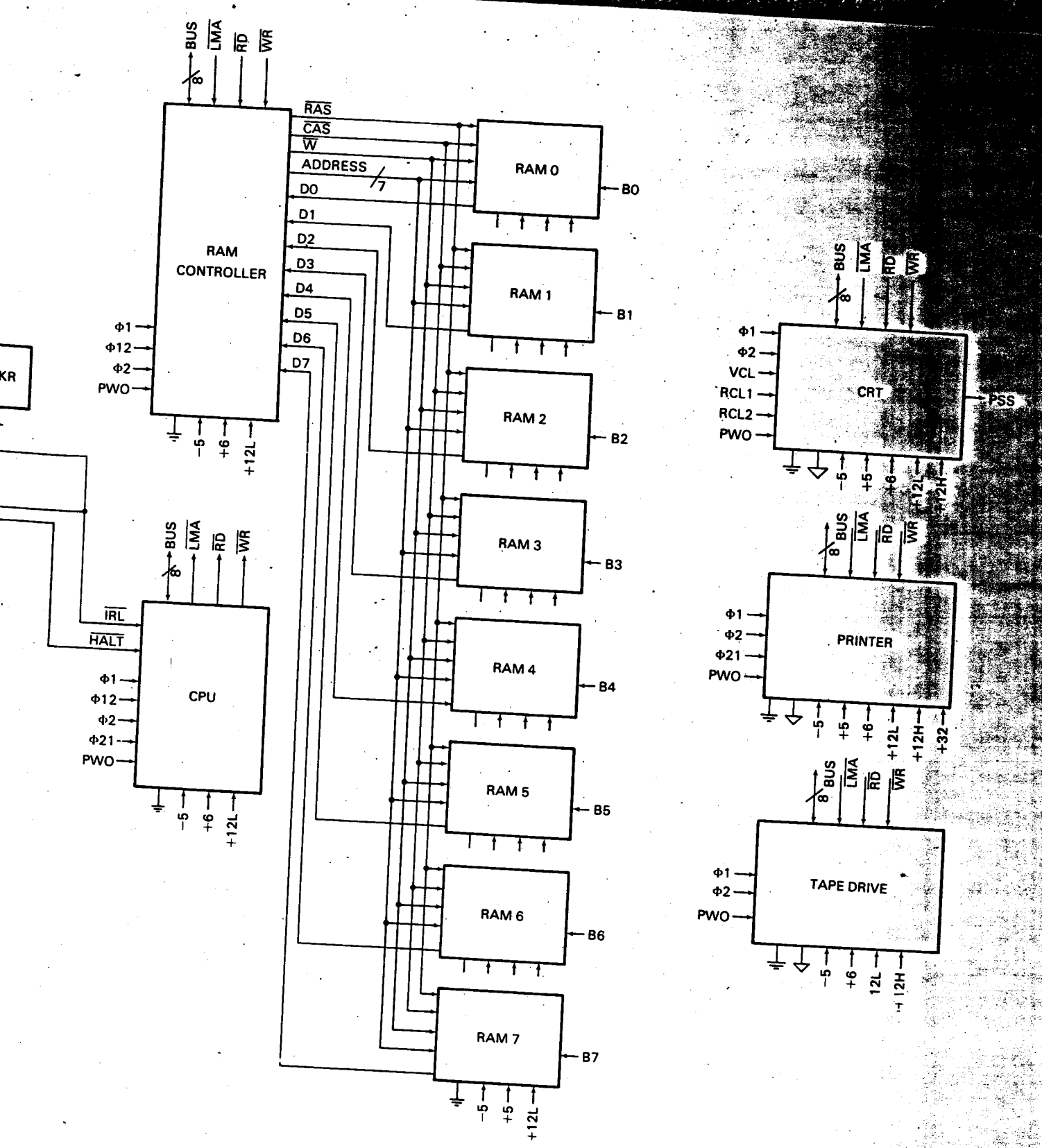
Diagrams

Appendix A

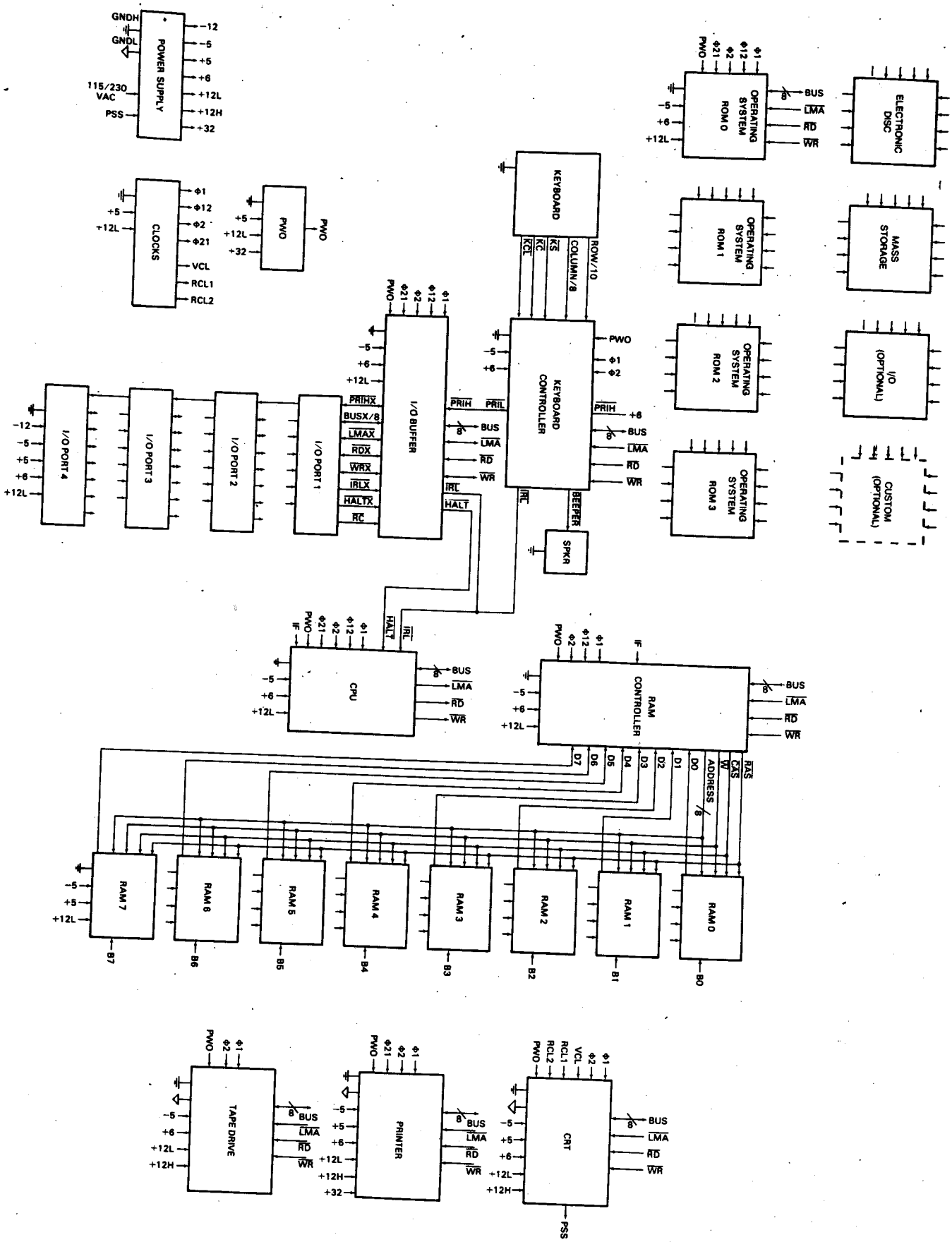


HP-85A Block Diagram

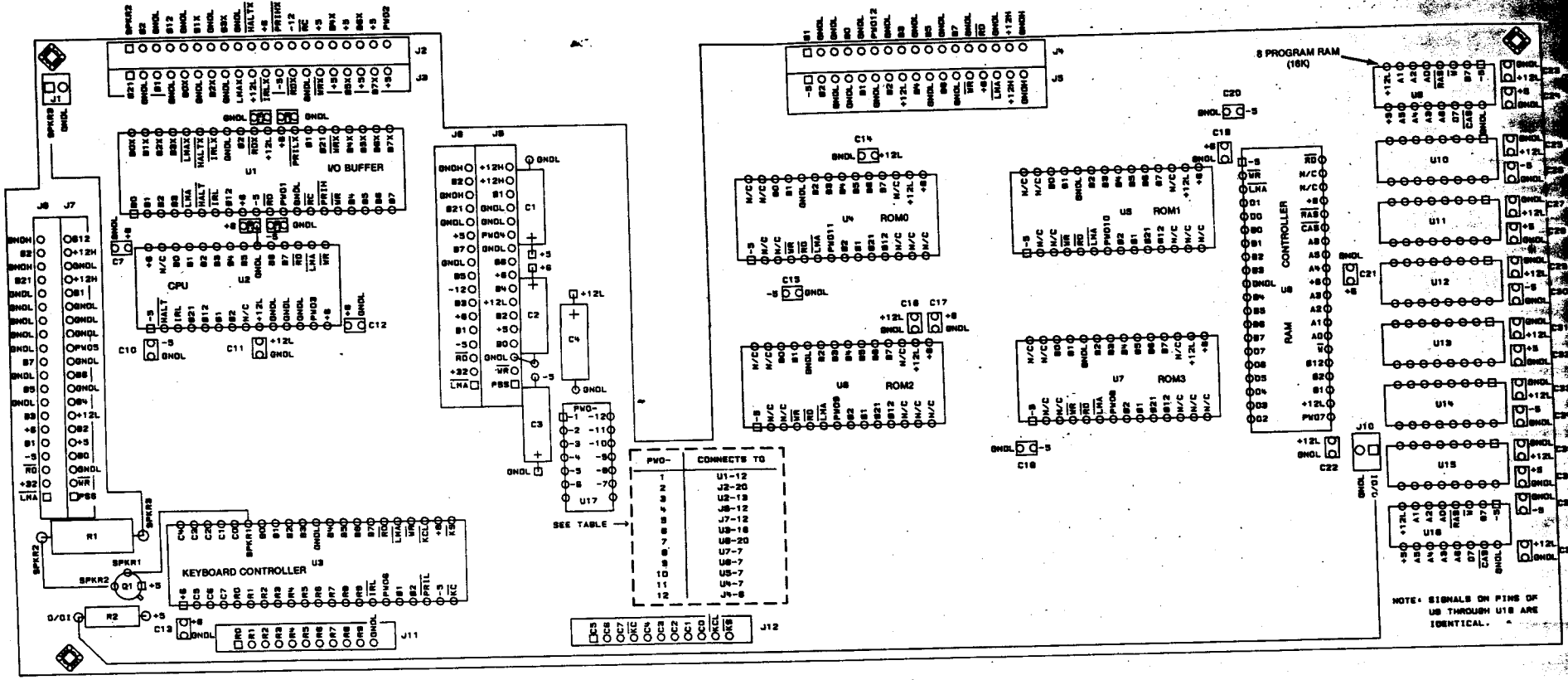

BUS
8
LMA
RD
WR
Φ1
Φ12
Φ2
Φ21
PWO
ROM 0
-5
+6
+12L
ROM 1
ROM 2
ROM 3
PWO
Φ1
Φ2
+6
PRIH
BUS
8
LMA
RD
WR
KEYBOARD
ROW/10
COLUMN/8
KS
KC
KCL
KEYBOARD CONTROLLER
BEEPER
SPKR
IRL
-5
+6
PRIL
PRIH
BUS
8
LMA
RD
WR
IRL
HALT
Φ1
Φ12
Φ2
Φ21
PWO
I/O BUFFER
-5
+6
+12L
PRIHX
BUSX/8
LMAX
RDX
WRX
IRLX
HALTX
RC
I/O PORT 1
I/O PORT 2
I/O PORT 3
I/O PORT 4
-12
-5
+5
+6
+12L
PWO
PWO
+5
+12L
+32
-12
-5
+5
+6
+12L
+12H
+32
POWER SUPPLY
GNDH
GNDL
115/230 VAC
PSS
Φ1
Φ12
Φ2
Φ21
VCL
RCL1
RCL2
CLOCKS
+5
+12L



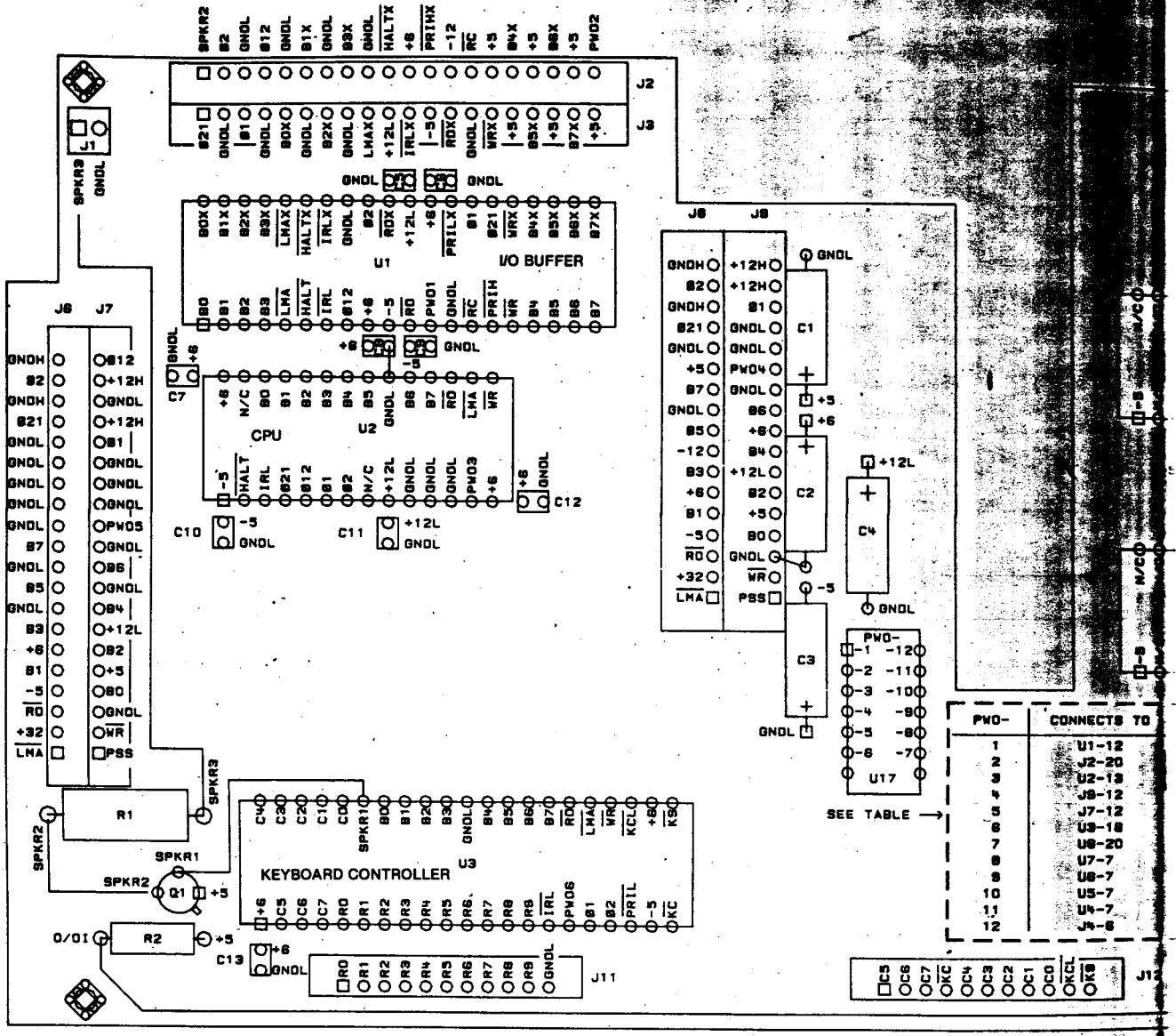
-85A Block Diagram



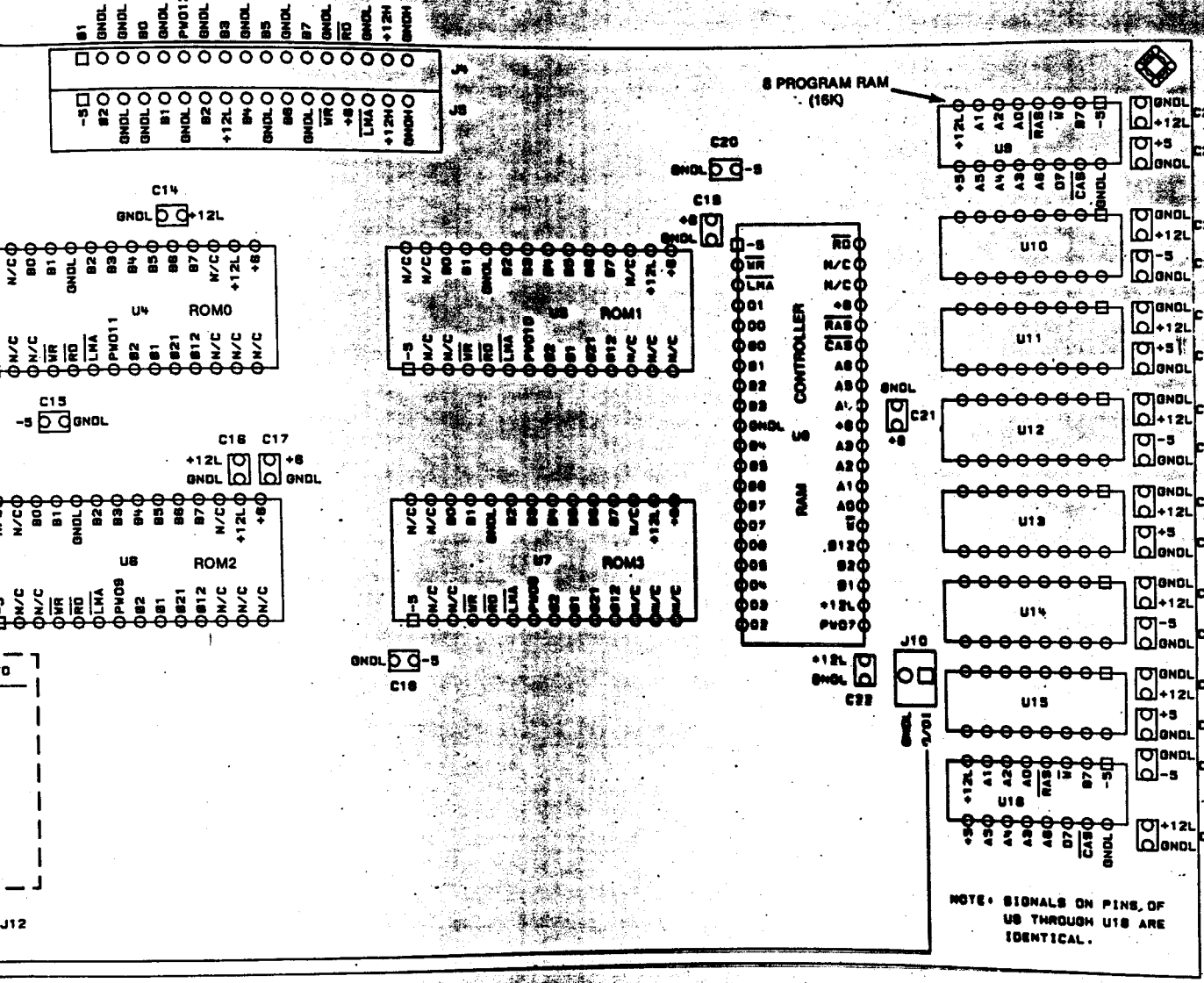
HP 85B Block Diagram



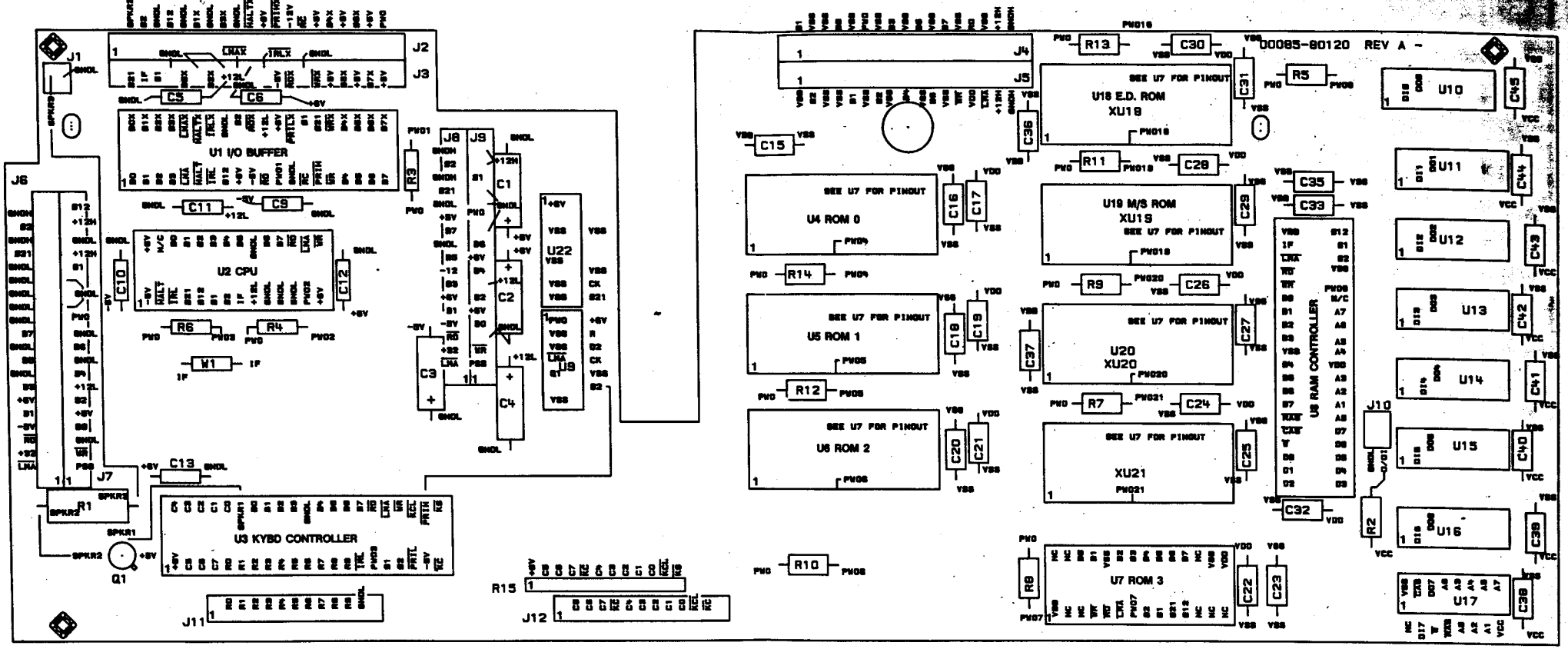
HP-85A Logic PCA Component Location Diagram



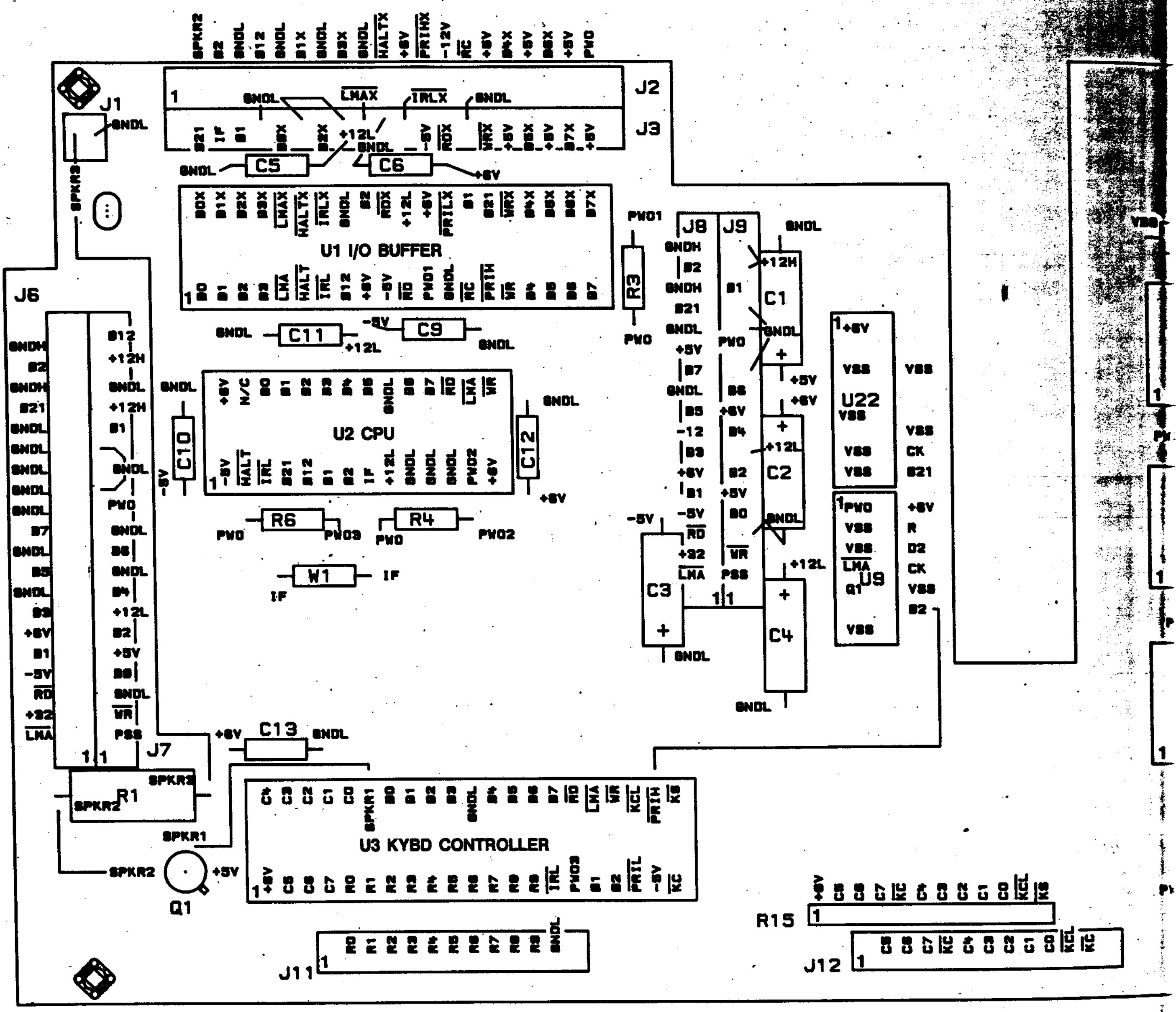
HP-85A Logic PCA Comp



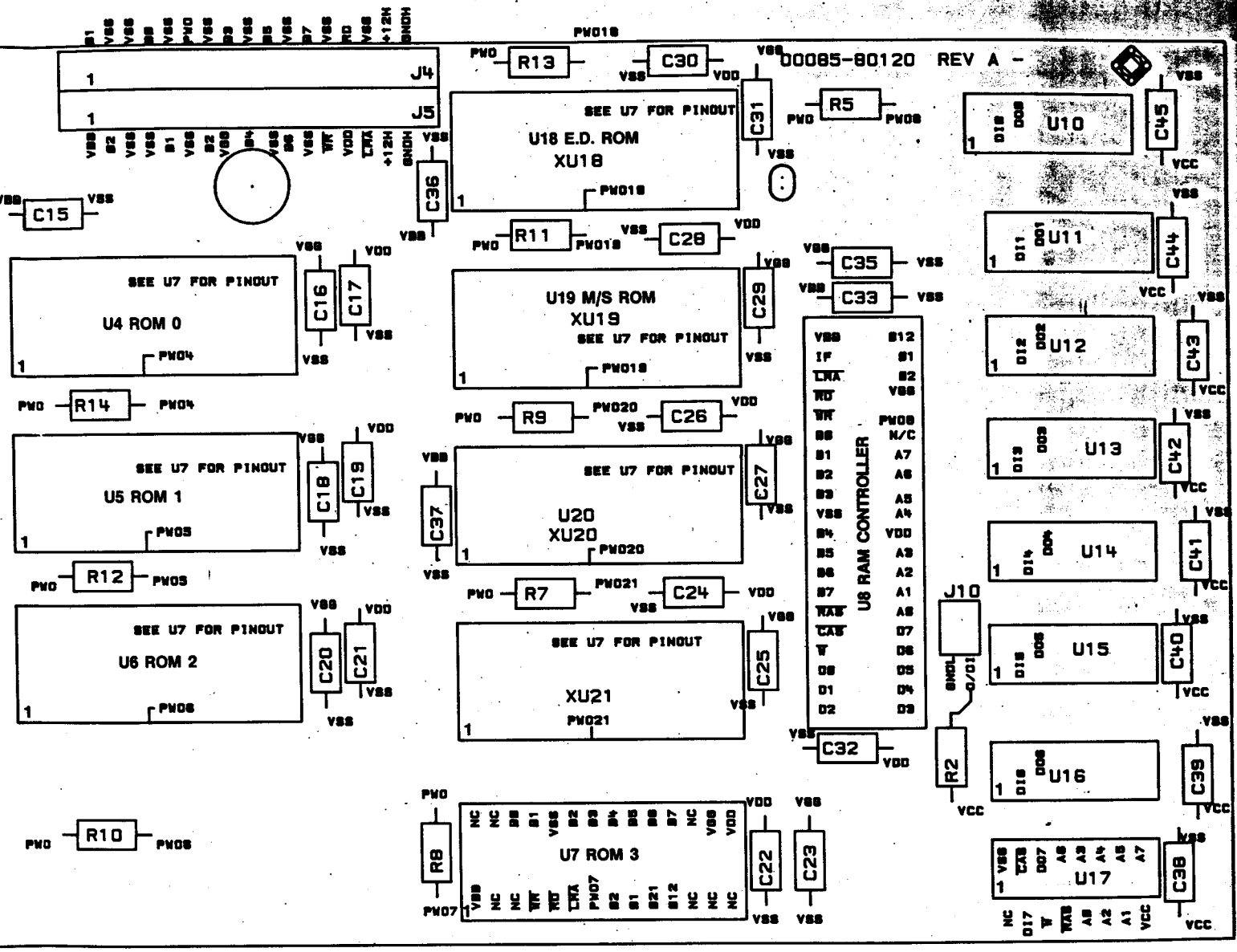
mponent Location Diagram



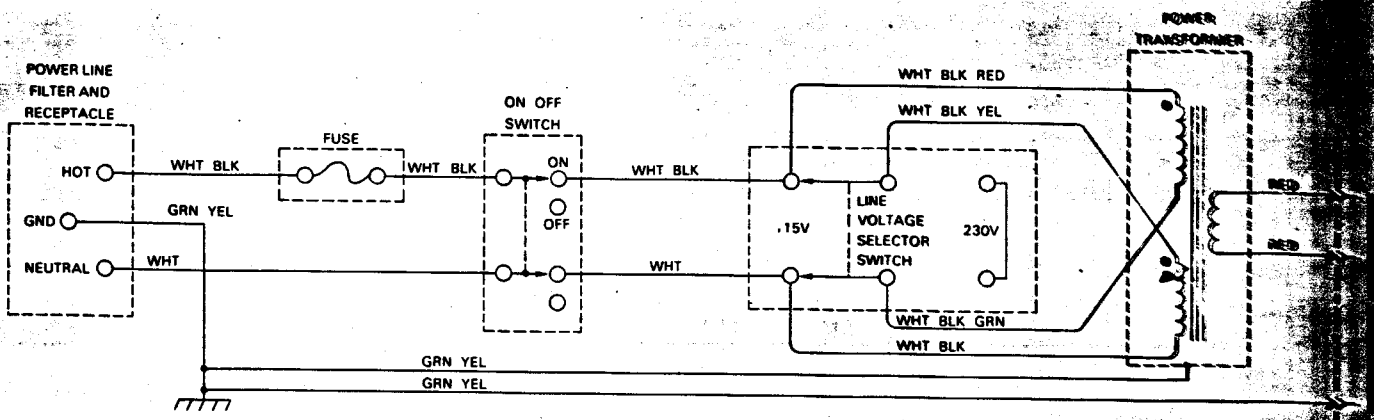
HP 85B Logic PCA Component Location Diagram



HP 85B Logic PCA Co



Component Location Diagram

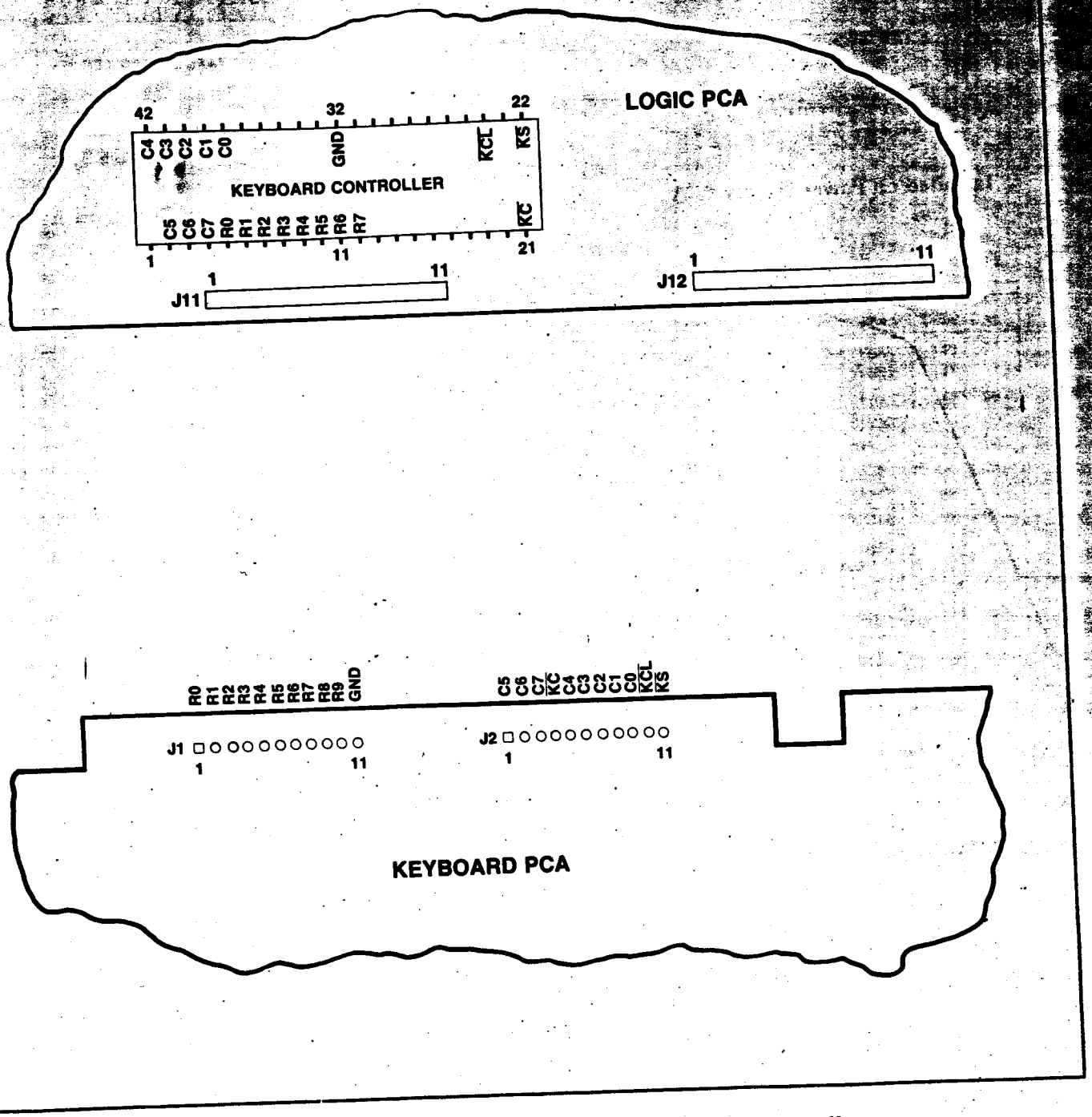


NOTES:

1 POWER LINE FILTER AND RECEPTACLE TERMINALS ARE IDENTIFIED AS FOLLOWS
HOT – BROWN DOT
NEUTRAL – BLUE DOT
GROUND – SOLDERED TO CASE.

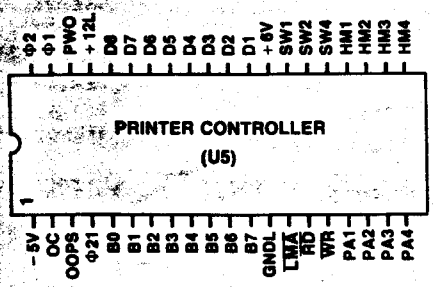
2 TRANSFORMER CORE MUST BE GROUNDED VIA 18 AWG WIRE CONNECTED TO SAME GROUND LUG AS GROUND ON LINE FILTER

Back Panel Assembly Schematic Diagram

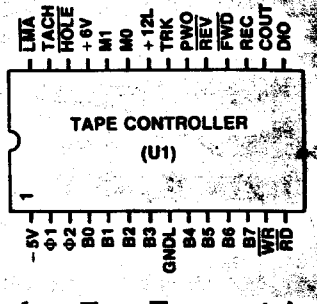


Row and Column Pins on Keyboard PCA and Keyboard Controller

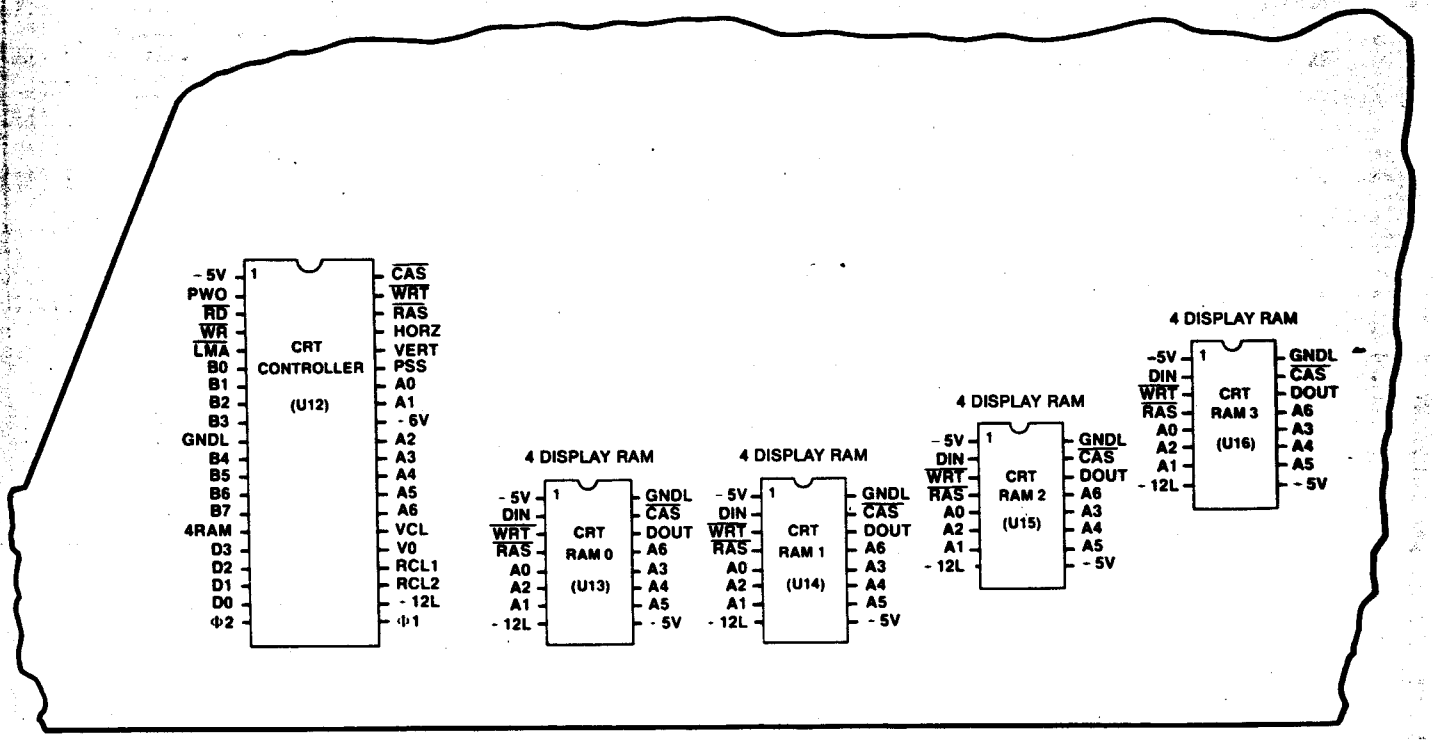
Installed on CRT PCA



Installed on Power Supply PCA



Installed on Tape Transport Assembly



Socketed IC Location Diagram for Printer, CRT, and Tape Drive

Reference Tables

Appendix B

Character and Key Codes

EQUIVALENT FORMS				EQUIVALENT FORMS				EQUIVALENT FORMS				EQUIVALENT FORMS			
Char.	Binary	Octal	Dec	Char.	Binary	Octal	Dec	Char.	Binary	Octal	Dec	Char.	Binary	Octal	Dec
@ᶜ	00000000	000	0	SPACE	00100000	040	32		01000000	100	64	KEY LABELˢ	01100000	140	96
Aᶜ	00000001	001	1	!	00100001	041	33	A	01000001	101	65	a	01100001	141	97
Bᶜ	00000010	002	2	"	00100010	042	34	B	01000010	102	66	b	01100010	142	98
Cᶜ	00000011	003	3	#	00100011	043	35	C	01000011	103	67	c	01100011	143	99
Dᶜ	00000100	004	4	$	00100100	044	36	D	01000100	104	68	d	01100100	144	100
Eᶜ	00000101	005	5	%	00100101	045	37	E	01000101	105	69	e	01100101	145	101
Fᶜ	00000110	006	6	&	00100110	046	38	F	01000110	106	70	f	01100110	146	102
Gᶜ	00000111	007	7	'	00100111	047	39	G	01000111	107	71	g	01100111	147	103
Hᶜ	00001000	010	8	(	00101000	050	40	H	01001000	110	72	h	01101000	150	104
Iᶜ	00001001	011	9	)	00101001	051	41	I	01001001	111	73	i	01101001	151	105
Jᶜ	00001010	012	10	*	00101010	052	42	J	01001010	112	74	j	01101010	152	106
Kᶜ	00001011	013	11	+	00101011	053	43	K	01001011	113	75	k	01101011	153	107
Lᶜ	00001100	014	12	,	00101100	054	44	L	01001100	114	76	l	01101100	154	108
CR Mᶜ	00001101	015	13	-	00101101	055	45	M	01001101	115	77	m	01101101	155	109
Nᶜ	00001110	016	14	.	00101110	056	46	N	01001110	116	78	n	01101110	156	110
Oᶜ	00001111	017	15	/	00101111	057	47	O	01001111	117	79	o	01101111	157	111
Pᶜ	00010000	020	16	0	00110000	060	48	P	01010000	120	80	p	01110000	160	112
Qᶜ	00010001	021	17	1	00110001	061	49	Q	01010001	121	81	q	01110001	161	113
Rᶜ	00010010	022	18	2	00110010	062	50	R	01010010	122	82	r	01110010	162	114
Sᶜ	00010011	023	19	3	00110011	063	51	S	01010011	123	83	s	01110011	163	115
Tᶜ	00010100	024	20	4	00110100	064	52	T	01010100	124	84	t	01110100	164	116
Uᶜ	00010101	025	21	5	00110101	065	53	U	01010101	125	85	u	01110101	165	117
Vᶜ	00010110	026	22	6	00110110	066	54	V	01010110	126	86	v	01110110	166	118
Wᶜ	00010111	027	23	7	00110111	067	55	W	01010111	127	87	w	01110111	167	119
Xᶜ	00011000	030	24	8	00111000	070	56	X	01011000	130	88	x	01111000	170	120
Yᶜ	00011001	031	25	9	00111001	071	57	Y	01011001	131	89	y	01111001	171	121
Zᶜ	00011010	032	26	:	00111010	072	58	Z	01011010	132	90	z	01111010	172	122
[ᶜ	00011011	033	27	;	00111011	073	59	[	01011011	133	91	π (/)ˢ	01111011	173	123
\ᶜ	00011100	034	28	<	00111100	074	60	\	01011100	134	92	|	01111100	174	124
]ᶜ	00011101	035	29	=	00111101	075	61	]	01011101	135	93	→ (−)ˢ	01111101	175	125
^ᶜ	00011110	036	30	>	00111110	076	62	^	01011110	136	94	Σ (*)ˢ	01111110	176	126
_ᶜ	00011111	037	31	?	00111111	077	63	_	01011111	137	95	⊢ (+)ˢ	01111111	177	127

Test	Key	Command
System	[A]	SYSTEM
*CPU	[B]	CPU
*RAM	[C]	RAM
*ROM	[D]	ROM
*Beeper	[E]	BEEPER
*CRT	[F]	DISPLAY
*Printer	[G]	PRT
*Tape (Abbreviated)	[H]	ATAPE
†,*Tape Write-Protect	[I]	TPROT
*Timer	[J]	TIMER
*Keyboard	[K]	KBD
External RAM	[L]	XRAM
External ROM	[M]	XROM
Heat	[N]	HEAT
Tape (Full)	[O]	TAPE
†Status	[P]	TSTAT
†Speed	[Q]	TSPEED
†Hole-Detect	[R]	THOLE
†Write	[S]	TWRITE
†Read	[T]	TREAD
†Record	[U]	TREC
Cycle	[V]	CYCLE

*The System Test automatically runs these tests in the order shown.

†The Full Tape Test automatically runs these tests in the order shown.

ICs Using System Clocks

IC	Clock Signal			
	01	012	02	021
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	X
Printer Controller	X			

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		
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	

Parts and Circuits Using Power Supply Lines (Continued)

Assembly	Part or Circuit	Power Supply Line						
		+12H	+12L	+6	+5	−5	−12	+32
Bottom Case	Speaker				X			
	Power Light				X			
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

Power Supply, PWO, and Clock Test Points

Lines	Source	Signal	Check Pin	Acceptable
Power supply	Printer PCA	+12	J1-16, 17	11.4V to 12.6V
		+6	J2-6	5.70V to 6.30V
	(HP 85A only)	+5	J2-12	4.75V to 5.25V
	(HP 85B only)	+5	Across 22-ohm load	5.20V to 5.60V*
	(HP 85B only)	+5	J2-12	5.15V to 5.35V†
		−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	01	J2-16	See Figure 2-7 on page 2-15 of the *HP 85 Assembly-Level Service Manual.*
		012	J2-20	
		02	J1-19	
		021	J1-17	

fer to page 2-14 in the *HP 85B Assembly-Level Service Manual.*

bbon cables must be connected from PR/PS PCA to Logic PCA.

onitor the PWO signal with an oscilloscope as you switch the power on. PWO should reach at least 4.4 Vdc a action of a second after you switch the power on—but not instantly.

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
{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

Mnemonics and Key Lines for Keys Expected (Continued)

Service ROM Mnemonic	Key Expected	Row Line	Column Line
{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
{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
{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

Plug-In ROM Codes

ROM Code	ROM	HP Part Number
232	Advanced Programming ROM	00085-15005
176	Matrix ROM	00085-15004
192	I/O ROM	00085-15003
208	Mass Storage ROM	00085-15001
209	Electronic Disc ROM	IMA7-0087
224	Service ROM	00085-15006
240	Plotter/Printer ROM	00085-15002
40	Assembler ROM	00085-15007

Troubleshooting Charts

Appendix C

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
PRT CONTROL BAD!	U5	printer
TAPE CONTROL BAD!	U1	tape drive
TIMER BAD!	U3	logic
KEY CONTROL BAD!	U3	logic

Keyboard Troubleshooting*

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. 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] appears to be down.	Press expected key again with [CAPS LOCK] key up.

Keyboard Troubleshooting* (Continued)

Message	Reason	Diagnosis/Repair
CAPS DOWN (key expected)	[CAPS LOCK] key appears to be up.	Press expected key again with [CAPS LOCK] key down.
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.
RETURN TO BASIC SYSTEM	The wrong character was entered, but, [SHIFT], [CAPS LOCK], and [CTRL] are functioning properly.	Refer to paragraph 4-10.
RETURN TO BASIC SYSTEM (one of first 32 characters in Table B-7)	[SHIFT], [CAPS LOCK], or [CTRL] appear to be down.	Refer to paragraph 4-11.
No response to pressing any key.	No key was entered.	Replace keyboard controller. If problem persists, refer to paragraph 4-6.

* Paragraph designations refer to the *HP 85 Assembly Level Service Manual*.

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 backdwards.	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.*

Printer Troubleshooting Guide (Continued)

Symptom	Possible Cause	Diagnosis/Repair
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 Lesson 5.)
	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 Lesson 5.)
	Print-head drive belt too tight.	Adjust tension on belt.** (Refer to adjusting the print-head drive belt, Lesson 5.)
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, Lesson 5.)
	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, Lesson 5.)
	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.
	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 Lesson 5.
	Paper-advance drive belt too loose or too tight.	Adjust tension on belt. (Refer to adjusting the paper advance belt, Lesson 5.)
	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.

Printer Troubleshooting Guide (Continued)

Symptom	Possible Cause	Diagnosis/Repair
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.*
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, Lesson 5.)
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.
	Print-head drive belt too tight (or too loose).	Adjust tension on belt.** (Refer to (Refer to adjusting the print-head drive belt.
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, Lesson 5.)
	Print-head drive belt too tight (or too loose).	Adjust tension on belt.** (Refer to adjusting the print-head drive belt, Lesson 5.)
Vertical streaks printed on all lines.	Bad platen.	Replace platen.

Printer Troubleshooting Guide (Continued)

Symptom	Possible Cause	Diagnosis/Repair
Streak(s) printed across lines.	Bad spring in print-head assembly.	Check spring and replace if necessary.
	Print head is dirty.	Clean with a pink pencil eraser.
	Bad print-head assembly.	Check for sharp corners on print head; replace if necessary.
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.
	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.
	Bad controller (U5).	Try new controller.
Print-head movement slow or erratic.	Print-head drive belt too tight.	Adjust tension on belt.** (Refer to adjusting the print-head drive belt, Lesson 5.)
Note: Slow print-head movement can destroy print-head resistors.	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.

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 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.*
Execessive 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. Belt or pulley worn or damaged.	Clean or replace.** 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 of Service Manual.) If printed lines are not correctly aligned, remove the jumper wire (W37) from the printer PCA if installed, or install one if not.

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 or 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		
TAPE ERROR! READ	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.
TAPE ERROR! WRITE (unless followed by {C}, {F}, {I}, or {L})	Cartridge not seating properly: dirt in mechanism, leaf spring bad, or graounding 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 tape head.
	Tape capstan dirty.	Clean capstan.
	Bad controller (U1).	Try replacing controller.
	Bad motor/capstan assembly.	Try replacing motor/capstan assembly.**
	Bad tape drive assembly.	Repalce tape drive assembly.
TAPE UNPROTECTED!	Bad controller (U1) (unless Abbreviated Tape Test or Tape Status Test has been passed).	Run Tape Status Test, and replace controller if TAPE CONTROL BAD! message appears.
TAPE UNPROTECTED!	Bad tape drive assembly.	Replace tape drive assembly.
TAPE ERROR! GAP	Bad controller (U1).	Try replacing controller.

Tape Drive Troubleshooting (Continued)

Service ROM Message	Possible Cause	Diagnosis/Repair
TAPE ERROR! SPEED	Bad motor/capstan assembly.	Try replacing motor/capstan assembly.**
TAPE STALLED!	Bad tape drive assembly.	Replace tape drive assembly.
TAPE ERROR! HOLE END OF TAPE!	Customer's tape cartridge bad (light path obscured).	Remove customer's tape cartridge and run Hole-Detect 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! TAPE OUT! TAPE PROTECTED!	Bad controller (U1).	Try replacing controller.
	Bad tape drive assembly.	Replace tape drive assembly.

* 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.

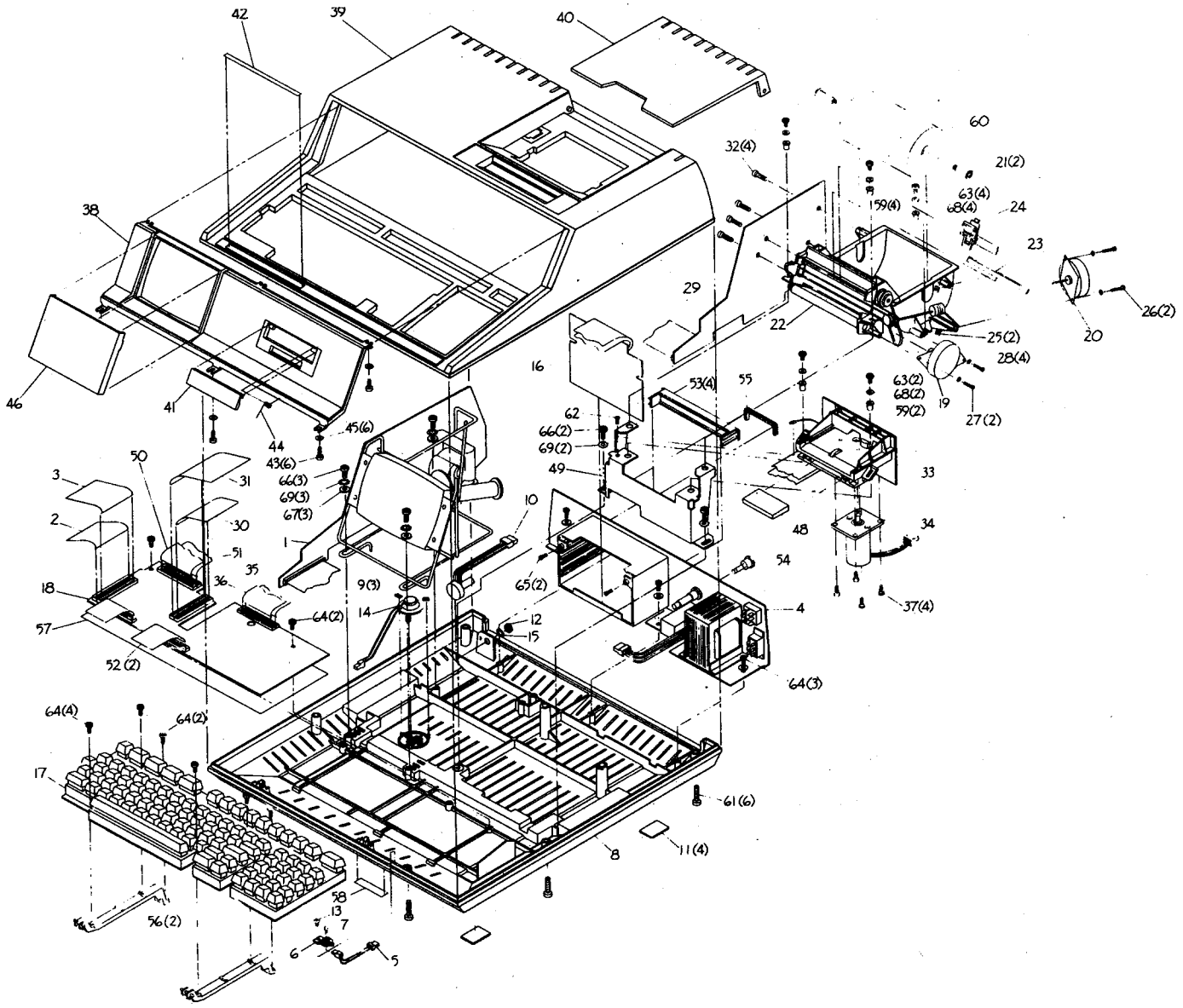
** If an oscilloscope is not available, replace the entire tape drive assembly instead of just the motor/capstan assembly. If an oscilloscope is available, check whether R7 must be connected or removed to match the motor/capstan assembly to the tape drive PCA.

ICs Indicated by CPU BAD! Or RAM BAD! Message

Character	RAM	Reference Designation
¿	0	U9
$\bar{x}$	1	U10
α	2	U11
Δ	3	U12
Θ	4	U13
(blank)	5	U14
@	6	U15
◀	7	U16

Service Manual Supplement

Appendix D



HP 85A Exploded View

Page & Index Number	HP Part Number	Description	Qty
D-1			
1	*00085-69004	ASSEMBLY CRT	1
1	†00085-69023	ASSEMBLY CRT	1
2	8210-3706	■ 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
4	*00085-60920	ASSEMBLY, back panel (refer to page D-5)	1
	†00085-60967	ASSEMBLY, back panel (refer to page D-5)	1
		ASSEMBLY, bottom case	1
	†00085-80006	■ APRON, EMI	1
5	00085-60025	■ ASSEMBLY, power light	1
6	00085-40019	■ HOLDER	1
7	1990-0524	■ 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 × 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
16	†00085-60968	ASSEMBLY I/O PC	1
17	00085-60919	ASSEMBLY, keyboard (refer to Table 4-4)	1
52	8120-3713	■ CABLE, ribbon (W9, 10)	2
56	00085-40031	■ HINGE, keyboard	2
64	0624-0314	■ SCREW, tapping, 4-20 × 0.375-inch	4
18	*00085-60918	ASSEMBLY, logic PC	1
18	†00085-69020	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
	*1MY7-0063	■ INTEGRATED CIRCUIT, ROM 3 (U7)	1
	*1MA2-0002	■ INTEGRATED CIRCUIT, RAM controller (U8)	1
	*1818-1396	■ INTEGRATED CIRCUIT, RAM (U9 thru U16)	8
	†1MA7-0096	■ IC, DIP I/O ROM "repair use only"	1
	†1MA7-0087	■ IC, DIP Mass Storage ROM "repair use only"	1
	†1MA7-0088	■ Electronic Disc ROM "repair use only"	1
	00085-60908	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	■ ASSEMBLY, platen	1
	00085-60056	■ ASSEMBLY, platen holder	1

*Parts unique to HP 85A

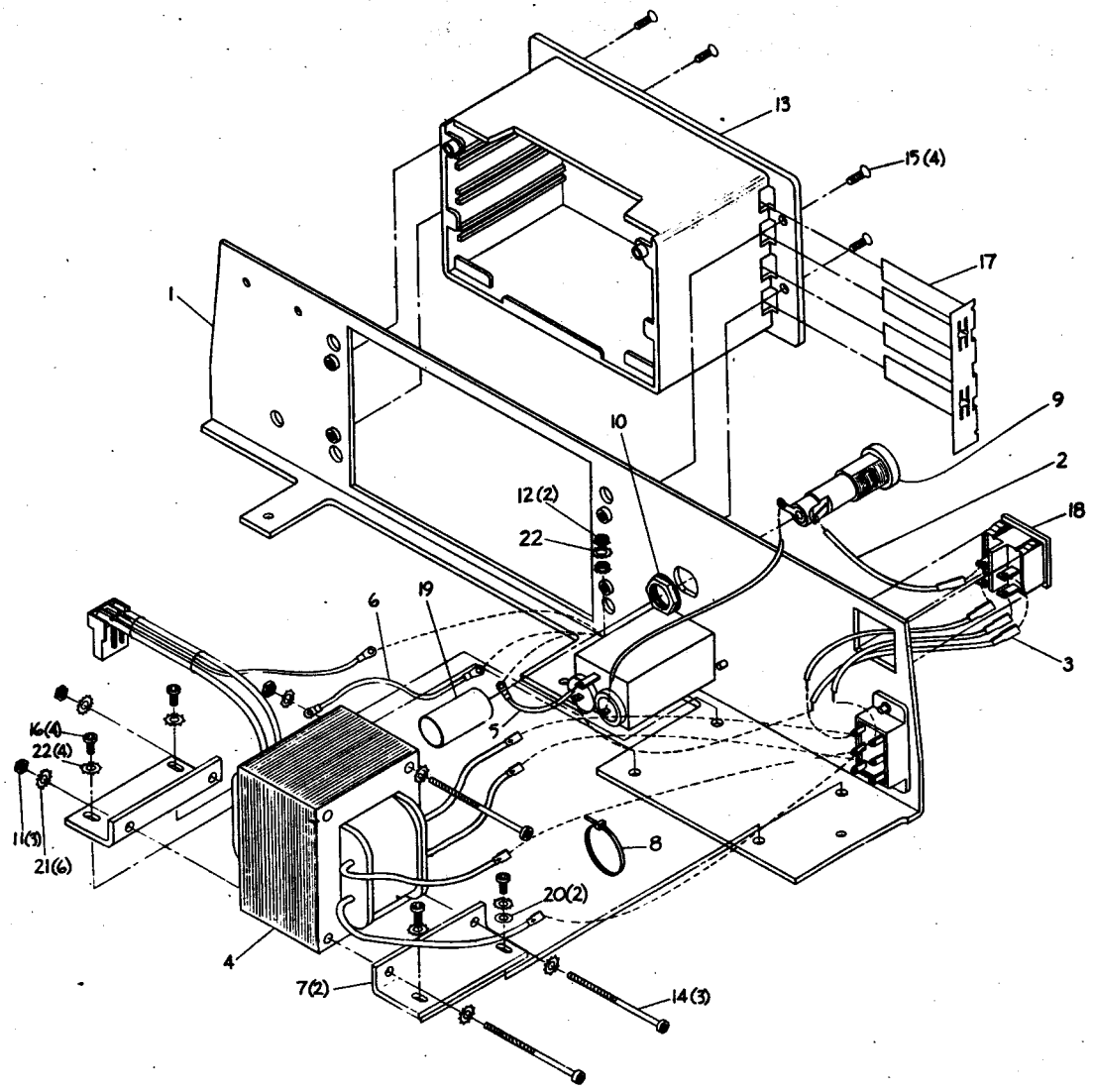
†Parts unique to HP 85B

Page & Index Number	HP Part Number	Description	Qty
24	00085-60923	■ ASSEMBLY, print head	1
	00085-40017	■ BEARING, steady, (print-head belt tension)	1
	1500-0572	■ BELT, paper-advance	1
	1500-0529	■ BELT, print-head	1
25	0590-0787	■ NUT, square, no chamfer, 4-40	2
26	2200-0589	■ SCREW, machine, 4-40 × 0.312-inch	2
27	0624-0314	■ SCREW, tapping, 4-20 × 0.375-inch	2
	1460-1732	■ SPRING, print-head belt tension	1
28	2190-0891	■ WASHER, flat metallic, #4	4
29	*00085-69002	ASSEMBLY, printer PC	1
29	†00085-69019	ASSEMBLY, printer PC	1
	1MA9-0101	■ INTEGRATED CIRCUIT, printer controller (U5)	1
30	8120-3709	■ CABLE, ribbon (W5)	1
31	8210-3710	■ CABLE, ribbon (W6)	1
32	0624-0394	■ SCREW, tapping, 10-32 × 0.375-inch	4
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	■ INTEGRATED CIRCUIT, tape controller (U1)	1
	*0683-4735	■ RESISTOR (R7), 47K, 5%, 0.25W	1
37	0624-0324	■ SCREW, tapping, 4-20 × 0.312-inch	4
		ASSEMBLY, top case	1
38	4040-1634	■ BEZEL	1
39	4040-1999	■ COVER	1
40	4040-1625	■ DOOR, paper	1
41	00085-40008	■ DOOR, tape	1
42	*7120-8171	■ LABEL, nameplate	1
42	†00085-90975	■ LABEL, nameplate, HP-85B	1
43	0624-0289	■ SCREW, tapping, 2-28 × 0.312-inch	6
44	1460-1726	■ SPRING, tape door	1
45	3050-0098	■ WASHER, flat metallis, #2	6
46	00085-40007	■ WINDOW, CRT	1
47	00085-40016	BAR, printer tear	1
48	00085-40020	BAR, tape ejector	1
49	1600-0924	BRACKET, tape drive support	1
50	8120-3702	CABLE, ribbon I/O (W3)	1
51	8120-3714	CABLE, ribbon, I/O (W4)	1
53	00085-40011	COVER, I/O port	4
54	00085-60088	FUSE with fuseholder cap, 115V	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

*Parts unique to HP 85A

†Parts unique to HP 85B

Page & Index Number	HP Part Number	Description	Qty
60	9270-0692	PAPER, thermal (two rolls)	1/2
61	2200-0147	SCREW, machine, 4-40 × 0.625-inch	6
62	2200-0103	SCREW, machine, 4-40 × 0.25-inch	1
63	2360-0205	SCREW, machine, 6-32 × 0.75-inch	6
64	0624-0314	SCREW, tapping, 4-20 × 0.375-inch	7
65	0624-0403	SCREW, tapping, 6-19 × 0.375-inch	2
66	0624-0446	SCREW, tapping, 6-19 × 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

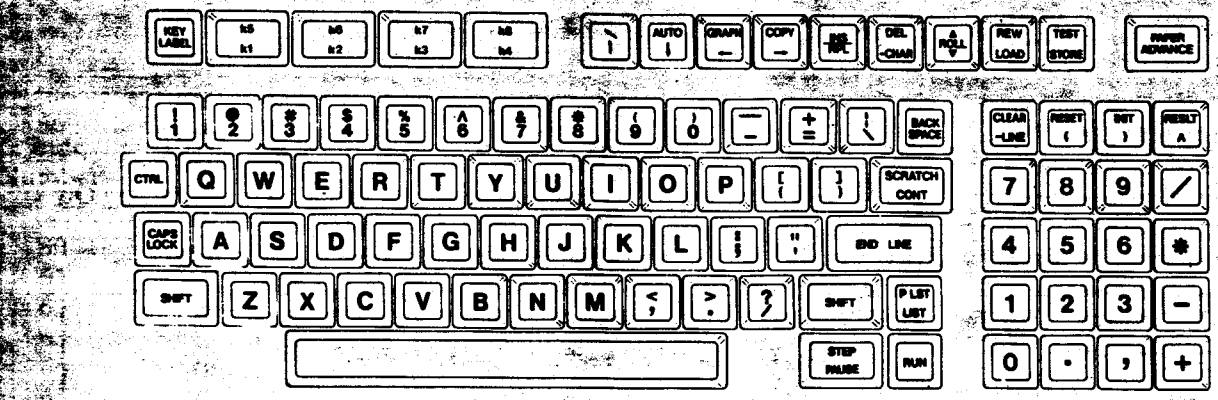


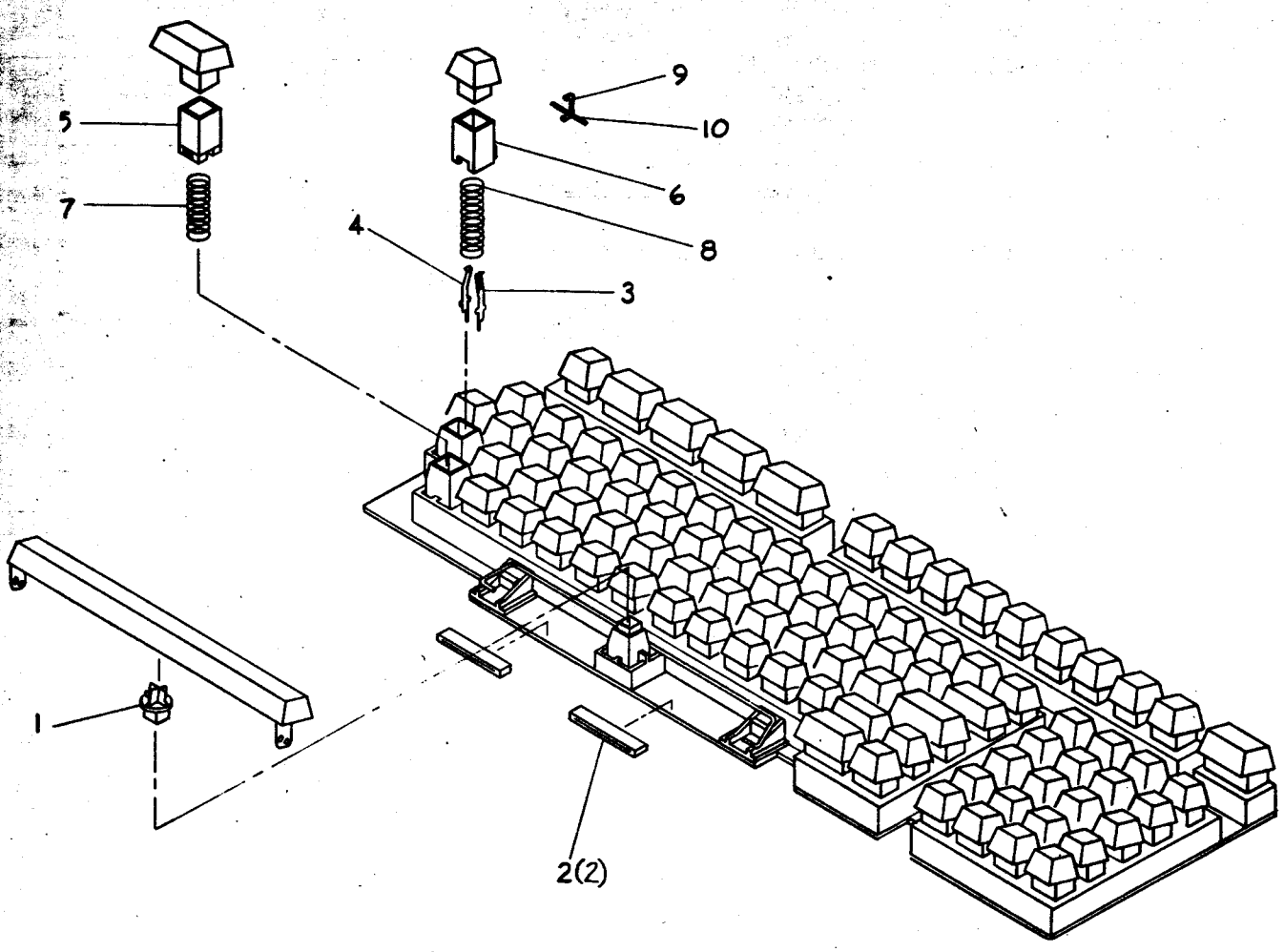
Back Panel Assembly Exploded View

Back Panel Assembly Replaceable Parts

Page & Index Number	HP Part Number	Description	Qty
D-4			
1	*00085-60920	ASSEMBLY, back panel with line filter and switch	1
1	†00085-60967	ASSEMBLY, back panel with line filter and switch	1
2	00085-60067	ASSEMBLY, connector, fuse to ON/OFF switch	1
3	00085-60066	ASSEMBLY, connector, line filter to ON/OFF switch	1
	0362-0554	■ 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	2
7	1600-0805	BRACKET, transformer	1
8	1400-0249	CABLE TIE	1
9	2110-0610	FUSEHOLDER	1
10	2110-0569	NUT, fuseholder	3
11	2260-0111	NUT, hex, 4-40	2
12	0590-0305	NUT, hex, 6-32, with lockwasher	1
13	00085-40010	RECEPTACLE, I/O	3
14	2200-0608	SCREW, machine, 4-40 × 2-inches	4
15	2360-0481	SCREW, machine, black, 6-32 × 0.375-inch	4
16	2360-0195	SCREW, machine, 6-32 × 0.312-inch	2
	†2360-0314	SCREW, machine, 6-32 × 0.250-inch	1
17	1600-0923	SPRING, grounding	1
18	3101-0402	SWITCH, ON/OFF	1
19	0890-1357	TUBING, heat shrinkable	2
20	3050-0399	WASHER, flat metallic, #6	6
21	2190-0411	WASHER, lock, external tooth, #4	5
22	2190-0563	WASHER, lock, external tooth, #6	
	†00085-00012	SHIELD, EMI	

*Parts unique to the HP 85A
†Parts unique to teh HP 85B





Keyboard Assembly Exploded View

Keyboard Assembly Replaceable Parts

HP Part Number	Description
0371-0136	CAP, key, [LABEL KEY]
0371-0149	CAP, key, [k1 k5]
0371-0150	CAP, key, [k2 k6]
0371-0151	CAP, key, [k3 k7]
0371-0152	CAP, key, [k4 k8]
0371-0092	CAP, key, [ ]
0371-0093	CAP, key, [AUTO]
0371-0094	CAP, key, [GRAPH]
0371-0095	CAP, key, [COPY]
0371-0096	CAP, key, [RPL INS]
0371-0098	CAP, key, [-CHAR DEL]
0371-0137	CAP, key, [ROLL]
0371-0138	CAP, key, [LOAD REW]
0371-0139	CAP, key, [STORE TEST]
0371-0144	CAP, key, [PAPER ADVANCE]
0371-0119	CAP, key, [1 !]
0371-0103	CAP, key, [2 @]
0371-0104	CAP, key, [3 #]
0371-0105	CAP, key, [4 $]
0371-0106	CAP, key, [5 %]
0371-0063	CAP, key, [6]
0371-0130	CAP, key, [7 &]
0371-0070	CAP, key, [8 *]
0371-0071	CAP, key, [9 (]
0371-0072	CAP, key, [0)]
0371-0073	CAP, key, [- _]
0371-0074	CAP, key, [= +]
0371-0075	CAP, key, [\ |]
0371-0076	CAP, key, [BACK SPACE]
0371-0069	CAP, key, [-LINE CLEAR]
0371-0141	CAP, key, [(RESET]
0371-0140	CAP, key, [) INIT]
0371-0097	CAP, key, [RESLT]
0371-0131	CAP, key, [CTRL]
0371-0101	CAP, key, [Q]
0371-0090	CAP, key, [W]
0371-0120	CAP, key, [E]
0371-0100	CAP, key, [R]
0371-0079	CAP, key, [T]
0371-0108	CAP, key, [Y]
0371-0080	CAP, key, [U]
0371-0085	CAP, key, [I]
0371-0133	CAP, key, [-]
0371-0125	CAP, key, [O]
0371-0123	CAP, key, [P]
0371-0143	CAP, key [([]
0371-0065	CAP, key, [)]]
0371-0145	CAP, key, (CONT]/[SCRATCH]
0371-0124	CAP, key, [7]
0371-0117	CAP, key, [8]
0371-0118	CAP, key, [9]
0371-0078	CAP, key, [/]
0371-0127	CAP, key, [CAPS LOCK]
0371-0142	CAP, key, [A]
0371-0099	CAP, key, [S]
0371-0121	CAP, key, [D]
0371-0088	CAP, key, [F]
0371-0087	CAP, key, [G]
0371-0086	CAP, key, [H]
0371-0084	CAP, key, [J]
0371-0083	CAP, key, [K]
0371-0082	CAP, key, [L]
0371-0132	CAP, key, [; :]
0371-0128	CAP, key, [' "]
0371-0153	CAP, key, [END LINE]
0371-0114	CAP, key, [4]
0371-0115	CAP, key, [5]
0371-0116	CAP, key, [6]
0371-0077	CAP, key, [*]
0371-0147	CAP, key, [SHIFT], right offset stem
0371-0107	CAP, key, [Z]
0371-0089	CAP, key, [X]
0371-0122	CAP, key, [C]
0371-0091	CAP, key, [V]
0371-0064	CAP, key, [B]
0371-0126	CAP, key, [N]
0371-0081	CAP, key, [M]
0371-0066	CAP, key, [, <]
0371-0067	CAP, key, [. >]
0371-0068	CAP, key, [/ ?]
0371-0146	CAP, key, [SHIFT], left offset stem
0371-0134	CAP, key, [LIST PLST]
0371-0111	CAP, key, [1]
0371-0112	CAP, key, [2]
0371-0113	CAP, key, [3]

Keyboard Assembly Replaceable Parts (Continued)

Figure & Index Number	HP Part Number	Description	Qty
D-6			
1	0371-0154*	CAP, key, [SPACE BAR]	1
		■ 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*	CONTACT, 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, 28mm (1.1-in.)	90
8	1150-1416*	SPRING, key, 35mm (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 (STACK POLE), use the following table:

Page & Index Number	HP Part Number	Description	Qty
D-6	0371-2738	CAP, key, [SPACE BAR]	1
3	3131-0458	CONTACT, key, slotted	92
4		CONTACT, key, solid	92
5	4040-2021	PLUNGER, key	91
6	4040-2020	PLUNGER, key, [CAPS LOCK]	1
7	1460-2012	SPRING, key, 22mm (0.89-in.)	90
8	1460-2014	SPRING, key, 26mm (1.01-in.)	2
9	1460-2013	WIRE, cam [CAPS LOCK]	1
10	7155-0489	WIRE, lock, [CAPS LOCK]	1

Quiz Answers

Appendix E

Quiz 1

1. 16K
   RAM
   64K
2. Keyboard
   RAM
   CRT
   Printer
   Tape
3. Four
4. Seven system clocks.
5. Top case
   Bottom case
   Keyboard
   CRT
   Printer
   Tape
   Back Panel
   Logic PCA
6. Bus
   Data

Quiz 2

1. Switch the computer power off and disconnect the power cord.
2. **CAUTIONS:** inform you of potential for damage to equipment.
   WARNINGS: inform you of potential danger to personnel.
3. True
4. False
5. False
6. Pale-blue color
   Buzzing emanating from sharp points in a circuit
   Ozone odor
7. Some circuits not ordinarily carrying high voltage can become lethally charged if a part is faulty or disconnected.
8. False

Quiz 3

1. A RAM IC is bad.
   The power supply is bad.
   The keyboard controller is bad.
2. False
3. By typing [A] when the Service ROM is in control
   By typing SYSTEM [END LINE] when the BASIC system is in control
4. False
5. True
6. The CPU is bad.
   The RAM controller is bad.
   A RAM IC is bad.

Quiz 4

1. The key is not operating properly.
   The key is stuck down.
   The key entered does not correspond to the key pressed.
2. In the keyboard controller.
3. a. CRT Test
   b. Keyboard Test
   c. External RAM Test
   d. Keyboard Test
   e. Abbreviated Tape Test
   f. Abbreviated Tape Test

Quiz 5

1. Pozidriv
2. The power is on
   The brightness control is disconnected or broken
3. Contaminating the surface could interfere with the EMI shielding
4. CRT assembly
5. False
6. Logic PCA
   CRT
   Tape
   Printer.

Quiz 6

1. CRT
   Back panel (I/O PCA)
   Tape Drive
   Printer
   Keyboard
2. False
3. Platen
   Print-head assembly
4. Oscilloscope
5. CR1
   TP4
   Fast-forward
6. Keyboard

Quiz 7

1. False
2. Print head
3. Cracks
   Damaged components
   Heat damage
   Loose solder connections
4. Keyboard
   Power supply
5. Power supplies
   Clocks
   Bus lines
   Control lines
6. Touch to see if hot
7. Cycle test
   A BASIC program using service ROM commands

Quiz 8

1. True
2. False
3. 16K Memory Module
   Mass Storage ROM
4. CRT PCA
   Logic PCA
   Back Panel
5. External RAM Test
   External ROM Test
   LDRAM
6. Replace Logic PCA

Course Completion Summary

Appendix F

After You've Finished...

Section	Date Completed	Time Required
General Theory		
Initial Set-Up		
Test Procedures		
Disassembly/Assembly		
Troubleshooting		
How to Keep It Running		
Options and Accessories		
The HP 85 Model B Computer		

Student's Signature

Manager's Signature

Date

Date

Course Evaluation Form

HP 85 Self-Paced Hardware Maintenance Study

Student Name: _____ Date: _____
Company: _____
Address: _____
_____
Service Manager: _____

	Yes	No
Do you feel the course objectives were met?	☐	☐
Did you find the course easy to read and understand?	☐	☐
Do you feel you need additional training?	☐	☐
Would you purchase another self-paced course?	☐	☐

How would you rate the following:

(check one)	Excellent	Very Good	Good	Acceptable	Poor
Quality of quizzes and exercises?	☐	☐	☐	☐	☐
Quality of information provided?	☐	☐	☐	☐	☐
Quantity of information provided?	☐	☐	☐	☐	☐
Service Manual provided?	☐	☐	☐	☐	☐
Diagnostic tests?	☐	☐	☐	☐	☐
Quality of troubleshooting labs?	☐	☐	☐	☐	☐
Overall rating of the course?	☐	☐	☐	☐	☐

Was the level of the course? ☐ trivial ☐ just right ☐ too technical

Would you recommend this program to other people in your organization? ☐ Yes ☐ No

Why (why not)?_____

Additional Comments: _____
_____
_____

Mail to: Hewlett-Packard, Computer Support Division
Attention: Training Program Engineering Manager
Hewlett-Packard Computer Support Division
19320 Pruneridge Avenue
Cupertino, CA 95014

Glossary and Bibliography

Appendix G

Glossary

A0 – A6=7 RAM IC address lines on Control PCA.

AC=alternating current.

B0 – B7=8 parallel data, instructions, or address bus lines.

Bus lines=lines used by the computer for transmitting data, instructions, and addresses between parts of the computer system.

CPU=the central processing unit that handles the computer arithmetic and logical operations, addressing, and instruction operations.

CRT=the computer display screen (cathode ray tube).

EMI=electromagnetic interference.

Keyboard=the module containing the typewriter keys, numeric keypad, and editing keys.

IC=integrated circuit.

I/O=input/output operations whereby the computer transmits information to the user or to other devices.

LMA=load memory address control signal on bus.

PCA=printed circuit assembly.

Pincushioning=a condition of the CRT where supposedly straight lines are displayed bent.

PWO=power-on circuitry that ensures that ICs are not enabled until the power supply and system clocks have reached their proper states.

POW=power on signal to main CPU.

RAM=random access (read/write) computer memory used for temporary storage of programs and data.

RD=read enable signal line on bus.

ROM=read-only memory used to store the computer operating system.

Skew=a condition of the CRT where straight lines are displayed straight, but rotated from the angle at which they should appear.

WR=write enable signal line on bus.

Bibliography

Manual	HP Part Number
HP 85 Owner's Manual and Programming Guide	00085-90002
HP 85 Assembly Level Service Manual	00085-90154
HP 82928A System Monitor Installation Sheet	82928-90001
HP 82928A System Monitor Service Manual	82928-90002
HP 82929A Programmable ROM Module Instruction Sheet	82929-90012
HP 82939A Programmable ROM Module Service Manual	82929-90002
HP 82937A HP-IB Interface Owner's Manual	82937-90017
HP 82937A HP-IB Interface Service Manual	82937-90013
HP 82938A HP-IL Interface Owner's Manul	82938-90001
HP 82938A HP-IL Interface Service Manual	82938-90002
HP 82939A Serial Interface Owner's Manual	82939-90012
HP 82939A Serial Interface Service Manual	82939-90008
HP 82940A GPIO Interface Owner's Manual	82940-90011
HP 82940A GPIO Interface Service Manual	82940-90007
HP 82941A BCD Interface Owner's Manual	82941-90011
HP 82941A BCD Interface Service Manual	82941-90007
HP 82949A Printer Interface Installation and Theory of Operation Manual	82949-90001
HP 82949A Printer Interface Service Manual	82949-90002
HP 82950A Modem Owner's Manual	82949-90001
HP 82905A Modem Interface Service Manual	82950-90002
HP 82903A 16K Memory Module Instruction Sheet	00085-90419
HP 82936A ROM Drawer Instruction Sheet	00085-90419
HP 82966A Data Link Owner's Manual	82966-90005
HP 82966A Data Link Interface Service Manual	82966-90007
HP 82967A Speech Synthesis Module Owner's Manual	82967-90005
HP 82967A Speech Synthesis Module Service Manual	82967-90007

HEWLETT PACKARD

Printed in U.S.A. 9/83
35106-90011

ERRATA CHANGES

Please make the following ERRATA CHANGES to your HP 85A/B Personal Computer Self-Paced Learning Guide, HP Part No. 35106-90011.

Page iii: The number of tools contained in the OEM Maintenance Kit has been reduced. Under "Materials Needed to Take This Course", the list of standard repair tools should reflect this change (as described below).

2. Standard repair tools (numbers after tool names are HP part numbers):

   a. #1 Pozidriv® screwdriver (8710-0899)
   b. #2 Pozidriv® screwdriver (8710-0900)
   c. Long-nose pliers (8710-1107)
   d. Contact inserter (8710-1254)*
   e. Alignment tool (8710-1355)*
   f. Brightness control assembly (00085-60027)*
   g. CRT test pattern overlay (00085-60955)*
   h. 2 pin-156 connector (1251-5752)*
   i. Ribbon cable (8120-3708)*
   j. Static wrist strap (9300-0791)
   k. 1/4-inch nut driver (8720-0002)
   l. 1/2-inch nut driver (8720-0007)
   m. HP 85 Personal Computer
   n. HP 82936A ROM Drawer
   o. DC voltmeter (HP 3465/3466 or equivalent)
   p. Cotton swabs
   q. Isopropyl alcohol

* Contained in the OEM Maintenance Kit (00085-83501), which also contains a 0.050-inch hex key (8710-0857), a 0.062-inch hex key (8710-0864), and a 0.109-inch hex balldriver (8710-1197).

This Errata Change Sheet should be included in the following kits:

35106B
35106-90012
35106-90111

HEWLETT PACKARD

HP 85 Final Review

(Total = 100; numbers in parentheses indicate the points per question.)

1. (16) Identify the printed-circuit assembly on which the following ICs are located:
   a. RAM 5 _____
   b. CRT controller _____
   c. CPU _____
   d. Keyboard controller _____

2. (5) True _____ or False _____? The System Test cannot be run if a problem exists in the CRT controller.

3. (10) Circle the two accessor modules tested by the Service ROM.

HP-IB interface	I/O ROM	system monitor
programmable ROM module	modem	16K memory module

4. (5) Which assembly could hold lethal voltages that might be contacted while the top case is being removed?
   _____

5. (16) Before the logic PCA can be replaced, ribbon cables from which assemblies must be disconnected?
   a. _____ b. _____
   c. _____ d. _____
   e. _____

6. (8) The printer asembly consists of the _____ and the _____

7. (8) Name the two motors in the printer assembly:
   _____ _____

8. (5) Circle the condition that requires replacement of the CRT assembly.

Out of focus	CRT not vertically centered
CRT skewed	CRT not pincushioned

9. (8) Preventative maintenance of the tape drive mechanism consists of clearning the _____ and _____.

10. (7) An _____ is necessary to replace the _____ rather than replacing the entire tape drive assembly.

11. (5) Each Series 80 interface contains switches for setting the _____ which the computer uses to distinguish that interface from any others.

12. (7) Servicing an accessory module usually involves replacing the _____ or the _____.

HP 85 Final Review Answers

1. a. Logic
   b. CRT
   c. Logic
   d. Keyboard Logic (85B)

2. False

3. I/O Rom
   16K memory module

4. CRT

5. CRT
   Back panel
   Printer/power supply
   Tape drive
   Keyboard

6. Printer/power supply PCA
   Printer mechanism

7. Paper advance
   print-head

8. CRT not pincushioned

9. Tape head
   Capstan

10. Oscilloscope
    Motor/capstan

11. Interface select code

12. Module's logic PCA
    Cable assembly