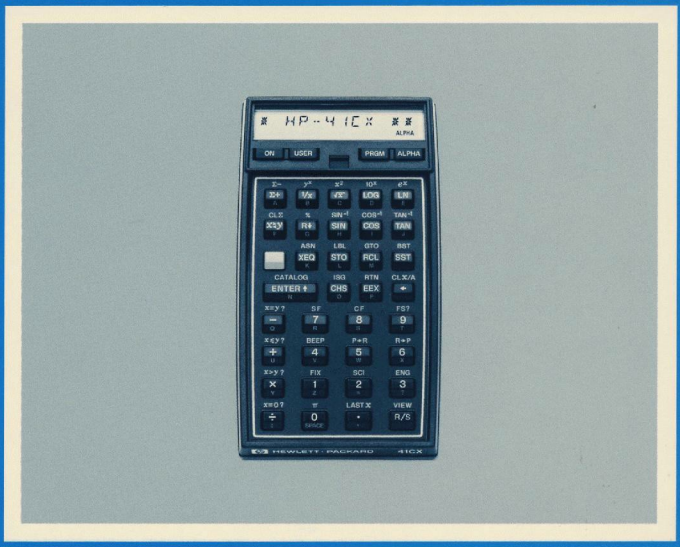
HP-41C/CV/CX

ALPHANUMERIC PROGRAMMABLE SCIENTIFIC CALCULATOR

SERVICE MANUAL



HEWLETT PACKARD

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Scientific Calculator

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General Information

1-1. INTRODUCTION

1-2. This service manual contains information necessary to troubleshoot and repair HP-41/C/CV/CX series calculators. Appendix A gives information for testing plug-in memory modules and application modules. Service information for other plug-in accessories is presented in separate manuals. Other reference material and service notes are contained in appendices B and C.

1-3. The manual is divided into six sections, which give:

a. A general description of the HP-41 calculators (section I).
b. An explanation of how they work (section II).
c. Information for disassembly and reassembly (section III).
d. Steps for troubleshooting and testing the calculators (section IV).
e. A description of the plug-in service modules (section V).
f. A list of replaceable parts (section VI).

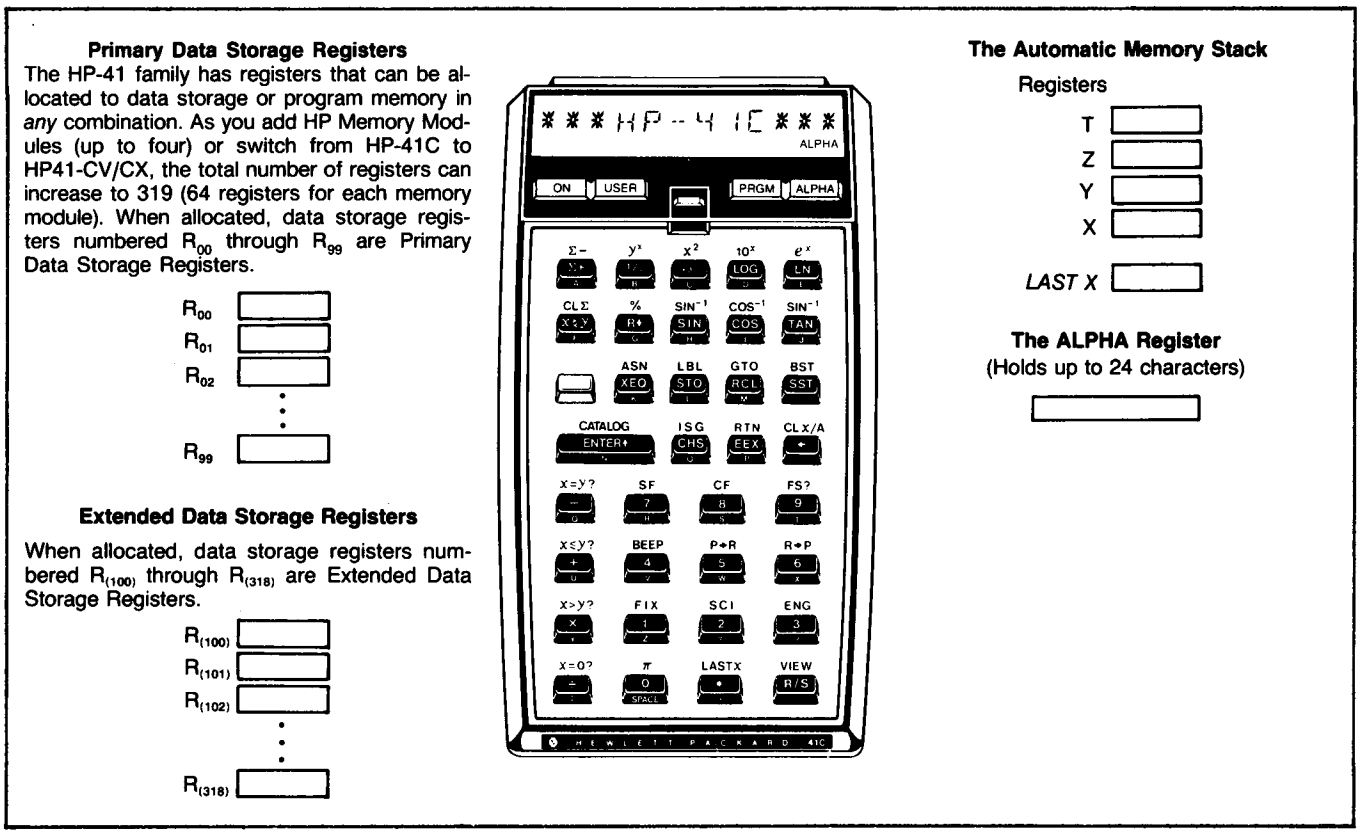


Figure 1-1. HP-41 Keyboard

1-4. DESCRIPTION

1-5. The HP-41 is a handheld, alphanumeric programmable scientific computer with input/output capabilities and a continuous memory. It also features a user-definable keyboard for personalized usage.

1-6. Memory Configuration

1-7. The memory configurations for the 41-series calculators are shown in table 1-1.

Table 1-1. Memory Configuration

		Main Memory Initial Configuration		Total Extended
Device	Total	Data Storage	Uncommitted	Memory
HP-41C	63	17 (R00-R16)	46	0
HP-41CV	319	273 (R00-R272)	46	0
HP-41CX	319	100 (R00-R99)	219	124

1-8. The automatic stack registers are T, Z, Y, X, and Last X. The ALPHA register holds up to 24 characters.

1-9. The 41-series calculators have registers that can be allocated to data storage or program memory in any combination. As you add HP Memory Modules (up to four) or step up to an HP-41CV or HP-41CX the total number of registers can increase to 319 (64 registers for each memory module). When allocated, data storage registers R00 through R99 are primary data storage registers. When allocated, data storage registers R100 through R318 are extended data storage registers.

1-10. The HP-41 system is designed for accurate service. The use of a plug-in service module reliably tests the entire calculator and provides a visual output of its diagnosis that expedites troubleshooting for most repairs.

1-11. The specifications of the HP-41 are summarized in table 1-2. A detailed description of the proper use of this calculator is contained in the HP-41C Owner's Handbook and Programming Guide. Operating conditions which result in an error message are presented in appendix E of the handbook.

Table 1-2. Specifications

Physical Properties

- Length: 14.27 centimeters (5.62 inches).
- Width: 7.86 centimeters (3.09 inches).
- Height: 3.33 centimeters (1.31 inches).
- Weight: 205 grams (7.2 ounces) with batteries.

Power

- Batteries: Four 1.5V, size N batteries, replaceable by the user.
- Battery current:

Mode	Typical	Worst Case
Run	10 ma	15 ma
Standby	1 ma	1 ma
Sleep	10 ua	30 ua

Temperature

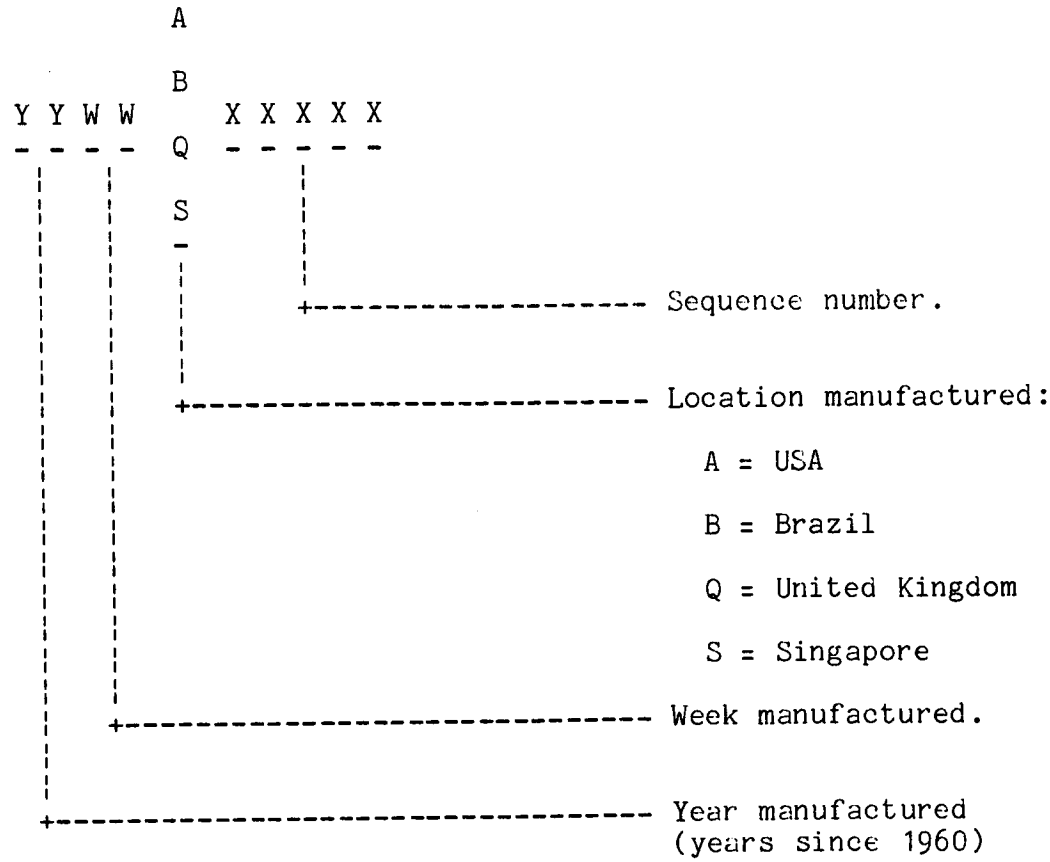
- Operating: 0° to 45°C (32° to 113°F)
- Storage: -20° to 60°C (-4° to 140°F)

Display

- Liquid crystal display has 12 character positions and 12 annunciator words.
- Each character position consists of 17 segments, including 3 punctuation segments.
- Numbers are shown with maximum of 10 digits, or an 8-digit mantissa and a 2-digit exponent.
- Displayed numbers are rounded to the last displayed digit; calculations are performed internally with at least 10 digits.
- Range of displayed numbers is $\pm 1.0000000 \times 10^{-99}$ to $\pm 9.9999999 \times 10^{99}$ plus zero.
- Alphanumeric characters include A through Z, a through e, 0 through 9, plus 37 special characters, some of which can be obtained only by using special plug-in accessories.

1-12. IDENTIFICATION

1-13. The serial number of the calculator is used for identification and determination of warranty status. It is located on the bottom case at the upper right-hand corner, adjacent to the I/O ports. Its format is described below:



1-14. The week code is set ahead by eight weeks to allow time for the product to get from the factory to the dealer. For example, a calculator with the week code 1945 was manufactured in week 37 (37+8=45) of 1979.

Note: Some errors were made in the week codes for the first weeks of a new year. For example, a week code of 1953 should read 2001.

SECTION
II

Theory of Operation

2-1. FUNCTIONAL DESCRIPTION

2-2. The HP-41C/CV/CX designs (see figures 2-1 and 2-2) are based on the following primary electrical components:

a. The CPU (central processing unit).
b. One, two or three ROMs (read only memory).
c. The D/S data storage circuits.
d. The display driver circuit.
e. The power supply.
f. The timer circuit (-41CX only).

The power supply is a conventional bipolar integrated cicuit (IC); all other ICs employ CMOS (complementary metal-oxide-semiconductor) circuitry, enabling the calculator to have a continuous memory.

2-3. Manual input to the calculator is through a 39-position keyboard; visual output is through an LCD (liquid crystal display) with 12 character positions. Four input/output (I/O) ports provide additional access to the calculator. An audible alarm is also featured.

2-4. The system operates serially on 56-bit information, with data represented as binary-coded-decimal (BCD) numbers, and instructions and addresses as binary numbers. The timing of the system is referenced to the Φ2 signal from the CPU. (Signal names are listed in table 2-1.) A bit time (the period during which a single bit of data is transferred) is the time interval between the trailing edges of two successive Φ2 pulses. A word time consists of 56 bit times (0 through 55) and is the basic interval for information transfer.

2-5. CPU

2-6. The CPU consists of eight basic sections:

a. Timing generator.
b. Instruction processor.
c. Address, status, and flag registers.
d. Data registers.
e. Arithmetic processor.
f. Conditional test logic.
g. Power control logic.
h. Keyboard interface.

These are described in the following paragraphs.

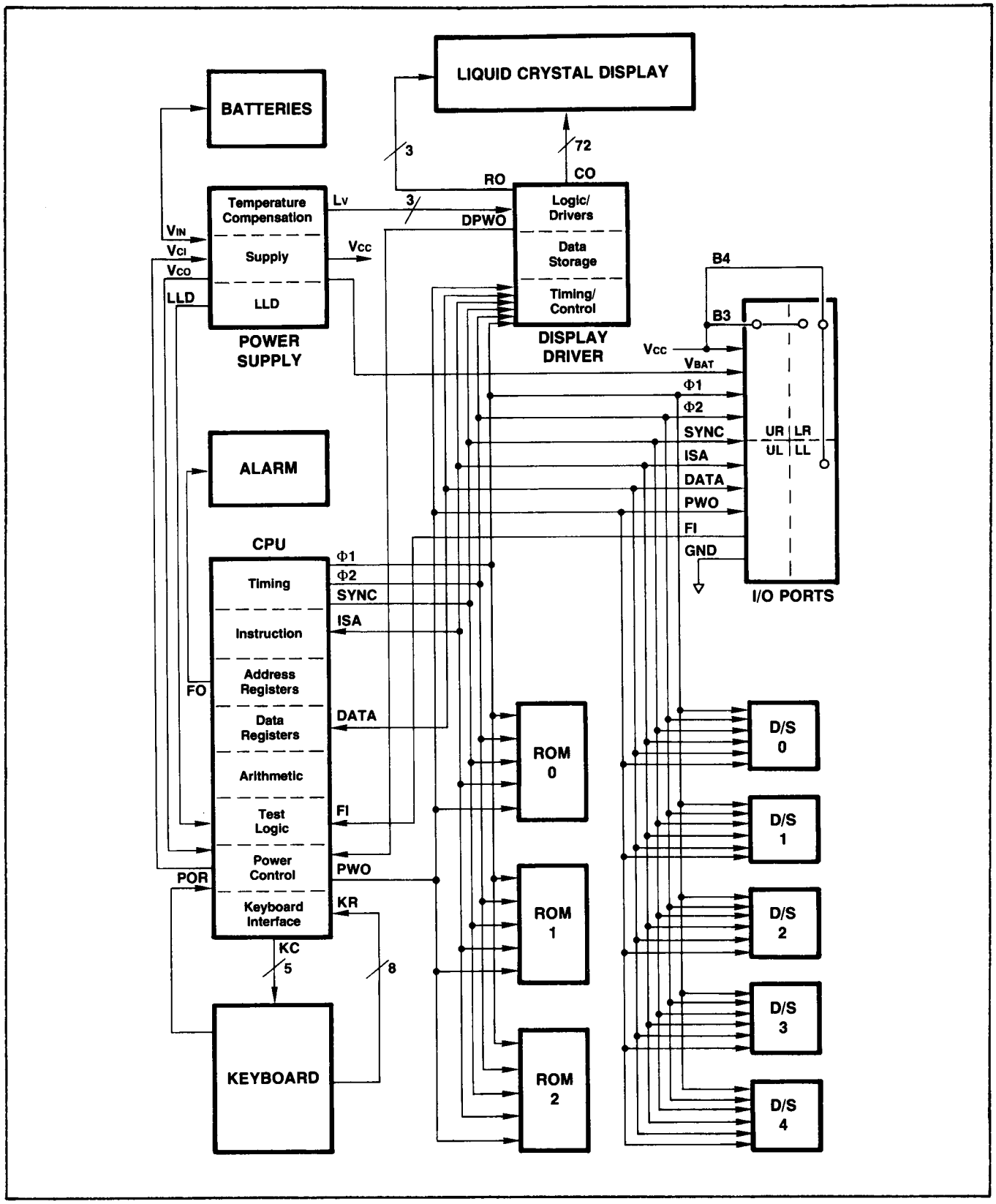


Figure 2-1. HP-41C/CV Block Diagram

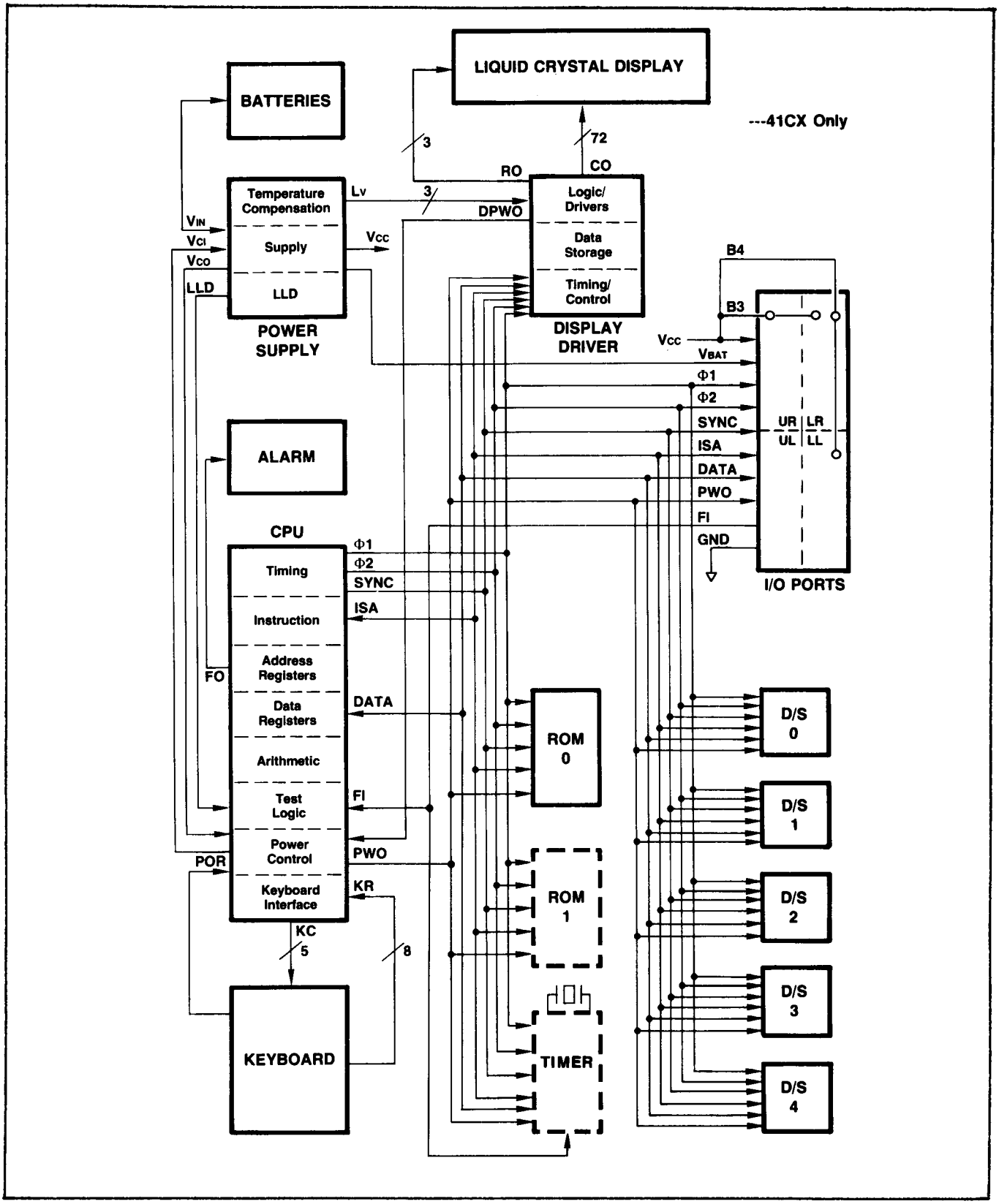


Figure 2-2. HP-41C/CV/CX Common Board Block Diagram

2-7. Timing Generator. This section of the CPU includes logic for generating three timing signals (Φ1, Φ2, and SYNC) used to synchronize the system ICs. The nominal oscillator frequency of 1440 kHz is reduced by a factor of 4 to produce a system operating frequency between 343 and 378 kHz, which is the frequency of the Φ1 and Φ2 pulses. These pulses have a width of approximately one-eighth of a period. The Φ1 pulses lead the Φ2 pulses by approximately three-eighths period.

Table 2-1. Signal Names

SIGNAL	DESCRIPTION
B3	I/O port coding
B4	I/O port coding
DATA	Data line
DPWO	Display power on/off line
FI	Input flag line
FO	Flag line to alarm
GND	Ground
ISA	Instruction/address line
KC0 thru KC4	Keyboard column lines
KR0 thru KR7	Keyboard row lines
LLD	Low level detect line
L1V thru L3V	Display voltages
OS1	Display oscillator
POR	Power-on reset line
PWO	Power on/off line
SYNC	Timing/information line
VBAT	Battery voltage
VCC	System voltage
VCI	Voltage control input line
VCO	Voltage control output line
Φ1	Timing line
Φ2	Timing line

2-8. The SYNC signal, consisting of a 10-bit pulse during bit times 44 through 53, has two main functions. The first SYNC pulse generated by the CPU following power-on is used to initialize the timing circuits of the system IC's. Subsequently, the presence or absence of the SYNC pulse indicates whether information on the ISA line is an instruction or an address. (The SYNC pulse is suppressed when the system is

controlled by a plug-in accessory.) Additionally, when the CPU timing circuit is disabled (STANDBY and SLEEP modes), the CPU sets the SYNC line equal to the DPWO signal from the display driver for access at the input/output ports.

2-9. The CPU also includes a status counter which generates a four-bit pulse at a digit time specified by the CPU instruction processor. It is used to set conditions within the CPU.

2-10. **Instruction Processor.** The CPU instruction processor decodes instructions arriving on the ISA line and directs the various sections of the CPU to perform the necessary operations. If system control is transferred to a plug-in accessory, the instruction processor does not decode instructions until system control is again returned to the CPU.

2-11. **Address, Status, and Flag Registers.**

This section of the CPU contains:

a. A 16-bit program counter used for the current instruction address.
b. Four 16-bit address registers used for return branching from subroutines.
c. A 14-bit system status register.
d. An 8-bit flag register used to store eight system flags (which are all equal). The CPU sequentially transmits the flag conditions on the FO line during each entire word time. By periodically setting and resetting the flags, the CPU can generate a signal to activate the audible alarm.

2-12. **Data Registers.** The CPU data registers consist of:

a. Three 56-bit working registers (A, B, and C) used for arithmetic operations by the CPU arithmetic processor. The C-register is connected to the DATA line and is used for data transfer operations with data storage.
b. Two 56-bit memory registers (M and N) used for temporary information storage.
c. One 8-bit register (G) used for the storage of portions of the C-register contents.

2-13. **Arithmetic Processor.** This CPU section consists of a 56-bit, serial, binary/BCD adder/subtracter which performs arithmetic operations on all or part of the data in the A-, B-, and C-registers. It also contains the logic for controlling data transfers among the CPU registers.

2-14. **Conditional Test Logic.** The conditional test logic is used to test the state of various one-bit flags, including 14 input flags (FIO

through FI13) on the FI line from the I/O ports, the low battery voltage signal from the power supply, and the adder carry flag, key flag, status bits, and arithmetic pointers within the CPU. The outcomes influence branching at the CPU address registers.

2-15. Power Control Logic. The power control logic in the CPU exercises the primary control of the system power mode. (The display driver determines the power mode when the CPU is inactive.) In response to signals received on the POR, ISA, DPWO, and VCO lines and from the keyboard interface section of the CPU, the power control logic determines the system voltage level provided by the power supply and enables or disables the system ICs. Control signals are sent on the VCI and PWO lines.

2-16. Keyboard Interface. The keyboard interface logic in the CPU is connected to the keyboard by five column lines (KC0 through KC4) and eight row lines (KR0 through KR7). In RUN power mode the logic scans the column lines, bringing each line low once every word time. When a key is pressed (connecting the corresponding row and column lines), the row line is brought low by the column line at the same rate, setting the key flags in the CPU power control logic and conditional test logic. The logic loads into the two keyboard interface buffers the four-bit codes for the row line and column line. The resultant eight-bit code is used by instructions in ROM to determine what operation is to be performed. Instructions in ROM cause the system to ignore the keyboard for 40 ms after a key is pressed and 5 ms after a key is released. These delays negate the effects of key bounce, which causes multiple entries.

2-17. ROM

2-18. The ROM (read only memory) consists of a set of ICs which contain microprogramming instructions which are used by the CPU to perform its functions. There are two possible configurations for the ROM ICs. Older -41C and -CV's are configured with three 40 Kbit ROMs. The later models are configured with one (-41C/CV) or two (-41CX) 120 kbit ROMs. Many operations require instructions stored in more than one ROM. However, only one ROM is accessed at any time. When the ROM address register in each ROM receives a 16-bit address from the ISA line, the decoder in that chip uses the most significant digits to determine if that address is contained in its memory. When the proper ROM has been addressed it will then transmit the information stored at that address out on the ISA line. During this period all other ROMs are disabled. A timing circuit inside each ROM synchronizes the ROM's operation with the rest of the system by using $\Phi 1$, $\Phi 2$, and SYNC from the CPU.

2-19. Data Storage

2-20. The data storage (RAM) consists of sets of ICs which are primarily

used to store information which the user enters into the -41. The information can be either user-entered programs or storage registers which contain either numeric or alpha information. The earliest model of the 41C used 5 data storage chips. Each of the 5 chips store 16 registers of information. Newer -41s have a combination of data storage ICs composed of one 16 register IC and 1, 5, or 7 of the 64 register ICs. These combinations result in the -41C, -41CV, and -41CX respectively. A timing circuit synchronizes the operation of the IC with the rest of the system using the Φ1, Φ2, and SYNC signals.

2-21. The 16 registers in D/S0 are used internally for the X, Y, Z, T, LAST X, and ALPHA registers, as well as for maintaining the internal status information. The registers in the remaining D/S ICs are accessible to the user for storing data and programs.

2-22. Liquid Crystal Display

2-23. The display is a 12-character, liquid crystal display (LCD). Each character position has 14 digit segments, 3 punctuation marks, and 1 annunciator space, which are defined by three row lines (common to all characters) and six column lines. (See figure 2-3.) The entire display constitutes a 3-row by 72-column matrix which is activated by the display driver.

2-24. A liquid crystal material between the upper and lower conducting glass surfaces produces a visible contrast between a character segment and the surrounding area when the voltage potential between the corresponding row and column lines is at least 3V (at 25°C). At lower voltages the contrast decreases. No visible contrast is produced for a voltage potential of approximately 1V. Optimum performance requires the continuous application of an alternating potential whose magnitude determines segment turn-on.

2-25. In order for the display to maintain proper contrast over a temperature range of 0° to 45° C, the peak drive voltage to the LCD must have an average decrease of 20 mV for each degree of temperature increase. This temperature compensation is provided by the power supply circuit.

2-26. Display Driver

2-27. The display driver performs three functions required to operate the LCD: timing and control, data storage, and display logic and drivers.

2-28. The timing and control section processes instructions arriving on the ISA line, directs the flow of data into the proper display data storage

registers, and provides system timing information to the driver section (utilizing the incoming PWO signal and internal status conditions).

2-29. The data storage registers allocate 10 bits of storage for each of the 12 character positions in the display. For each position one of these bits controls the annunciator word; the remaining bits represent the character and punctuation at the position.

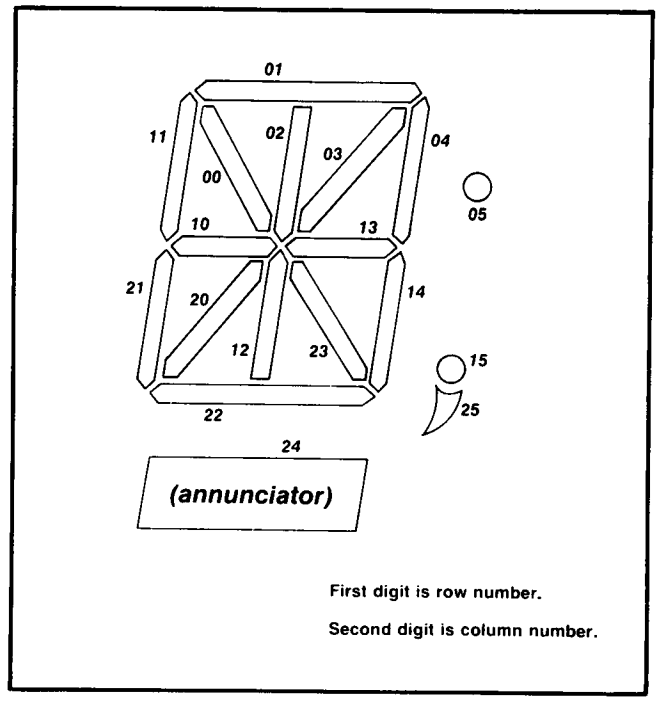


Figure 2-3. Display Character Structure

2-30. Display logic encodes each character in the data storage registers into the six appropriate column signals and stores them in the corresponding drive registers. Using the three temperature-compensated voltages from the power supply, the driver circuitry provides 72 column signals (12 characters, each with six columns) to the LCD according to the information stored in the 72 driver registers, and 3 different row signals, one on each of the three LCD row lines. Each of these signals has a complex, rectangular waveform and is continuously present while the display is active. The row and column signals are structured such that each LCD segment that is "off" experiences an alternating 1V potential; each segment that is "on" has a similar type of signal except that a 3V peak potential exists during one-third of the cycle. Thus each LCD segment is continuously driven by an alternating signal (equal to the potential difference between the corresponding row and column signals) with the peak potential determining segment turn-on. (Previous LED displays have had digit segments being activated for approximately 1 percent of the

display cycle, with no voltage applied for the remaining interval.) The 3V peaks are staggered so that at any instant only one row has segments being turned on.

2-31. The driver section also includes a timing circuit and clock. This circuitry synchronizes the driver signals and causes the display to be refreshed approximately 90 times per second. When the incoming PWO signal from the CPU is high (RUN mode), the timing circuit uses the SYNC signal from the CPU as a timing reference. When the PWO signal is low and the display is to be active (STANDBY mode), the DPWO output line to the CPU is set high and the internal driver clock synchronizes the driver signals for a period up to approximately 10 minutes. When the PWO signal is low and the display is inactive (SLEEP mode), the DPWO output is set low.

2-32. Power Supply

2-33. Four replaceable 1.5V, size N batteries connected in series are the standard source of power for the HP-41. Three diodes (CR1, CR5, and CR6, figures 4-8a through f) protect against reverse polarity and provide isolation for the batteries and other power sources (such as in a plug-in accessory). A storage capacitator (C1) temporarily supplies power to maintain the system memory while the calculator is off and the batteries are being changed.

2-34. The power supply circuit consists of a low-power bipolar IC and discrete components which perform all voltage-control functions for the system: system voltage supply and regulation, supply and temperature compensation of the LCD voltages, low battery voltage detection (LLD), and system reset.

2-35. Two selectable voltage levels are available from the power supply. While the display is active (RUN and STANDBY power modes), a voltage converter circuit produces a regulated output of 6V (at VCC). When the display is inactive (SLEEP power mode), the voltage output is approximately 1V less than the battery voltage and is not regulated.

2-36. The determination of the correct system voltage is made by the CPU, which sets the appropriate signal on the VCI line to the power supply: a current signal (at approximately 0.7V) selects the regulated 6V supply; a grounded signal disables the regulator, selecting the unregulated battery voltage. As the regulated supply is being activated, a differential amplifier in the power supply circuit compares the supply voltage to a reference voltage and generates a momentary ground signal on the VCO line to the CPU when the supply voltage reaches 6V.

2-37. Three temperature-compensated voltage levels (nominally 1.1, 2.2, and 3.3V) are provided to the display driver by the power supply.

A transistor in the power supply IC responds to changes in the ambient temperature, producing the -20 mV/ C output variation required by the display.

2-38. The power supply circuit monitors the input voltage level by comparing it with a reference voltage generated internally. A differential amplifier in the IC senses whether the voltage has fallen below 4.2V at the IC, and if so, it grounds the LLD line connected to the CPU.

2-39. The reset circuit initializes the CPU whenever the CPU is in RUN mode and a decrease occurs on the Vcc line. This circuit provides a method for restarting the CPU if it "locks up" in a condition in which the system does not respond to keyboard or peripheral input. With the system in RUN mode, capacitor C9 (see figures 4-9a and b) is charged and transistors Q1 and Q2 are off. If Vcc drops, C9 turns on Q1, which then turns on Q2. Transistor Q2 draws sufficient current to pull PWO low even though the CPU tries to hold it high. This is sensed by the CPU, which interrupts its operation and returns to STANDBY mode. (In later versions this circuit is included in an IC.)

2-40. Keyboard

2-41. Data is manually entered into the calculator through the keyboard, consisting of 35 function keys and 4 operating keys mounted in the top case. Each key is located above a dome-shaped "snap disk" which is mounted over the keyboard PC. The 39-position keyboard matrix is connected to the CPU by five column lines and eight row lines. When a key is pressed, the center of the disk snaps down and makes electrical contact between the corresponding row and column lines.

2-42. Input/Output Ports

2-43. The four input/output ports on the HP-41 allow the user to expand the calculator's capacity and to have it interact with external components. Electrical contact is provided by a flexible printed-circuit strip mounted on a contact frame. The system lines which are accessible at the I/O ports are:

a. Φ1 (timing line).
b. Φ2 (timing line).
c. SYNC (timing/information line).
d. ISA (instruction/address line).
e. DATA (data line).
f. PWO (power on/off line).
g. FI (input flag line).
h. VBAT (battery voltage).
i. VCC (system voltage).

j. GND (ground).
k. B3 (I/O port coding).
l. B4 (I/O port coding).

2-44. The B3 and B4 lines from each of the four ports are wired differently at each port so that each plug-in accessory will have a unique identification code. (Refer to table 2-2.)

Table 2-2. Coding of I/O Ports

I/O PORT LOCATION	I/O PORT NUMBER	B3 CONTACT	B4 CONTACT
Upper Left	1	Open	Open
Upper Right	2	VCC	Open
Lower Left	3	Open	VCC
Lower Right	4	VCC	VCC

2-45. Audible Alarm

2-46. The audible alarm is a piezoelectric device, which converts an alternating electrical signal into a mechanical vibration. The signal is generated by the CPU and transmitted to the alarm on the FO line. Because physical stress on the piezoelectric device can induce excessive voltage at FO, diodes CR3 and CR4 (see figure 4-9) assure that the voltage across the alarm does not exceed approximately 6V.

2-47. SYSTEM OPERATION

2-48. To the user, the HP-41 appears to have two power conditions: "on" and "off". However, there are actually three power modes: RUN, STANDBY, and SLEEP. The use of these three modes provides extended battery life by minimizing the current drain.

2-49. In RUN mode the CPU actively controls the flow and processing of data and the display presents information to the user. In STANDBY mode the system timing and data processing are disabled, while the display continues to operate. The calculator appears to be "on" in RUN and STANDBY modes. In SLEEP mode all functions, including display, are disabled and the calculator appears to be "off", although a low-level current maintains the system's memory.

2-50. The following paragraphs describe system power modes and IC conditions and responses corresponding to a typical sequence of operations.

2-51. Initial Condition

2-52. The calculator is in SLEEP mode when the PWO signal from the CPU and the DPWO signal from the display driver are both low. The low PWO signal disables the ROM and D/S ICs to prevent them from responding to spurious signals. The power supply is inactive, leaving the system voltage set at the battery voltage level. The display and CPU are inactive. Only a minimum current supply is required to maintain the system's memory.

2-53. Power ON Response

2-54. When the power ON key is pressed, the CPU senses the ground signal at its POR input and generates a current on the VCI line to the power supply. (The same result is obtained by having a plug-in accessory momentarily set the ISA line high.) The power supply then provides the regulated 6V and puts a low signal on the VCO line to the CPU when the voltage is at the proper level. The CPU initiates its timing signals ($\Phi 1$, $\Phi 2$, and SYNC) defining bit time 52, and sets PWO high at a bit time 54 to enable the ROM and D/S IC's and the display driver. At this time the calculator is temporarily in RUN mode. The CPU checks the status of the system, checks the I/O ports, and sets the display. A transistor circuit (Q3, R4, and R5; see figure 4-7) uses the $\Phi 2$ signal to set the DATA line low at the start of each bit time interval.

2-55. After the necessary operations have been performed, the CPU sets PWO low at the next bit time 54 to disable the ROM and D/S IC's and to cause the display driver to set DPWO high and start its clock. The CPU clock stops at bit time 55, the SYNC line is set high, and the keyboard column lines are all set low. The display remains active, with timing provided by its internal clock. The calculator is in STANDBY mode.

2-56. Key Entry Response

2-57. When a key is pressed in STANDBY mode, the corresponding keyboard row line to the CPU is brought low through the column line. The CPU responds by initiating the system timing signals (defining bit time 52) and setting PWO high at bit time 54 to enable the ROM and D/S IC's and to turn off the display driver clock. The CPU begins scanning the five keyboard column lines by sequentially grounding each line for four bit times during each word time. (See figure 2-4.) The CPU loads into its key buffers the two four-bit keycodes corresponding to the key pressed. The CPU also checks the status of the system and the I/O ports.

2-58. The CPU carries out the specified operation by executing a series of instructions contained in ROM. The CPU obtains each instruction from ROM by transmitting the 16-bit address of the instruction over the ISA

line during bit times 14 through 29. The ROM containing the address transmits the contents of that location over the ISA line during bit times 44 through 53. (See figure 2-4.)

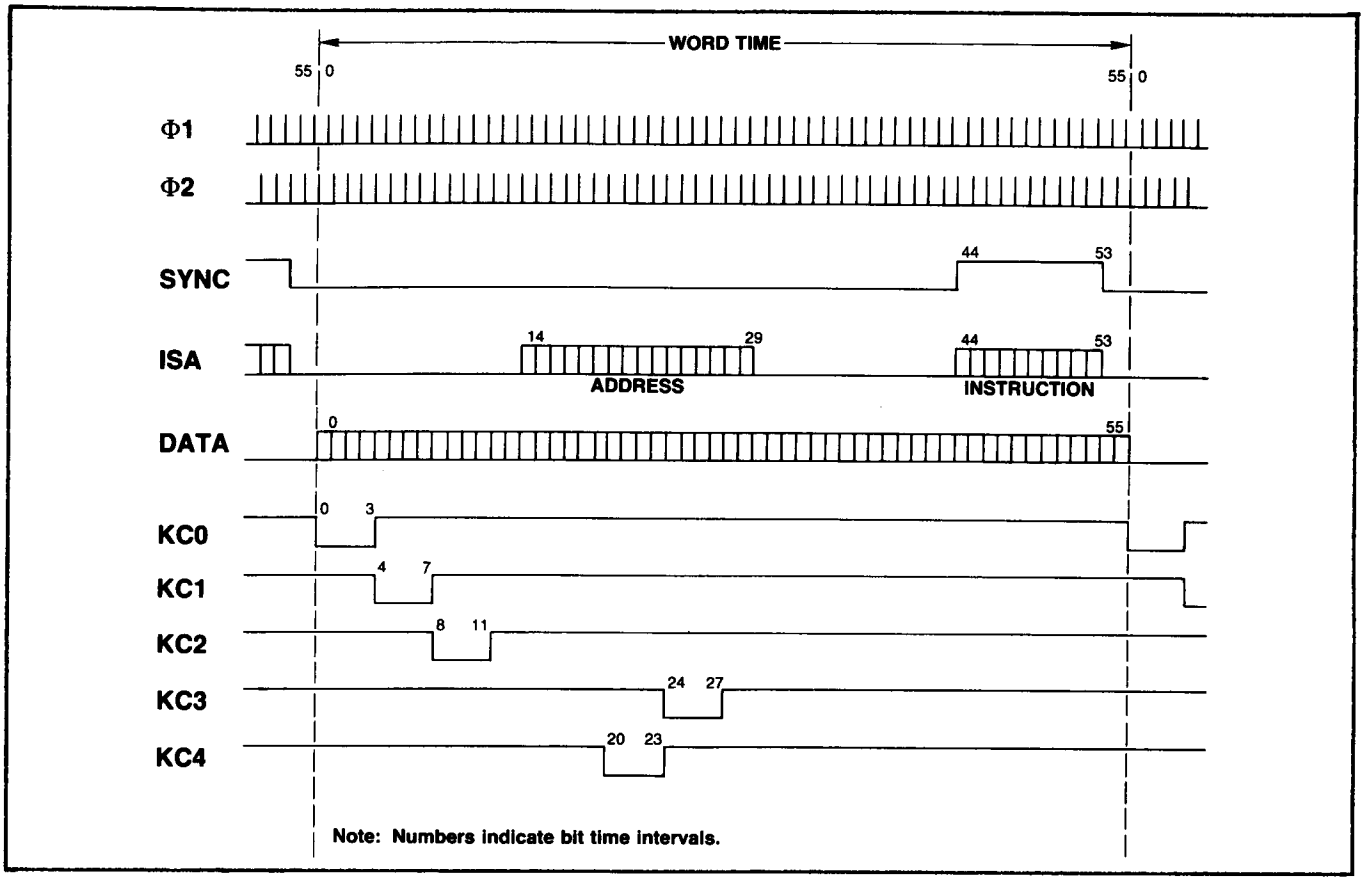


Figure 2-4. System Timing

2-59. If the transmitted ROM contents are an instruction to be executed, the CPU generates a pulse over the SYNC line at the same time that the instruction is being transmitted (bit times 44 through 53). This tells D/S to monitor the instruction to determine whether action (such as data tranfer) is required. The CPU executes the instruction during the following word time, and increments its program counter by one to specify the next address.

2-60. If the transmitted ROM contents are an address to be used for branching, the CPU suppresses the SYNC pulse while the address is being transmitted on the ISA line. This prevents D/S from responding to the ISA signal. The CPU transmits this address during the next word time.

2-61. If a ROM instruction specifies a transfer of data, the data is sent over the DATA line during bit times 0 through 55 of the next word time. (See

figure 2-4.) The transfer is made serially, least-significant bits first.

2-62. When all specified operations have been performed, the CPU initiates the power-down sequence described in paragraph 2-55, which places the calculator in STANDBY mode.

2-63. If additional keys are now pressed, the calculator returns to RUN mode, as described in paragraph 2-57.

2-64. Power OFF Response

2-65. If the power ON key is pressed while the calculator is in RUN or STANDBY mode, the POR input to the CPU is brought low through the KC0 column line. The CPU returns the calculator to RUN mode (paragraph 2-57) and sets the display driver for immediate turn-off. At the next bit time 53 the CPU sets PWO low to disable the ROM and D/S IC's and the display. The CPU stops its clock at bit time 55, sets the SYNC and keyboard column lines low, and grounds the VCI line to the power supply. The VCI signal disables the power circuit, causing the system voltage to drop to the unregulated battery voltage. The calculator is now in SLEEP mode.

2-66. Alternately, if no additional operations are requested within approximately 10 minutes following the beginning of STANDBY mode (paragraph 2-62), the display driver sets DPWO low, turns off the display and deactivates its clock. The CPU responds to the DPWO signal by setting the SYNC line low and grounding the VCI line to the power supply. This disables the power supply circuit, dropping the system voltage to the unregulated battery voltage. The calculator is left in SLEEP mode.

Section
III

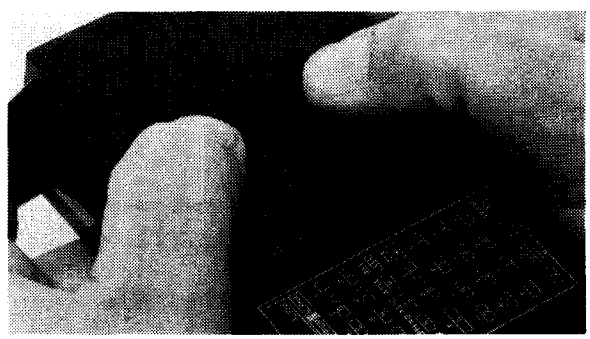
Disassembly and Reassembly

The following procedures desribe the steps necessary to disassemble and reassemble the HP-41 calculators in order to replace components or assemblies that are faulty. For additional aid, see the exploded view, figure 6-1.

> **CAUTION**
> Ensure that adequate precautions are taken regarding electrostatic protection. Use the antistatic desoldering tool (8690-0227) and work at a bench setup that is electrostatically protected. Otherwise, ICs may be damaged.

3-1. CASE SEPARATION

a. Remove the battery case by pressing its top edge toward the upper end of the calculator until the case snaps free.



b. Remove and set aside batteries if the customer has left any in the case.

c. Remove the four rubber feet from the bottom case by lifting them out with a pointed knife or tweezers.

d. Remove the four screws located in the foot recesses using a small Phillips screwdriver.

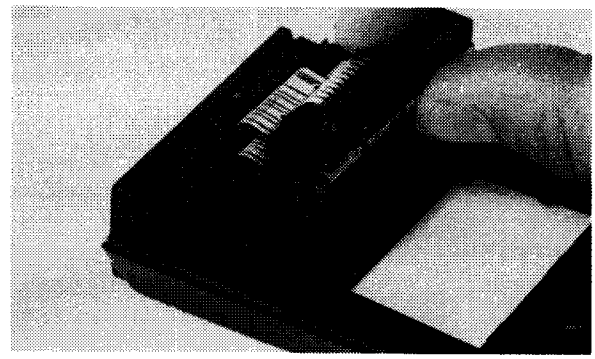
e. Lift off the bottom case and center case.

3-2. I/O ASSEMBLY REPLACEMENT

After separating the case (procedure 1):

a. Remove the I/O contact assembly from the bottom case by lifting it out.

b. Install the I/O contact assembly in the bottom case by lowering it into position. Be sure that the cross webs on the underside of the connector are located between the tabs on the bottom case. If the cross webs are properly aligned, the bottom of the contact assembly will seat flush on the case with only slight pressure.



3-3. DISPLAY DISASSEMBLY AND REPLACEMENT

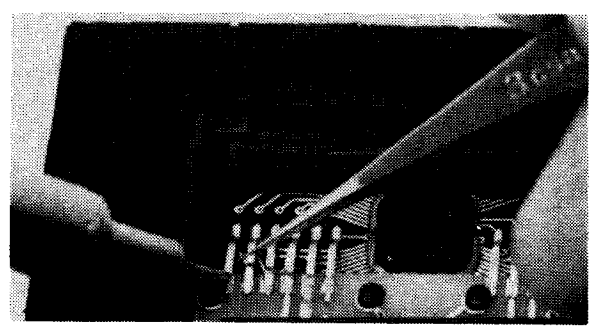
Note: If the display assembly is to be replaced as a unit, perform steps a through c and i through l.

CAUTION

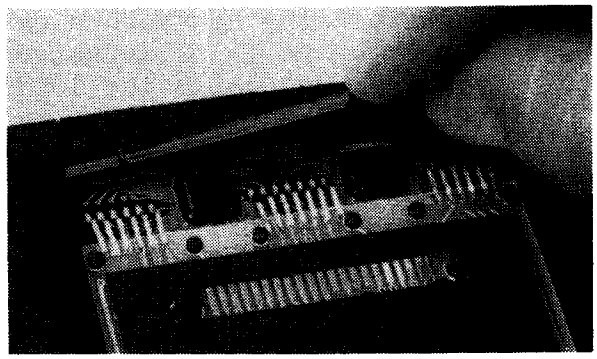
Wear finger cots (part number 9300-0398) and use care when handling the display assembly. The front and back glass surfaces of the LCD module each have a plastic layer that is easily damaged, and the contact fingers on the display driver PCA are easily damaged.

After separating the case (procedure 1):

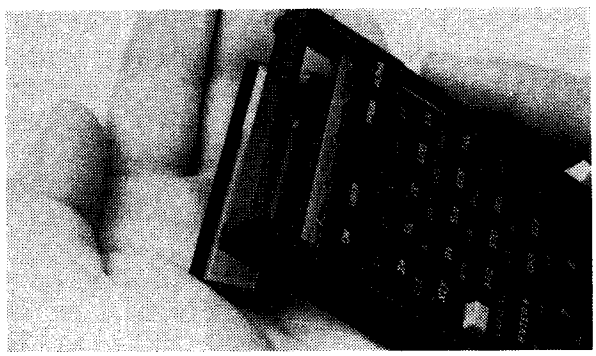
a. Unsolder the contact fingers from the keyboard PCA.



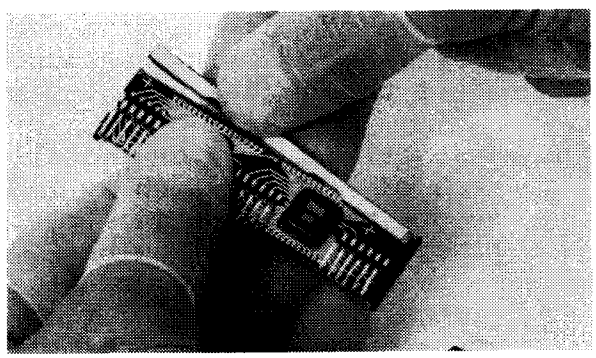
b. Remove the display shield from the top edge of the display assembly.



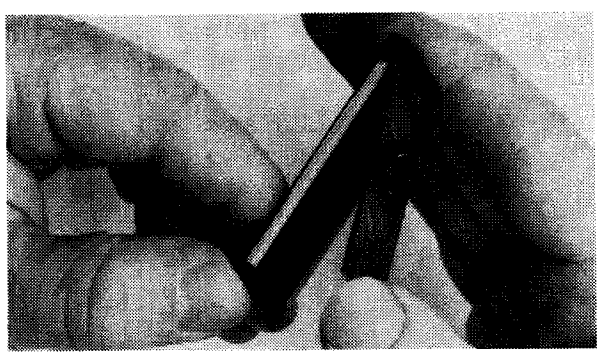
c. Remove the display assembly from the keyboard assembly by lifting it out top edge first or tapping the inverted assembly on your hand.



d. Remove the display clips and insulators from the long edges of the display assembly. Grasp the assembly and firmly pull each clip outward, one at a time.

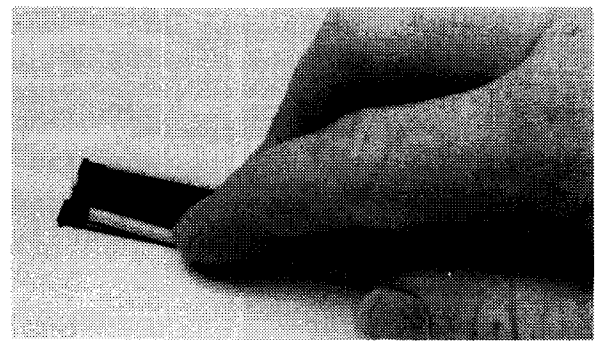


e. Separate the LCD and display driver and lift the assemblies apart.



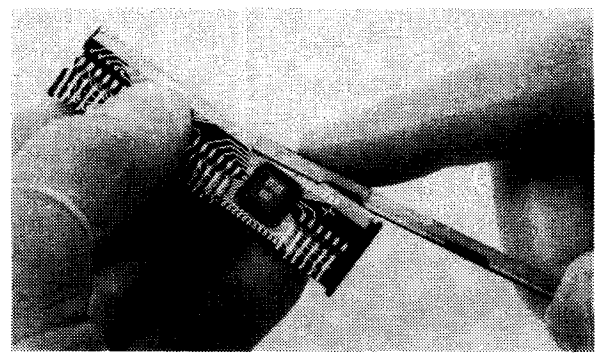
CAUTION
The display driver is subject to electrostatic discharge damage. Be sure you are wearing a ground strap when working with it.

f. If necessary, replace the display locator or the connectors on the LCD module. A strip of adhesive transfer tape holds the locator to the raised portion of the back surface of the LCD. After removing the old adhesive, the locator is installed by positioning the end with the LARGE pin opposite to the sealant end of the LCD. Then press into place along the entire length.



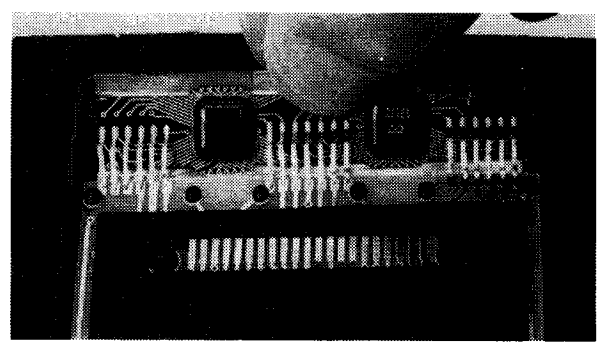
The adhesive side of the connector is placed against the raised portion of the LCD back surface and along the side edge of the locator. The connector should span all the contact pads on the LCD. Do NOT reuse any locators or connectors that have been removed from the LCD.

g. Mount the display driver on the LCD, being sure that the pin on the display locator fits into the hole in the driver. Use flush-cutting snips or a sharp knife to trim off any portion of the pin that protrudes above the surface of the driver.

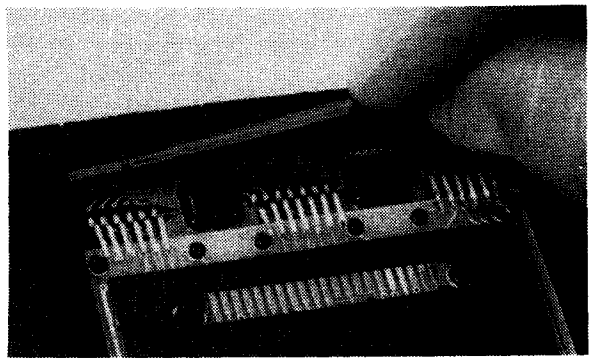


h. Install an insulator and clip along each edge of the display assembly. Secure the upper edge first. First place the insulator along the edge so that the flap covers the surface of the display driver; then slide the clip into place from the end of the assembly. The curl in the edge of each clip should be on the display driver side.

i. Clean the LCD surface, if necessary. Use a cotton swab or soft cloth moistened with isopropyl alcohol. Do not use an abrasive cloth that could scratch the plastic surface.



j. Install the display assembly into the keyboard assembly. Be sure the contact fingers fit over the edge of the keyboard PCA as the bottom edge of the display is lowered into position, then press the top edge into place.

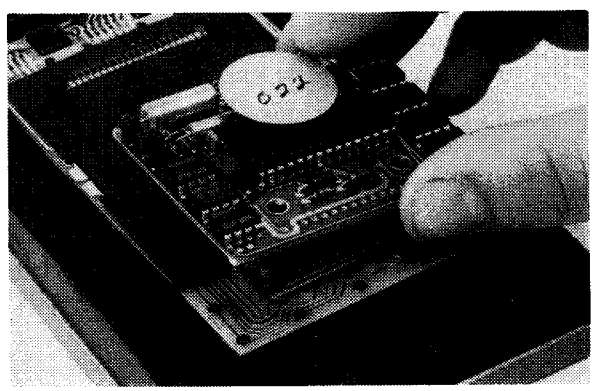


k. Solder the contact fingers to the keyboard PCA. Be sure that the display assembly is fully seated.

l. Install the display shield over the top edge of the display assembly. The ridges on the shield should face toward the bottom-case location.

> CAUTION
> The DDH is a static sensitive part. Always wear wrist straps when handling this part.

3-4. LOGIC PCA REPLACEMENT



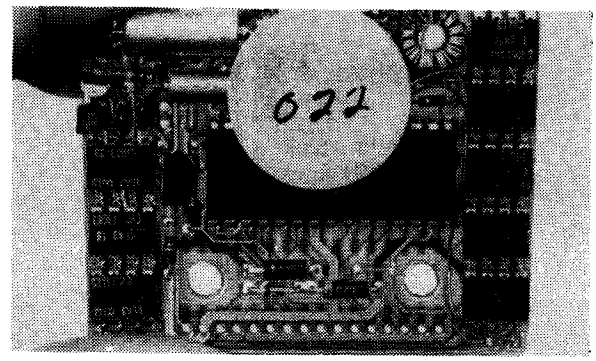
After separating the case (procedure 1):

a. If you are working on an early 41, unscrew the two nuts holding the logic PCA. Use the 1/4-inch nut driver (8720-0002).

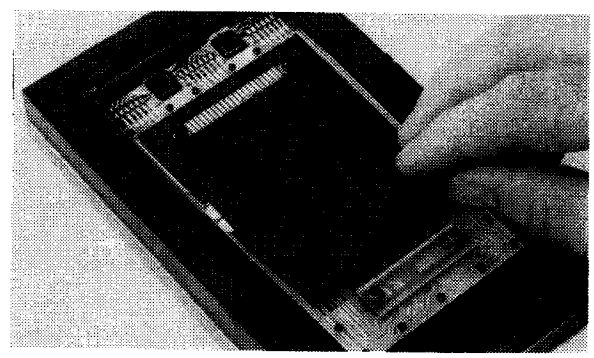
b. Lift off the logic PCA.

c. If necessary, replace the logic connector. Be sure it is retained by the posts on the keyboard assembly.

CAUTION
When removing the alarm disk, lift the foam tape with a thin tool. If you pull on the edge of the disk, the disk may be damaged.



d. Check the alarm-disk position to ensure that it is properly located on the logic PCA. A piece of two-sided foam tape located on the CPU IC (U2) holds the alarm, which is centered across the width of the PCA and has its upper edge centered on inductor L1 for the HP-41C/CV. (In the HP-41CX, the alarm is centered on the PCA board using care to assure that the alarm does not touch other components . Also make sure that the adhesive strip does not touch either lead of crystal Y2.)

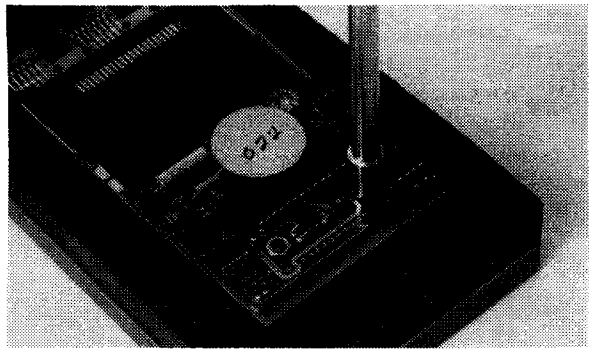


e. Check the clearance of the alarm-disk with respect to the toroid. If they are touching, or close to touching, remove the alarm-disk, replace the adhesive foam strip, and reposition the alarm-disk.

f. Check that the battery cover is not damaged and is properly located by the upper posts on the keyboard assembly.

g. Install the logic PCA over the posts on the keyboard assembly, making sure that the components face upward, away from the keyboard PCA. Make sure that all leads have been trimmed on the underside of the logic PCA.

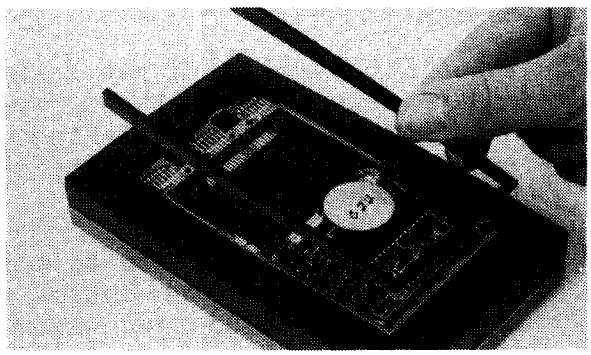
CAUTION
Do not apply excessive torque when tightening the retaining nuts; excessive torque may deform the top case or damage the threads. If the threads are damaged, use undersized nuts, part number 2740-0013.



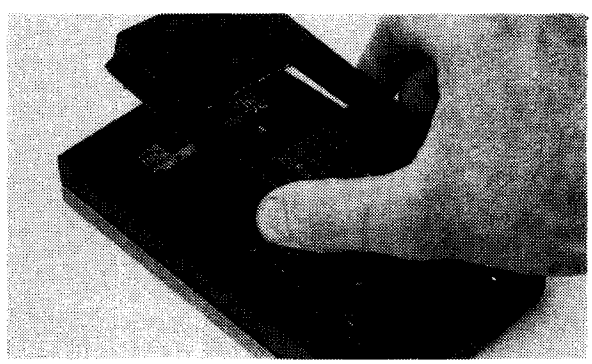
h. Install the proper size spacer or install the two nuts onto the posts using the 1/4-inch nut driver. Tighten them until the logic PCA is securely clamped in position. Newer revisions use spacers or a molded back case instead of nuts.

3-5. CASE REASSEMBLY

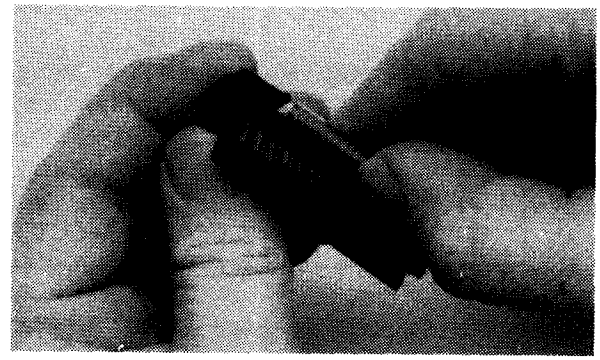
a. Position the center case on the keyboard assembly. The sides of the center case have a slight slant. Place the narrower span against the keyboard assembly. The mold marks should face up towards the back case.



b. Install the bottom case onto the center case. Make sure that the I/O contact assembly is seated squarely in the bottom case. The bottom case should not completely seat against the center case unless pressure is exerted to compress the I/O contact assembly and alarm spacer.



If necessary, squeeze the contact assembly between thumb and forefinger to insure enough pressure when the case closes.



c. Install the four screws through the foot recesses in the bottom case, installing the two longer screws at the upper end of the calculator. If the case threads at the lower end are damaged, use longer screws, part number 0624-0436.

d. Attach four new rubber feet in the recesses on the bottom case, pressing firmly to assure complete bonding.

e. Install batteries in the battery case. Observe the alternating orientation of the batteries as shown by the symbols on the closed end of the battery case.

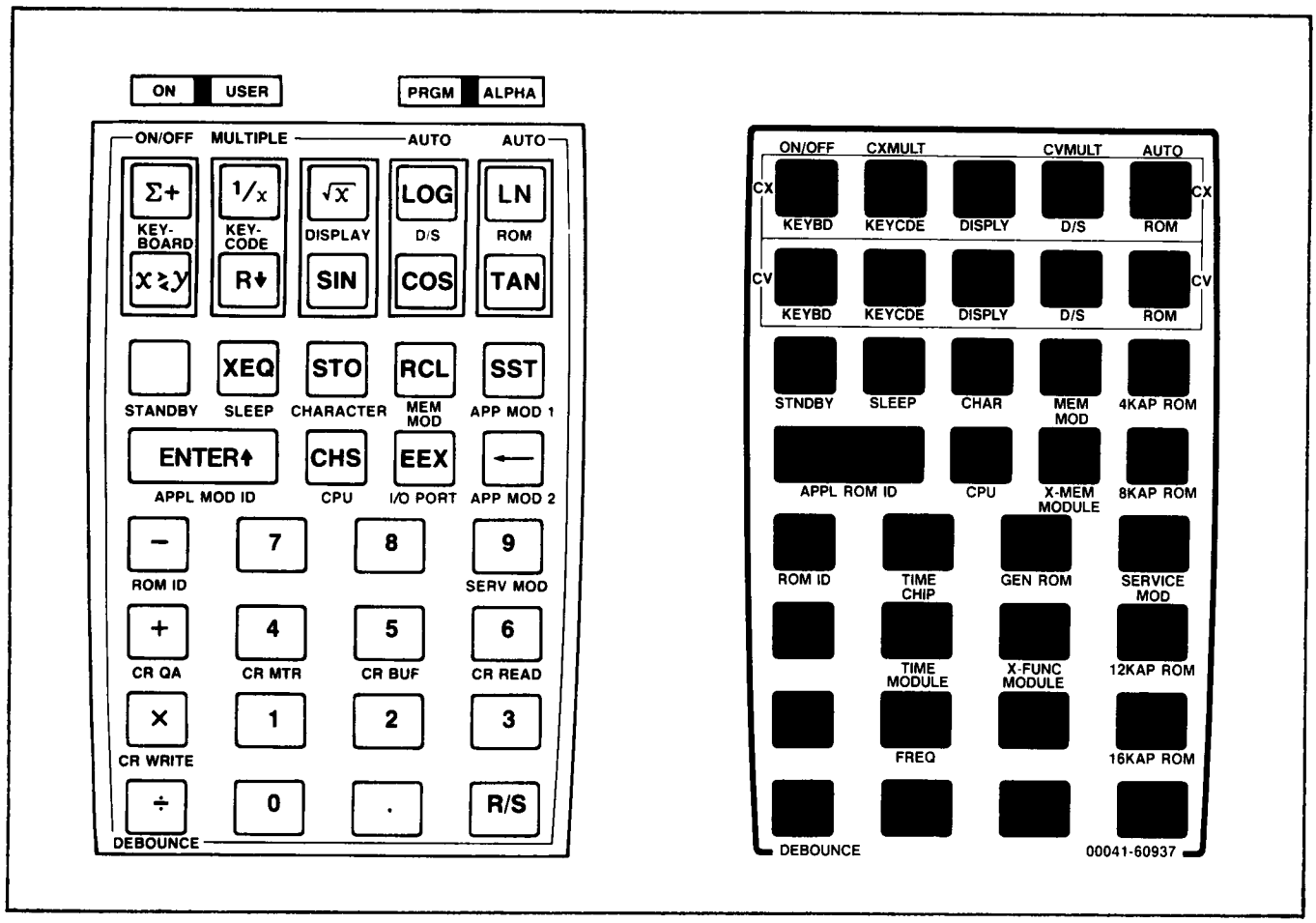
f. Insert the battery case by placing its open end into the bottom case adjacent to the contact assembly, and then pressing the battery case up and in.

SECTION
IV

Troubleshooting and Testing

4-1. INTRODUCTION

4-2. The troubleshooting and testing procedures presented in this section deal with the HP-41C, HP-41CV, and HP-41CX calculators. Service information for memory/applications modules is contained in appendix A. Service information for plug-in accessories compatible with the calculator system is covered in a separate manual for each accessory. Additional service information is contained in sevice notes in appendix C.



ET-11966 5061-7221

Figure 4-1. Key Assignments for Service Modules as Represented on Keyboard Overlays

4-3. The troubleshooting and testing procedures incorporate the use of one of two plug-in service modules, which are capable of testing the entire calculator. The service modules and other tools which are used to service the HP-41s are listed in table 4-1. Key reassignments made by the two service modules are shown in figure 4-1.

Table 4-1. Recommended Tools

HP PART/ MODEL NUMBER	DESCRIPTION
5061-7221	Service Module CV/CX/Enhancements
00041-60937	Keyboard Overlay
ET-11966	Service Module 41C/CV/Card Reader
ET-11945	Port Extender
00041-60940	Port Extender, Modified (see paragraph 4-21 for modification) includes 3 each 1990-0662 LED Arrays
	Test Calculator Parts:
T-190639	o Modified Keyboard Assembly
T-190638	o Modified Bottom Case
T-93328*	Molded Holding Nest
8720-0002	Nut Driver, 1/4-inch
HP 82106A	Memory Module (2 required)
8690-0227	Desoldering Tool, antistatic
8690-0253	Desoldering Tool Tip, antistatic
8690-0129	Soldering Iron
8690-0130	Soldering Iron Stand
8700-0003	X-acto Knife
8700-0006	X-acto Knife Blade
8730-0008	Small Flat-Blade Screwdriver
8730-0020	Phillips Screwdriver
HP 190C/ 1801A/1820C	Oscilloscope. Measures pulse at 0.50 us; maximum amplitude 13Vdc.
0960-0062	Continuity Tester
HP 6213C	Power Supply. Variable supply rated at 10 Vdc at 5A.(Add a 0.1 uf ceramic capacitor across output terminals.)
HP 3469B	Multimeter. Accurate to 0.01 Vdc.
HP 10004	Oscilloscope Probe
HP 82143	Printer
00041-90001	HP-41C Owner's Handbook and Programming Guide
00041-90474	HP-41CX Owner's Manual, Vol.1
00041-90492	HP-41CX Owner's Manual, Vol.2
00041-60939	5081-5564 PC Board with IC sockets

4-4. The following paragraphs describe the procedures that are necessary to troubleshoot the HP-41s. The diagnostic tests detailed in paragraphs 4-7 and 4-12 are also used as the performance tests to verify the proper operation of the calculator after it is repaired. Read through the entire procedure, including table 4-2, before attempting to troubleshoot a calculator.

CAUTION

Ensure that adequate precautions are taken regarding electrostatic protection. Use the antistatic desoldering tool (8690-0227), and work at a bench setup that is electrostatically protected. Otherwise, ICs may be damaged.

4-5. INITIAL PREPARATION

4-6. Perform the following steps before attempting to troubleshoot the calculator:

a. Visually inspect the calculator for case damage (including the overlay latch), I/O contact damage, LCD cracks, discoloration, and bubbles (dark spots). Note any parts that require replacement.

b. Install four good batteries in the calculator. Observe the alternating orientation of the batteries as shown by symbols on the closed end of the battery case. Does the calculator turn on? If so, try to duplicate the customer's complaint. If not, follow the procedure in figure 4-3.

c. Remove the batteries and insert power through an I/O port. Turn the calculator on, and attempt to duplicate the customer's complaint.

- If the problem relates to low-battery detection, use port power (without the service module installed) and press the ON key. Then press a function key. If the low battery annunciator appears in the display the low battery detection circuit is operating properly. If the low battery annunciator does not appear, check the LLD and VBAT line continuity through to the display.

- If the customer complaint is a calculator lock-up problem but attempts to duplicate the problem with normal battery operation fail, remove the batteries from the calculator. Insert the service module in an I/O port, and apply power into another I/O port. Turn the calculator on and quickly remove and then reinsert the power. The calculator should lock up. If recovery can not be accomplished by pressing any function key, proceed to the diagnostic tests in paragraph 4-7.

- For other problems, or if the problem is not known, proceed to the diagnostic tests (paragraph 4-7 or 4-12).

- If the customer returns the batteries with the calculator, test them using the battery test (paragraph 4-16).

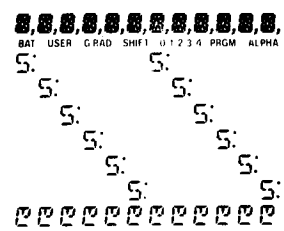
Note: The service module is a tool only. It does not detect all defects.

4-7. 41C/CV DIAGNOSTIC TEST USING THE ET 11966 SERVICE ROM MODULE

4-8. Perform the diagnostic test procedure outlined below. For each step that is described, the proper LCD display is shown at the right. This listing gives the responses for a good calculator; other responses can occur and indicate improper operation. (Each * below denotes an alarm beep.)

- If the proper responses are observed, the calculator is probably good. However, the service module may not detect all problems. Repeat the heat run and retest to identify possible intermittent problems.
- If an error display occurs, refer to the corresponding section of the detailed listing (table 4-2) and continue testing using that table. Be sure to record each LCD error message to aid the repair process. Repair the calculator according to paragraph 4-14.

  Note: Do not operate the calculator on alkalines for an extended period of time with the service module plugged in. This module prevents the system from switching to a low-power mode and can cause excessive battery drain.

1. Preparation	
Be sure calculator is off. Insert service module in lower left I/O port.	(blank display) (blank display)
2. CPU	CPU OK
Press the [ON] key.	SELECT TEST(***)
3. Display Press the [USER] key. (Press and hold the [R/S] key to pause at any display.)	
4. D/S	D/S TEST D/S OK

5. ROM

ROM TEST
ROM OK

While in this mode, read the current meter on the power supply. With only the service module installed, the current should not exceed 10 ma. If it does, proceed to the diagnostic test in paragraph 4-12.

6. Keyboard

KYBOARD TEST

Press each key, left-to-right, top-to-bottom. This includes the [ON], [USER], [PRGM], and [ALPHA] keys.

KYBOARD TEST(*)

If any other message is displayed, press [R/S] [R/S], then repeat this test by pressing [Y] or [+], and verify keyboard operation.

KYBOARD OK

KYBD AGAIN?

7. Standby

Press the [R/S] key.
Press any key (except [ON]).

STANDBY TEST
STANDBY OK

While in this mode, read the current meter on the power supply. With only the service module installed, the current should not exceed 1 ma. If it does, proceed to the diagnostic test in paragraph 4-12.

8. Sleep

SLEEP TEST
(blank display)
(blank display)
SLEEP OK (*)

Press any key (except [ON]).
Press the [ON] key.

While in this mode, adjust the power supply to 4V, and set the meter to read 200 uA full scale.

Repeat this test.

For older HP-41C logic boards, immediately after the screen goes blank, you should observe a decrease in the current. (The rate of decrease may fluctuate.) The current should stabilize at some value below 5 uA.

For the HP-41CV and the newer HP-41C economy logic boards, after the screen goes blank, the current should decrease, increase and then decrease again before stabilizing below 5 uA. (The decrease and

increase in current may occur several times.) The cyclical peaks should not exceed 20 uA.

If the above performance is not observed, proceed to the diagnostic test in paragraph 4-12.

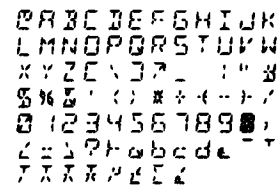
9. Multiple Summary — ALL TESTS OK

If ERROR appears in the display, the numbers that follow indicate which of the previous tests resulted in an error: 1=display, 2=D/S, 3=ROM, 4=keyboard, 5=standby, 6=sleep.

Press the [R/S] key. — SELECT TEST

10. Character

Press the [STO] key. (Press and hold the [R/S] key to pause at any display.)



Press the [R/S] key. — SELECT TEST

11. Keycode

Press the [1/x] or [R] key.	KEYCODE TEST
Press and hold [5]; press and hold [4].	KEYCODE TEST
Release the [5] key.	63
Release the [4] key.	62
Press and hold [5]; Press and hold [6].	62
Release the [5] key.	63
Release the [6] key.	64
Press and hold [5]; press and hold [2].	64
Release the [5] key.	63
Release the [2] key.	73
Press and hold [5]; press and hold [8].	73
Release the [5] key.	63
Release the [8] key.	53
Press the [R/S] key, then release.	84
Press the [R/S] key again.	SELECT TEST

12. I/O Port

Remove the batteries and all modules from the calculator. Insert the port extender T11945 into port 1. Connect +5V to the GND terminal. Probe each of the remaining port terminals on the extender with the negative lead from the power

supply. Look for a 5 volt reading on the power supply voltmeter. Wiggle the port extender to detect open-circuit conditions.

Repeat for ports 2, 3, and 4.

Each line should always give a voltage reading except B3 and B4 which should read as follows:

Port	B3	B4
1	0V	0V
2	5V	0V
3	0V	5V
4	5V	5V

(Note: Refer to paragraph 4-26 for information which will expedite this measurement.)

13. ROM Identification

Press the [-] key to check the ROM revision codes. (The actual codes may differ from those shown.)	ROM 0:D 1:D 2:C through 0:G 1:F 2:F etc.
Press the [R/S] key.	SELECT TEST

14. Completion

Press the [ON] key.	(blank display)
Remove the plug-in modules.	(blank display)

4-9. THE 5061-7221 DIAGNOSTIC ROM MODULE

4-10. There are several differences between ET 11966 and 5061-7221. First there are some differences in the way similar tests are accessed and what the tests will tell you.

- The 5061-7221 diagnostic ROM was designed to fully test the 41CX and 41CV. The ROM uses a CPU status bit to keep track of whether it is testing a 41CV or 41CX. This status bit starts out cleared which indicates that a 41CV is being tested. If the user key or top row of keys are used the bit is set indicating a 41CX. The status bit MUST be set properly before doing individual D/S or ROM tests. The bit will only be cleared by turning the 41 off.

Note: If the CPU is not working properly, it may ignore the signal which distinguishes between the HP-41CV and the HP-41CX. This condition requires replacement of the CPU.

- Both the USER and PGRM keys will now start the multiple test but the USER key indicates that a 41CX is being tested while the PRGM key indicates that a 41CV is being used.
- The top row and second row of keys perform the same functions as the old diagnostic ROM but the top row of keys is used to test the 41CX and the second row of keys is used to test the 41CV. The D/S now tests all data storage ICs.
- The ROM test will expect that the 120K ROMs are being used. If an old style 41 is tested and any of the three ROMs is bad then "ROM 0, BAD" will be displayed. If this occurs use the ET 11966 ROM to determine which ROM is faulty.
- The memory module test now tests QUAD memory modules rather than single memory modules. Use ET 11966 to test the single memory modules. This test can only be performed with a 41C.
- I/O port and Card Reader tests are not in this ROM. You must use ET 11966 for these tests.
- The mainframe ROM ID key displays the mainframe code revision levels in a different format. The new format is "0:ABC" where 0 refers to ROM 0, the 120K ROM, and the letters refer to the revision number in each of the 4K byte banks of ROM.

4-11. There are also several additional tests in the 5061-7221 Diagnostic ROM. These tests are used to test the expanded capabilities of the HP41CV/CX.

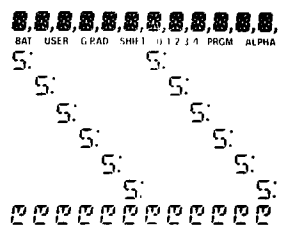
- Several new modules can be tested with the 5061-7221 diagnostic ROM which could not be as fully or easily tested with ET 11966. QUAD memory modules for the 41C, Extended Memory, Extended Functions, Timer, and various size application ROMs can be tested.
- There is also a test to determine the clock frequency of the mainframe clock. This test also requires a time module for the 41C and 41CV.

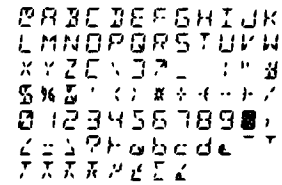
4-12. 41CV/CX DIAGNOSTIC TEST USING THE 5061-7221 SERVICE ROM MODULE

4-13. Perform the diagnostic test procedure outlined below. For each step that is described, the proper LCD display is shown at the right. This listing gives the responses for a good calculator; other responses can occur and indicate improper operation. (Each * below denotes an alarm beep.)

o If an error display occurs, refer to the corresponding section of the detailed listing (table 4-2) and continue testing using that table. Be sure to record each LCD error message to aid the repair process. Repair the calculator according to paragraph 4-14.

Note: The 5061-7221 service module is intended to test 41CVs and -CXs. Many of the tests will not work with a 41C. Use the 5061-7221 only to test modules for a 41C but not the mainframe itself.

1. Preparation	
Be sure calculator is off. Insert service module into any I/O port.	(blank display) (blank display)
2. CPU	
Press the [ON] key.	SELECT TEST(***)
3. Multiple Test With Display First	
For the 41CX press the USER key, for the 41CV press the PRGM key. (Press and hold the [R/S] key to pause at any display.)	
4. D/S	D/S TEST D/S OK
5. ROM Monitor the calculator current during execution of this test. It should not exceed 15 mA.	ROM TEST ROM OK
6. Keyboard	KYBOARD TEST
Press each key, left-to-right, top-to-bottom. This includes the [ON], [USER], [PRGM], and [ALPHA] keys.	KYBOARD TEST(*)
If any other message is displayed, press [R/S] [R/S], then repeat this test by pressing [Y] or [+], and verify keyboard operation.	KYBOARD OK KYBD AGAIN?

7. Standby	
Press the [R/S] key	STANDBY TEST
Press any key (except [ON]).	STANDBY OK
Monitor the calculator current during execution of this test. It should not exceed 1 ma.	
8. Sleep	
	(blank display)
Press any key (except [ON]).	(blank display)
Press the [ON] key.	SLEEP OK (*)
Monitor the calculator current during execution of this test. It should not exceed 30 uA.	
9. Timer Test	NO POWER UP TIME IC OK
If you are testing a 41CX a timer chip test will execute at this point. If the calculator is not coming from a cold start you will have an indication of this by the NO POWER UP display.	
10. Multiple Summary	ALL TESTS OK
If ERROR appears in the display, the numbers that follow indicate which of the previous tests resulted in an error: 1=display, 2=D/S, 3=ROM, 4=keyboard, 5=standby, 6=sleep, 7=timer.	
Press the [R/S] key.	SELECT TEST
11. Character	
Press the [STO] key. (Press and hold the [R/S] key to pause at any display.)	
Press the [R/S] key.	SELECT TEST
12. Keycode	
Press the [1/x]for 41CX or [R↓] key for 41CV.	KEYCODE TEST
Press and hold [5]; press and hold [4].	KEYCODE TEST
Release the [5] key.	63
Release the [4] key.	62

Press and hold [5]; Press and hold [6].	62
Release the [5] key.	63
Release the [6] key.	64
Press and hold [5]; press and hold [2].	64
Release the [5] key.	63
Release the [2] key.	73
Press and hold [5]; press and hold [8].	73
Release the [5] key.	63
Release the [8] key.	53
Press the [R/S] key and release .	84
Press the [R/S] key again.	SELECT TEST
13. ROM Identification	
Press the [-] key to check the ROM revision codes. (The actual codes may differ from those shown.)	0:DDC through 0:GFF etc.
Press the [R/S] key.	SELECT TEST
14. Frequency Test	
If you are testing a 41C or 41CV you MUST plug a good time module into any port of the calculator for this test.	
Press the [1] key.	360 kHz
Frequency should be between 340 and 380 kHz.	
Press the [R/S] key.	SELECT TEST
15. Completion	
Press the [ON] key.	(blank display)
Remove the plug-in modules.	(blank display)

4-14. REPAIR AND TEST

4-15. After completing the procedures in the diagnostic test sequence, replace bad components using the guidelines below. For reference information concerning component locations, circuit information, and part numbers, see figures 4-8a through f, 4-9a through f, and 6-1, and refer to tables 4-5a through f and 6-1.

- If any components are individually specified as bad, replace them.
- If any components are specified as possibly bad, decide which test errors may be related and replace the component that is most likely causing them.
- Certain error possiblities may be resolved by installing the logic PCA in a test calculator and trying the appropriate tests again.

- If the same ROM error occurs after any indicated ROMs have been replaced, other ROMs may be interfering with their operation. In this case, replace other ROM ICs until the ROM error is corrected. Replace them in the order of ROM 0, ROM 2, ROM 1 for old style 41Cs and 41CVs. For the 41CX replace ROM 0 first if you are unsure of which ROM is faulty.

- If memory is not preserved in low-power modes (standby or sleep tests), replace the indicated ICs only if a few are specified or if they may be causing other error conditions. If most of the ICs included in the low-power memory check are specified, replace the power supply (bipolar) IC. (See figure 4-3 for additional power supply troubleshooting information.)

4-16. Rerun the entire diagnostic test (paragraph 4-7 or 4-12) after repairing the logic PCA or the calculator. The logic PCA may be tested using a test calculator as shown in figure 4-2. Next test the complete calculator. If additional repairs are required, be sure to rerun the diagnostic test.

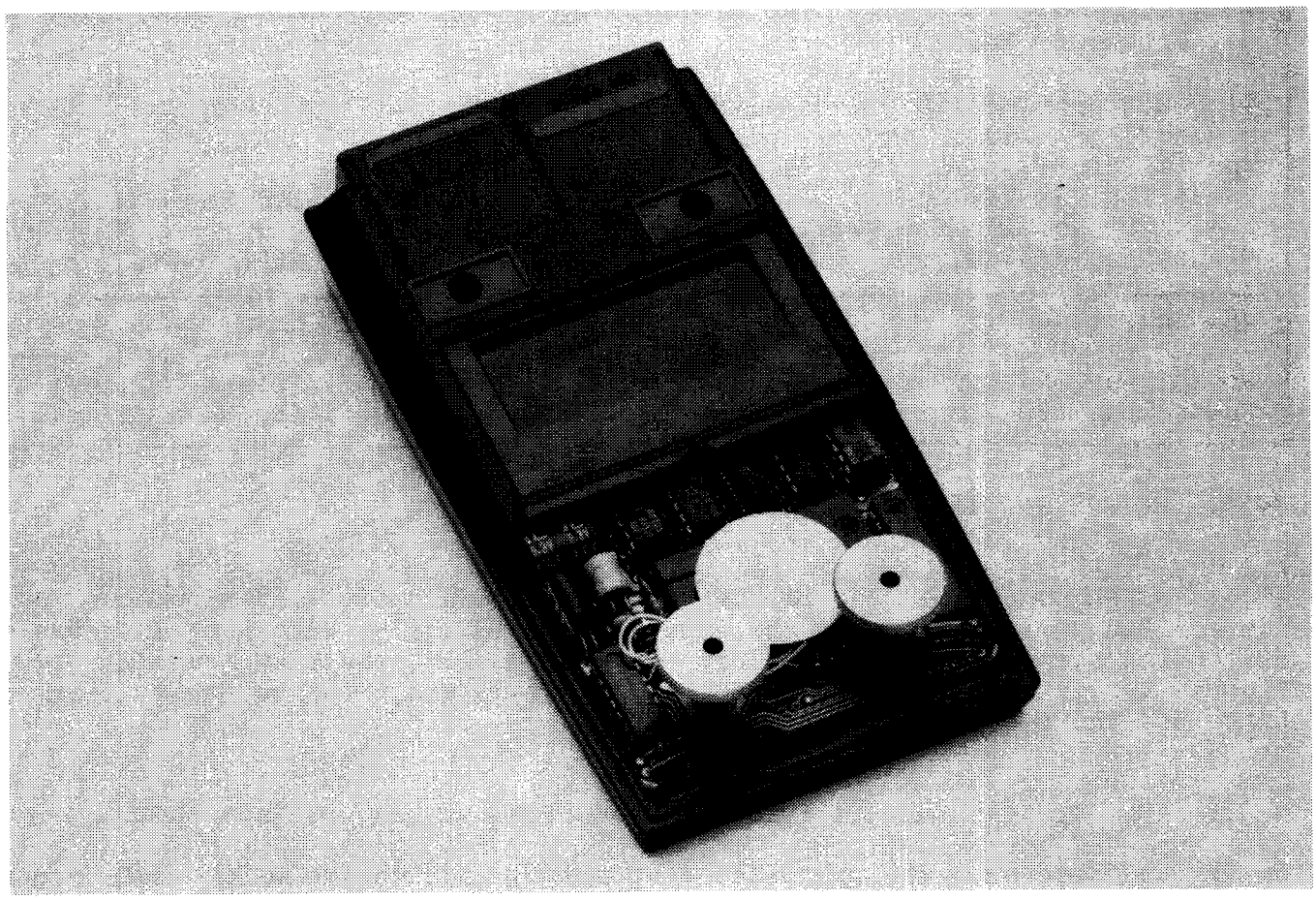


Figure 4-2. Test Calculator

Table 4-2. Detailed Diagnostic Test Procedure

This table presents a detailed description of the diagnostic test procedure. For each step, conditions that can occur are listed and the LCD displays are shown. Where there are differences between the two diagnostic ROMs, these differences will be noted.

STEP	DISPLAY
1. Preparation	
a. Be sure that the calculator is off. If the display is active, press the [ON] key to turn it off.	
b. Insert the service module in the lower left I/O port. Do not insert any modules while the calculator is turned on. (The 5061-7221 ROM can be used in any port.)	
Note: Step c applies only to the 41C.	
c. Insert two good memory modules in the remaining I/O ports. These modules provide additional loading on the system lines in order to approximate worst-case operating conditions and permit testing of all I/O ports. (On 41C only.)	
2. CPU Test	
a. Press the [ON] key to turn on the calculator and start the diagnostic test. Watch for:	
o Triple beeps and this flashing LCD message indicates that the alarm and tested portion of the CPU are good. If this expected display is not observed, but portions of it are recognizable in the actual display, or if the display is flashing, then the CPU is still considered to be good. (The message CPU OK may appear momentarily in the display.)	SELECT TEST
o This LCD message indicates that the CPU is bad. Press the [ON] key to turn off the calculator. Refer to table 4-3.	CPU BAD
o For any other CPU test result, the test interpretation and procedure is given in table 4-3.	

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

STEP	DISPLAY
Note: An erratic, intermittent, or squealing sound is not a valid alarm beep. If such a sound persists, it indicates the need for further diagnostic testing (and perhaps a heat run) to isolate the problem.	
b. If the alarm is bad, replace it now only if the CPU is being replaced or if the expected display was not recognizable, then restart the diagnostic test. Otherwise, replace a defective alarm when replacing other components or at the end of the test.	
c. For the 41C using the ET 11966 Diagnostic ROM, Press the [USER] key to select the multiple test sequence with manual interaction, consisting of tests 3 through 9. For the 41CV and 41CX use the 5061-7221 Diagnostic ROM and press USER for a 41CX or PRGM for a 41CV.	
3. Display Test	
a. Watch for:	
o This LCD message or a continuous alarm tone indicates that there is a bad D/S IC in the system. If the plug-in memory modules are known to be good and the LCD message is legible, press the [R/S] key to go on to the next test. Otherwise, perform step c.	SOME D/S BAD
o This LCD message or a series of single beeps indicates that the display driver, the D/S or ROM 0, or the CPU is bad. If the LCD message is legible, press [R/S] key to go on to the next test. Otherwise, perform step c.	DRIV/CPU BAD
o This LCD message or a series of double beeps indicates that the display driver is bad. If the LCD message is legible, press the [R/S] key to go on to the next test. Otherwise, perform step c.	DISP DRIV BAD
b. Observe the three visual tests to evaluate the brightness, contrast, and response of the LCD unit.	

Table 4-2. Detailed Diagnostic Test procedure (Continued)

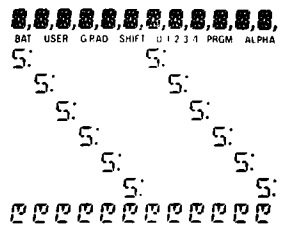
STEP	DISPLAY
Make sure that there are no missing or extra segments. Press and hold the [R/S] key to make the display pause; release it to continue.	
(1) Starburst-comma-annunciator test. Check that all LCD segments (except upper dots) turn on. Look for both segments in each comma.	
(2) S-colon test.	
(3) @-test	
c. Replace faulty components indicated by previous LCD messages or by the visual test, and then restart the diagnostic test. Evaluate components as follows:	
o Nonuniform or weak contrast or black spots (bubbles) in the display indicate that the LCD, display or connector is bad. A bad power supply (bipolar) IC or improper operation of the clock in the display driver can also cause poor overall contrast.	
o Improper operation of display segments or no display is most likely caused by a bad display driver. Other less likely causes include defective display connectors, a bad LCD, and a bad power supply (bipolar) IC.	
4. D/S Test	D/S TEST
Watch for:	
o Any change in the display indicates that the display driver is bad.	
o This LCD message indicates that all internal D/S ICs are good	D/S OK
o This LCD message indicates that any specified D/S ICs are bad. Press the [R/S] key to continue.	D/S 0-7 BAD

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

STEP	DISPLAY
5. ROM Test	ROM TEST
a. The flag annunciators indicate which ROM IC is being tested (0, 1, or 2). For the 120k bit ROMs the flags indicate which 40k block is being tested.	
b. Watch for:	
o This LCD message indicates that all internal ROM's are good.	ROM OK
o This LCD message indicates that any specified ROM ICs are bad. Press the [R/S] key to continue. Note: When testing a calculator with three 40K mainframe ROMs using the 5061-7221 ROM, if any ROM is bad the indication will be ROM 0 BAD. When this happens use ET 11966 to isolate which ROM has failed.	ROM 0,2,BAD
6. Keyboard Test	KYBOARD TEST
a. Press each keyboard key, left-to-right, top-to-bottom. This includes the four operating (switch-type) keys at the upper end of the keyboard. Watch for:	
o A beep or this LCD message after each keystroke indicates that each pressed key is good. Continue pressing keys.	KYBOARD TEST
o This LCD message after all of the keys have been pressed indicates that all of the keys are good. Go on to step b.	KYBOARD OK
o This LCD message indicates that a double entry has been caused by noisy key contact. Press the [R/S] (or [ON]) key twice to go on to step b.	DOUBLE ENTER
o This LCD message indicates that the pressed key is bad or that the keying was improper. Press the [R/S] (or [ON]) key twice to go on to step b.	KYBOARD BAD

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

STEP	DISPLAY
b. Decide whether to test the keyboard again. This decision also will influence the keycode test later.	KYBD AGAIN?
o If all of the keys are good, press the [R/S] key or [N] (no) key to go on to the next test.	
o If a keyboard error occurred, press the [Y](yes) key or the [Σ+] or [X⇆Y] key (keyboard test keys) to repeat thes test. Note which keys cause errors or whether improper keying causes errors.	
7. Standby Test	STANDBY TEST
a. Observe the display for at least 3 seconds after the start of this test:	
o No changes in the composition and quality of the display indicate that the display driver is probably good.	
o Any change in the display indicates that the display driver, oscillator capacitor (C2), or CPU is bad.	
o This LCD message indicates that the CPU is bad. Press the [R/S] key to go on to the next test.	CPU BAD
b. Press any key (except [ON]) after the observation period, but before 10 minutes has elapsed. Watch for:	
o This LCD message indicates that the calculator operates properly in STANDBY power mode.	STANDBY OK
o This LCD message indicates that the contents of any indicated components are not preserved in STANDBY mode. This test checks the contents of the D/S ICs (0 through 7). Either the indicated ICs or the power supply (bipolar) IC is bad. Press the [R/S] key to continue.	MEM 1-8 LOST

STEP	DISPLAY
8. Sleep Test	SLEEP TEST
a. Observe the display after the start of this test:	
o A blanked display indicates that the display has been properly disabled.	(blank display)
o This LCD message indicates that the CPU is bad. Press the [R/S] key to go on to the next test.	CPU BAD
o Any other display indicates that the display driver is probably bad. A bad CPU is a second, but less likely, cause.	
b. Press the [R/S] key to check for no response. Any other keys (except the [ON] key) may also be tried. Watch for:	
o No response is the proper outcome.	
o Any response indicates that the display driver or CPU is bad. Also, the next step may not function properly.	
c. Press the [ON] key to turn on the calculator. Watch for:	
o A beep and this LCD message indicates that the calculator operates properly in SLEEP power mode.	SLEEP OK
o This LCD message indicates that the contents of any indicated components are not preserved in SLEEP mode. This test checks the contents of the display driver (D) and D/S (0 through 7). Either the indicated ICs or the power supply (bipolar) IC is bad. Press the [R/S] key to continue.	MEM D,2,LOST
9. Timer Test (41CX and 5061-7221 ROM only.)	
a. Watch the LCD during this test for the proper indications.	

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

STEP	DISPLAY
o This LCD message is normal except when the calculator has gone through a hard reset* just before testing. If this message appears after a hard reset check the CPU, power supply, and timer IC.	NO POWER UP
o This message indicates that the CPU would not turn off when the timer IC sets an alarm.	CPU BAD
o This message indicates that the time IC passed all tests.	TIME OK
o This indication means that the Timer IC failed some portion of the test. First check and replace if needed the crystal for the timer chip. If problems still exist replace the timer IC.	TIME(IorB)BAD
10. Summary	
a. Watch for:	
o This LCD message indicates that the tested portions of the electronic components are good. This message does not give any indication of alarm or LCD performance.	ALL TESTS OK
o This LCD message is a reminder that the indicated tests in this sequence were not passed. These tests are summarized: display (1), D/S (2), ROM (3), keyboard (4), standby (5), sleep (6), and timer(7).	ERROR 1-7
b. Press the [R/S] key to select the next test.	SELECT TEST
11. Character Test	
a. Press the [STO] key to select the character test.	

* Hard reset requires removing all power from the calculator and pressing the [ON] key for five seconds. This procedure must be followed for all HP-41CX and HP-41C/CV calculators when the customer returns an HP 82182A Time Module with the calculator. Plug the diagnostic ROM into the calculator BEFORE restoring power from any source.

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

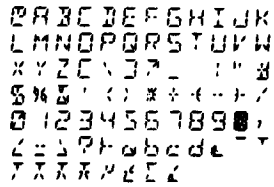
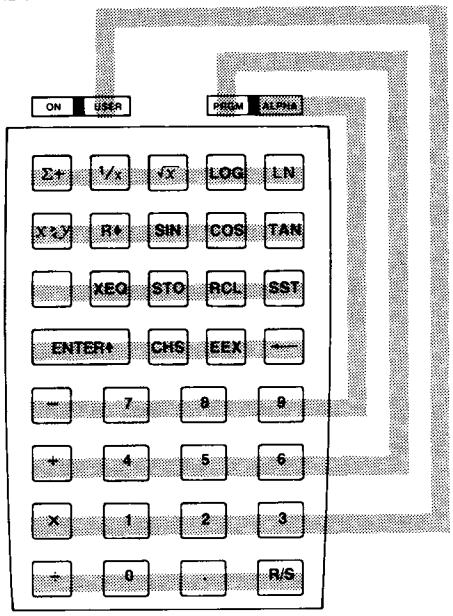
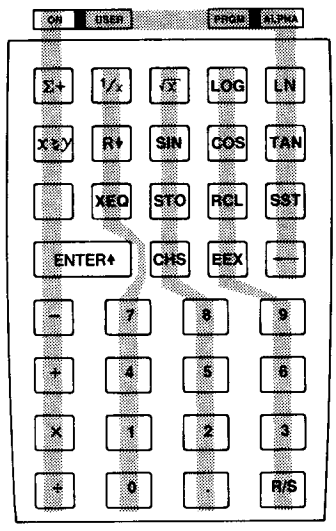
STEP	DISPLAY
b. Observe the seven LCD displays for improper character structure (extra or missing segments). Any improper structure indicates that the display driver is bad. Press and hold the [R/S] key to make the display pause; release it to continue.	
c. Press the [R/S] key to select the next test.	SELECT TEST
12. Keycode Test	
a. Press the [1/X] or [R↓] key to select the keycode test. (For the 5061-7221 diagnostic ROM use [1/X] for 41CX and [R↓] for 41CV.)	KEYCODE TEST
b. If the keyboard is good as determined from the earlier keyboard test go to step e.	
c. Press each suspected key as determined from the keyboard test. Note which keys give erroneous responses.	
Watch for:	
o If the proper keycode is displayed, that key is functioning properly. (The upper four operating keys comprise row 0.)	43
o If there is no response, use step d to determine the bad component.	
o If the wrong keycode is displayed, use step d to determine the bad component.	
o This LCD message indicates that a double entry has been caused by noisy key contact. (Rapid double keying can also cause this message.)	DOUBLE ENTER
o This LCD message indicates that the CPU is bad.	CPU BAD
d. Press other keys on the same row and column line as each bad key (see below) to determine if it is an isolated bad key or a bad row or column:	
o If there is an isolated bad key, the keyboard assembly is bad. (Exception: an isolated key giving an incorrect keycode indicates a bad CPU.)	

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

STEP	DISPLAY



ROW LINE



COLUMN LINE

- o If there is a bad row or column, a key line is open or short-circuited (keyboard assembly, logic board, logic connector) or the CPU is bad.

e. Press keys in the rollover area (2,4,5,6, and 8 keys) for proper two-way rollover response. For each of the four combinations, press and hold the 5 key, press and hold one of the adjacent keys, release the 5 key (observing the corresponding keycode, 63, in the display), and then release the second key (observing its row and key number). A keycode should appear in the display when the key is released.

- o If both keycodes are correct for each combination, the CPU is properly detecting the keys.
- o If either keycode is not correctly displayed for any combination and all of the keys operated properly individually, then the CPU is bad.

f. Press the [R/S] (or [ON]) key twice to go on to the next test. SELECT TEST

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

STEP	DISPLAY
13. I/O Port Test	
Remove the batteries and all modules from the calculator. Insert the port extender, T11945, into port 1. Connect +5V to the GND terminal. Probe each of the remaining port terminals on the extender with the negative lead from the power supply. Look for a 5 volt reading on the power supply volt meter. Wiggle the port extender to detect open-circuit conditions.	
Each line should always give a voltage reading except B3 and B4 which should read as follows:	
Port B3 B4 1 0V 0V 2 5V 0V 3 0V 5V 4 5V 5V	
(Note: Refer to paragraph 4-26 for information on how to build an improved port extender.)	
14. ROM Identification Check	
Press the [-] key to select the internal ROM identification check. This LCD message indicates the revision code for each of the three internal ROM IC's.	ROM 0:D 1:D 2:C or ROM 0:G 1:F 2:F etc. or other designations as ROMs are revised.
When using the 5061-7221 service ROM module:	Or 0:DDC Or 0:GFF etc.
b. Press the [R/S] key to select the next test.	SELECT TEST
15. Frequency Test	
a. This test is used to determine the clock frequency of the 41C/CV/CX under test. The test uses the time module (41C and 41CV) or timer IC (41CX) as a reference to determine clock frequency. For a 41C or 41CV you MUST have a time module plugged in. If you try this test without a time module the calculator will lock up.	

Table 4-2. Detailed Diagnostic Test Procedure (Continued)

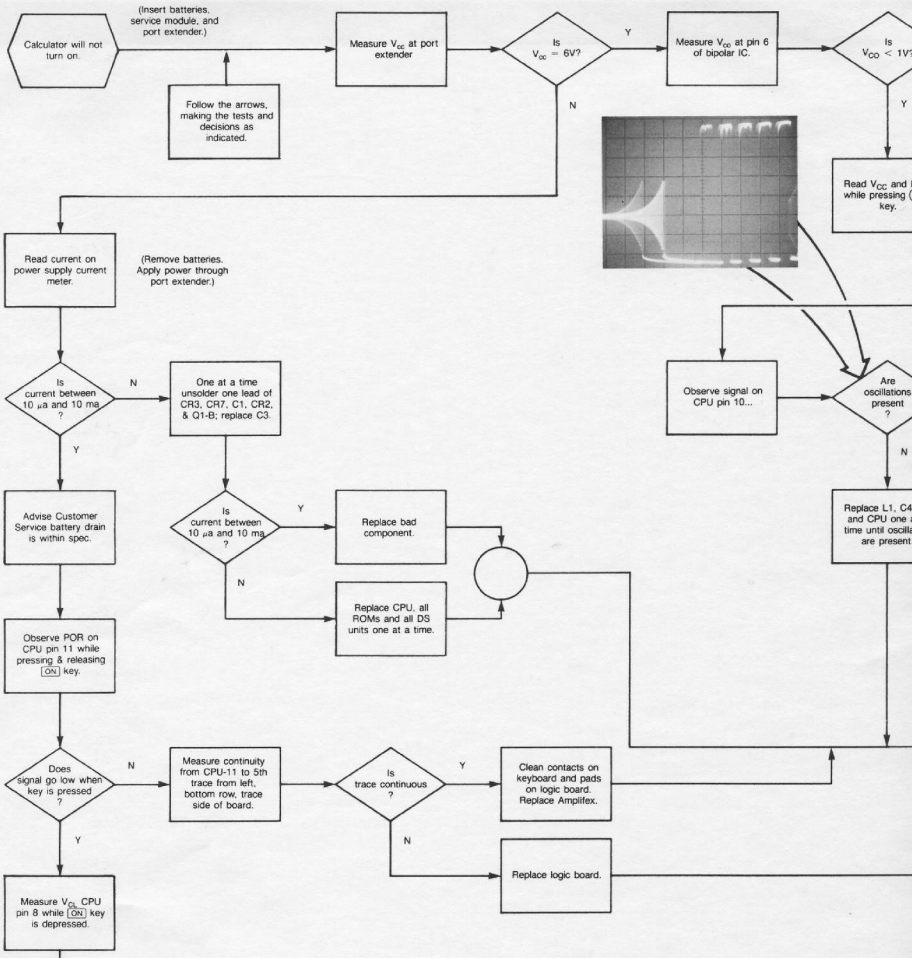
STEP	DISPLAY
b. Press the [1] key. This will run the frequency test. The value diplayed must fall in the range from 340 to 380 kHz. The value displayed is the clock frequency within 2 kHz. If the value is out of range replace the oscillator components, capacitors first, on the logic board you are testing. Components will vary depending on which revision you have.	360 KHZ
c. Press [R/S] (or [ON]) key to go to next test.	SELECT TEST
16. Test Selection/Completion	
a. If necessary, press any designated key to perform the corresponding test (see figure4-1) in order to verify a bad component. Normally, this step is not required.	
b. Press the [ON] key to turn off the calculator, completing the test.	
c. Remove the plug-in modules. Do not unplug them while the calculator is turned on.	

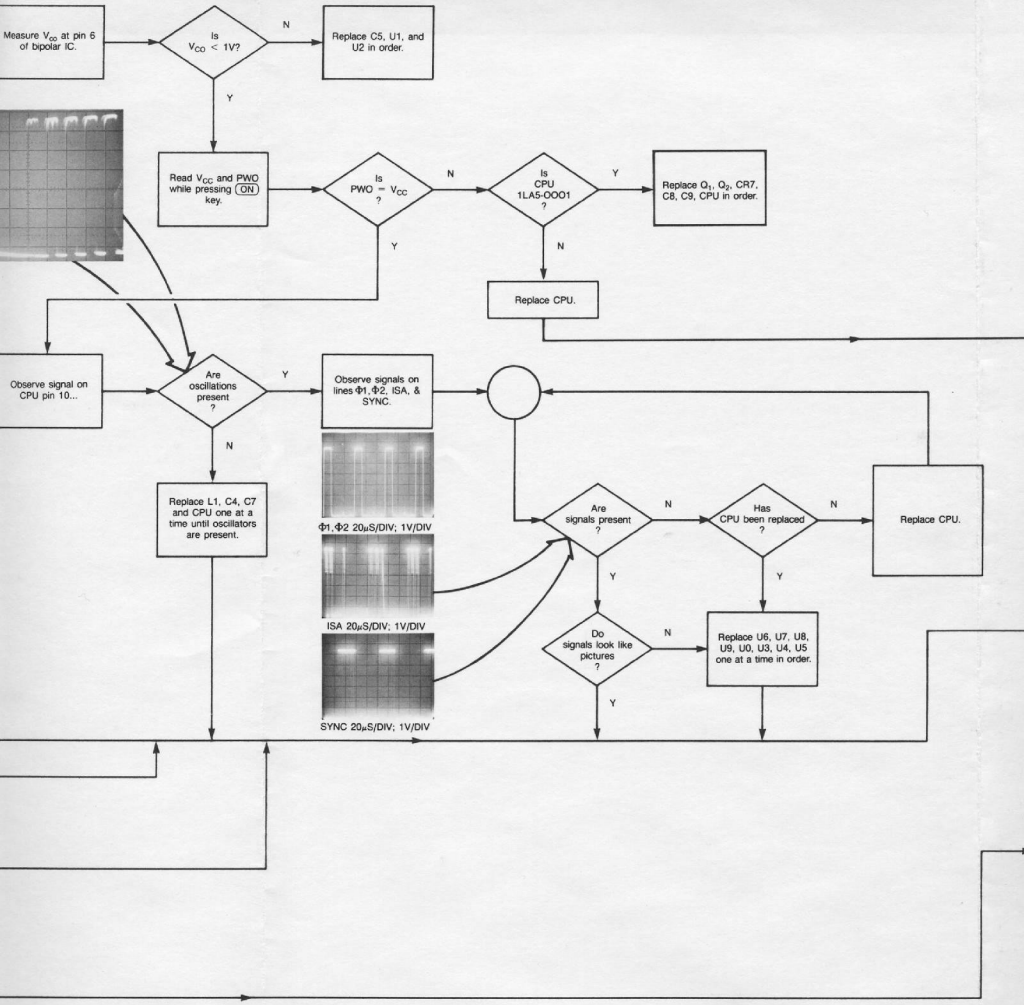
Table 4-3. CPU Test Interpretation and Procedures

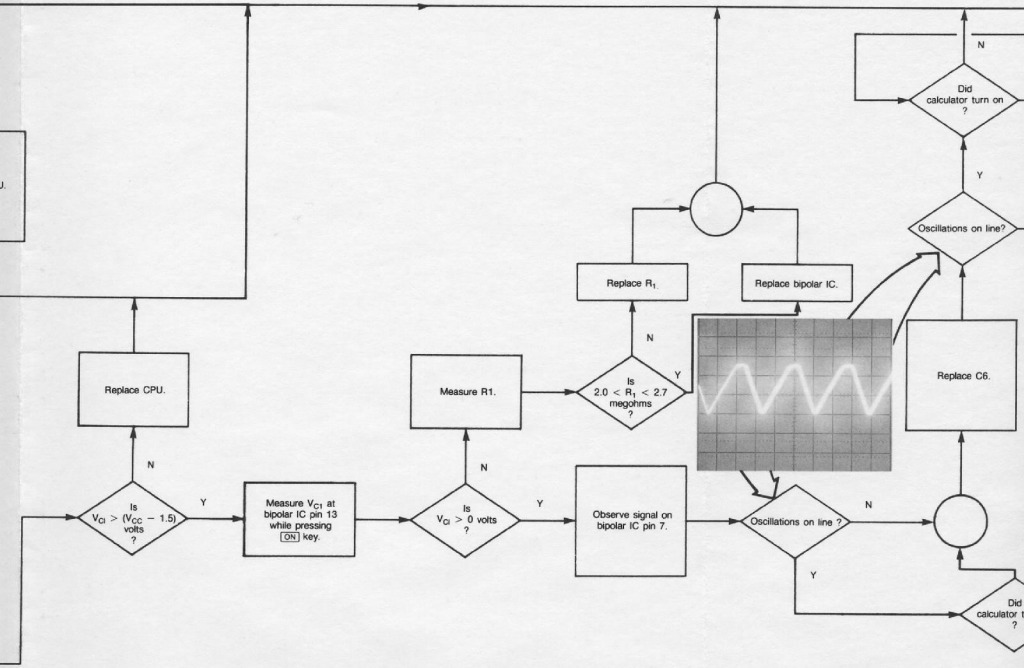
Use this table to interpret the results of the CPU test performed by the service module and to correct the problem(s). Find the test result in the top row of symptoms. Read down the symptom column taking the indicated actions in order. Repeat the diagnostic test after replacing a component.

Triple beeps, "SELECT TEST" or flashing display.	Triple beeps, unrecognizable or blank display.	No beeps, "SELECT TEST".	No beeps, "CPU BAD" or other display.	Single beep, blank display*, "CPU BAD" or other display.	No beeps, blank display*.
CPU is good. Alarm is good.	CPU is good. Alarm is good.	CPU is good. Alarm is bad.	CPU is bad. Alarm is bad.	CPU is bad. Alarm is good.	Remove and reinsert batteries. Retest.
		Repair alarm.	Replace CPU. Repair alarm.	Replace CPU.	Unplug accessories. Retest.
Proceed with diagnostic test.	Proceed with diagnostic test.				Test logic PCA in test calculator.
					Test power supply (table 4-4).
					Check traces and connectors.
					Replace CPU.
					Replace display driver.
					Proceed with diagnostic test.

* If display is blank, turn calculator off by removing batteries or port power.


Calculator will not turn on.
(Insert batteries, service module, and port extender.)
Follow the arrows, making the tests and decisions as indicated.
Measure V_{cc} at port extender
Is V_{cc} = 6V?
Y
N
Measure V_{cc} at pin 6 of bipolar IC.
Is V_{CC} < 1V?
Y
Read V_{CC} and
while pressing
key.
Read current on power supply current meter.
(Remove batteries. Apply power through port extender.)
Is current between 10 μa and 10 ma ?
N
Y
One at a time unsolder one lead of CR3, CR7, C1, CR2, & Q1-B; replace C3.
Advise Customer Service battery drain is within spec.
Is current between 10 μa and 10 ma ?
Y
N
Replace bad component.
Replace CPU, all ROMs and all DS units one at a time.
Observe POR on CPU pin 11 while pressing & releasing ON key.
Does signal go low when key is pressed ?
N
Y
Measure continuity from CPU-11 to 5th trace from left, bottom row, trace side of board.
Is trace continuous ?
Y
N
Clean contacts on keyboard and pads on logic board. Replace Amplifex.
Replace logic board.
Measure V_{CC} CPU pin 8 while ON key is depressed.
Observe signal on CPU pin 10...
Are oscillations present ?
N
Replace L1, C4
and CPU one
time until oscill
are present.


Measure V_{CC} at pin 6 of bipolar IC.
Is V_{CC} < 1V?
N
Replace C5, U1, and U2 in order.
Y
Read V_{CC} and PWO while pressing (ON) key.
Is PWO = V_{CC} ?
N
Is CPU 1LA5-OOO1 ?
Y
Replace Q_1, Q_2, CR7, C8, C9, CPU in order.
Y
N
Replace CPU.
Observe signal on CPU pin 10...
Are oscillations present ?
Y
Observe signals on lines Φ1, Φ2, ISA, & SYNC.
N
Replace L1, C4, C7 and CPU one at a time until oscillators are present.
Φ1, Φ2 20μS/DIV; 1V/DIV
ISA 20μS/DIV; 1V/DIV
SYNC 20μS/DIV; 1V/DIV
Are signals present ?
N
Has CPU been replaced ?
N
Replace CPU.
Y
Y
Do signals look like pictures ?
N
Replace U6, U7, U8, U9, U0, U3, U4, U5 one at a time in order.
Y


N
Did calculator turn on ?
Y
Oscillations on line?
Replace R_1
Replace bipolar IC.
N
Is $2.0 < R_1 < 2.7$ megohms ?
Y
Replace CPU.
Measure R1.
Replace C6.
N
Is $V_{CI} > (V_{CC} - 1.5)$ volts ?
Y
Measure V_{C1} at bipolar IC pin 13 while pressing ON key.
N
Is $V_{CI} > 0$ volts ?
Y
Observe signal on bipolar IC pin 7.
Oscillations on line ?
N
Y
Did calculator t ?

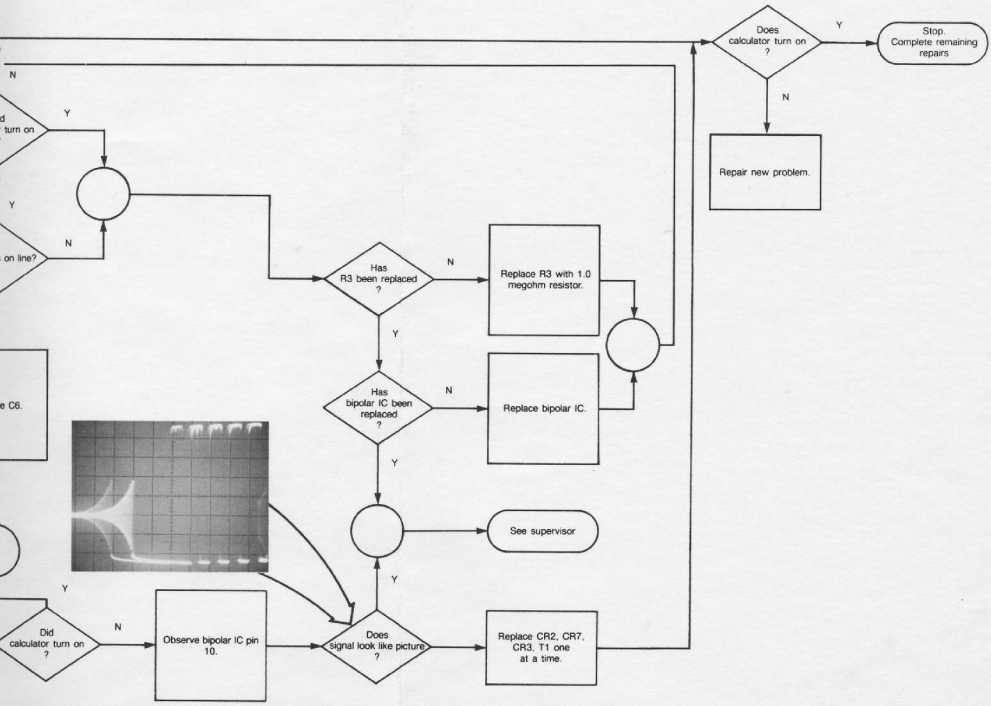
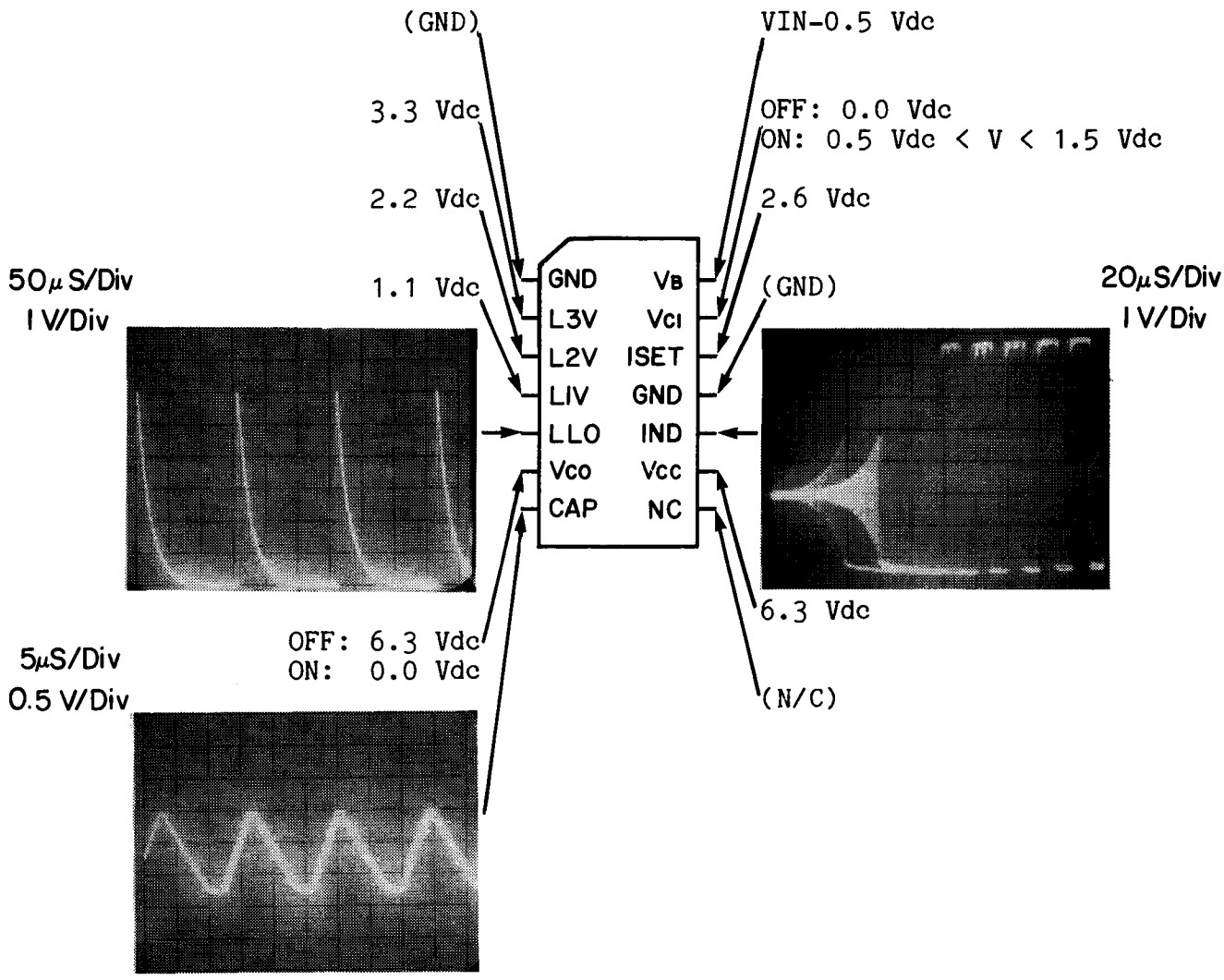


Figure 4-3.
Power Supply Troubleshooting Flow Chart

Table 4-4. Power Supply Bipolar IC Signals

Use this table for reference. All readings are approximate dc volts.



4-17. AUXILIARY TESTS

4-18. Low-Level Detection Test

4-19. If necessary, perform the following steps to test the operation of the low-level detection circuit:

a. Make sure the calculator is off.

b. Remove the battery case from the calculator and set it aside.

c. Insert the port extender into the lower right I/O port.

d. Connect a variable dc power supply and dc voltmeter to VBAT and GND on the port extender.

e. Adjust the power supply to +5 to +6 Vdc at Vbat.

f. Press the [ON] key to turn on the calculator.

g. Measure VCC to be sure that it is 6.0 to 6.5 Vdc. If it is not, perform the power supply troubleshooting procedure (figure 4-3).

h. Vary VBAT from 5.5 to 4.5 Vdc while repeatedly pressing the [R/S] key. (It is assumed that the proper operation of the display assembly has been verified by the diagnostic test, paragraph 4-7.)

   If the BAT annunciator turns on and off at 4.5 to 5.0 Vdc at VBAT, the low-level detection circuit is good.

   Measure the voltage on LLD. If it changes voltage level, the bipolar IC is probably good.

   Otherwise, the power supply (bipolar) IC or CPU is bad.

i. Press the [ON] key to turn off the calculator.

4-20. Rerun the diagnostic test (paragraph 4-7) after making any repairs.

4-21. Battery Test

4-22. If it is necessary to test alkaline size N batteries returned with a calculator, perform the following steps for each cell:

a. Connect a 13-ohm, 5%, 1/4W resistor across the battery terminals.

b. Measure the dc voltage across the load.

   o If the voltage is at least 1.1 Vdc, the cell is good.

- o If the voltage is less than 1.1 Vdc, the cell is bad.

4-23. HP-41CV D/S TEST PROCEDURE

Note: These procedures are used only if the 5061-7221 Diagnostic ROM is not available. The 5061-7221 ROM will test all CV D/S ICs.

4-24. Diagnostic Test Procedure

4-25. Complete the diagnostic procedure outlined in paragraph 4-7 except for step 14. This procedure checks out D/S IC's U6 and U7. The remaining D/S IC's are tested by the following procedure:

a. Execute the memory diagnostic test as outlined in paragraph A-10. This procedure checks out U11.

b. Execute a master clear by turning the calculator on while holding down the [<] key.

c. Execute [SIZE] 319. The calculator should come back with a normal display However, if TRY AGAIN is displayed, go to the troubleshooting procedures in steps f and g.

d. Execute [SIZE] 000 and then press the [PRGM] key. The calculator should display REG 319. If anything else is displayed, go on to the trouble-shooting procedures in steps f and g.

e. Press the [ON] key. The test is complete.

f. D/S Troubleshooting Detail

Some D/S errors can be isolated to individual IC's by using the following procedure:

1. Execute a master clear by turning on the calculator while holding down the [<] key.

2. Execute [SIZE]063. If TRY AGAIN is displayed, U7 is bad.

3. Execute [SIZE]127. If TRY AGAIN is displayed, U8 is bad.

4. Execute [SIZE]191. If TRY AGAIN is displayed, U9 is bad.

5. Execute [SIZE]255. If TRY AGAIN is displayed, U10 is bad.

6. Execute [SIZE]319. If TRY AGAIN is displayed, U11 is bad.

g. Many times there can be one block or one register bad. This will not appear unless D/S memory is accessed. To accomplish this, do the following:

1. Remove all service modules and batteries. Apply port power.

2. Load the following test program:

```
01   LBL DS
02   REG=?
03   PROMPT
04   LBL 01
05   STO IND X
06   ISG X
07   GTO 01
08   END
```

3. Press [GTO][.][.]

4. Press [XEQ] Alpha [SIZE] Alpha. Input the correct size according to the following list:

Calculator Configuration	SIZE	REG=?
-41CV, -41CX, or -41C with quad or four memory modules	316	.315
-41C with three memory modules	252	.251
-41C with two memory modules	182	.181
-41C with one memory module	124	.123
-41C only	060	.059

5. Press [XEQ] Alpha DS Alpha. When REG=? appears in the display, key in the appropriate number from the above list.

6. Press [R/S]. The program will then store values into all registers. The integer part of the value stored will be the same as the register designation in which it is stored. The decimal part of the value stored represents the total number of registers that were loaded.

7. Connect the calculator to an HP 82143A printer.

8. Press [XEQ] Alpha PRREG Alpha. The register contents are printed out. Any data lost or altered indicates a defective register or block of registers. That can be an indication of which IC or memory module is defective.

For -41CV and -41CX:

Bad Register	Defect is in
00-59	D/S 1
60-123	D/S 2
124-187	D/S 3
188-251	D/S 4
252-315	D/S 5

For -41C with quad memory module:

Bad Register	Defect is in
61 or higher	Quad module

For -41C only:

Bad Register	Defect is in
00-12	D/S 1
13-28	D/S 2
29-44	D/S 3
45-60	D/S 4

If the calculator contains an 1LE7-0001, the defect for any register from 00 to 60 will be in it since it contains all registers.

For -41C and:

Number of Memory Modules	Bad Register	Defect is in Module in Port
1	061-124	1
2	125-188	2
3	189-252	3
4	253-315	4

If (1) the customer complaint is intermittent operation, or (2) D/S problems occurred, it may be necessary to allow the calculator to "time out" overnight, and then run the above program again.

4-26. I/O Port Testing

4-27. The following modification to the T-11945 port extender tool provides a very useful I/O port continuity tester.

4-28. When +5V is applied to the ground pin and all other lines are placed at the power ground potential, the input protection diodes are reversed biased, allowing current to flow if the traces are continuous. This tester allows checking of the lines simultaneously. The status of lines B3 and B4

depends upon which port the extender is in, as described in table 4-2 step 13.

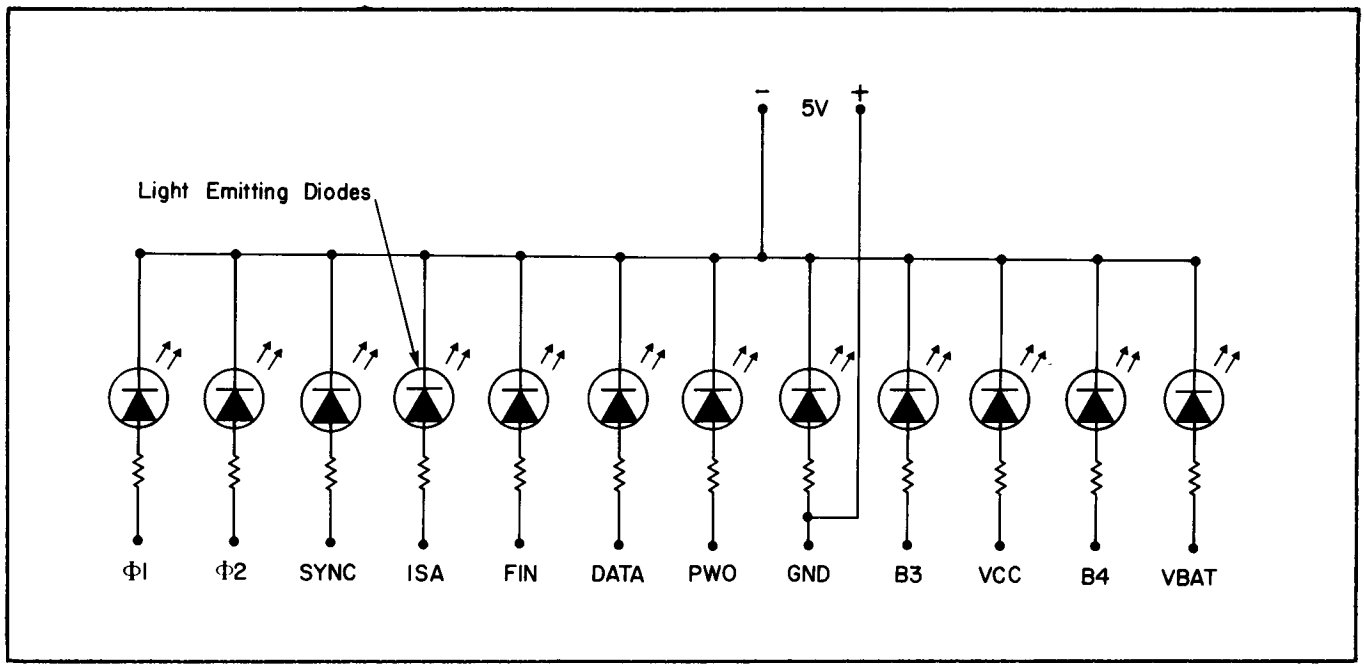


Figure 4-4. Port Extender Modification Schematic

4-29. Timer Failures (HP-41CX Only)

4-30. Check all signals on the timer chip. If the CPU signals were good and the timer chip signals were bad, there is probably an open circuit between the CPU and the timer.

4-31. Check pin 3 (OSC out) for a 32768 Hz sine wave. The amplitude should be between 1 and 4 volts. A distorted sine wave is acceptable. If no signal is present, measure the resistance between pin 5 (OSC in) and pin 3 (OSC out). Its value should be 22M ±10%. If the value is low, clean the board and remeasure. If it is still low, remove the crystal and remeasure. If it is still low, replace the chip and reconnect the crystal and resistor. If the value is too large, replace the resistor, and inspect the board for an open circuit between the IC and the resistor. If the value is good and no signal is present, replace the crystal. If there is still no oscillation, replace the IC.

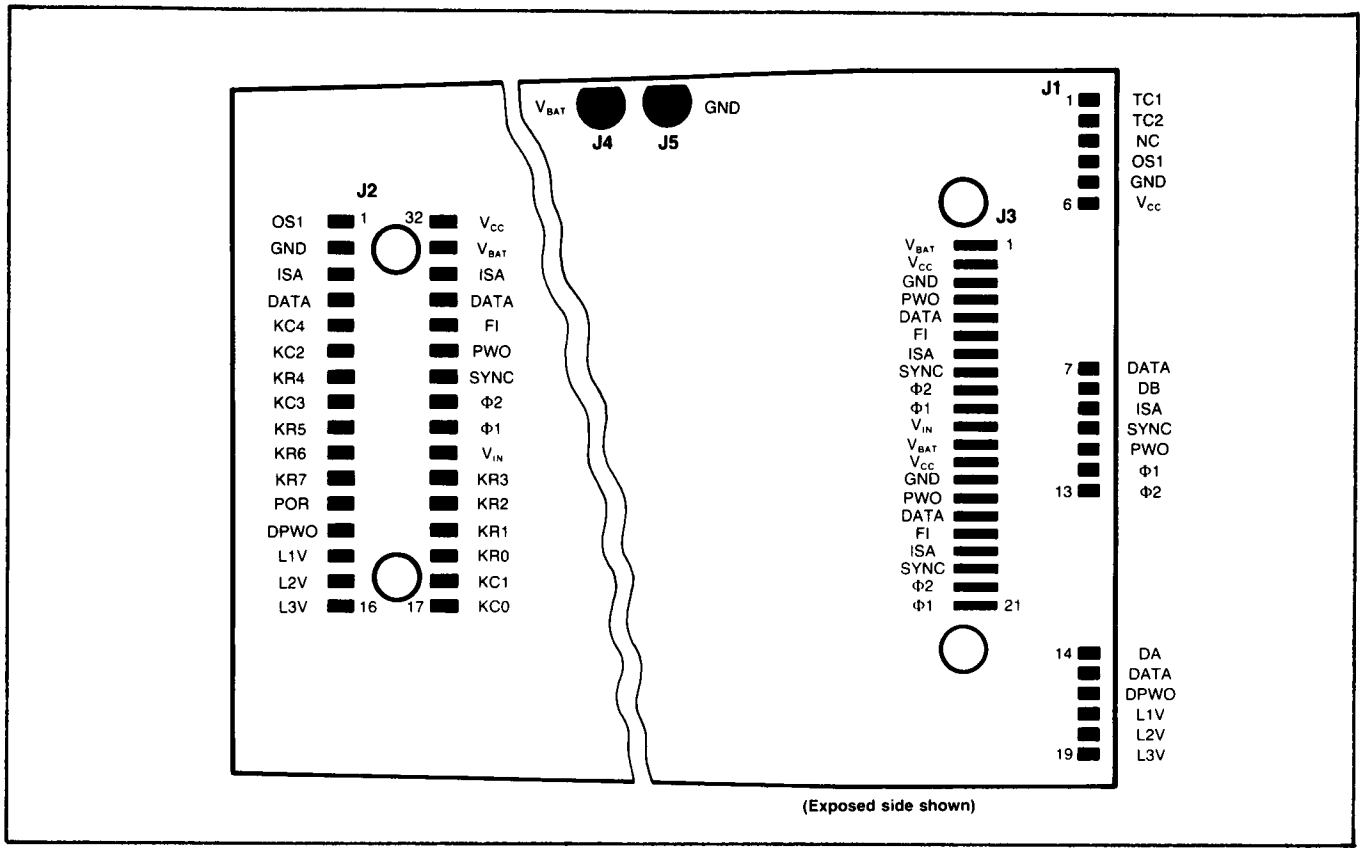


Figure 4-5. Contacts on Keyboard PC Board

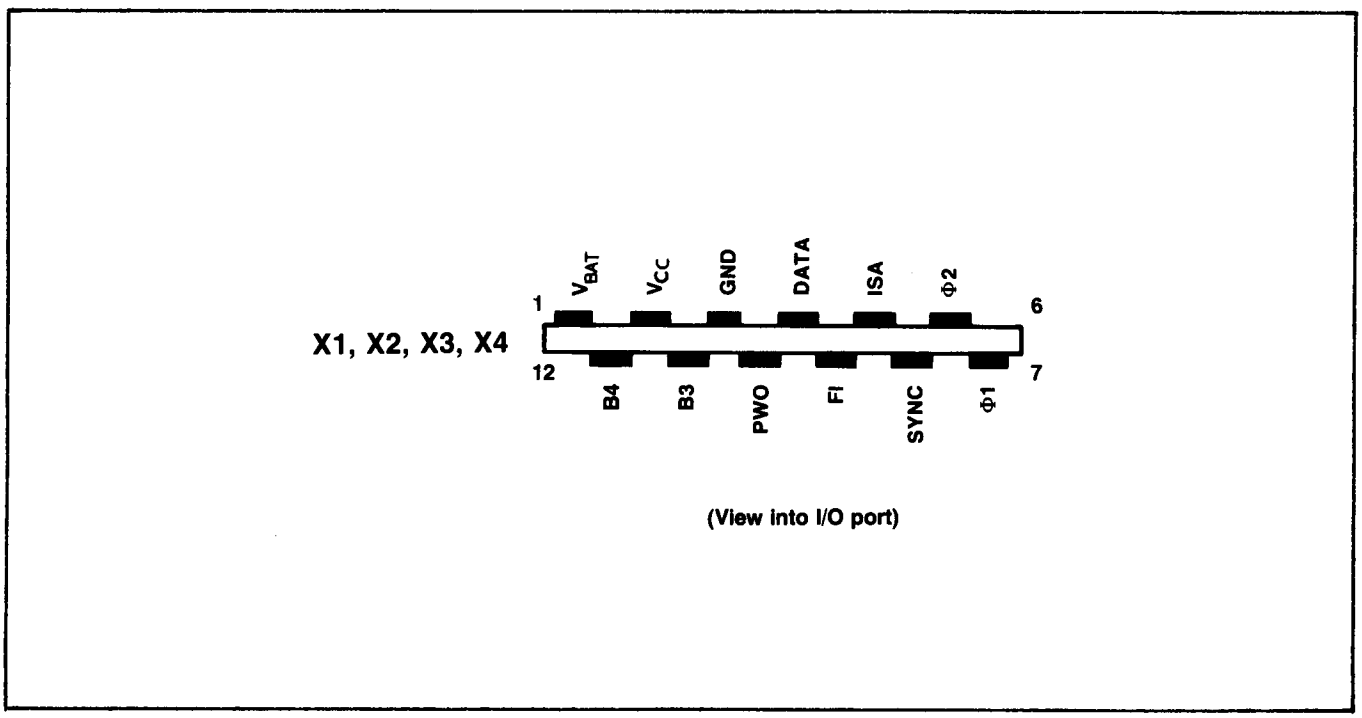
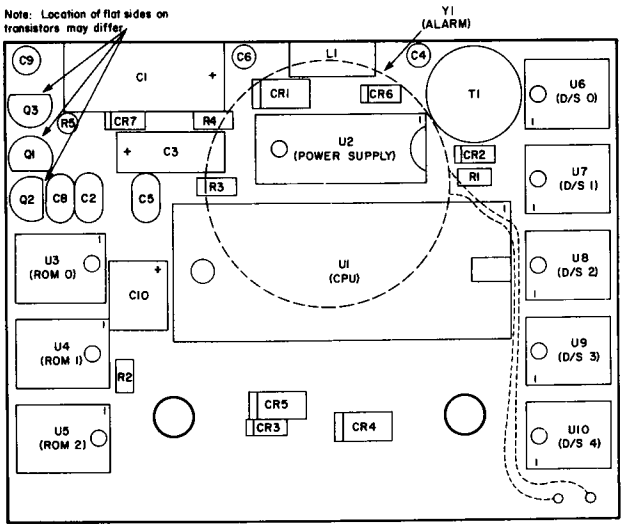


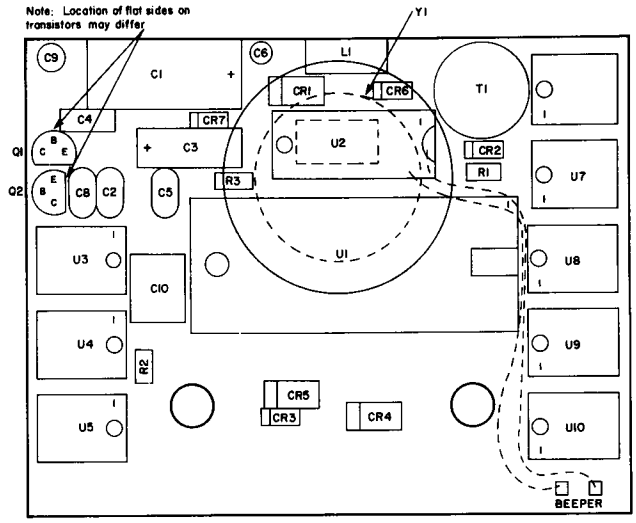
Figure 4-6. Contacts at I/O Port

Figure 6-5. Completed PC Board

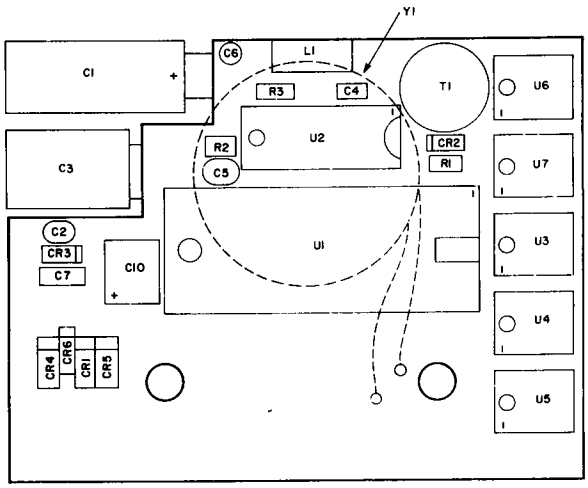
Figure 6-6. Soldering an IC Part



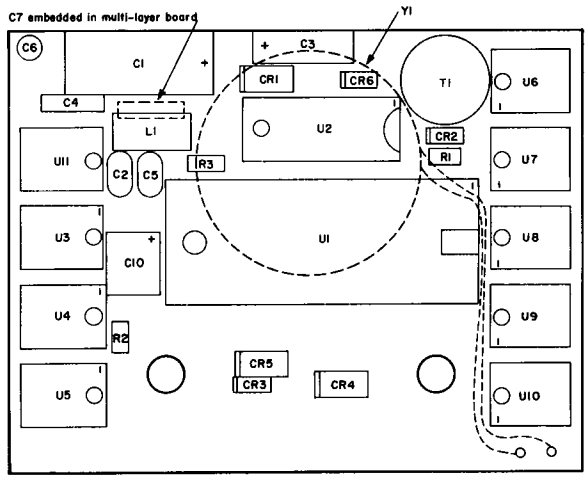
Initial HP-41C



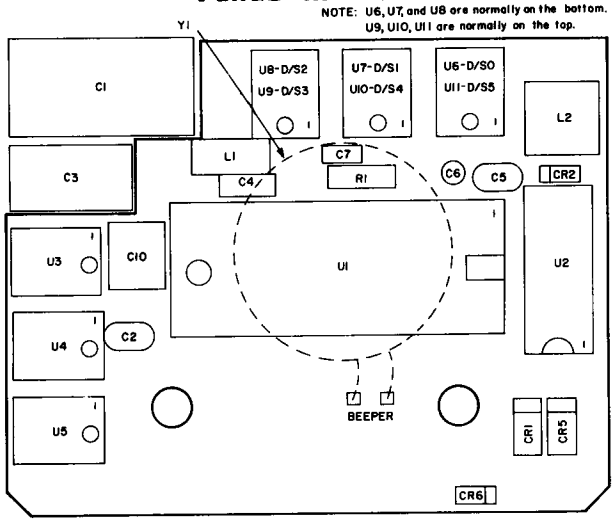
HP-41C Two Transistor



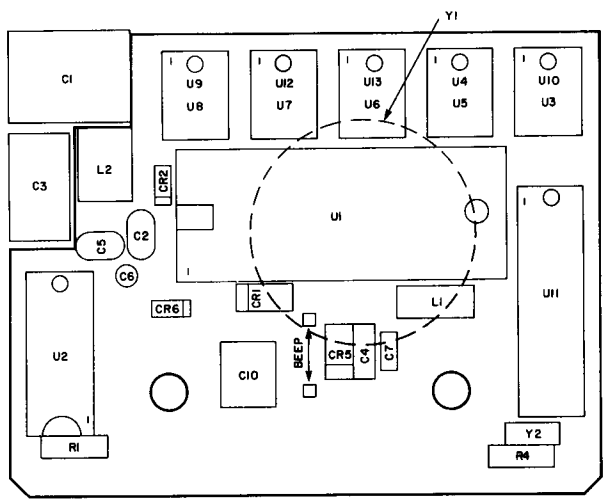
Final HP-41C



Initial HP-41CV



HP-41C/CV Common Board



HP-41C/CV/CX Common Board

Figure 4-7. HP-41 Series Logic PC Board History

Table 4-5a. Initial HP-41C Logic PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
A3	5081-5564	PCA BOARD, logic	00041-80001	*, Rfc-Cost**	1
C1	0180-2910	CAPACITOR, 470 uF, 6V			1
C2	0160-0571	CAPACITOR, 470 pF	0160-3914 0.01 uF	Use with Rev. F display driver.	1
C3	0180-2925	CAPACITOR, 82 uF, 10V			1
C4	0160-5489	CAPACITOR, 140 pF, 5%	0160-0687, 150 pF	Rfc-Cost	1
C5	0160-4685	CAPACITOR, 0.1 uF, 50V	0160-0576	Rfc-Update	1
C6	0160-3802	CAPACITOR, 150 pF, 10%			1
C8	0160-3914	CAPACITOR, 0.01 uF, 10%		***	1
C9	0180-0575	CAPACITOR, 2.2 uF, 15V, 20%		***	1
C10	0180-2663	CAPACITOR, 6.8 uF	0180-0376 33 uF 0180-2978 33 uF	Rfc-Cost Rfc-Cost	1
CR1,CR5	1901-0868	DIODE, Schottky			2
CR2,CR3, CR6,CR7	1901-1098	DIODE, switching		***	4
CR4	1902-0049	DIODE, zener, 6.19V, 5%		***	1
L1	9140-0471	INDUCTOR, 82 uH, 5%	9140-0238	Rfc-Update	1
Q1	1853-0482	TRANSISTOR, PNP	1853-0020	***, Rfc-Poor Fit	1

* - When installing, use washer W1. See figure 6-1.
** - Rfc: Reason for change.
*** - When U1-1LF5-0002 is installed, C8, C9, CR3, CR4, CR7, and Q1 should be removed.

Table 4-5a. Initial HP-41C Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
Q2	1854-0857	TRANSISTOR, NPN	1854-0668	*, Rfc-Poor Fit**	1
Q3	1854-0092	TRANSISTOR, NPN		***	1
R1	0698-7187	RESISTOR, 2 Mohm, 1/8W, 5%			1
R2	0698-6725	RESISTOR, 100 Kohm, 1/8W, 10%		****	1
R3	0698-7097	RESISTOR, 1 Mohm, 1/8W, 5%	0698-7187 2 Mohm	****, Rfc-Value Change	1
R4	0698-6000	RESISTOR, 2.7K, 5% 1/8W		***	1
R5	0698-5426	RESISTOR, 10K, 10% 1/8W		***	1
T1	9140-0647	INDUCTOR, toroidal, 1 mH	9100-3594	Rfc-Cost	1
U1	1LF5-0002	INTEGRATED CIRCUIT, CPU	1LE3-0002, 1LA5-0001	*, Rfc-Cost	1
U2	1826-0953	INTEGRATED CIRCUIT, bipolar power supply	1826-0566	****, Rfc-Cost	1

* - When U1-1LF5-0002 is installed, C8, C9, CR3, CR4, CR7, Q1, and Q2 should be removed.
** - Rfc: Reason for change.
*** - When U3-1LG9-0001 is installed, Q3, R4, and R5 should be removed.
**** - When U2-1826-0953 is installed, R2 and R3 should be removed.

Table 4-5a. Initial HP-41C Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
U3	1LG9-0001	INTEGRATED CIRCUIT, ROM 0, 120 K	U3-1LE9-0006 -1LB7-0038 -1LB7-0001 -1LA3-0033 -1LA3-0015 Prior ROM 0 Array U4-1LE9-0007 -1LB7-0039 -1LB7-0002 -1LA3-0016 Prior ROM 1 Array U5-1LE9-0008 -1LB7-0040 -1LB7-0003 -1LA3-0022 Prior ROM 2 Array	*	1
U6	1LA7-0001	INTEGRATED CIRCUIT, D/S 0			1
U7	1LE7-0001	INTEGRATED CIRCUIT, D/S 1	U7-1LA7-0002 U8-1LA7-0003 U9-1LA7-0004 U10-1LA7-0005	Rfc-Cost**	1
W1	00041-20005	WASHER, 0.013 in thick		***, Rfc-To compensate for change in new PC board thickness.	2
Y1	0960-0509 0460-1688	ALARM TAPE, foam	0460-1447 0460-1528	Rfc-Quality Rfc-Update	1

* - When U3-1LG9-0001 is installed, Q3, R4, and R5 should be removed.
** - Rfc: Reason for change
*** - Use when installing the 5081-5564 PC board. See figure 6-1.

Table 8-9a. Initial HP-41C Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATOR	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
[illegible]	1LE9-0001	INTEGRATED CIRCUIT, ROM 0, 120 K	U3-1LE9-0006 -1LB7-0038 -1LB7-0001 -1LA3-0033 -1LA3-0015 Prior ROM 0 Array U4-1LE9-0007 -1LB7-0039 -1LB7-0002 -1LA3-0016 Prior ROM 1 Array U5-1LE9-0008 -1LB7-0040 -1LB7-0003 -1LA3-0022 Prior ROM 2 Array	*	1
[illegible]	1LB?-0001	INTEGRATED CIRCUIT, D/S 0			1
[illegible]	1LF?-0001	INTEGRATED CIRCUIT, D/S 1	U7-1LA7-0002 U8-1LA7-0003 U9-1LA7-0004 U10-1LA7-0005	Idc-Cont**	1
[illegible]	[illegible]-0005	WASHER, 0.015 in thick		***, Efc-To compensate for change in new PC board thickness.	2
[illegible]	[illegible]	LABEL, TAPE, Foam	0460-1447 0460-1528	Efc-Quality Efc-Update	1

* - When U3-1LE9-0001 is installed, U3, U4, and U5 should be [illegible].

** - [illegible] for change

*** - [illegible] when installing the 00041-??561 PC board. See Figure 8-1.

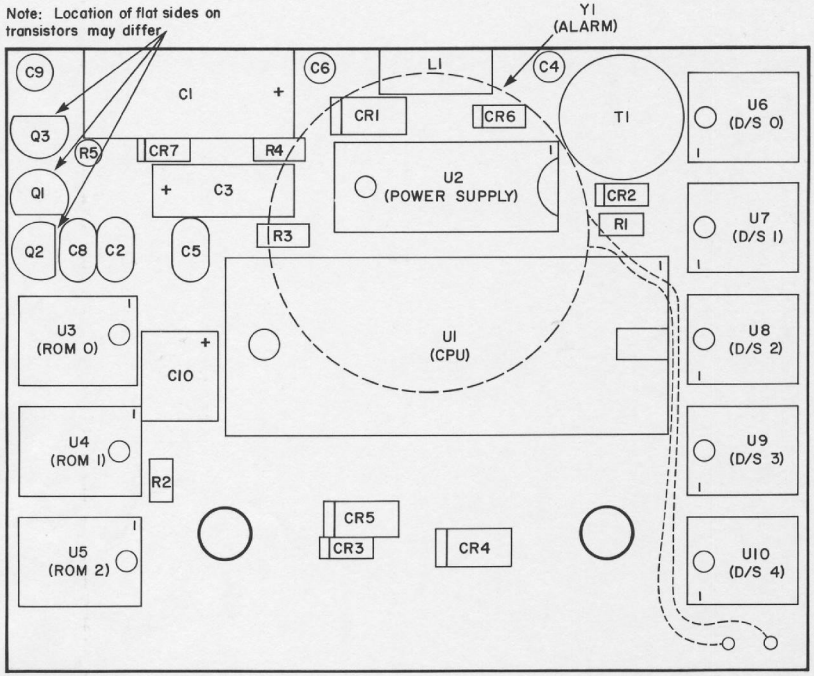
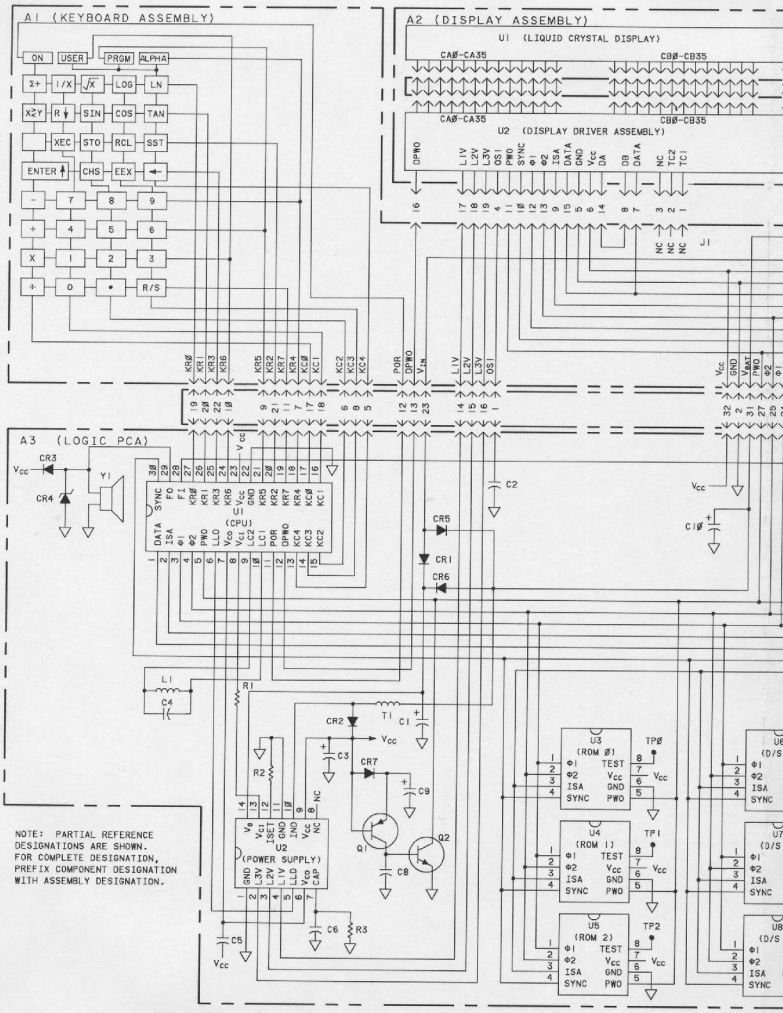


Figure 4-8a. Initial HP-41C Component Location Diagram


A1 (KEYBOARD ASSEMBLY)
ON
USER
PRGM
ALPHA
Σ+
1/X
√X
LOG
LN
X≷Y
R↓
SIN
COS
TAN
XEQ
STO
RCL
SST
ENTER↑
CHS
EEX
←
R/S
A2 (DISPLAY ASSEMBLY)
U1 (LIQUID CRYSTAL DISPLAY)
U2 (DISPLAY DRIVER ASSEMBLY)
A3 (LOGIC PCA)
U1 (CPU)
(POWER SUPPLY)
(ROM Ø)
(ROM 1)
(ROM 2)
J1
NOTE: PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX COMPONENT DESIGNATION WITH ASSEMBLY DESIGNATION.

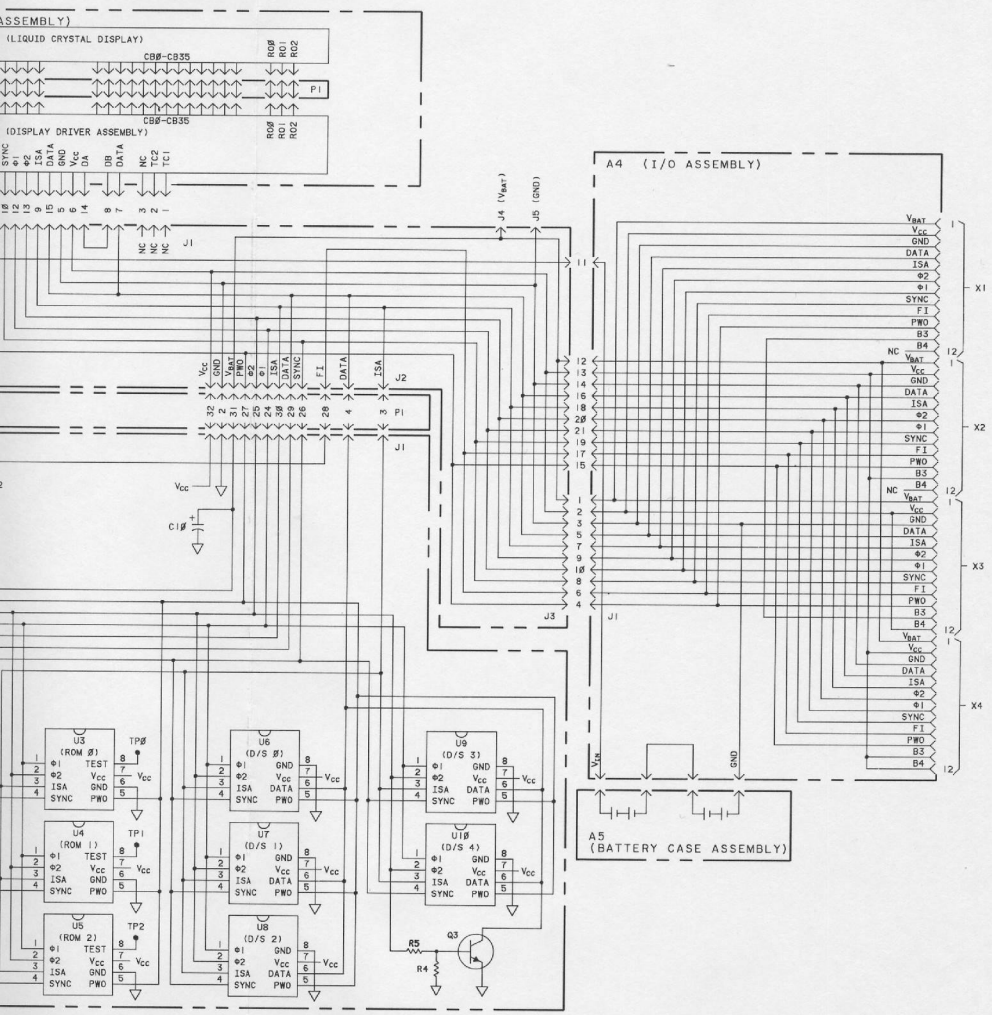


Figure 4-9a. Initial HP-41C Schematic Diagram

Table 4-5b. HP-41C Two Transistor Logic PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART	DESCRIPTION	REPLACES	COMMENT	QTY
A3	5081-5564	PCA BOARD, logic	00041-80001	*, Rfc-Cost**	1
C1	0180-2910	CAPACITOR, 470 uF, 6V			1
C2	0160-0571	CAPACITOR, 470 pF	0160-3914 0.01 uF	Use with Rev. F display driver.	1
C3	0180-2925	CAPACITOR, 82 uF, 10V			1
C4	0160-5489	CAPACITOR, 140 pF, 5%	0160-0687 150 pF	Rfc-Cost	1
C5	0160-4685	CAPACITOR, 0.1 uF, 50V	0160-0576	Rfc-Update	1
C6	0160-3802	CAPACITOR, 150 pF, 10%			1
C8	0160-3914	CAPACITOR, 0.01 uF, 10%		***	1
C9	0180-0575	CAPACITOR, 2.2 uF, 15V, 20%		***	1
C10	0180-2663	CAPACITOR, 6.8 uF	0180-0376 33 uF	Rfc-Cost	1
			0180-2978 33 uF	Rfc-Cost	1
CR1,CR5	1901-0868	DIODE, Schottky			2
CR2,CR3 CR6,CR7	1901-1098	DIODE, switching		***	4
CR4	1902-0049	DIODE, zener 6.19V, 5%		***	1
L1	9140-0471	INDUCTOR, 82 uH, 5%	9140-0238	Rfc-Update	1
Q1	1853-0482	TRANSISTOR, PNP	1853-0020	***, Rfc-Poor Fit	1

* - When installing, use washer W1. See figure 6-1.
** - Rfc: Reason for change.
*** - When U1-1LF5-0002 is installed, C8, C9, CR3, CR4, CR7, and Q1 should be removed.

Table 4-5b. HP-41C Two Transistor Logic PCA Replaceable Parts (Continued)

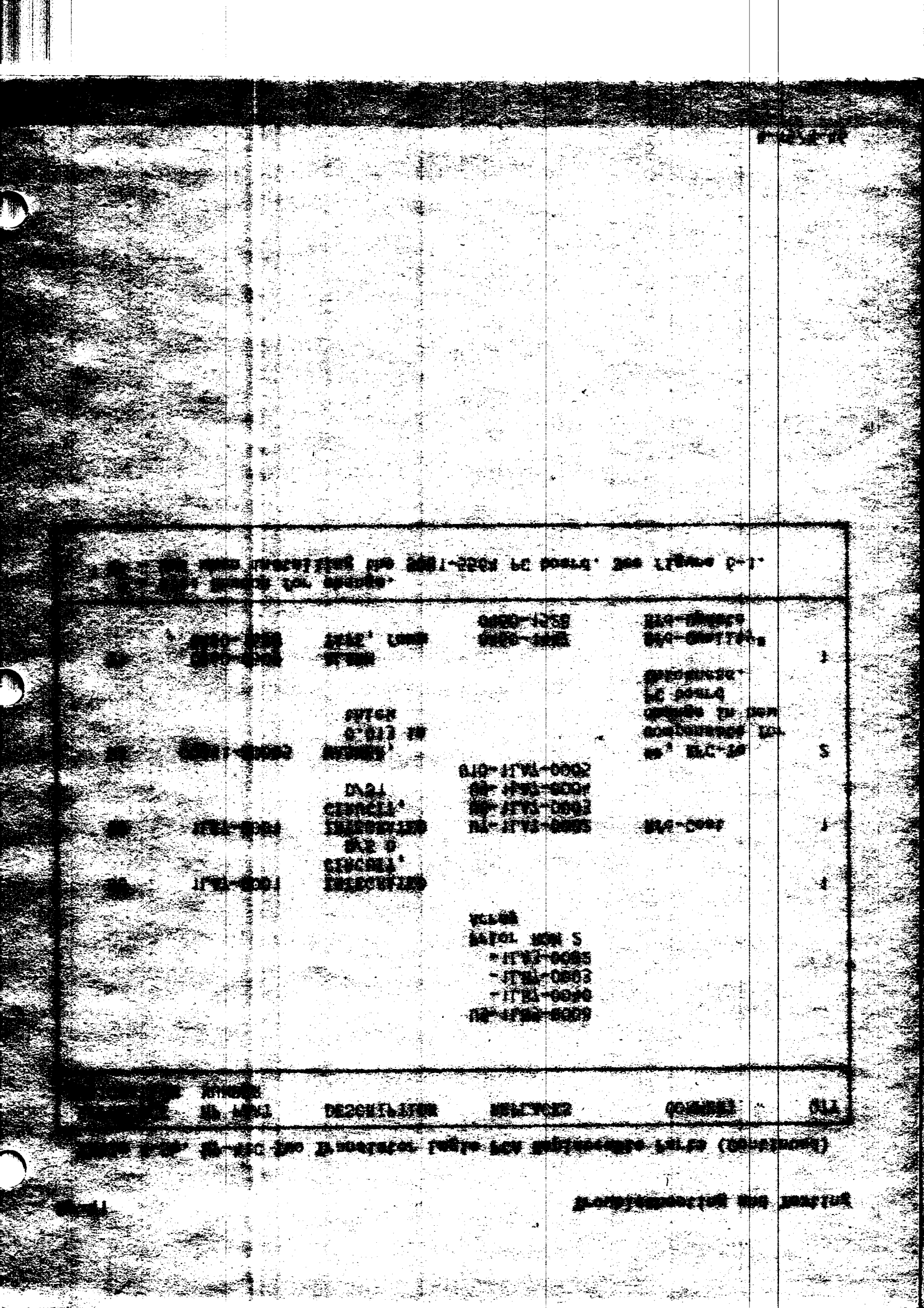
REFERENCE DESIGNATION	HP PART	DESCRIPTION	REPLACES	COMMENT	QTY
Q2	1854-0857	TRANSISTOR, NPN	1854-0668	*, Rfc-Poor Fit**	1
R1	0698-7187	RESISTOR, 2 Mohm, 1/8W, 5%			1
R2	0698-6725	RESISTOR, 100 Kohm, 1/8W, 10%		***	1
R3	0698-7097	RESISTOR, 1 Mohm 1/8W, 5%	0698-7187 2 Mohm	***, Rfc-Value Change	
T1	9140-0647	INDUCTOR, toroidal, 1 mH	9100-3594	Rfc-Cost	1
U1	1LF5-0002	INTEGRATED CIRCUIT, CPU	1LE3-0002 1LA5-0001	*, Rfc-Cost	1
U2	1826-0953	INTEGRATED CIRCUIT, bipolar power supply	1826-0566	***. Rfc-Cost	1
U3	1LG9-0001	INTEGRATED CIRCUIT, ROM 0 120K	U3-1LE9-0006 -1LB7-0038 -1LB7-0001 -1LA3-0033 -1LA3-0015 Prior ROM 0 Array U4-1LE9-0007 -1LB7-0039 -1LB7-0002 -1LA3-0016 Prior ROM 1 Array		1

* - When U1-1LF5-0002 is installed, C8, C9, CR3, CR4, Q1 and Q2 should be removed.
** - Rfc: Reason for change.
*** - When U2-1826-0953 is installed, R2 and R3 should be removed.

Table 4-5b. HP-41C Two Transistor Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
			U5-1LE9-0008 -1LB7-0040 -1LB7-0003 -1LA3-0022 Prior ROM 2 Array		
U6	1LA7-0001	INTEGRATED CIRCUIT, D/S 0			1
U7	1LE7-0001	INTEGRATED CIRUCIT, D/S1	U7-1LA7-0002 U8-1LA7-0003 U9-1LA7-0004 U10-1LA7-0005	Rfc-Cost	1
W1	00041-20005	WASHER, 0.013 in thick		**, RFC-To compensate for change in new PC board thickness.	2
Y1	0960-0509 0460-1688	ALARM TAPE, foam	 0460-1447 0460-1528	 Rfc-Quality* Rfc-Update	1

* - Rfc: Reason for change.
** - Use when installing the 5081-5564 PC board. See figure 6-1.



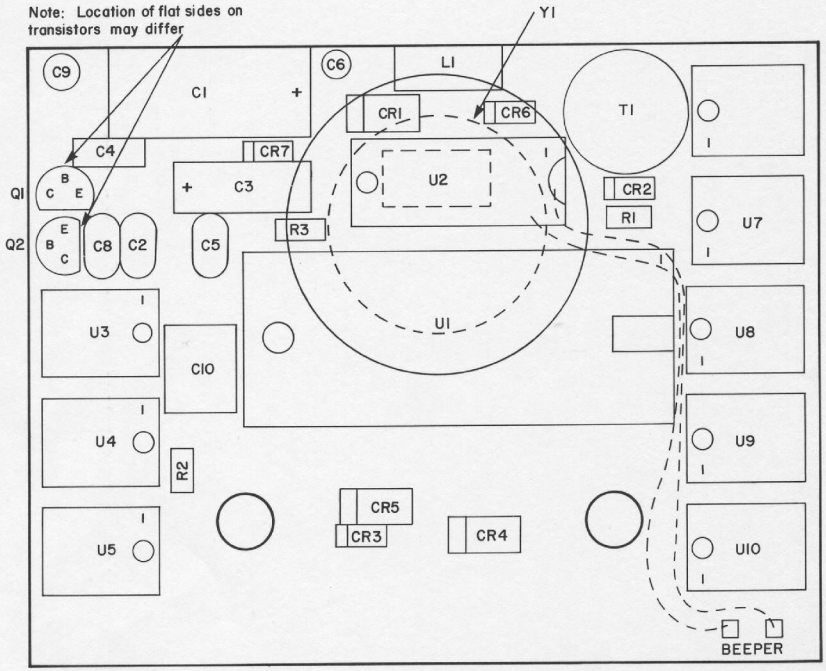
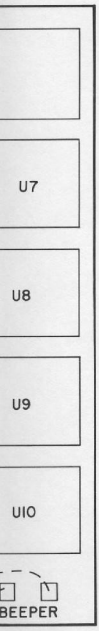
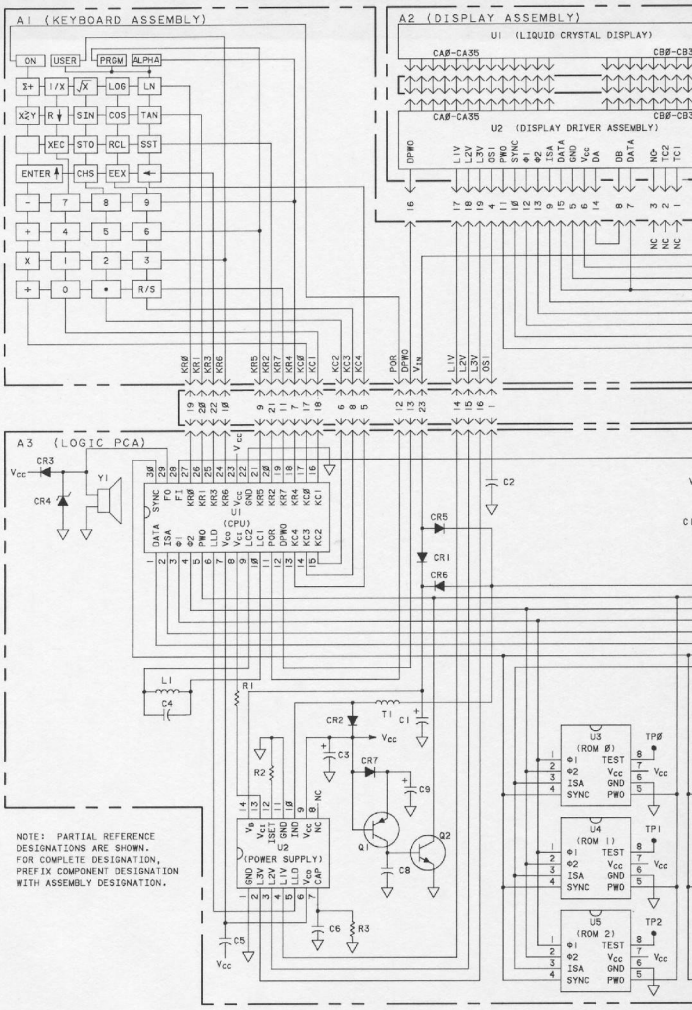


Figure 4-8b. HP-41C Two Transistor Component Location Diagram


U7
U8
U9
U10
BEEPER


A1 (KEYBOARD ASSEMBLY)
A2 (DISPLAY ASSEMBLY)
U1 (LIQUID CRYSTAL DISPLAY)
U2 (DISPLAY DRIVER ASSEMBLY)
A3 (LOGIC PCA)
(CPU)
(POWER SUPPLY)
(ROM Ø)
(ROM 1)
(ROM 2)
NOTE: PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX COMPONENT DESIGNATION WITH ASSEMBLY DESIGNATION.

agram

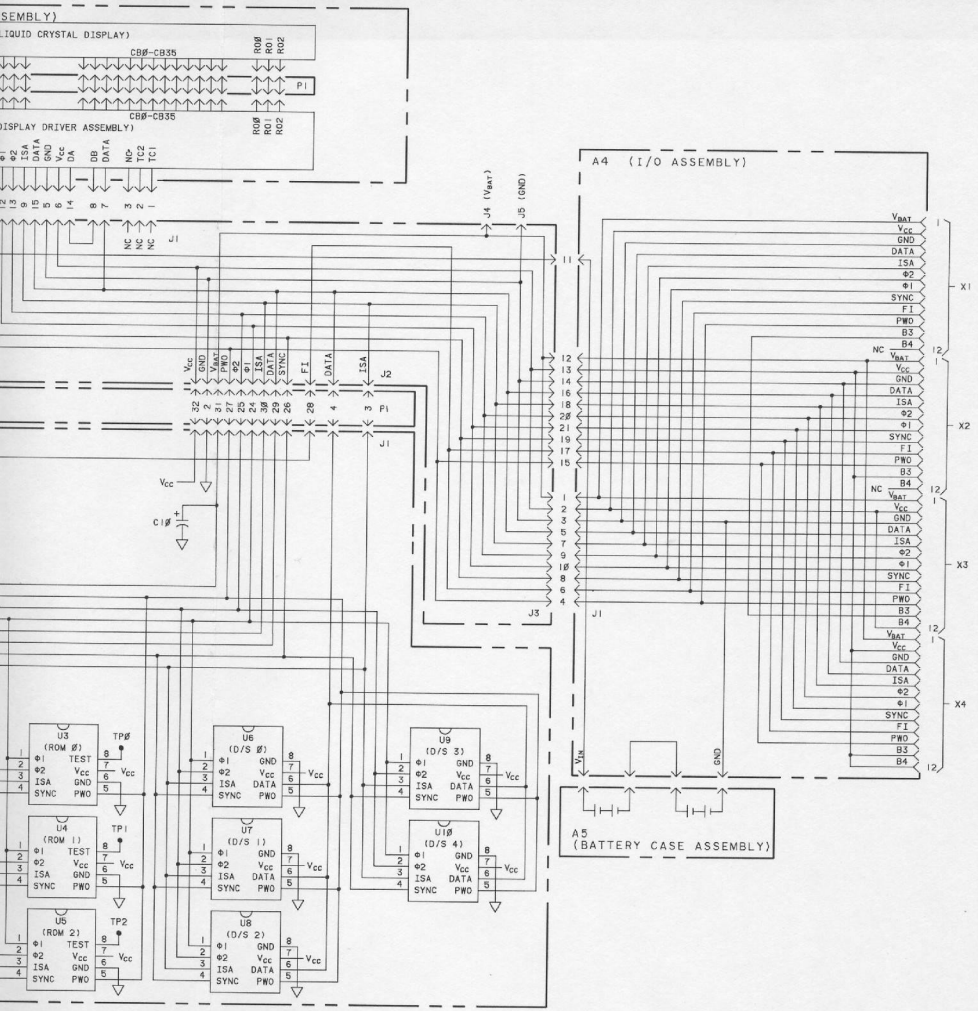


Figure 4-9b. HP-41C Two Transistor Schematic Diagram

Table 4-5c. Final HP-41C Logic PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NUMBER	DESIGNATION	REPLACES	COMMENT	QTY
A3	5081-5564	PCA BOARD, logic	00041-80105	*, Rfc-Cost**	1
C1	0180-3229	CAPACITOR, 470 uF, 6V	0180-3107	Rfc-Size	1
C2	0160-0571	CAPACITOR, 470 pF,	0160-3914 0.01 uF	Use with Rev. F display driver.	1
C3	0180-3228	CAPACITOR, 100 uF, 10V	0180-3108	Rfc-Size	1
C4	0160-5489	CAPACITOR, 140 pF, 5%	0160-0687 150 pF	Rfc-Cost	1
C5	0160-4685	CAPACITOR, 0.1 uF 50V	0160-0576	Rfc-Update	1
C6	0160-3802	CAPACITOR, 150 pF, 10%			1
C7	0160-3337	CAPACITOR, 10 pF			1
C10	0180-2663	CAPACITOR, 6.8 uF	0180-0376 33 uF 0180-2978 33 uF	Rfc-Cost Rfc-Cost	1
CR1,CR5	1901-0868	DIODE, Schottky			2
CR2,CR3 CR6,CR7	1901-1098	DIODE, switching		***	4
CR4	1902-0049	DIODE, zener 6.19V, 5%		***	1
L1	9140-0471	INDUCTOR, 82 uH, 5%	9140-0238	Rfc-Update	1
R1	0698-7187	RESISTOR, 2 Mohm, 1/8W, 5%			1
R2	0698-6725	RESISTOR, 100 Kohm, 1/8W, 10%		****	1
R3	0698-7097	RESISTOR, 1 Mohm, 1/8W, 5%	0698-7187 2 Mohm	****, Rfc-Value Change	1

* - When installing, use washer W1. See figure 6-1.
** - Rfc: Reason for change.
*** - When U1-1LF5-0002 is installed, CR3, and CR4 should be removed.
**** - When U2-1826-0953 is installed, R2 and R3 should be removed.

Table 4-5c. Final HP-41C Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
T1	9140-0647	INDUCTOR, toroidal, 1 mH	9100-3594	Rfc-Cost*	1
U1	1LF5-0002	INTEGRATED CIRCUIT, CPU	1LE3-0002	**, Rfc-Cost	1
U2	1826-0953	INTEGRATED CIRCUIT, bipolar power supply	1826-0566	***, Rfc-Cost	1
U3	1LG9-0001	INTEGRATED CIRCUIT, ROM 0, 120K	U3-1LE9-0006 -1LB7-0038 -1LB7-0001 -1LA3-0033 -1LA3-0015 Prior ROM 0 Array U4-1LE9-0007 -1LB7-0039 -1LB7-0002 -1LA3-0016 Prior ROM 1 Array U5-1LE9-0008 -1LB7-0040 -1LB7-0003 -1LA3-0022 Prior ROM 2 Array		1
U6	1LA7-0001	INTEGRATED CIRCUIT, D/S 0			1
U7	1LE7-0001	INTEGRATED CIRCUIT, D/S 1			1
W1	00041-20005	WASHER 0.013 in thick		****	2
Y1	0960-0509	ALARM			1
	0460-1688	TAPE, foam	0460-1447 0460-1528	Rfc-Quality Rfc-Update	

* - Rfc: Reason for change.
** - When U1-1LF5-0002 is installed, CR3 and CR4 should be removed.
*** - When U2- 1829-0953 is installed, R2 and R3 should be removed
**** - Use when installing the 5081-5564 PC board. See figure 6-1.

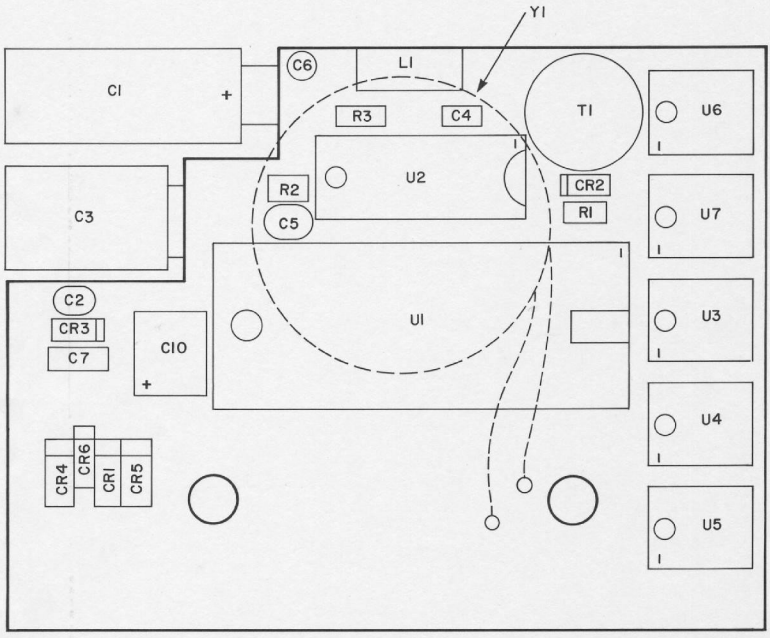
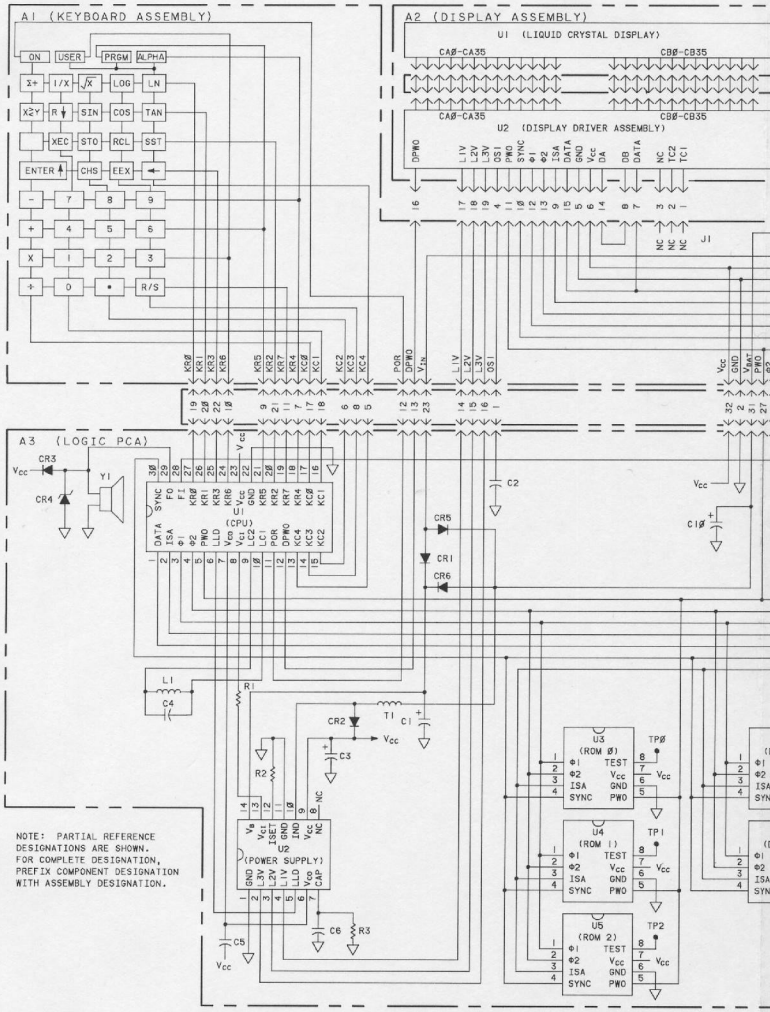


Figure 4-8c. Final HP-41C PCA Component Location Diagram


A1 (KEYBOARD ASSEMBLY)
A2 (DISPLAY ASSEMBLY)
U1 (LIQUID CRYSTAL DISPLAY)
U2 (DISPLAY DRIVER ASSEMBLY)
A3 (LOGIC PCA)
(CPU)
(POWER SUPPLY)
(ROM Ø)
(ROM 1)
(ROM 2)
NOTE: PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX COMPONENT DESIGNATION WITH ASSEMBLY DESIGNATION.

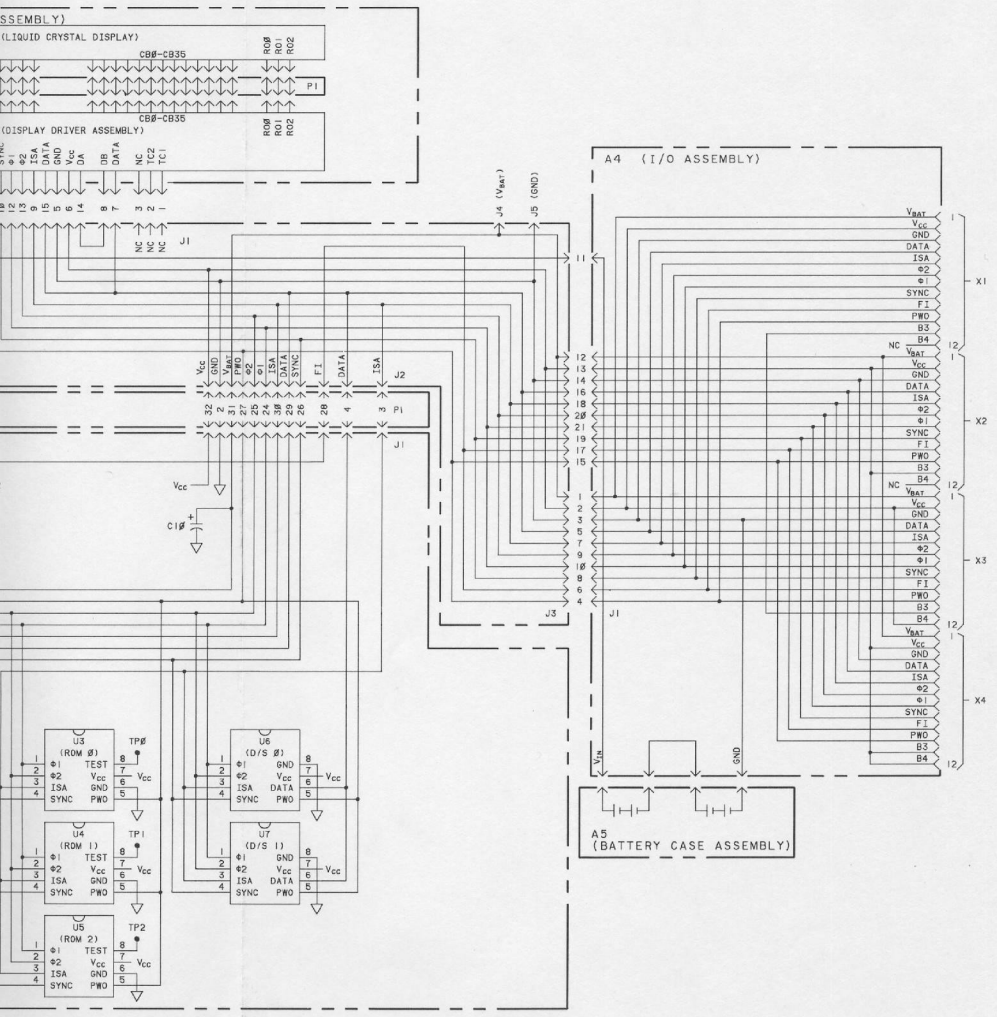


Figure 4-9c. Final HP-41C PCA Schematic Diagram

Table 4-5d. Initial HP-41CV Logic PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
A3	5081-5564	PCA BOARD, logic	00041-80104	*, Rfc-Cost**	1
C1	0180-2910	CAPACITOR, 470 uF 6V			
C2	0160-0571	CAPACITOR, 470 pF	0160-3914	Use with Rev. F display driver.	1
C3	0180-2925	CAPACITOR, 82 uF, 10V			
C4	0160-5489	CAPACITOR, 140 pF 5%	0160-0687 150 pF	Rfc-Cost	1
C5	0160-4685	CAPACITOR, 0.1 uF, 50V,	0160-0576	Rfc-Update	1
C6	0160-3802	CAPACITOR, 150 pF, 10%			
C7	0160-3337	CAPACITOR, 10 pF			
C10	0180-2663	CAPACITOR, 6.8 uF	0180-0376 33 uF 0180-2978 33 uF	Rfc-Cost Rfc-Cost	1
CR1,CR5	1901-0868	DIODE, Schottky			2
CR2,CR3 CR6,CR7	1901-1098	DIODE, switching		***	4
CR4	1902-0049	DIODE, zener 6.19V, 5%		***	1
L1	9140-0471	INDUCTOR, 82 uH, 5%	9140-0238	Rfc-Update	1
R1	0698-7187	RESISTOR, 2 Mohm, 1/8W, 5%			1
R2	0698-6725	RESISTOR, 100 Kohm, 1/8W 10%		****	1
R3	0698-7097	RESISTOR, 1 Mohm 1/8W, 5%	0698-7187 2 Mohm	****, Rfc-Value change	1

* - When installing, use washer W1. See figure 6-1.
** - Rfc: Reason for change.
*** - When 1LF5-0002 is installed, CR3 and CR4 should be removed.
**** - When U2-1826-0953 is installed, R2 and R3 ahould be removed.

Table 4-5d. Initial HP-41CV Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
T1	9140-0647	INDUCTOR, toroidal, 1 mH	9100-3594	Rfc-Cost*	1
U1	1LF5-0002	INTEGRATED CIRCUIT, CPU	1LE3-0002	**. Rfc-Cost	1
U2	1826-0953	INTEGRATED CIRCUIT, bipolar power supply	1826-0566	***, Rfc-Cost	1
U3	1LB9-0001	INTEGRATED CIRCUIT, ROM 0 120K	U3-1LE9-0006 -1LB7-0038 -1LB7-0001 -1LA3-0033 -1LA3-0015 Prior ROM 0 Array U4-1LE9-0007 -1LB7-0039 -1LB7-0002 -1LA3-0016 Prior ROM 1 Array U5-1LE9-0008 -1LB7-0040 -1LB7-0003 -1LA3-0022 Prior ROM 2 Array		1
U6	1LA7-0001	INTEGRATED CIRCUIT, D/S 0			1
U7	1LE7-0001	INTEGRATED CIRCUIT, D/S 1			1
U8	1LE7-0002	INTEGRATED CIRCUIT, D/S 2			1

* - Rfc: Reason for change
** - When U1-1LA5-0002 is installed, CR3 and CR4 should be removed.
*** - When U2-^1826-0953 is installed, R2 and R3 should be removed.

Table 4-5d. Initial HP-41CV Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DWSCRIPTION	REPLACES	COMMENT	QTY
U9	1LE7-0003	INTEGRATED CIRCUIT, D/S 3			1
U10	1LE7-0004	INTEGRATED CIRCUIT, D/S 4			1
U11	1LE7-0005	INTEGRATED CIRCUIT, D/S 5			1
W1	00041-20005	WASHER, 0.013 in thick		*, Rfc- To compensate for change in new PC board thickness.**	2
Y1	0960-0509	ALARM			
	0460-1688	TAPE, foam	0460-1447	Rfc-Quality	1

* - Use when installing the 5081-5564 PC board. See figure 6-1.
** - Rfc: Reason for change.

Table 6-6. Initial RF-PCF Logic PCB Replacement Parts (Continued)

DESIGNATION	QTY PER ASSEMBLY	DESCRIPTION	REFERENCE	COMMENT	QTY
[illegible]	[illegible]	INTEGRATED CIRCUIT, DM8 3	[illegible]	[illegible]	1
[illegible]	[illegible]	INTEGRATED CIRCUIT, DM8 4	[illegible]	[illegible]	1
[illegible]	[illegible]	INTEGRATED CIRCUIT, DM8 5	[illegible]	[illegible]	1
[illegible]	[illegible]	RESISTOR, 0.01% 1/4 Watt	[illegible]	8, 10%, 5% composite for chassis in two RC board thickness, 8%	8
[illegible]	[illegible]	RESISTOR, [illegible]	[illegible]	[illegible]	1

* Must be ordered using the 9001-2504 PC board. See Figure 6-1, Key 1, for parts for change.

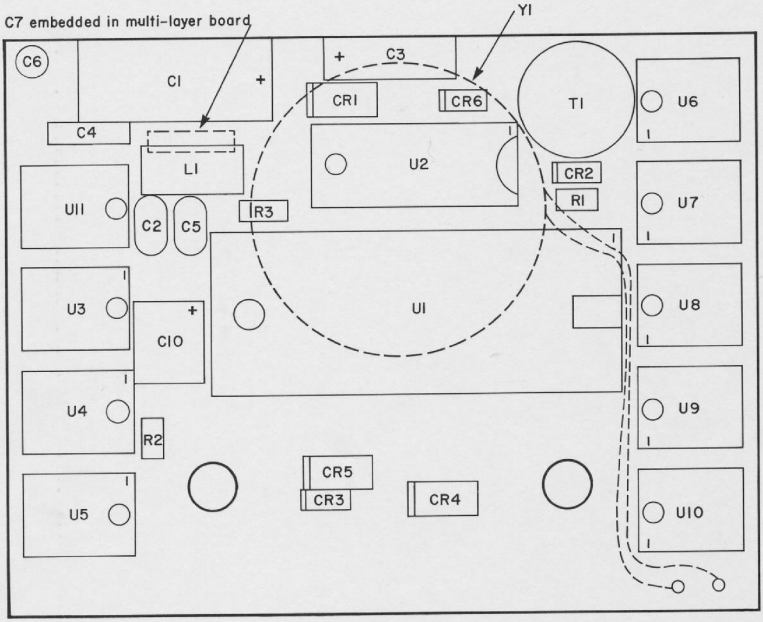
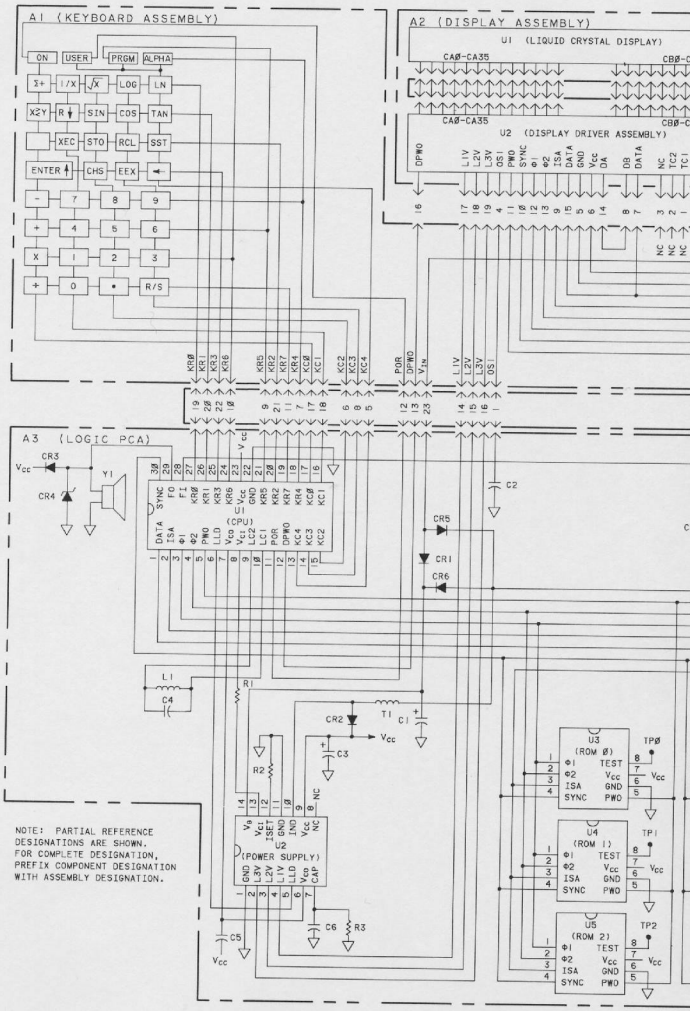


Figure 4-8d. Initial HP-41CV Component Location Diagram


A1 (KEYBOARD ASSEMBLY)
A2 (DISPLAY ASSEMBLY)
U1 (LIQUID CRYSTAL DISPLAY)
U2 (DISPLAY DRIVER ASSEMBLY)
A3 (LOGIC PCA)
U1 (CPU)
U2 (POWER SUPPLY)
U3 (ROM Ø)
U4 (ROM 1)
U5 (ROM 2)
NOTE: PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX COMPONENT DESIGNATION WITH ASSEMBLY DESIGNATION.

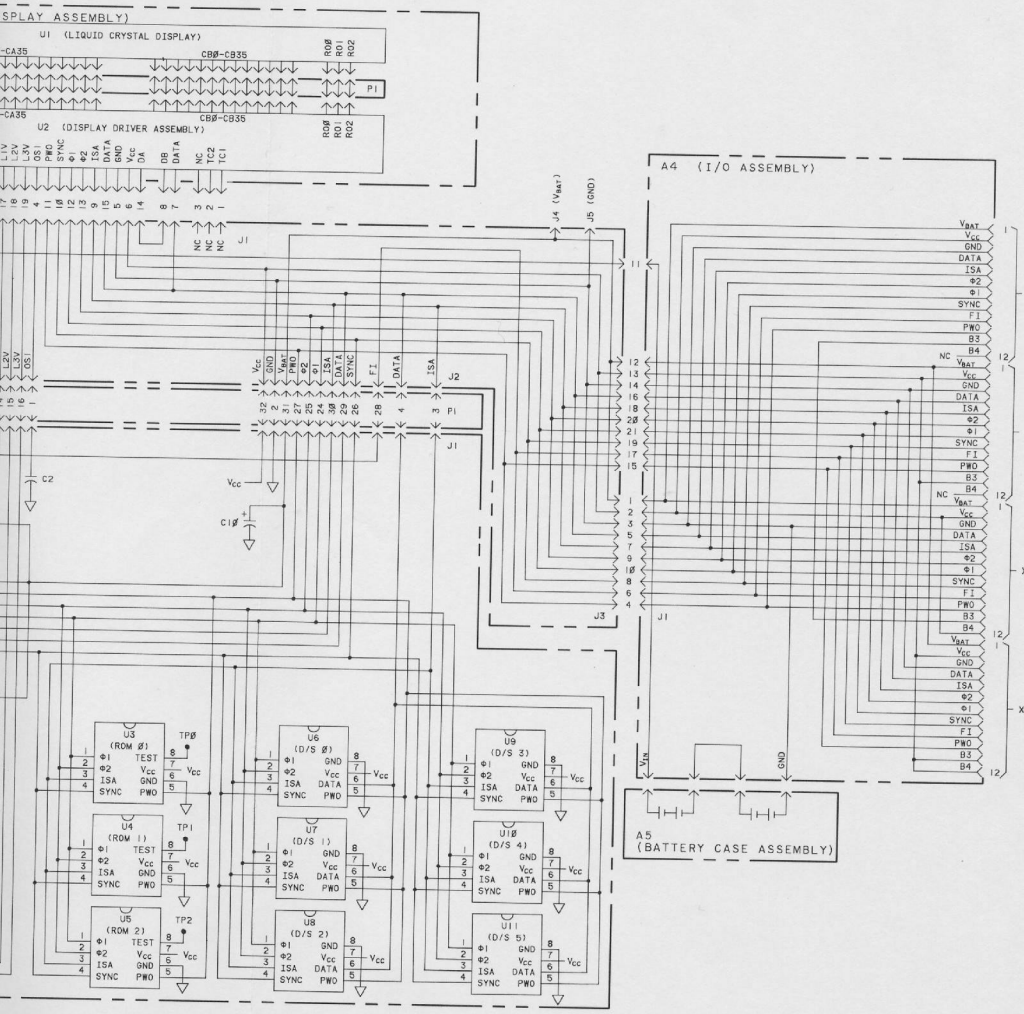


Figure 4-9d. Initial HP-41CV Schematic Diagram

Table 4-5e. HP-41C/CV Common Board Logic PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
A3	5081-5564	PCA BOARD, logic	5081-5563	*, Rfc-Cost**	1
C1	0180-3229	CAPACITOR, 470 uF, 6V	0180-3107	Rfc-Size	1
C2	0160-0571	CAPACITOR, 470 pF	0160-3914	Use with Rev. F display driver.	1
C3	0180-3228	CAPACITOR, 100 uF, 10V	0180-3108	Rfc-Size	1
C4	0160-5489	CAPACITOR, 140 pF 5%	0160-0687	Rfc-Cost	1
C5	0160-4685	CAPACITOR, 0.1 uF, 50V	0160-0576	Rfc-Update	1
C6	0160-3802	CAPACITOR, 150 pF, 10%			1
C7	0160-3337	CAPACITOR, 10 pF			1
C10	0180-2663	CAPACITOR, 6.8 uF	0180-0376 33 uF 0180-2978 33 uF	Rfc-Cost Rfc-Cost	1
CR1,CR5	1901-0868	DIODE, Schottky			2
CR2,CR3 CR6,CR7	1901-1098	DIODE, switching			4
L1	9140-0471	INDUCTOR, 82 uH, 5%	9140-0238	Rfc-Update	1
L2	9140-0647	INDUCTOR, toroidal, 1 mH			1
R1	0683-2055	RESISTOR, 2 Mohm, 1/4W, 5%	0698-7187 1/8W	Rfc-Cost	1
R2	0683-1045	RESISTOR, 100 Kohm, 1/4W 5%	0698-6725 1/8W	***, Rfc-Cost	1

* - When installing, use washer W1. See figure 6-1.
** - Rfc: Reason for change
*** - When U2-1826-0953 is installed, R2 should be removed.

Table 4-5e. HP-41C/CV Common Board Logic PCA Replaceable Parts (Continued)

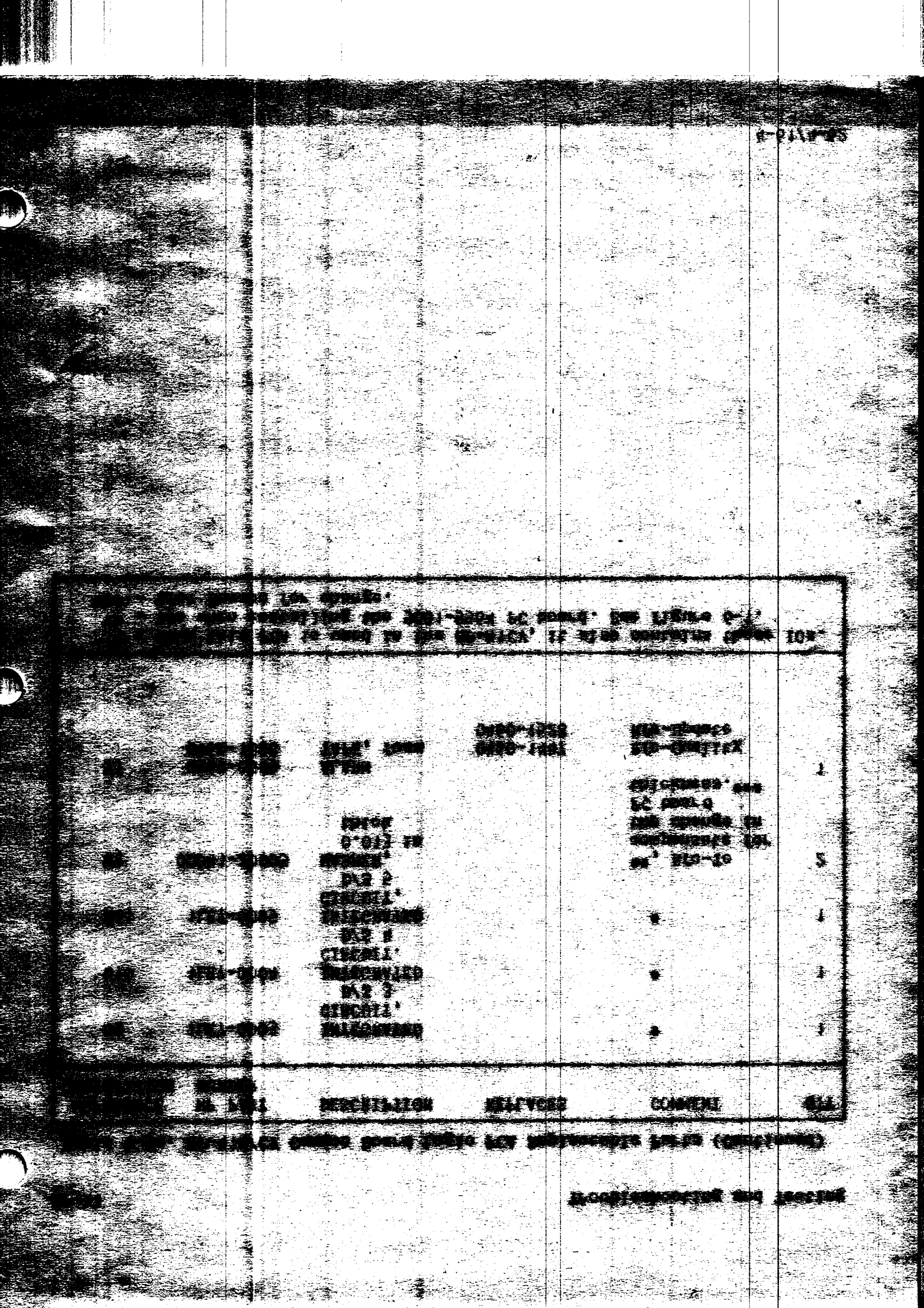
REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
R3	0683-1055	RESISTOR, 1 Mohm, 1/4W, 5%	0698-7097	*, Rfc-Cost**	1
U1	1LF5-0002	INTEGRATED CIRCUIT, CPU	1LE3-0002	Rfc-Cost	1
U2	1826-0953	INTEGRATED CIRCUIT, bipolar power supply	1826-0566	*, Rfc-Cost	1
U3	1LG9-0001	INTEGRATED CIRCUIT, ROM 0 120K	U3-1LE9-0006 -1LB7-0038 -1LB7-0001 -1LA3-0015 Prior ROM 0 Array U4-1LE9-0007 -1LB7-0039 -1LB7-0002 -1LA3-0016 Prior ROM 1 Array U5-1LE9-0008 -1LB7-0040 -1LB7-0003 -1LA3-0022 Prior ROM 2 Array		1
U6	1LA7-0001	INTEGRATED CIRCUIT, D/S 0			1
U7	1LE7-0001	INTEGRATED CIRCUIT, D/S 1			1
U8	1LE7-0002	INTEGRATED CIRCUIT, D/S 2		***	1

* - When U2-1826-0953 is installed, R2 and R3 should be removed.
** - Rfc: Reason for change
*** - When this PCA is used in the HP-41CV, it also contains this IC.

Table 4-5e. HP-41C/CV Common Board Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
U9	1LE7-0003	INTEGRATED CIRCUIT, D/S 3		*	1
U10	1LE7-0004	INTEGRATED CIRCUIT. D/S 4		*	1
U11	1LE7-0005	INTEGRATED CIRCUIT, D/S 5		*	1
W1	00041-20005	WASHER, 0.013 in thick		**, Rfc-To compensate for the change in PC board thickness.***	2
Y1	0960-0509	ALARM			1
	0460-1688	TAPE, foam	0460-1447 0460-1528	Rfc-Quality Rfc-Update	

* - When this PCA is used in the HP-41CV, it also contains these ICs.
** - Use when installing the 5081-5564 PC board. See figure 6-1.
*** - Rfc: Reason for change.



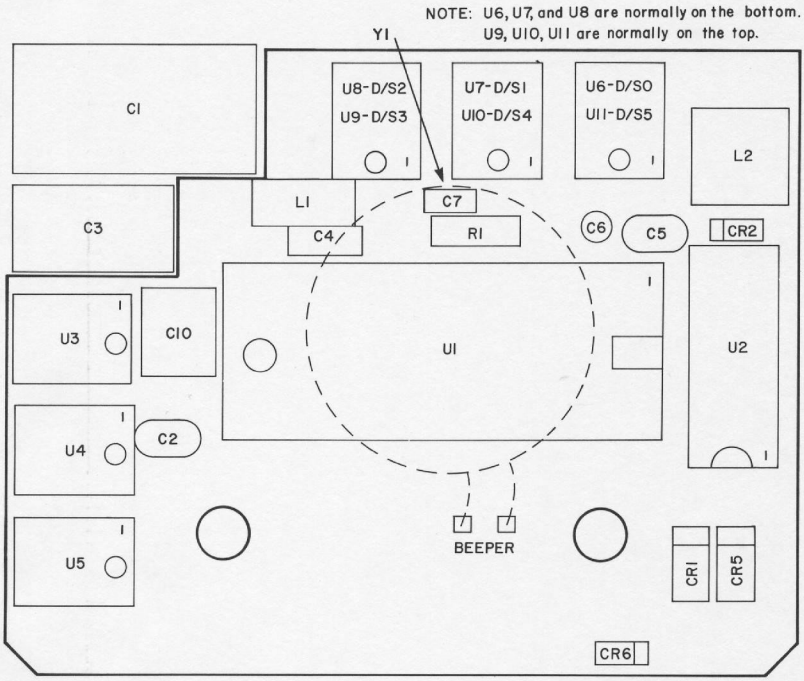
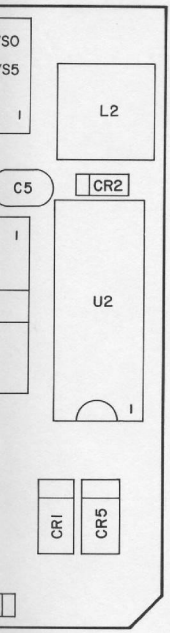
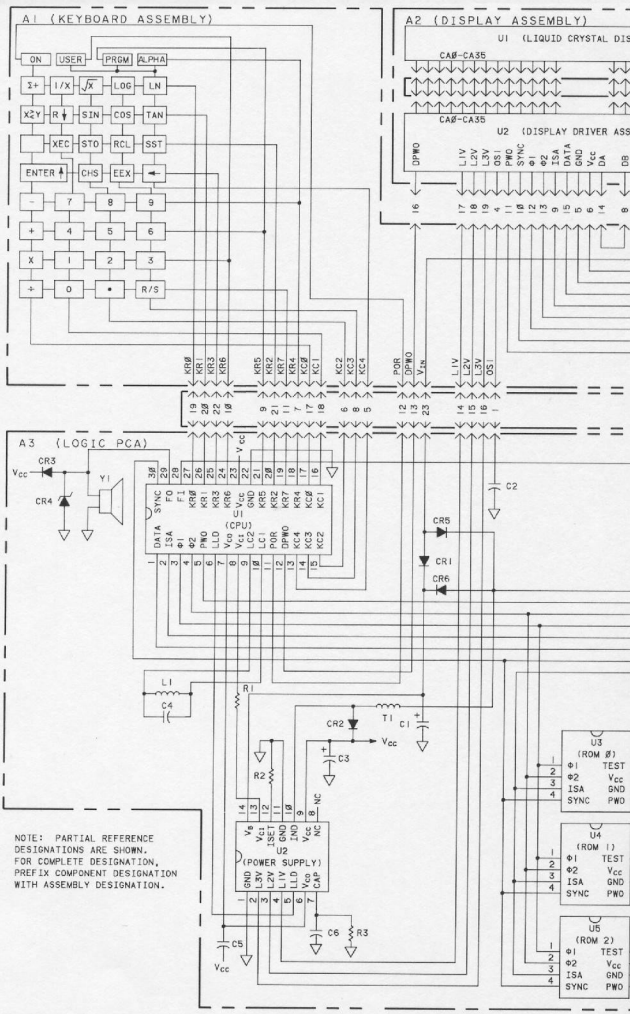


Figure 4-8e. HP-41C/CV Common Board Component Location Diagram

ormally on the bottom.
mally on the top.



ion Diagram



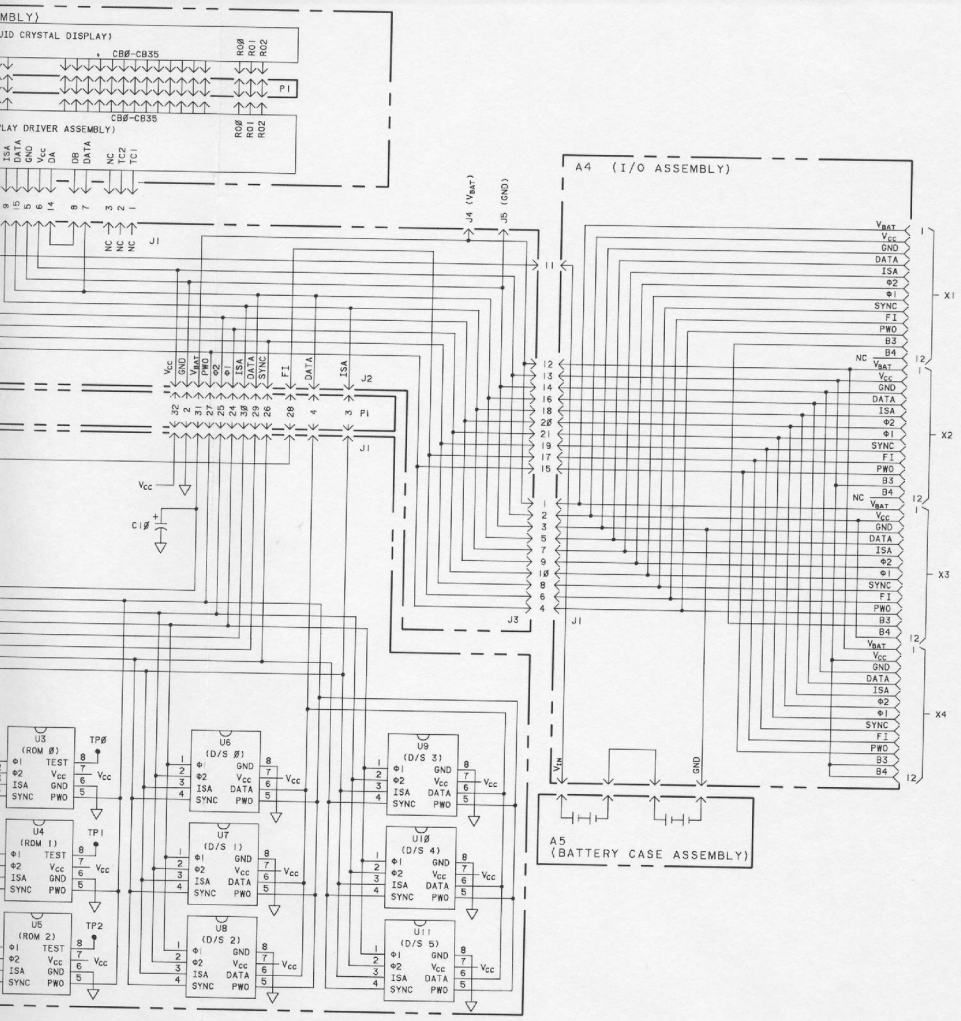


Figure 4-9e. HP-41C/CV Common Board Schematic Diagram

Table 4-5f. HP-41C/CV/CX Common Board Logic PCA Replaceable Parts

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
A3	5081-5564	PCA BOARD, logic		*	1
C1	0180-3229	CAPACITOR, 470 uF, 6V			1
C2	0160-0571	CAPACITOR, 470 pF			1
C3	0180-3228	CAPACITOR, 100 uF, 10V			1
C4	0160-5489	CAPACITOR, 140 pF, 5%			1
C5,C10	0160-4685	CAPACITOR, 0.1 uF, 50V			2
C6	0160-3802	CAPACITOR, 150 pF, 10%			1
C7	0160-3337	CAPACITOR, 10 pF			1
CR1,CR5	1901-0868	DIODE, Schottky			2
CR2,CR6	1901-1098	DIODE, switching			2
L1	9140-0471	INDUCTOR, 82 uH, 5%			1
L2	9140-0647	INDUCTOR, toroidal, 1 mH			1
R1	0683-2055	RESISTOR 2 Mohm 1/4W, 5%			1
R4	0683-2265	RESISTOR, 22 Mohm, 10%		Used in HP-41CX only.	1
U1	1LF5-0002	INTEGRATED CIRCUIT, CPU			1
U2	1826-0953	INTEGRATED CIRCUIT, bipolar power supply			1

* - When installing, use washer W1. See figure 6-1.

Table 4-5f. HP-41C/CV/CX Common Board Logic PCA Replaceable Parts (Continued)

REFERENCE DESIGNATION	HP PART NUMBER	DESCRIPTION	REPLACES	COMMENT	QTY
U3	1LG9-0001	INTEGRATED CIRCUIT, ROM 0 120K		*	1
U6	1LA7-0001	INTEGRATED CIRCUIT, D/S 0		**	1
U7	1LE7-0001	INTEGRATED CIRCUIT, D/S 1		***	1
U8	1LE7-0004	INTEGRATED CIRCUIT, D/S 4		Used in the HP-41CV.	1
U9	1LE7-0005	INTEGRATED CIRCUIT, D/S 5		Used in the HP-41CV.	1
U10	1LG9-0011	INTEGRATED CIRCUIT, ROM 1, 120K		Used in the HP-41CX.	1
U11	1LF6-0001	INTEGRATED CIRCUIT, timer		Used in the HP-41CX.	1
U12	1LE7-0006	INTEGRATED CIRCUIT, D/S 6		Used in the HP-41CX.	1
U13	1LE7-0007	INTEGRATED CIRCUIT, D/S 7		Used in the HP-41CX	1
W1	00041-20005	WASHER, 0.013 in		****	2
Y1	0960-0509	ALARM			1
Y2	0410-1381	CRYSTAL, quartz		*****, Used in the HP-41CX.	1
	0460-1688	TAPE, foam, alarm			
	0460-1851	TAPE, foam crystal		Used in the HP-41CX.	

* - When used in the HP-41CX, U3 is a 1LG9-0008.
** - When used in the HP-41CV, U6 is a 1LE7-0002.
*** - When used in the HP-41CV, U7 is a 1LE7-0003.
**** - Use when replacing old PC boards to compensate for the difference in board thicknesses.
***** - DO NOT ALLOW TAPE TO TOUCH CRYSTAL LEADS. OTHERWISE TIME IC MAY FAIL TO OPERATE.

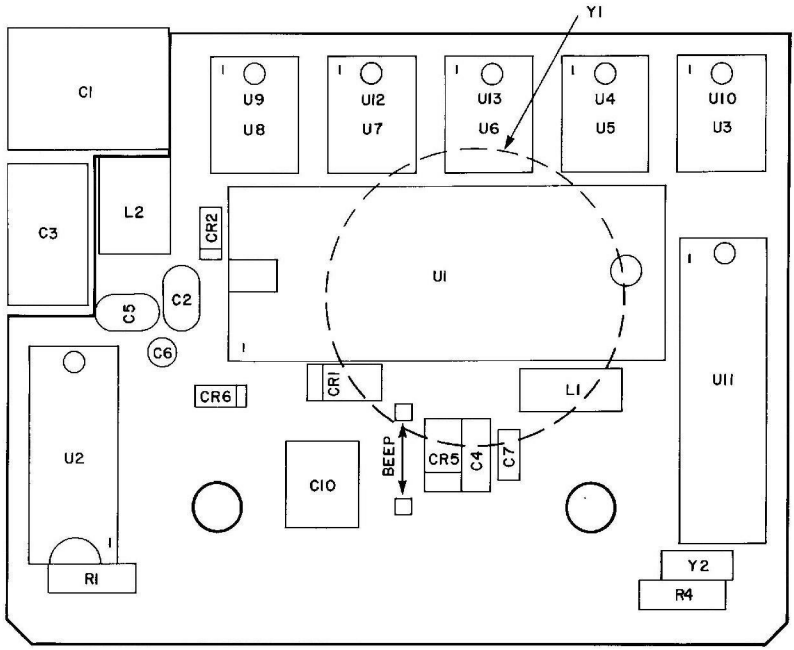
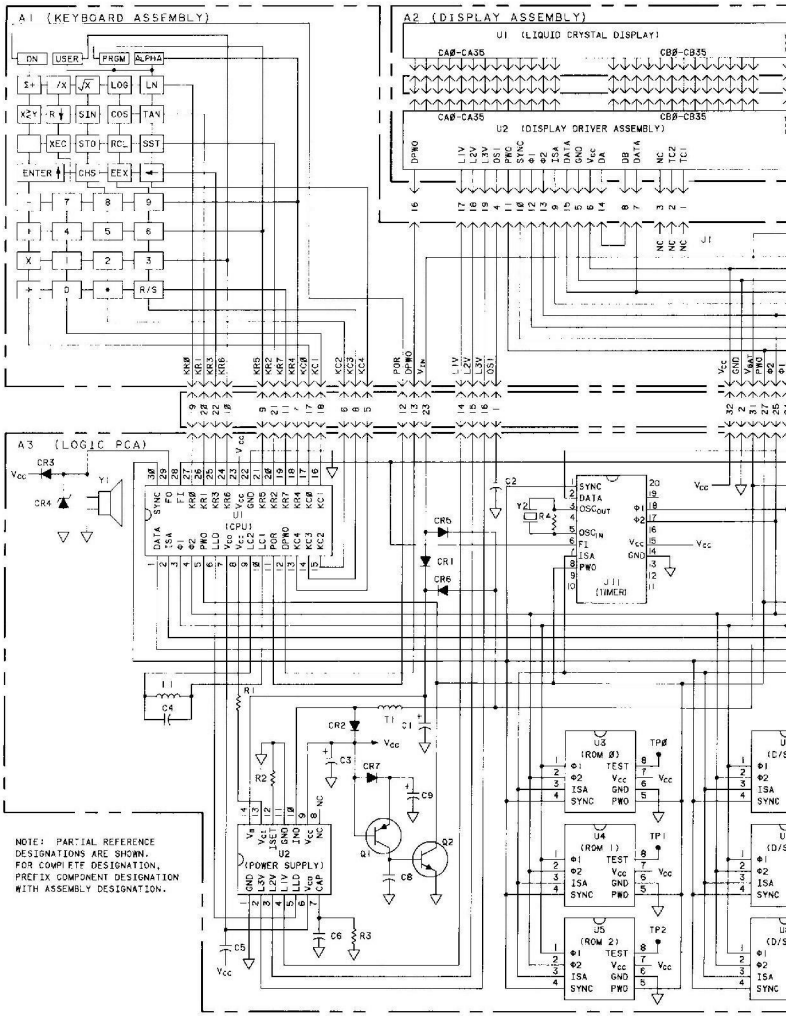


Figure 4-8f. HP-41C/CV/CX Common Board Component Location Diagram


A1 (KEYBOARD ASSEMBLY)
A2 (DISPLAY ASSEMBLY)
U1 (LIQUID CRYSTAL DISPLAY)
U2 (DISPLAY DRIVER ASSEMBLY)
A3 (LOGIC PCA)
(CPU)
(TIMER)
(POWER SUPPLY)
(ROM Ø)
(ROM 1)
(ROM 2)
NOTE: PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX COMPONENT DESIGNATION WITH ASSEMBLY DESIGNATION.

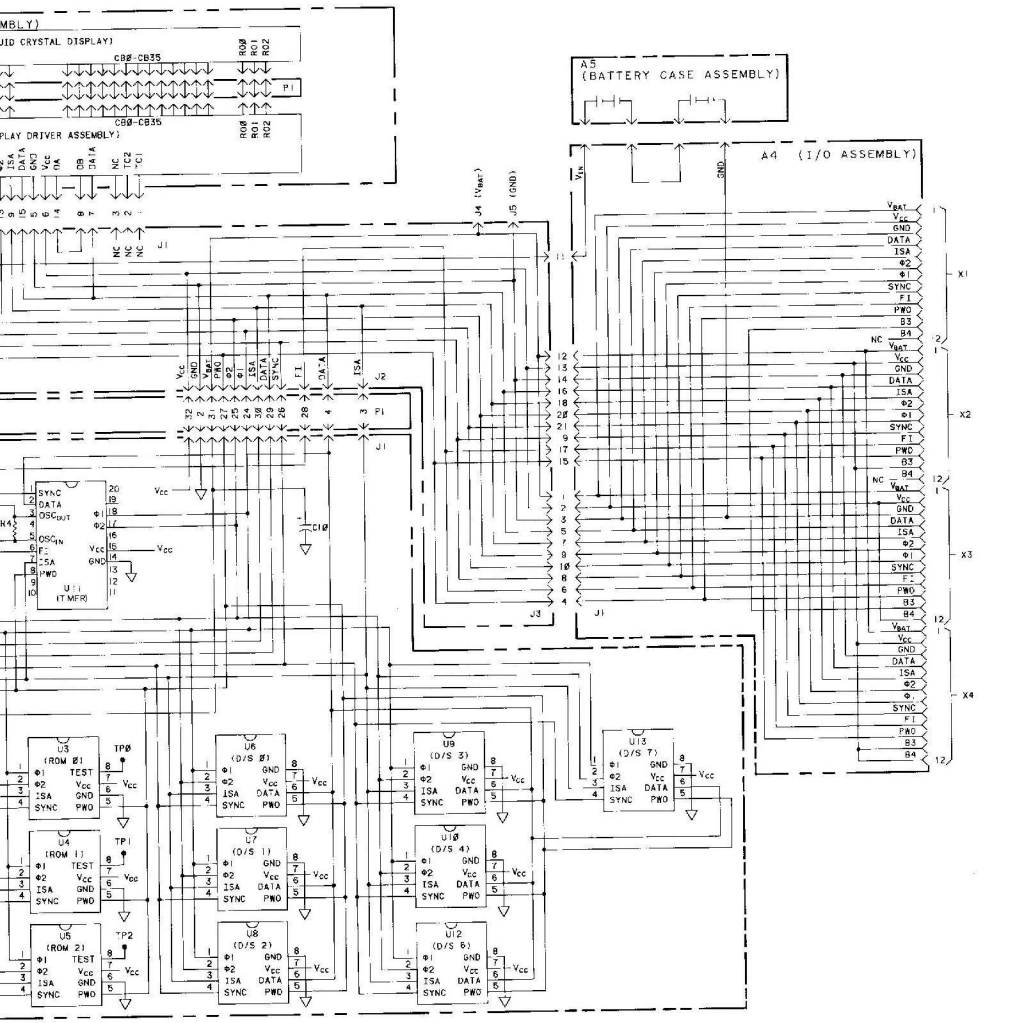


Figure 4-9f. HP-41C/CV/CX Common Board Schematic Diagram

SECTION
V

Service Module and Diagnostic ROM

5-1. INTRODUCTION

5-2. This section gives a summary of the capabilities of the plug-in service module, ET-11966, and the new diagnostic ROM, 5061-7221. Both tables are intended as a reference only. Do not use them as test procedures.

5-3. The plug-in service modules are capable of performing diagnostic tests on essentially all portions of the HP-41 calculators. In addition, ET-11966 can test plug-in memory modules, and the HP 82104A Card Reader. The 5061-7221 can also test timer and extended function modules. Either module can test itself. The calculator's display is used to give a visual output of test results.

5-4. Table 5-1 summarizes the capabilities of ET-11966. Options, possible LCD displays, comments, and actions are described for each test. Refer to paragraph 4-7 for additional information about using the module. See figure 4-1 to determine key assignments for specifying particular tests.

5-5. Table 5-2 provides the same information for the 5061-7221 diagnostic ROM. Refer to paragraph 4-12 for further information about using the ROM.

Service Module and Diagnostic ROM

[illegible]

[illegible] gives a summary of the capabilities of the plug-in service [illegible], and the new diagnostic ROM, 3061-1251. Both topics are [illegible] reading once only. Do not take them as test procedures.

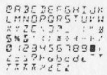
[illegible] describing the capacity of performing diagnostic tests [illegible] all procedures of the HP-41 calculators. In addition, E-11960 [illegible] memory modules, and the HP IL/MLDL Card Reader. The [illegible] other test items and extended functions modules. Either modules [illegible]. The calculator's display is used to give a visual output of [illegible].

[illegible] determines the capabilities of E-11960. Options, [illegible], commands, and options are described for each test. [illegible] for additional information about using the modules. [illegible] to interpret key assignments for specifying parameter tests.

[illegible] provides the same information for the 3061-1251 diagnostic [illegible] for improper information about using the ROM.

Table 5-1. Summary of ET-11966 Service Module Operation

TEST	LCD DISPLAY	COMMENT	NEXT STEP
* CPU	***CPU OK*** ***CPU BAD*** (blank)	Tested portion of CPU is good. Tested portion of CPU is bad. Calculator has undiagnosed malfunction.	• Press [R/S] for test selection, or press any test key. Press [ON] to turn off the calculator. Remove batteries to turn off the calculator.
Test Selection	***SELECT TEST*** ***(AUTO)***	Ready for test selection. Indicates selection of automatic operation.	Press any test key (manual operation), or press [PRGM] or [ALPHA] to select automatic operation. Press any test key (automatic operation), or press [R/S] to cancel automatic operation.
† Display	***SOME D/S BAD*** ***DRIV/CPU BAD*** ***DISP DRV BAD*** 	Indicates improper D/S response. Display driver or CPU is bad. Display driver is bad. } Displays for checking segment operation.	o Press [R/S] for test selection, or press any test key. o Press [R/S] for test selection, or press any test key. o Press [R/S] for test selection, or press any test key. } § Press and hold [R/S] to pause. § Press [R/S] for test selection, or press any test key.
† D/S	***D/S TEST*** ***D/S OK*** ***D/S 0,2, BAD***	Display during test. All D/S IC's are good. Indicated D/S IC's are bad.	• • Press [R/S] for test selection, or press any test key. o Press [R/S] for test selection, or press any test key.
† ROM	***ROM TEST*** ***ROM OK*** ***ROM 0,2, BAD***	Display during test. All ROM IC's are good. Indicated ROM IC's are bad.	• • Press [R/S] for test selection, or press any test key. o Press [R/S] for test selection, or press any test key.
‡ Keyboard	***KYBOARD TEST*** ***KYBOARD OK*** ***KYBOARD BAD*** ***DOUBLE ENTER*** ***KYBD AGAIN?***	Display during test. All keys registered in proper sequence. Key entered out of sequence or not registered properly. Noisy entry of a key. Message after test results (manual multiple mode).	Press keys in order. Press [R/S] [R/S] to stop automatic operation, if selected. Press [R/S] for test selection, or press any test key. Press [R/S] [R/S] for test selection (for retest option in manual multiple mode). Press [R/S] [R/S] for test selection (for retest option in manual multiple mode). Press [N] or [R/S] to continue sequence, or press [Y], [Σ+], or [X≷Y] to repeat test.
‡ Standby	***STANDBY TEST*** ***CPU BAD*** ***STANDBY OK*** ***MEM 1,2,LOST***	Display during test. CPU is bad. Memory maintained in STANDBY mode. Contents of indicated IC's altered.	Press [R/S] (or any other key) to complete test. o Press [R/S] for test selection, or press any test key. • Press [R/S] for test selection, or press any test key. o Press [R/S] for test selection, or press any test key.
‡ Sleep	***SLEEP TEST*** ***CPU BAD*** (blank) ***SLEEP OK*** ***MEM D,2,LOST***	Display at start of test. CPU is bad. Proper blank display in SLEEP mode. Memory maintained in SLEEP mode. Contents of indicated IC's altered.	o Press [R/S] for test selection, or press any test key. Press any key except [ON] to verify no response. Then press [ON] to complete test. • Press [R/S] for test selection, or press any test key. o Press [R/S] for test selection, or press any test key.
‡ Multiple Summary	***ALL TESTS OK*** ***ERROR 3,6,***	All tests in multiple sequence were passed. Indicated tests in multiple sequence not passed: (1 = Display, 2 = D/S, 3 = ROM, 4 = Keyboard, 5 = Standby, 6 = Sleep).	Press [R/S] for test selection, or press any test key. Press [R/S] for test selection, or press any test key.

	D/S OK ***D/S 0,2, BAD***	All D/S IC's are good. Indicated D/S IC's are bad.	• Press R/S for test selection, or press any test key. ○ Press R/S for test selection, or press any test key.
† ROM	***ROM TEST*** ***ROM OK*** ***ROM 0,2, BAD***	Display during test. All ROM IC's are good. Indicated ROM IC's are bad.	• • Press R/S for test selection, or press any test key. ○ Press R/S for test selection, or press any test key.
‡ Keyboard	***KYBOARD TEST*** ***KYBOARD OK*** ***KYBOARD BAD*** ***DOUBLE ENTER*** ***KYBD AGAIN?***	Display during test. All keys registered in proper sequence. Key entered out of sequence or not registered properly. Noisy entry of a key. Message after test results (manual multiple mode).	Press keys in order. Press R/S R/S to stop automatic operation, if selected. Press R/S for test selection, or press any test key. Press R/S R/S for test selection (for retest option in manual multiple mode). Press R/S R/S for test selection (for retest option in manual multiple mode). Press N or R/S to continue sequence, or press Y, Σ+, or x≷y to repeat test.
‡ Standby	***STANDBY TEST*** ***CPU BAD*** ***STANDBY OK*** ***MEM 1,2,LOST***	Display during test. CPU is bad. Memory maintained in STANDBY mode. Contents of indicated IC's altered.	Press R/S (or any other key) to complete test. ○ Press R/S for test selection, or press any test key. • Press R/S for test selection, or press any test key. ○ Press R/S for test selection, or press any test key.
‡ Sleep	***SLEEP TEST*** ***CPU BAD*** (blank) ***SLEEP OK*** ***MEM D,2,LOST***	Display at start of test. CPU is bad. Proper blank display in SLEEP mode. Memory maintained in SLEEP mode. Contents of indicated IC's altered.	○ Press R/S for test selection, or press any test key. Press any key except ON to verify no response. Then press ON to complete test. • Press R/S for test selection, or press any test key. ○ Press R/S for test selection, or press any test key.
‡ Multiple Summary	***ALL TESTS OK*** ***ERROR 3,6,***	All tests in multiple sequence were passed. Indicated tests in multiple sequence not passed: (1 = Display, 2 = D/S, 3 = ROM, 4 = Keyboard, 5 = Standby, 6 = Sleep).	Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key.
Character		Displays for evaluating character structure.	§ Press and hold R/S to pause. § Press R/S for test selection, or press any test key.
Keycode	***KEYCODE TEST*** ***43*** ***DOUBLE ENTER*** ***CPU BAD***	Display at start of test. Row and column of pressed key. Noisy entry of a key. Invalid row or column number generated by CPU.	Press R/S R/S for test selection, otherwise continue testing. Press R/S R/S for test selection, otherwise continue testing. Press R/S R/S for test selection, otherwise continue testing.
ROM ID Check	***ROM 0:D 1:D 2:C***	Internal ROM's have indicated revisions.	Press R/S for test selection, or press any test key.
I/O Port	***IO PORT TEST*** ***PORTS OK*** ***F,2,3,FAIL***	Display during test. I/O ports are good for lines tested. Indicated function or ports do not respond properly.	• • Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key.
Debounce	***MIN DEBOUNCE*** ***KYBOARD OK*** ***KYBOARD BAD*** ***DOUBLE ENTER***	Display during test. All keys registered in proper sequence. Key entered out of sequence or not registered properly. Noisy entry of key.	Press keys in order. Press R/S R/S to stop automatic operation, if selected. Press R/S for test selection, or press any test key. Press R/S R/S for test selection. Press R/S R/S for test selection.
Memory Module	***MEM MOD TEST*** (blank) ***MEM MOD OK*** ***MEM MOD BAD*** ***MEMORY LOST***	Display at start of test. Proper blank display in SLEEP mode (manual operation). Memory module is good. Memory module is bad. Memory module is bad.	• Press ON to complete test. • Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key.
Application Module 1	***AP1 MOD TEST*** ***AP1 MOD OK*** ***AP1 MOD BAD***	Display during test. Application module is good. Application module is bad.	• • Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key.
Application Module 2	***AP2 MOD TEST*** ***AP2 MOD OK*** ***AP2 MOD BAD***	Display during test. Application module is good. Application module is bad.	• • Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key.

	AP2 MOD BAD	Application module is bad.	Press R/S for test selection, or press any test key.
Application Module ID	***MA-1B***	ID, revision for good single-chip module.	Press R/S for test selection, or press any test key.
	ST-1B ST-1A	ID's, revisions for good double-chip module.	Press R/S for test selection, or press any test key.
Quality Assurance (Card Reader)	***CR Q. A. TEST***	Display at start of test.	
	CR ROM TEST	Display during first part of test.	
	ROM BAD	ROM IC is bad.	Press R/S for test selection, or press any test key.
	CRC BAD	CRC IC is bad.	Press R/S for test selection, or press any test key.
	CLIPPED CARD	Operating instruction.	Insert clipped card into slot.
	PROTECTED	Detected clipped corner on card.	
	HD SWITCH BAD	Head switch not working properly.	Press R/S for test selection, or press any test key.
	CI SWTCH BAD	Card insert switch not working properly.	Press R/S for test selection, or press any test key.
	SPD= 162	Motor speed in counts.	
	BLANK CARD	Operating instruction.	Insert blank, unclipped card into slot.
	SAME CARD	Operating instruction.	Reinsert card from previous step.
	WRT/READ O. K.	Write and read operations work properly.	Insert blank card to repeat, or press R/S for test selection.
	WRT/READ ERR	Write or read operation is faulty.	Insert blank card to repeat, or press R/S for test selection.
	NO DATA	No data detected on card.	
Motor Speed (Card Reader)	***CR MTR TEST***	Display at start of test.	Insert card into slot.
	CRC BAD	CRC IC is bad.	Press R/S for test selection, or press any test key.
	SPD= 162	Motor speed in counts.	Insert card to repeat, or press R/S for test selection.
	PROTECTED	Detected clipped corner on card.	
	HD SWTCH BAD	Head switch not working properly.	Press R/S for test selection, or press any test key.
	CI SWTCH BAD	Card insert switch not working properly.	Press R/S for test selection, or press any test key.
Write Mode (Card Reader)	***CR WRITE***	Display at start of test.	
	CRC BAD	CRC IC is bad.	Press R/S for test selection, or press any test key.
	BLANK CARD	Operating instruction.	Insert blank card into slot, or press R/S for test selection.
	PROTECTED	Detected clipped corner on card.	
Read Mode (Card Reader)	***CR READ TEST***	Display at start of test.	
	CRC BAD	CRC IC is bad.	Press R/S for test selection, or press any test key.
	SAME CARD	Operating instruction.	Insert card from Write Mode, or press R/S for test selection.
	READ O. K.	Read operation works properly.	
	READ ERR	Read operation is faulty.	
	NO DATA	No data detected on card.	
	HD SWTCH BAD	Head switch not working properly.	Press R/S for test selection, or press any test key.
Buffer/Speed (Card Reader)	***CR BUF TEST***	Display at start of test.	Insert recorded card into slot.
	CRC BAD	CRC IC is bad.	Press R/S for test selection, or press any test key.
	SPD 02% SLOW	Relative motor speed.	Insert recorded card to repeat, or press R/S for test selection.
	SPD 03% FAST	Relative motor speed.	Insert recorded card to repeat, or press R/S for test selection.
	SPD TOO SLOW	Motor speed more than 20 percent slow.	Insert recorded card to repeat, or press R/S for test selection.
	SPD TOO FAST	Motor speed more than 20 percent fast.	Insert recorded card to repeat, or press R/S for test selection.
	SPD UNSTABLE	Motor speed not constant.	
	NO DATA	No data detected on card.	Insert recorded card to repeat, or press R/S for test selection.
	HD SWTCH BAD	Head switch not working properly.	Press R/S for test selection, or press any test key.
	CI SWTCH BAD	Card insert switch not working properly.	Press R/S for test selection, or press any test key.
Service Module	***SRV MOD TEST***	Display during test.	•
	SM-2;A OK	Service module is good.	• Press R/S for test selection, or press any test key.
	SRV MOD BAD	Service module is bad.	Press R/S for test selection, or press any test key.

* This test is included in the multiple test sequence only during automatic operation.

† This test is included in the multiple test sequence.

‡ This test is included in the multiple test sequence only during manual operation.

• Press R/S (or any other key) to stop automatic operation, if selected.

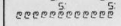
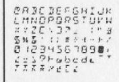
○ When performed in manual multiple mode, press R/S to continue sequence, or press any test key to perform that test.

§ Press any key *except* R/S to stop automatic operation, if selected.

Note: Press ON at any time during testing to turn off the calculator at the end of the test section, with three exceptions: during the keyboard test, during the sleep test, and during the keycode test.

Table 5-2. Summary of 5061-7221 Diagnostic ROM Operation

Test	LCD Display	Comment	Next Step
* CPU	***CPU OK*** ***CPU BAD*** (blank)	Tested portion of CPU is good. Tested portion of CPU is bad. Calculator has undiagnosed malfunction.	** Press [R/S] for test selection, or press any test key. Press [ON] to turn off the calculator. Remove batteries to turn off the calculator.
Test Selection	***SELECT TEST*** ***(AUTO)***	Ready for test selection. Indicates selection of automatic operation.	Press any test key (manual operation), or press [PRGM] (-41CV), or [USER] (-41CX) to select automatic operation. Press any test key (automatic operation), or press [R/S] to cancel automatic operation.
† Display	***SOME D/S BAD*** ***DRIV/CPU BAD*** ***DISP DRV BAD*** 	Indicates improper D/S response. Display driver or CPU is bad. Display driver is bad. } Displays for checking segment operation.	†† Press [R/S] for test selection, or press any test key. †† Press [R/S] for test selection, or press any test key. †† Press [R/S] for test selection, or press any test key. } ‡‡ Press and hold [R/S] to pause. ‡‡ Press [R/S] for test selection, or press any test key.
† D/S	***D/S TEST*** ***D/S OK*** ***D/S 0,2, BAD***	Display during test. All D/S IC's are good. Indicated D/S IC's are bad.	** ** Press [R/S] for test selection, or press any test key. †† Press [R/S] for test selection, or press any test key.
† ROM	***ROM TEST*** ***ROM OK*** ***ROM O,2, BAD***	Display during test. All ROM IC's are good. Indicated ROM IC's are bad.	** ** Press [R/S] for test selection, or press any test key. †† Press [R/S] for test selection, or press any test key.
‡ Keyboard	***KYBOARD TEST*** ***KYBOARD OK*** ***KYBOARD BAD*** ***DOUBLE ENTER*** ***KYBD AGAIN?***	Display during test. All keys registered in proper sequence. Key entered out of sequence or not registered properly. Noisy entry of a key. Message after the test results (manual multiple mode).	Press keys in order. Press [R/S] [R/S] to stop automatic operation, if selected. Press [R/S] for test selection, or press any test key. Press [R/S] [R/S] for test selection (for retest option in manual multiple mode). Press [R/S] [R/S] for test selection (for retest option in manual multiple mode). Press [N] or [R/S] to continue sequence, or press [Y], [Σ+], or [x≷y] to repeat test.
‡ Standby	***STANDBY TEST*** ***CPU BAD*** ***STANDBY OK*** ***MEM 1,2,LOST***	Display during test. CPU is bad. Memory maintained in STANDBY mode. Contents of indicated IC's altered.	Press [R/S] (or any other key) to complete test. †† Press [R/S] for test selection, or press any test key. ** Press [R/S] for test selection, or press any test key. †† Press [R/S] for test selection, or press any test key.
‡ Sleep	***SLEEP TEST*** ***CPU BAD*** (blank) ***SLEEP OK*** ***MEM D,2,LOST***	Display at start of test. CPU is bad. Proper blank display in SLEEP mode. Memory maintained in SLEEP mode. Contents of indicated IC's altered.	†† Press [R/S] for test selection, or press any test key. Press any key except [ON] to verify no response. Then press [ON] to complete test. ** Press [R/S] for test selection, or press any test key. †† Press [R/S] for test selection, or press any test key.
‡ Multiple	***ALL TESTS OK***	All tests in multiple sequence were passed.	Press [R/S] for test selection, or press any test key.

		}	} ‡‡ Press R/S for test selection, or press any test key.
† D/S	***D/S TEST*** ***D/S OK*** ***D/S 0,2, BAD***	Display during test. All D/S IC's are good. Indicated D/S IC's are bad.	** ** Press R/S for test selection, or press any test key. †† Press R/S for test selection, or press any test key.
† ROM	***ROM TEST*** ***ROM OK*** ***ROM O,2, BAD***	Display during test. All ROM IC's are good. Indicated ROM IC's are bad.	** ** Press R/S for test selection, or press any test key. †† Press R/S for test selection, or press any test key.
‡ Keyboard	***KYBOARD TEST*** ***KYBOARD OK*** ***KYBOARD BAD*** ***DOUBLE ENTER*** ***KYBD AGAIN?***	Display during test. All keys registered in proper sequence. Key entered out of sequence or not registered properly. Noisy entry of a key. Message after the test results (manual multiple mode).	Press keys in order. Press R/S R/S to stop automatic operation, if selected. Press R/S for test selection, or press any test key. Press R/S R/S for test selection (for retest option in manual multiple mode). Press R/S R/S for test selection (for retest option in manual multiple mode). Press N or R/S to continue sequence, or press Y, Σ+, or x≷y to repeat test.
‡ Standby	***STANDBY TEST*** ***CPU BAD*** ***STANDBY OK*** ***MEM 1,2,LOST***	Display during test. CPU is bad. Memory maintained in STANDBY mode. Contents of indicated IC's altered.	Press R/S (or any other key) to complete test. †† Press R/S for test selection, or press any test key. ** Press R/S for test selection, or press any test key. †† Press R/S for test selection, or press any test key.
‡ Sleep	***SLEEP TEST*** ***CPU BAD*** (blank) ***SLEEP OK*** ***MEM D,2,LOST***	Display at start of test. CPU is bad. Proper blank display in SLEEP mode. Memory maintained in SLEEP mode. Contents of indicated IC's altered.	†† Press R/S for test selection, or press any test key. Press any key except ON to verify no response. Then press ON to complete test. ** Press R/S for test selection, or press any test key. †† Press R/S for test selection, or press any test key.
‡ Multiple Summary	***ALL TESTS OK*** ***ERROR 3,6,***	All tests in multiple sequence were passed. Indicated tests in multiple sequence not passed: (1 = Display, 2 = D/S, 3 = ROM, 4 = Keyboard, 5 = Standby, 6 = Sleep).	Press R/S for test selection, or press any test key. Press R/S for test selection, or press any test key.
Character		} Displays for evaluating character structure.	} ‡‡ Press and hold R/S to pause.
Keycode	***KEYCODE TEST*** ***43*** ***DOUBLE ENTER*** ***CPU BAD***	Display at start of test. Row and column of pressed key. Noisy entry of a key. Invalid row or column number generated by CPU.	Press R/S R/S for test selection, otherwise continue testing. Press R/S R/S for test selection, otherwise continue testing. Press R/S R/S for test selection, otherwise continue testing.
ROM ID Check	***O:DDD -41CV*** ***O:NFL 1:CBc-41CX***	Internal ROM's have indicated revisions.	Press R/S for test selection, or press any test key.
General ROM	***NO ROM FOUND*** ***GEN ROM TEST*** ***XX-XX BAD*** ***XX-XX GOOD***	No plug-in ROMs were found. Test in progress. Indicated ROM is bad. Indicatd ROM is good.	End of test indicated by a single beep. Press R/S for test selection, or press any test key.
Debounce	***MIN DEBOUNCE*** ***KYBOARD OK***	Display during test. All keys registered in proper sequence.	Press keys in order. Press R/S R/S to stop automatic operation, if selected. Press R/S for test selection, or press any test key.

Check	O:NFL 1:CBc-41CX		
General ROM	***NO ROM FOUND***	No plug-in ROMs were found.	End of test indicated by a single beep.
	GEN ROM TEST	Test in progress.	Press R/S for test selection, or press any test key.
	XX-XX BAD	Indicated ROM is bad.	
	XX-XX GOOD	Indicatd ROM is good.	
Debounce	***MIN DEBOUNCE***	Display during test.	Press keys in order. Press R/S R/S to stop automatic operation, if selected.
	KYBOARD OK	All keys registered in proper sequence.	Press R/S for test selection, or press any test key.
	KYBOARD BAD	Key entered out of sequence or not registered properly.	Press R/S R/S for test selection.
	DOUBLE ENTER	Noisy entry of key.	Press R/S R/S for test selection.
Quad Memory Module	***MEM MOD TEST***	Display at start of test.	**
	(blank)	Proper blank display in SLEEP mode (manual operation).	Press ON to complete test.
	MEM MOD OK	Memory module is good.	** Press R/S for test selection, or press any test key.
	MEM MOD BAD	Memory module is bad.	Press R/S for test selection, or press any test key.
Application Module (4K...16K Inclusive)	***AP1 MOD TEST***	Display during test.	**
	AP1 MOD OK	Application module is good.	** Press R/S for test selection, or press any test key.
	AP1 MOD BAD	Application module is bad.	Press R/S for test selection, or press any test key.
Application Module ID	***MA-1B***	ID, revision for good single-chip module.	Press R/S for test selection, or press any test key.
	ST-1B ST-1A	ID's, revisions for good double-chip module.	Press R/S for test selection, or press any test key.
Time IC	***NO POWER UP***	Refer to detailed procedure.	
	TIME IC TEST	Test in progress.	
	TIME IC OK	Time IC is good.	
	TIME IC BAD	Time IC is bad.	
Time Module	***NO POWER UP***	Refer to detailed procedure.	
	TIME IC TEST	Test in progress.	
	TIME IC OK	Time module is good.	Press R/S for test selection, or press any test key.
	TIME IC BAD	Time module is bad.	Press R/S for test selection, or press any test key.
Extended Function Module	***X-FUNCT TEST***	Test in progress.	Press ON to complete.
	(blank)	Calculator is in SLEEP mode.	Press R/S for test selection, or press any test key.
	X-FUNCT OK	Module is good.	Press R/S for test selection, or press any test key.
	X-FUNCT BAD	Module is bad.	
Frequency	***XXX KHZ***	Mainframe clock frequency should be 340 to 380 KHZ.	Press R/S for test selection, or press any test key.
Extended Memory Module	***X-MEM TEST***	Test in progress.	Press ON to complete.
	(blank)	Calculator is in SLEEP mode.	Press R/S for test selection, or press any test key.
	X-MEM OK	Module is good.	Press R/S for test selection, or press any test key.
	X-MEM BAD	Module is bad.	
Service Module	***SRV MOD TEST***	Display during test.	**
	SM-2:A OK	Service module is good.	** Press R/S for test selection, or press any test key.
	SRV MOD BAD	Service module is bad.	Press R/S for test selection, or press any test key.

* This test is included in the multiple test sequence only during automatic operation.

† This test is included in the multiple test sequence.

‡ This test is included in the multiple test sequence only during manual operation.

** Press R/S (or any other key) to stop automatic operation, if selected.

†† When performed in manual multiple mode, press R/S to continue sequence, or press any test key to perform that test.

‡‡ Press any key *except* R/S to stop automatic operation, if selected.

Note: Press ON at any time during testing to turn off the calculator at the end of the test section, with three exceptions: during the keyboard test, during the sleep test, and during the keycode test.

SECTION
VI

Replaceable Parts

6-1. INTRODUCTION

6-2. This section contains information pertaining to the parts used in the HP-41, illustrated in figure 6-1. Parts, descriptions, quantities, HP stock numbers, reference designations (where applicable) and assembly breakdowns are given. (Refer to table 6-1.)

6-3. Replaceable parts for the logic PCAs (table 4-5a through f) are listed for convenience in front of their component location and schematic diagrams in section IV.

6-4. ORDERING INFORMATION

6-5. To order replacement parts or assemblies, address order or inquiry to Corporate Parts Center or Parts Center Europe. Specify the following information for each part ordered:

a. Calculator model and serial number.

b. HP part number.

c. Description.

d. Complete reference designation (if applicable).

Table 6-1. HP-41 Replaceable Parts

INDEX NUMBER, FIGURE 6-1	HP PART NUMBER	DESCRIPTION	QTY
1	00041-60009	ASSEMBLY, battery case (A5)	1
	00041-40005	o CASE, battery	1
	00041-00009	o KEEPER, battery	2
	1460-1695	o SPRING, battery	2
2*	00041-60912	ASSEMBLY, display (A2)	1
	00041-60147	o ASSEMBLY, display driver (A2U2)	1
	1660-1350	o CLIP, display	2
	1251-7987	o CONNECTOR, display (A2P1)	2
	1990-0798	o DISPLAY, liquid crystal (LCD)	1
	0340-0919	o INSULATOR, display	2
	00041-40147	o LOCATOR, display	1
	0460-1553	o TAPE, adhesive transfer	
3	00041-60XXX	ASSEMBLY, logic PC (A3)	1
4	00041-60008	ASSEMBLY, I/C (A4)	1
5	00041-60907	ASSEMBLY, keyboard, service (A1)	1
	7121-0337	OVERLAY, (41C)	1
	7121-1354	OVERLAY, (41CV/CX)	1
6**	00041-20002	BALL, ac contact	2
7	00041-60100	CASE, bottom	1
8	00041-40006	CASE, center	1
9	1251-5731	CONNECTOR, logic (P2)	1
10	00041-40025	COVER, ac tunnel	1
11	4040-1522	COVER, battery recess	1
12	00041-40007	DOOR, I/O blank	4
13	0403-0279	FOOT, rubber	4
14	7120-8153	LABEL, logo (41C)	1
	7121-1848	LABEL, logo (41CV)	1
	00041-80021	LABEL, logo (41CX)	1
15	7120-8154	LABEL, alpha (41C/CV)	1
	00041-80022	LABEL, alpha (41CX)	1
16	3050-1051	SPACER, 0.80-inch (white)	2
	3050-1111	SPACER, 0.75-inch (red)	2
	3050-1112	SPACER, 0.70-inch (blue)	2
	2740-0014	NUT, hex	2
	2740-0013	NUT, hex (undersized)	2
17**	00041-40067	RETAINER, ac contact	1
18	0624-0435	SCREW, 0.25-inch	2
	0624-0436	SCREW, 0.38-inch (oversized)	
19	0624-0432	SCREW, 0.75-inch	2
20	00041-40064	SHIELD, display	1
21**	1460-1767	SPRING, ac contact	2
22***	00041-20005	WASHER, 0.013 inch	2

* When updating from a rev F display driver hybrid (square plastic cover over IC's) you must replace C2 with a 470uf capacitor.
** Removed on later versions.
*** Use only with the 5081-5564 logic board.

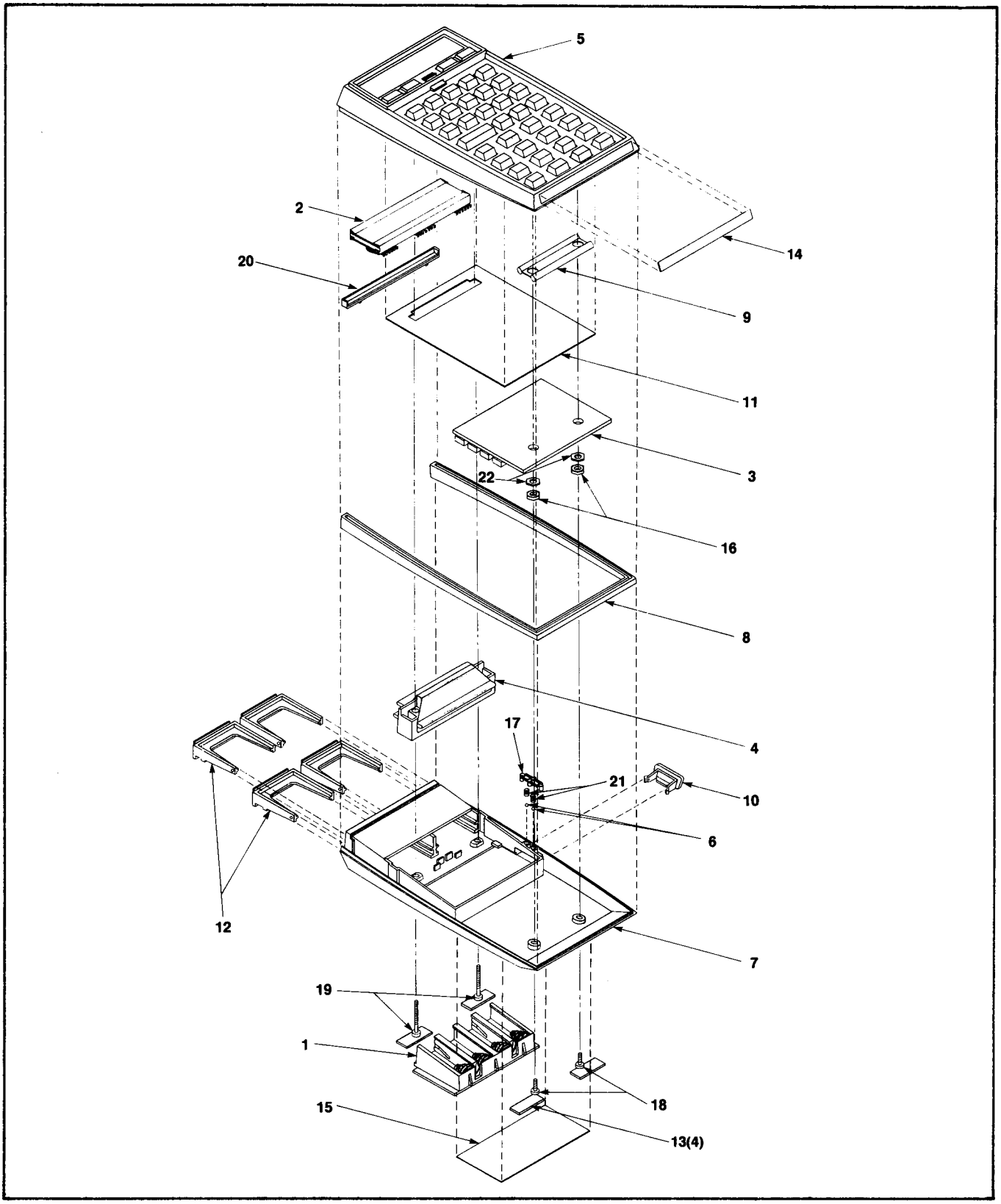


Figure 6-1. HP-41 Exploded View

APPENDIX
A

Memory/Application Module Test

A-1. INTRODUCTION

A-2. This appendix contains information necessary to test HP-41 style memory modules and application modules. These modules are not repairable. A module should be replaced if it is defective.

A-3. DESCRIPTION

A-4. Memory and application modules compatible with the HP-41 style calculator are designed to expand the capabilities of the calculator system. They interface with the calculator through its input/ output ports, which electrically connect the CMOS hybrid IC's in the modules directly to the main system lines. Specifications for the modules are presented in table A-1.

A-5. Each HP82106A Memory Module contains 64 registers of data memory, which can accommodate 448 bytes of program memory. The modules become part of the calculator's continuous memory.

Table A-1. Module Specifications

Physical Properties

- Length: 3.12 centimeters (1.23 inches).
- Width: 2.95 centimeters (1.16 inches).
- Height: 0.89 centimeters (0.35 inches).
- Weight: 5.9 grams (0.21 ounces).

Compatibility

- Plugs into HP-41 style calculator.
- Power supplied by the calculator.

Temperature

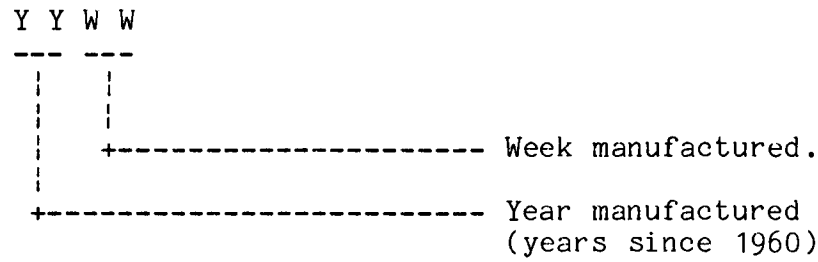
- Operating: 0° to 45° C (32° to 113° F).
- Storage: -20° to 65° C (-4° to 149° F).

A-6. Each plug-in application module contains 4,8,12, or 16 K bytes of microprogrammed memory. A maximum of 31 different versions may be available.

A-7. The memory and application modules operate as an extension of the calculator's D/S and ROM capabilities. Their interaction with the calculator system is identical to that of the main D/S and ROM IC's.

A-8. IDENTIFICATION

A-9. The serial number of the memory module or application module is used for determination of warranty status. It is located on the bottom of the module below the label. Its format is described below:



A-10. DIAGNOSTIC TEST

A-11. Test a memory module or application module by performing the following procedures and observing the indicated displays. For each step or condition that can occur, the resulting LCD display on the test calculator is shown at the right. Note: Do not operate the test calculator on batteries for an extended period of time with the service module plugged in. This module prevents the system from switching to a low-power mode and can cause excessive battery drain.

1. Preparation

a. Be sure that the test calculator is off. If the display is active, press the "on" key to turn it off.

b. Insert the service module in the lower left (#3) I/O port. Do not insert any modules while the calculator is turned on.

   Note: These procedures assume that you are using the 5061-7221 Diagnostic ROM for testing purposes.

c. Insert an HP 82170A Quad Memory (-41C only) module or application module in the lower right (#4) I/O port.

d. Press the [ON] key to turn on the calculator and start the diagnostic test. Watch for:

   o A triple beep and this blinking LCD display indicate that the test calculator is operating properly. (The message "CPU OK" may appear momentarily in the display.)

   o Any other outcome indicates improper operation. In this case, turn the calculator off, remove the memory or application module, and turn the calculator on again. If the proper outcome (above) occurs, the removed module is bad; otherwise, the test calcultor or service module is bad.

2. Application Module Tests

After the initial preparation (procedure 1), perform these steps to test an application module located in the lower right (#4) I/O port:

a. Press the [SST] key to select the single-IC application module test. Most application modules contain only one 4k of ROM. If the module has two ROM ICs (ET 11966 only), press the [<-] key to select the double-IC applicati on module test. The [6] and [3] keys are used for 12K and 16K modules respectively. Watch for: "4K MOD TEST", etc.

   o The flag annunciators indicate which IC is being tested (1 thru 4).

   o Either of these LCD messages indicate that the application module is good. "4K MOD OK", etc.

   o Any of these LCD messages indicate that the application module is bad. Proceed to step c. "4K MOD BAD", 8K MOD BAD".

b. Press the [ENTER] key to select the application module identification check. The two letters and number in each identification represent the particular application pac; the following letter represents the revision. Watch for:

   o This type of LCD display indicates the identification for a good single-IC module. "MA-1B"

   o This type of LCD display indicates the identifications for a good double-IC module. "ST-1B ST-1A"

   o Any other display (especially one containing @'s or o's) indicates a bad module.

c. Press the [ON] key to turn off the calculator, completing the test.

3. Memory Module Test

Note: ET-11966 will test a single memory module and 5061-7221 a Quad.

After the initial preparation (procedure 1), perform these steps to test a memory module located in the lower right (#4) I/O port:

a. Press the [RCL] key to select the memory module test. Observe the display: "MEM MOD TEST"

   - o A blanked display indicates that the display has been properly disabled. (blank display) or "MEM MOD BAD"
   - o Any other display indicates improper operation, which can be caused by a bad memory module.

b. Press the [ON] key. Watch for:

   - o This LCD message indicates that the memory module is good. "MEM MOD OK"
   - o This LCD message indicates that the memory module is bad. "MEM MOD BAD"
   - o This LCD message indicates that the memory module is bad. "MEMORY LOST"

c. Press the [ON] key to turn off the calculator, completing the test.

4. Time Module Test

a. The 5061-7221 Diagnostic ROM can be used to test the 82182A Time Module. Plug the time module to be tested into port #4 and press the [4] key. The diagnostic ROM must be in place before installing the time module.

   - o This message indicates a bad time module when it appears the first time after installing the module. Ignore this message if the [4] key is pressed a second or more times. "NO POWER UP"
   - o This message indicates the test is being run. "TIME TEST"
   - o This LCD message indicates that the module is functioning properly. "TIME OK"
   - o This LCD message indicates that the module is bad. "TIME BAD"

5. Extended Function Module Test

a. The 5061-7221 Diagnostic ROM is also used to test the 82180A Extended Functions Rom and the 82181A Extended Memory Modules. Follow this test procedure.

b. Plug the extended functions module into Port #4. Press the [5] key.

o This LCD message indicates the test has started. "X-FUNCT TEST"

c. If no errors are detected the calculator will turn off to test data retention. Press the [ON] key.

o This message indicates the module tests good. "X-FUNCT OK"

o This message indicates the module is bad. "X-FUNCT BAD"

6. Extended Memory Module Test

a. Plug the Extended Memory Module or Modules into ports 2 or 4. Press the [EEX] key.

o This LCD message indicates the test has begun. "X-MEM TEST"

o This message indicates a failure early in the test procedure. "REG NOT DEAD"

b. If no errors are detected the calculator will turn itself off to test data retention. Press the [ON] key to resume the test.

o This LCD message indicated that all tests were passed. "X-MEM GOOD"

o This LCD message indicates a failure. "X-MEM BAD"

[illegible] Extended Functions Module Test

[illegible] Diagnostic ROM is also used to test the 82180A Extended Functions and the 82181A Extended Memory Modules. Follow this test [illegible]

[illegible] Extended Functions module into Port #4. [illegible] the [5] key.

[illegible] message indicates the test has started. "X-FUNCT TEST"

[illegible] errors are detected the calculator will turn off to test data retention. Press the [ON] key.

[illegible] message indicates the module tests good. "X-FUNCT OK"

[illegible] message indicates the module is bad. "X-FUNCT BAD"

[illegible] Memory Module Test

[illegible] Extended Memory Module or Modules into [illegible] 3 or 4. [illegible] the (SST) key.

[illegible] message indicates the test has begun. "X-MEM TEST"

[illegible] indicates a failure early in the [illegible] "[illegible]"

[illegible] errors are detected the calculator will turn off to test data retention. Press the [illegible] the test.

[illegible] message indicates that all tests were passed. "X-MEM GOOD"

[illegible] indicates a failure. "X-MEM BAD"

APPENDIX
B

Software/ROM Updates and Addendums

B-1. INTRODUCTION

B-2. This appendix contains information which will be updated periodically by the responsible service engineer. The information includes current revisions of all HP-41 ROMS, any owner's manual addenda, and all information on past revisions. The software replacement policies are outlined in other documents.

B-3. Table of Contents

CORVALLIS DIVISION

41C-61
41CV-22

S E R V I C E N O T E

SECOND
REVISION 2/24/83

SUBJECT: APPLICATION PAC'S

DISCUSSION: TABLE 1 LISTS ALL APPLICATION PAC'S WITH THEIR ROM'S AND ADDENDUM CARDS. SPECIFIC SERVICE NOTES ARE OR WILL BE WRITTEN IN EACH CASE WHERE A ROM UPDATE TAKES PLACE.

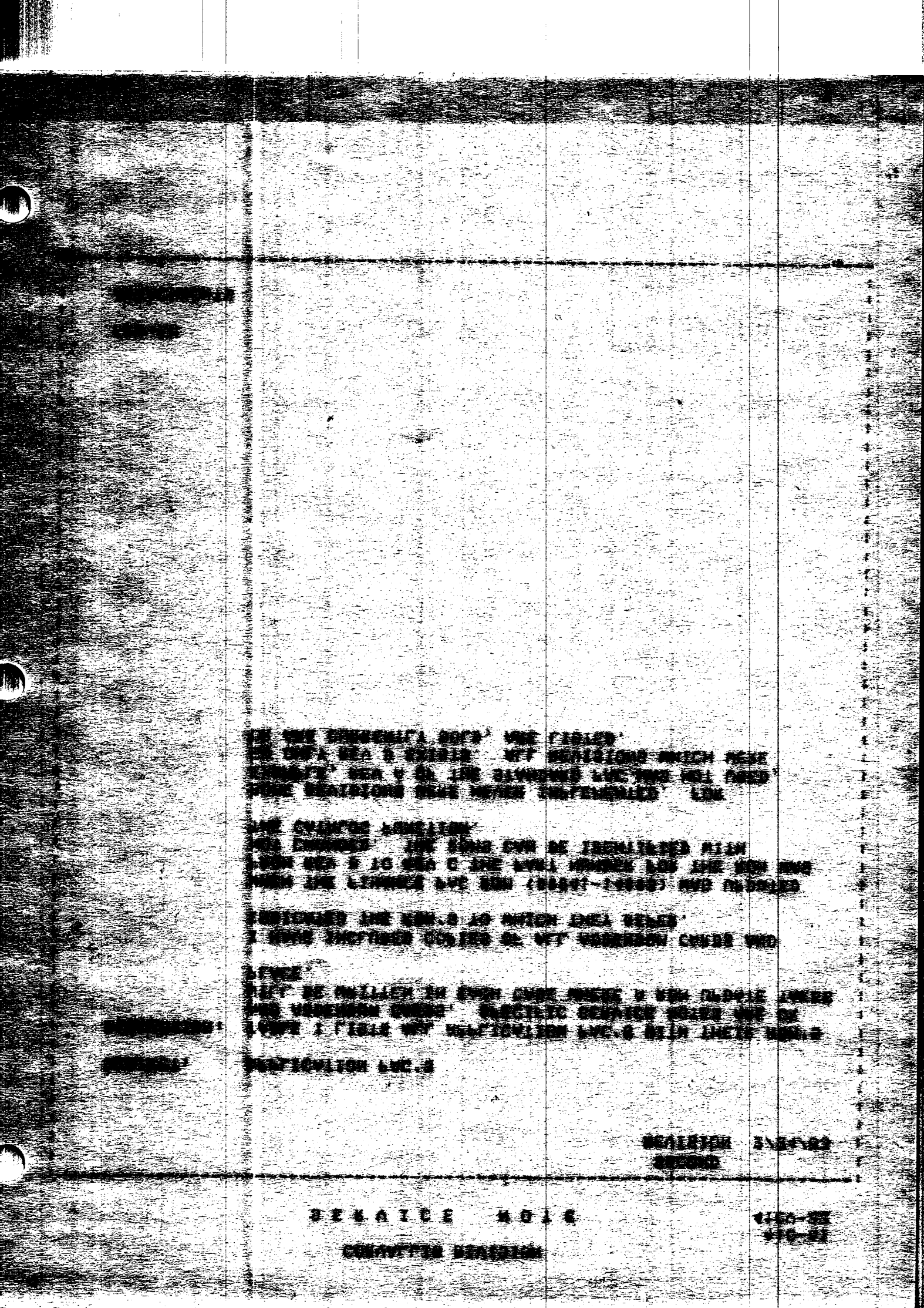
I HAVE INCLUDED COPIES OF ALL ADDENDUM CARDS AND INDICATED THE ROM'S TO WHICH THEY REFER.

WHEN THE FINANCE PAC ROM (00041-14003) WAS UPDATED FROM REV B TO REV C THE PART NUMBER FOR THE ROM WAS NOT CHANGED. THE ROMS CAN BE IDENTIFIED WITH THE CATALOG FUNCTION.

SOME REVISIONS WERE NEVER IMPLEMENTED. FOR EXAMPLE, REV A OF THE STANDARD PAC WAS NOT USED, SO ONLY REV B EXISTS. ALL REVISIONS WHICH WERE OR ARE CURRENTLY SOLD, ARE LISTED.

FRW:EM

ATTACHMENTS



APPLICATION PAC SUMMARY

February 1983

Application Pac		ROM Module	Addendum Card	Availability	Service Note
P/N	Description				
00041-15001	Standard B	00041-14017	00041-90360	Obsolete	None
00041-15001	Standard C	00041-14027	00041-90360	Current	None
00041-15002	Statistics B	00041-14001	None	Current	None
00041-15003	Math A	00041-14002	00041-90199	Obsolete	41C-60
00041-15003	Math B	00041-14023	00041-90399	Obsolete	41C-60
00041-15003	Math C	5061-5261	None	Current	
00041-15004	Finance B	00041-14003	00041-90251	Obsolete	41C-46
00041-15004	Finance C	00041-14003	00041-90357 00041-90358	Obsolete	41C-46
00041-15004	Finance D	00041-14026	None	Current	41C-66
00041-15005	Surveying B	00041-14004	None	Current	None
00041-15006	Circuit Anal. A	00041-14005	00041-90289	Current	None
00041-15016	Real Estate A	00041-14006	00041-90323	Obsolete	41C-48
00041-15016	Real Estate B	00041-14021	00041-90352	Current	41C-48
00041-15017	Navigation A	00041-14007	00041-90377	Obsolete	None
00041-15017	Navigation B	00041-14028	00041-90397	Current	41C-66

APPLICATION PAC SUMMARY

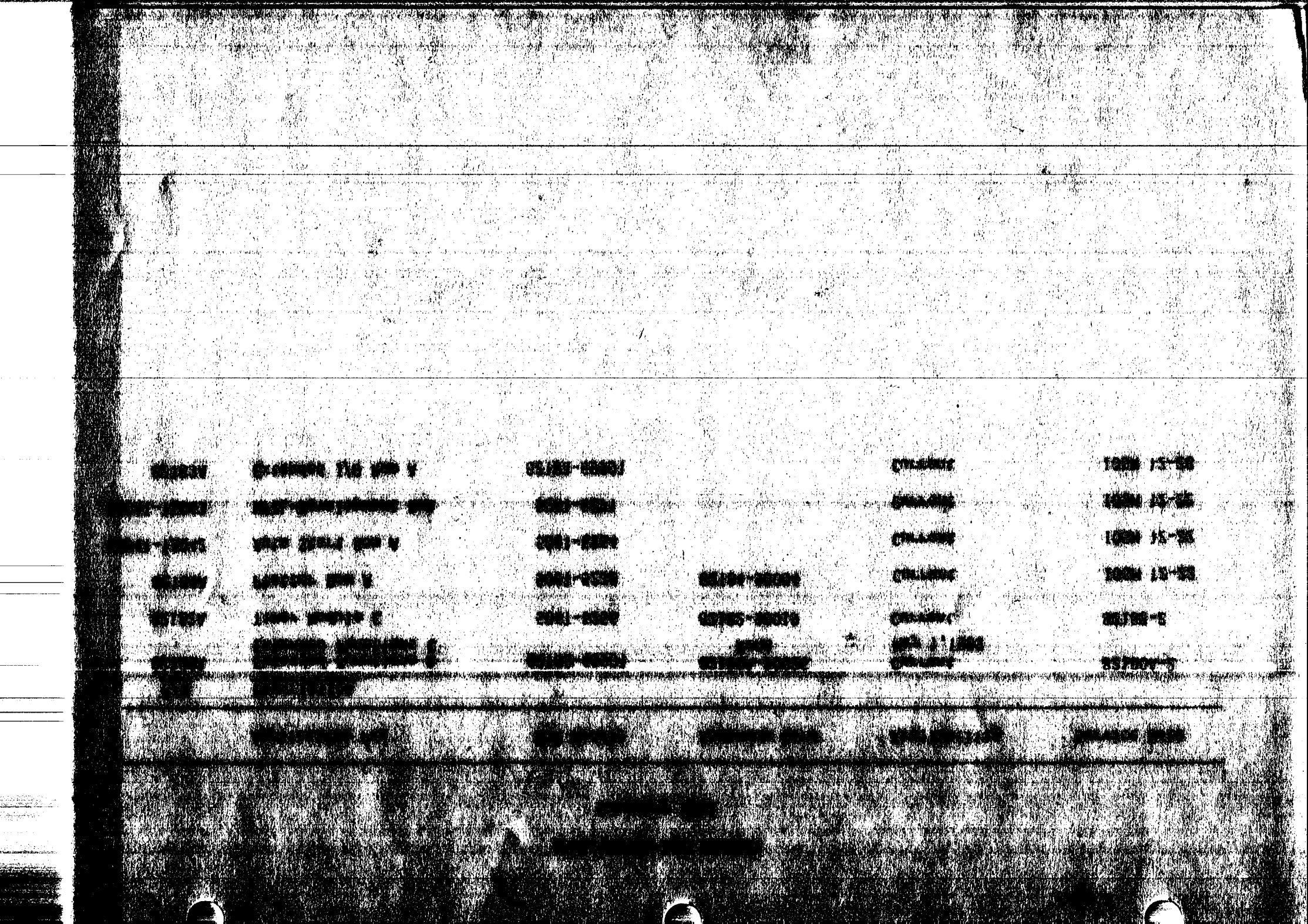
February 1983

Application Pac		ROM Module	Addendum Card	Availability	Service Note
P/N	Description				
00041-15018	Aviation A	00041-14008	00041-90404	Current	None
00041-15018	Aviation B	00041-14XXX	None	Not determined	None
00041-15019	Thermal A	00041-14009	None	Current	None
00041-15020	Machine Design A	00041-14010	None	Current	None
00041-15021	Structures A	00041-14011	00041-90250	Obsolete	41C-59
00041-15021	Structures B	00041-14024	None	Current	41C-59
00041-15022	Games A	00041-14012	None	Current	None
00041-15023	Home Mgt A	00041-14013	00041-90447 00041-90361	Current	41C-45
00041-15024	Clin. Lab A	00041-14014	None	Current	None
00041-15026	Securities A	00041-14016	00041-90369	Obsolete	None
00041-15026	Securities B	00041-14029	None	Current	None
00041-15027	Stress A	00041-14018	00041-90250	Obsolete	41C-66
00041-15027	StressB	00041-14025	None	Current	41C-66
00041-15039	Petroleum B	00041-14019	None	Current	None

APPLICATION PAC SUMMARY

February 1983

	Application Pac	ROM Module	Addendum Card	Availability	Service Note
P/N	Description				
82180A	Extended Functions B Extended Functions C	82180-69901	82180A-90026 None	Current May 1,1983	82180A-2
82182A	Timer Module C	5061-5256	82182-90019	Current	82182-2
82184A	Plotter Rom A	5061-5238	82184-90004	Current	IOSM 12-22
00041-15042	Auto Start Rom A	5061-5264		Current	IOSM 12-22
00041-15043	HPIL-Development Rom	5061-5271		Current	IOSM 12-22
82183A	Extended I/O Rom A	82183-69901		Current	IOSM 12-28



Standard Handbook and Standard 1A ROM Addendum Card

1. The program "Vector Operations" requires the instruction [x≷y] between steps 04 and 05 to subtract vectors correctly.

2. The "Arithmetic Teacher" program sometimes creates poor multiplication and division problems with the digit 0. Such problems can be avoided by replacing lines 106 and 107 with [RCL] 05 and by inserting the following steps after line 111:

```
111 LBL "/"
112 X=0?      } "new"
113 E1X       }
114 STO 02    }
```

3. A final paragraph for the description of "Root Finder" should read as follows:

   This program will calculate the closest obtainable approximation to a root, but may continue to iterate when the magnitude of the function evaluated at these approximations exceeds the tolerance. You can check the progress of the solution by inspecting the current guesses in registers 1 and 2 using the VIEW function.

4. For some combinations of values, "Financial Calculations" fails to converge to a solution for periodic interest i. This effect may be avoided by using a different initial value for i. You may try your own non-zero initial value by storing it into register 09 and executing Label 06. The value you store should be expressed as a decimal.

   Example: Try a guess of 1%:
   .01 [STO] 09 [XEQ] 06

5. The "Calendar Functions" program is valid from March 1, 1900 to February 28, 2100.

This addendum applies to both the Standard 1A Module and Standard Manual. It is possible that comments 3, 4 and 5 have already been incorporated in your manual.

HEWLETT PACKARD

00041-90360 3/81 Printed in U.S.A.

HP-41C
Math Pac I
Addendum Card

When the order of the first coefficient is zero, the Fourier Series program does not compute correct values of the series at user-specified points (t). After the coefficients have been calculated, use the following procedure to determine f(t) for a given t.

Keystrokes:	Display:	
RCL 22	(R)	Register number
2 STO + (R)		
STO + (R-1)		
USER		Set USER mode
t E	f(t)/2	
2 ×	f(t)	

Alternatively, the program could be copied into program memory and line 160 changed to FS?C 02. (However, one Memory Module is required to execute the program.)

HEWLETT PACKARD

Printed in U.S.A. 10/79 00041-90199

Addendum for Math A (00041-14002)

HP-41C
Math Pac
Addendum Card

In the program "TRANS", clear Flag 01 before attempting to transform a point from the original system to the translated system. If Flag 01 is not cleared, the results will be in error. This applies to both 2 and 3 dimensional cases.

The program "POLY" may calculate incorrect roots for fourth and fifth degree equations. To determine whether a calculated root is correct, rerun the Poly program and follow the instructions on page 22 for evaluating a function. When the program asks "X = ?", input the root in question. If the result is a very small number close to zero, then the root is correct. For fifth degree polynomials, only the second real root need be evaluated. For fourth degree polynomials, only the first real root need be evaluated.

HEWLETT PACKARD

Corvallis Division
1000 N.E. Circle Blvd., Corvallis, OR 97330

00041-90399 Rev. B Printed in U.S.A. 4/82

Addendum for Math B (00041-14023)

HP-41C
Financial Decisions Pac
Addendum Card

In the FINANCE 1B Module, the prompts for the Modified Internal Rate of Return (MIRR) program were inadvertently reversed. When ***SAFE RATE=?*** is displayed, key in the risk rate. Likewise, when ***RISK RATE=?*** is displayed, key in the safe rate. In the example on Page 25 of the applications book, the risk rate is 8% and the safe rate is 10%.

This Addendum Card applies to manuals with part number 00041-90042 (original printing and Rev. B).

HEWLETT PACKARD

00041-90251 1/80 Printed in U.S.A.

Addendum for Finance B (00041-14003)

HP-41C
Financial Decisions Pac
Addendum Card

1. The 360 calendar mode in DAYS does not calculate the correct number of days between dates when the first date occurs on the 31st day of the month and the 2nd date occurs any day except the 31st. The result is 1 day less than the correct answer.

2. After initialization of the Compound Interest program ([XEQ] [MONEY]) or after clearing the financial registers ([■] [E]), if I is the variable solved for when N, PV, and FV are known (PMT=0), you cannot solve for another variable until a value has been stored.

3. When I=0 in the Compound Interest program, you cannot solve for N, PV, PMT, or FV (gives DATA ERROR or an incorrect result).

HEWLETT PACKARD

00041-90358 2/81 Printed in U.S.A.

Addendum for Finance C (00041-14003)

HP-41C
Circuit Analysis Pac
Addendum Card

A note regarding the format of node designations should be added to the GNAP user instructions.

Note: The grounded node of a passive branch must be the TO node.

HEWLETT PACKARD

00041-90289 6/80 Printed in U.S.A.

Addendum for Circuit Analysis A (00041-14005)

HP-41C
Real Estate Pac
Addendum Card

INCOME PROPERTY ANALYSIS

If the amount of building and/or personal property depreciation is zero, the calculator will stop with an error message in the display when it attempts to calculate each year's total depreciation. This can be corrected by storing any non-zero value in R_{20} (building life) and R_{23} (personal property life) just prior to the prompt for transaction costs (*TRANS CST%=?*).

HEWLETT PACKARD

Printed in U.S.A. 00041-90323 9/80

Addendum for Real Estate A (00041-14006)

HP-41C
Real Estate Pac
Addendum Card

1. In the REAL EST 1B module, "The Rent or Buy Decision" program was changed to include the amount of interest earned by the alternative investment in the annual yield calculation. Please make the following changes to the "Display" column on page 58 of your manual:

   Display

   YLD=18.63
   $GAIN=4,119.73
   VAL=74,267.31
   %APPREC=6.89
   B-E RENT=390.75

2. When using "Income Property Analysis," the amount of the first mortgage must be a non-zero value.

00041-90352 4/81 Printed in U.S.A.

Addendum for Real Estate B (00041-14021)

HP-41
Navigation Pac
Addendum Card

Module Corrections

The following corrections are for the Navigation Module, revision 1A. The revision number of the module may be examined by executing [CATALOG] 2.

Celestial Navigation

The declination of the star Acrux is incorrect. If this star is used, the following short program must be placed in program memory. This program will correct the problem for all programs except the STAR subroutine itself. It requires ten program registers. In order for the program to be properly stored, the Navigation Module must be plugged into the HP-41. The program can be entered with the following keystrokes:

Keystrokes	Display
■ [GTO] [.] [.]	
[PRGM]	*00 REG nnn*
[XEQ] [ALPHA] *STAR [ALPHA]	*01 XROM"*STAR*
■ [GTO] [.] 000	*00 REG nnn*
■ [LBL] [ALPHA] *STAR [ALPHA]	*01 LBL"*STAR*
[ALPHA] NU* [ALPHA]	*02"NU**
30	*03 30_*
[RCL] 47	*04 RCL 47*
[XEQ] [ALPHA] INT [ALPHA]	*05 INT*
■ [X≠Y?]	*06 X=Y?*
[ALPHA] ■ [ASTO] 47 [ALPHA]	*07 ASTO 47*
[SST]	*08 XROM"*STAR*
■ [RTN]	*09 RTN*
■ [LBL] [ALPHA] NU* [ALPHA]	*10 LBL"NU**
[ALPHA] ACRUX [ALPHA]	*11"ACRUX*
30.057	*12 30.057_*
[STO] 47	*13 STO 47*
62.9275 [CHS]	*14 -62.9275_*
[ENTER↑]	*15 ENTER↑*
173.785	*16 173.785_*
[PRGM]	

Now you are ready to use the star Acrux in the celestial navigation programs.

Note that in using these programs, entering the name of the desired star instead of its number requires more program execution time. In the case that using a star name is preferred, only the first six letters of the name need to be entered.

Course Planning

If you are using programs outside the Navigation Pac, make sure that register 11 contains the desired eccentricity before using either GCPLAN or GCPLOT. This quantity may be examined by the key sequence [RCL] 11 and may be changed by keying in the desired value then pressing [STO] 11.

Additional Information

The programs GCPLAN, STAR, LOTOL, JD, and GST require a larger size than specified in the manual. Sizes of 49, 51, 16, 37, and 37 registers respectively will assure proper operation.

Always place the Navigation Pac in the lowest numbered port if the Games, Standard, Clinical Lab, Machine Design, Surveying, Petroleum Fluids, or Aviation Pac is currently in the calculator.

Flag 00 should be initially cleared to achieve results identical to the examples shown in the manual. See Page 10 for a further explanation of Flag 00 and its use.

Misprints in the Manual

The following corrections are for the Navigation Pac Manual, part number 00041-90120 (no revision number or letter) which appears on the back cover.

Page 13: The input column in step 5 should read *Hi,d.d* (d.d meaning decimal degrees) instead of *Hi,d.ms*.

Page 20: The words "*GCPLOT" and "*GCPLAN" are interchanged in paragraph 1, lines 3 and 4.

Page 24: In the example, the direction should be 250.5 not 250.0.

Page 26: The sextant reading should be 74° 40′ instead of 73° 50′ in the example at the bottom of the page.

Page 27: Line 8, in the display column, should read *SUN s=4.2 A* not *SUN s=4.1 A*.

Page 31: The instruction for step 12 should read "Key in DEC at previous whole hour".

Page 32: The second line from the bottom should read *PLANET s=1.4T* not *PLANET s=1.4A*.

Page 35: Under "Great Circle Heading and Distance" the instructions should read "Use L2 instead of d" not "use L2 instead of Hc".

Page 37: The letters "t" and "T" should be exchanged in the first paragraph, fourth sentence. In the example, 12 should be stored in register 34 instead of 0. The result should read *2,444,509.000* instead of *2,444,508.500*.

Page 44: In the keystrokes for Example 2, the second line should read 23.441884 [STO] 29, not 23.44184 [STO] 29.

Pages 50 and 52: The star Polaris, object 0, should be included in these lists.

Page 53: Flag 09 is not used, but flag 08 is used by NA.

HEWLETT PACKARD

00041-90377 6/81 Printed in U.S.A.

HP-41
Navigation Pac
Addendum Card

The program GCPLOT works very well when the longitudinal separation is less than or equal to 90°. For longitudinal separations greater than 90°, the program GCPLAN should be used to generate intermediate points less than 90° apart. Then GCPLOT can be used for the intervals between the intermediate points. GCPLOT will not work completely on intervals greater than 90°.

HEWLETT PACKARD

00041-90397 10/81 Printed in U.S.A.

Addendum for Navigation B (00041-14028)

HP-41
Aviation Pac
Addendum Card

1. When using the Aviation Pac program "PLAN", always be sure to use at least two legs; one-leg flights will be computed incorrectly if there are winds aloft or if the climb true air speed doesn't match the descent true air speed.

   Be sure that the planned final descent takes place in only the final leg, with no part of the climb in that leg.

   If leg length or rate of descent parameters are not compatible, the planned mid-flight climbs or descents will be incorrectly computed.

   The "PLAN" program will not prompt for winds at altitudes higher than the highest specified flight level or for winds at altitudes below the lower of the starting and destination points. The program assumes that all flight levels are above the starting point or destination altitudes.

2. Clear Flag 21 before using the program "FM".

3. The program "TAS" will stop to display the Mach number rather than pause, as stated in the manual.

Remember:

The Aviation Pac is intended for pre-flight planning use. Flight conditions constantly change while in flight; this pac should be used as a planning aid in conjunction with your own computations and equipment.

HEWLETT PACKARD

Corvallis Division
1000 N.E. Circle Blvd., Corvallis, OR 97330

00041-90404 Printed in U.S.A.

HP-41C
Stress Analysis and Structural Analysis Addendum Card

Simply Supported Continuous Beams-1A Versions*

An error was found in the "FIXR" option of this program. If you have a beam with a fixed right end, follow the procedure described in the user instructions up to the point of executing "MOMENTS." Before executing "MOMENTS," perform the following keystrokes:

[RCL] 19
7 [−] 0 [STO] [■] [·] Y

*You may distinguish the "1A" version of the module (which contains the error) from the "1B" version (which is correct), with the following procedure.

Turn the HP-41C off and remove all extension modules (you do not need to remove memory modules). Insert the Stress or Structures module. Press [■] [CATALOG] 2. The first entry in the catalog specifies the module name (STRESS of STRCTA) followed by the revision code (1A, 1B, 1C... etc.). If the revision code on your module is "1A," follow the procedure above. For later revisions, ignore the procedure.

HEWLETT PACKARD

Printed in U.S.A. 1/80 00041-90250

Addendum for Structures A (00041-14011)
Stress A (00041-14018)

Home Management Pac Addendum Card

1. The commission of the last stock in "Stock Portfolio Evaluation" is not recorded on data cards with the rest of the portfolio. To store all of the portfolio data, press:

   [■] [D] [←]
   [EEX] 3 [CHS] [+]
   [XEQ] [ALPHA] WDTAX [ALPHA] → *RDY 01 OF NN*

   Input blank magnetic cards to record data.

2. In "The Rent or Buy Decision" program, the annual yield calculation does not take into account the interest earned by the alternative investment made at the bank's interest rate.

3. If there is a partial first year in "Home Owner's Equity Analysis," the final year of the analysis is calculated based on 12 mortgage payments instead of 12-M payments, where M is the number of months in the partial first year.

4. When using "Your Financial Calculator," it is possible to define problems where you cannot solve for i. Such problems usually result in an error message, but may continue to run indefinitely.

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00041-90361 3/81 Printed in U.S.A.

Addendum for Home Management A (00041-14013)

HP-41C
Securities Pac
Addendum Card

1. In the BONDS program, the price and yield of a 360-day bond held for exactly 6 months is incorrect. The correct price may be determined by adding the calculated price and accrued interest (X and Y registers respectively). The yield cannot be determined by keystrokes alone.
2. The calculated high and low break-even points in OPTION are incorrectly labeled; the high break-even is first, and then the low break-even.

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00041-90369 5/81 Printed in U.S.A.

Addendum for Securities A (00041-14016)

Addendum

This addendum contains information regarding the *HP 82180A Extended Functions/Memory Module Owner's Manual,* part number 82180-90001, dated November 1981 or April 1982.

Page 8, under Configurations. If you have the HP 82104A Card Reader plugged into the calculator and an HP 82181A Extended Memory Module plugged into port 2, and you execute the card reader function [VERIFY], some information in that extended memory module may be changed. Therefore, you should avoid using the [VERIFY] function if you are also using an extended memory module in port 2.

Page 17, under Clearing Programs. If you execute [PCLPS] from the keyboard, be sure the calculator is positioned in program memory. You can position the calculator in program memory in any of the following ways:

- Press ■ [CATALOG] [1] followed by [R/S] (as described under Using [CATALOG] for Positioning in your calculator owner's manual).
- Press ■ [GTO] [ALPHA] *label* [ALPHA] using a label in program memory (one that is listed in CATALOG 1).
- Press ■ [GTO] [·] [·].

If the calculator is positioned to a program in a plug-in application module or device when you execute [PCLPS], the information in the calculator's memory will be lost and the calculator will display **MEMORY LOST**.

Page 24, under [PURFL]. After a file in extended memory is purged, there is no working file. Therefore, before subsequently executing functions that operate on the working file, you should execute a function (such as [SEEKPTA]) that defines the working file (that is, makes the specified file the working file—refer to Working Files, page 23). For example, after executing [PURFL], write the name of an existing file in the ALPHA register, then execute [FLSIZE]—that file now becomes the working file. After executing [PURFL], you should *always* define a working file before executing functions that operate on it; otherwise, all files in extended memory will be lost.

Page 25, before Program File Operations. If a register in a file contains a string of seven characters all having character code 255, and if another file closer to the beginning of extended memory is purged, then all information from that register to the end of extended memory may be lost. To ensure that this doesn't occur, avoid appending, inserting, or adding to a file more than six consecutive characters having the character code 255.

Page 25, under Program File Operations. If you execute [SAVEP] from the keyboard, be sure the calculator is positioned in program memory (as described above). If the calculator is positioned to a program in a plug-in application module or device when you execute [SAVEP], the information in the calculator's memory and in extended memory may be changed or lost.

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82180-90026

Printed in U.S.A. 4/82

Addendum

This addendum contains information for the *HP 82182A Time Module Owner's Manual*, part number 82182-90001, dated January 1982.

Page 43, under The Alarm Catalog. When printing the alarm catalog, port 3 of the calculator should be empty or contain one of the following accessories only: the HP 82143A Printer, the HP 82160A HP-IL Module, or the time module. Improper operation may occur if another module or accessory is plugged into this port while the Alarm Catalog is being printed.

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82182-90019

Printed in U.S.A. 2/82

Addendum

This addendum contains information regarding the *HP 82184A Plotter Module Owner's Manual*, part number 82184-90001, dated September 1982.

Page 69, under [LIMIT]. If, in addition to the plotter, an HP-IL device *other than* an HP 82161A Digital Cassette Drive, an HP 82162A Thermal Printer, an HP 82163 Video Interface, or an HP 82905B Printer is on the loop, the plotter must be selected as the primary device before executing [LIMIT]. (Refer to "Selecting an HP-IL Device" in section 4 of the *HP 82160A HP-IL Module Owner's Manual.*) Otherwise, the HP-41 may display the message **PL:RANGE ERR** when [LIMIT] is executed.

Page 136, under [BCREGX]. When executing [BCREGX], if there are two or more consecutive specified registers containing zero, the HP-41 may display a **NONEXISTENT** error message. If this occurs, execute [BCREGX] repeatedly until the error message no longer appears in the display. (At most, [BCREGX] will need to be repeated once for each consecutive specified register containing zero.)

Also, when using [BCREGX] with an HP-41C that *does not* have an HP 82170A Quad Memory Module, ensure that the registers you specify exist. Otherwise [BCREGX] may place null bytes in the ALPHA register corresponding to any nonexistent registers which are specified.

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82184-90004

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Addendum

APPENDIX
C

Service Notes

C-1. INTRODUCTION

C-2. This manual incorporates most of the service notes written for the HP-41 through March 1983. Those service notes that could not be easily incorporated are included in this section. In addition, all future service notes should be filed in this appendix for easy reference. The table of contents will be updated occasionally to keep the manual current.

C-3. Table of Contents

[redacted]

[redacted]

[redacted]

HEWLETT PACKARD

CORVALLIS DIVISION
SERVICE NOTE

41C-03

Supersedes:
10/1/79

SUBJECT: HP-41C LOCKUP

SYMPTOMS: Calculator does not respond to keyboard. Calculator may not turn on or off. Display may be blank or there may be invalid characters in the display.

PROBLEM: The HP-41C has all CMOS circuits (except for the power supply). Because these circuits are never completely turned off, they are very sensitive to interference. Static electricity, plugging in modules or peripherals with the power turned on, or severe mechanical shock may cause spurious signals which the calculator does not know how to respond to. The calculator then "locks up" and won't respond to the keyboard.

DISCUSSION: All HP-41C's can "lock up". Usually this is a rare occurrence. But some 41C's are more susceptible to "lock up". The owner's manual tells users to remove their batteries when "lock up" occurs (see SERVICE Section of Owner's Handbook). The period of time that batteries must be removed varies from calculator to calculator; it may be anywhere from 5 seconds to overnight. If removing the batteries does not fix the "lock up", then you should suspect another problem. Calculator lockup is one of the most difficult problems you will have to troubleshoot, especially when the problem is intermittent and you can't duplicate the customer's complaint.

SOLUTION: When lockup occurs frequently, there are several steps which can be tried to fix the problem. First, try replacing the CPU. If that doesn't work, try replacing the display driver hybrid. If lockup only occurs when a card reader is plugged in, try cleaning the card reader contacts first, and then try replacing the CRC (P/N 1LA3-0023/1LA3-0034).

JA:em

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CONVALLIS DIVISION
SERVICE NOTE

[redacted]

10/1/79

[redacted] HP-41C LOCKUP

[redacted] Calculator does not respond to keyboard. Calculator may not turn on or off. Display may be blank or there may be invalid characters in the display.

[redacted] The HP-41C has all CMOS circuits (except for the power supply). Because these circuits are never completely turned off, they are very sensitive to interference. Static electricity, plugging in modules or peripherals with the power turned on, or severe mechanical shock may cause spurious signals which the calculator does not know how to respond to. The calculator then "locks up" and won't respond to the keyboard.

[redacted] All HP-41C's can "lock up". Usually this is a rare occurrence. But some HTC's are more susceptible to "lock up". The owner's manual tells users to remove their batteries when "lock up" occurs (see BATTERY Section of Owner's Handbook). The period of time that batteries must be removed varies from calculator to calculator; it may be anywhere from 5 seconds to overnight. If removing the batteries does not fix the "lock up", then you should suspect another problem. Calculator locking is one of the most difficult problems you will have to troubleshoot, especially when the problem is intermittent and you can't duplicate the customer's complaint.

[redacted] When locking occurs frequently, there are several steps which can be tried to fix the problem. First, try replacing the CPU. If that doesn't work, try replacing the display driver chip. If locking only occurs when a card reader is plugged in, try cleaning the card reader contacts first, and then try replacing the CCE (P/N 1LA3-0023/1LA3-0024).

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CORVALLIS DIVISION

SERVICE NOTE

SUBJECT: HP-41C TROUBLESHOOTING HINTS

10/1/79
Supersedes:

The following is a summary of problems the U.S. Repair Center has found in customer HP-41C's and the action taken to fix the units. This information may be useful to you in troubleshooting the HP-41C, but it is not intended to be a complete list of all faults or symptoms.

SYMPTOM	POSSIBLE CURES
NO TURN ON	Replace C_5. Cold solder joints between display and keyboard. Replace CR_1.
LOCKS UP	See Service Note 41C-03. Replace display driver hybrid. Replace CPU.
HIGH SLEEP CURRENT	See Service Note 41C-05. Replace display driver hybrid. Replace CPU. Replace D/S 0-4 one at a time.
SHOCK SENSITIVE	Cold solder joints between display and keyboard.
MISSING SEGMENTS OR DIGITS, ERRONEOUS CHARACTERS	Does twisting the case change the display? If so, check connection between display and keyboard. Check that nuts holding logic board are tight enough. Check that case screws are tight enough (but do not overtighten - the keyboard bosses may strip out). If twisting the case does nothing: Replace display driver hybrid. Replace LCD.
BEEPS WHEN ANY KEYS ARE PRESSED	Replace CPU.
PRESSING ONE KEY RESULTS IN SOME OTHER FUNCTION BEING PERFORMED	Has key been reassigned? If not, replace CPU.
WHEN 41C TURNED ON, DISPLAY SHOWS * - THEN "NULL"	Replace CPU.
IN ALPHA MODE LETTERS ARE SHOWN AS Ø BEEP	Replace ROM2.
CALCULATOR WON'T GO INTO STANDBY MODE	Replace display driver hybrid. Replace C_2.

For additional troubleshooting hints, see pages 4-12 to 4-14 of the 41C Service Manual.

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CONVAIR DIVISION
SERVICE NOTE

[redacted]

[redacted]: 4P-4fC TROUBLESHOOTING HINTS

10/1/73

The following is a summary of problems the G.E. Repair Center has found in computer 4P-4fC's and the action taken to fix the units. This information may be useful to you in troubleshooting the 4P-4fC, but it is not intended to be a complete list of all faults or symptoms.

[redacted]	PROBABLE CAUSES
[redacted]	Replace C4.
[redacted]	Cold solder joints between display and keyboard.
[redacted]	Replace CR1.
[redacted]	See Service Note 4fC-08.
[redacted]	Replace display driver hybrid.
[redacted]	Replace CPU.
[redacted]	See Service Note 4fC-08.
[redacted]	Replace display driver hybrid.
[redacted]	Replace CPU.
[redacted]	Replace SV5 D-4 one at a time.
[redacted]	Cold solder joints between display and keyboard.
[redacted]	Does switching the case change the display? If so, check connection between display and keyboard. Check that nuts holding logic board are tight enough. Check that case screws are tight enough (but do not over-tighten - the keyboard bezels may strip out).
[redacted]	If switching the case does nothing: Replace display driver hybrid. Replace LCD.
[redacted]	Replace CPU.
[redacted]	Has key been restrained? If not, replace CPU.
[redacted]	Replace CPU.
[redacted]	Replace ROM.
[redacted]	Replace display driver hybrid. Replace C9.

[redacted] troubleshooting hints, see pages 4-12 to 4-16 of CSD 4fC

[redacted]

[redacted]

HEWLETT PACKARD

CORVALLIS DIVISION

SERVICE NOTE

Revised 2/13/81 Supersedes:

SUBJECT: MICROCODE ERRORS, HP-41C

The following is a list of known microcode errors in the HP-41C. An update policy will be established in a few weeks. Table 1 gives additional information such as ROM configuration and date codes of calculators with these errors.

1. USER CAN CONTROL SYSTEM FLAGS - The 41C was designed to have user-controlled flags (00-29) and system flags (30-55). The system flags were not supposed to be controlled by users, but the first 5000 calculators built allowed users to set and clear them. For example, to set flag 49, the low battery flag, the following steps could be used:

   ```
   49
   STO 00 (or any storage register)
   SF IND 00
   ```

   This is not a serious problem - many users like having this feature. ROM Ø : F (P/N 1LA3-0033) corrected this problem.

2. REGISTER ADDRESS WRAPAROUND - With a value of $X \geq 785$ in the display, RCL IND .X will recall data from the system scratch pad.

3. LN(1+X) - the function ln (1+X) gives wrong answers for values of X between -.9990234374 and -1.00.

4. $(.1)^{-43}$ - This operation gives an answer of $9.999999999 \times 10^{+42}$. The correct answer is $1.000000000 \times 10^{+43}$.

5. Σ+/LAST X - The Σ+ and Σ- functions do not update the LAST X register as indicated in the owner's manual.

6. SINE OF VERY SMALL ANGLES - The sine of very small angles ($\approx 10^{-99}$) gives wrong answers.

7. NO DECOMPILE - If a user is in PRGM mode, has edited his program, and turns the 41C off (or allows it to timeout), the changes he made to his program are not decompiled. If the user then turns his 41C on and tries to run the program, it will not work correctly. When the user goes into PRGM mode to check his program, the program is automatically decompiled. It will then work correctly. If a user has this problem, he can avoid it by always going back into

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RUN mode after changing a program.

8. ALPHA STRING COMPARES - If a customer uses ASTOX to put 6 characters from a longer string in the X register and then tries to compare those 6 characters to 6 in the y register, the 41C will respond "no" even if true. Example:

```
ALPHA MODE
ABCDEFG ASTO.X
ABCDEF ASTO.Y
RUN MODE
X=Y? → "NO"
```

9. CLP - The "clear program" function (CLP) will only clear 1089 steps if the printer is not plugged in. If the printer is plugged in and in MANUAL mode, CLP will clear 1089 steps. If the printer is plugged in and in NORMAL or TRACE mode, CLP will only clear 233 steps.
   NOTE: A customer can get around this problem temporarily by using DEL 999 twice for long programs.

JA:em
Attachment

11/21/79

SUBJECT: DISPLAY DRIVER REVISION F TO G

Revision "G" display drivers will appear in 41C calculators with S/N 1954AXXXXX. All calculators beginning with S/N 2003AXXXXX will contain Revision "G" display drivers. The Part Number will, however, remain unchanged.

There are differences in appearance as well as in the automatic (10 minute) time-out feature. This is primarily due to a change in C_2 capacitor of the logic board from .01 uf to 470 pf.

Revision "G" uses 470 pf/0160-0571

Revision "F" uses .01 uf/0160-3914

The difference in appearance can be seen by looking at the covering over the display hybrids.

Revision "G" is covered by epoxy.

Revision "F" is covered by a plastic cap.

If the value of capacitor is interchanged with revision of the display driver assembly the following symptoms occur:

1. Revision "G" with 470 pf

   Frequency = 8.3 KHZ
   Timeout = 9 minutes
   Display = OK

2. Revision "G" with .01 uf

   Frequency = 435 KHZ
   Timeout = ?
   Display = flickering

3. Revision "F" with .01 uf

   Frequency = 6.3 KHZ
   Timeout = 12 minutes
   Display = OK

4. Revision "F" with 470 pf

   Frequency = 110 KHZ
   Timeout = 40 seconds
   Display = OK

NC:em

11/21/79

[illegible] DISPLAY DRIVER REVISION F TO G

[illegible] delay drivers will appear in ADC catalogues with [illegible]. All calculators beginning with S/N 2000XXXXX will [illegible] "G" display drivers. The Part Number will, however, remain unchanged.

[illegible] differences in appearance as will be in the waveshapes [illegible] turn-out features. This is primarily due to a change in [illegible] of the logic board from .01 uF to 470 pF.

Duration "D" uses 470 pF/MYLAR-0017

Duration "F" uses .01 uF/MYLAR-3317

[illegible] in appearance can be seen by touching at the covered [illegible] display bipolar.

Duration "D" is covered by epoxy.

Duration "F" is covered by a plastic cap.

If the value of capacitor is interchanged with revision of the display [illegible] the following symptoms occur:

1. Duration "D" with 470 pF

[illegible] = 0.1 sec
[illegible] = 1 minutes
[illegible] = OK

2. Duration "D" with .01 uF

[illegible] = 150 sec
[illegible] = 1
[illegible] = Flickering

3. Duration "F" with .01 uF

[illegible] = 0.1 sec
[illegible] = 12 minutes
[illegible] = OK

4. Duration "F" with 470 pF

[illegible] = 150 sec
[illegible] = 30 seconds
[illegible] = OK

SERVICE NOTE

Supersedes:
3/21/80

SUBJECT: 41C BATTERY LIFE

Many HP-41C users believe they are not achieving normal battery life. The owner's manual quotes 9-12 months as normal life expectancy but this estimate is based on usage assumptions which may be too low. Corvallis Q.A. recently did some testing to define average battery life. The results were incorporated in a letter which we sent to 41C users asking about battery life. Attached is a copy of that letter which you may adapt to suit your needs.

JA:em

Attachment

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HEWLETT PACKARD
PERSONAL COMPUTER DIVISION
1010 N.E. Circle Boulevard, Corvallis, Oregon 97330, Telephone 503 757-2000 TWX# 510-596-0683

Dear Customer,

Battery life is dependent on many factors, including how you use your HP-41C, what peripherals are attached and how fresh your batteries are. The HP-41C is designed to coax maximum life from a set of batteries by two power-down modes. When keys are being pressed or a program run, the calculator is in RUN mode. When sitting idle (turned on) the HP-41C powers down to STANDBY mode, consuming about 1/7 the power of RUN mode. If the calculator remains idle for about ten minutes, it powers down again to SLEEP mode, effectively turning itself off and consuming only about 1/100 the power of STANDBY mode.

From battery life testing by Hewlett-Packard, median values for life expectancy have been measured and are listed below:

HP-41C Only	Median Life (hours)
RUN Mode Operation:	
Hours to "BAT" Annunciator	≃ 60
Hours to Dead Calculator	≃ 80
HP-41C and 82104A Card Reader	
# Passes to "BAT" Annunciator	≃ 1000
# Passes to Refusal to Read	≃ 1200

When comparing your actual battery usage to the above figures, keep the following points in mind:

1. Testing was done with fresh batteries.

2. The above values are median values, and your actual usage may be slightly higher or lower.

3. Pass is defined as a card read or write on one track.

4. Combinations of 41C use and card reader use will result in lower battery life values than those above. When the card reader motor turns on, it drains a large current from the batteries. This pulls the battery voltage down. As you get closer to the end of battery life (but before the "BAT" annunciator turns on), your HP-41C may function normally alone but trying to read a card pulls the battery voltage down below the low battery reference level. This turns the "BAT" annunciator on. The point here is that 60 hours of HP-41C only RUN mode operation is not equivalent to 1000 card passes.

5. When batteries are consumed to the point that a card cannot be read, they are still adequate to support HP-41C only use for some period of time. In this manner you can achieve additional battery usefulness.

6. Memory modules/application modules further limit battery life.

7. If you own the 82143A printer, remember that when it is printing, the HP-41C is in RUN mode. Extensive printing therefore depletes the 41C's batteries.

Sincerely,

Service Representative

Sincerely,

Service Representative

HEWLETT PACKARD

CORVALLIS DIVISION

SERVICE NOTE

Supersedes:
4/9/80

SUBJECT: HP-41C ROM UPDATE

The HP-41C ROM Update Program will begin April 1 in the U.S. and May 1 in all other countries. It's purpose is to correct the known major microcode errors in the 41C. It does not cure lockup or short battery life problems. Updates should be done by customer request only - they are not automatic. You should not solicit people to update their ROM's unless they complain of a problem associated with a known microcode error.

The update should be charged to warranty. If you use the Corvallis produced short form screens, complete a separate R.O. for the ROM update. If a 41C needs repair and a ROM update, complete two R.O.'s. If you use SIS screens, use a continuation. In both cases, use repair class MO for the ROM update and list the part numbers of the three ROM's. Pay type would be Ø2N.

Update charges are as follows:

	Labor	Materials (U.S. $)
ROM Update Only	0.5 Hr.	$32
ROM Update With Repair	0.25 Hr.	$32

The new ROM Part Numbers are:

	Old P/N	New P/N
ROM 0	1LB7-0001 1LA3-0033 1LA3-0015	1LB7-0038
ROM 1	1LB7-0002 1LA3-0016	1LB7-0039
ROM 2	1LB7-0003 1LA3-0022	1LB7-0040

You should use up your existing stock of the old ROM's in normal repairs. However, do not replace a defective new ROM with an old ROM. When your old ROM's are gone, use new ROM's in all repairs.

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The microcode errors which will be corrected by this update are detailed in Figure 1, a copy of the addendum card which has been enclosed with new HP-41C's since November 1979.

In addition, HP-41C's date-coded prior to 1951 have other microcode errors which can be corrected by this ROM update. These microcode errors are summarized in Service Note 41C-07 (Revised 4/2/80).

Corvallis uses two form letters when doing ROM updates. Figure 2 is a copy of the letter sent to customers who have requested the update. Figure 3 is a copy of the letter sent to customers who have had a defective old ROM replaced with a new ROM.

JA:em

Attachments

FIGURE 1

Important HP-41C Information

Program Mode Power-Off. If you turn the HP-41C off (or if it turns off automatically) while the unit is in PRGM (program) mode, you should toggle into and back out of PRGM mode again when you resume operation. This ensures that changes made to programs in previous editing sessions will be compiled by the HP-41C system.

Program Clearing Restrictions. When you wish to clear very long programs (longer than 233 lines), you must set the HP 82143A Printer (if present) to MAN (manual) mode when you execute the [CLP] function. Programs longer than 1089 lines must be cleared using [DEL] nnn. (For example, to clear a 1980-line program execute [DEL] and press [EEX] 980.) Refer to the *HP-41C Owner's Handbook and Programming Guide*, page 135 for more information about long programs.

ALPHA String Testing Restrictions. If you are testing two ALPHA strings that were originally longer than six characters (when created in the ALPHA register), then you must perform the following procedure to ensure proper string truncation and test results. Strings can only be tested with the [X=Y?] or [X≠Y?] functions.

1. Store the first string into a register using [ASTO] nn. If the string is not longer than six characters, skip this step and go on to step 4.
2. Clear the ALPHA register with [CLA].
3. Recall the string into the ALPHA register using [ARCL] nn.
4. Store the string into the X-register using [ASTO] [.] X.
5. Store the second string into a register using [ASTO] nn. If the string is not longer than six characters, skip this step and go on to step 8.
6. Clear the ALPHA register with [CLA].
7. Recall the string into the ALPHA register using [ARCL] nn.
8. Store the string into the Y-register using [ASTO] [.] Y.
9. Execute [X=Y?] or [X≠Y?].

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00041-90221

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FIGURE 2

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Dear Customer,

As you requested, your HP-41C has been updated to correct known microcode errors. This is in keeping with our desire to provide you with the most up-to-date circuitry. We do not anticipate any further updates being required.

Sincerely,

Service Representative

FIGURE 3

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Dear Customer,

Repair of your HP-41C necessitated the replacement of a ROM (integrated circuit). This ROM is an updated version of the one which failed in your calculator. It is in keeping with our desire to provide you with the most up-to-date circuitry.

Sincerely,

Service Representative

TABLE 1

MICROCODE ERROR SUMMARY

ROM CONFIGURATION	PROBLEMS CORRECTED	PART NO. TO FIX	PARTS AVAILABLE	DATE CODES AFFECTED	
				FROM	TO
0:D, 1:D, 2:E	-----	-----	-----	1926-	1938-
0:F, 1:D, 2:E	1	1LB7-0002	Now	1936-	1952-
0:F, 1:E, 2:E	2,3,4,5,6	1LB7-0002	Now	1951-	2034
0:G, 1:F, 2:F	7,8,9	1LB7-0038 1LB7-0039 1LB7-0040	U.S.-April '80 Int'l-May '80	2035	

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CORVALLIS DIVISION

SERVICE NOTE

Supersedes
4/28/80

SUBJECT: HP-41C SYSTEM CONTACT TEST

The contacts internal to the HP-41C and between the 41C and its plug-in accessories are very important for proper system operation. Poor contacts can cause lockup, alteration of program memory or data storage registers, improper plug-in accessory operation, etc.

To test contacts, do the following tests:

1. HP-41C

   A. Unplug all modules. Execute a Catalog 3, and while it is running, drop the 41C on its back from a height of 5 cm. Do this five times and watch for improper execution (execution stops, incorrect display, etc.).

   B. If the unit fails this test, lift the top (display) end of the 41C off the table to a 45^{0} angle and let it drop (while Catalog 3 is running). Do this five times. A failure here could be due to a cold solder joint between the keyboard and display. Try the same test with the bottom end of the calculator - lift to 45^{0} and drop five times with Catalog 3 running. A failure here could be due to contamination on the contact pads on the logic or keyboard. Or the logic board nuts may not be tight enough.

2. Memory Module

   A. Plug all of the customer's memory modules into his HP-41C. (Remember that when you plug in a memory module and turn the 41C on, the registers in the module are allocated as data storage registers.) Load the following program into the 41C:

```
LBL A
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
GTO A
```

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B. To test each memory module, store in Register 01 the number of a register you know is in the module under test. For example:

To test module in Port #	Store this number in Register 01
1	64
2	128
3	192
4	256

C. Execute the program "A", and while it is running, lift the top (display) end of the 41C off the table to a 45^{o} angle and let it drop. Do this 20 times and watch for the program to stop (it may say "NONEXISTENT" when it stops). If the program continues to run, the memory module contacts and port are good.

D. If a memory module fails the test, try the same test with another module in the same port. This will tell you whether the module is actually bad or the port is bad.

E. Clean the module contacts with a lint-free cloth and alcohol followed by Freon. Clean the I/O assembly with a Q-tip and alcohol followed by Freon. If cleaning does not solve the problem, replace the module or I/O assembly, whichever was found faulty by the tests above.

3. Application Module

A. Perform the same tests as in 2C and 2D above but execute a Catalog 2 instead of the program above.

B. Clean or replace as indicated by test results (see 2E).

JA:em

HEWLETT PACKARD

CORVALLIS DIVISION

SERVICE NOTE

Supersedes: 4/28/80

SUBJECT: LOCKUP/SHORT BATTERY LIFE

POSSIBLE COMPLAINTS:

- 41C won't turn on.
- 41C won't turn off. No response when pressing keys.
- Functions on right hand column of keys, (LN, TAN, etc.) transposed to left side of keyboard.
- Batteries last only a few days.
- Contents of registers altered; possibly strange characters.

DISCUSSION: Because of its CMOS design, the HP-41C is susceptible to various forms of noise. The three most common sources of noise identified up to now are:

1) static discharge
2) poor contact (I/O connectors)
3) plugging in or removing peripherals with 41C on

The 41C responds to these types of noise in one of several ways (in order of severity):

1) no adverse effects
2) lockup (no keyboard response) - memory not lost
3) transposition of keys, contents of some registers altered
4) loss of memory, very short battery life, no keyboard response

Battery life is shortened in the last three cases due to higher than normal current drain. In lockup, current draw is equal to run mode current (<15 ma). In case (3), current draw may be 15-20 ma and in case (4), as much as 500 ma.

Since the alkaline batteries are rated at about 450 ma-hours, the effective battery life can be found for each case by dividing the capacity (450 ma-h) by the appropriate current draw. For example, in case (4), battery life could be as short as one hour.

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Discussion (Continued):

All of the above reactions can be cleared by removing the batteries (for several seconds to as much as 12 hours).

Static discharge is a major source of lockup problems. Static increases with decreasing humidity, so it is more likely a problem in cold, dry climates. A heated building decreases the humidity and therefore increases risk of static. Synthetic carpets (nylon, etc.) and leather-soled shoes contribute to large static charges built up by a person's body. The static discharge does not have to be to the 41C to lock it up; it can be a discharge to another object near the 41C. The resulting field generated by the discharge can cause lockup. This static discharge may or may not be noticeable by the customer!

Currently there is no fix which will reduce the susceptibility of the 41C to these forms of noise. However, there are some steps you can take to improve poor contacts and to make the customer aware of problems in his environment which affect the 41C.

1) Perform the normal troubleshooting procedures as outlined in Service Note 41C-22.

2) Determine if the problem is due to poor contacts by doing a contact test (see Service Note 41C-23).

3) Talk to the customer if possible and determine under what circumstances his 41C locks up. This may provide clues to what is causing his problem. If the customer is experiencing short battery life, he is probably also experiencing lockup or one of the other complaints discussed above. If static is a possibility, advise the customer to take certain precautions:

   A) When walking up to the 41C, try to touch some sort of ground (such as a metal desk) before touching the 41C.

   B) If the customer does not keep his card reader or memory modules plugged into the 41C, be sure he keeps them stored in the pink anti-static bags in which they were enclosed when purchased.

C) Be cautious of storing the 41C in foam-lined camera cases. This type of plastic foam can build up large static charges.

D) If the customer typically experiences lockup when removing the 41C from its soft case, tell the customer not to use his soft case for awhile and see if his problem disappears. The soft case may be building up a static charge.

E) Send the customer an antistatic bag (P/N 9222-0690) and recommend he store his 41C in the bag when he is not using it.

F) It should always be stressed that static is a factor of the customer's environment, not a fault of the 41C.

4. When a unit is returned to a customer with No Trouble Found and the complaint was lockup or short battery life, the U.S. Repair Center sends a form letter and an antistatic bag to the customer, Figures 1 and 2 are examples of these form letters.

5. After a second unsuccessful repair for lockup or short battery life, the customer is advised that there is currently nothing that can be done to solve his problem. Again it should be stressed that the problem is a product of the user's environment. Maintain a file of these customers' names and advise them that when a fix is available they will be contacted.

6. For some customers, the rechargeable battery pack (82120A) is a short term solution, particularly for short battery life complaints.

JA:em

Attachment

[redacted]

SERVICE NOTE

Supersedes:

11/11/80

SUBJECT: REVISED SERVICE PROCEDURES

Attached are revised service procedures for the HP-41C. They will be incorporated at a later date into an updated service manual for the 41C.

41C UPDATED SERVICE PROCEDURES

I. TESTING

- A. GENERAL TEST AND REPAIR PROCEDURE
- B. CURRENT TEST
- C. CONTACT TEST

II. TROUBLESHOOTING

- A. NO TURN ON
  1. Very low current (∿ 0)
  2. 2-3 ma
  3. High current (∿ 150 ma)
  4. Display lit only when key is pressed (blanked in standby)
  5. Turns on OK, turn off, then won't turn on again.
- B. SHORT BATTERY LIFE
  1. High standby current (>1 ma)
  2. High sleep current
  3. Sleep current normal, then increases within 30 seconds.
- C. LOCKUP
  1. General
  2. GTO .. causes lockup
  3. Won't turn off, pressing "ON" key causes beep

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4. Locked up, pressing keys causes beep

5. Pressing any key causes lockup and "MEMORY LOST"

D. SHOCK SENSITIVE

E. BATTERIES WARM TO TOUCH

F. 41C WON'T RECOGNIZE PERIPHERALS

G. DISPLAY FADES OUT/MISSING SEGMENTS/STRANGE CHARACTERS IN DISPLAY

H. CALCULATOR TURNS OFF AFTER 10 TO 20 SEC./DISPLAY FLICKERS

I. WAKES UP FROM DIAGNOSTIC SLEEP TEST SAYING "STANDBY OK"

J. LOSS OF REGISTERS

K. DIAGNOSTIC TEST STOPS AT "SELECT TEST"

L. HMS +/HMS - GIVES INVALID ANSWERS

M. PRESSING A KEY GIVES ANOTHER FUNCTION

N. DISPLAY SHOWS "*" - THEN "NULL"

O. IN ALPHA MODE, LETTERS ARE SHOWN AS Ø BEEP

P. CALCULATOR WON'T GO INTO STANDBY MODE

Q. SOFTWARE BUGS

I. TESTING

A. The following HP-41C test and repair procedure is being used by the U.S. Repair Center. However, it is not rigid, since each customer unit is different. But it allows you a basic framework to work within.

1. Open the customer's package and read the paperwork, looking for a description of the customer's complaint.

2. Try to duplicate the complaint. Note cosmetic damage (scratches, spots in LCD, etc.). Check for mushy or sticky keys.

3. Insert the Service Module and set up for current measurements (see Section B below).

4. Run the Service Module multi-test and observe current levels for all tests (a. Display Test, b. Date Storage Test, c. ROM Test, d. Keyboard Test, e. Standby Test, f. Sleep Test). Memory modules inserted in the 41C will increase run mode currently by 1-2 ma per module. Indicate on the R.O. if any tests were failed.

   a. Experience has shown that the Service Module will find only about 50% of the probelems. Conventional troubleshooting techniques are required for the rest.

5. Try to isolate the problem between the logic board and the rest of the calculator by using the test calculator. Once you have verified the customer's complaint, put his logic board in the test calculator and see if the problem occurs now with your test calculator. This technique will be especially helpful in separating display driver problems from logic problems.

6. If the calculator fails any of the previous tests, repair the fault and retest.

7. If accessories are included with the 41C, these are tested with the appropriate Service Module Test (a. Memory Module Test, b. Application Module Test). Replace modules which fail.

8. If the calculator passes all previous tests, remove the current measuring equipment and Service Module. Insert a battery pack. Perform Contact Test (see Section C below).

9. Load two memory modules, flag module and service module. Perform an I/O Port Test (41C Service Manual, p. 4-11).

10. If all tests are passed and the customer's complaint cannot be duplicated, heat run the unit on AUTO MULTI Test for 12-24 hours.

11. All I.C. replacements should be heat run also.

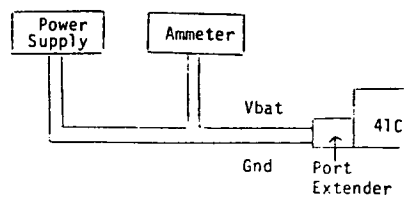
12. After heat run, perform the tests again.

13. If the complaint is lockup and/or very short (< 1 week) battery life, see Sections II B and C.

14. Complete paperwork and ship unit back to customer.

B. CURRENT TEST

1. Current drain can be checked using the port extender (T-11945). Connect an ammeter and a power supply across the V_{bat} and GND lines on the port extender as shown below:



2. Remove the batteries from the 41C and set the power supply at 4 volts. Measure awake current (RUN mode), standby current and sleep current. Worst case values can be found on p. 1-2 of the 41C Service Manual. Typical values we have found are:

	Current
AWAKE CURRENT	10 ma
STANDBY CURRENT	1 ma
SLEEP CURRENT	3 μa

C. CONTACT TEST

1. The contacts internal to the HP-41C and between the 41C and its plug-in accessories are very important for proper system operation. Poor contacts can cause lockup, alteration of program memory or data storage registers, improper plug-in accessory operation, etc.

2. To test contacts, do the following tests:

a. HP-41C

1) Unplug all modules. Execute a Catalog 3, and while it is running, drop the 41C on its back from a height of 5 cm. Do this five times and watch for improper execution (execution stops, incorrect display, etc.).

2) If the unit fails this test, lift the top (display) end of the 41C off the table to a 45° angle and let it drop (while Catalog 3 is running). Do this five times. A failure here could be due to a cold solder joint between the keyboard and display. Try the same test with the bottom end of the calculator - lift to 45° and drop five times with Catalog 3 running. A failure here could be due to contamination on the contact pads on the logic or keyboard. Or the logic board nuts may not be tight enough.

b. Memory Module

1) Plug all of the customer's memory modules into his HP-41C. (Remember that when you plug in a memory module and turn the 41C on, the registers in the module are allocated as data storage registers.) Load the following program into the 41C:

```
LBL A
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
RCL IND 01
GTO A
```

2) To test each memory module, store in Register 01 the number of a register you know is the module under test. For example:

To test module in Port #	Store this number in Register 01
1	64
2	128
3	192
4	256

3) Execute the program "A", and while it is running, lift the top (display) end of the 41C off the table to a 45° angle and let it drop. Do this 20 times and watch for the program to stop (it may say "NONEXISTENT" when it stops). If the program continues to run, the memory module contacts and port are good.

4) If a memory module fails the test, try the same test with another module in the same port. This will tell you whether the module is actually bad or the port is bad.

5) Clean the module contacts with a lint-free cloth and alcohol followed by Freon. Clean the I/O assembly with a Q-tip and alcohol followed by Freon. If cleaning does not solve the problem, replace the module or I/O assembly, whichever was found faulty by the tests above.

c. Application Module

1) Perform the same tests as in b.3) and b.4) above but execute a Catalog 2 instead of the program above.

2) Clean or replace as indicated by test results (see b.5.).

II. TROUBLESHOOTING

A. NO TURN ON

Do a current test (see Section I.B.) by holding the "ON" button down. The amount of current drain from the batteries in a no turn on condition may give some clues as to the source of the problem. Isolate the drain using the technique in Section I-A.5. If the logic board is not at fault, replace the display driver hybrid. Cold solder joints between the display and the keyboard may cause the problem.

1. Very low current ($\sim$ 0)

a. Measure V_{CC} (+ end of C3). If $V_{CC} \cong 6V$, then go on to step e.

b. Check diodes CR5, CR1 and CR6 by a quick front-to-back ratio. Replace if bad.

c. Check for oscillations on the CAP line (U2 pin 7). Chick and replace C6 or R3 if necessary.

d. Check for a potential difference across C5 (V_{CC}/V_{CO}). If none, replace C5.

e. Check to see if the PWO line (U1 pin 5) goes high when the "ON" switch is pressed. If it does, check the main signal lines ($\emptyset_1$, $\emptyset_2$, SYNC, ISA, DATA) at the CPU. If any of these lines have noise on them, replace the CPU.

f. If PWO does not go high, do the following:

1) Check transistors Q1 and Q2 (front-to-back ratio or junctions). Replace if required.

2) Check CR7 and replace if necessary.

3) Replace, one at a time, C9, C8 and C3.

g. If the problem still exists, start pulling the data storage IC's (U6, U7, U8, U9, U10) and then the ROM's (ROM 2, ROM 1, ROM Ø) one at a time.

2. Current ∿ 2-3 ma

a. Replace C5

b. Replace U2 (power supply)

3. High Current (∿ 150 ma)

a. Check for the alarm buzzer (Y1) shorting out to the transformer (T1).

b. Check Q1 and Q2. If they are hot to the touch or defective, replace them.

c. Check the following capacitors to see if they have shorted to ground: C3, C9, C8, C2, C10.

d. Check diodes CR1, CR5 and CR6.

e. Replace U2 (power supply).

f. Feel the I.C.'s to see if any are hot. Replace if necessary.

g. If you haven't fixed the problem yet, start removing the I.C.'s one at a time, CPU first, until the current drops sharply.

4. Display lit only when a key is pressed (blanked in standby)

a. Replace display driver hybrid (P/N 00041-60090)

5. Turns on OK, turn off, then won't turn on again

a. Replace C9

b. Replace U2 (power supply)

B. SHORT BATTERY LIFE

Short battery life can be due to many factors. The customer may have unrealistic expectations of battery life, especially since

thw owner's manual says 9 to 12 months. He may not realize how severe a drain additonal plug-in peripherals are on the batteries. Sleep current or standby current may be excessive. The 41C may be locking up and draining the batteries. Or one of the chips in the 41C may be latching up, which can drain the batteries in an hour. The first step in troubleshooting this problem is to see if the customer is experiencing frequent lockups or is using his peripherals heavily. Also, run a current check in standby and sleep modes (see Section I-A.4.). If lockup appears to be the problem, see Section II-C.

1. High Standby Current (> 1 ma)

    a. Standby currents in the approximate range of 1.3-1.6 ma are usually caused by ROM's. Replace ROM 2, ROM 1 and ROM Ø one at a time until problem is solved.

    b. Standby currents greater than 2 ma are usually caused by bad power supplies. Replace U2.

2. High Sleep Current

    a. Is the problem in the logic board? (Test per Section I-A.5.)

        1) Yes - Data storage chips usually cause this problem. Replace DSØ, DS2, DS3, DS4 one at a time to solve the problem.

        2) No - Replace display driver hybrid.

3. Sleep current normal, then increases within 30 seconds.

    Typical calues are 30-50 ma

    a. Check C9 and C3; replace if necessary.

    b. Replace U2 (power supply)

    c. Replace CPU

    d. Replace data storage chips one at a time.

    e. Replace ROM 2, ROM 1 and ROM Ø one at a time.

C. LOCKUP

There are many symptoms possible in lockup. The calculator may not turn on or off, the functions on the right hand column of keys may be transposed to the left column, various display annunciators may be lit, batteries may run down quickly, contents of registers may be altered, or memory may be lost entirely.

1. General Troubleshooting

    a. Isolate problem to logic or display hybrid if lockup is a real failure. If hybrid faulty, replace.

b. Check for alarm (Y1) shorting to transformer (T1).

c. Do a contact test (see Section I-C.).

d. Check for loose logic nuts.

e. Clean connectors if needed.

Discussion & Specific Troubleshooting

Because of its CMOS design, the HP-41C is susceptible to various forms of noise. The three most common sources of noise identified up to now are:

1) static discharge

2) poor contact (I/O connectors)

3) plugging in or removing peripherals with 41C on

The 41C responds to these types of noise in one of several ways (in order of severity):

1) no adverse effects

2) lockup (no keyboard response) - memory not lost

3) transposition of keys, contents of some registers altered.

4) loss of memory, very short battery life, no keyboard response.

Battery life is shortened in the last three cases due to higher than normal current drain. In lockup, current draw is equal to run mode current (< 15 ma). In case (3), current draw may be 15-20 ma and in case (4), as much as 500 ma.

Since the alkaline batteries are rated at about 450 ma-hours, the effective battery life can be found for each case by dividing the capacity (450 ma-h) by the appropriate current draw. For example, in case (4), battery life could be as short as one hour.

All of the above reactions can be cleared by removing the batteries (for several seconds to as much as 12 hours).

Static discharge is a major source of lockup problems. Static increases with decreasing humidity, so it is more likely a problem in cold, dry climates. A heated building decreases the humidity and therefore increases risk of static. Synthetic carpets (nylon, etc.) and leather-soled shoes contribute to large static charges built up by a

person's body. The static discharge does not have to be to the 41C to lock it up; it can be a discharge to another object near the 41C. The resulting field generated by the discharge can cause lockup. This static discharge may or may not be noticeable by the customer!

Currently there is no fix which will reduce the susceptibility of the 41C to these forms of noise. However, there are some steps you can take to improve poor contacts and to make the customer aware of problems in his environment which affect the 41C.

1) Perform the normal troubleshooting procedures as outlined in Section I-A.

2) Determine if the problem is due to poor contacts by doing a contact test (see Section I-C.).

3) Talk to the customer if possible and determine under what circumstances his 41C locks up. This may provide clues to what is causing his problem. If the customer is experiencing short battery life, he is probably also experiencing lockup or one of the other complaints discussed above. If static is a possibility, advise the customer to take certain precautions:

   a) When walking up to the 41C, try to touch some sort of ground (such as a metal desk) before touching the 41C.

   b) If the customer does not keep his card reader or memory modules plugged into the 41C, be sure he keeps them stored in the pink anti-static bags in which they were enclosed when purchased.

   c) Be cautious of storing the 41C in foam-lined camera cases. This type of plastic foam can build up large static charges.

   d) If the customer typically experiences lockup when removing the 41C from its soft case, tell the customer not to use his soft case for awhile and see if his problem disappears. The soft case may be building up a static charge.

   e) Send the customer an antistatic bag (P/N 9222-0690) and recommend he store his 41C in the bag when he is not using it.

   f) It should always be stressed that static is a factor of the customer's environment, not a fault of the 41C.

4) When a unit is returned to a customer with No Trouble Found and the complaint was lockup or short battery life, the U.S. Repair Center sends a form letter and an antistatic bag to the customer. Figures 1 and 2 are examples of these form letters.

5) After a second unsuccessful repair for lockup or short battery life, the customer is advised that there is currently nothing that can be done to solve his problem. Again it should be stressed that the problem is a product of the user's environment. Maintain a file of these customers' names and advise them that when a fix is available, they will be contacted.

6) For some customers, the rechargeable battery pack (82120A) is a short term solution, particularly for short battery life complaints.

2. GTO .. Causes lockup

   a. Replace CPU

3. Won't turn off, pressing "ON" key causes beep

   a. Replace CPU

   b. Replace D/S Ø

4. Locked up, pressing keys causes beep

   a. Replace CPU

   b. Replace D/S 4

5. Pressing any key caused lockup and "MEMORY LOST"

   a. Replace D/S 3

   b. Replace CPU

D. SHOCK SENSITIVE

1. Check for cold solder joints, especially between display and keyboard.

2. Check for loose logic board nuts.

3. Check for contamination on connectors or faulty connectors.

4. Check for alarm (Y1) shorting to transformer (T1).

E. BATTERIES WARM TO TOUCH

1. See Sections II-A.3. and II-C.

F. 41C WON'T RECOGNIZE PERIPHERALS

1. Replace I/O assembly (P/N 00041-60008)

2. Replace CPU

G. DISPLAY FADES OUT/MISSING SEGMENTS/STRANGE CHARACTERS IN DISPLAY

1. Check for cold solder joints between display and keyboard.

2. Check display connectors (P/N 1251-5400)

3. Replace display driver hybrid.

4. Replace display (1PT1-0001)

H. CALCULATOR TURNS OFF AFTER 10 TO 20 SEC./DISPLAY FLICKERS

1. Check C2. Make sure it is matched to the display driver hybrid (see Service Note 41C-13).

I. WAKES UP FROM DIAGNOSTIC SLEEP TEST SAYING "STANDBY OK"

1. Check connection between display end keyboard.

2. Replace power supply (U2).

J. LOSS OF REGISTERS

1. Do a contact test (Section I-C) if the 41C doesn't recognize more registers when a memory module is added.

2. See Service Note 41C-10.

K. DIAGNOSTIC TEST STOPS AT "SELECT TEST"

1. See Service Note 41C-27.

L. HMS +/HMS - GIVES INVALID ANSWERS

1. See Service Note 41C-28.

M. PRESSING A KEY GIVES ANOTHER FUNCTION

1. Has the key been reassigned? If not, replace CPU.

N. DISPLAY SHOWS "*" - THEN "NULL"

1. Replace CPU.

O. IN ALPHA MODE, LETTERS ARE SHOWN AS Ø BEEP.

1. Replace ROM 2.

P. CALCULATOR WON'T GO INTO STANDBY MODE

1. Replace C2.

2. Replace display driver hybrid.

Q. SOFTWARE BUGS

The following list contains the major software bugs. They can be cured by a ROM Update (see Service Note 41C-19).

1. USER CAN CONTROL SYSTEM FLAGS - The 41C was designed to have user controlled flags (00-29) and system flags (30-55). The system flags were not supposed to be controlled by users, but the first 5000 calculators built allowed user to set and clear them. For example, to set flag 49, the low battery flag, the

following steps could be used:

```
49
STO 00 (or any storage register)
SF IND 00
```

This is not a serious problem - many users like having this feature. ROM Ø : F (P/N 1LA3-0033) corrected this problem.

2. REGISTER ADDRESS WARPAROUND - With a value of $\chi \geq 785$ in the display, RCL IND .χ will recall data from the system scratch pad.

3. LN(1+χ) - the function ln (1+χ) gives wrong answers for values of χ between -.9990234374 and -1.00.

4. $(.1)^{-43}$ - This operation gives an answer of $9.999999999 \times 10^{+42}$. The correct answer is $1.000000000 \times 10^{+43}$.

5. Σ+/LAST χ - The Σ+ and Σ- functions do not update the LAST χ register as indicated in the owner's manual.

6. SINE OF VERY SMALL ANGLES - The sine of very small angles ($\simeq 10^{-99}$) gives wrong answers

7. NO DECOMPILE - If a user is in PRGM mode, has edited his program, and turns the 41C off (or allows it to timeout), the changes he made to his program are not decompiled. If the user then turns his 41C on and tries to run the program, it will not work correctly. When the user goes into PRGM mode to check his program, the program is automatically decompiled. It will then work correctly. If a user has this problem, he can avoid it by always going back into RUN mode after changing a program.

8. ALPHA STRING COMPARES - If a customer uses ASTOχ to put 6 characters from a longer string in the χ register and then tries to compare those 6 characters to 6 in the y register, the 41C will respond "no" even if true. Example:

```
ALPH MODE
ABCDEFG ASTO.χ
ABCDEF ASTO.Y
RUN MODE
χ=Y? → "NO"
```

9. CLP - The "clear program" function (CLP) will only clear 1089 steps if the printer is not plugged in. If the printer is plugged in and in MANUAL mode, CLP will clear 1089 steps. If the printer is plugged in and in NORMAL or TRACE mode, CLP will only clear 233 steps.

   NOTE: A customer can get around this problem temporarily by using DEL 999 twice for long programs.

HEWLETT hp PACKARD

CORVALLIS SERVICE DEPARTMENT • 1000 N.E. Circle Boulevard, P.O. Box 999, Corvallis, Oregon 97330, Telephone 503 757-2000

September 2, 1980

Dear Sir:

We have thoroughly tested your HP-41C but were unable to find any mechanical or electrical defect. Our testing included a 24-hour diagnostic analysis which your HP-41C passed without incident.

We have verified that noise from electrostatic discharge, heavy electrical equipment or powerful electrical fields can force an HP-41C into a state which causes a high current drain from the batteries.

Please examine your environment for these conditions, as well as where you store your HP-41C when it is not in use. Your unit has been shipped back to you in an anti-static bag and we suggest that you use this bag for storage of your calculator. We also recommend operating your HP-41C on a grounded surface (such as a metal desk) if you have a carpeted floor or if you use it in an area of low humidity.

The problem could also be caused by intermittant contact to the peripherals (modules, cardreader or printer).

If you continue to have problems with this unit, please return the entire system, along with a detailed description explaining the symptoms and the circumstances in which they occurred.

Please feel free to write to me or call me at the above telephone number, extension 2181, if I can help you in any other way regarding your calculator.

Sincerely,

Service Representative

[redacted]

[redacted]

September 5, 1988

[redacted]

[redacted] the above-referenced HP-41C but were unable to find any [redacted] device. The testing included a 24-hour diagnostic [redacted] with your HP-41C powered without incident.

[redacted] that noted the electrostatic discharge, heavy [redacted], or powerful electrical fields can cause an HP-41C [redacted] causes a high current drain from the batteries.

[redacted] environment for these conditions, as well as [redacted] HP-41C shows it is not in use. Your unit has been [redacted] is not in an anti-static bag and we suggest that you use [redacted] of your calculator. We also recommend operating [redacted] on a grounded surface (such as a metal desk) if you have a [redacted] do if you have it in an area of low humidity.

[redacted] should also be examined by internal contact to the [redacted], connector or printer.

[redacted] with this unit, please return the [redacted] along with a detailed description explaining the symptoms [redacted] in which they occurred.

[redacted] to write to me or call me at the above telephone [redacted], if I can help you in any other way regarding [redacted].

Sincerely,

[redacted]

Service Representative

HEWLETT hp PACKARD

CORVALLIS DIVISION • 1000 N.E. Circle Boulevard, Corvallis, Oregon 97330, Telephone 503 757-2000 TWX # 510-596-0683

We have thoroughly tested your HP-41C for possible causes of excessive battery drain but were unable to find any mechanical or electrical defect with your calculator. Our testing included a 24-hour diagnostic analysis, which your HP-41C passed without incident.

We have verified that noise from electrostatic discharge, heavy electrical equipment or powerful electrical fields can force an HP-41C into a state which causes a high current drain from the batteries.

Please examine your environment for these conditions, as well as where you store your HP-41C when it is not in use. We would appreciate knowing the results that you have in protecting your unit from this type of environment as we are investigating methods to make the HP-41C less susceptible to this phenomenon. Your name will be maintained on file for distribution of our findings.

Your unit has been shipped back to you in an anti-static bag and we suggest that you use this bag for storage of your calculator. We also recommend operating your HP-41C on a grounded surface (such as a metal desk) if you have a carpeted floor or if you use it in an are with low humidity.

If we can be of any further assistance, please feel free to contact our Service Department at the above address. Thank you for your patience and cooperation.

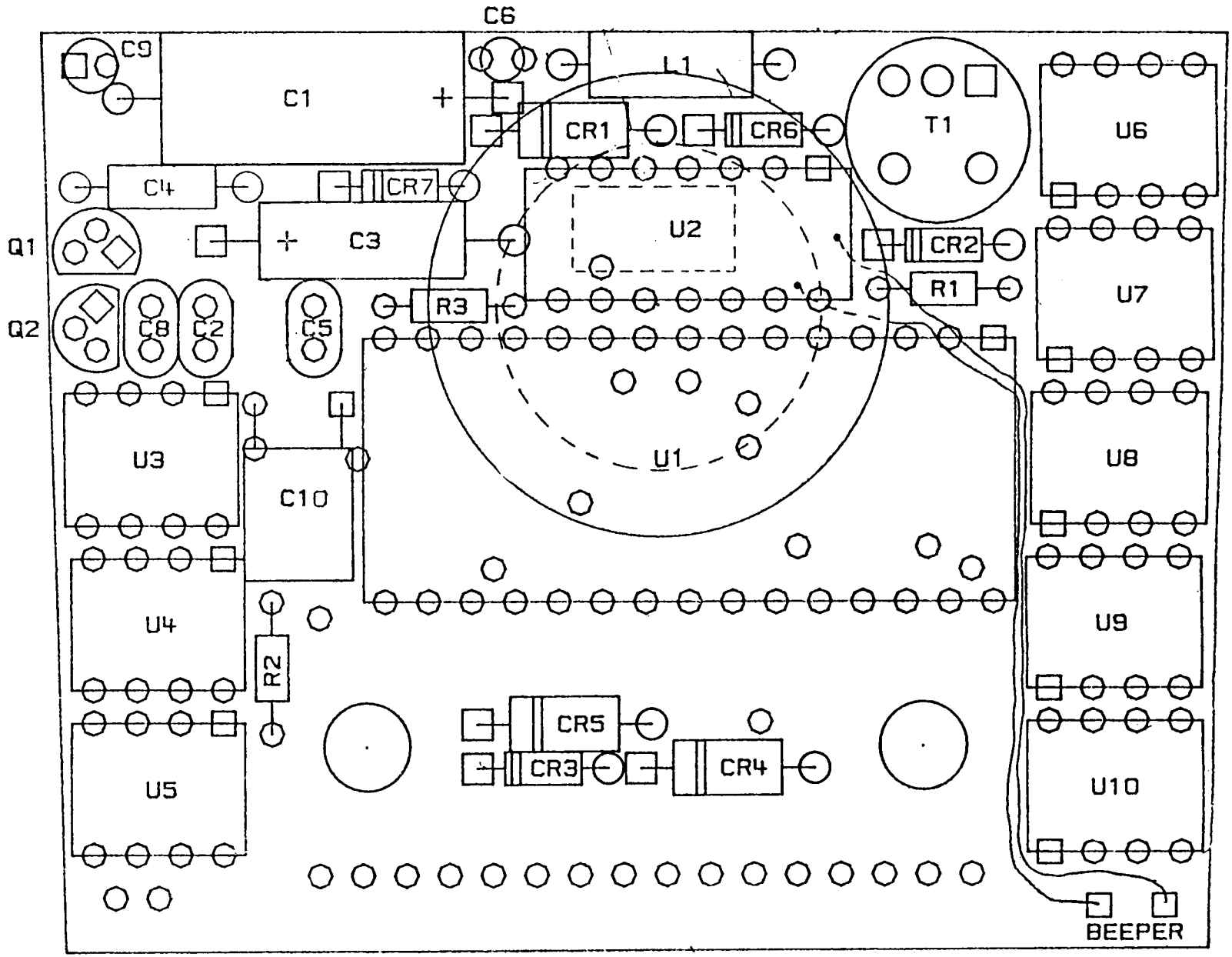
Sincerely,

Service Representative

[redacted]

Sincerely,

Service Representative


C6
C9
C1
L1
CR1
CR6
T1
U6
C4
CR7
U2
CR2
Q1
C3
R1
U7
R3
Q2
C8
C2
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U4
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R2
CR5
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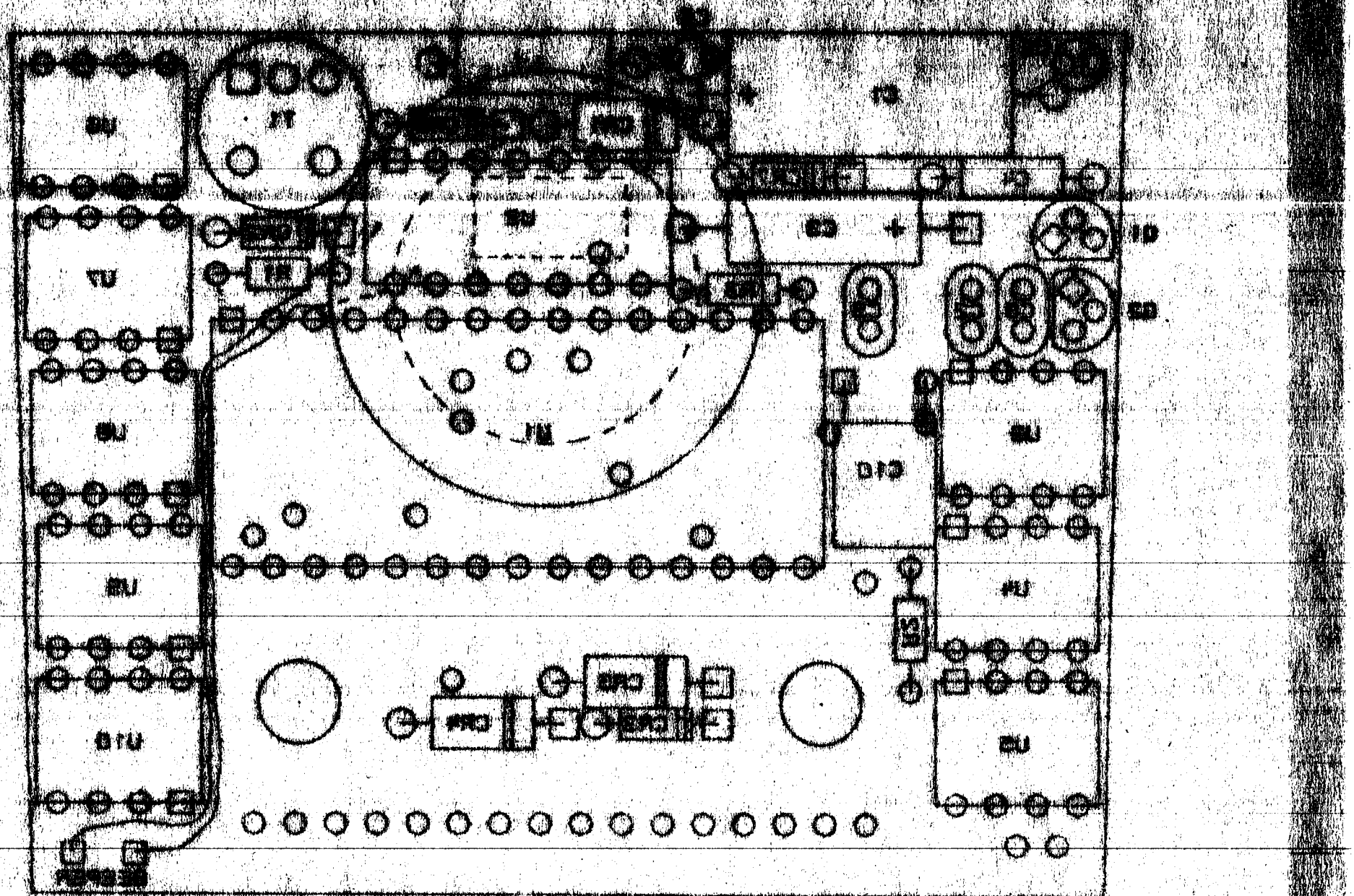
CR4
U5
U10
BEEPER



HEWLETT PACKARD

CORVALLIS DIVISION

SERVICE NOTE

Supersedes:

6/4/81

SUBJECT: SLEEP CURRENT

The following table shows sleep current values for the 41C and 41CV with no modules.

	SLEEP CURRENT	
	Spec.	Typical
41C	15 µa	3 µa
41CV	15 µa	3 µa *

The spec. value is the maximum current drain permissible.

The typical value is an average value. It will vary from unit to unit, depending on the individual I.C.'s. HP-41C's with memory modules will have higher sleep current (as much as 1-2 µa per module).

NOTE: Change Service Note 41C-05 "SLEEP CURRENT" from 8 µa to 3 µa.

* HP-41CV's have fluctuating sleep current. It may vary from 1 µa up to 30-40 µa. However, it should be below 15 µa the majority of the time. This phenomenon is being investigated by Production Engineering to determine the cause. It does not significantly affect battery life.

JA:em

For more information, contact the Service Engineering Manager, Corvallis Division—1000 N.E. Circle Blvd., Corvallis, Oregon 97330
Telephone (503) 757-2000 • TWX # 510-596-0683

Printed in U.S.A.

CORVALLIS DIVISION

SERVICE NOTE

6/4/81

SUBJECT: SLEEP CURRENT

The following table shows sleep current values for the 41C and 41CV with no modules.

SLEEP CURRENT

	Max.	Typical
41C	15 µa	3 µa
41CV	15 µa	3 µa *

The max. value is the maximum current drain permissible.

The typical value is an average value. It will vary from unit to unit, depending on the individual I.C.'s. HP-41C's with memory modules will have higher sleep current (as much as 1-2 µa per module).

* This changes Service Note 41C-[illegible] "SLEEP CURRENT" from 8 µa to 3 µa.

Some units have fluctuating sleep current. It may vary from 1 µa up to 20-40 µa. However, it should be below 15 µa the majority of the time. This phenomenon is being investigated by Production Engineering to determine the cause. It does not significantly affect battery life.

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CORVALLIS DIVISION

82104A-16
**41C-56
**41CV-17

S E R V I C E N O T E

REVISED 12/10/81

SUBJECT: NEW CARD READER ROM 1LB7-0050

DISCUSSION: A NEW CARD READER ROM HAS BEEN MADE TO CORRECT A MINOR SOFTWARE BUG. THE OLD ROM 1LB7-0030 WOULD INTERMITTENTLY CHANGE THE "T" REGISTER AND/OR A RANDOM DATA REGISTER WHEN READING A MULTI-CARD PROGRAM. THE NEW ROM IS FULLY BACKWARDS COMPATIBLE.

**THE NEW ROM ALSO CORRECTS ONE ADDITIONAL PROBLEM. WHEN EXECUTING SIZE OR GTO• (GO TO LINE), INCORRECT ENTRIES CAN BE CANCELLED USING THE BACK ARROW. HOWEVER, WHEN CARD READERS WITH ROMS OF EARLIER VERSIONS THAN THE 1LB7-0050 ARE USED WITH A 41C/CV WITH 1LB7-0038, - 0039, AND -0040 ROMS, A PROBLEM OCCURS. WITH THE CARD READER PLUGGED IN, AN ATTEMPT TO CORRECT THE MOST SIGNIFICANT DIGIT WILL RETURN A DISPLAY WITH "SIZE" OR "GTO•" AT THE RIGHT SIDE OF THE DISPLAY. REPLACING THE CUSTOMER'S CARD READER ROM WITH A 1LB7-0050 WILL CORRECT THIS PROBLEM. IF A CUSTOMER COMPLAINS OF THIS PROBLEM, REPLACE THE CARD READER ROM AND CHARGE WARRANTY.

ACTION TO BE TAKEN:

USE UP YOUR EXISTING STOCK OF 1LB7-0030 ROMS BEFORE ORDERING NEW ROMS.

IF A CUSTOMER COMPLAINS ABOUT THE BUG, REPLACE HIS/HER ROM WITH THE NEW 1LB7-0050 AND CHARGE THE REPAIR TO WARRANTY.

NOTE: TWO OTHER VERSIONS OF THE ROM WERE USED ON EARLY MODELS. SEE SERVICE NOTE 82104A-15 FOR FURTHER INFORMATION.

HL:EM

CORVALLIS DIVISION

[illegible]

SERVICE NOTE

REVISED 12/10/81

SUBJECT: NEW CARD READER ROM 1LB7-0050

SITUATION: A NEW CARD READER ROM HAS BEEN MADE TO CORRECT A MINOR SOFTWARE BUG. THE OLD ROM 1LB7-0020 WOULD INTER- MITTENTLY CHANGE THE "T" REGISTER AND/OR A RANDOM DATA REGISTER WHEN READING A MULTI-CARD PROGRAM. THE NEW ROM IS FULLY BACKWARD COMPATIBLE.

THE NEW ROM ALSO CORRECTS ONE ADDITIONAL PROBLEM. WHEN EXECUTING SIZE OR GTO (GO TO LINE), INCORRECT ENTRIES CAN BE CANCELLED USING THE BACK ARROW. HOWEVER, WHEN CARD READERS WITH ROMS OF EARLIER VERSIONS THAN THE 1LB7-0050 ARE USED WITH A 41C/CV WITH 1LB7-0030, -0037, AND -0040 ROMS, A PROBLEM OCCURS. WITH THE CARD READER PLUGGED IN, AN ATTEMPT TO CORRECT THE MOST SIGNIFICANT DIGIT WILL RETURN A DISPLAY WITH "SIZE" OR "GTO." AT THE RIGHT SIDE OF THE DISPLAY. REPLACING THE CUSTOMER'S CARD READER ROM WITH A 1LB7-0050 WILL CORRECT THIS PROBLEM. IF A CUSTOMER COMPLAINS OF THIS PROBLEM, REPLACE THE CARD READER ROM AND CHARGE WARRANTY.

SOLUTION/ACTION:

USE UP YOUR EXISTING STOCK OF 1LB7-0020 ROMS BEFORE ORDERING NEW ROMS.

IF A CUSTOMER COMPLAINS ABOUT THE BUG, REPLACE HIS/HER ROM WITH THE NEW 1LB7-0050 AND CHARGE THE REPAIR TO WARRANTY.

NOTE: TWO OTHER VERSIONS OF THE ROM WERE USED IN EARLY MODELS. SEE SERVICE NOTE [illegible] FOR FURTHER INFORMATION.

S E R V I C E N O T E

REVISED 7/23/82

SUBJECT: 41C/CV DISPLAY ASSEMBLY PARTS CHANGE

DISCUSSION: THE 41C/CV DISPLAY ASSEMBLY HAS GONE THROUGH A NUMBER OF CHANGES. THE FOLLOWING IS AN ACCURATE UP TO DATE LISTING OF THE CHANGES.

A. ORIGINAL DISPLAY ASSEMBLY (00041-60005)

THE ORIGINAL DISPLAY ASSEMBLY CONSISTED OF THE FOLLOWING PARTS:

LCD	1PT1-0001
LOCATOR	00041-40065
DDH	00041-60090
CONNECTOR	1251-5400

B. MAY 5, 1980 - DISPLAY ASSY P/N CHANGE.

THE ORIGINAL DISPLAY ASSEMBLY PART NUMBER 00041-60005 WAS CHANGED TO 00041-60912 DUE TO A PRODUCTION CHANGE. THE ASSEMBLY PHYSICALLY DID NOT CHANGE.

C. MAY 6, 1980 - DIFFERENT LCD AVAILABLE (1990-0761).

A NEW LCD BECAME AVAILABLE (1990-0761) THAT WAS MADE BY HITACHI. THE ORIGINAL LCD (1PT1-0001) WHICH WAS MADE BY HP WAS DELETED.

D. MARCH 25, 1981 - NEW DISPLAY CLIPS.

THE OLD DISPLAY CLIPS (00041-00013) WERE REPLACED BY NEW DISPLAY CLIPS (00041-00014). THESE NEW CLIPS WERE EASIER TO INSTALL.

E. MAY 8, 1981 - NEW DISPLAY CONNECTORS AND LOCATORS.

THE AMPLEFLEX CONNECTOR (1251-5400) USED WAS CHANGED TO AN ELASTOMERIC TYPE (1251-7207). THE OLD LOCATOR (00041-40065) WAS ALSO CHANGED. THE NEW LOCATORS PART NUMBER WAS (00041-40103).

F. JUNE 1981 - NEW LCD (1990-0818) AND LOCATOR (00041-40193).

THE OLD LCD (1990-0761) WAS REPLACED BY A LESS EXPENSIVE LCD (1990-0818). THE NEW LCD WAS POLYMER SEAL TYPE WITH LARGER DIMENSIONS THAN THE OLD LCD. THE NEW LCD ALSO REQUIRED A LARGER LOCATOR (00041-40143) THAN THE OLD LOCATOR (00041-40103). THE NEW LCD TOGETHER WITH THE NEW LOCATOR WERE REVERSE COMPATIBLE. HOWEVER, THEY WERE NOT REVERSE COMPATIBLE WHEN USED SEPARATELY.

G. JUNE 28, 1982 - NEW LCD (1990-0798) LOCATOR (00041-40147), AND DISPLAY DRIVER HYBRID (DDH) (00041-60147).

THE OLD LCD WAS REPLACED BY A HIGHER QUALITY, AND WIDER LCD. IT TOO IS A POLYMER SEAL TYPE. BECAUSE OF ITS INCREASED WIDTH, A NEW LOCATOR, AND DDH ARE USED.

	OLD	NEW
LCD	1990-0761	1990-0798
LOCATOR	00041-40103	00041-40147
DDH	00041-60090	00041-60147
CONNECTORS	1251-7207	1251-7207

THE NEW LCD (1990-0798) IS ONLY FORWARD COMPATIBLE, WHILE THE NEW LOCATOR (00041-40147) AND DDH (00041-60147) ARE BOTH FORWARD/BACKWARD COMPATIBLE. THE FOLLOWING TABLE DESCRIBES THE COMPATIBILITY OF THE THREE DIFFERENT DISPLAYS.

NEW LCD (1990-0798)

LOCATOR	/ DDH	/CONNECTORS
00041-40147	/ 00041-60147	/ 1251-7207

INTERIM LCD (1990-0818)

LOCATOR	/ DDH	/CONNECTORS
00041-40143	/ 00041-60090	/ 1251-7207
00041-40143	/ 00041-60147	/ 1251-7207

OLD LCD (1990-0761)

LOCATOR	/ DDH	/CONNECTORS
00041-40147	/ 00041-60147	/ 1251-7207
00041-40103	/ 00041-60090	/ 1251-7207
00041-60065	/ 00041-60090	/ 1251-5400

DUE TO THE INCREASED WIDTH OF THE NEW LCD (1990-0798), IT CANNOT BE USED WITH THE OLD DDH AND/OR LOCATORS.

AUGUST 2, 1982 - DISPLAY CLIP CHANGE

THE OLD DISPLAY CLIP (P/N 00041-00014) HAS BEEN REPLACED BY A NEW CLIP (P/N 1600-1350). THE NEW CLIP COSTS LESS THAN THE OLD CLIP.

7/23/82

ACTION TO BE TAKEN:
USE UP EXISTING STOCK OF THE "OLD" AND "INTERIM" DISPLAY ASSEMBLY PARTS. WHEN THESE PARTS ARE GONE, USE THE FOLLOWING NUMBERS WHEN ORDERING DISPLAY REPLACEMENT PARTS.

DISPLAY CLIP	1660-1350
LCD	1990-0798
LOCATOR	00041-40147
DDH	00041-60147
CONNECTORS	1251-7207

PLEASE MAKE THESE CHANGES TO YOUR SERVICE MANUAL. BE SURE TO USE ONLY PERMISSIBLE COMBINATIONS OF LCD'S, LOCATORS, DDH'S, AND CONNECTORS TO INSURE PROPER CONTACT THROUGHOUT THE DISPLAY ASSEMBLY. THE NEW DISPLAY CLIPS WILL WORK WITH ALL PERMISSABLE COMBINATIONS OF DISPLAY PARTS.

HL:EM

CORVALLIS DIVISION

S E R V I C E N O T E

41C-74
41CV-35

5/10/82

SUBJECT: DISPLAY ASSEMBLY TESTING

DISCUSSION: WHEN DIAGNOSING A PROBLEM WITH THE DISPLAY ASSEMBLY, REPLACE THE DISPLAY CONNECTORS FIRST AND THEN RETEST THE ASSEMBLY. OFTEN THE LCD AND DISPLAY HYBRID ARE NOT AT FAULT FOR A DISPLAY PROBLEM. THIS PROCEDURE HAS SIGNIFICANTLY REDUCED THE NUMBER OF IMPROPERLY DIAGNOSED DISPLAY HYBRIDS FOR THE U.S. REPAIR CENTER. ALWAYS FOLLOW THIS PROCEDURE WHEN MISSING OR EXTRA SEGMENTS ARE OBSERVED ON THE LCD.

FRW:EM

[redacted]

[redacted]

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[redacted]

CORVALLIS DIVISION

S E R V I C E N O T E

41C-77
41CV-38

7/27/82

SUBJECT: NEW POWER SUPPLY (1826-0953)

DISCUSSION: A NEW BI-POLAR POWER SUPPLY HAS BEEN DESIGNED FOR THE 41C/CV. SOME CIRCUITRY HAS BEEN PULLED INTO THE IC WHICH ELIMINATES THE NEED FOR R2 AND R3. THE PART NUMBER IS AS FOLLOWS:

NEW PART NUMBER	OLD PART NUMBER
1826-0953	1826-0566

ACTION TO BE TAKEN:

WHEN EXISTING STOCK OF 1826-0566 IS USED UP BEGIN ORDERING NEW PART NUMBER.

WHEN REPLACING A POWER SUPPLY ON A BOARD WHICH USED THE OLD POWER SUPPLY (1826-0566) YOU MUST REMOVE R2 AND R3. R2 IS A 100K OHM RESISTOR AND R3 MAY BE EITHER A 1 MEG OHM OR 2 MEG OHM RESISTOR.

NOTE: YOU MAY SEE A TENDENCY FOR THE STANDBY TO OSCILLATE SLIGHTLY DUE TO THE NEW POWER SUPPLY. THIS IS NORMAL.

FRW:EM

HEWLETT PACKARD

Section VII
Addendum
to the
HP41C/CV/CX Service Manual
(00041-90472)

Reorder Number
00041-90542

Printed in U.S.A
11/84

HEWLETT
PACKARD

Chapter VII
Addendum
to the
HP41CV/CX Service Manual
(00041-90179)

* 1982 Hewlett-Packard Co.

Printed in U.S.A.
11/82

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Section VII
HP-41 Halfnut Construction

7-1. Introduction

7-2. This section relates to the HP-41C/CV/CX calculators fabricated with the simplified construction technique known as Halfnut. Information in other parts of this manual not specifically replaced by information in this section is still valid.

7-3. Product Information

7-4. The Halfnut construction technique was designed for minimal impact on the HP-41 operating system. The following paragraphs describe the essential unique physical characteristics of units containing Halfnut components.

7-5. The theory of operation in section II of this manual is valid for the Halfnut units with the exception of paragraphs 2-22 through 2-31 describing the display and display driver.

7-6. The display is a new type of LCD. It is driven by a six-way multiplex driver that generates the characters in a slightly different format than is used in earlier displays.

7-7. The difference in the character format and the presence under the glass of a black frame around the display are two characteristics you can use to identify a Halfnut unit without opening it. (Serial numbers can not be relied upon for this purpose since they will be retained even after units have been repaired with Halfnut assemblies.) You should familiarize yourself with these and the following Halfnut characteristics.

7-8. The display driver, power supply, data/storage (RAM), and ROM are all encapsulated in one hybrid IC that is crimped onto the display. The display is installed on the main PCB which is then heat-staked into the top case.

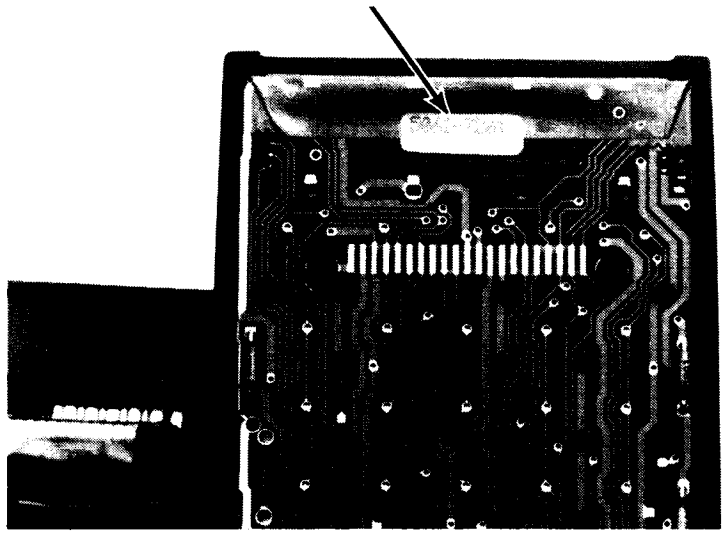

Figure 7-1. Halfnut Display Hybrid IC

7-9. The new CPU is contained in a 44-pin quad flatpack installed on the main PCB.

7-10. The timer, xfun, and xmem enhancements in the HP-41CX calculator are encapsulated in one hybrid IC mounted on a small PCB that is in turn mounted on the main PCB by means of extended solder pins. The only components visible on the bottom of the small PCB are the IC, a 22-megohm resistor, and a small tubular crystal.

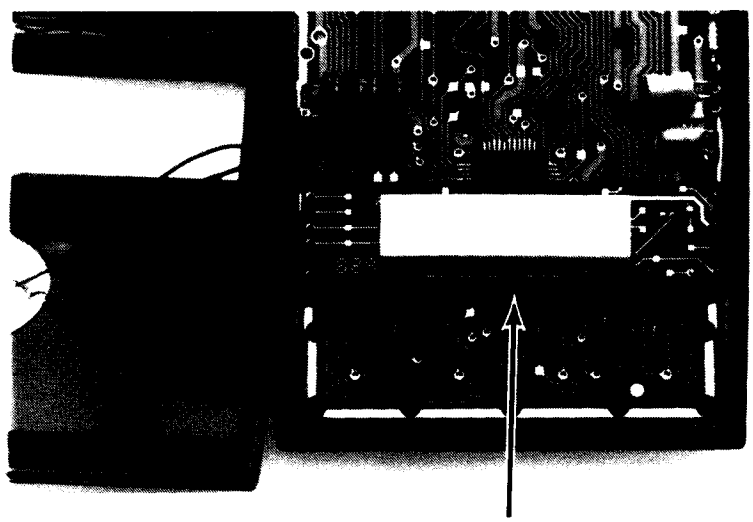

Figure 7-2. Halfnut Enhancement IC

7-11. The alarm has been relocated to the bottom case in all Halfnut units. Two wires connect it to the main PCB.

7-12. Other parts and assemblies of the HP-41s remain the same.

7-13. Repair Philosophy

7-14. The Halfnut units contain considerably fewer replaceable parts than previous versions of the HP-41. You should use only those parts listed in table 7-3 for making repairs.

Note: Except for those part replacements described in this section, no replacements requiring the use of a soldering iron are authorized.

7-15. Initial Repair Evaluation

7-16. You will need to determine as quickly as possible which of the following categories describes the repair you are making:

- Time and materials repair. - Customer damage or battery-corrosion damage.
- Adjustment repair. - No trouble found. Defective batteries or lockup.
- All other repairs. - Repair by throwaway and replacement.

7-17. To verify the problem, go to paragraph 4-6 of section IV, and perform steps a, b, and c.

Note: If you observe a low battery indication during these steps and you are applying power through a port extender, you should apply power through the battery terminals and repeat the tests. You may use a known-good battery pack or an external power supply connected to the terminals. A change in the Halfnut IC design will cause an incorrect low battery indication when power is applied through a port extender.

7-18. If the problem is other than a time and materials or adjustment repair, go to paragraph 7-26. You should record the results of any diagnostic tests you run, in order to help you decide which part you need to replace.

7-19. Troubleshooting and Repair

7-20. Perform the tests and repairs described below.

7-21. In addition to the standard repair tools listed elsewhere in this manual, you will need the items listed in table 7-1. These items are available from CPC or PCE.

Table 7-1. Additional Repair Tools

Corporate Part Number	Manufacturer's Part Number	Description
8690-0353	EC 2000*	Soldering iron, temperature controlled (110V)
8690-0354	EC 2000D	Soldering iron, temperature controlled (220V Europe)
8690-0355	ESK 330*	Soldering iron tip

* - or equivalent to Weller Mfg. Co.

CAUTION

Application of heat from a soldering iron to areas of the PCAs other than those described in these procedures could make it necessary to replace the entire assembly.

There are no approved soldering or unsoldering techniques for ICs or discrete surface-mounted components.

Note: The part number for the 5061-7221 service module has been changed to 00041-60938. The part number for the ET 11966 service module has been changed to 00041-60915. The corresponding modules are fully interchangeable.

7-22. Time and Materials Repairs

7-23. Repairs in this category will consist primarily of cleaning procedures and/or the replacement of damaged parts and assemblies. Cleaning procedures are authorized for the bottom-case, center-case, battery-case, and I/O assemblies and the alarm only. No cleaning procedure has been established for the top case assembly. Parts will be replaced with Halfnut parts and assemblies only. Refer to table 7-3 for applicable part numbers. Refer to paragraph 7-31 for information on disassembly and reassembly procedures.

7-24. Adjustment Repairs

7-25. Repairs in this category may be either charge- or no-charge activities. Clearing of the customer's problem will usually occur during, and often as a direct result of, complaint verification. No further repair action is required. (Refer to appendix C and service notes 41C-16 and 41C-35 for examples of letters which should accompany units returned to the customer when no trouble is found.)

7-26. All Other Repairs

7-27. Review the results of the diagnostic tests you ran during your initial repair evaluation; determine which of the following assemblies is most likely at fault:

- Battery-case assembly.
- Enhancement assembly (timer, xfun, xmem, crystal) (For HP-41CX units only).

- I/O assembly.
- Piezoelectric alarm assembly.
- top case assembly (CPU, ROM, RAM, D/S, power supply, and display)

CAUTION

If you are servicing a unit that may have Halfnut assemblies installed in it and you are required to open the case, be sure to follow the disassembly procedure in paragraph 7-31. Otherwise, you may damage the alarm leads.

7-28. Refer to table 7-2, and replace the indicated assemblies. Repeat the diagnostic test(s) to verify that the fault has been repaired.

7-29. After you make the necessary repairs but before reassembling the unit, you may wish to run the thermal-stress test described in service notes 41C-91, 41CV-52, and 41CX-03. It is not required, however.

7-30. After you have reassembled the unit, you may wish to run the four-hour heat test described in service notes 41C-91, 41CV-52, and 41CX-3. It is not required, however.

7-31. Disassembly and Reassembly

7-32. Perform the following steps to disassemble units containing Halfnut assemblies:

7-33. To Open the Unit:

1. Remove all batteries and I/O port power from the unit.
2. Place the unit on the bench with the keyboard facing down and the I/O ports facing away from you.

Figure 7-3. Opening the Case - Initial Position

3. Using an X-Acto knife, remove the four rubber feet. (Save the feet for reuse if possible.)
4. Remove the four case screws.
5. Carefully remove the bottom case by rotating it along the left-hand side of the calculator (as if you were opening a book).

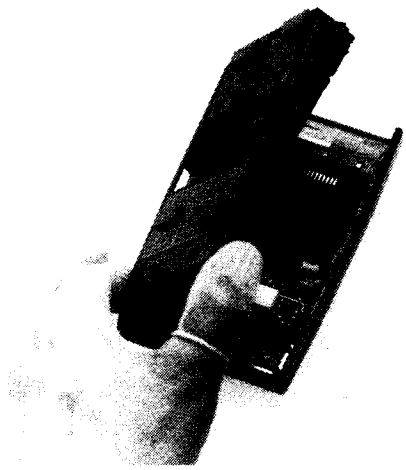

Figure 7-4. Opening the Case - Rotating the Bottom Case

6. Lay the bottom case, outside down, along side the top case.

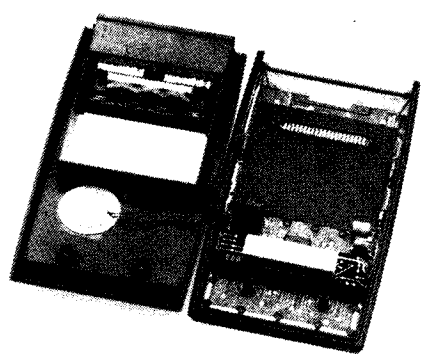

Figure 7-5. Opening the Case—Final Position

7-34. To Remove the Bottom Case

CAUTION

Apply your soldering iron for *no more* than 3 seconds at a time to the main PCA. You must prevent any solder from running through lead holes to the underside of the PCA. Otherwise, solder bridges may be formed that would make necessary the replacement of the entire top case assembly.

7-35. Carefully unsolder the alarm leads from the main PCA. You may use standard soldering tools and techniques to do this.

7-36. To Remove the HP-41CX Enhancement Assembly

CAUTION

You must use extreme care when you disassemble the HP-41CX Enhancement Assembly (P/N 00041-60943). You must also use a soldering iron capable of controlling the tip temperature.

7-37. The assembly is mounted on the top case assembly by means of ten solder pins, five on each end.

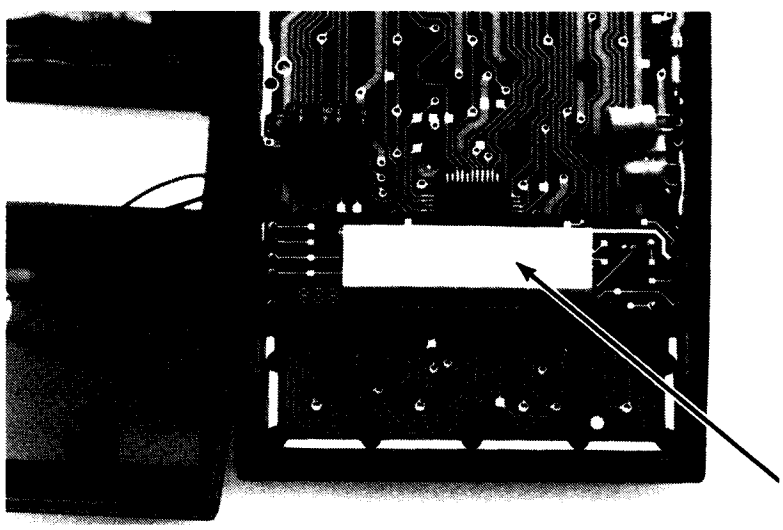

Figure 7-6. The HP-41CX Enhancement Assembly

CAUTION

Under no circumstances should you attempt to unsolder or solder the solder pins at the main PCB. You may damage the main PCB if you do. All soldering of the -60943 assembly should be done on the assembly itself.

1. Make sure your temperature-controlled soldering iron is equipped with a blade-shaped tip 0.600 inch thick.

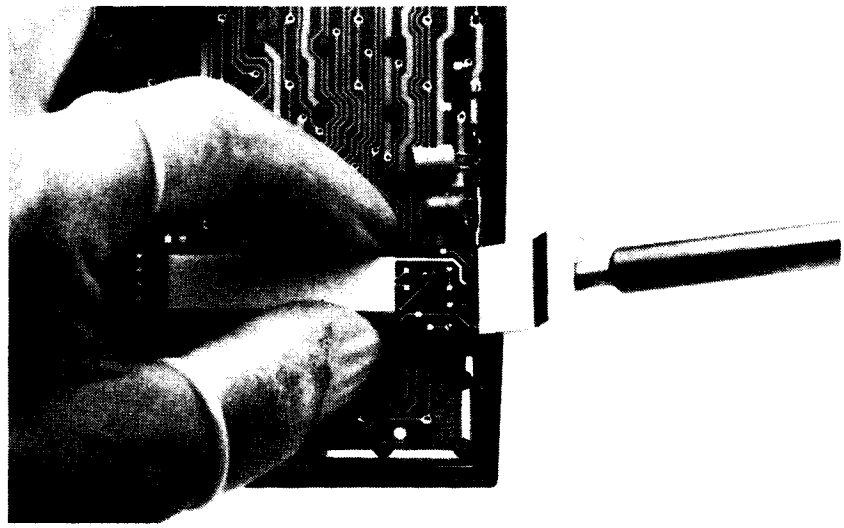

Figure 7-7. Blade-Shaped Soldering Iron Tip in Use

2. Using the blade-shaped tip, apply heat to all five solder pins at once on one end of the 00041-60943 assembly.

CAUTIONS

Heat should be applied for no more than 5 seconds at a time. Tip temperature should not exceed 246±2°C (475±5° F).

If you intend to reinstall the 00041-60943 assembly on another main PCA, you should be very careful to hold it by the edges only. If you touch the components on the bottom of the assembly, contamination from your fingers may cause the assembly to fail.

You should not apply greater force to the assembly than can be applied with the fingers. Never use a tool to pry the assembly away from the solder pins. Damage to the assembly and/or the main PCA may result if you do.

3. As the pins become unsoldered, gently pull the assembly out of contact with the pins.

4. Repeat the process on the pins on the other end of the assembly.

> **Note:** You can remove excess solder from the solder pins after the 00041-60943 assembly has been removed.

Using this procedure for removing the assembly, you are less likely to cause damage than if you use more conventional procedures for unsoldering and desoldering one pin at a time.

7-38. To Replace the HP-41CX Enhancement Assembly

1. Clean the top of the assembly before you install it. (If the assembly has been used before, clean both sides.)

   Note: Isopropyl alchohol is the only approved cleaning fluid you should use. Remove the excess alcohol by spraying the assembly only with freon applied from a pressurized container. *Never* use compressed air for this purpose. The air may contain contaminants.

   If you are using a new assembly, you may omit the cleaning with alchohol.

2. Check the ten solder pins for correct alignment.

   Note: You may make minor adjustments of the pin alignment using needle-nose pliers. If a considerable amount of bending of the pins is required, however, you should replace the top case assembly. If the pins are bent too much, they may crack and fail at a later time.

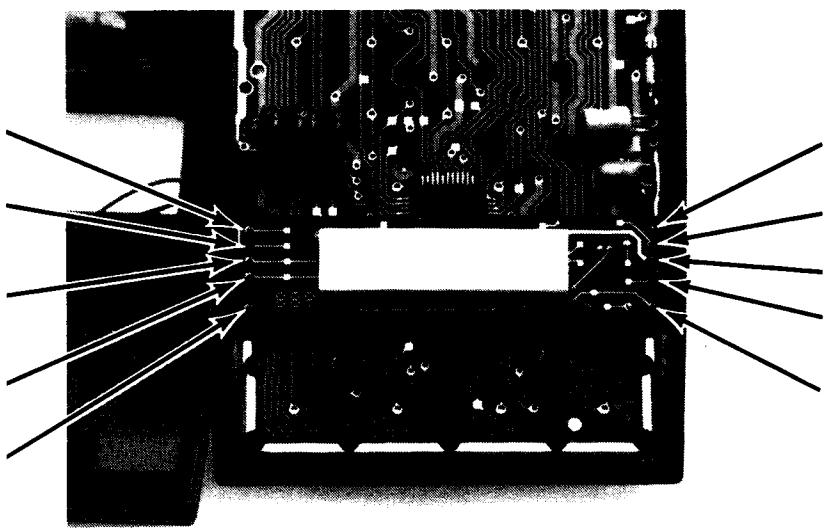

Figure 7-8. 00041-60943 Assembly Standoff Pins

3. Orient the 00041-60943 assembly relative to the main PCA so that the middle plastic standoff pin will not touch the CPU IC on the main PCA. (If the assembly is not aligned correctly, it will not fit properly, and you will not be able to solder the pins correctly.)
4. Resolder each of the ten pins at the surface of the 00041-60943 assembly one at a time. Use a standard-tip soldering iron and neutral flux 63/37 alloy solder. Never heat a pin for more than three seconds at a time.
5. After the soldering is complete, remove flux residue, excess solder or any other contaminants from the top surface only of the assembly. Use isopropyl alcohol and pressurized freon only.

7-39. To Reassemble Units Containing Halfnut Cases

7-40. You may use the procedure in paragraph 3-5 to reassemble the unit.

CAUTION

The alarm is installed in the bottom case, and its leads are attached to the main PCA in the top case. When you reassemble the bottom case on the top case, you must make sure that the leads are not pinched between case sections or, in the HP-41CX, are not trapped between the bottom case and the foam block on top of the 00041-60943 assembly.

Table 7-2. Diagnostic/Replacement Matrix

Diagnostic Test	Action If Test Is Bad
41C/CV Diagnostic Test (Use the 00041-60915 diagnostic module. Refer to paragraph 4-7, pp 4-4 through 4-7, and table 4-3, p 4-24.) **Note:** The character display test is slightly different for Halfnut units. With earlier versions, the last portion of this test showed four trailing blanks; Halfnut units show four characters instead.	If any applicable test in paragraph 4-7 except test 12 is bad, replace the top case assembly.
I/O Port Test (Use the 00041-60940 port extender.)	Replace the I/O assembly. If still bad, replace the top case assembly.
Alarm	Replace the alarm. If still bad, replace the top case assembly.
41CV/CX Diagnostic Test (Use the 00041-60938 diagnostic module. Refer to paragraph 4-12, pp 4-8 through 4-11, table 4-2, p 4-13, and table 4-3, p 4-24.)	
CPU test	Replace the top case assembly.
Alarm test.	Replace the alarm.
Display and keyboard tests.	If "BAT" (low battery indicator) is displayed, and you are applying power through a port extender, apply power through the battery terminals, and repeat the test. If "BAD --" is still displayed, replace the I/O assembly. If "BAD --" is still displayed or other parts of the test are bad, replace the top case assembly.

Table 7-2. Diagnostic/Replacement Matrix (Continued)

Diagnostic Test	Action If Test Is Bad
D/S test	If D/S 6 or 7 is bad, replace the timer-crystal-xfun assembly (HP-41CX only). If any one of the D/S 1 through 5 tests is bad, replace the top case assembly.
ROM test	If ROM 1 is bad, replace the timer-crystal-xfun assembly (HP-41CX only). If any ROM other than ROM 0 is bad, replace the top case assembly.
Memory tests	If MEM 6 or MEM 7 is bad, replace the timer-crystal-xfun assembly (HP-41CX only). If any MEM other than MEM 6 or MEM 7 is bad, replace the top case assembly.
Timer test	If any one of the test results is bad, replace the timer-crystal-xfun assembly (HP-41CX only). If still bad, replace the top case assembly.
Character test **Note:** The character display test is slightly different for Halfnut units. With earlier versions, the last portion of this test showed four trailing blanks; Halfnut units show four characters instead.	If any one of the test results is bad, replace the top case assembly.
Keycode test	If any one of the test results is bad, replace the top case assembly.
I/O Port test (Use the 00041-60940 port extender.)	If any one of the test results is bad, replace the I/O assembly. If still bad, replace the top case assembly.
ROM ID test	For ROM update requests, verify the ROM ID. ROM update requires replacement of the top case.
Frequency test	Replace the timer-crystal-xfun assembly (HP-41CX only).

7-41. Diagrams

7-42. The schematic diagrams for the Halfnut HP-41C/CV/CX are shown in figures 7-9, 7-10, and 7-11, respectively. They are provided for information only since the alarm is the only replaceable discrete component.

7-43. Replaceable Parts

7-44. Replaceable parts for the Halfnut HP-41C/CV/CX are listed in table 7-3.

7-45. An exploded-view drawing of the Halfnut HP-41C/CV/CX is shown in figure 7-12.