

COMPUTER:

APPLE® IIe
MODEL A2S2064



TECHNICAL SERVICE DATA FOR YOUR COMPUTER

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This publication was a series of loose pages folded in half and inserted into an envelope. Many of the diagrams were spread over 2, 3 or even 4 pages. The first part of this reproduction presents the document in page order; I have taken the multi-page diagrams and combined them into single, landscape pages which are attached after the "back cover" (i.e., the back side of the envelope in which this publication was provided.

~drkenb~

PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of Computer malfunctions.

Check all interconnecting cables for good connection and correct hookup before making service checks.

Disconnect all peripherals except the Monitor from the Computer to eliminate possible external malfunctions.

Replacement or repair of the power supply board, main board, disk II interface board, keyboard, or connectors may be necessary after the malfunction has been isolated.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT	TOOLS
Digital Volt/Ohm Meter	Phillips Screwdriver
Logic Probe	Low Voltage Soldering Iron
Frequency Counter	Desoldering Tool
Monitor	Contact Cleaner

REPLACEMENT PARTS AND DESCRIPTION

IDENT PART NO. DESCRIPTION

DISK II INTERFACE BOARD

UA2	IC, SN74LS132N
UA3	IC, Flip/Flop, 74LS174PC
UB2	IC, 74LS05PC
UC2	IC, Latch, N9334N
UC3	IC, Shift Register, SN74LS323N
UD2	IC, Timer, MC3456P
UD3	IC, PROM, 31-0127-A

MAIN BOARD

CR1	LED, Power
F1	Fuse, AC, 2.75A
S1	Switch, Power
SP1	Speaker
UA11	IC, RC741N
UA12	IC, Timer, NE558N
UB1	IC, Tri-State Buffer, SN74LS244N
UB2	IC, Transceiver, 74LS245N

IDENT PART NO. DESCRIPTION

UB5	IC, Decoder/Mux, 74LS138PC
UB8	IC, SN74S02N
UC1	IC, Flip/Flop, 74F109DC
UC4	IC, Microprocessor, R6502-40
UC5	IC, HD74LS10P
UC10	IC, Decoder/Demux, DM74LS154N
UC12	IC, Mux, SN74LS251NDS
UD1	IC, Program Logic Array, HAL16R8CN
UE1	IC, DM74LS125AN
UE4	IC, Memory Management Unit, 344-0010-B
UE5	IC, Input/Output Unit, 344-0020-A
UE8	IC, CD-ROM, 342-0135-B
UE10	IC, EF-ROM, C19659
UE12	IC, Keyboard ROM, 342-0132-B
UE14	IC, Decoder, AY-5-3600-PRO
UF4	IC, Video ROM 342-0133-A
UF5	IC, Shift Register, 74166N
UF6 Thru UF13	IC, RAM, TMS4164-15NLJ
Y1	Crystal, 14.31818MHz

PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS

SEE INTERCONNECTING DIAGRAM AND PHOTOS TO MATCH THE NUMBER IN THE CIRCLES WITH THOSE IN THE FOLLOWING DATA FOR SERVICE CHECKS TO BE PERFORMED.

① COMPUTER DEAD

- (A) If the Power LED (CR1) is not lit, disconnect the Power Supply from Connector J14 and check for 5.3V at pin 3, 12.5V at pin 4, -11.9V at pin 5 and -5.0V at pin 6 of Connector P14. If all the voltages are missing, check AC Fuse (F1), Power Switch (S1) and the AC Line Cord (P20).
- (B) If the Power Supply operates normally, turn Off the Computer and remove any boards plugged into the seven Peripheral Slots (J1 thru J7) or the Auxiliary Connector (J0). Turn the Computer On and check its operation. If the Computer starts functioning, turn the Computer Off and plug each board back into its respective peripheral slot, one board at a time. After each board is reinstalled, turn On the Computer and check its operation. Continue this process until the defective board is found.
- (C) If the Computer does not function with the peripheral boards removed, listen for a beep when turning On the Computer or while pressing the CONTROL and G keys at the same time. A beep indicates the Microprocessor IC (UC4) is working and the problem may be in the video circuits. If a beep is heard, refer to the "Video" section of this Service Checks guide. If there is no beep, check for a momentary Low logic reading, then a High logic reading at pin 40 of IC UC4 while turning On the Computer. If the logic reading is incorrect, check Input/Output Unit IC (UE5) by substitution.
- (D) If pin 40 of Microprocessor IC (UC4) is normal, check for clock pulses at pin 37 of IC UC4 and pin 12 of IC UE1. If pulses are present at IC UE1 and missing at IC UC4, check Flip/Flop IC (UC1), Program Logic Array (UD1), and ICs UE1 and UB8 by substitution.
- (E) If the clock pulses are normal, check the Microprocessor IC (UC4), CD-ROM IC (UE8), EF-ROM IC (UE10) and RAM ICs (UF6 thru UF13) by substitution.
- (F) If the Computer is still inoperative, check Tri-State Buffer IC (UB1), Transceiver IC (UB2), Memory Management Unit IC (UE4) and Input/Output Unit IC (UE5) by substitution.

② VIDEO

- (A) No video display and no beep is heard when the Computer is turned On. Refer to the "Computer Dead" section of this Service Checks guide. If a beep is heard, check the video cable going to the Monitor for good connections and possible open circuits. Also, check the Monitor by substitution.
- (B) Check IC UC5, Input/Output Unit IC (UE5), Video ROM IC (UF4) and Shift Register IC (UF5).

③ NO VIDEO SYNC

- (A) Monitor display rolls vertically and tears horizontally. Check the Input/Output Unit IC (UE5) by substitution.

④ GRAPHICS MODE DOES NOT WORK

- (A) Check Input/Output Unit IC (UE5) and Video ROM IC (UF4) by substitution.

⑤ NO COLOR

- (A) Check the frequency of the 14.31818MHz Oscillator at pin 12 of IC UE1. If the Oscillator is off frequency, check the 14.31818MHz Crystal (Y1) by substitution.
- (B) If the Oscillator is on frequency, check Input/Output Unit IC (UE5) and IC UB8 by substitution.

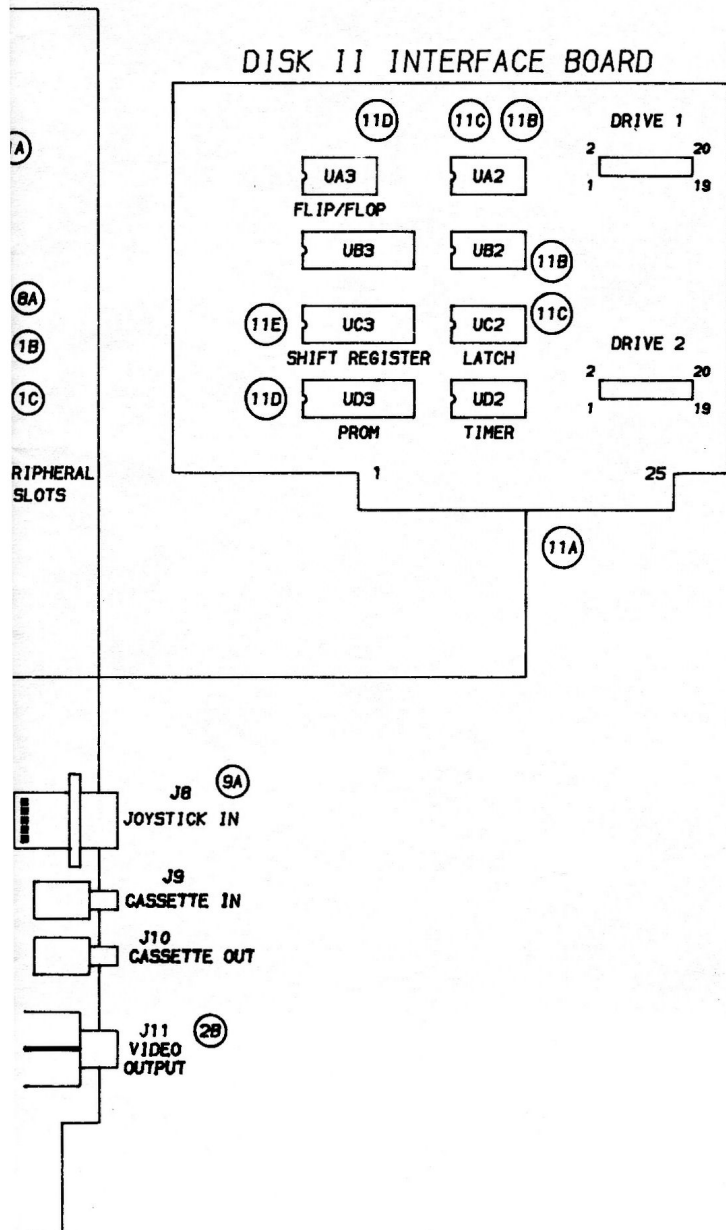
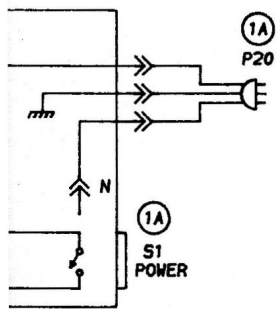
⑥ KEYBOARD

- (A) Keyboard is inoperative. Check the keyboard cable and connectors for good connections.
- (B) If the keyboard cable and connectors are good, check Memory Management Unit IC (UE4), Input/Output Unit IC (UE5), Keyboard ROM IC (UE12) and Decoder IC (UE14) by substitution.
- (C) Wrong character appears on Monitor screen when a key is pressed. Check Keyboard ROM IC (UE12) and Decoder IC (UE14) by substitution.
- (D) Character repeats itself when a key is pressed momentarily or will not repeat when a key is held down. Check Decoder IC (UE14) by substitution.
- (E) A group of keys do not work. Check the keyboard cable and Connector J17A for good connections and check Decoder IC (UE14) by substitution.
- (F) One key does not work or is erratic. Clean the key contacts. If the key still does not work, check the solder connections on the bad key and check the key contact with an ohmmeter.

⑦ NO BEEP FROM SPEAKER

- (A) Computer is functioning but there is no sound from the speaker when the CONTROL and G keys are pressed. Check the Speaker Connector (J18) for good connections and check the Speaker (SP1) voice coil for a resistance of 7.6 Ohms.
- (B) Check Input/Output Unit IC (UE5) by substitution.

PRELIMINARY SERVICE CHECKS (Continued)



INTERCONNECTING DIAGRAM

SERVICE CHECKS (Continued)

8 BOARDS PLUGGED INTO PERIPHERAL SLOTS DO NOT FUNCTION

- Check the edge connectors on the board for dirty contacts. Use a pencil eraser to clean the contacts if dirty.
- Check Decoder/Mux (Multiplexer) IC (UB5), Decoder Demux (Demultiplexer) IC (UC10) and IC UC5 by substitution.

9 JOYSTICKS OR PADDLES DO NOT FUNCTION

- Check Connectors J8 and J15 for good connections.
- Check Timer IC (UA12), Transceiver IC (UB2), Decoder/Mux (Multiplexer) IC (UB5), Decoder/Demux (Demultiplexer) IC (UC10), Mux (Multiplexer) IC (UC12), Memory Management Unit IC (UE4) and IC UB8 by substitution.

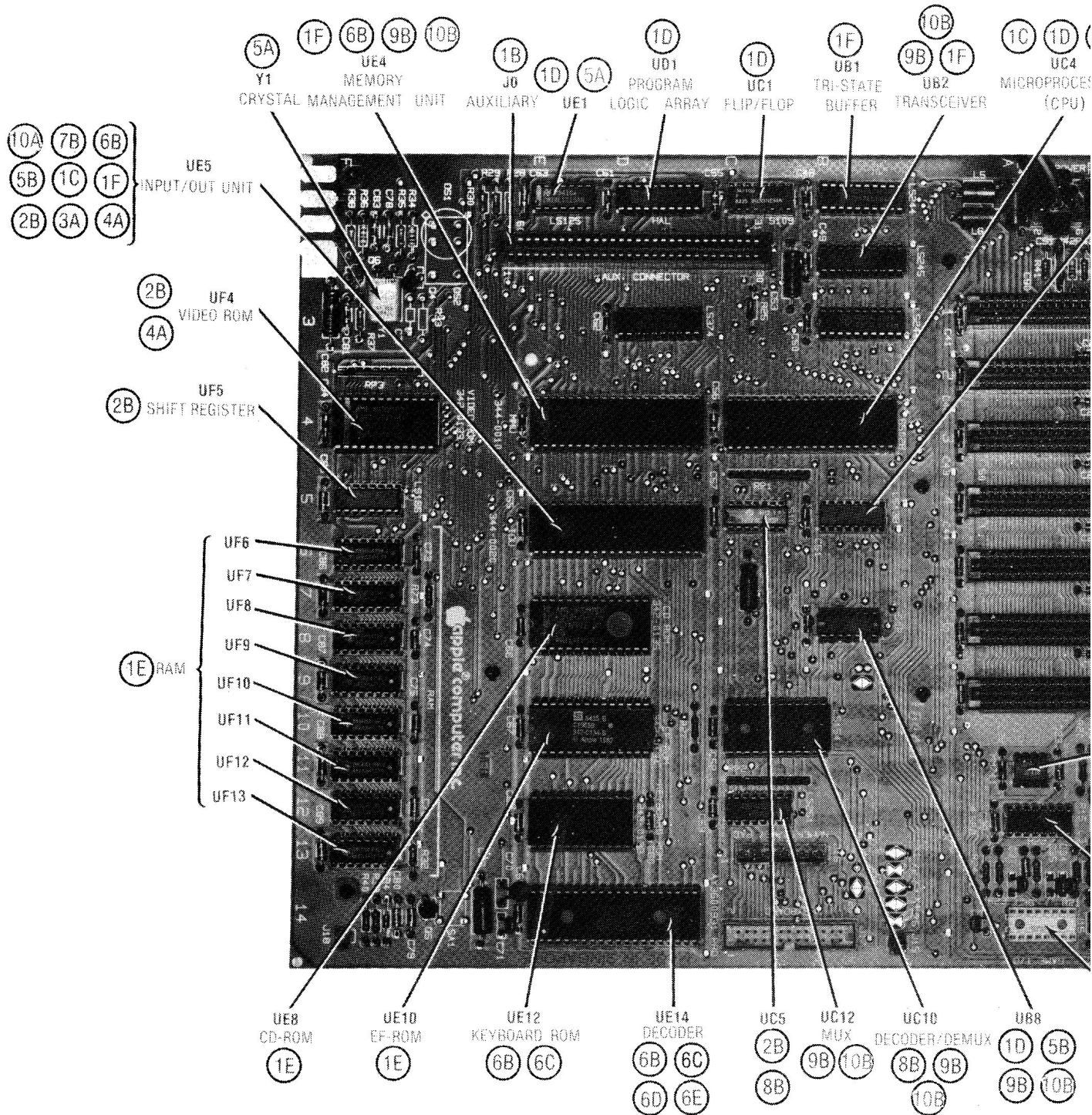
10 CASSETTE

- Computer will not save a program onto tape. Check Input/Output Unit IC (UE5) by substitution.
- Computer will not load a program from tape. Check Transceiver IC (UB2), Decoder/Mux (Multiplexer) IC (UB5), Mux (Multiplexer) IC (UC12), Decoder/Demux (Demultiplexer) IC (UC10), Memory Management Unit IC (UE4) and ICs UA11 and UB8 by substitution.

11 DISK II INTERFACE BOARD

- Disk Drive operation is erratic. Check the two Disk Drive connectors for good connections and check the Disk II interface board edge connector for dirty contacts. Clean the edge connector with a pencil eraser if dirty.
- Disk Drive does not turn On. Check Latch IC (UC2), Timer IC (UD2) and ICs UA2 and UB2 by substitution.
- Will not select proper Disk Drive. Check Latch IC (UC2) and IC UA2 by substitution.
- Read or write problems. Check Flip/Flop IC (UA3), Shift Register IC (UC3), PROM IC (UD3) and IC UA2 by substitution.
- Does not recognize the write protect signal. Check Shift Register IC (UC3) by substitution.

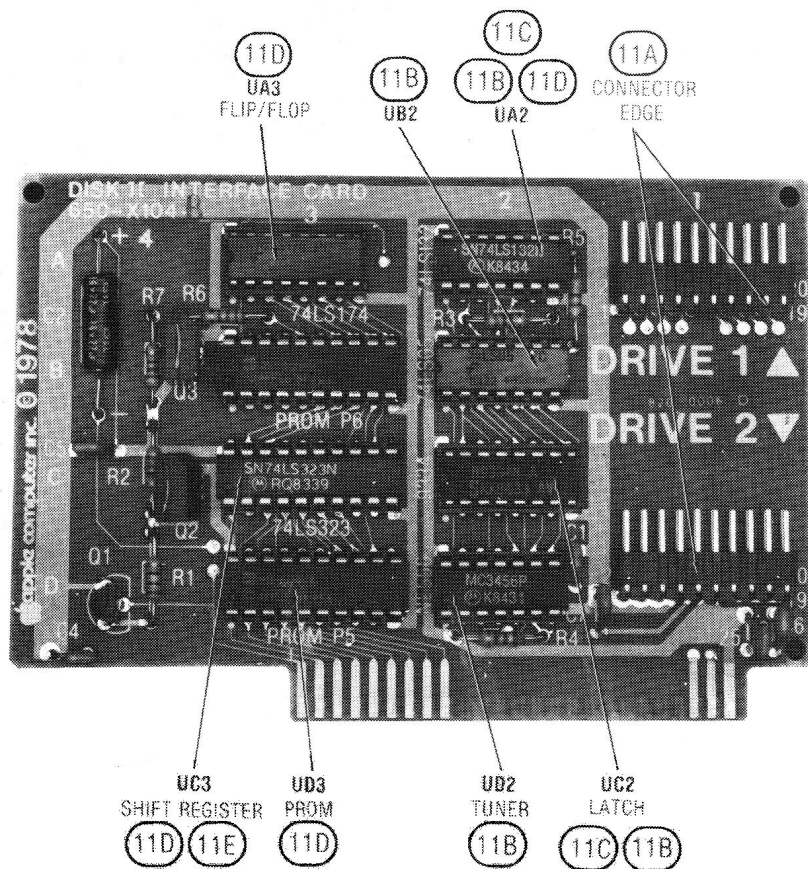
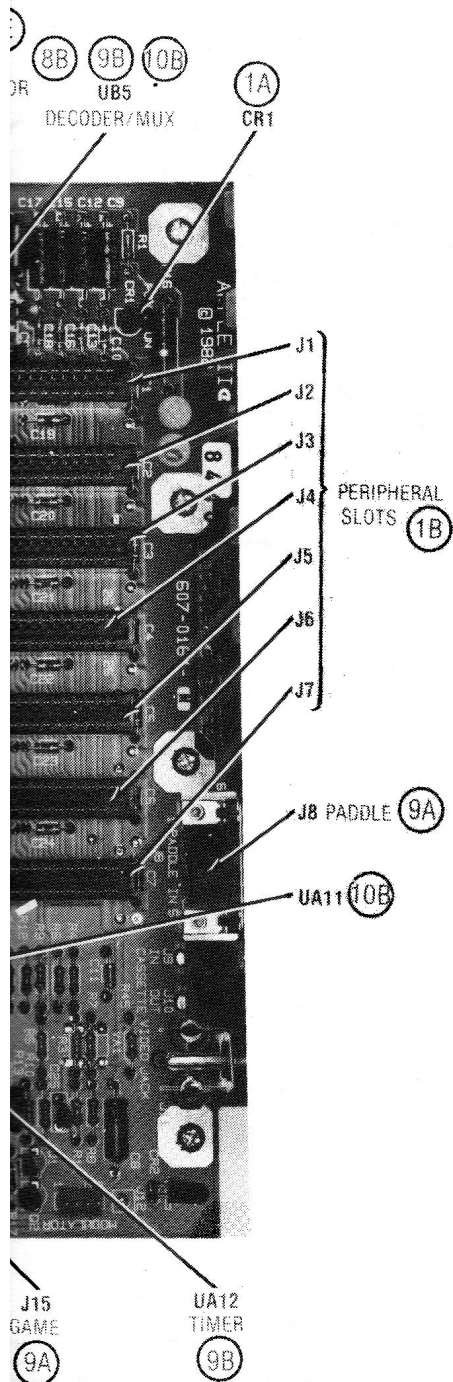
PRELIMINARY SERVICE CHECKS (Continued)



MAIN BOARD

IV

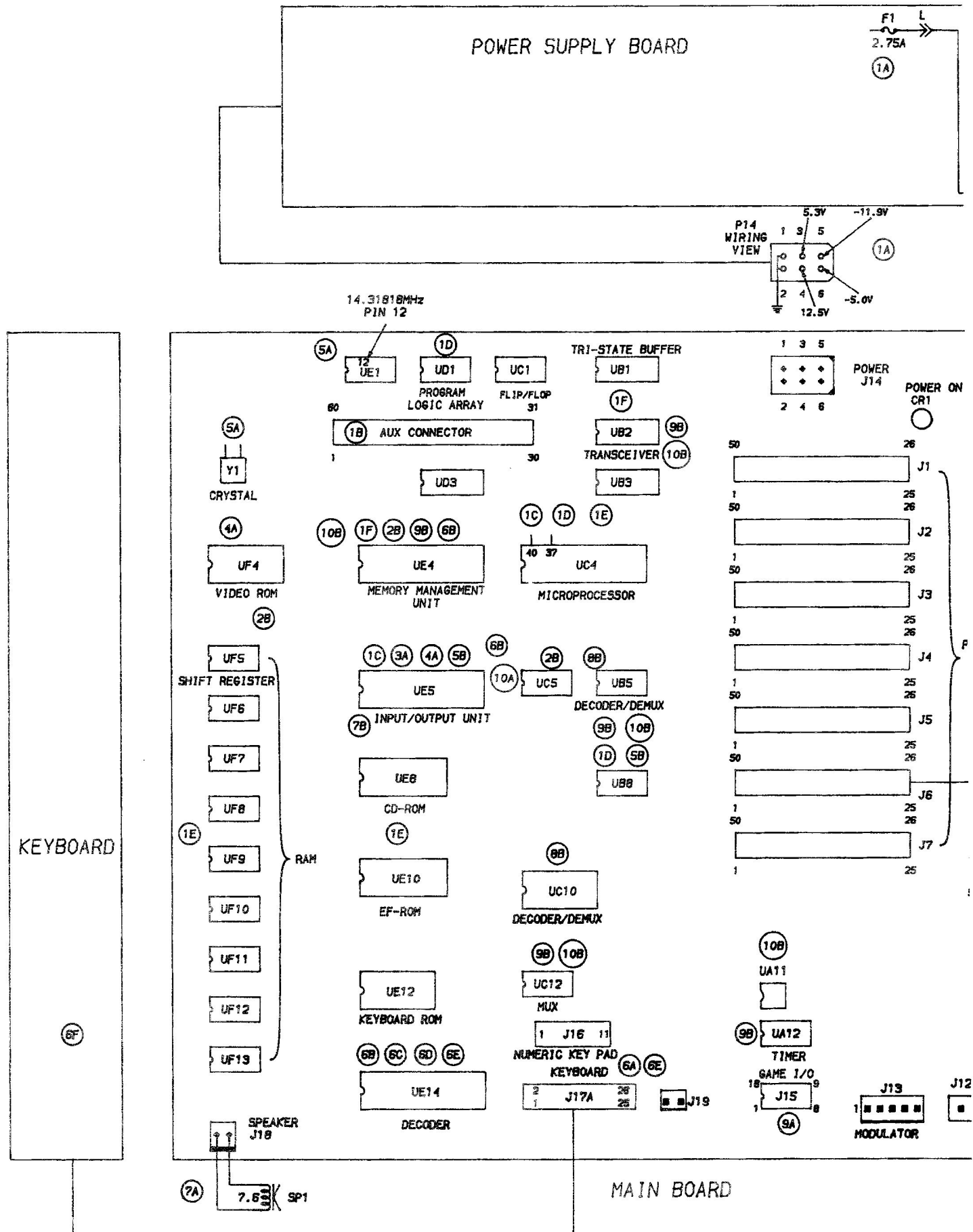
PRELIMINARY SERVICE CHECKS (Continued)



APPLE
MODEL IIe

DISK II INTERFACE BOARD

PRELIMINARY SERVICE CHECKS (Continued)



INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)

PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of any of the Computer system; Computer Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptible power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If the disk drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

APPLE
MODEL IIe
CC10



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MODEL IIe
CC10

SAFETY PRECAUTIONS

See page 30.

PRELIMINARY SERVICE CHECKS

ENCLOSED

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SAMS[™]

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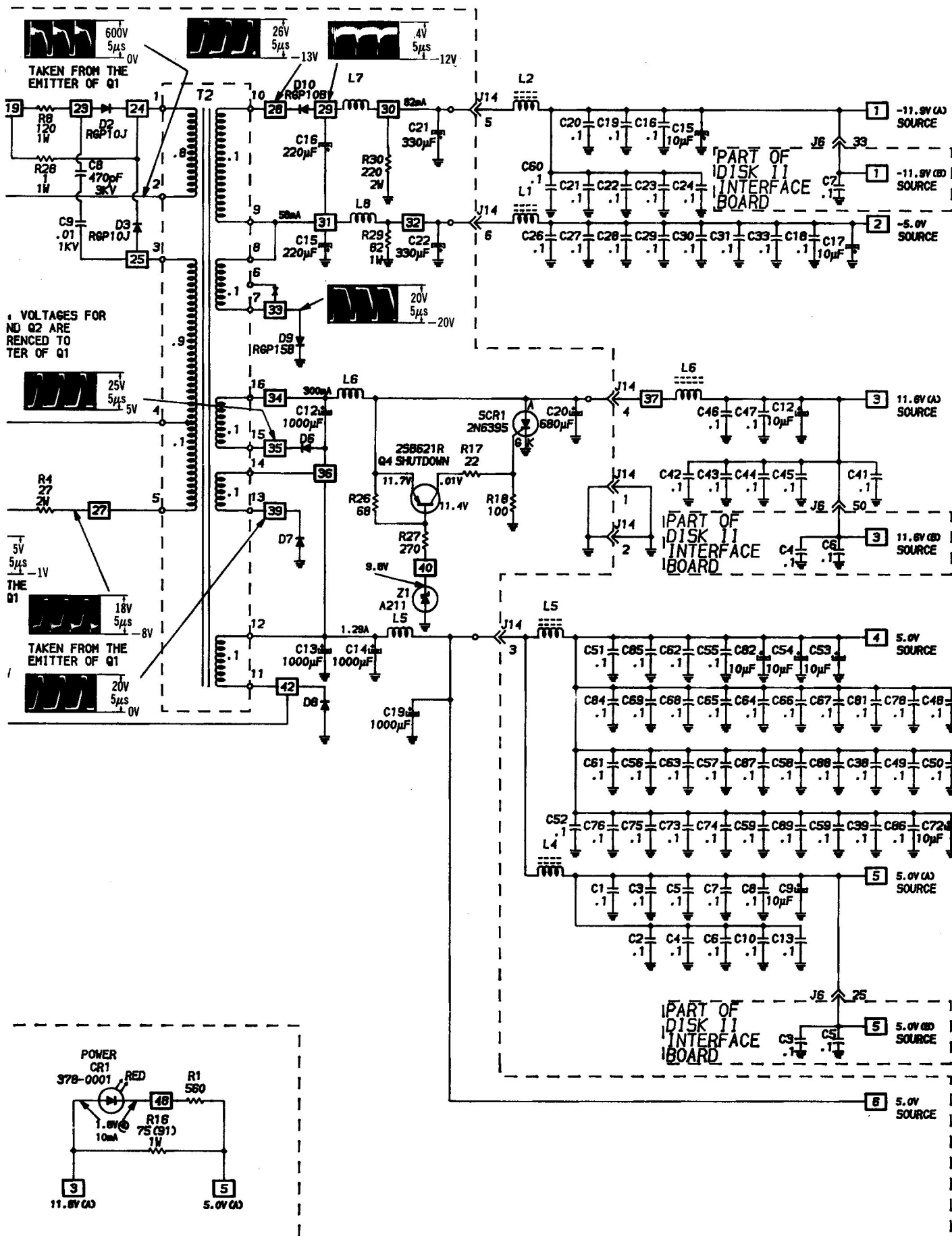
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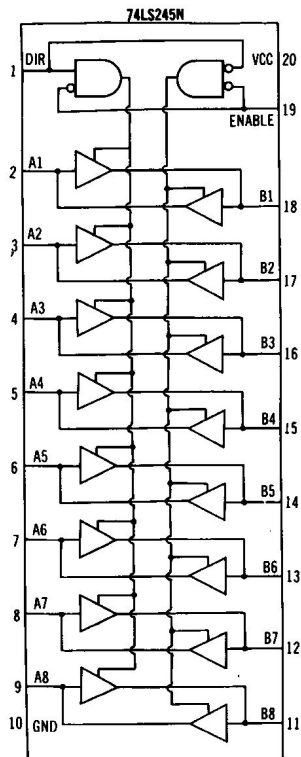
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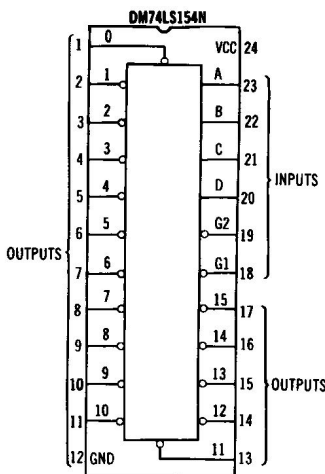
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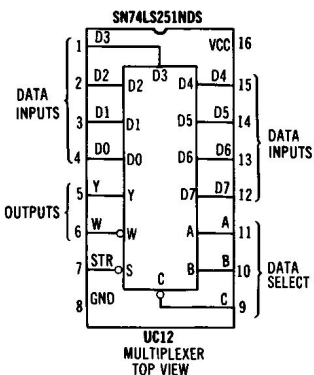
POWER SUPPLY



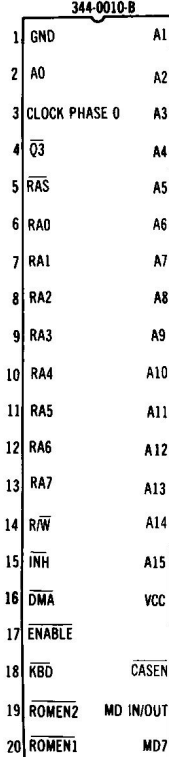
UB2
TRANSCEIVER
TOP VIEW



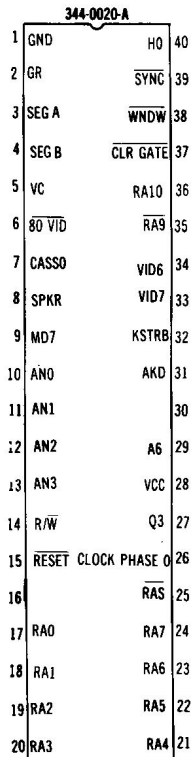
UC10
DECODER/MULTIPLEXER
TOP VIEW



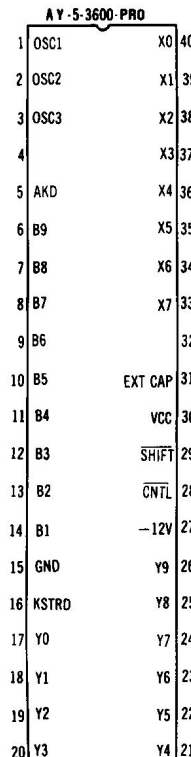
UC12
MULTIPLEXER
TOP VIEW



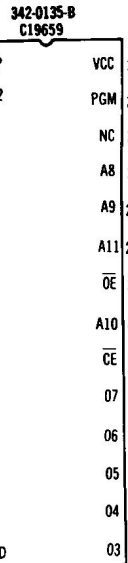
UE4
MEMORY
MANAGEMENT UNIT
TOP VIEW



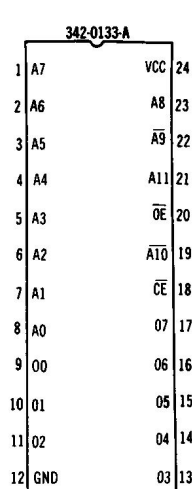
UE5
INPUT/OUTPUT UNIT
TOP VIEW



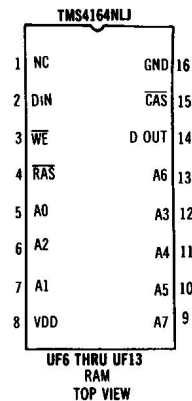
UE14
DECODER
TOP VIEW



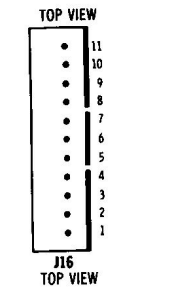
UE8, UE10
CD-ROM, EF-ROM
TOP VIEW



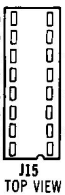
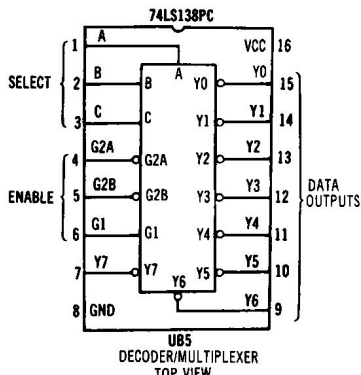
UF4
VIDEO ROM
TOP VIEW



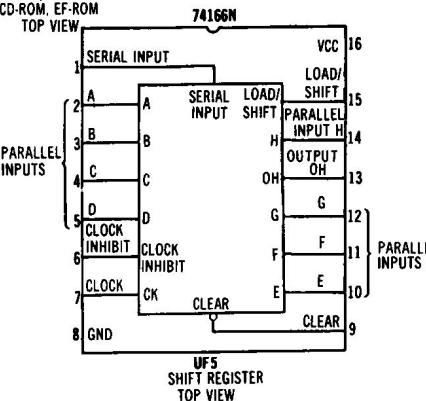
UF6 THRU UF13
RAM
TOP VIEW



TOP VIEW



J15
TOP VIEW



UF5
SHIFT REGISTER
TOP VIEW

GENERAL OPERATING INSTRUCTIONS

POWER UP

The Computer will come up in Basic mode when turned On with no Disk Drive connected. If a Disk Drive is connected the Computer will automatically boot up any bootable diskette that is inserted into the Disk Drive. If no diskette is in the Disk Drive, press the CONTROL and RESET keys at the same time to stop the Disk Drive and put the Computer in Basic mode.

SWITCHING FROM BASIC TO MONITOR MODE

Type CALL-151 and press RETURN key. An asterisk will appear on the Monitor screen indicating the Computer is in the Monitor mode.

SWITCHING FROM MONITOR TO BASIC MODE

Press the CONTROL and C keys at the same time, then press the RETURN key (any Basic program already in memory, before going to the Monitor mode, will remain in memory).

Press the CONTROL and B keys at the same time, then press the RETURN key (any Basic program in memory will be lost).

RESET

Press the CONTROL and RESET keys at the same time to reset the Computer to Basic mode. Press the OPEN APPLE key (located on the left side of SPACE bar), CONTROL key and RESET key at the same time to reboot the system on any bootable diskette in the Disk Drive.

OPERATING THE DISK SYSTEM FROM BASIC MODE (DOS3.3 OR PRODOS)

Type CATALOG and press the RETURN Key to get a list of the programs which are on the diskette. Type CATALOG, D1 for Disk Drive 1 or CATALOG, D2 for Disk Drive 2 if the current disk drive is not the one desired.

Type LOAD and the program name, then press the RETURN key to load a program from the diskette.

Type SAVE and the program name, then press the RETURN key to save a program on the diskette.

BOOTING UP THE DISK OPERATING SYSTEM (DOS)

Insert a diskette containing a DOS into the Disk Drive 1 and turn On the Computer. The Computer will automatically load the DOS and come up in Basic mode if DOS3.3 is used.

If PRODOS is used the Computer will come up with menu of PRODOS features on the Monitor screen.

To boot from Basic mode, type PR#6 or 1N#6 and press the RETURN key. If there is no diskette in the Disk Drive, the Disk Drive will continue to run until a diskette is inserted or the CONTROL and RESET keys are pressed at the same time.

DOS can also be rebooted by pressing the OPEN APPLE key (located on left side of SPACE bar), CONTROL key and RESET key at the same time.

USING BLANK DISKETTES

A blank diskette must be Initialized (DOS3.3) or Formatted (PRODOS) before it can be used to save data. To initialize a diskette using DOS3.3, boot the disk operating system from a diskette containing DOS3.3, remove the DOS3.3 diskette and put the blank diskette into Disk Drive 1. Type INIT HELLO and press the RETURN key. The diskette will be initialized when the drive stops. NOTE: Any previous information on diskette will be over written and lost when initialized.

If PRODOS is being used, select the PRODOS FILER (press F key) from the menu that comes up when PRODOS is booted up. Select Volume Commands (press V key) from the second menu that comes up and then select Format A Volume (press F key) from the third menu that comes up. Insert the blank diskette into the Disk Drive and follow the instructions on the Monitor screen to format the diskette.

CASSETTE OPERATION

NOTE: The following procedure will not work if PRODOS is loaded into the Computer. PRODOS does not support the Cassette input-output ports.

Connect the microphone cable from the Cassette to the Cassette Out Jack on the Computer.

Connect the speaker cable from the Cassette In Jack on the Computer.

To save a Basic program put the Cassette in Record mode, type SAVE and press the RETURN key. The program has been saved when the second beep is heard.

To load a Basic program set the tone control to the high end adjust the volume to just audible. Type LOAD and press the RETURN key. Set the Cassette to the beginning of the program and press the PLAY button on the Cassette. When second beep is heard, the program has been loaded.

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Remove nine screws from cabinet bottom. Lift cabinet top and keyboard from chassis and disconnect keyboard plug.

MAIN BOARD REMOVAL

Release six plastic locking pins and remove four screws holding main board to cabinet bottom. Disconnect speaker

plug and power supply plug from main board and remove board from cabinet.

POWER SUPPLY BOARD REMOVAL

Remove four screws holding power supply to cabinet bottom and remove from cabinet. Remove ten screws, five from each side of power supply case for access to power supply board.

TROUBLESHOOTING

SELF TEST

The Computer has a self test that disables any peripheral boards that are plugged into the main board and tests all programmable memory. To run the self test hold down the CONTROL and SOLID APPLE (located on the right side of space bar) keys and press the RESET key. The Monitor screen will turn white, then black, then white again, then black again and come up with the message "KERNAL OK" if no problems are found. An error message will be displayed on the Monitor screen if a problem is found.

COMPUTER DEAD

NOTE: Turn Off the Computer before inserting or removing boards from the peripheral slots.

No display on the Monitor screen when the Computer is turned On. Check the Power LED (CR1). If LED CR1 is not lit, disconnect the Power Supply Connector (J14) and check for 5.0V at pin 3, 11.7V at pin 4, - 11.9V at pin 5 and - 5V at pin 6 of Connector J14. If the voltages are incorrect, refer to the "Power Supply" section of this Troubleshooting guide.

If the power supply checks normal, remove all the boards plugged into the Auxiliary Connector Slot (J0) or the seven Peripheral Slots (J1 thru J7) and check the Computer operation. If the Computer starts functioning normally after removal of peripheral boards, turn Off the Computer and plug the boards into the peripheral slots one at a time. Re-check the operation until the defective board is found.

If the Computer does not function with all the peripheral boards removed from the slots, listen for a beep from the internal speaker when the Computer is turned On or when the CONTROL and G keys are pressed at the same time. If there is no beep, see the "Microprocessor (CPU) Operation" section of this Troubleshooting guide. If there is a beep, check the cable from the Computer to the Monitor for good connections. If the cable checks normal, refer to the "Video Display" section of this Troubleshooting guide.

POWER SUPPLY

NOTE: Use an isolation transformer when troubleshooting the power supply.

Check the AC Fuse (F1) and if Fuse F1 is open, check AC Line Choke Coil (T1) for a possible short. If Coil T1 is good, check associated components for shorts and check from each lead of Coil T1 to the chassis for shorts. Check for a possible shorted Driver Transistor (Q2).

If Fuse F1 is not open, apply AC power and check for 120VAC between Connector L and N. If 120VAC is missing, check the Power Switch (S1), Coil T1 and the AC Power cord Connector (P21). If 120VAC is present, check for 120VAC across the AC inputs of Diode DB1. If 120VAC is missing, check Coil T1 and Thermistor R1.

If 120VAC is present, check for 330V between the negative and positive output of Diode DB1 and if 330V is missing, replace Diode DB1. If 330V is present, check the waveform at the base of the Oscillator Transistor (Q1). If Transistor Q1 is not oscillating, check the voltages and components associated with the Regulator Transistor (Q3), Regulator IC

(IC1), Transistor Q1 and Driver Transistor (Q2). Also check the windings on Transformers T2 and T3 for continuity.

If the Transistor Q1 is oscillating properly, check the voltages at pins 3, 4, 5 and 6 of Connector J14. If 5.0V at pin 3 of Connector J14 is missing, check Diodes D7 and D8, Coil L5 and Capacitors C13 and C14. Also check the Transformer T2 windings between pin 11 and pin 12 and pin 13 and pin 14 of Transformer T2.

If 11.7V at pin 4 of Connector J14 is missing, check Diode D6, Coil L6, Electrolytics C12 and C20 and winding between pin 15 to pin 16 of Transformer T2 and check Shutdown Transistor (Q4) and SCR SCR1.

If - 5V at pin 6 of Connector J14 is missing, check Diode D9, Coil L8, Electrolytics C15 and C22 and the winding between pin 7 and pin 8 of Transformer T2.

If the - 11.9V at pin 5 of Connector J14 is missing, check Diode D10, Coil L7, Electrolytics C16 and C21 and the winding between pin 9 and pin 10 of Transformer T2.

MICROPROCESSOR (CPU) OPERATION

If the Computer is dead and the power supply is normal, check the logic reading on pin 40 of the Microprocessor (CPU) IC (UC4) when Computer is turned On. The logic reading will be Low for about .1 second then change to High. It should also read Low as long as the CONTROL and RESET keys are held down. If the logic reading is incorrect, check Input/Output Unit IC (UE5) by substitution.

If the reset circuit is working, check the 1MHz clock waveform at pin 37 of IC UC4. If the waveform is missing, check the waveform at pin 14 of Program Logic Array IC (UD1). If the waveform is present at pin 5 of IC UB8 and pin 6 of IC UB8 logic reading is Low, check IC UB8 by substitution. If the waveform is missing at pin 5 of IC UB8, refer to the "Crystal Oscillator and Dividers" section of this Troubleshooting guide.

If the clock waveform at pin 37 of IC UC4 is normal, check for clock pulses at pins 3 and 39 of IC UC4. If the pulses are missing, check IC UC4 by substitution. If the pulses are present, check for a High logic reading on pins 2, 4 and 6 of IC UC4. If any of the logic readings are Low, check the part of Resistor Network RP1 connected to the pin with the Low logic reading. Also check for a possible short to ground and check IC UC4 by substitution.

To check the address lines, turn Off the Computer, remove any peripheral boards plugged into the main board, connect a jumper from pin 2 of IC UB8 to ground, turn On the Computer and check for a Low logic reading on pins 9 thru 20 and 22 thru 25 of IC UC4. If any of the pins do not read correctly, check IC UC4 and the Tri-State Buffer ICs (UB1 or UB3) connected to the bad pin, by substitution. If the address lines on IC UC4 read logic Low, check the buffered address lines, pins 3, 5, 7, 9, 12, 14, 16 and 18 of ICs UB1 or UB3 for a logic Open (No lights On). If any of the buffered address lines read a logic High or Low check by substitution any IC associated with the defective line.

If no problems have been found at IC UC4, check CD-ROM IC (UE8) and EF-ROM IC (UE10), Memory Management Unit IC (UE4) and RAM ICs (UF6 thru UF13) by substitution.

TROUBLESHOOTING (Continued)

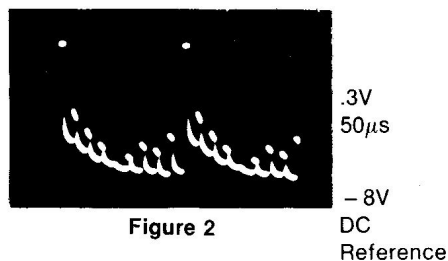
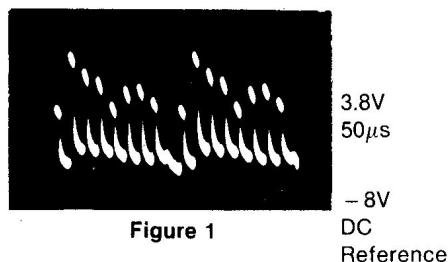
CRYSTAL OSCILLATOR AND DIVIDERS

Check the oscillator frequency (14.31818MHz) at pin 12 of IC UE1. If the oscillator is off frequency, check 14.31818MHz Crystal (Y1). If the oscillator is not working, check the voltages and components associated with Output Transistor (Q4) and Oscillator Transistor (Q6).

If the oscillator is working, check the waveform at pin 11 of IC UE1. If the waveform is missing and pin 13 of IC UE1 logic reading is Low, check IC UE1 by substitution. If the waveform is good, at pin 11 of IC UE1, check for a frequency of 3.5795MHz at pin 10 of Flip/Flop IC (UC1). If the signal is missing or the frequency is incorrect, check IC UC1 by substitution. If the frequency is correct at pin 10 of IC UC1, check the waveforms at pins 14 thru 16 and 19 of Program Logic Array IC (UD1) and pins 6 and 15 of Shift Register IC (UF5). If any of the waveforms are missing, check IC UD1 by substitution.

KEYBOARD

If Computer comes up properly but the keyboard is dead or has no response when any key is pressed, check Connector J14 and the cable from the keyboard to the main board for good connections. If the cable and connectors are normal, check for -11.9V at pin 27 of the Decoder IC (UE14). If -11.9V is missing, refer to the "Power Supply" section of this Troubleshooting guide. If -11.9V is present, check the waveform at pin 1 of IC UE14. If the waveform is missing, check Capacitor C70, Resistor R32 and check IC UE14 by substitution. If the waveform is present at pin 1 of IC UE14, check the waveforms on pins 16 thru 26 and 33 thru 40 of IC UE14. The waveforms on pins 17 thru 26 should look similar to the waveform shown in Figure 1 and the waveforms on pins 33 thru 40 should look similar to Figure 2.



If any waveform is missing, check IC UE14 by substitution. If the waveforms are present, check the logic readings on pins 5 and 16 of IC UE14. Pin 5 logic reading should be High and pin 16 should read a Pulse when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE Keys. If either reading is incorrect, check IC UE14 by substitution. If the readings are correct, check waveform at pin 18 of the Memory Management Unit IC (UE4). If the waveform is missing at pin 18, check the IC UE4 by substitution. If the waveform is present at pin 18 of IC UE4, check IC UE12 and Input/Output Unit IC (UE5) by substitution.

If only one key does not work, check the solder connection on the defective key and check the key for continuity when the key is pressed.

If only one key is erratic, clean the contacts of the defective key. If a wrong character appears on the Monitor screen when a key is pressed, check ICs UE12 and UE14 by substitution.

If a character appears more than once on the Monitor screen when a key is pressed momentarily, check Capacitor C71 and check IC UE14 by substitution.

If a character does not repeat, when a key is held down, check Capacitor C70 and check IC UE14 by substitution.

If any one group of keys do not work, check the keyboard cable and Connector J17A and J17B for good connection and also check IC UE14 by substitution.

VIDEO DISPLAY

No video on the Monitor screen, check the Video Output Jack (J11) and the cable connecting the Computer to the Monitor for good connections. If the cable and connectors are good, check for a 2.5V pp video waveform at the base of Mixer Transistor (Q1). If the waveform is present, check the voltages and components associated with Transistor Q1 and Video Output Transistor (Q2). If the video portion of the waveform is missing, horizontal and vertical sync pulses appear, check for pulses at pin 3 of IC UC5. If pulses are present and pin 4 of IC UC5 logic reading is High, check Resistor R7 and check IC UC5 by substitution. If pulses are missing at pin 4 of IC UC5, check Shift Register IC (UF5), Video ROM IC (UF4) and Input/Output Unit IC (UE5) by substitution.

If a graphics function (low resolution) or flash and inverse video functions do not work, check ICs UE5 and UF4 by substitution.

If the cursor is defective or there is no cursor, check EF-ROM IC (UE10) and IC UF4 by substitution.

VIDEO SYNC

Monitor has no horizontal or vertical sync. Check the Input/Output Unit IC (UE5) by substitution and check Capacitor C25 and Resistors R5 and R10.

COLOR

No color, type and run the following Basic program and check for pulses at pins 11 and 13 of IC UB8.

1 GR: COLOR = 4: HLIN 0.39 AT 20

If pulses are missing at pin 11, check Input/Output Unit IC (UE5) by substitution. If pulses are missing from pin 13 of IC UB8, check Capacitor C32, Coil L3 and check the frequency of 14.31818MHz Crystal (Y1) at pin 12 of IC UE1. If Crystal Y1 is off frequency, check Crystal Y1 by substitution. If pulses are missing from pin 13 of IC UB8, check IC UB8 by substitution.

If colors are incorrect, the above program should produce a green horizontal bar on the Monitor screen. Check the frequency of Crystal Y1 at pin 12 of IC UE1. If Crystal Y1 is off frequency, check Crystal Y1 by substitution. If Crystal Y1 is normal, check ICs UD1 and UE5 by substitution.

TROUBLESHOOTING (Continued)

INTERNAL SPEAKER

If there is no sound from the internal speaker, check the Speaker (SP1). If the speaker checks normal, type and run the following Basic program.

```
1 PRINT CHR$(7): GOTO 1
```

Check for pulses at pin 8 of the Input/Output Unit IC (UE5). If pulses are missing, check IC UE5 by substitution. If pulses are present, check the voltages and components associated with Amp Transistor (Q5).

CASSETTE

Computer will not load a program from the tape but game paddles and switches are working normally. Check the voltages and components associated with IC UA11 and check Mux (Multiplexer) IC (UC12) by substitution.

Computer will not load and there are problems with the game paddles and switches. See "Game Paddles Do Not Function" or "Game Switches (Joysticks) Do Not Function" sections of this Troubleshooting guide.

Computer will not save a program on tape. Check Resistors R6 and R9 and check Input/Output Unit IC (UE5) by substitution.

PERIPHERAL SLOTS

If a board which is plugged into one of the seven Peripheral Slots (J1 thru J7) does not work, check that peripheral slot for damaged or dirty pins or for possible broken solder joints. Use a pencil eraser to clean the contacts of the board if they appear dirty.

See that the peripheral slots pins 1, 20 and 41 that may be used to select the board, are functioning. To do this, run the following Basic program and check for pulses at pins 1, 20 and 41 of the peripheral slots.

```
1 FOR X = - 16255 TO - 16127 STEP 16: Y = PEEK (X):  
  NEXT X  
2 FOR X = - 16128 TO - 14336 STEP 256: Y = PEEK (X):  
  NEXT X  
3 GOTO 1
```

If pulses are missing at pin 1 of any peripheral slot, check Decoder/Mux (Multiplexer) IC (UB5) by substitution. If pulses are missing at pin 20 of any peripheral slot, check IC UC5 by substitution. If pulses are missing at pin 41 of any peripheral slot, check Decoder/Demux (Demultiplexer) IC (UC10) by substitution.

GAME PADDLES DO NOT FUNCTION

Type and run the following Basic program to check the operation of the game paddle circuits.

```
10 FOR Y = 0 TO 3  
20 Z = PDL (Y)  
30 PRINT "PADDLE"; Y, Z  
40 NEXT Y  
50 PRINT  
60 FOR T = 1 TO 500: NEXT T  
70 GOTO 10
```

The program scans all four paddles and displays the paddle number (0 thru 3) on the Monitor screen along with a number that is read from each paddle. The number read from each paddle should vary between 0 and 255 as that paddle is varied from MINIMUM to Maximum positions. If paddles are not available, a 100K potentiometer can be used by connecting one end of the potentiometer to 5.0V (pin 1 of Connector J15) and the center tap to one of the paddle inputs (pins 6, 7, 10 and 11 of J15).

Check Connectors J8 or J15 for good connections. If none of the paddle inputs function, check for pulses at pin 3 of Timer IC (UA12) and pin 7 of Mux (Multiplexer) IC (UC12) while the above program is running. If pulses are missing, check ICs UB5 and UC10 and Memory Management Unit IC (UE4) by substitution. If pulses are present at pins 3 of IC UA12 and pin 7 of IC UC12, check for pulses at pins 1 and 19 of Transceiver IC (UB2) while the above program is running. If pulses are missing at pin 1 of IC UB2, check IC UE4 by substitution. If pulses are missing at pin 19 of IC UB2, check IC UB8 by substitution and check Capacitors C34, C35, C37 and C40 and Resistors R21 thru R24.

GAME SWITCHES (JOYSTICK) DO NOT FUNCTION

Game paddles function but game switches do not function, check the switch input pins, pins 2, 3 and 4 of Connector J15 and pins 1, 6 and 7 of Connector J8, for good connections. If the connections are good, check IC UC12 by substitution.

The following Basic program can be used to check the operation of the switch input circuit.

```
10 Z = 2  
20 PRINT "SOCKET", "X"  
30 FOR Y = - 16287 TO - 16285  
40 X = PEEK (Y)  
50 PRINT "J15 PIN"; Z, X  
60 Z = Z + 1: NEXT Y  
70 FOR T = 1 TO 500: NEXT T  
80 PRINT: GOTO 10
```

The program repeatedly displays on the Monitor screen the input pin number of Connector J15 being checked with a number X associated with the pin number given. The number X should be 127 or less if Connector J15 pin number shown on the Monitor screen is connected to ground (pin 8 of J15) and 128 or more if the pin is connected to 5.0V (pin 1 of J15).

CHECKING GAME I/O STROBE SIGNAL

Type and run the following Basic program and check for pulses at pin 5 of Connector J15. If pulses are missing, check Decoder/Mux (Multiplexer) IC (UB5), Decoder/Demux (Demultiplexer) IC (UC10), Memory Management Unit IC (UE4) by substitution.

```
1 X = PEEK (- 16320): GOTO 1
```

TROUBLESHOOTING (Continued)

DISK II INTERFACE BOARD

If the disk II interface board is not working, check the Disk Drive Connectors (J1 and J2) and Edge Connector J6 for good connections. If the Edge Connector J6 contacts appear dirty, use a pencil eraser to clean them.

If the connectors are normal, check the logic reading at pin 5 of Timer IC (UD2) while turning On the Computer. The logic reading should be High for about .1 second then change to Low. If the reading is incorrect, check Capacitor C1, Resistor R4 and check IC UD2 by substitution.

If IC UD2 circuitry checks normal, turn Off the Computer. Disconnect the Disk Drives from the disk II interface board and plug the disk II interface board into Peripheral Slot (J6). Turn On the Computer, press the CONTROL and RESET keys at the same time to get the Computer into the Basic mode. Type and run the following Basic program. All tests made from this point should be made while the program is running. Press the CONTROL and RESET keys at the same time to stop the program.

DISK II INTERFACE TEST PROGRAM

```
10 X = PEEK ( - 16151)
20 X = PEEK ( - 16149)
30 X = PEEK ( - 16148)
40 X = PEEK ( - 16146)
50 X = PEEK ( - 16145)
60 X = PEEK ( - 16147)
70 FOR Y = - 16153 TO - 16160 STEP - 1
80 X = PEEK (Y)
90 NEXT Y
100 X = PEEK ( - 14608): GOTO 20
```

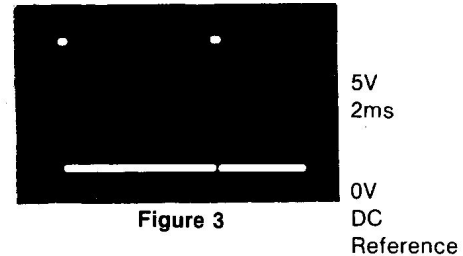
Check for a High logic reading at pin 9 of IC UD2. If the logic reading is not High, check for a High logic reading at pin 9 of Latch IC (UC2). If the logic reading is not High at IC UC2, check IC UC2 by substitution. If the logic reading is High at IC UC2 check for a Low logic reading at pin 6 of IC UB2. If the logic reading is not Low at IC UB2, check IC UB2 by substitution. If the logic reading is Low at IC UB2, check IC UD2 by substitution.

If the logic reading is High at pin 9 of IC UD2, check for 4.9V at pin 16 of Flip/Flop IC (UA3). If 4.9V is missing, check for a Low logic reading at pin 10 of IC UB2. If the reading is not Low at IC UB2, check IC UB2 by substitution. If the reading is Low at IC UB2, check Resistor R6 and R7 and Switch Transistor (Q3).

If 4.9V is present at pin 16 of IC UA3, check for pulses at pin 20 of PROM IC (UD3). If pulses are missing, check Driver Transistor (Q1) and Switch Transistor (Q2) and Resistors R1 and R2.

If pulses are present at pin 20 of IC UD3, check the waveform at pin 3 of IC UA2. If the waveform is missing, check IC UA2 by substitution.

Check the Head Position Motor Outputs (pins 4, 5, 6 and 7 of IC UC2) by checking for the waveform shown in Figure 3 at pins 4, 5, 6 and 7 of IC UC2. If any of the waveforms are incorrect, check IC UC2 by substitution.



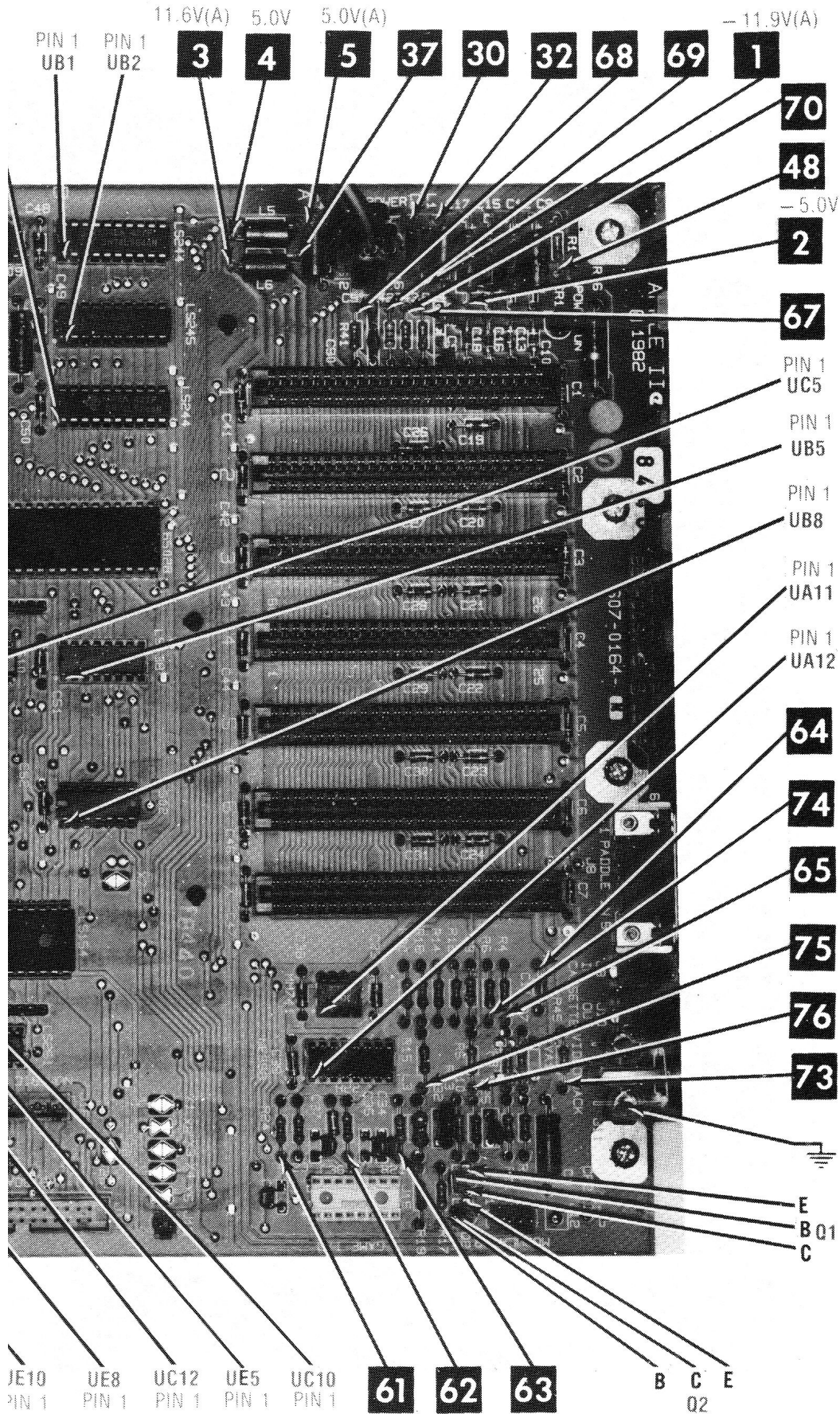
The Disk II Interface Test Program enables Disk Drive 2, pin 6 of IC UA2 logic reading should be Low and pin 10 of IC UC2 logic reading should be High. To enable Disk Drive 1, change the number - 16149 in line 20 to - 16150 and run the program. Pin 8 of IC UA2 and pin 10 of IC UC2 logic reading should be Low with Disk Drive 1 enabled. If the logic reading at pin 10 of IC UC2 is not Low, check IC UC2 by substitution. If the reading at pin 6 or pin 8 of IC UA2 is not Low, check ICs UA2, UD2 and UB2 by substitution.

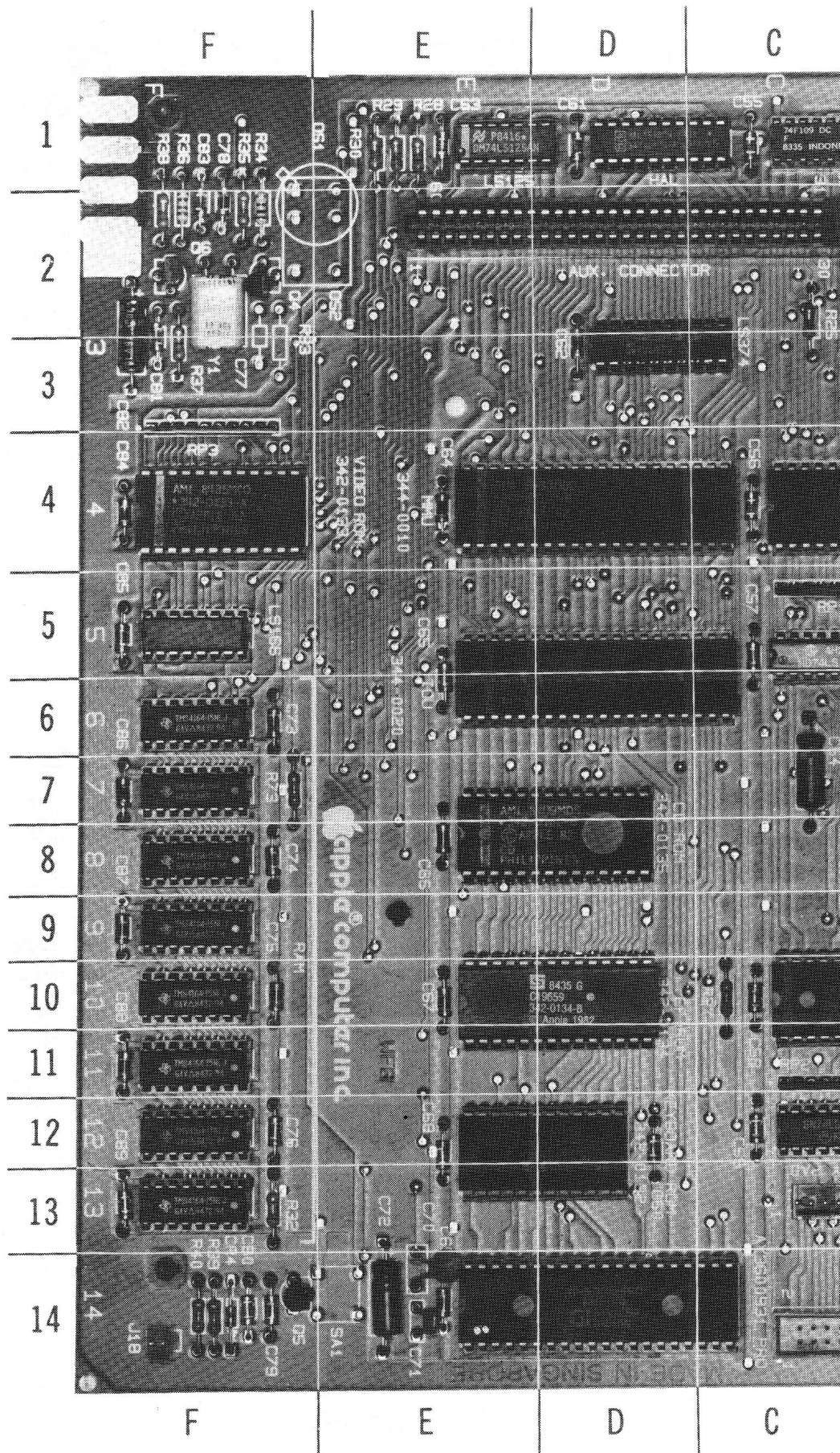
To check the write and read circuits, turn Off the Computer, connect two Disk Drives to the disk II interface board and plug the board into Peripheral Slot (J6). Type and run the Disk II Interface Test Program. Check for pulses on pin 4 of IC UB2 and at pins 11 and 12 of IC UC2. If pulses are missing at pin 4 of IC UB2 and present at pin 12 of IC UC2, check IC UB2 by substitution. If pulses are missing at pins 11 or 12 of IC UC2, check IC UC2 by substitution. If pulses are present at pins 11 and 12 of IC UC2 and the disk II interface board still has write problems, check A3 and PROM IC (UB3) by substitution.

If the disk II interface board has read problems, check for pulses at pins 10 and 11 of IC UA3. If pulses are missing at pins 10 or 11 of IC UA3, check IC UA3 by substitution. If pulses are present at pins 10 and 11 of IC UA3, check for pulses at pins 12 and 11 of IC UA2. If pulses are missing at pin 12 of IC UA2, check IC UB2 by substitution. If pulses are present at pin 12 and missing from pin 11 of IC UA2, check IC UA2 by substitution. If pulses are present at pin 11 of IC UA2, check IC UB3 and Shift Register IC (UC3) by substitution.

If the disk II interface board can not detect the Write Protect signal, pin 11 of IC UC3, when a write protected diskette is being used, check IC UC3 by substitution.

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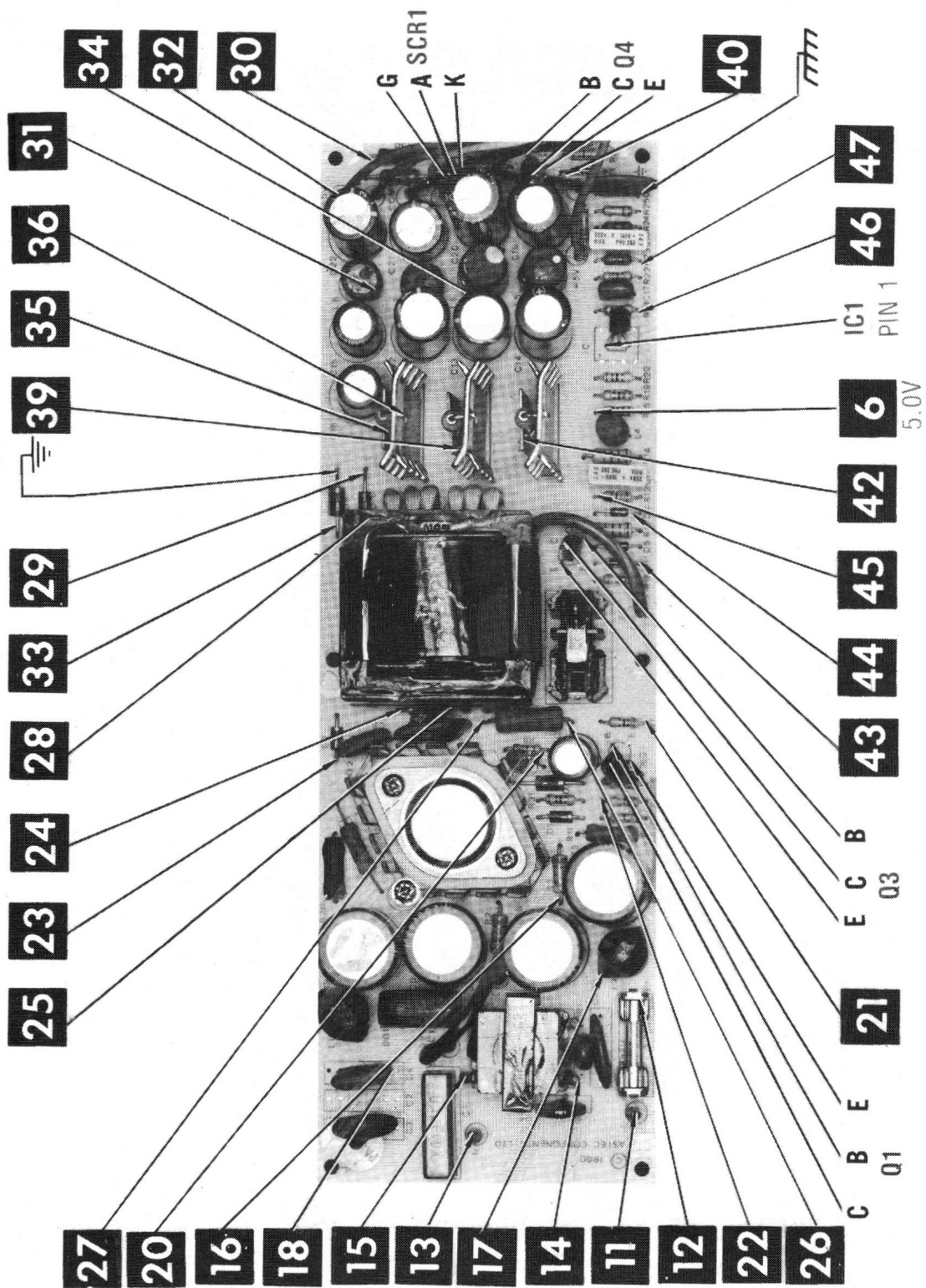




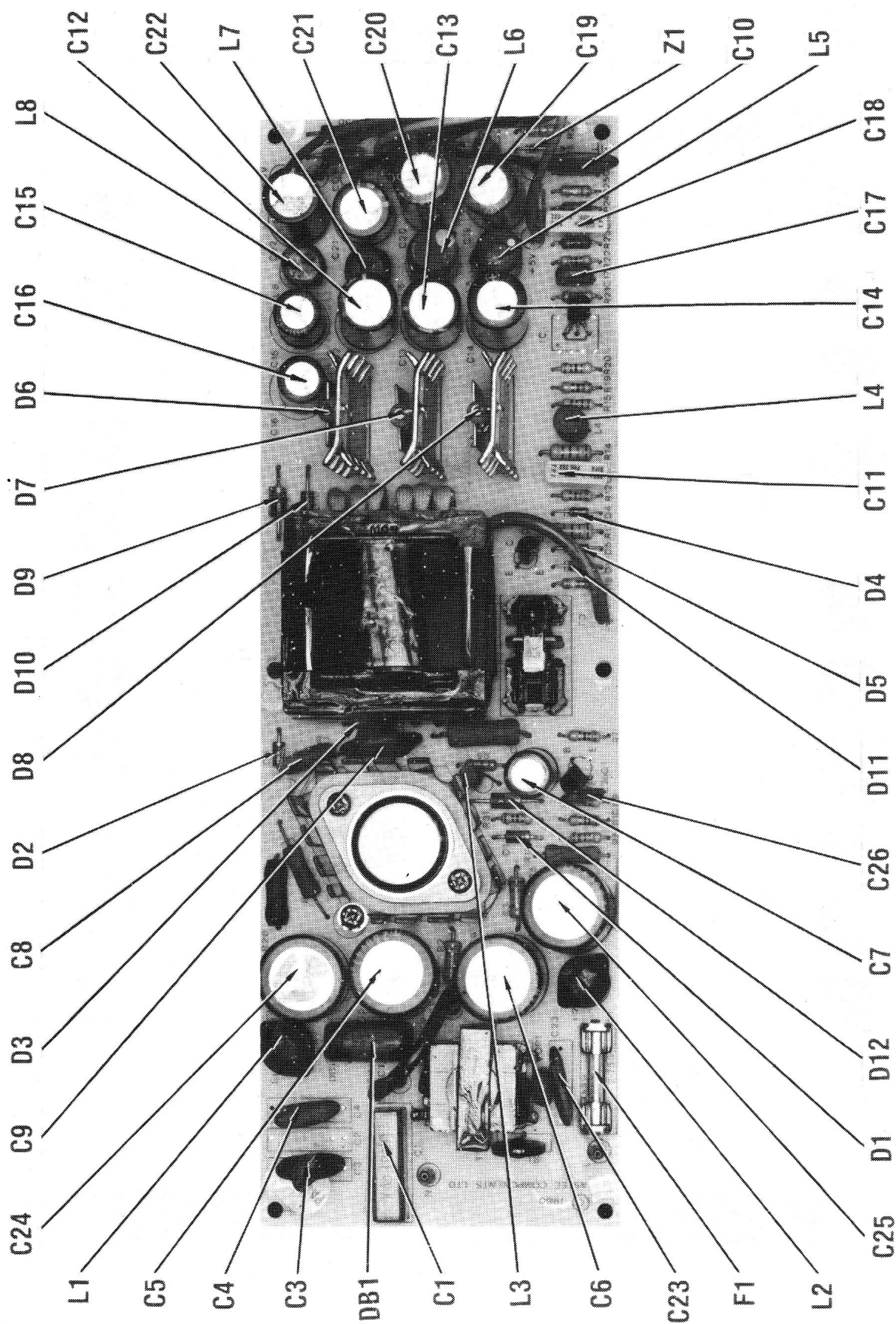
MAIN BOARD

A Howard W. Sams **GRIDTRACE™** Photo

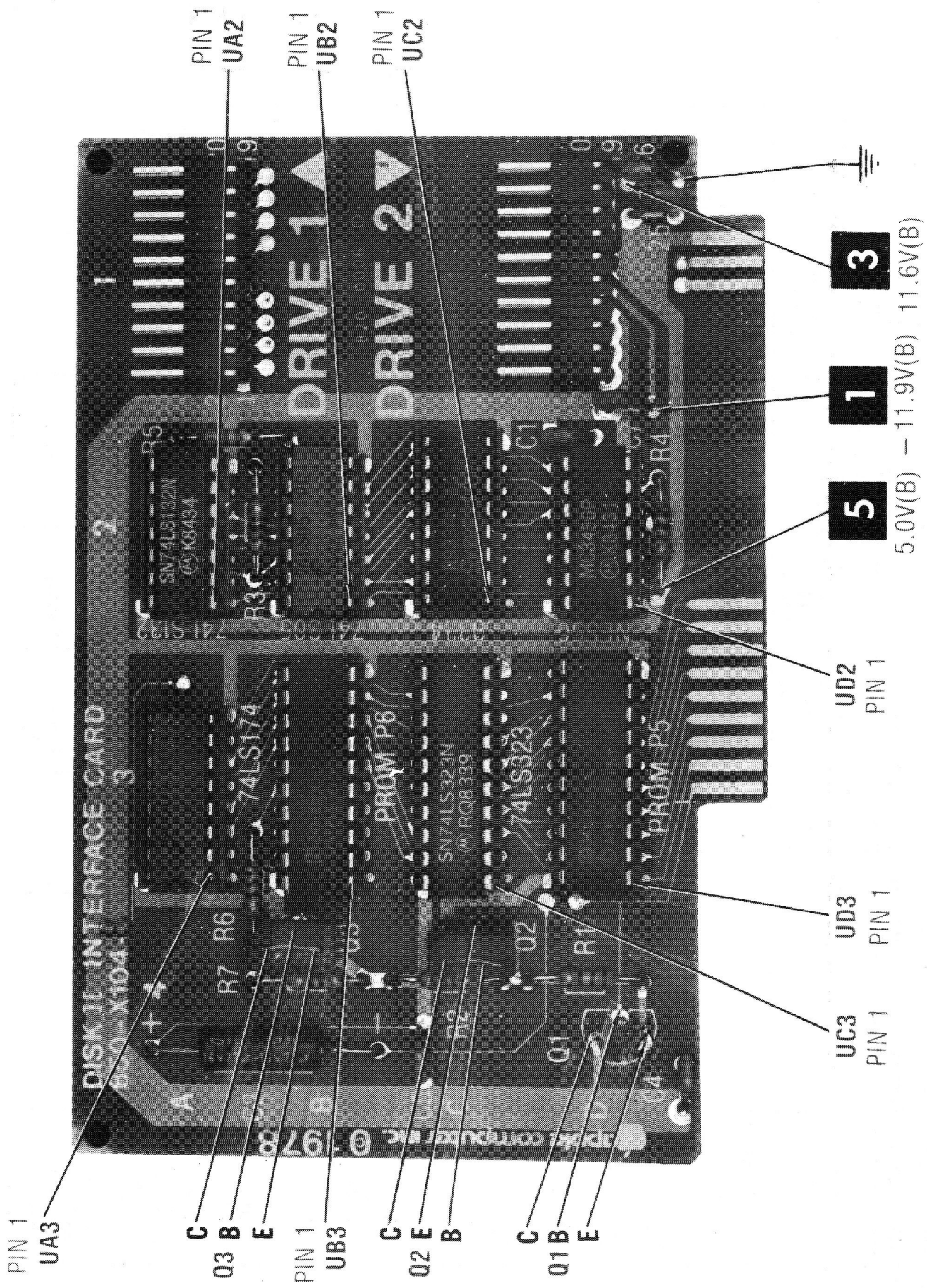
**APPLE
MODEL IIe**

A Howard W. Sams **CIRCUITRACE®** Photo

POWER SUPPLY BOARD



POWER SUPPLY BOARD



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 MODEL IIe
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6 PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NEW-TONE NTE PART No.	PHILIPS ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
DISK II INTERFACE BOARD								
Q1	2N3906		GE-82	NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
Q2,3	NSDU51		GE-253	NTE211	ECG211	SK3203/211	WEP759/211	121-Z9056
	MPSU51		GE-218	NTE189	ECG189	SK3200/189	WEP857/189	121-C9053
UA2	SN74LS132N		74LS132	NTE74LS132	ECG74LS132			HE-443-792
UA3	74LS174PC		74LS174	NTE74LS174	ECG74LS174	SK74LS174		HE-443-879
UB2	74LS05PC		74LS05	NTE74LS05	ECG74LS05	SK74LS05		HE-443-818
UB3	341-0128-A							
	6309 P6A							
UC2	N9334N							
UC3	SN74LS323N							
UD2	MC3456P			NTE978	ECG978	SK3689/978		221-Z9152
	556			NTE978	ECG978	SK3689/978		221-Z9152
UD3	341-0127-A							
	P5A							
MAIN BOARD								
Q1	2N3906		GE-82	NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
Q2	2N3904		GE-123AP	NTE123AP	ECG123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q4	MPS4258							
Q5	MPSA13		GE-64	NTE172	ECG172	SK3156/172A	WEP971/172	121-Z9024
Q6	MPS4258		GE-82	NTE159	ECG159	SK3466/159	WEP62/159	121-Z9003
	2N4258							
UA11	RC741N			NTE941M	ECG941M	SK3552/941M	WEP933/941M	HE-442-22
	MM741			NTE941M	ECG941M	SK3552/941M	WEP933/941M	HE-442-22
UA12	NE558N			NTE926	ECG926			
UB1	SN74LS244N		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
UB2	74LS245N		74LS245	NTE74LS245	ECG74LS245	SK74LS245		HE-443-885
UB3	SN74LS244N		74LS244	NTE74LS244	ECG74LS244	SK74LS244		HE-443-791
UB5	74LS138PC		74LS138	NTE74LS138	ECG74LS138	SK74LS138		HE-443-877
UB8	SN74S02N		74LS02	NTE74LS02	ECG74LS02	SK74LS02		HE-443-779
UC1	74F109DC							
	S109							
UC4	R6502-40			NTE6502	ECG6502			
	6502B			NTE6502	ECG6502			

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NEW-TONE NTE PART No.	PHILIPS ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
UC5	HD74LS10P	341-0170-A(1)	74LS10	NTE74LS10	ECG74LS10	SK74LS10		HE-443-797
UC10	DM74LS154N			NTE74LS251	ECG74LS251			
UC12	SN74LS251NDS							
UD1	HAL16R8CN							
UD3	74LS374N		74LS374	NTE74LS374	ECG74LS374			HE-443-863
UE1	DM74LS125AN	342-0134-B(1)	74LS125A	NTE74LS125A	ECG74LS125A	SK74LS125A		HE-443-811
UE4	344-0010-B							
UE5	344-0020-A							
UE8	342-0135-B							
	2365							
	2764							
UE10	C19659	PRO-050(1)						
	2365							
	2764							
UE12	342-0132-B							
	2716							
UE14	AY-5-3600-PRO	PRO-050(1)						
	AY3600931PRO							
UF4	342-0133-A							
	2732							
UF5	74166N		74166	NTE74166	ECG74166	SK74166		HE-443-892
UF6 Thru UF13	LS166		74LS166	NTE74LS166	ECG74LS166			
	TMS4164-15NLJ				ECG2164			
	6664				ECG6664			
POWER SUPPLY BOARD								
D1	RG10A		GE-511	NTE552	ECG552	SK5014	WEP172/506	103-287
D2,3	RG10J		GE-511	NTE552	ECG552	SK3318A	WEP172/506	103-287
D4,5	1N4606		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
D6 Thru D8								
D9	RG15B		GE-511	NTE552	ECG552	SK5014	WEP172/506	103-287
D10	RG10B		GE-511	NTE552	ECG552	SK9000/552	WEP172/506	103-287
D11	1N4606		GE-300	NTE177	ECG177	SK9091/177	WEP1062/177	103-131
D12	RG15B		GE-511	NTE552	ECG552	SK5014	WEP172/506	103-287

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APPLE MODEL IIe

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA					
			GENERAL ELECTRIC PART No.	NEW-TONE NTE PART No.	PHILIPS ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
DB1	KBP08		GEER-1000	NTE170	ECG170	SK3649/170	WEP1056/170	212-Z9002
IC1	TI18231							
Q1	2SD467B		GE-243*	NTE85	ECG85	SK3449/297	WEP59/128*	121-792*
Q2								
Q3,4	2SB621R		GE-48	NTE294	ECG294	SK3841/294	WEP916/294	121-Z9067
SCR1	2N6395		2N6395	NTE5552	ECG5552	SK3574		
Z1	A211		GEZD-11	NTE5020A	ECG5020A	SK11A/5020A	WEP1421/5020	103-279-20

(1) Number on unit.

WIRING DATA

Shielded Hook-up Wire Use BELDEN No. 8401 or 8421 (Single-Conductor)

8208 (Two-Conductor)

General-use Unshielded Hook-up Wire Use BELDEN No. 8529 (Solid) Available in 13 Colors

8522 (Stranded) Available in 13 Colors

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS Item numbers not listed are normally available at local distributors.

ITEM No.	RATING	MFGR. PART No.
MAIN BOARD		
C70	47 N470 50V 5%	

ITEM No.	RATING	MFGR. PART No.
POWER SUPPLY BOARD		
C1	.1 125VAC	
C3	.0022 400VAC	
C4	.0022 400VAC	

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NEW-TONE PART No.	WORKMAN PART No.
MAIN BOARD				
RP1	Resistor Network (1)	111-0017 (3)		
RP2	Resistor Network (2)	CRL-HC3110102M (3)		
RP3	Resistor Network (1)	111-0017 (3)		
POWER SUPPLY BOARD				
R1	NTC 5 Cold			
R23	2700 2% 1/4W Metal Film		QW227	22-2246
R24	2700 2% 1/4W Metal Film		QW227	22-2246
VDR1	VDR	TNRG471K (1)		

APPLE
MODEL Iie

(1) Number on unit.

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
MAIN BOARD		
L1	RF Choke	
L2	RF Choke	
L3	RF Choke	
L4	RF Choke	
L5	RF Choke	
L6	RF Choke	

ITEM No.	FUNCTION	MFGR. PART No.
POWER SUPPLY BOARD		
L1	RF Choke	
L2	RF Choke	
L3	RF Choke	
L4	RF Choke	
L5	RF Choke	
L6	RF Choke	
L7	RF Choke	
L8	RF Choke	
L99	Line Choke	
T1	AC Line Choke	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

TRANSFORMERS

ITEM No.	FUNCTION	REPLACEMENT DATA		
		MFGR. PART No.	OTHER IDENTIFICATION	
POWER SUPPLY BOARD				
T2	Switching Power			
T3	Switching Driver			

SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA		NOTES
		MFGR. PART No.	QUAM PART No.	
SP1	2 1/4" PM, 8 Ohms			

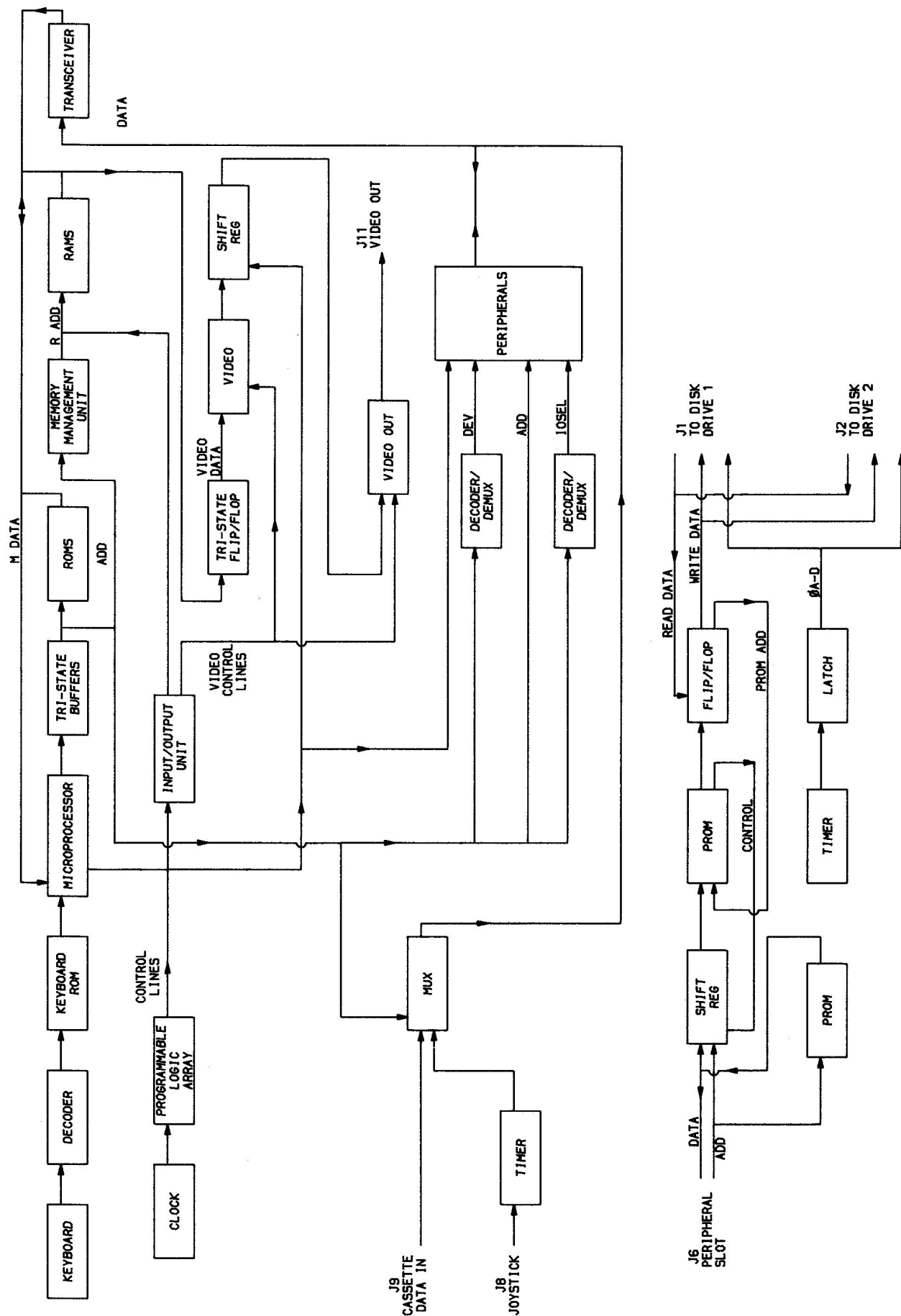
FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	2.75A @ 125V Fast-Acting			

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
KEYBOARD			
PL1	Lamp		Power
S1 thru S63	Switch		Part of Keyboard
MAIN BOARD			
CR1	LED		Power, Red (1.8V @ 10mA)
CR2	LED		Audio Test, Red (1.8V @ 10mA)
Y1	Crystal		14.31818MHz
POWER SUPPLY BOARD			
S1	Switch		Power

CABINET & CABINET PARTS (When ordering specify model, chassis & color)

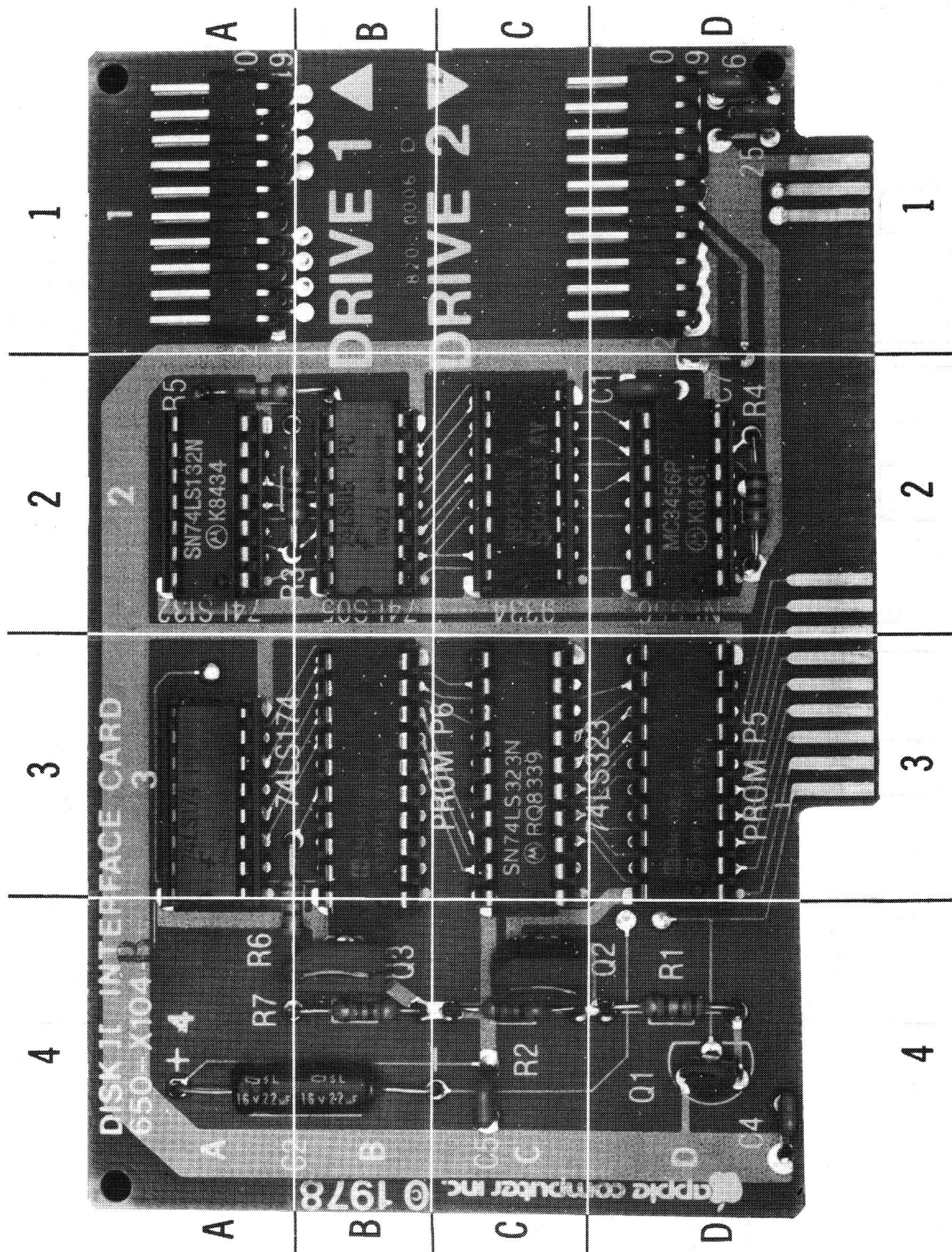


APPLE
MODEL IIE

BLOCK DIAGRAM

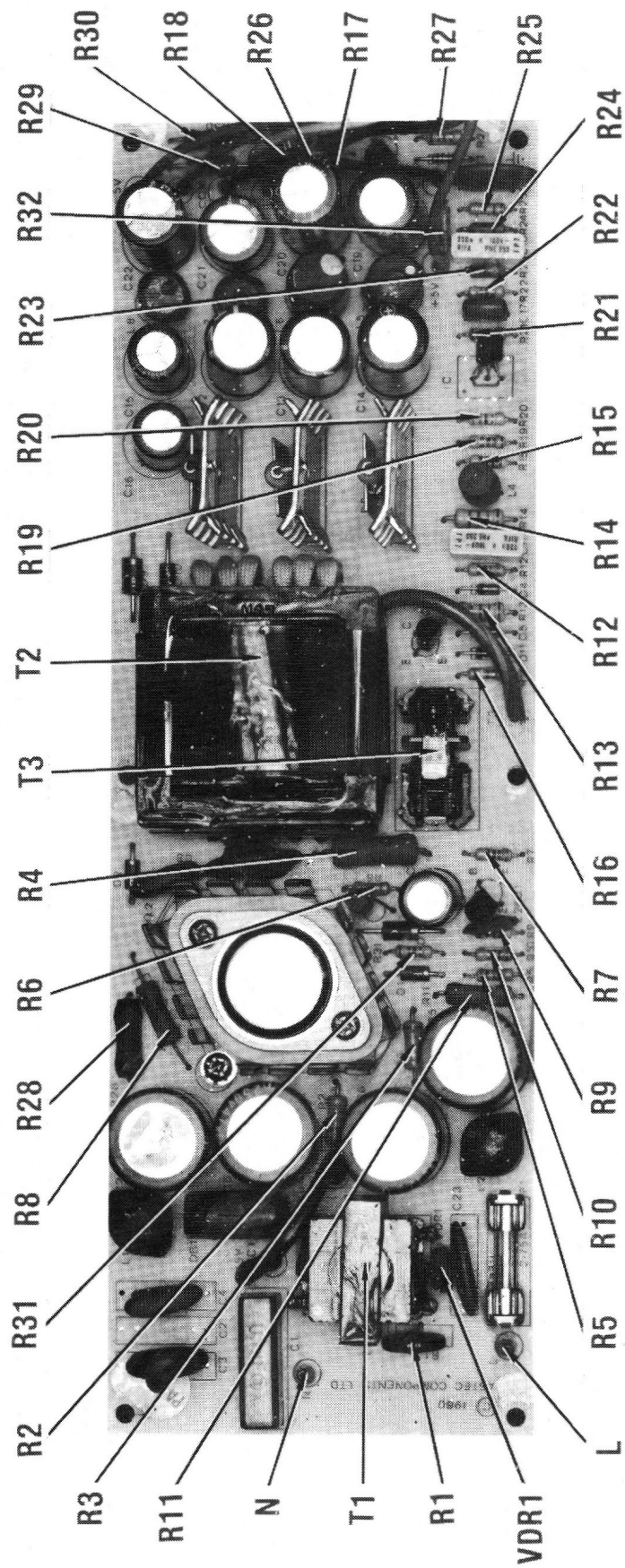
**DISK II INTERFACE
BOARD**
GridTrace
LOCATION GUIDE

C1	D-2
C2	B-4
C3	D-1
C4	D-4
C5	C-4
C6	D-1
C7	D-1
J1	A-1
J2	D-1
J6	D-3
Q1	D-4
Q2	C-4
Q3	B-4
R1	D-4
R2	C-4
R3	B-2
R4	D-2
R5	A-2
R6	A-4
R7	B-4
UA2	A-2
UA3	A-3
UB2	B-2
UB3	B-3
UC2	C-2
UC3	C-3
UD2	D-2
UD3	D-3



DISK II INTERFACE BOARD

A Howard W. Sams **GRIDTRACE™** Photo

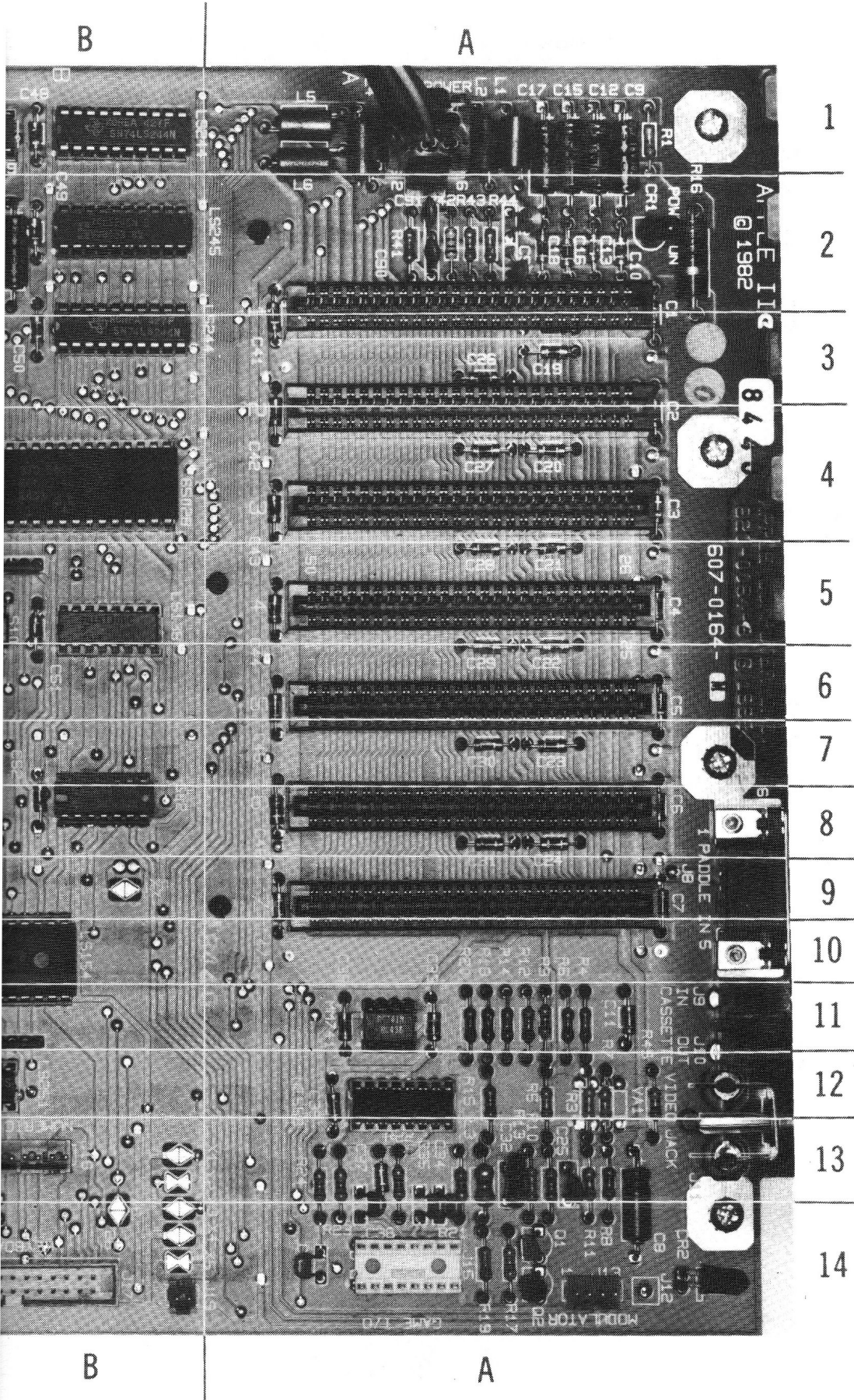


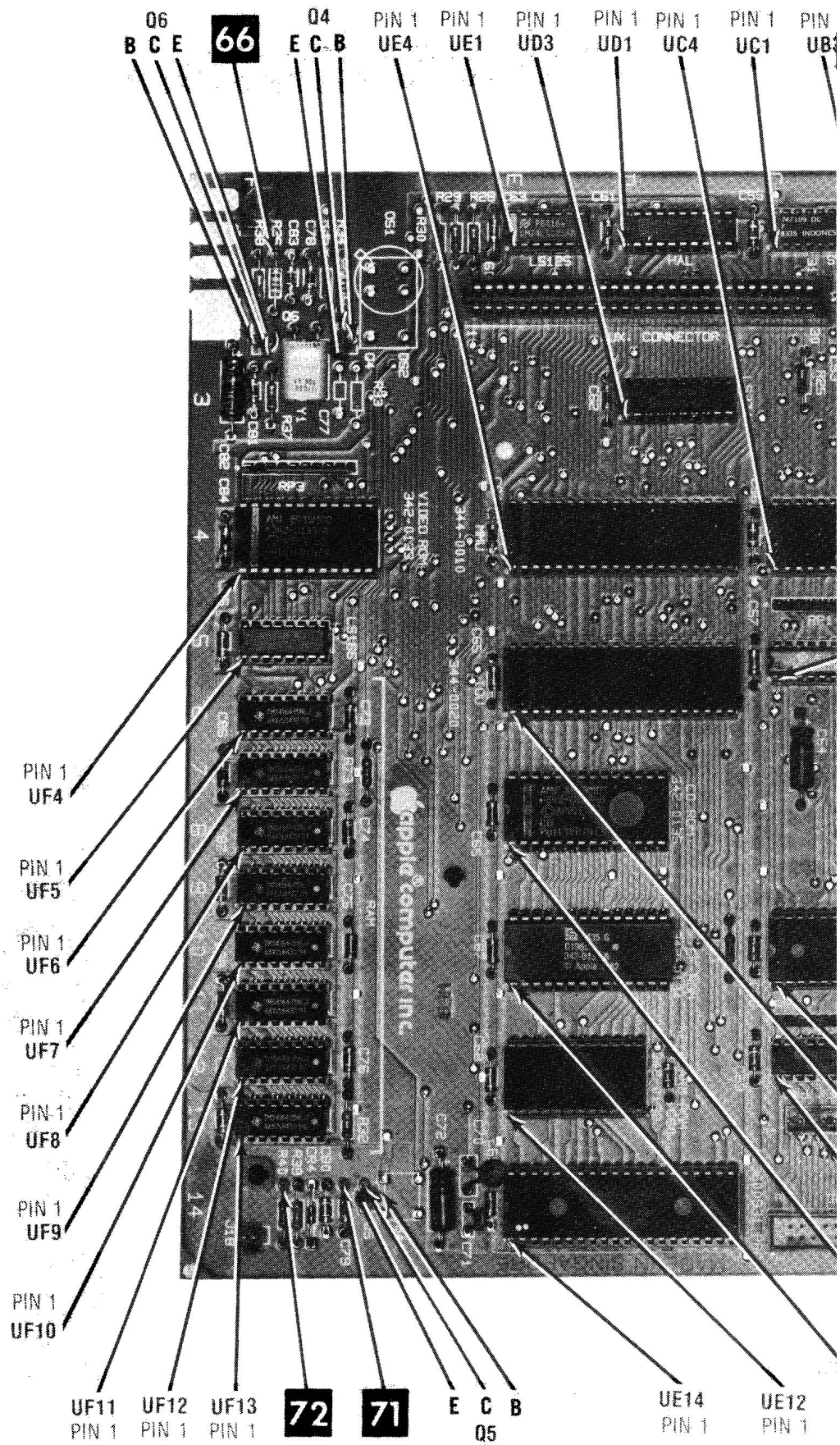
APPLE
MODEL IIe

POWER SUPPLY BOARD

MAIN BOARD GridTrace LOCATION GUIDE

C1	A-3	C76	F-12	R27	C-10
C2	A-3	C78	F-2	R28	E-1
C3	A-4	C79	F-14	R29	E-1
C4	A-5	C80	F-14	R30	E-1
C5	A-6	C81	F-3	R32	F-13
C6	A-8	C82	F-3	R34	F-2
C7	A-9	C83	F-2	R35	F-2
C8	A-14	C84	F-4	R36	F-2
C9	A-1	C85	F-5	R37	F-3
C10	A-1	C86	F-7	R38	F-2
C11	A-11	C87	F-9	R39	F-14
C12	A-1	C88	F-11	R40	F-14
C13	A-2	C89	F-13	R41	A-2
C15	A-1	C90	A-2	R42	A-2
C16	A-2	C91	A-2	R43	A-1
C17	A-1	C92	A-1	R44	A-1
C18	A-2	C93	A-1	R45	A-12
C19	A-3	CR1	A-2	R73	F-7
C20	A-4	CR2	A-14	RP1	C-5
C21	A-5	CR4	F-14	RP2	C-11
C22	A-6	J0	D-2	RP3	F-4
C23	A-7	J1	A-2	UA11	A-11
C24	A-8	J2	A-4	UA12	A-12
C25	A-13	J3	A-4	RB1	B-1
C26	A-3	J4	A-5	UB2	B-2
C27	A-4	J5	A-6	UB3	B-3
C28	A-5	J6	A-8	UB5	B-5
C29	A-6	J7	A-9	UB8	B-8
C30	A-7	J8	A-9	UC1	C-1
C31	A-8	J9	A-11	UC4	B-4
C32	A-13	J10	A-11	UC5	C-5
C33	A-11	J11	A-13	UC10	C-10
C34	A-14	J13	A-14	UC12	C-12
C35	A-15	J14	A-1	UD1	D-1
C36	A-13	J15	A-14	UD3	D-3
C37	A-13	J16	B-13	UE1	E-1
C38	A-11	J17A	B-14	UE4	D-4
C39	A-12	J18	F-14	UE5	D-6
C40	A-14	J19	B-14	UE8	D-8
C41	A-3	L1	A-1	UE10	D-10
C42	A-4	L2	A-1	UE12	E-12
C43	A-4	L3	A-13	UE14	D-14
C44	A-5	L4	A-1	UF4	F-4
C45	A-6	L5	A-1	UF5	F-5
C46	A-8	L6	A-1	UF6	F-6
C47	A-9	Q1	A-14	UF7	F-7
C48	B-1	Q2	A-14	UF8	F-8
C49	B-2	Q4	F-2	UF9	F-9
C50	B-3	Q5	F-14	UF10	F-10
C51	B-5	Q6	F-2	UF11	F-11
C52	B-7	R1	A-1	UF12	F-12
C53	B-2	R3	A-12	UF13	F-13
C54	C-6	R4	A-11	X1	B-13
C55	C-1	R5	A-12	X2	B-13
C56	C-4	R6	A-11	X3	B-14
C57	C-5	R7	A-12	X4	B-14
C58	C-10	R8	A-13	X5	B-15
C59	C-12	R9	A-11	X6	B-14
C60	D-12	R10	A-13	X7	B-9
C61	D-1	R11	A-13	Y1	F-2
C62	D-3	R12	A-11		
C63	E-1	R13	A-13		
C64	E-4	R14	A-11		
C65	E-5	R15	A-12		
C66	E-8	R16	A-1		
C67	E-10	R17	A-14		
C68	E-12	R18	A-11		
C69	E-14	R19	A-14		
C70	E-14	R20	A-11		
C71	E-14	R21	A-13		
C72	E-14	R22	A-13		
C73	F-6	R23	A-13		
C74	F-8	R24	A-13		
C75	F-10	R25	C-2		





MAIN BOARD

LOGIC CHART MAIN BOARD LOGIC

PIN NO.	IC UA11	IC UA12	IC UB1	IC UB2	IC UB3	IC UB5	IC UB8	IC UC1	PIN NO.	IC UC4	PIN NO.	IC UC4	PIN NO.	IC UC5
1	P	H	L	L	L	P	L	H	1	L	21	L	1	P
2	L	*	P	P	P	P	H	H	2	H	22	L	2	P
3	L	H	P	P	P	P	L	L	3	P	23	L	3	P
4	P	H	P	P	P	P	P	P	4	H	24	P	4	H
5	P	H	P	P	P	P	P	H	5	*	25	P	5	H
6	P	*	P	P	P	P	L	P	6	H	26	P	6	P
7	H	H	P	P	P	P	L	P	7	P	27	P	7	L
8	*	H	P	P	L	L	P	L	8	H	28	P	8	H
9		H	P	P	P	H	P	P	9	P	29	P	9	L
10		*	L	L	L	H	P	P	10	P	30	P	10	H
11		H	P	P	P	H	H	H	11	P	31	P	11	H
12		L	P	P	P	H	P	P	12	P	32	P	12	H
13		H	P	P	P	H	L	P	13	P	33	P	13	P
14		H	P	P	P	H		P	14	P	34	P	14	
15		*	P	P	L	P		H	15	P	35	*		
16		H	P	P	P	H		H	16	P	36	*		
17			P	P	L				17	P	37	P		
18			P	P	L				18	P	38	H		
19			L	P	L				19	P	39	P		
20			H	H	H				20	L	40	H		
PIN NO.	IC UC10	IC UC12	IC UD1	IC UD3	IC UE1	PIN NO.	IC UE4	PIN NO.	IC UE4	PIN NO.	IC UE5	PIN NO.	IC UE5	
1	P	*	P	P	P	1	L	21	P	1	L	21	P	
2	H	L	P	P	P	2	P	22	L	2	L	22	P	
3	H	L	P	P	P	3	P	23	P	3	P	23	P	
4	H	H	P	P	L	4	P	24	P	4	P	24	P	
5	H	P	P	P	P	5	P	25	H	5	P	25	P	
6	H	*	P	P	P	6	P	26	P	6	H	26	P	
7	H	H	H	P	L	7	P	27	P	7	L	27	P	
8	H	L	P	P	H	8	P	28	P	8	L	28	H	
9	H	P	H	P	P	9	P	29	P	9	P	29	P	
10	H	P	L	L	H	10	P	30	P	10	L	30	P	
11	H	P	L	P	P	11	P	31	P	11	L	31	L	
12	L	H	P	P	P	12	P	32	P	12	H	32	L	
13	H	H	P	P	L	13	P	33	P	13	H	33	P	
14	H	H	P	P		14	P	34	P	14	P	34	P	
15	H	H	P	P		15	H	35	P	15	H	35	P	
16	H	H	P	P		16	H	36	P	16	*	36	P	
17	H		P	P		17	H	37	P	17	P	37	H	
18	P		P	P		18	P	38	P	18	P	38	P	
19	P		P	P		19	H	39	P	19	P	39	P	
20	P		H	H		20	P	40	P	20	P	40	P	
21	P													
22	P													
23	P													
24	H													

APPLE
MODEL IIe

NOTE: Logic probe readings taken in Power Up mode, without Disk II Interface Board inserted, no keys pressed unless otherwise noted.

Logic Probe Display

L = Low

H = High

P = Pulse

* = Open (No light On)

(1) Probe indicates L when CONTROL key is pressed.

(2) Probe indicates L when SHIFT key is pressed.

(3) Probe indicates H when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE keys.

(4) Probe indicates P when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE keys.

(5) Probe indicates H when CAPS LOCK key is up.

(6) Readings taken after pressing SPACE bar.

LOGIC CHART (Continued) **MAIN BOARD LOGIC (Continued)**

PIN NO.	IC UE8	PIN NO.	IC UE8	PIN NO.	IC UE10	PIN NO.	IC UE10	PIN NO.	IC UE12	PIN NO.	IC UE12	PIN NO.	IC UE14	PIN NO.	IC UE14
1	H	15	P	1	H	15	P	1	L(6)	13	P	1	P	21	L
2	P	16	P	2	P	16	P	2	L(6)	14	P	2	P	22	L
3	P	17	P	3	P	17	P	3	L(6)	15	P	3	P	23	L
4	P	18	P	4	P	18	P	4	H(6)	16	P	4	L	24	L
5	P	19	P	5	P	19	P	5	L(6)	17	H	5	L(3)	25	L
6	P	20	L	6	P	20	L	6	L(6)	18	L	6	L(6)	26	L
7	P	21	P	7	P	21	P	7	H(6)	19	L	7	L(6)	27	L
8	P	22	P	8	P	22	H	8	H(6)	20	P	8	H(6)	28	H(1)
9	P	23	P	9	P	23	P	9	P	21	H	9	L(6)	29	H(2)
10	P	24	P	10	P	24	P	10	P	22	L(5)	10	L(6)	30	H
11	P	25	P	11	P	25	P	11	P	23	H(6)	11	L(6)	31	L
12	P	26	H	12	P	26	H	12	L	24	H	12	H(6)	32	P
13	P	27	H	13	P	27	H					13	H(6)	33	P
14	L	28	H	14	L	28	H					14	H(6)	34	P
												15	L	35	P
												16	L(4)	36	P
												17	L	37	P
												18	L	38	P
												19	L	39	P
												20	L	40	P
PIN NO.	IC UF4	PIN NO.	IC UF4	PIN NO.	IC UF5	IC UF6	IC UF7	IC UF8	IC UF9	IC UF10	IC UF11	IC UF12	IC UF13		
1	P	13	P	1	P	H	H	H	H	H	H	H	H		
2	P	14	P	2	P	P	P	P	P	P	P	P	P		
3	P	15	P	3	P	P	P	P	P	P	P	P	P		
4	P	16	P	4	P	P	P	P	P	P	P	P	P		
5	P	17	P	5	P	P	P	P	P	P	P	P	P		
6	P	18	L	6	P	P	P	P	P	P	P	P	P		
7	P	19	P	7	P	P	P	P	P	P	P	P	P		
8	P	20	P	8	L	H	H	H	H	H	H	H	H		
9	P	21	L	9	H	P	P	P	P	P	P	P	P		
10	P	22	L	10	P	P	P	P	P	P	P	P	P		
11	P	23	P	11	P	P	P	P	P	P	P	P	P		
12	L	24	H	12	P	P	P	P	P	P	P	P	P		
				13	P	P	P	P	P	P	P	P	P		
				14	P	P	P	P	P	P	P	P	P		
				15	P	P	P	P	P	P	P	P	P		
				16	H	L	L	L	L	L	L	L	L		

NOTE: Logic probe readings taken in Power Up mode, without Disk II Interface Board inserted, no keys pressed unless otherwise noted.

Logic Probe Display

L = Low

H = High

P = Pulse

* = Open (No light On)

(1) Probe indicates L when CONTROL key is pressed.

(2) Probe indicates L when SHIFT key is pressed.

(3) Probe indicates H when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE keys.

(4) Probe indicates P when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE keys.

(5) Probe indicates H when CAPS LOCK key is up.

(6) Readings taken after pressing SPACE bar.

LOGIC CHART (Continued) **DISK II INTERFACE BOARD LOGIC**

PIN NO.	IC UA2	IC UA3	IC UB2	IC UB3	IC UC2	IC UC3	IC UD2	IC UD3
1	P	H	L	P	P	P	L	P
2	H	P	H	P	P	P	H	P
3	P	P	P	P	P	P	H	P
4	H	P	H	P	L	P	H	P
5	L	P	P	P	L	P	L	P
6	H	P	L	P	L	P	H	P
7	L	P	L	P	L	P	L	P
8	L	L	P	P	L	P	L	P
9	H	P	L	P	P	P	H	P
10	H	P	L	L	L	L	H	L
11	P	P	H	P	P	L	H	P
12	P	P	P	P	P	P	L	P
13	P	P	P	P	P	P	*	P
14	H	P	H	L	P	P	H	P
15		P		L	H	P		H
16		H		L	H	P		L
17				P		P		P
18				P		P		P
19				P		P		P
20				H		H		L

NOTE: Logic probe readings taken while running the following program.

```

10 D$ = CHR$(4)
20 PRINT D$; "OPEN SAMS"
30 PRINT D$; "WRITE SAMS"
40 FOR X = 1 TO 50
50 PRINT "THIS IS A TEST"
60 NEXT X
70 PRINT D$; "CLOSE"
80 GOTO 20

```

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No light On)

APPLE
MODEL IIe

SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove power from the Computer before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. The Computer cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
10. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
11. Never expose the Computer to water. If exposed to water, turn the unit Off. Do not place the Computer near possible water sources.
12. Never leave the Computer unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
13. Never use liquids or aerosols directly on the Computer. Spray on cloth and then apply to the Computer cabinet. Make sure the Computer is disconnected from the power line.

SCHEMATIC NOTES

—X— Circuitry not used in some versions

--- Circuitry used in some versions

○ See parts list

⊕ Ground

≡ Chassis

Waveforms and voltages taken from ground, unless noted otherwise

Voltages, Waveforms and Logic Probe readings for main board taken with Computer in Power Up mode, no keys pressed, unless otherwise noted.

Voltages, Waveforms and Logic Probe readings for disk II interface board taken while running the following Basic program.

```
10 DS = CHR$(4)
20 PRINT DS; "OPEN SAMS"
30 PRINT DS; "WRITE SAMS"
40 FOR X = 1 TO 50
50 PRINT "THIS IS A TEST"
60 NEXT X
70 PRINT DS; "CLOSE"
80 GOTO 20
```

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.

Time in $\mu\text{sec.}$ per cm, given with p-p reading at the end of each waveform.

Item numbers in rectangles appear in the alignment/adjustment instructions.

Supply voltages maintained as shown at input.

Voltages measured with digital meter, no signal.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

Capacitors are 50 volts or less, 5% unless noted.

Electrolytic capacitors are 50 volts or less, 20% unless noted.

Resistors are $\frac{1}{2}W$ or less, 5% unless noted.

Value in () used in some versions.

Measurements with switching as shown, unless noted.

Logic Probe Display

L = Low

H = High

P = Pulse

* = Open (No light On)

(1) Probe indicates L when CONTROL Key is pressed.

(2) Probe indicates L when SHIFT key is pressed.

(3) Probe indicates H when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE keys.

(4) Probe indicates P when any key is pressed except the CONTROL, SHIFT, CAPS LOCK, RESET and APPLE keys.

(5) Probe indicates H when CAPS LOCK key is up.

(6) Readings taken after pressing SPACE bar.

(7) Logic readings not taken.

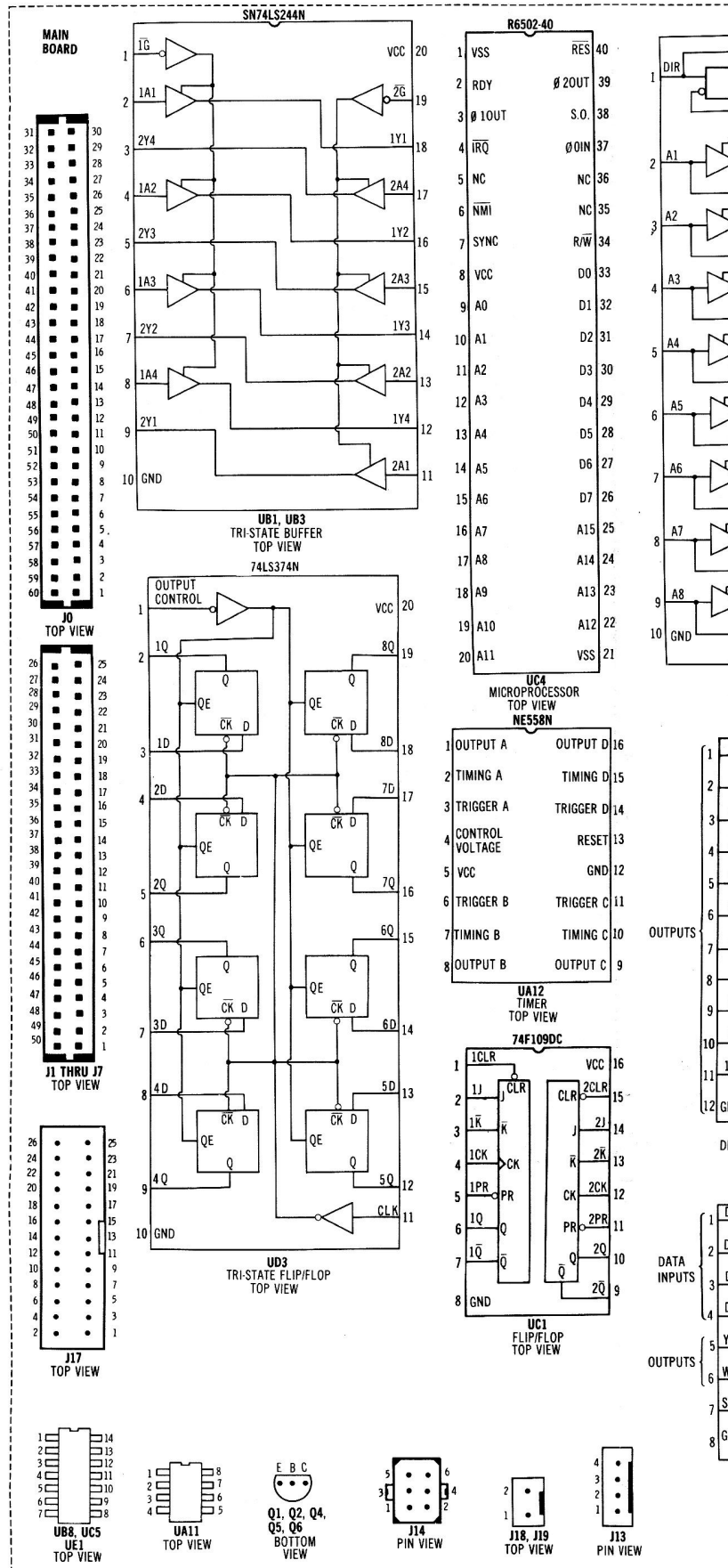
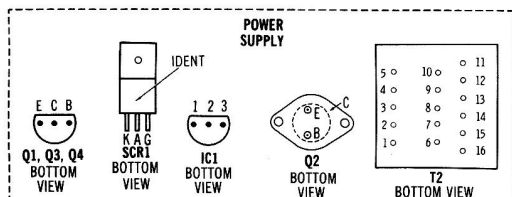
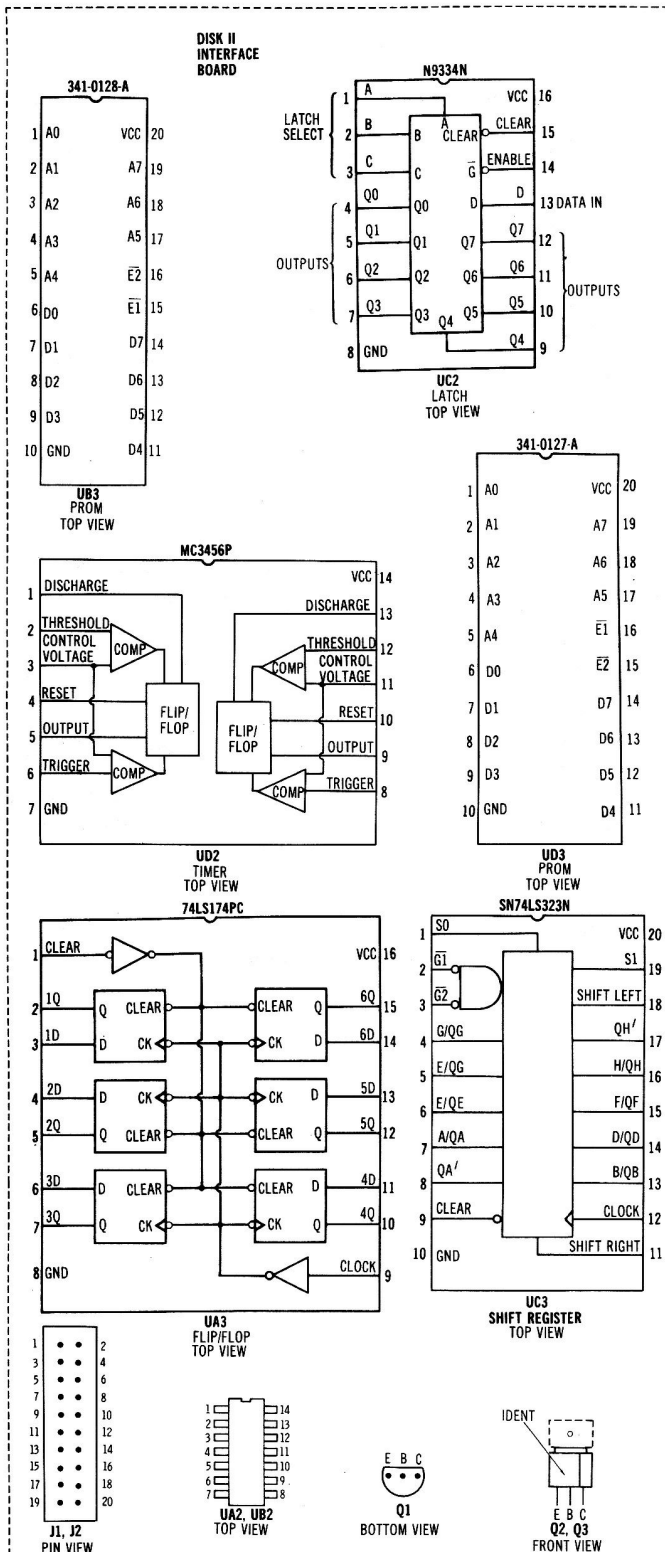
LINE DEFINITIONS

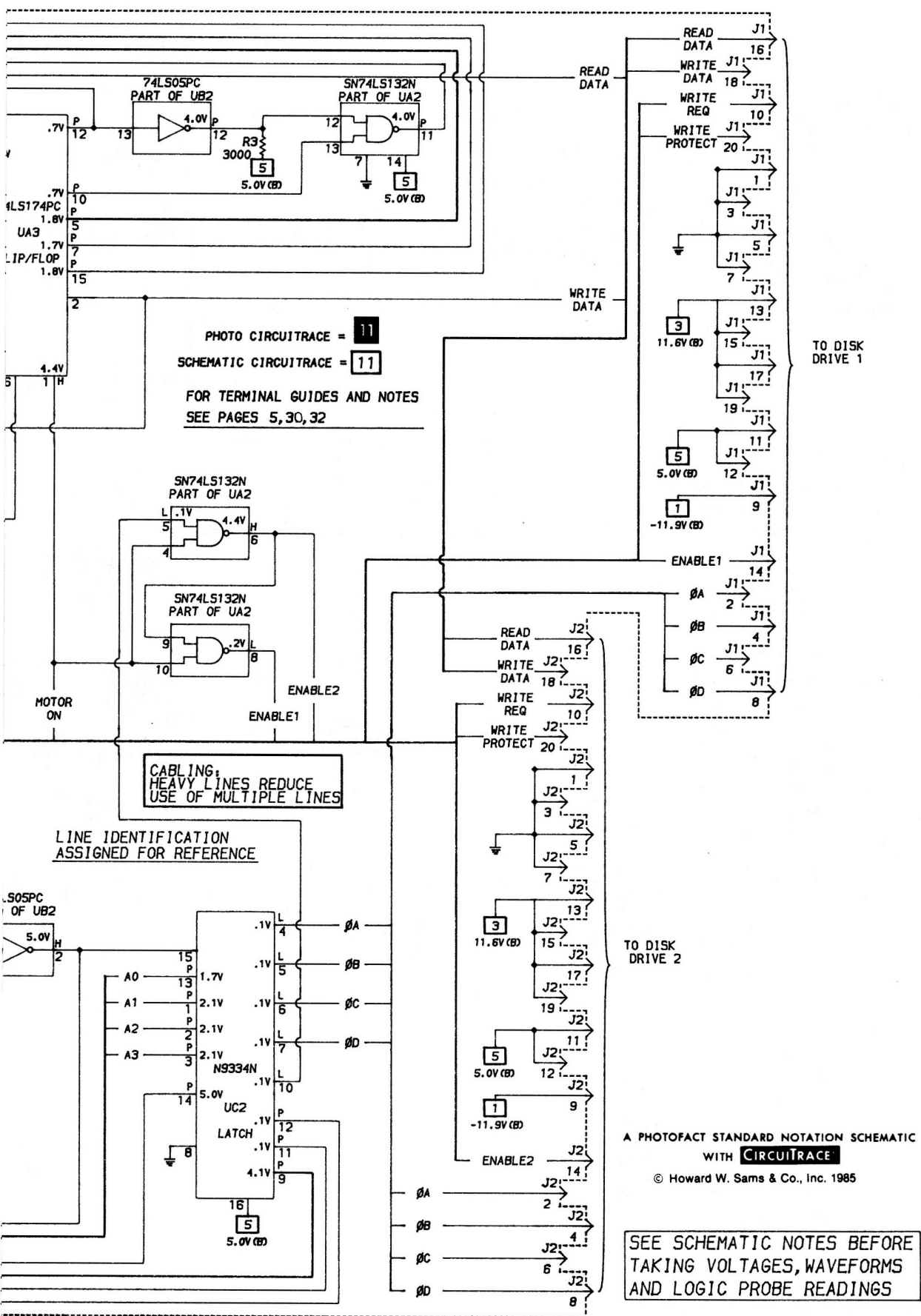
A0 Thru A15	Address Lines	Q3	General Purpose Clock
AKD	Acknowledge	RA0 Thru RA7, RA9, RA10	
ALTVID		RDY	Ready
AN0 Thru AN3		RESET	Reset
CASEN	Cassette Enable	READ DATA	Read Data
CAPLOCK	Capital (Letter) Lock	ROMEN1, ROMEN2	ROM Enable Lines
CLKEN	Clock Enable	R/W	Read/Write
CLRGATE	Clear Gate	R/W80	Read/Write 80 Character
CNTL	Control	SEGA	
COXX		SEGB	
CO6X, CO7X		SEROUT	Serial Output
CXXX		SHFT	Shift
DMA	Direct Memory Access	SPKR	Speaker
D0 Thru D7	Data Lines	STB	Strobe
DEV1 Thru DEV7	Peripheral Device Select	SW0/OAPL	
ENABLE1, ENABLE2	Enable	SW1/CAPL	Switch Capital
ENKBD	Enable Keyboard	SW2	
ENTMG		SYNC	Sync
ENVID	Enable Video	VC	
EN80	Enable 80 Character Width	VID0 Thru VID7	
FRCTXT		VID7M	
GR	Graphics	WNDW	Window
H0	Horizontal 0	WRITE DATA	Write Data
I/OSTROBE	Input/Output Strobe	WRITE PROTECT	Write Protect
INH		WRITE REQ	Write Request
IOSEL	Input/Output Select	X0 Thru X7	
IRQ	Input Request	Y0 Thru Y9	
KBD	Keyboard	3.58M	3.58MHz
KSTRB		7M	7MHz
LDPS	Load Parallel to Serial	14M	14MHz
MD0 Thru MD7	Buffered Data Lines	80VID	80 Character Video
MD IN/OUT	Buffered Data Input/Output	μPSYNC	
MOTOR ON	Motor On	O0	Phase 0
MR	Memory Read	O1	Phase One
NMI	Non-Maskable Interrupt	OA	Phase A
PDL0 Thru PDL3	Game Paddle Lines	OB	Phase B
PCAS		OC	Phase C
PRAS		OD	Phase D

Any Bar above any alphabetical or numerical combination indicates line level in a low (0) state.

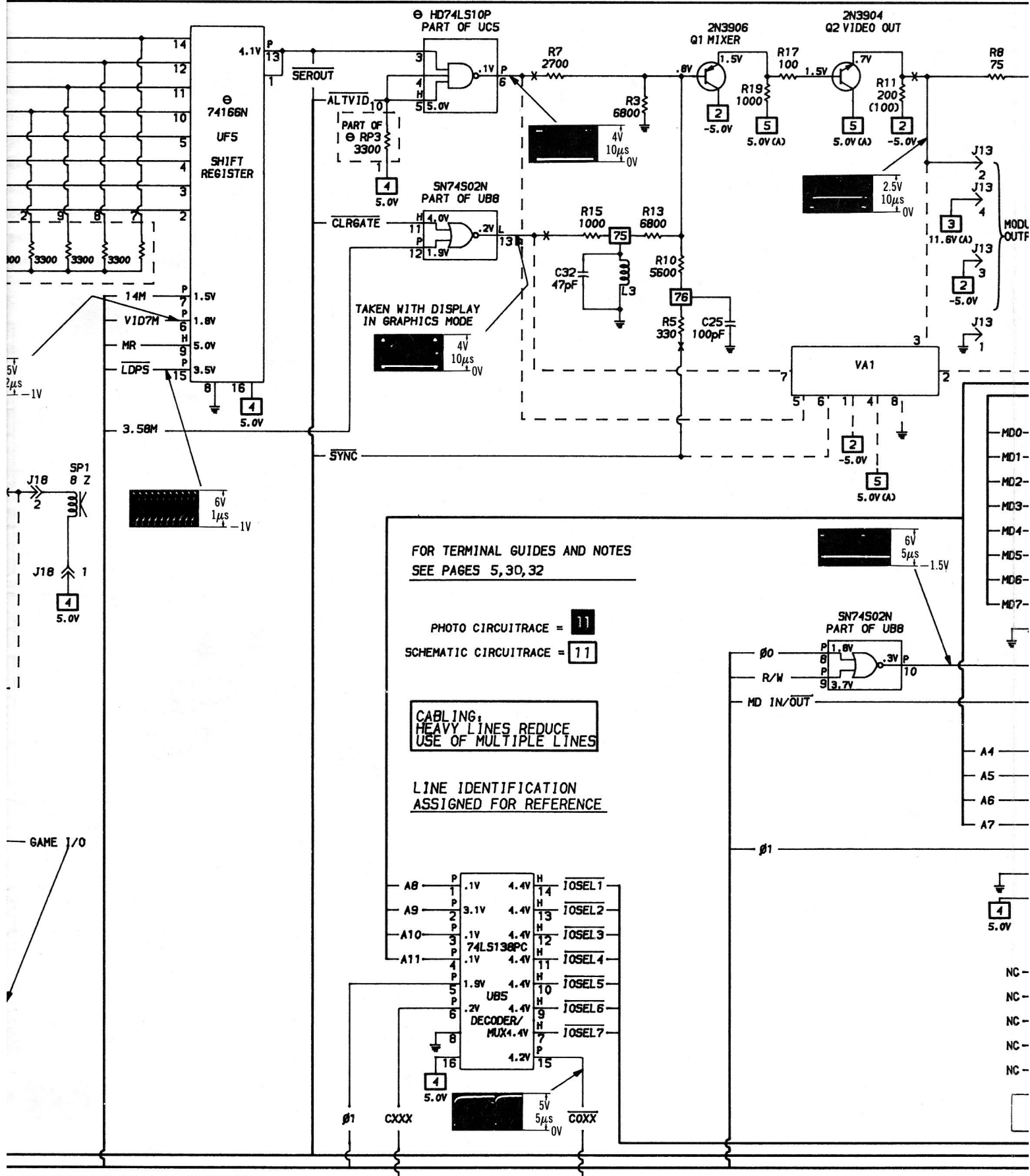
APPLE
MODEL IIe

IC PINOUTS & TERMINAL

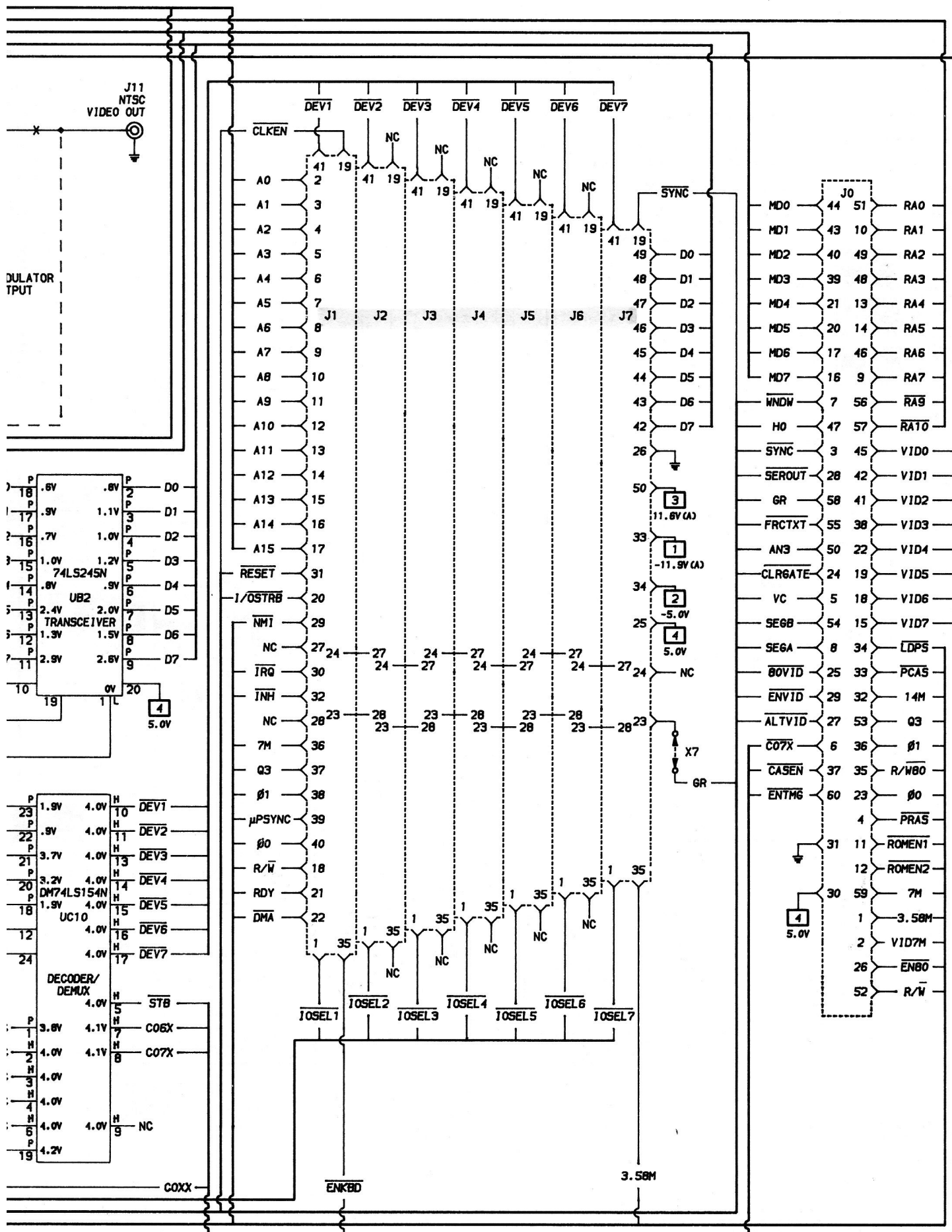




APPLE
MODEL IIe



SEE LINE DEFINITIONS ON PAGE 31



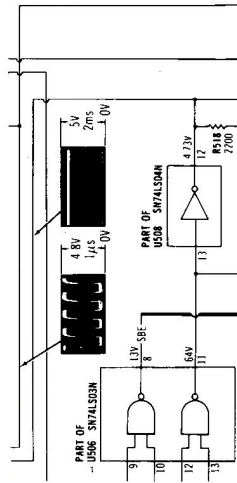
APPLE
MAIN BOARD MODEL IIe



COMPUTERFACTS™ put easy to use, informative technical data right at your fingertips. Each edition includes specific service information on the individual component, along with some overall troubleshooting hints.

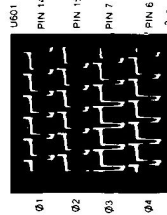
The following information is just a sample of the many valuable time saving features contained in this exclusive Sams COMPUTERFACTS publication:

- Preliminary Service Checks section is an easy to use, step by step guide for the experienced technician or hobbyist, and even beginners.
- SAMS famous industry accepted standardized notation schematics containing CIRCUITRACE®, GRIDTRACE™, waveforms, voltages and stage identification.



- Step by Step Troubleshooting guides the technician through the necessary procedures to quickly locate the problem.

TROUBLESHOOTING



MICROPROCESSOR CHIP (CPU) OPERATION

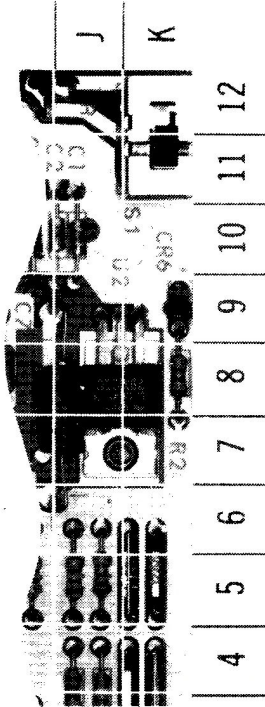
Verify the processor is functioning by checking the signals on the address lines (pins 10 thru 24 of IC U600) and the data lines (pins 41 thru 56) using a logic probe or a scope. If a logic probe is used, the signal should be a square wave. If a scope is used, the waveforms on the address lines (except pins 22 and 23 which have no signal in Power Up mode) should be similar to Figure 1. The waveforms on the data lines should be similar to Figure 2.

- Logic Chart containing logic probe readings to isolate defective circuitry and components.

LOGIC

PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100
1	P	21	P	2	P	1	L	3	H	4	L	5	L	6	L
2	P	22	P	3	H	2	P	4	L	5	L	6	L	7	L
3	P	23	P												

- Quick Component Location using the SAMS exclusive GRIDTRACE, CIRCUITRACE, and component photographs.



- Complete Components Parts List in an easy to use format with field replacements shown when possible. SAMS unique semiconductor, chip and IC cross-reference gives you many replacements to choose from and is available at your Electronic Distributor.

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA						
			EGG PART No.	GENERAL ELECTRIC PART No.	MOTOROLA PART No.	NTE PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
0102	15553	1149-2576	EGG519	GE-514	1N4935	NTE519	SK9091/177	WEF925/519	103-131
0103	1N602M	1149-2527	EGG109	1N60	1N4004	NTE109	SK308B	WEF134/109	103-23001
0201	1N4004GP	1201-4205	EGG116	GE-504A	1N4935	NTE116	SK3312	WEF157	212-76-02
0501 thru 0503	15553	1149-2576	EGG519	GE-514	1N4935	NTE519	SK9091/177	WEF925/519	103-131

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Apple is a registered trademark of Apple Computer, Inc.

To order, see your Sams Representative, or telephone 800-428-SAMS.



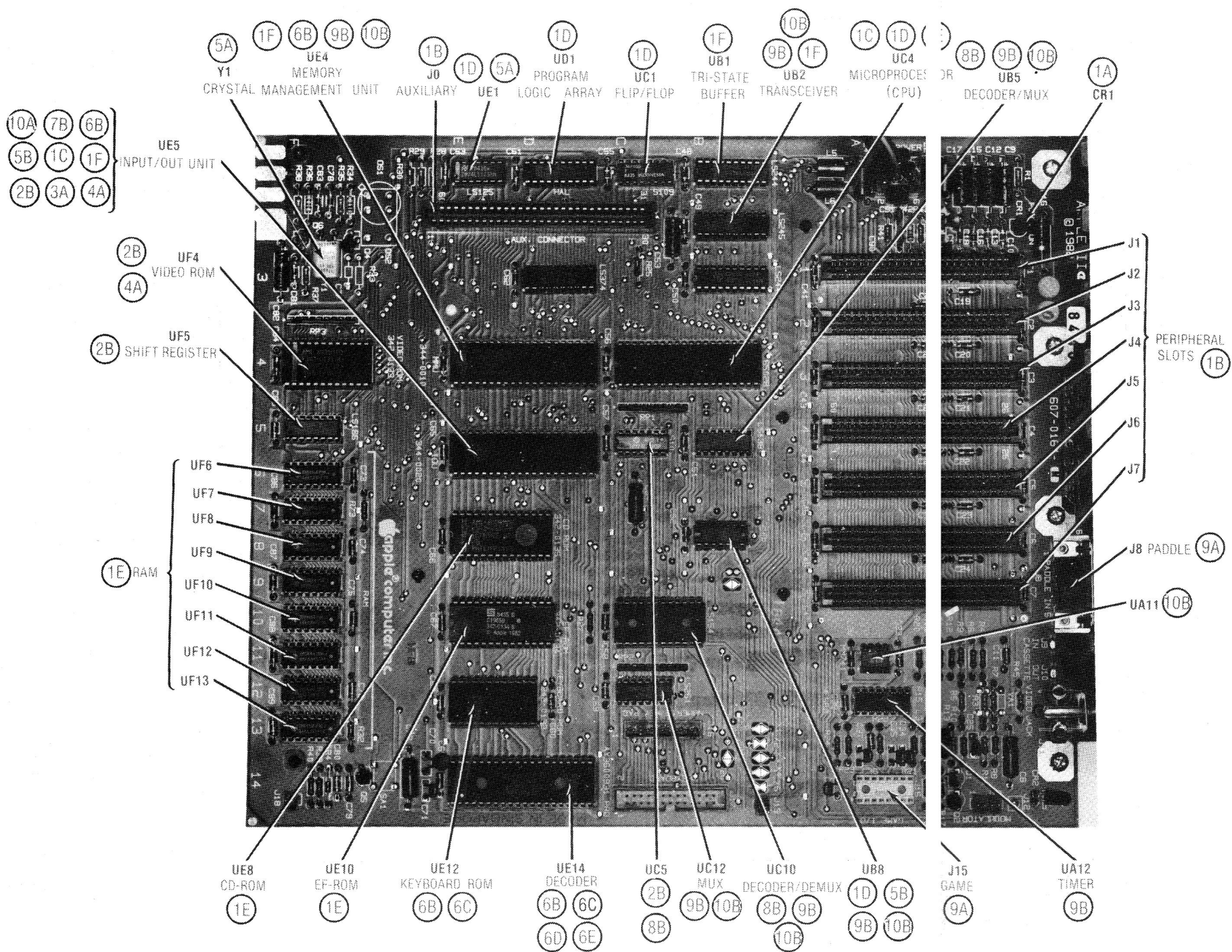
Howard W. Sams & Co., Inc.

4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

CC10
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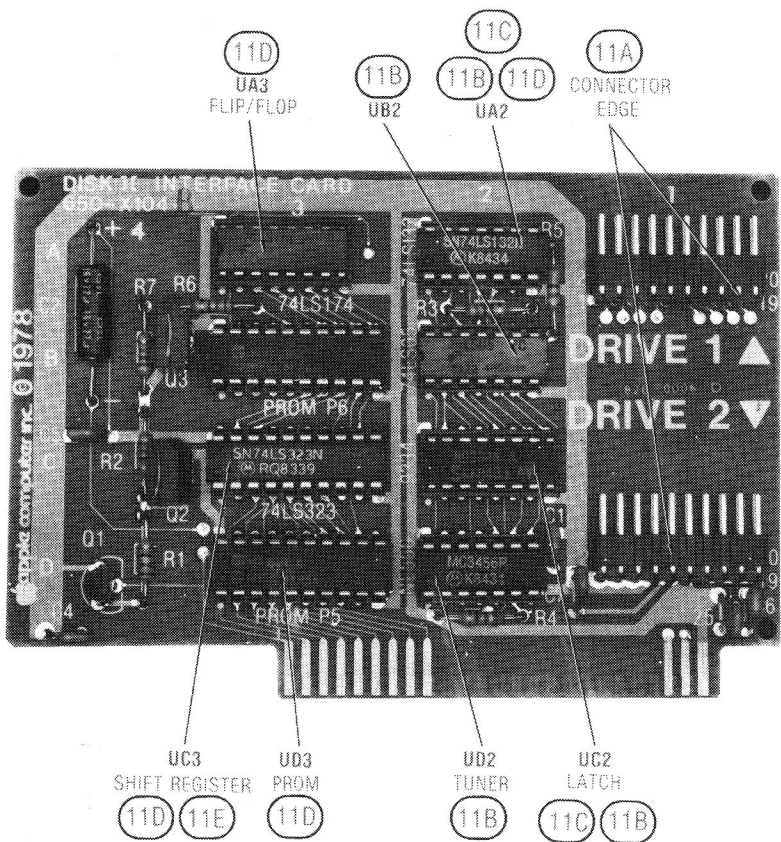


PRELIMINARY SERVICE CHECKS (Continued)

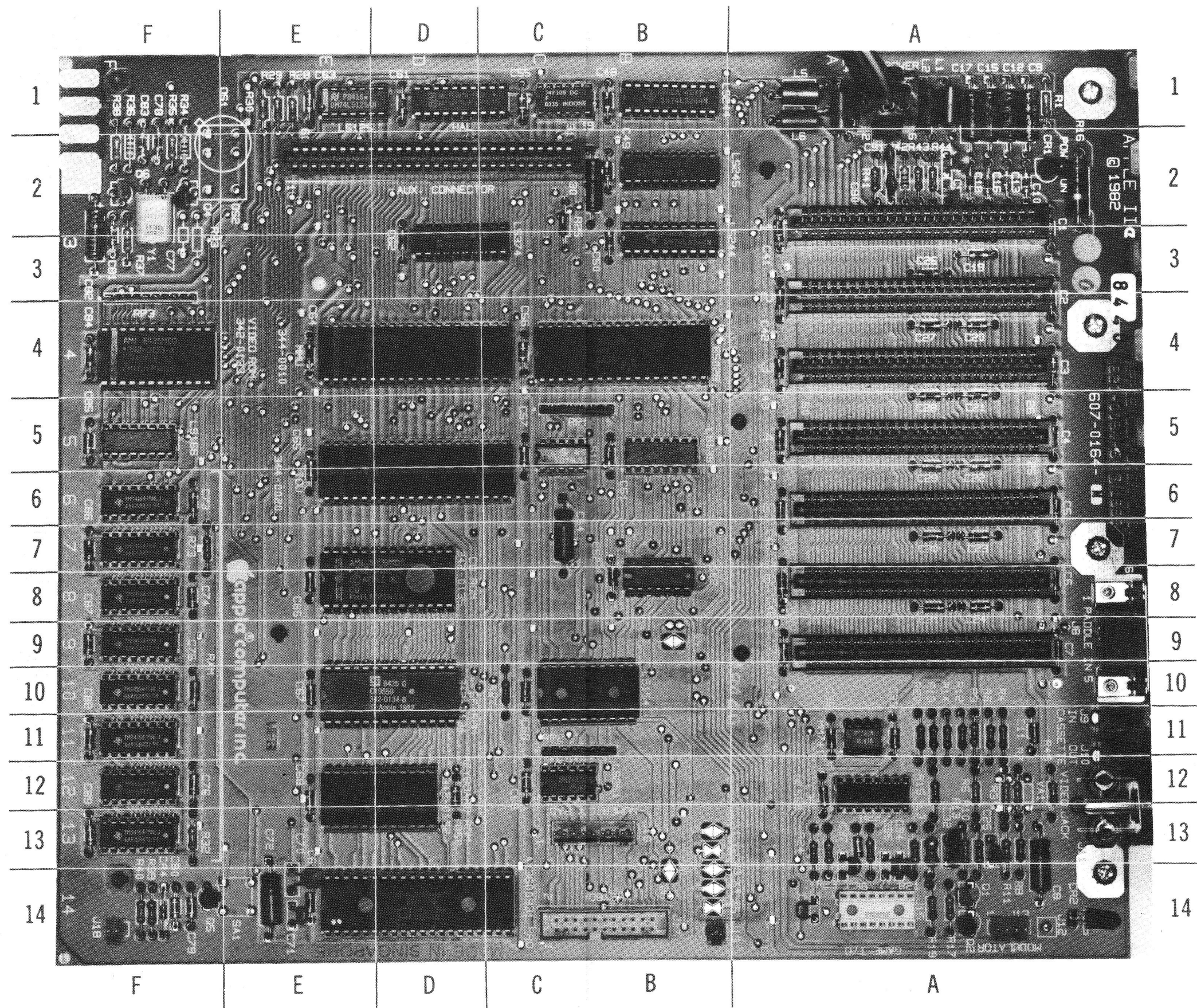


MAIN BOARD

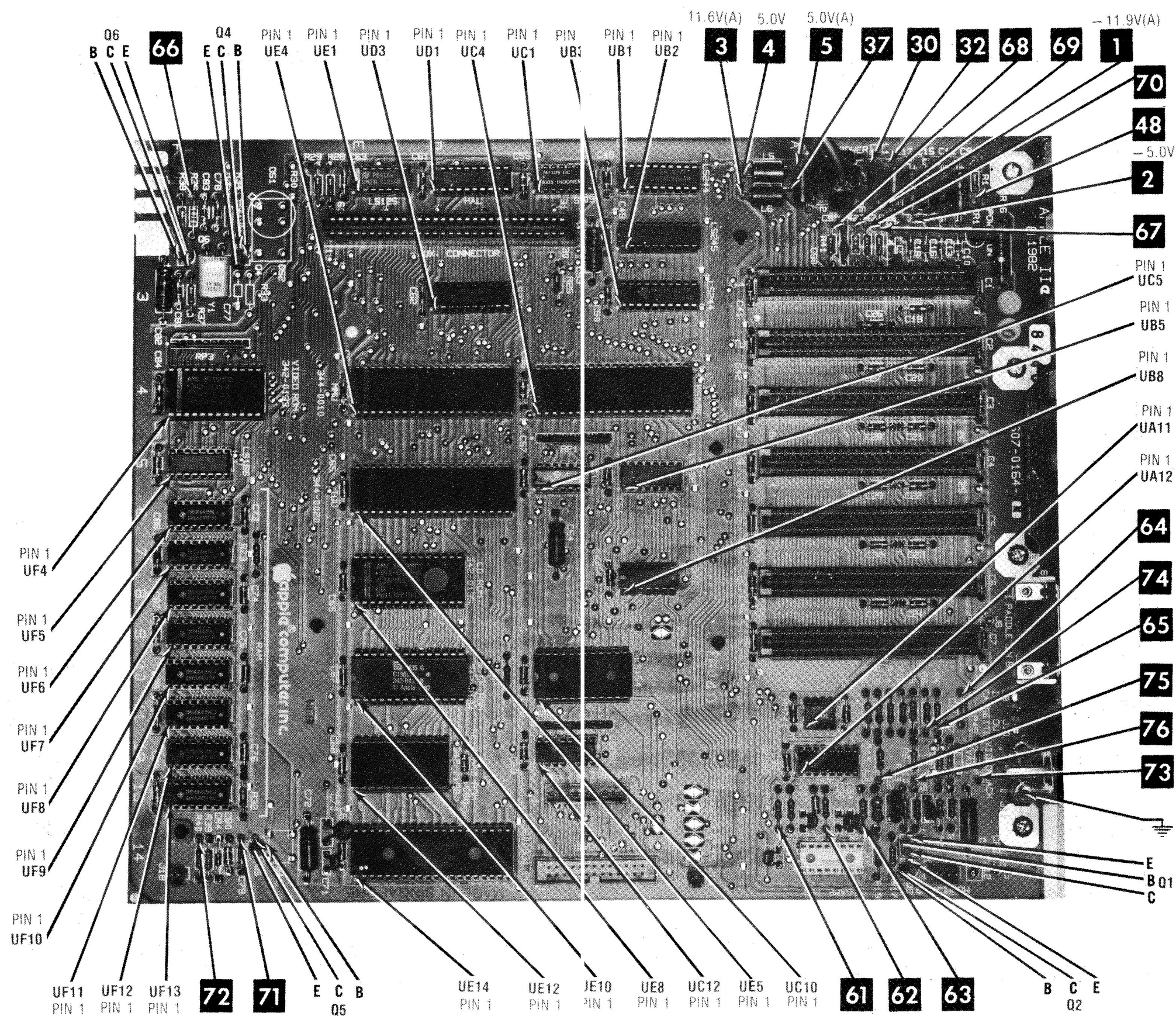
PRELIMINARY SERVICE CHECKS (Continued)



DISK II INTERFACE BOARD



**APPLE
MODEL IIe**







DISK II INTERFACE BOARD

CC10
APPLE
MODEL 11e



