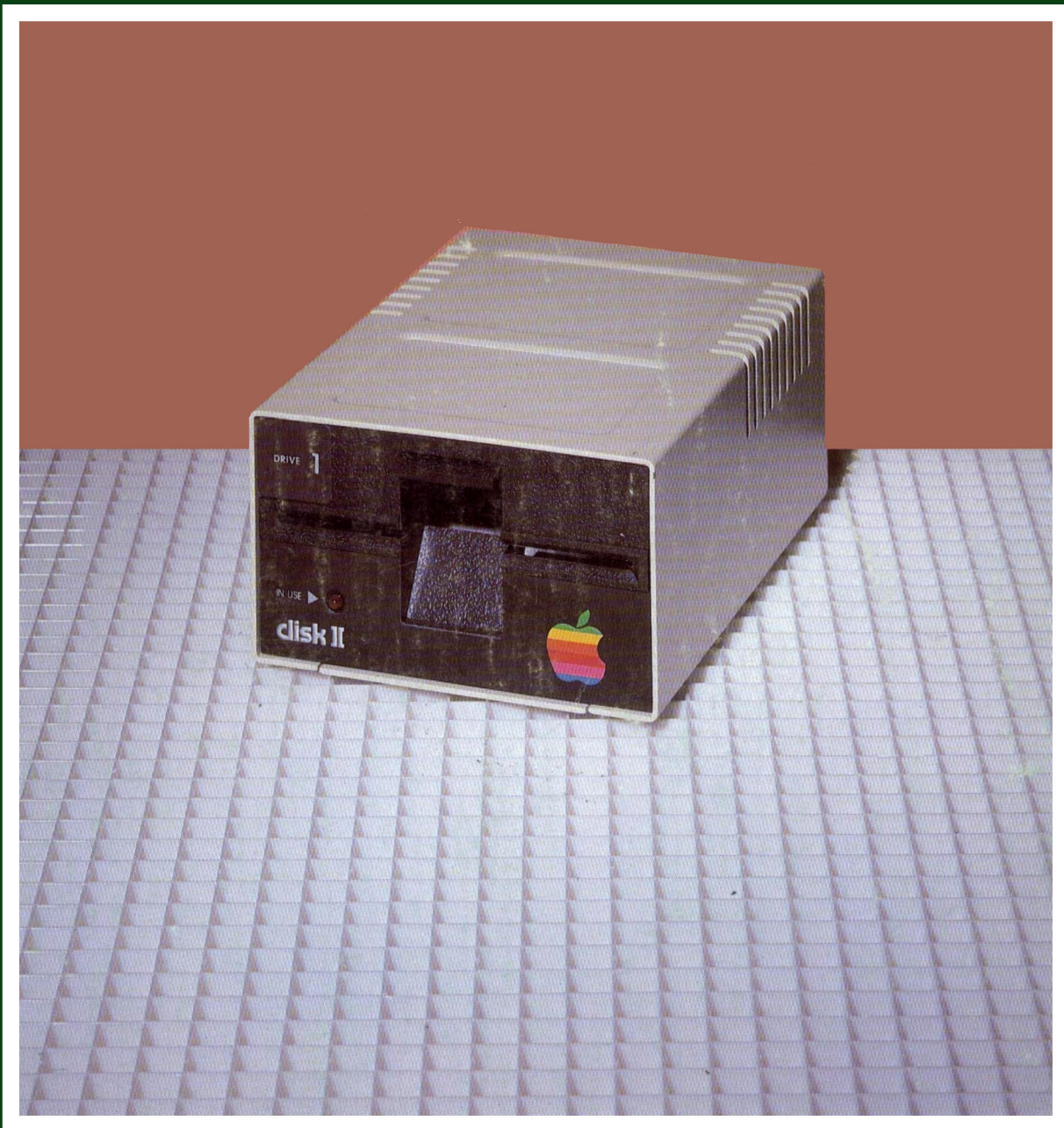


DISK DRIVE: APPLE® II MODEL A2M0003



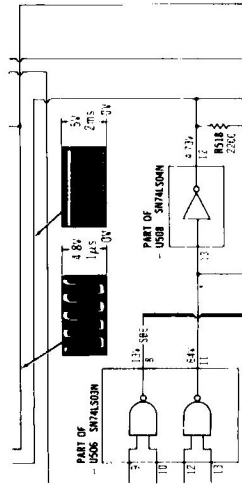
TECHNICAL SERVICE DATA FOR YOUR DISK DRIVE



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 CIRCUITTRACE®, GRIDTRACE™, waveforms, voltages and stage identification.

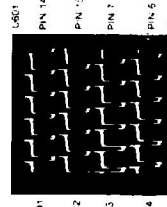


• Step by Step Troubleshooting guides the technician through the necessary procedures to quickly locate the problem.

TROUBLESHOOTING

MICROPROCESSOR CHIP (CPU) OPERATION

With the processor is functioning, to check the data lines (pins 41 thru 56) using a logic probe or a scope. The logic probe is used here to the "Logic Chart" for the correct readings. In a scope is used the waveforms of the address mode should be similar to Figure 1. The waveforms of the data lines should be similar to Figure 2.



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

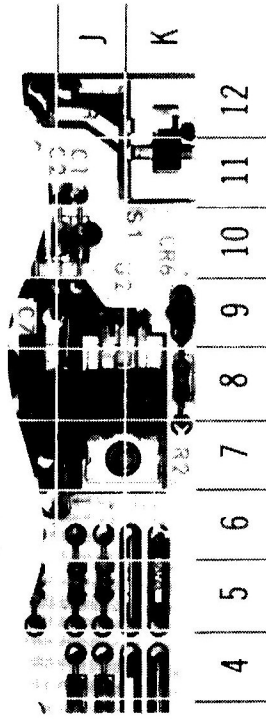
LOGIC

PIN NO.	IC U100	PIN NO.	IC U100	IC U101	IC U102	IC U103	IC U104	IC U105	IC U106	IC U107	IC U108	IC U109
1	P	21	P	1	L	L	L	L	L	L	L	L
2	P	22	P	2	P	P	P	P	P	P	P	P
3	P	23	P	3	H	H	H	H	H	H	H	H

If seal is broken, nonreturnable.

• Quick Component Location using the SAMS exclusive GRIDTRACE, CIRCUITTRACE, 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.



• 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						WORKMAN PART No.	ZENITH PART No
			EGC PART No	GENERAL ELECTRIC PART No	MOTOROLA PART No	NTE PART No	RCA PART No.	SK PART No.		
D102	15553	1149-2576	GE-514	1M4935	1M4935	NTE519	SK6091/177	#EP925/519	103-131	
D103	1N60FM	1149-2527	1M60	1M4004	1M4004	NTE109	SK3088	#EP134/109	103-2001	
D201	1N4004GP	1201-4205	EGC116	GE-504A	1M4004	NTE116	SK3312	#E1157	212-76-02	
D501 thru D503	15553	1149-2576	EGC519	GE-514	1M4935	NTE519	SK6091/177	#EP925/519	103-131	

CIRCUITTRACE is a registered trademark of Howard W. Sams & Co., Inc. COMPUTERFACTS and GRIDTRACE are trademarks of Howard W. Sams & Co., Inc. 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.

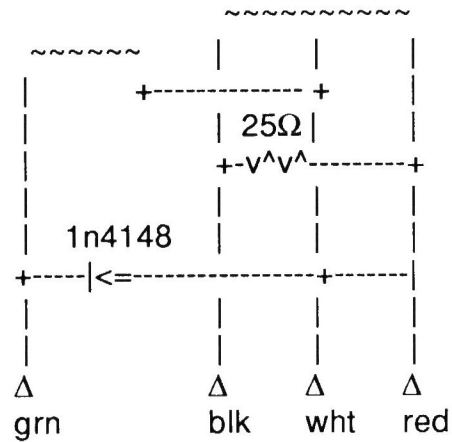
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

CD6
08938



Disk II Head Ω Readings

Readings of the impedance of the head of a Disk II.



red blk 25Ω
 red brn 20.6Ω
 red wht 12.2Ω

wht blk 12Ω
 wht grn 8.3Ω

grn blk 20.5Ω

Disk II Repair Pricings

Ribbon retainer \$ 3.00
 IC - standard \$ 5.00
 IC - special \$ 7.50
 R/W head \$25.00

PRELIMINARY SERVICE CHECKS

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

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

Replacement or repair of the analog board and motor speed control board or connectors may be necessary after the malfunction has been isolated.

APPLE
MODEL DISK II
CD6

APPLE
MODEL DISK II
CD6

REPLACEMENT PARTS AND DESCRIPTION

ITEM	PART NO.	DESCRIPTION
C4		Electrolytic, 470 μ F
C5		Electrolytic, 10 μ F
IC1	(1)	IC, Speed Control, CX065B
M1		Motor, Drive
M2		Motor, Stepper
M3		Head, W/R,E
Q1		Transistor, Switch, NSDU51
Q2		Transistor, Switch, 2N3906
Q4	(1)	Transistor, Motor Control, 2SB596-0
S1		Switch, Notch
VR1	(1)	Control, Speed, 50K
1B		IC, Read Amp, MC3470P
3A		IC, Write Amp, CA3146E
4B		IC, SN74LS125N
4D		IC, Driver, ULN2003A
		Belt, Drive
		P.C. Board, Analog
		P.C. Board, Motor Speed Control

(1) Located on Motor Speed Control Board

SAMS™ Howard W. Sams & Co., Inc.
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein.

© 1985 Howard W. Sams & Co., Inc.

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

Printed in U.S. of America.

84CD14920

DATE 3-85

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 POWER SUPPLY

- (A) Check for 11.6V at the emitter, 11.6V at the collector, and 10.8V at the base of Switch Transistor (Q1). If the 11.6V is missing, check the cable to the Computer and Connector J1.
- (B) If the 10.8V is missing, check Switch Transistor (Q1).
- (C) Check for 5.0V at the positive lead of Electrolytic C4.
- (D) Check for -12.0V on the negative lead of Electrolytic C5.

② DISK DRIVE OPERATION IS ERRATIC

Check for possible interference from the Monitor or other electronic equipment. Position the Disk Drive away from the Monitor and other electronic equipment and check operation of the Disk Drive.

- (A) Clean the W/R,E Head (M3) with a cotton swab or lint free cloth dampened with 91% isopropyl alcohol and dry with a lint free cloth.

③ DISK DRIVE MOTOR DOES NOT TURN DISKETTE

- (A) Check for a loose Drive Belt.
- (B) Check and adjust the Speed Control (VR1), for correct speed. See "Motor Speed Adjustment" section of Miscellaneous Adjustments.
- (C) Remove the Drive Belt, turn On power and see if Drive Motor (M1) runs freely. If Motor M1 starts then decreases to a stop and is jammed, check Motor M1 by substitution.
- (D) If Drive Motor (M1) does not run, check the winding resistances of the Motor M1.
- (E) Check for 10.4V at pin 7 of the Speed Control IC (IC1) and 10.4V at the emitter and 6.0V at the collector of Motor Control Transistor (Q4). If these voltages are normal, check the Motor Speed Control Board by substitution.

④ DISK DRIVE WILL NOT WRITE

- (A) Check for 11.6V at pin 8 of Write Amp IC (3A) or at the base of Switch Transistor (Q2).

- (B) Check the adjustment of the speed of the Disk Drive, see "Motor Speed Adjustment" section of Miscellaneous Adjustments.

- (C) Check the resistance of the W/R,E Head (M3) and clean Head M3.

- (D) If the W/R,E Head (M3) checks normal, check the Write Amp IC (3A) and IC 4B by substitution.

- (E) Check Connector J3 for open or intermittent connections.

⑤ DISK DRIVE WILL NOT READ

- (A) Clean the W/R,E Head (M3).

- (B) Check the Radial alignment of the disk drive, see "Radial Alignment Adjustment" section of Miscellaneous Adjustments.

- (C) Check the adjustment of the speed of the Disk Drive, see "Motor Speed Adjustment" section of Miscellaneous Adjustments. Also check IC 4B by substitution.

- (D) Check the Read Amp IC (1B) by substitution.

- (E) Check Connector J3 for open or intermittent connections.

⑥ WRITE PROTECT DOES NOT FUNCTION

- (A) Check Notch (Write Protect) Switch (S1) for normal operation.

- (B) If operation of the Notch (Write Protect) Switch (S1) checks normal, check IC 4B by substitution.

⑦ STEPPER MOTOR INOPERATIVE

- (A) Check for 11.6V at pins 11, 12, M, N, P and R of Connector J2.

- (B) Check the resistance of the windings of the Stepper Motor (M2).

- (C) Check the Driver IC (4D) by substitution.

- (D) Check for good connection at Connector J2.

TEST EQUIPMENT AND TOOLS

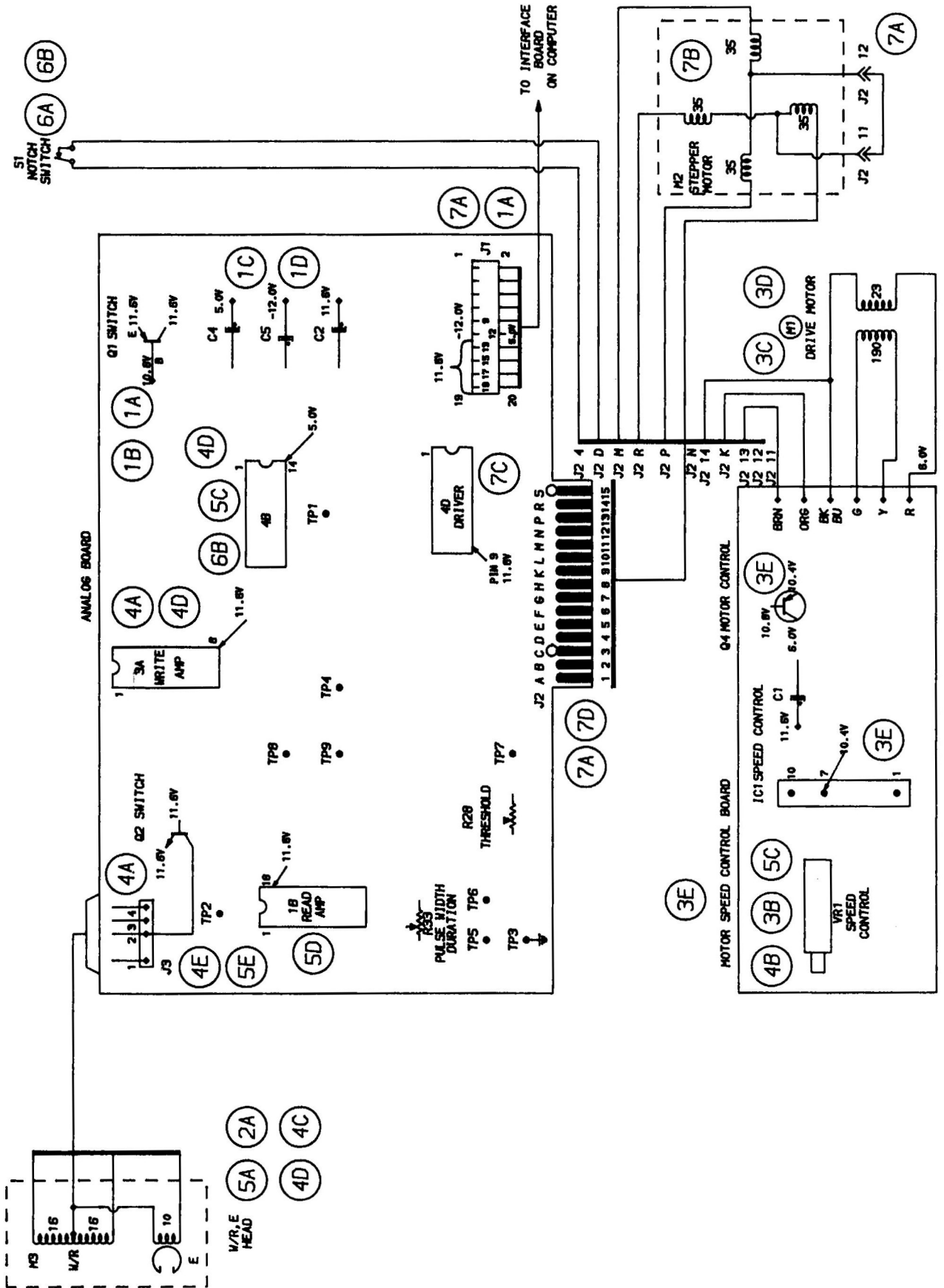
TEST EQUIPMENT

Digital Volt/Ohm Meter
Logic Probe
Monitor
Host Computer

TOOLS

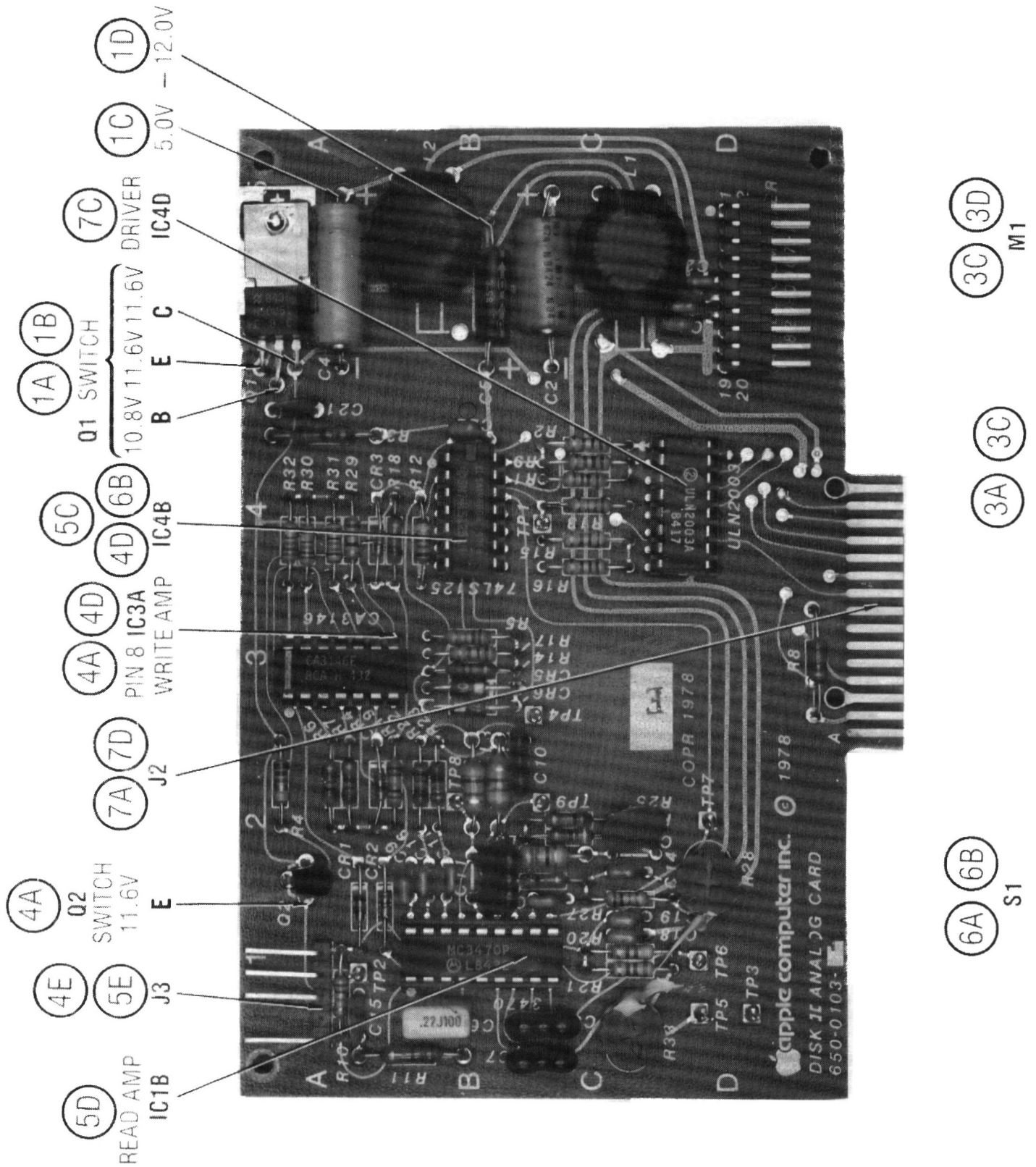
Phillips Screwdriver
Small Screwdriver
Low Voltage Soldering Iron
Head Cleaning Fluid, 97% Isopropyl alcohol or
Head Cleaning Diskette Kit
Desoldering Tool

PRELIMINARY SERVICE CHECKS (Continued)



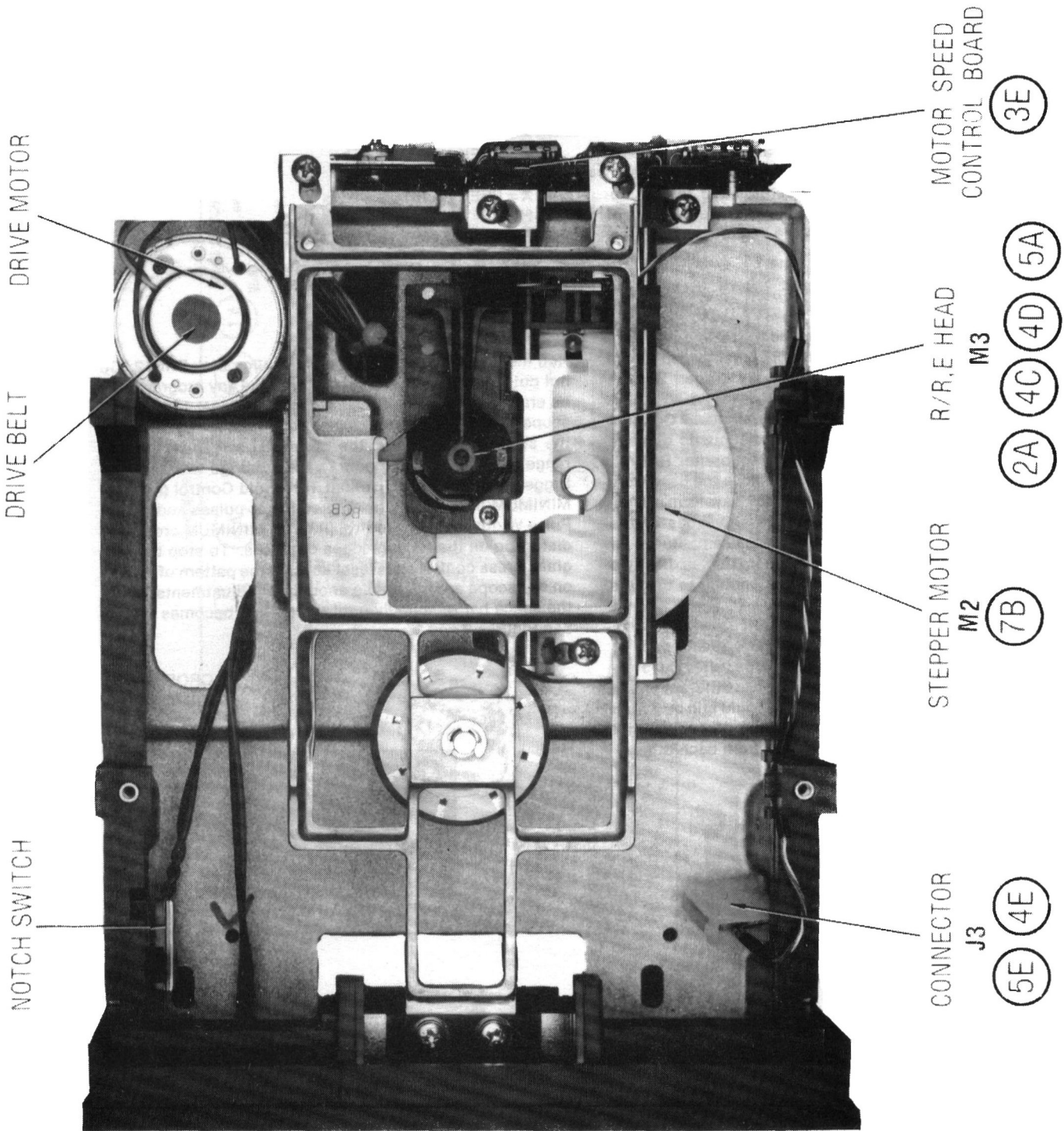
INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)



ANALOG BOARD

PRELIMINARY SERVICE CHECKS (Continued)



APPLE
MODEL DISK II

MECHANICAL-TOP VIEW

PRELIMINARY SERVICE CHECKS (Continued)

MISCELLANEOUS ADJUSTMENTS

NOTE: Use a diagnostic diskette and a Dysan Analog Alignment Diskette 224/2A.

WARNING

It is possible for a defective Disk Drive to write on or erase information on a diskette even if the diskette has been write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless so instructed in the alignment procedures. The test equipment may cause the disk drive circuits to erase sections of the alignment diskette even when the diskette is write protected with a write protect tab.

RADIAL ALIGNMENT ADJUSTMENT

Connect the channel 1 input of a scope to TP8 and the channel 2 input to TP9. Set the scope horizontal sweep to the 20ms range, the vertical inputs to the .2V range. Set the scope to add mode with one channel inverted. Put the diagnostic diskette into the drive to be aligned. Connect power to the Computer. Replace the diagnostic diskette with the Analog Alignment Diskette. Select or run "RADIAL ALIGNMENT" test. Press space bar to move the head from track 00 to track 16. A shape of CAT-EYES waveform will appear on the scope, see Figure 1. The two lobes of the waveform should be within 70% of equal amplitude. If lobes are less than 70% of each other, loosen the two screws holding Stepper Motor (M2) just enough to turn the motor until the lobes are within 70%.

Press space bar to move the head to track 39 and back to track 16, check the two lobes on the scope, after the stepper motor stops. See if the smaller lobe is a different phase than the first two lobes. The two lobes should still be within tolerance of 70% of each other. Repeat this procedure until the two lobes are within 70% tolerance from each other.

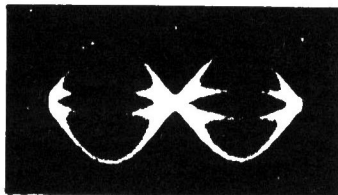


FIGURE 1

MOTOR SPEED ADJUSTMENT

Remove the cabinet bottom and cover and set the Disk Drive on its side. Insert a diskette into the Disk Drive and close the door. Activate the Drive Motor (M1), see "Direct Operation of Disk Drive" section of the Troubleshooting guide. Use the outer trace of the pattern on the spindle pulley of 60Hz AC power is being used and the inner trace if 50Hz AC power is being used. Use a 50Hz or 60Hz fluorescent light to view the pattern, adjust the Speed Control (VR1) until the pattern appears to stand still.

READ CIRCUIT ALIGNMENT ADJUSTMENT

Type the following program and save on a diskette using a good Disk Drive. Then use the diskette to align the read circuits. The program is set up to align Disk Drive 2, if used to align Disk Drive 1, change the number in line 20 from (- 16149) to (- 16150).

```
10 X = PEEK (- 16151)
20 X = PEEK (- 16149)
30 X = PEEK (- 16145)
40 X = PEEK (- 16147)
50 HOME
60 PRINT "ADJUST R28 AND R33"
70 GET A$
80 X = PEEK (- 16148)
90 X = PEEK (- 16146)
100 GOTO 30
```

Run the program from Disk Drive 1 to align Disk Drive 2. Do not put a diskette in Disk Drive 2 because any program may be erased in that Disk Drive. Connect channel 1 input of a scope to TP5 and channel 2 input of the scope to TP7. Set the scope to add mode, the horizontal sweep to the 2μs range and the vertical inputs to the 2V range with external trigger from channel 2. Adjust Threshold Control (R28) for MINIMUM jitter on the leading edges of pulses and adjust Pulse Width Duration Control (R33) for MINIMUM crossover distortion on the trailing edges of pulses. To stop the program, press control and Reset keys. If the pattern of pulses on the scope are not stable enough for adjustments, press the space bar repeatedly until the pattern becomes stable. See Figures 2 and 3.

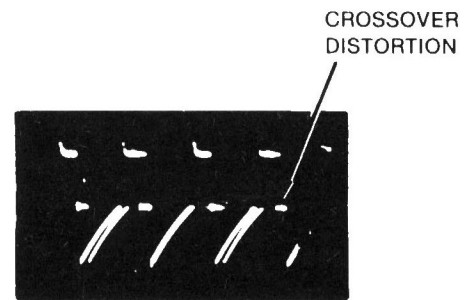


FIGURE 2

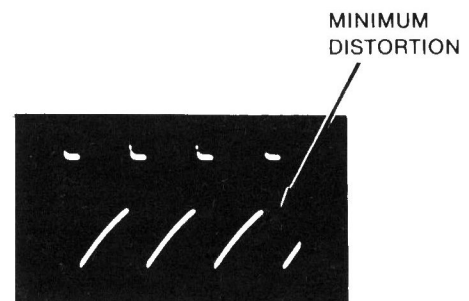


FIGURE 3

PRELIMINARY SERVICE CHECKS (Continued)

MISCELLANEOUS ADJUSTMENTS (Continued)

AZIMUTH CHECK ADJUSTMENT

Connect the channel 1 input of a scope to TP8 and the channel 2 input to TP9. Set the horizontal sweep to the .5ms range, the vertical inputs to the 50mV range and set the scope to add mode with one channel inverted. Insert the alignment diskette into the Disk Drive to be checked. Run the "Azimuth" function. A pattern of four vertical bars should appear on the scope. The correct azimuth is indicated when the two inside bars are longer than the two outside bars, see Figure 4.

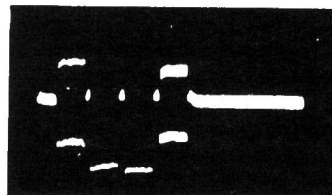


FIGURE 4

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.

PRELIMINARY SERVICE CHECKS (Continued)

GENERAL OPERATING INSTRUCTIONS

BOOTING THE DISK OPERATING SYSTEM (DOS)

Insert a diskette containing DOS into Disk Drive 1, and turn On the Computer. The Computer will automatically load 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 IN#6 and press the Return key. With 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 be rebooted by pressing the Open Apple key (key with Apple symbol, located on left side of space bar), Control key and Reset key at the same time.

OPERATING THE DISK 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.

USING BLANK DISKETTES

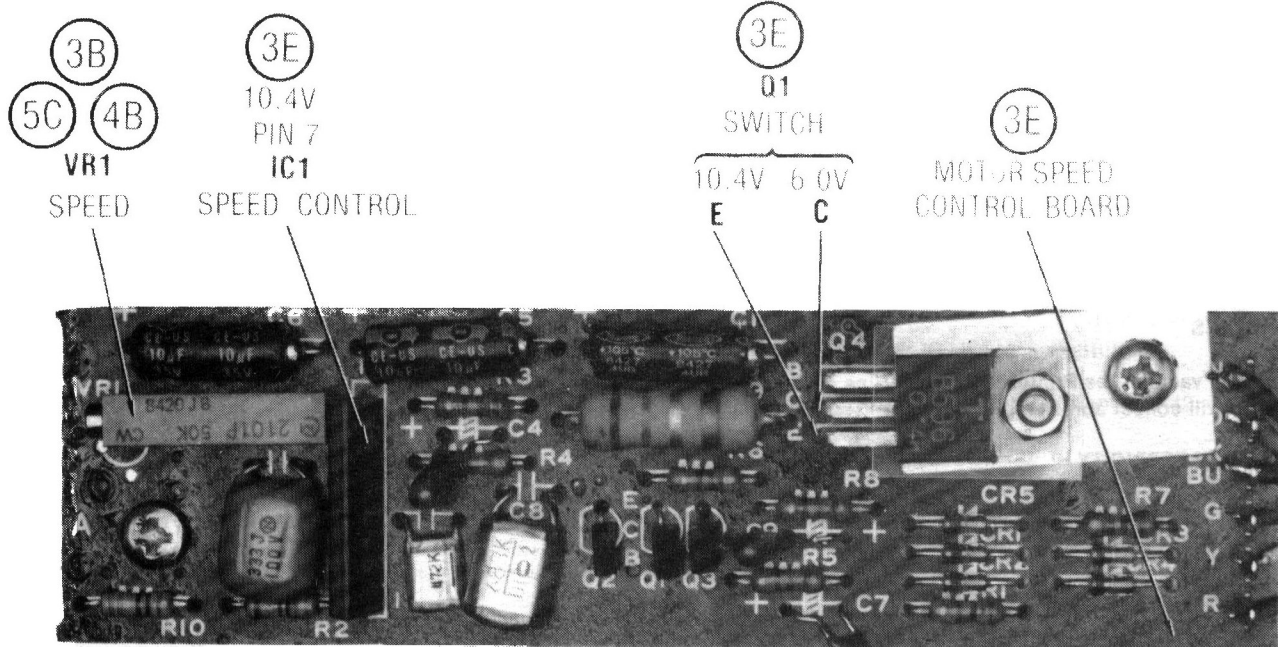
A blank diskette must be initialized (DOS3.3) or formatted (PRODOS) before it can be used to save data. To initialize a diskette using DOS3.3, boot DOS from a diskette containing DOS3.3 then remove the DOS3.3 diskette and insert a blank diskette in Disk Drive 1. Type INIT HELLO and press the Return key. The diskette will be initialized when the drive stops. NOTE: Any information on diskette will be overwritten.

If PRODOS is being used, select the PRODOS FILER (press key F) from the menu that comes up when PRODOS is booted up. Select Volume commands (press key V) from the second menu that comes up. Then select Format A Volume (press key F) 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.

DISASSEMBLY INSTRUCTIONS

CAUTION: To protect R/W,E Head (M3), insert a protective cardboard disk or a blank diskette into Disk Drive before disassembly.

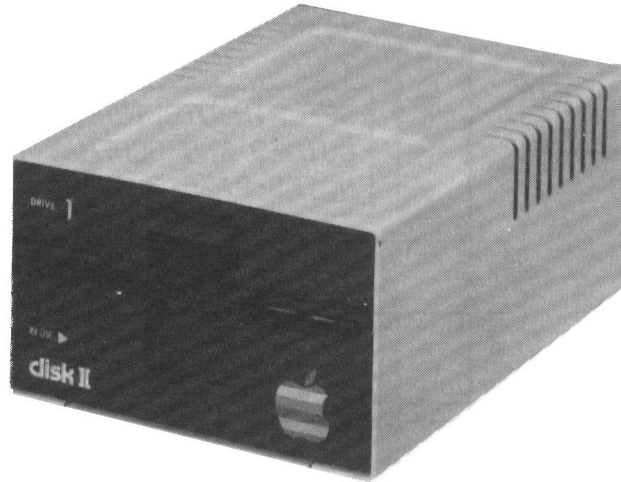
Remove four screws from bottom edges. Pull cover back and lift off. Remove four flat head screws holding bottom cover. Release plastic wire clip at rear of bottom cover and remove cover.



MOTOR SPEED CONTROL BOARD

APPLE
MODEL DISK II
CD6

APPLE
MODEL DISK II
CD6



MODEL DISK II

SAFETY PRECAUTIONS

See page 16.

PRELIMINARY SERVICE CHECKS

ENCLOSED

INDEX

	Page		Page
Block Diagram	14	Photos	
Disassembly Instructions	16	Analog Board	6,11
General Operating Instructions	16	Mechanical-Top View	12
GridTrace Location Guide		Motor Speed Control Board	7,10
Analog Board	6,11	Safety Precautions	16
Motor Speed Control Board	10	Schematic	2,15
Line Definitions	5	Schematic Notes	3
Logic Chart	5	Terminal Guides and Pinouts	3
Miscellaneous Adjustments	4,5	Troubleshooting	13
Parts List	8,9		

SAMS™ **Howard W. Sams & Co., Inc.**

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

The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed.

Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein.

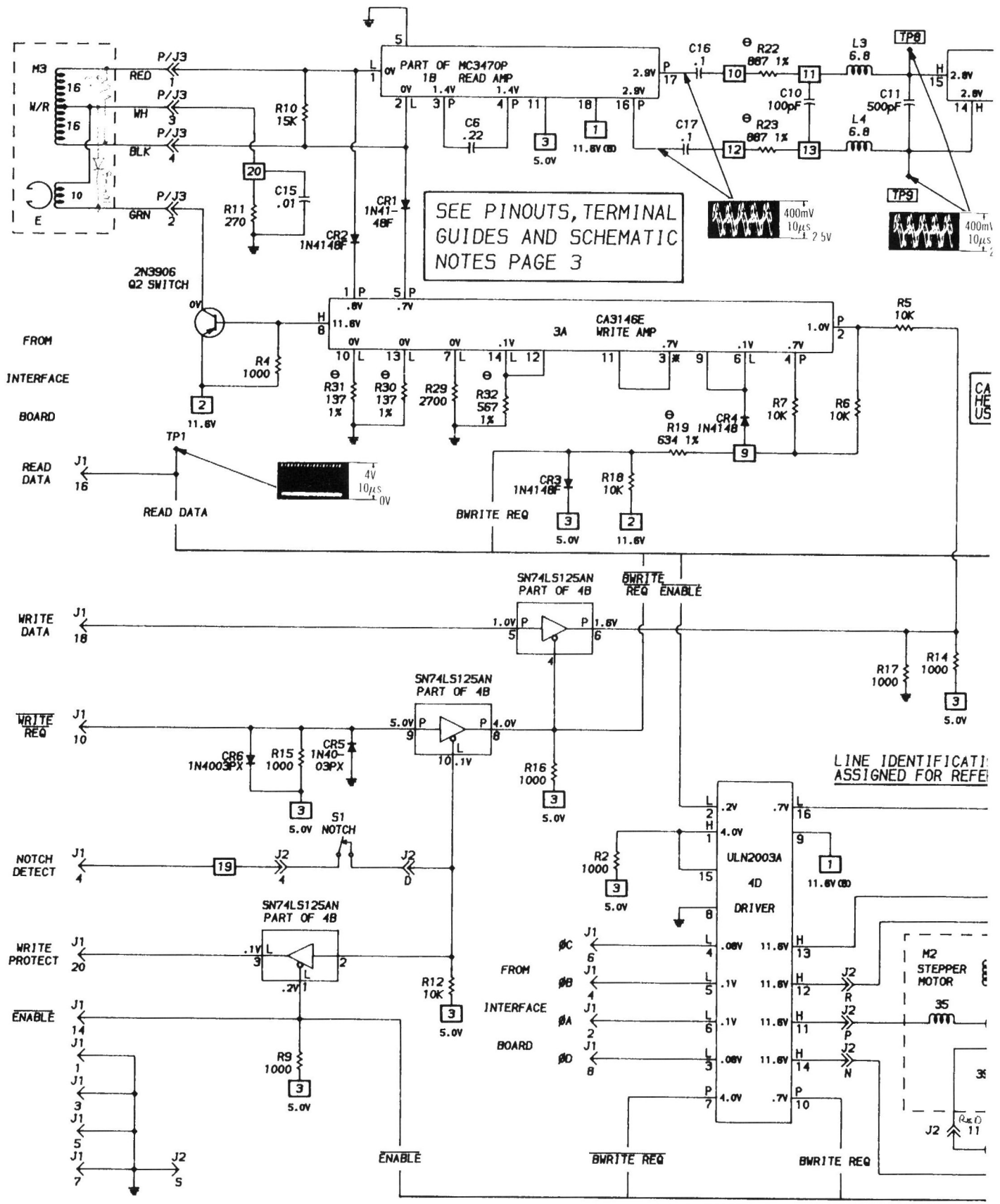
© 1985 Howard W. Sams & Co., Inc.

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

Printed in U.S. of America.

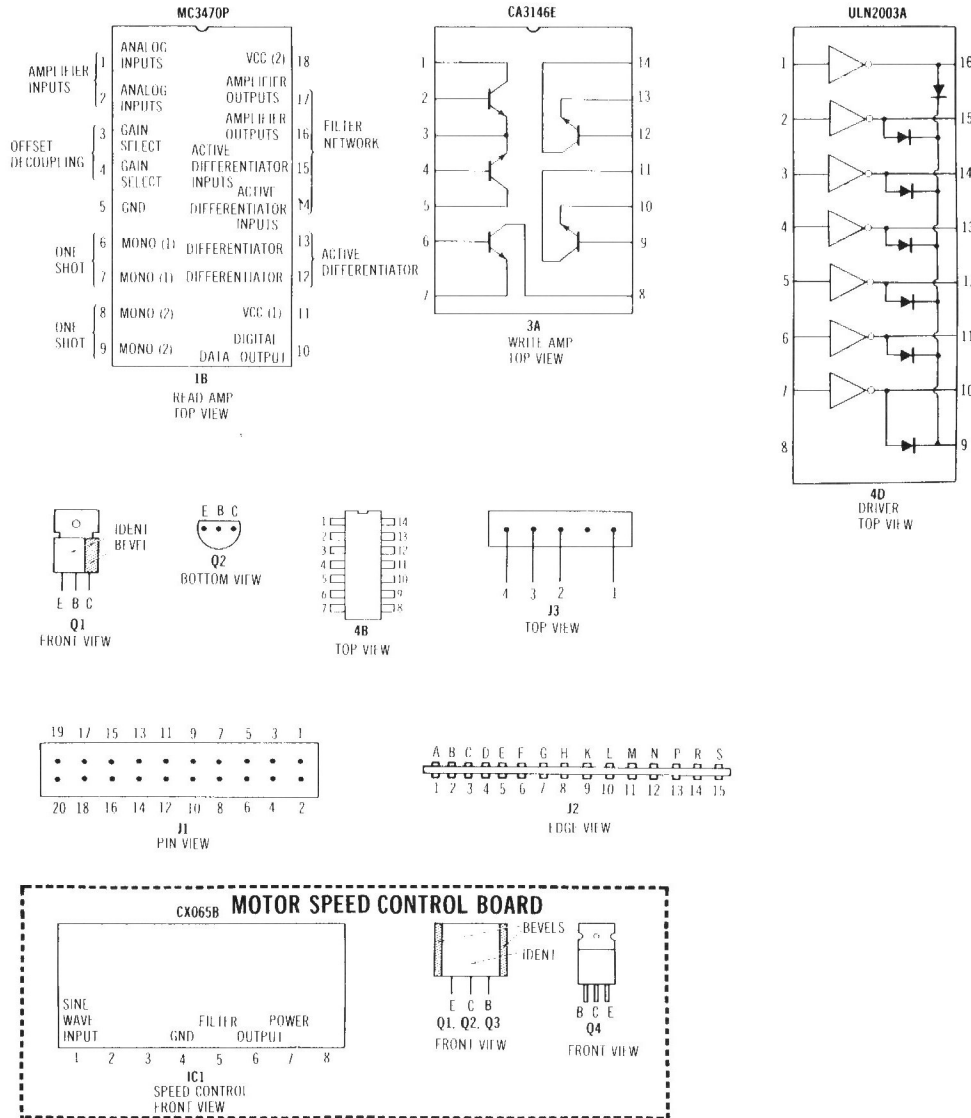
84CD14920

DATE 3-85



A PHOTOFAC STANDARD NOTATION SCHEMATIC WITH **CIRCUITRACE**
 © Howard W. Sams & Co., Inc. 1985

IC PINOUTS & TERMINAL GUIDES



SCHEMATIC NOTES

- *— Circuitry not used in some versions
 - - - Circuitry used in some versions
 - ⊕ See parts list
 - ⊕ Ground
- Waveforms and voltages are taken from ground, unless noted otherwise.
- Voltages, Waveforms and Logic probe readings taken while running the following Basic program without the Stepper Motor operating, unless noted otherwise. Read and Write circuits are active while the program is running.
- ```

10 D$ = " " (Put a CTRL D between the quotes)
20 PRINT D$; "OPEN SAMS"
30 PRINT D$; "WRITE SAMS"
40 FORX = 1 TO 50
50 PRINT "THIS IS A TEST"
60 NEXTX
70 PRINT D$; "CLOSE"
80 GOTO 20

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

- 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  $\mu$ 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.

## MISCELLANEOUS ADJUSTMENTS

NOTE: Use a diagnostic diskette and a Dysan Analog Alignment Diskette 224/2A.

### WARNING

It is possible for a defective Disk Drive to write on or erase information on a diskette even if the diskette has been write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless so instructed in the alignment procedures. The test equipment may cause the disk drive circuits to erase sections of the alignment diskette even when the diskette is write protected with a write protect tab.

### RADIAL ALIGNMENT ADJUSTMENT

Connect the channel 1 input of a scope to TP8 and the channel 2 input to TP9. Set the scope horizontal sweep to the 20ms range, the vertical inputs to the .2V range. Set the scope to add mode with one channel inverted. Put the diagnostic diskette into the drive to be aligned. Connect power to the Computer. Replace the diagnostic diskette with the Analog Alignment Diskette. Select or run "RADIAL ALIGNMENT" test. Press space bar to move the head from track 00 to track 16. A shape of CAT-EYES waveform will appear on the scope, see Figure 1. The two lobes of the waveform should be within 70% of equal amplitude. If lobes are less than 70% of each other, loosen the two screws holding Stepper Motor (M2) just enough to turn the motor until the lobes are within 70%.

Press space bar to move the head to track 39 and back to track 16, check the two lobes on the scope, after the stepper motor stops. See if the smaller lobe is a different phase than the first two lobes. The two lobes should still be within tolerance of 70% of each other. Repeat this procedure until the two lobes are within 70% tolerance from each other.

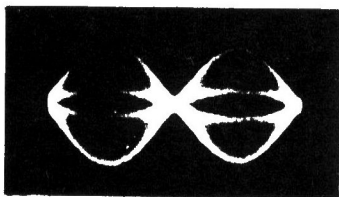


FIGURE 1

### MOTOR SPEED ADJUSTMENT

Remove the cabinet bottom and cover and set the Disk Drive on its side. Insert a diskette into the Disk Drive and close the door. Activate the Drive Motor (M1), see "Direct Operation of Disk Drive" section of the Troubleshooting guide. Use the outer trace of the pattern on the spindle pulley of 60Hz AC power is being used and the inner trace if 50Hz AC power is being used. Use a 50Hz or 60Hz fluorescent light to view the pattern, adjust the Speed Control (VR1) until the pattern appears to stand still.

### READ CIRCUIT ALIGNMENT ADJUSTMENT

Type the following program and save on a diskette using a good Disk Drive. Then use the diskette to align the read circuits. The program is set up to align Disk Drive 2, if used to align Disk Drive 1, change the number in line 20 from (- 16149) to (- 16150).

```
10 X = PEEK (- 16151)
20 X = PEEK (- 16149)
30 X = PEEK (- 16145)
40 X = PEEK (- 16147)
50 HOME
60 PRINT "ADJUST R28 AND R33"
70 GET A$
80 X = PEEK (- 16148)
90 X = PEEK (- 16146)
100 GOTO 30
```

Run the program from Disk Drive 1 to align Disk Drive 2. Do not put a diskette in Disk Drive 2 because any program may be erased in that Disk Drive. Connect channel 1 input of a scope to TP5 and channel 2 input of the scope to TP7. Set the scope to add mode, the horizontal sweep to the  $2\mu\text{s}$  range and the vertical inputs to the 2V range with external trigger from channel 2. Adjust Threshold Control (R28) for MINIMUM jitter on the leading edges of pulses and adjust Pulse Width Duration Control (R33) for MINIMUM crossover distortion on the trailing edges of pulses. To stop the program, press control and Reset keys. If the pattern of pulses on the scope are not stable enough for adjustments, press the space bar repeatedly until the pattern becomes stable. See Figures 2 and 3.

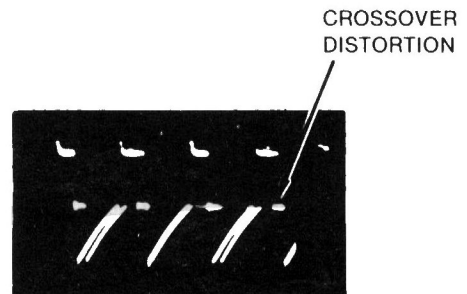


FIGURE 2

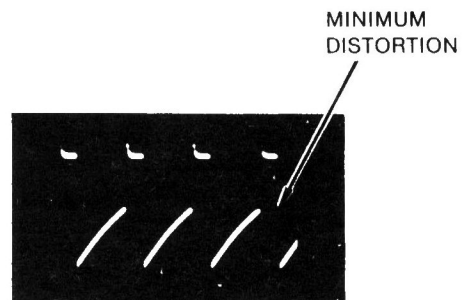


FIGURE 3

## MISCELLANEOUS ADJUSTMENTS (Continued)

### AZIMUTH CHECK ADJUSTMENT

Connect the channel 1 input of a scope to TP8 and the channel 2 input to TP9. Set the horizontal sweep to the .5ms range, the vertical inputs to the 50mV range and set the scope to add mode with one channel inverted. Insert the alignment diskette into the Disk Drive to be checked. Run the "Azimuth" function. A pattern of four vertical bars should appear on the scope. The correct azimuth is indicated when the two inside bars are longer than the two outside bars, see Figure 4.

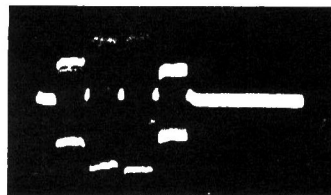


FIGURE 4

### LINE DEFINITIONS

**BWRITE REQ** ..... Buffered Write Request  
**ENABLE** ..... Enable  
**READ DATA** ..... Read Data  
**WRITE REQ** ..... Write Request

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

### LOGIC CHART

| PIN NO. | IC 1C1 | IC 1B | IC 3A | IC 4B | IC 4D |
|---------|--------|-------|-------|-------|-------|
| 1       | P      | L     | P     | L     | H     |
| 2       | L      | L     | P     | L     | L     |
| 3       | L      | P     | *     | L     | L     |
| 4       | L      | P     | P     | P     | L     |
| 5       | L      | L     | P     | P     | L     |
| 6       | *      | P     | L     | P     | L     |
| 7       | H      | P     | L     | L     | P     |
| 8       | H      | P     | H     | L     | L     |
| 9       |        | P     | L     | P     | H     |
| 10      |        | P     | L     | L     | P     |
| 11      |        | H     | *     | P     | H     |
| 12      |        | P     | L     | P     | H     |
| 13      |        | P     | L     | L     | H     |
| 14      |        | H     | L     | H     | H     |
| 15      |        | H     |       |       | H     |
| 16      |        | P     |       |       | L     |
| 17      |        | P     |       |       |       |
| 18      |        | H     |       |       |       |

Logic probe readings taken while running the following Basic program without the Stepper Motor operating, unless noted otherwise. Read and Write circuits are active while the program is running.

```
10 D$=" "(Put a CTRL D between the quotes)
20 PRINT D$; "OPEN SAMS"
30 PRINT D$; "WRITE SAMS"
40 FORX = 1 TO 50
50 PRINT "THIS IS A TEST"
60 NEXTX
70 PRINT D$; "CLOSE"
80 GOTO 20
```

Logic Probe Display

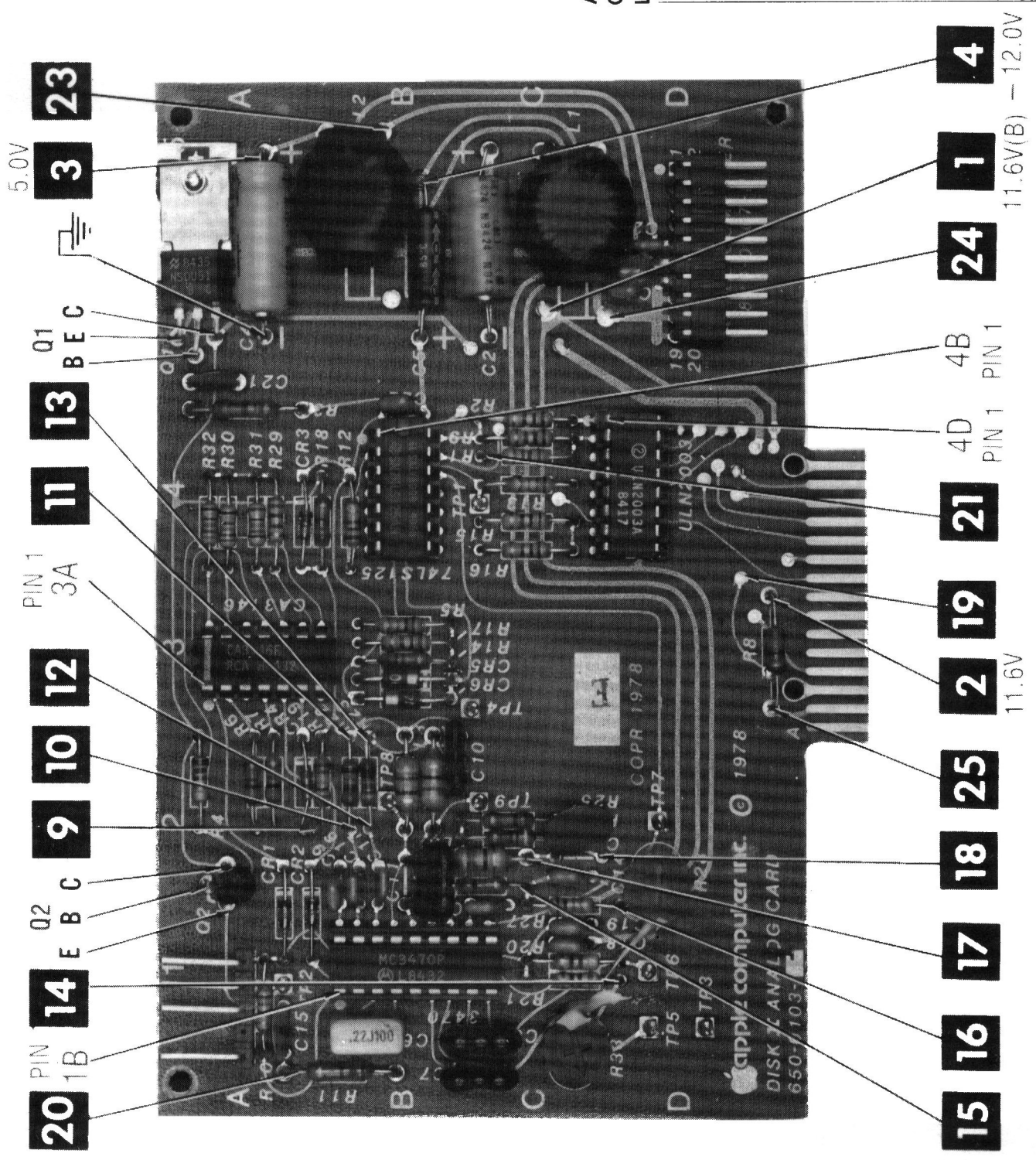
L = Low

H = High

P = Pulse

\* = Open (No light On)



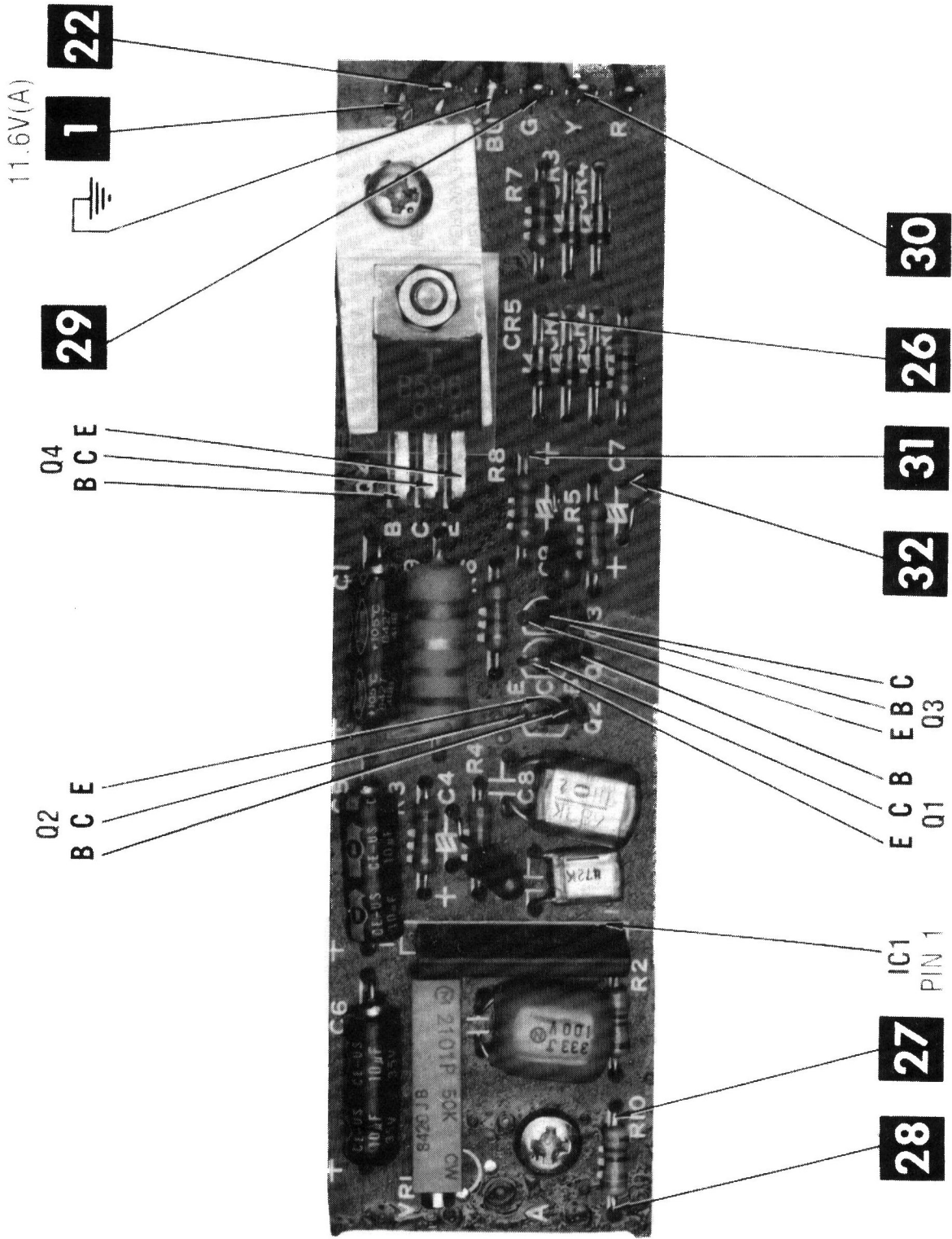


**ANALOG BOARD**  
GridTrace  
**LOCATION GUIDE**

|     |     |
|-----|-----|
| C1  | D-5 |
| C2  | C-5 |
| C3  | D-5 |
| C4  | A-5 |
| C5  | B-5 |
| C6  | B-1 |
| C7  | C-1 |
| C8  | C-1 |
| C9  | B-2 |
| C10 | B-2 |
| C11 | B-2 |
| C12 | C-1 |
| C13 | C-2 |
| C14 | C-2 |
| C15 | A-1 |
| C16 | B-2 |
| C17 | B-2 |
| C18 | C-1 |
| C19 | C-1 |
| C20 | D-5 |
| C21 | A-4 |
| C22 | B-4 |
| CR1 | A-1 |

ANALOG BOARD A Howard W. Sams **CIRCUITRACE** Photo

APPLE  
MODEL DISK II  
CD6



## PARTS LIST AND DESCRIPTION

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

### WIRING DATA

|                                           |                                                                                              |
|-------------------------------------------|----------------------------------------------------------------------------------------------|
| Shielded Hook-up Wire .....               | Use BELDEN No. 8401 or 8421 (Single-Conductor)<br>8208 (Two-Conductor)                       |
| General-use Unshielded Hook-up Wire ..... | Use BELDEN No. 8529 (Solid) Available in 13 Colors<br>8522 (Stranded) Available in 13 Colors |
| Shielded Disk Drive Head Cable .....      | Use BELDEN No. 9534 (Four-Conductor)                                                         |

### SEMICONDUCTORS (Select replacement transistor for best results)

| ITEM No.                         | TYPE No.    | MFR. PART No. | REPLACEMENT DATA          |                       |                      |              |                  |            | ZENITH PART No. |
|----------------------------------|-------------|---------------|---------------------------|-----------------------|----------------------|--------------|------------------|------------|-----------------|
|                                  |             |               | GENERAL ELECTRIC PART No. | NEW-TONE NTE PART No. | PHILIPS ECG PART No. | RCA PART No. | WORKMAN PART No. |            |                 |
| CR1 thru CR3                     | 1N4148F     |               | GE-514                    | NTE519                | ECG519               | SK3100/519   | WEP925/519       | 103-131    |                 |
| CR4                              | 1N4148      |               | GE-514                    | NTE519                | ECG519               | SK3100/519   | WEP925/519       | 103-131    |                 |
| CR5,6                            | 1N4003PX    |               | GE-504A                   | NTE116                | ECG116               | SK3311       | WEP156           | 212-76-02  |                 |
| Q1                               | NSDU51      |               | GE-253                    | NTE211                | ECG211               | SK3203/211   | WEP759/211       | 121-Z9056  |                 |
| Q2                               | 2N3906      |               | GE-82                     | NTE159                | ECG159               | SK3466/159   | WEP62/159        | 121-Z9003  |                 |
| 1B                               | MC3470P     |               |                           |                       | ECG3470              | SK3697       |                  | 221-94     |                 |
| 3A                               | CA3146E     |               |                           |                       | ECG74LS125A          | SK74LS125A   |                  | HE-443-811 |                 |
| 4B                               | SN74LS125AN |               | 74LS125A                  | NTE74LS125A           | ECG74LS125A          | SK9093/2013  |                  |            |                 |
| 4D                               | ULN2003A    |               |                           | NTE2013               | ECG2013              |              |                  |            |                 |
| <b>MOTOR SPEED CONTROL BOARD</b> |             |               |                           |                       |                      |              |                  |            |                 |
| CR1 thru CR5                     |             |               | GE-210                    | NTE85                 | ECG85                | SK3124A/289A | WEP910/289       | 921-1114   |                 |
| IC1                              | CX065B      |               | GE-269                    | NTE290A               | ECG290A              | SK3114A/290A | WEP911/290A      | 121-Z9003* |                 |
| Q1,2                             | 29C2785F    |               | GE-250                    | NTE197                | ECG197               | SK3441/292   | WEP757/197       | 121-988-03 |                 |
| Q3                               | 2SA1175F    |               |                           |                       |                      |              |                  |            |                 |
| Q4                               | 29B596-0    |               |                           |                       |                      |              |                  |            |                 |

\*Lead configuration may vary from original.

## PARTS LIST AND DESCRIPTION (Continued)

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

### CONTROLS (All wattages 1/2 watt, or less, unless listed)

| ITEM NO.                         | FUNCTION                             | RESISTANCE | MFGR. PART NO. | NOTES |
|----------------------------------|--------------------------------------|------------|----------------|-------|
| R28<br>R33                       | Threshold<br>Pulse Width<br>Duration | 10K<br>10K |                |       |
| <b>MOTOR SPEED CONTROL BOARD</b> |                                      |            |                |       |
| VR1                              | Speed                                | 50K        | 2101P (1)      |       |

(1) Number on unit.

### RESISTORS (Power and Special)

| ITEM No.                         | RATING                  | REPLACEMENT DATA |                   |                  |
|----------------------------------|-------------------------|------------------|-------------------|------------------|
|                                  |                         | MFGR. PART No.   | NEW-TONE PART No. | WORKMAN PART No. |
| R19                              | 634 1% 1/4W Carbon Film |                  |                   |                  |
| R22                              | 887 1% 1/4W Carbon Film |                  |                   |                  |
| R23                              | 887 1% 1/4W Carbon Film |                  |                   |                  |
| R30                              | 137 1% 1/4W Metal Film  |                  |                   |                  |
| R31                              | 137 1% 1/4W Metal Film  |                  |                   |                  |
| R32                              | 576 1% 1/4W Carbon Film |                  |                   |                  |
| <b>MOTOR SPEED CONTROL BOARD</b> |                         |                  |                   |                  |
| R2                               | 68K 1% 1/4W Metal Film  |                  | QW251             |                  |
| R10                              | 5100 3% 1/4W Metal Film |                  |                   |                  |

APPLE  
MODEL DISK II

### COILS (RF-IF)

| ITEM No. | FUNCTION | MFGR. PART No. |
|----------|----------|----------------|
| L1       | RF Choke |                |
| L2       | RF Choke |                |
| L3       | Peaking  |                |

| ITEM No. | FUNCTION | MFGR. PART No. |
|----------|----------|----------------|
| L4       | Peaking  |                |
| L5       | Peaking  |                |

### MISCELLANEOUS

| ITEM No. | PART NAME       | MFGR. PART No. | NOTES                  |
|----------|-----------------|----------------|------------------------|
| LED1     | LED             |                | Busy, Red (1.9V @ 8mA) |
| M1       | Motor/Generator |                | Drive                  |
| M2       | Motor           |                | Stepper                |
| M3       | Head            |                | W/R, E                 |
| S1       | Switch          |                | Notch                  |
|          | Belt            |                | Drive                  |

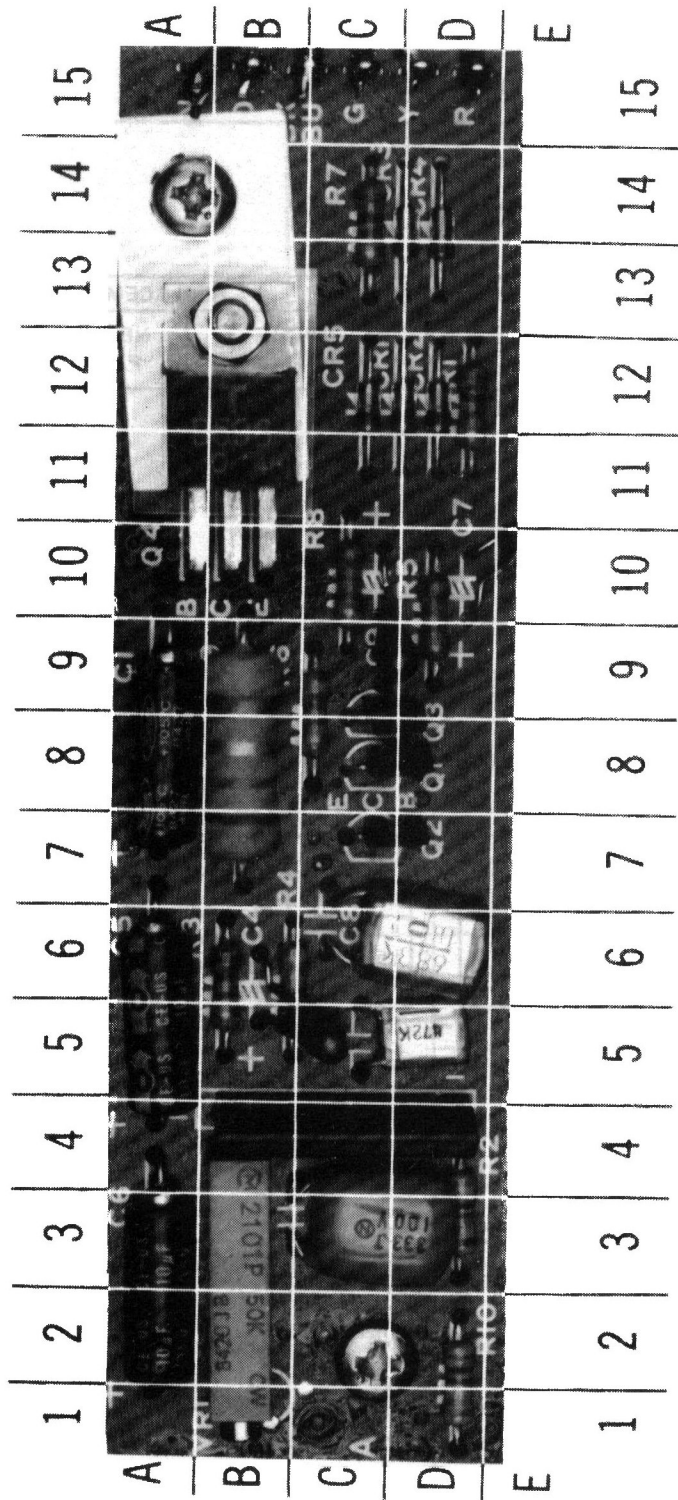
### CABINET & CABINET PARTS (When ordering specify model, chassis & color)

**MOTOR SPEED CONTROL BOARD**

A Howard W. Sams **GRIDTRACE™** Photo

**MOTOR SPEED  
CONTROL BOARD  
GridTrace  
LOCATION GUIDE**

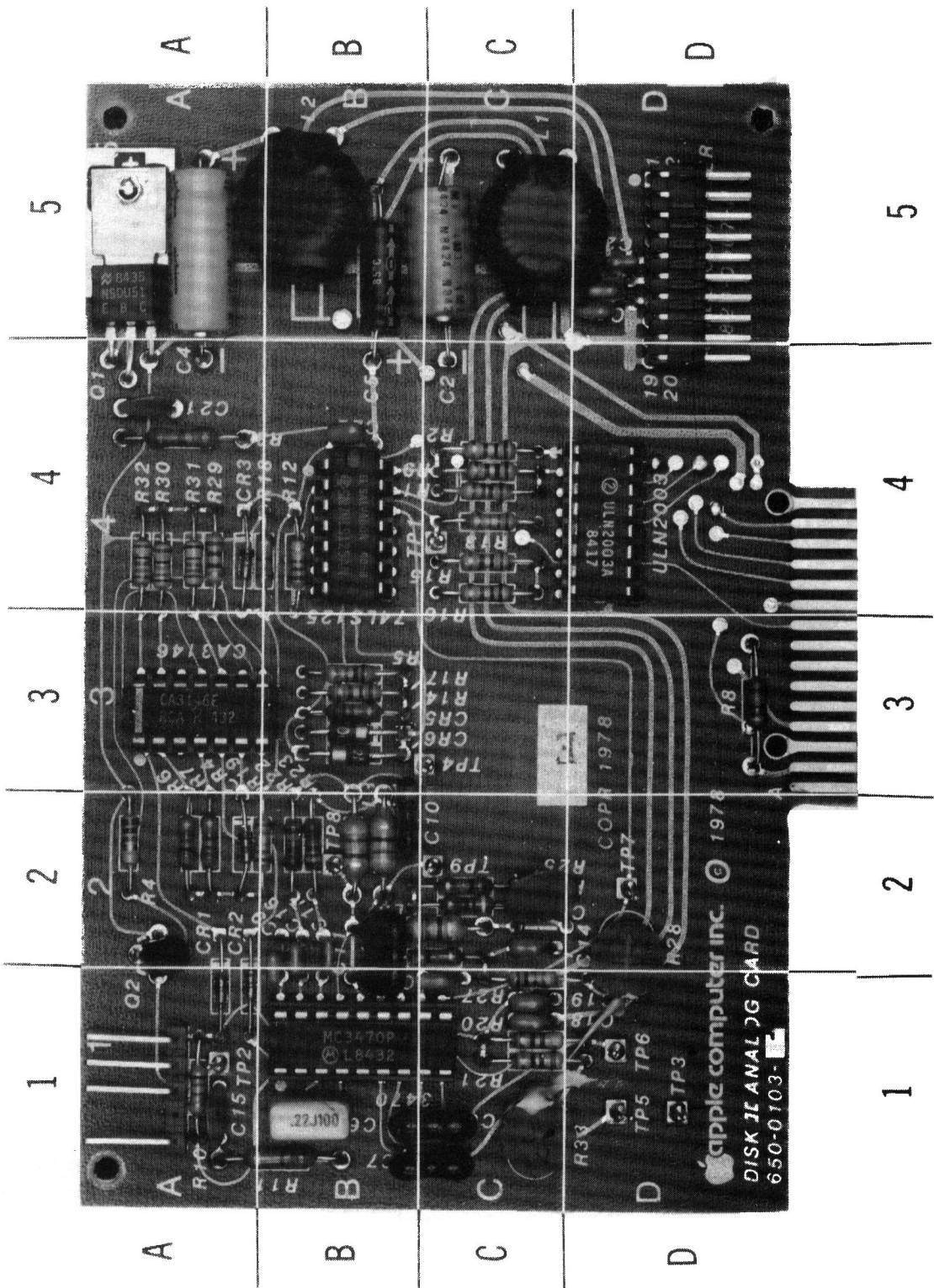
|     |      |
|-----|------|
| R1  | D-12 |
| R2  | D-3  |
| R3  | B-6  |
| R4  | B-6  |
| R5  | D-10 |
| R6  | C-8  |
| R7  | C-14 |
| R8  | C-10 |
| R9  | B-8  |
| R10 | D-1  |
| C1  | A-8  |
| C2  | C-5  |
| C3  | C-3  |
| C4  | B-6  |
| C5  | A-5  |
| C6  | A-2  |
| C7  | E-10 |
| C8  | C-6  |
| C9  | C-10 |
| CR1 | C-12 |
| CR2 | D-12 |
| CR3 | C-14 |
| CR4 | D-14 |
| CR5 | C-12 |
| IC1 | C-4  |
| Q1  | C-8  |
| Q2  | C-7  |
| Q3  | C-9  |
| Q4  | B-10 |
| VR1 | B-2  |



**MOTOR SPEED  
CONTROL BOARD  
GridTrace  
LOCATION GUIDE**

|     |      |
|-----|------|
| R1  | D-12 |
| R2  | D-3  |
| R3  | B-6  |
| R4  | B-6  |
| R5  | D-10 |
| R6  | C-8  |
| R7  | C-14 |
| R8  | C-10 |
| R9  | B-8  |
| R10 | D-1  |
| C1  | A-8  |
| C2  | C-5  |
| C3  | C-3  |
| C4  | B-6  |
| C5  | A-5  |
| C6  | A-2  |
| C7  | E-10 |
| C8  | C-6  |
| C9  | C-10 |
| CR1 | C-12 |
| CR2 | D-12 |
| CR3 | C-14 |
| CR4 | D-14 |
| CR5 | C-12 |
| IC1 | C-4  |
| Q1  | C-8  |
| Q2  | C-7  |
| Q3  | C-9  |
| Q4  | B-10 |
| VR1 | B-2  |

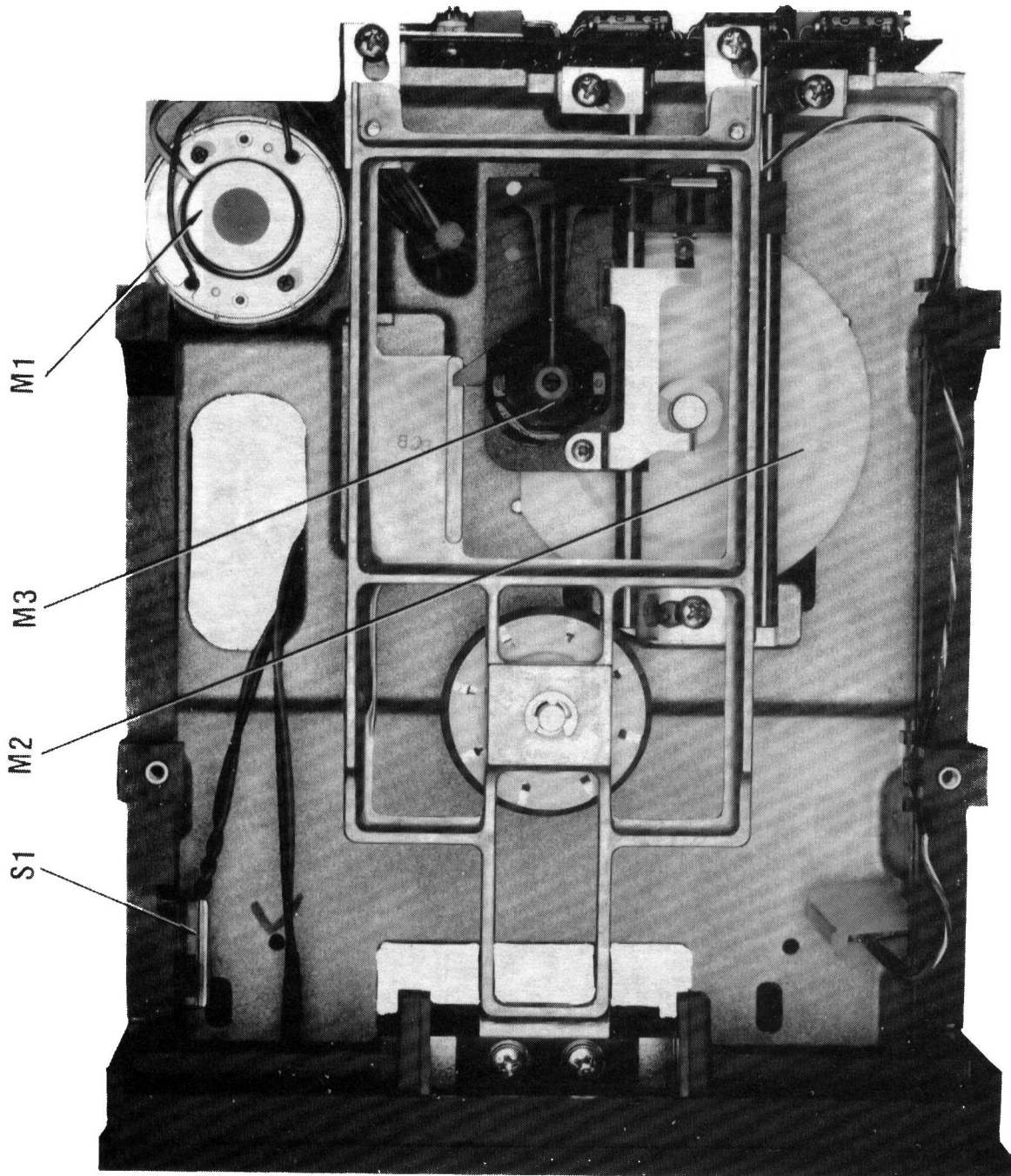
CR2  
 CR3  
 CR4  
 CR5  
 CR6  
 J1  
 J2  
 J3  
 L1  
 L2  
 L3  
 L4  
 L5  
 Q1  
 Q2  
 R1  
 R2  
 R3  
 R4  
 R5  
 R6  
 R7  
 R8  
 R9  
 R10  
 R11  
 R12  
 R13  
 R14  
 R15  
 R16  
 R17  
 R18  
 R19  
 R20  
 R21  
 R22  
 R23  
 R24  
 R25  
 R26  
 R27  
 R28  
 R29  
 R30  
 R31  
 R32  
 R33  
 TP1  
 TP2  
 TP3  
 TP4  
 TP5  
 TP6  
 TP7  
 TP8  
 TP9  
 A-1  
 A-2  
 A-3  
 A-4  
 B-1  
 B-2  
 B-3  
 B-4  
 C-1  
 C-2  
 C-3  
 C-4  
 D-1  
 D-2  
 D-3  
 D-4  
 A-1  
 A-2  
 A-3  
 A-4  
 B-1  
 B-2  
 B-3  
 B-4  
 C-1  
 C-2  
 C-3  
 C-4  
 D-1  
 D-2  
 D-3  
 D-4  
 A-1  
 A-2  
 A-3  
 A-4  
 B-1  
 B-2  
 B-3  
 B-4  
 C-1  
 C-2  
 C-3  
 C-4  
 D-1  
 D-2  
 D-3  
 D-4



A Howard W. Sams GRIDTRACE™ Photo

ANALOG BOARD

APPLE  
MODEL DISK II



MECHANICAL-TOP VIEW

# TROUBLESHOOTING

## POWER SUPPLY

Connect the Disk Drive to the Computer. Insert a blank diskette into the Disk Drive and turn On the Computer. Connect the negative lead of a voltmeter to TP3 and positive lead to the emitter of Switch Transistor (Q1) and check for 11.6V. Check for 11.6V at the collector of Transistor Q1, and for 10.8V at the base of Transistor Q1. If the voltage is missing at the emitter or the collector of Transistor Q1, check the connector cable and the interface board. If the voltage is missing from only the base of Transistor Q1, check Transistor Q1 by substitution. Check for 5V at the positive lead of Electrolytic C4, and check for - 12.0V at the negative lead of Electrolytic C5.

## WARNING

It is possible for a defective Disk Drive to write on or erase information on a diskette even when the diskette is write protected. Check a questionable Disk Drive by first using a diskette that contains programs that have been duplicated on another diskette.

## DIRECT OPERATION OF DISK DRIVE

Pin 14 of Connector J1 and pin 10 of Connector J1 can be controlled from the Computer keyboard. If two Disk Drives are being used, the Disk Drive being selected can also be controlled from the Computer keyboard. To perform the desired operation put the Computer in Monitor mode. Type (Call-151), press Return key, then type the hex number from the chart that follows for the desired operation and press Return key.

NOTE: The Disk Drive interface board must be connected to slot 6 of the Computer for the following hex numbers to work.

| FUNCTION            | ACTIVE OFF | ACTIVE ON |
|---------------------|------------|-----------|
| Pin 14 of J1        | C0E9       | C0E8      |
| Pin 10 of J1        | C0EF       | C0EE      |
| Select Disk Drive 1 | C0EA       |           |
| Select Disk Drive 2 | C0EB       |           |

## WILL NOT WRITE

If the Disk Drive does not write information onto a non-write protected diskette when using Computer keyboard commands, check for a Low logic reading on pin 20 of Connector J1. If the reading is High, check for a Low logic reading on pin 1 and pulses on pin 2 of IC4B. Check the Notch (Write Protect) Switch (S1).

If the readings have been normal to this point, check for a Low logic reading on pin 10 of Connector J1. Check for pulses on the collector of Switch Transistor (Q2) located on the analog board. The pulses may also be noted at the erase section of R/W,E Head (M3) and are only present when the Save function is in progress.

Check for pulses at pins 1 and 5 of the Write Amp IC (3A). If the pulses are missing, check voltages and logic readings associated with pins 2, 4, 6 and 8 of IC 3A. Check for pulses at pins 5 and 6 of IC 4B while the Save function is in progress. If the pulses at pins 1 and 5 of IC 3A are present, check Diodes CR1 and CR2. Also check the resistance of all sections of Head M3. Check Switch Transistor (Q2) located on the analog board and associated components.

## WILL NOT READ

If the Disk Drive does not read from a diskette, insert a diskette into the Disk Drive and close the door, the diskette must be fully loaded with programs to ensure that R/W,E Head (M3) will be reading information from the diskette. Check for Low logic reading at pin 14 of Connector J1. Check voltages, waveforms and logic readings associated with pins 7 thru 10 and 13 thru 18 of Read Amp IC (1B). If any of the waveforms are missing, check the voltages and associated components of the missing waveform.

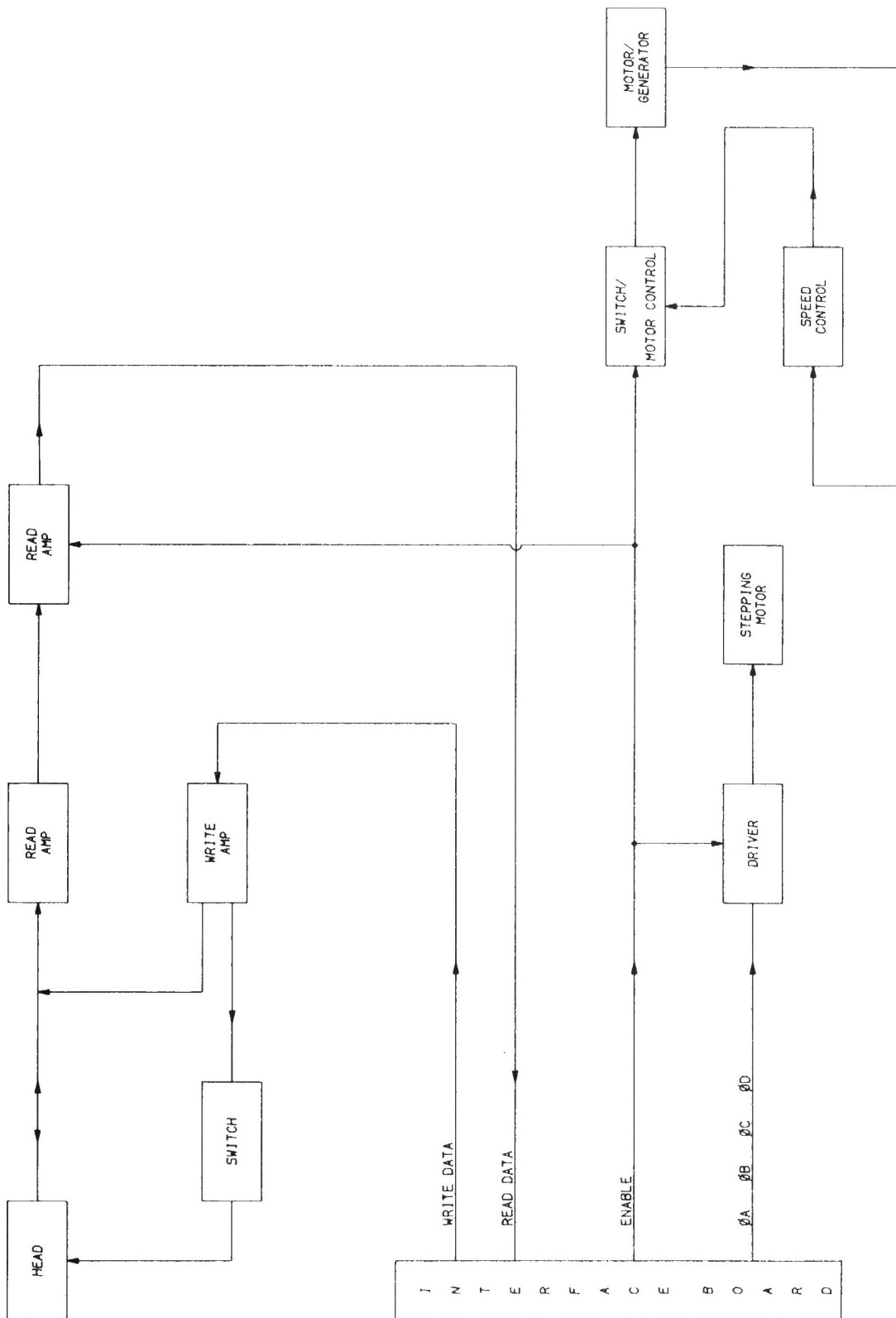
## DISK DRIVE WILL NOT RUN

Check the power supply source voltages, refer to the "Power Supply" section of this Troubleshooting guide. If the 11.6V source is present, check for 6.0V at collector of Motor Control Transistor (Q4). If the 6.0V is missing, check the voltages and components associated with Motor Control Transistors (Q3 and Q4). If Transistors Q3 and Q4 check normal, check the winding resistance of Drive Motor (M1) or check Motor M1 by substitution. If Motor M1 speed is not constant, check the voltages and waveforms on pins 1 thru 8 of Speed Control IC (IC1) and check the adjustment of the Speed Control (VR1).

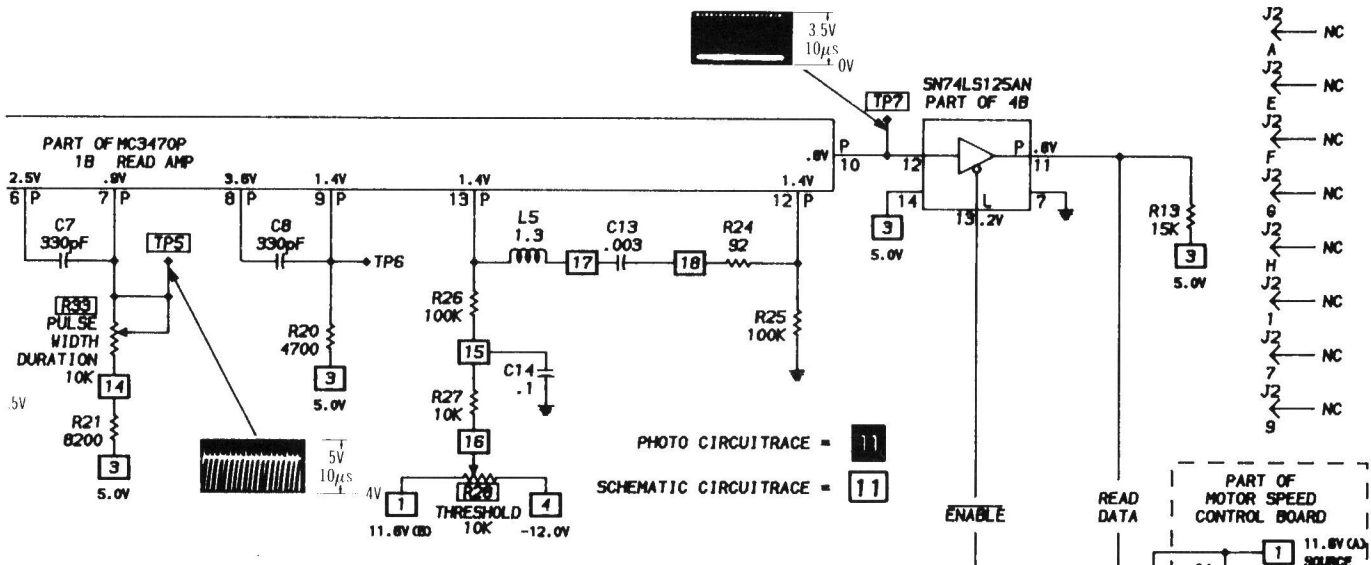
## STEPPER MOTOR INOPERATIVE

Check the voltages on pins 11 thru 14 of the Driver IC (4D). If all the voltage readings are not approximately 11.6V, check the resistance of the associated winding of Stepper Motor (M2). Check for 11.6V at pins 11 and 12 of Connector J2. Check for short to ground between any of pins 9, 11, 12, 13 and 14 of IC 4D. If any pins are shorted, check IC 4D by substitution. If IC 4D checks good and Motor M2 checks normal, check the Disk Drive interface board by substitution.

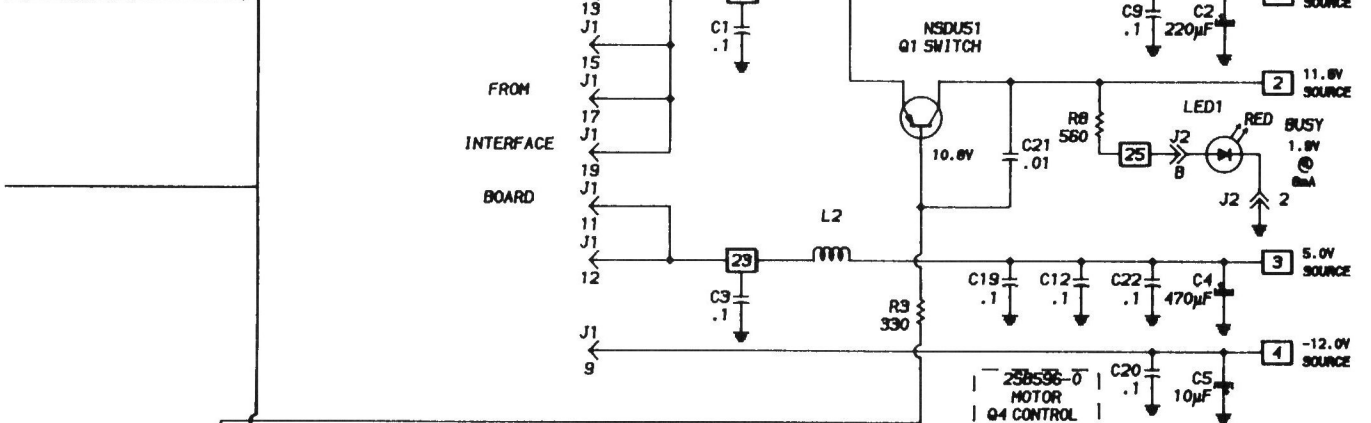




**BLOCK DIAGRAM**

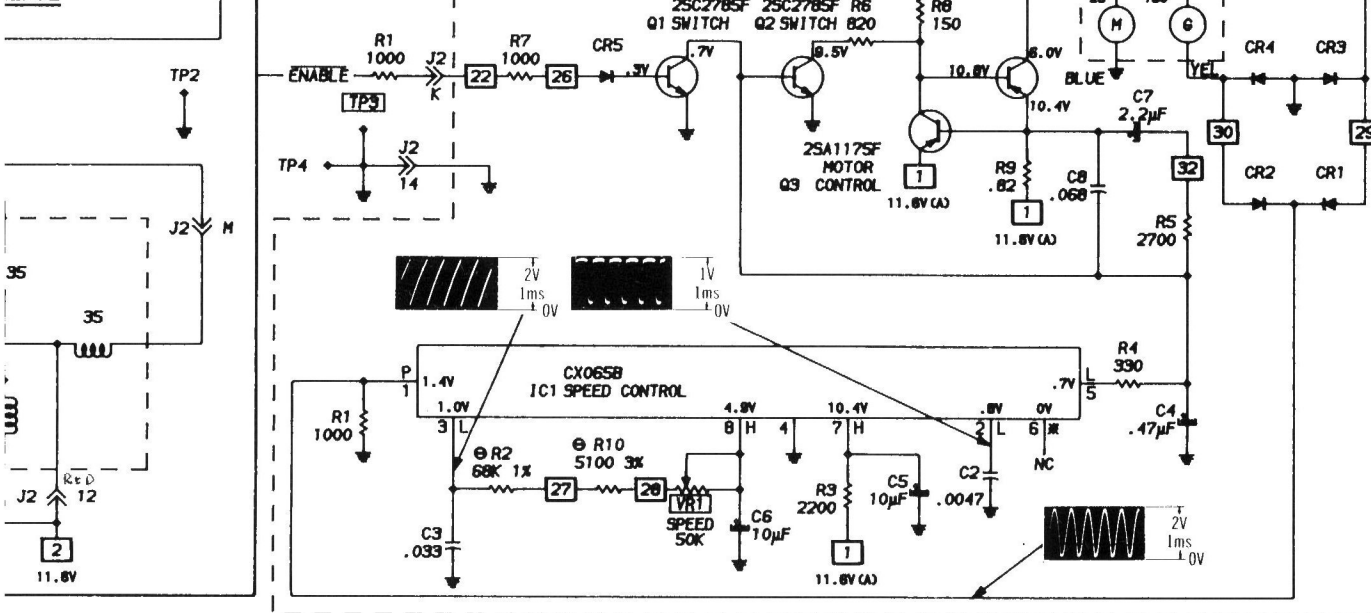


BLING  
 AVY LINES REDUCE  
 E OF MULTIPLE LINES



APPLE MODEL DISK II

INS  
TENCE



# GENERAL OPERATING INSTRUCTIONS

## BOOTING THE DISK OPERATING SYSTEM (DOS)

Insert a diskette containing DOS into Disk Drive 1, and turn On the Computer. The Computer will automatically load 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 IN#6 and press the Return key. With 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 be rebooted by pressing the Open Apple key (key with Apple symbol, located on left side of space bar), Control key and Reset key at the same time.

## OPERATING THE DISK 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.

## 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 DOS from a diskette containing DOS3.3 then remove the DOS3.3 diskette and insert a blank diskette in Disk Drive 1. Type INIT HELLO and press the Return key. The diskette will be initialized when the drive stops. NOTE: Any information on diskette will be overwritten.

If PRODOS is being used, select the PRODOS FILER (press key F) from the menu that comes up when PRODOS is booted up. Select Volume commands (press key V) from the second menu that comes up. Then select Format A Volume (press key F) 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.

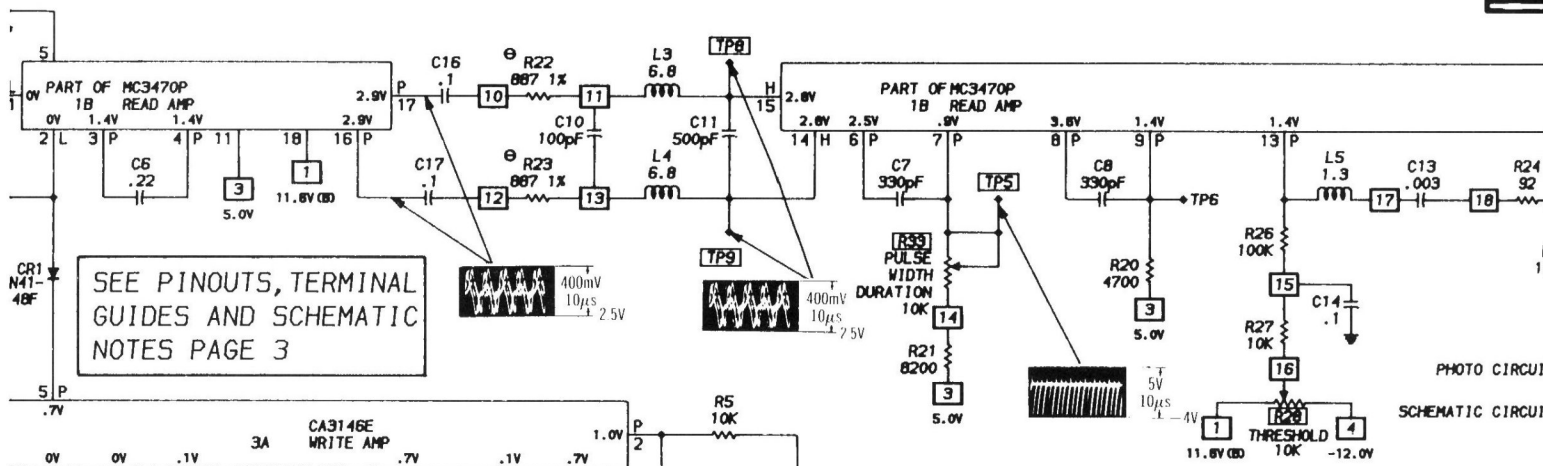
# DISASSEMBLY INSTRUCTIONS

**CAUTION:** To protect R/W,E Head (M3), insert a protective cardboard disk or a blank diskette into Disk Drive before disassembly.

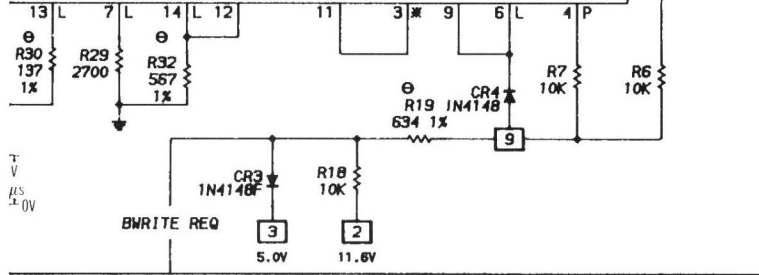
Remove four screws from bottom edges. Pull cover back and lift off. Remove four flat head screws holding bottom cover. Release plastic wire clip at rear of bottom cover and remove cover.

# SAFETY PRECAUTIONS

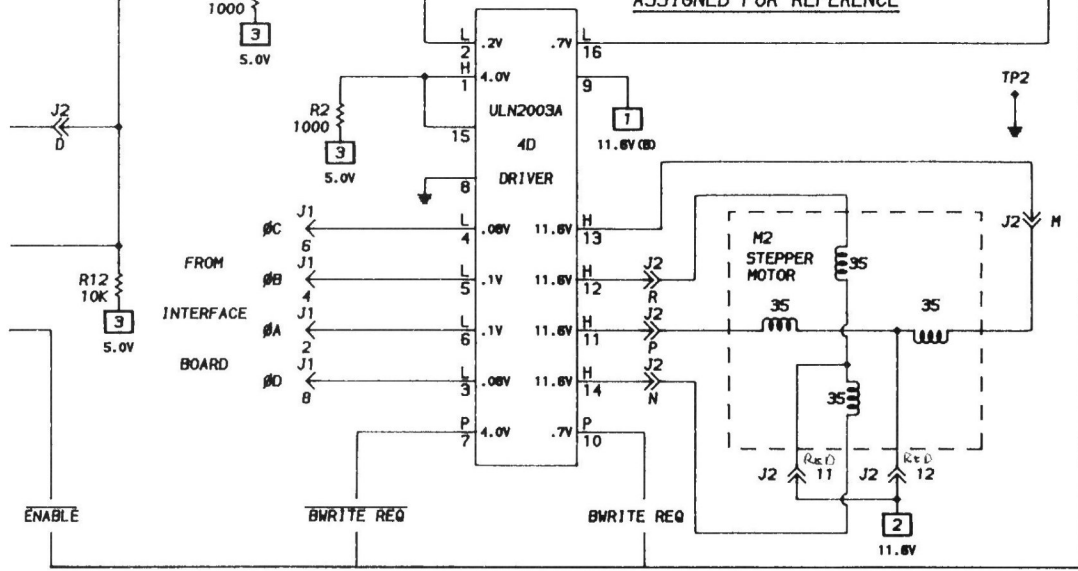
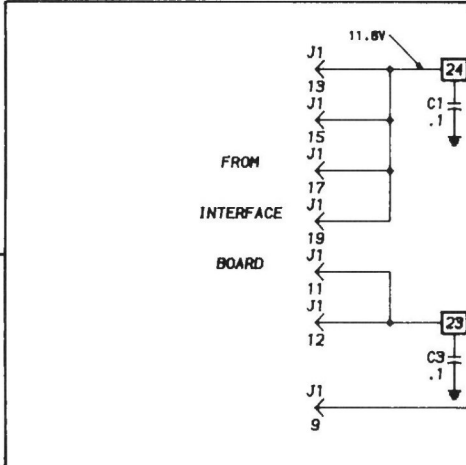
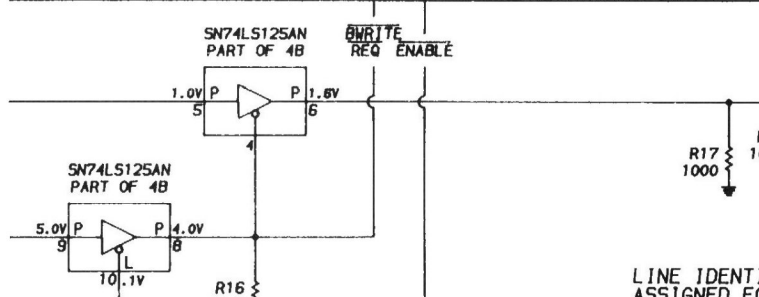
1. Remove power from the Disk Drive before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
2. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged 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.
3. Use a grounded-tip, low voltage soldering iron.
4. Use an isolation (times 10) probe on scope.
5. Do not remove or install boards with power On.
6. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
7. The Disk Drive cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
8. 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.
9. Never expose the Disk Drive to water. If exposed to water turn Off the unit. Do not place the Disk Drive near possible water sources.
10. Never use liquids or aerosols directly on the Disk Drive. Spray on cloth and then apply to the Disk Drive cabinet. Make sure the Disk Drive is disconnected.



SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGE 3



CABLING HEAVY LINES REDUCE USE OF MULTIPLE LINES



LINE IDENTIFICATIONS ASSIGNED FOR REFERENCE

