

# COMPUTERFACTS™

Technical Service Data

## TANDY® MODEL 1000 EX COMPUTER



FEATURES COMPLETE SCHEMATICS • PRELIMINARY SERVICE CHECKS • TROUBLESHOOTING TIPS •  
EASY-READ WAVEFORMS • REPLACEMENT PARTS LISTS • SEMICONDUCTOR CROSS-REFERENCE

## PRELIMINARY SERVICE CHECKS

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

Check all interconnecting cables for good connection and correct hook-up before making service checks.

Always turn the Computer Off before connecting or disconnecting connectors, boards or peripherals.

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

Replacement or repair of the Power Supply, System Board, Keyboard, Disk Drives or connectors may be necessary after the malfunction has been isolated.

### TEST EQUIPMENT AND TOOLS

#### TEST EQUIPMENT

Digital Volt/Ohm Meter  
Logic Probe  
Frequency Counter  
Monitor with Audio Input  
Disk Drive Tester or Test Program

#### TOOLS

Head Cleaning Equipment  
Contact and Switch Cleaner (non-spray type)  
Phillips Screwdriver  
Flat Blade Screwdriver  
1/4" Socket  
IC Insertion and Removal Tools 14, 16, 24,  
28 and 40 pin  
Low Wattage Soldering Iron  
Desoldering Equipment

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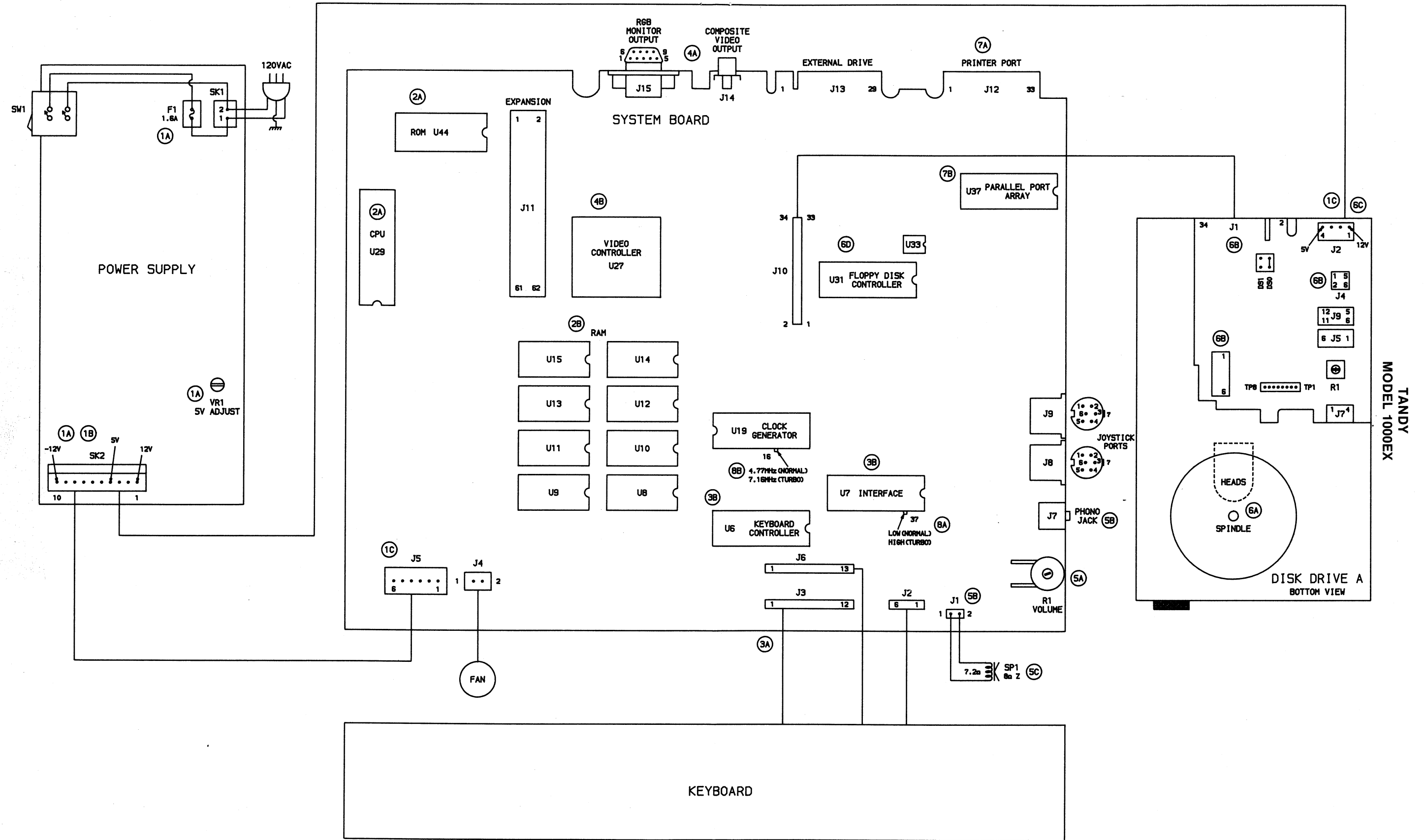
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PRELIMINARY SERVICE CHECKS (Continued)



# PRELIMINARY SERVICE CHECKS (Continued)

## SERVICE CHECKS

MATCH THE NUMBERS ON THE INTERCONNECTING DIAGRAM AND PHOTOS WITH THE NUMBERS ON THE SERVICE CHECKS TO BE PERFORMED.

### ① COMPUTER DEAD

- (A) Check for 12.0V at pin 1, 5.0V at pin 4 and -12.0V at pin 10 of Connector SK2 on Power Supply Board. If voltages are missing, check Connector SK1 and Fuse F1. If voltages are not correct, check adjustment of 5V Adjust Control (VR1), see "Miscellaneous Adjustments".
- (B) If Connector and Fuse are good, disconnect Connector from Connector SK2. Connect a #93 lamp to 12.0V source (pin 1 to pin 2 of Connector SK2) and a #1129 lamp to 5.0V source (pin 4 to pin 3 of Connector SK2). WARNING: Operating Power Supply without a load may cause damage. Turn Power Supply On and recheck output voltages. If voltages are still missing, troubleshoot Power Supply.
- (C) If the correct voltages return, reconnect the Power Supply to the System Board and Disk Drives one at a time until the Board or Drive that is causing the Power Supply to shut-down is found. WARNING: Be sure Power Supply is turned Off when connecting to the System Board or Disk Drive.

### ② SYSTEM BOARD

- (A) System Board is dead. Check CPU IC (U29) and ROM IC (U44) by substitution.
- (B) A program runs for a while, then suddenly stops or becomes erratic in operation. Check RAM IC's U8 thru U15.

### ③ KEYBOARD DEAD

- (A) Check Connectors J3 and J6 and Keyboard Ribbon Cable.
- (B) Check Keyboard Controller IC (U6) and Interface IC (U7) by substitution.

### ④ VIDEO

- (A) No video or video display is not correct. Check Connectors J14 and J15 and the Video Cable going to Monitor.
- (B) Check Video Controller IC (U27) by substitution.

### ⑤ SOUND

- (A) No sound from Internal Speaker (SP1). Check setting of Volume Control (R1).
- (B) Check Phono Jack (J7) and Speaker Connector (J1).
- (C) Check Speaker (SP1).

### ⑥ DISK DRIVE

- (A) Disk Drive operation is erratic. Clean the Drive heads. Check the Drive Spindle Speed, see "Spindle Speed Check".
- (B) Check Connectors J1, J2, J4 thru J7 and J9 on the Disk Drive and Connector J10 on the System Board for good connections.
- (C) Drive dead. Check for 12V at pin 1 and 5V at pin 4 of Connector J2 on the Drive Board. If the voltages are missing, check the Power Supply.
- (D) Check IC's U31 and U33 on the System Board by substitution.

### ⑦ PRINTER PORT

- (A) Printer Port does not work. Check Connector J12.
- (B) Check Parallel Port Array IC (U37) by substitution.

### ⑧ NORMAL/TURBO CPU CLOCK

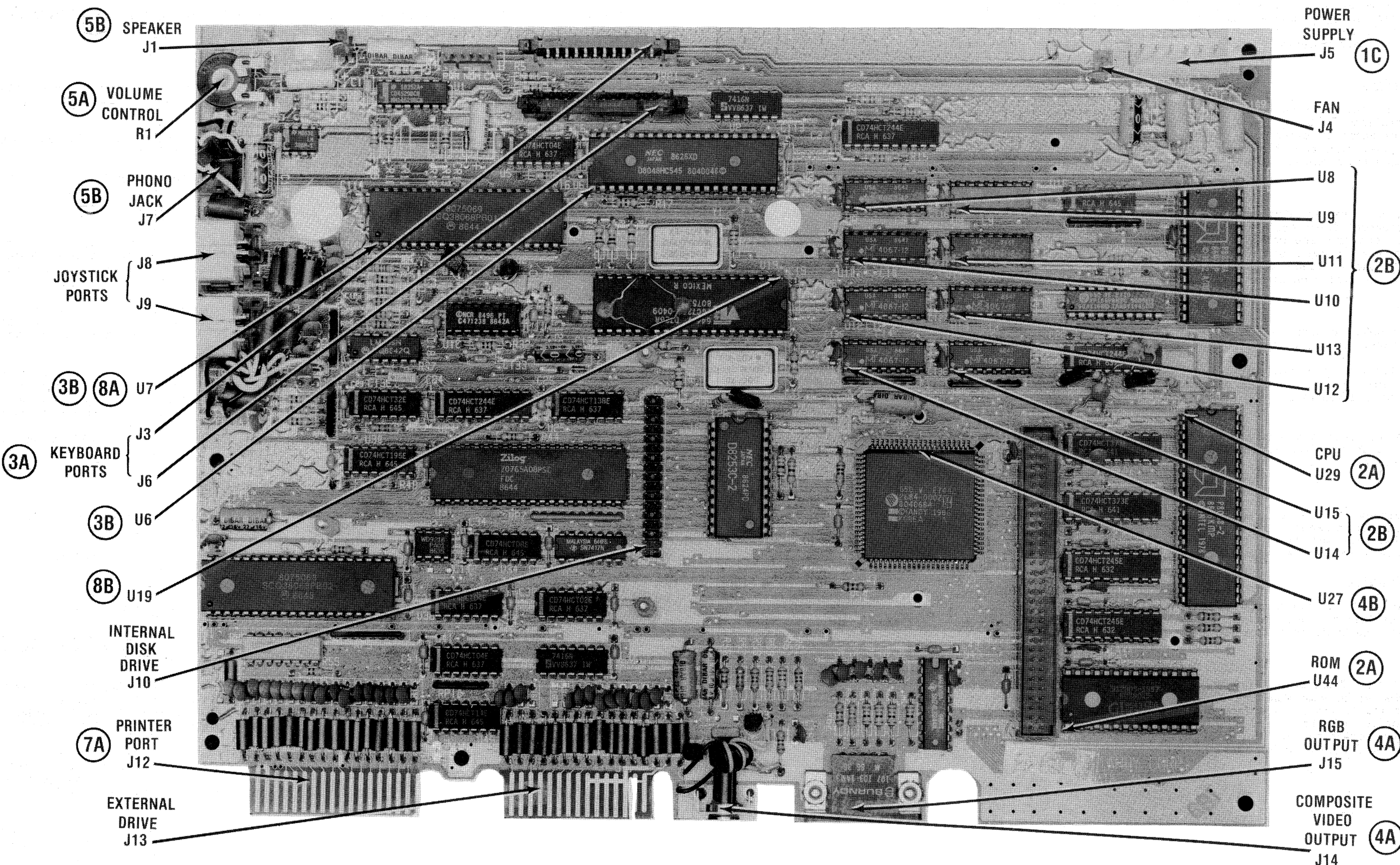
- (A) Run the following program to switch the CPU clock speed each time a key is pressed:

```
10 OUT 98,32:PRINT "NORMAL (4.77MHz)"
20 AS=INKEYS:IF AS="" THEN 20
30 OUT 98,40:PRINT "TURBO (7.16MHz)"
40 AS=INKEYS:IF AS="" THEN 40 ELSE 10
```

Check for a logic Low at pin 37 of IC U7 with the speed set to "Normal" and logic High with the speed set to "Turbo". If the reading is not correct, check IC U7.

- (B) Check for a frequency of 4.77MHz at pin 16 of IC U19 with the speed set to "Normal" and 7.16MHz with the speed set to "Turbo". If the frequency does not switch, check IC U19.

PRELIMINARY SERVICE CHECKS (Continued)



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# PRELIMINARY SERVICE CHECKS (Continued)

## GENERAL OPERATING INSTRUCTIONS

### BOOT UP

Insert a bootable diskette into Disk Drive A and turn On the Computer. The Computer will automatically boot up using the diskette in Disk Drive A. If a MS-DOS (Microsoft Disk Operating System) diskette is used, the Computer will display the date and time and ask for a new date and time. After date and time have been entered, the version of DOS will be displayed on the Monitor screen along with an A which indicates the DOS is running.

If Function Key F3 is pressed immediately after the Computer beeps when turned On, the Computer will boot up from a diskette inserted in Drive B.

### MS-DOS

For a list of file names on the diskette in the current Disk Drive, type DIR and press the ENTER key. To specify Disk Drive that is not current (default), use DIR A: for Disk Drive A or DIR B: for Disk Drive B.

To return to MS-DOS from Basic, type SYSTEM and press the ENTER key.

To load a (System) program from a diskette while in DOS, type the program name and press the ENTER key.

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before the Computer will boot up using that diskette.

Insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press the ENTER key. Follow Instructions on the Monitor screen to format the unformatted diskette. NOTE: Formatting a diskette will wipe out any programs previously placed on the diskette. The Computer automatically defaults to Disk Drive A if the destination Disk Drive is not specified. Be sure to specify the destination Disk Drive of the diskette to be formatted or the original diskette may be ruined by the default action. Type a space after the word FORMAT, then the Drive letter followed by a colon to specify a different Drive (FORMAT B:).

### BASIC

When turned On, the Computer will come up in MS-DOS as long as the MS-DOS diskette is in Drive A. The version of MS-DOS will appear at the top of the screen.

The manufacturer also supplies Disk Basic on diskette. To load Disk Basic, first boot up

DOS. Insert a diskette with Disk Basic program on it. Type BASIC and press the RETURN key or type BASICA and press the RETURN key to load Disk Basic. To return to DOS from Basic, type SYSTEM and press the ENTER key.

To view a list and the names of programs on a diskette in the current Drive, type FILES and press the ENTER key. Type FILES "B:" and press the ENTER key to list programs from Disk Drive B. Type FILES "A:" to list programs from Disk Drive A if it is not the current (default) drive.

To load a program in Disk Basic or Advanced Disk Basic from the diskette, type LOAD, the program name enclosed in quotes, and press the ENTER key.

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key.

To run a program from any Basic mode, type RUN and press the ENTER key. To stop a program, press the CTRL and BREAK keys at the same time. NOTE: Some programs will disable or not recognize the CTRL and BREAK keys to prevent the user stopping the program while it is running.

### RESETTING COMPUTER

Press the CTRL, ALT and DEL keys, all three at the same time, to reset the Computer.

### CHANGING OPERATING MODES

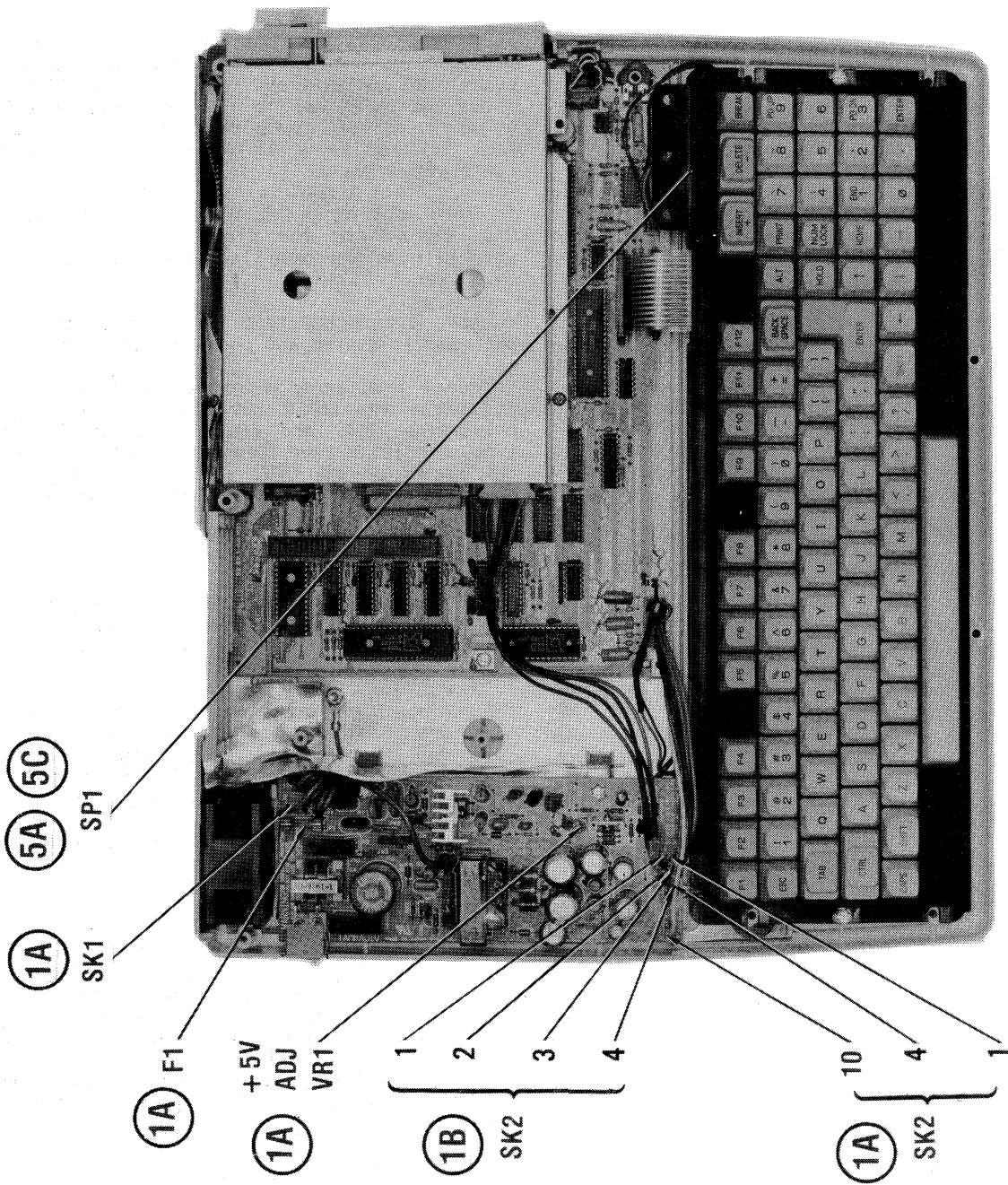
The Video, Disk Drive and CPU speed modes can be changed by pressing Functions Keys F1 thru F4 immediately after the Computer beeps when it is turned On. Use the following chart to determine the function of each Key:

- F1 - Changes the Video mode to Monochrome mode. (Computer normally comes up in Color Graphics mode.)
- F2 - Changes the Video mode to TV mode.
- F3 - Swaps Disk Drive references. Drive A becomes Drive B and Drive B becomes Drive A. The computer will boot up from the top Drive (normally Drive B).
- F4 - Changes CPU speed to 4.77MHz. The Computer normally comes up with a CPU speed of 7.16 MHz.

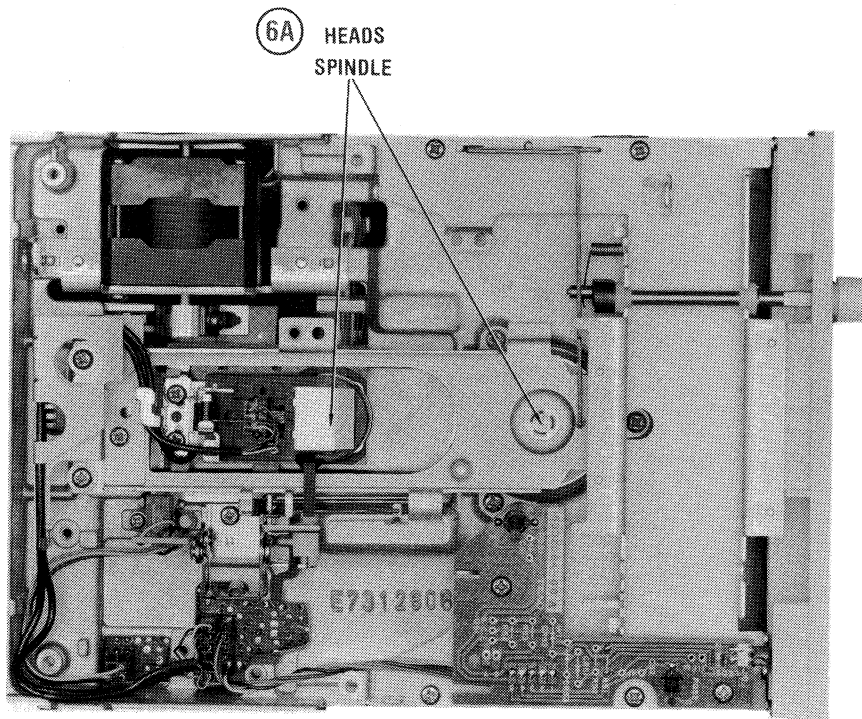
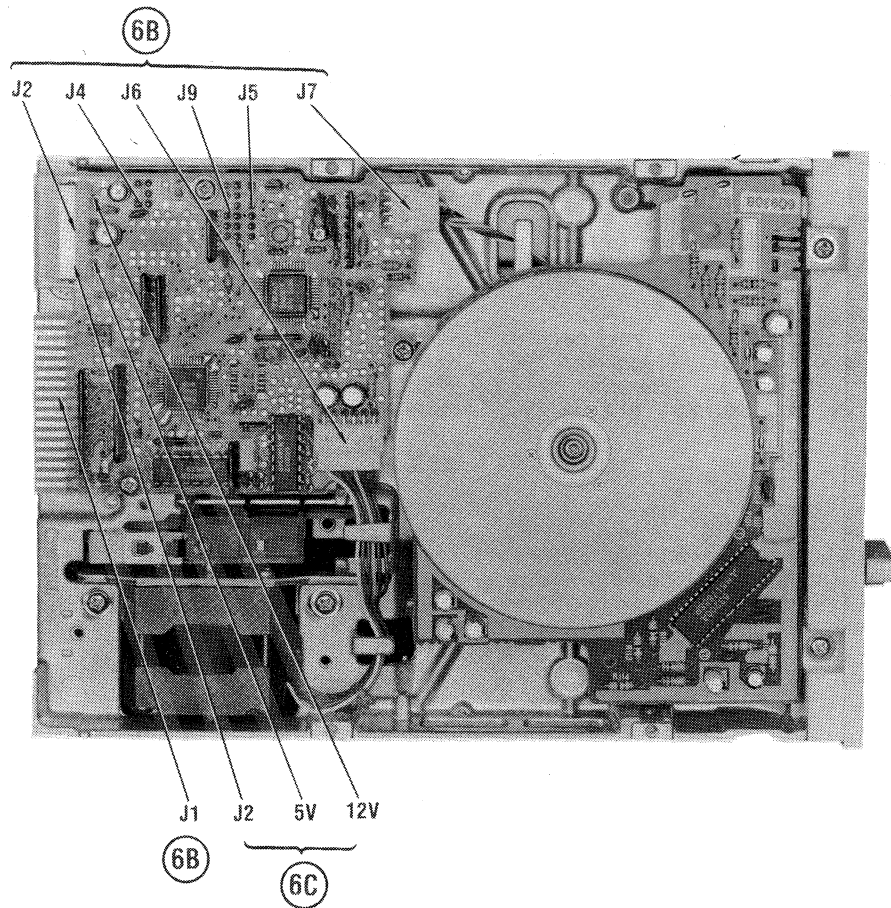
### VOLUME CONTROL

A Volume Control (R1) is provided on the Main System Board to set the volume of the internal speaker. The control is located on right bottom side of cabinet.

PRELIMINARY SERVICE CHECKS (Continued)



# PRELIMINARY SERVICE CHECKS (Continued)



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# PRELIMINARY SERVICE CHECKS (Continued)

## DISASSEMBLY INSTRUCTIONS

### CABINET TOP REMOVAL

Remove six screws from bottom of Computer. Turn Computer right side up and remove option cover (press down on front of cover and slide it back). Remove two screws from left side of option compartment. Lift cabinet top off.

### DISK DRIVE REMOVAL

Remove cabinet top. Remove one screw holding ground strap to side of Drive. Disconnect two connectors at rear of Drive. Remove three screws holding Drive to cabinet bottom and remove Drive.

### SYSTEM BOARD REMOVAL

Remove cabinet top and Disk Drive. Pull Volume Control knob Off. Disconnect three Keyboard Connectors (pull up Ribbon Connector top before pulling ribbon cable out), Power Supply Connector and Fan Connectors. Remove

four nuts holding shield and remove three screws holding shield under right side of System Board. Lift shield up and push over to left. Remove four screws holding board to cabinet bottom. Remove two screws holding Monitor Connector (J15) to cabinet rear. Lift System Board out of cabinet.

### POWER SUPPLY REMOVAL

Remove cabinet top. Disconnect Connectors SK1 and SK2 from Power Supply Board. Remove two screws from right side of board and remove from cabinet.

### KEYBOARD REMOVAL

Remove cabinet top. Disconnect three Keyboard Connectors (pull up Ribbon Connector top before pulling ribbon cable out) from System Board. Remove one screw from each side of Keyboard and remove Keyboard from cabinet.

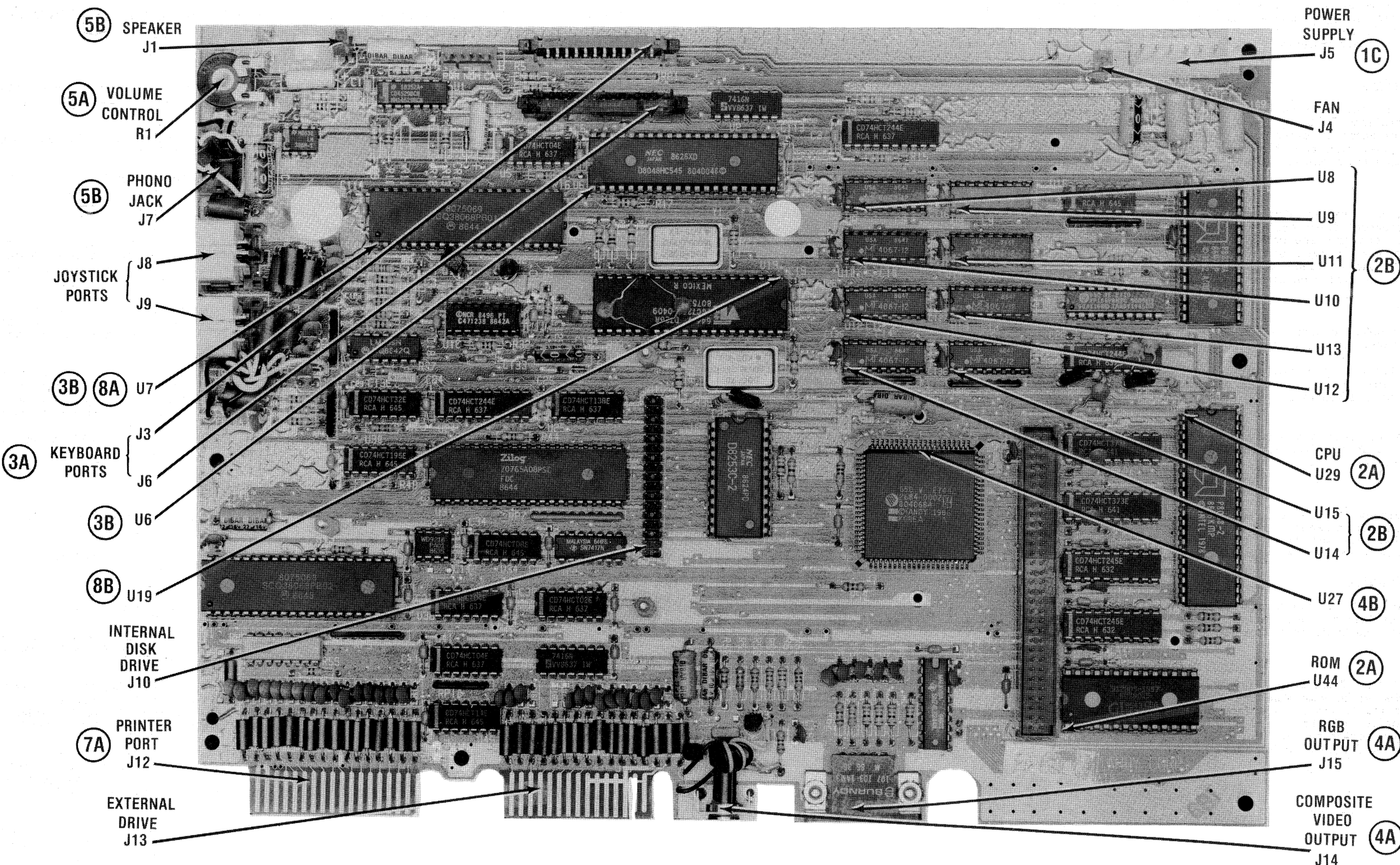
## MISCELLANEOUS ADJUSTMENT

### POWER SUPPLY

#### 5V ADJUSTMENT

Connect Input of a voltmeter to 5.0V source (pin 4 of Connector SK2). Turn Computer On and adjust 5V Adjust Control (VR1) for 5.0V.

PRELIMINARY SERVICE CHECKS (Continued)



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# **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 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 noninterruptible 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 between the keys. Use a nonabrasive 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 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 clean 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

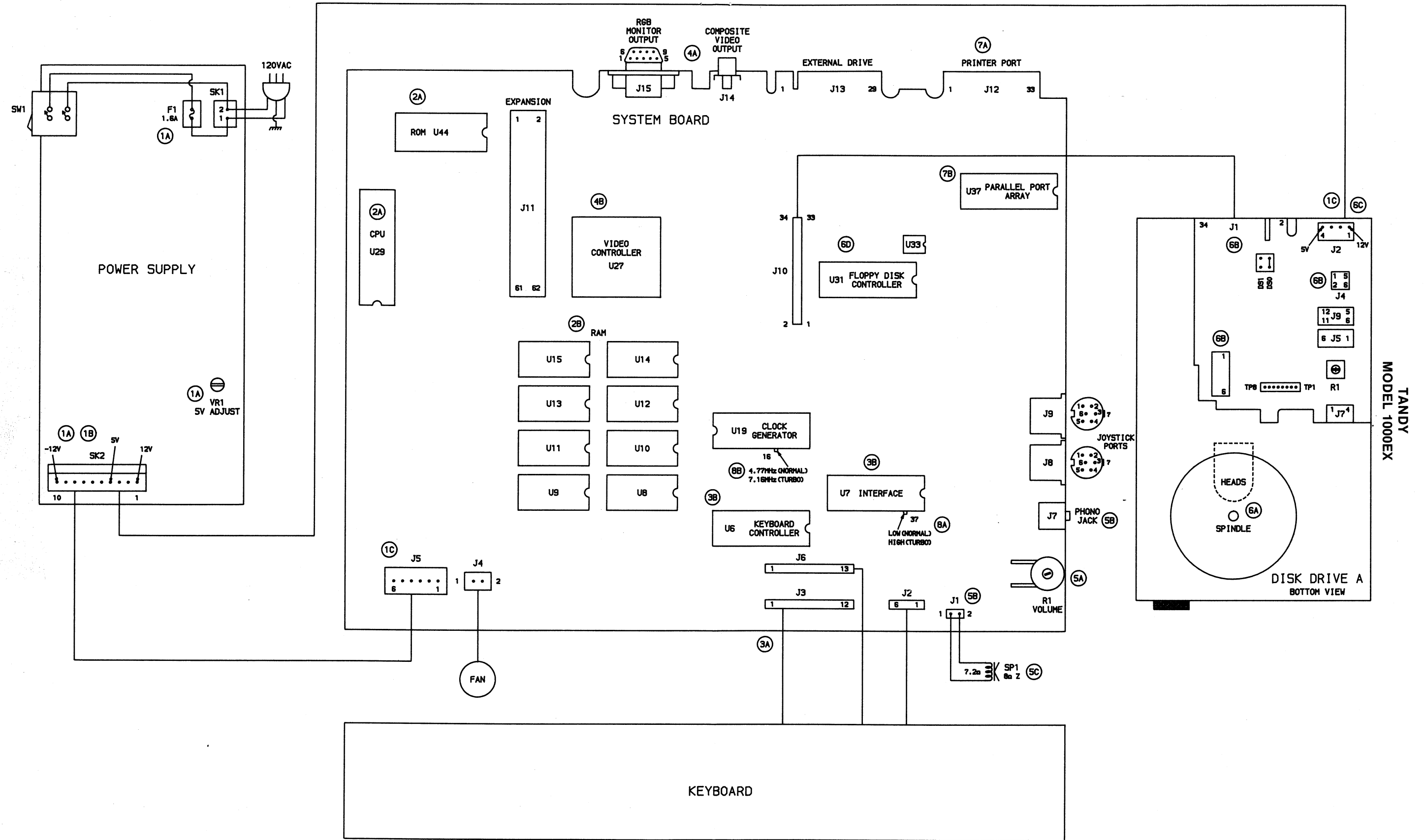
Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials and maintain good humidity in the Computer environment.

### 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)



INTERCONNECTING DIAGRAM

INTERCONNECTING DIAGRAM

## **PRELIMINARY SERVICE CHECKS (Continued)**

### **NOTES**

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## SAFETY PRECAUTIONS

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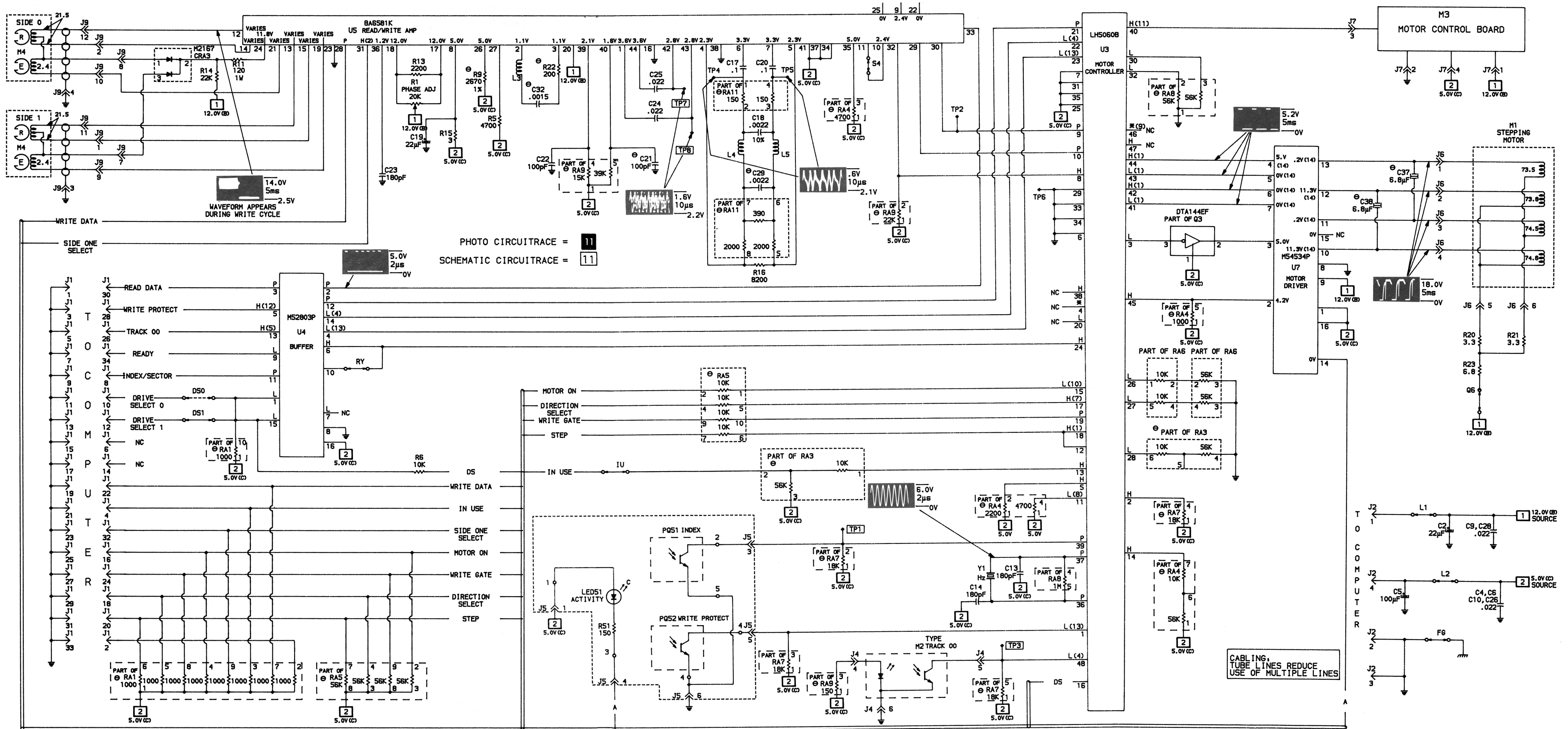
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# TROUBLESHOOTING

## TEST SETUP

Connect a Disk Drive known to be operating properly to the Computer as Disk Drive A. Connect the defective Disk Drive as Disk Drive B. Use Disk Drive A to load any alignment or test program needed to check the defective Disk Drive.

**WARNING:** It is possible for a defective Disk Drive to write on or erase information on a diskette, even if the diskette is write protected. Check the Disk Drive by first using a diskette that has programs that have been backed up on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless specified in the alignment procedures. The test equipment may cause the Disk Drive circuits to erase sections of the alignment diskette even if the diskette is write protected.

Check all setup jumpers and switches for correct positions and check all interconnecting cables for good connections.

## HEAD CLEANING INSTRUCTIONS

Use a cotton swab or lint-free cloth dampened with 91% isopropyl alcohol and dry with a lint-free cloth or use a non-abrasive cleaning Diskette.

## CONTINUOUS OPERATION OF DISK DRIVE

Use the following Basic program to keep Drive A running continuously in the read mode. Change the number 20 in the program to number 37 to make Drive B run continuously.

```
10 OUT 1014,128:OUT 1010,20:GOTO 10
```

## OSCILLATOR

Verify the oscillator is working properly by checking the 480KHz waveform at pin 37 of Drive Controller IC (U3). If waveform is missing or the frequency not correct, check Crystal Y1, Capacitors C13 and C14, Resistor RA8 from pin 4 to pin 5, and IC U3.

## WILL NOT READ

Insert a diskette containing data in Disk Drive B and close the door. Type in and run the following Basic program to keep the Disk Drive running in read mode.

```
10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 OUT 1013,74:S=INP(1012)
40 OUT 1013,Y:S=INP(1012)
50 FOR X=1 TO 7
60 S=INP(1013):S=INP(1012):PRINT S
70 NEXT X:LOCATE 1,1
80 IF Y=1 THEN Y=5 ELSE Y=1
90 GOTO 20
```

To operate Drive A, change line 10 to OUT 1014,128:OUT 1010,16:OUT 1010,20.

The program displays seven numbers on the Monitor screen. The numbers should change when a

diskette with data on it is inserted in the Drive and the Drive door closed. While the above program is running, check for a logic High on the Write gate (pin 24) of Connector J1 on the Disk Drive Board to verify the Disk Drive is in read mode.

If reading is not correct, check the Disk Drive Interface circuit on the Computer System Board. If reading is correct, check for a logic Low at pin 10 of Drive Controller IC (U3). If reading is not correct, check IC U3. If reading is correct, check the waveform at pin 2 of Buffer IC (U4) while opening and closing the Drive door (with diskette in Drive). There should be a noticeable change in the waveform as the Drive door is opened and closed. If there is no change, check the head winding for continuity, check Connector J9 for good connections, and check the voltages and components associated with pins 1 thru 26 and 34 thru 44 of Read/Write Amp IC (U5). If the waveform checks good at pin 2 of IC U4, check for pulses at pin 3 of IC U4. If pulses are missing, check IC U4. If pulses are present, check the Drive cable and check the Disk Drive Interface circuit on the Computer System Board.

## WILL NOT WRITE

Insert a blank diskette into the Disk Drive and close the door. Type in and run the following Basic program which writes continuously to the Diskette and displays a number on the upper left corner of the Monitor screen. The number should be 0 when the Diskette is not write protected and change to 2 when a write protected Diskette is inserted into the Drive. If the numbers are not correct, refer to the "Write Protect Does Not Function" section of this Troubleshooting guide.

```
10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 S=INP(1012)
40 OUT 1013,77:S=INP(1012)
50 OUT 1013,Y:S=INP(1012)
60 OUT 1013,1:S=INP(1012)
70 OUT 1013,12:S=INP(1012)
80 OUT 1013,12:S=INP(1012)
90 OUT 1013,0:S=INP(1012)
100 S=INP(1013):S=INP(1012)
110 PRINT INP(1013) AND 2:S=INP(1012)
120 FOR X=1 TO 5
130 S=INP(1013):S=INP(1012)
140 NEXT X:LOCATE 1,1
150 IF Y=1 THEN Y=5 ELSE Y=1
160 GOTO 20
```

To operate Drive A, change line 20 to OUT 1014,128:OUT 1010,16:OUT 1010,20.

**NOTE:** this program will not write to the diskette if the diskette index sensor circuits are not working. Check for index pulses at pin 11 of Buffer IC (U4) while the Drive is running with a blank diskette inserted. If pulses are missing, refer to the "Index Sensor" section of this Troubleshooting guide.

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## TROUBLESHOOTING (Continued)

While the above program is running, check for pulses at pins 22 and 24 of Connector J1. If pulses are missing, check the Drive cable and check the Disk Drive Interface circuits on the Computer System Board. If pulses are present, check for pulses at pins 9 (TP2) and 10 of Drive Controller IC U3. If pulses are missing, check IC U3. If pulses are present, check the head windings for continuity, check Connector J9 for good connections, and check the voltages and components associated with pins 12 thru 27 of Read/Write Amp IC (U5).

### WRITE PROTECT DOES NOT FUNCTION

Type in and run the program listed under the "Will Not Write" section of this Troubleshooting guide. The program will display the number 0 on the left upper corner of the Monitor screen if a diskette that is not write protected is inserted into the Drive and the number 2 if the diskette is write protected.

**WARNING:** This program also writes on the diskette. Do not use a diskette that has data on it that is important. Insert a blank write protected diskette into the Drive and close the door.

While the program is running, insert a write protected diskette into the Drive and check for a logic High at pin 5 of Connector J5. If reading is not correct, check Connector J5 for good connections and check the Write Protect Sensor (PQ52). If reading is correct, check for a logic High at pin 4 and logic Low at pin 5 of Buffer IC U4. If reading is not correct at pin 4, check Drive Controller IC (U3). If reading is correct at pin 4 and not correct at pin 5, check IC U4.

### INDEX SENSOR

To check the Index Sensor circuits, type in and run the program given under "Continuous Operation of Disk Drive" to keep the drive running. Insert a diskette in the Disk Drive and close the door. Check for pulses at TP1 (pin 3 of Connector J5). If pulses are missing, check Connector J5 for good connections, Resistor RA7 from pin 2 to pin 1 and the Index Sensor (PQ51). If pulses are present, check for pulses at pin 12 of the Buffer IC (U4). If pulses are missing, check the Drive Controller IC (U3). If pulses are present, check for pulses at pin 11 of IC U4. If pulses are missing, check IC U4. If pulses are present, check pin 8 of Connector J1 for good connections.

### TRACK 00 SENSOR

Disk Drive Head bangs against the Track 00 stop. Type in and run the following Basic program to check the Track 00 detector circuits. The program will step the Head back to Track 00 and display the number 16 on the Monitor screen to indicate the head is on Track 00. If the head is manually pushed off Track 00 the number should change to the number 0.

### DRIVE A

```
10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1014,128:OUT 1010,16:OUT 1010,20
60 S=INP(1012)
70 OUT 1013,4:S=INP(1012)
80 OUT 1013,2:S=INP(1012)
90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40
```

### DRIVE B

```
10 OUT 1014,128:OUT 1010,33:OUT 1010,37
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 T=1 TO 500:NEXT T
50 OUT 1014,128:OUT 1010,33:OUT 1010,37
60 S=INP(1012)
70 OUT 1013,4:S=INP(1012)
80 OUT 1013,2:S=INP(1012)
90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40
```

If the number on the Monitor screen is not correct, check for a logic High at TP3 when the head is On Track 00 and a logic Low when the head is Off Track 00. If readings are not correct, check Connector J4 for good connections, check the Track 00 Sensor (M2) and Resistor RA7 from pin 5 to pin 1. If readings are correct, check for a logic High at pin 14 and a logic Low at pin 13 of Buffer IC (U4) with the head On Track 00 and a logic Low at pin 14 and a logic High at pin 13 with the head Off Track 00. If readings are not correct at pin 14, check Drive Controller IC (U3). If readings are correct at pin 14 and not correct at pin 13, check IC U4.

### DRIVE MOTOR

Drive Motor will not run. Check Connectors J1 and J7 on the Disk Drive Board for good connections. Check for 5.0V at pin 4 and 12.0V at pin 1 of Connectors J2 on the Disk Drive Board. If the voltages are missing, check the power supply.

Type in and run the program given under "Continuous Operation of Disk Drive" to keep the Drive running. Check for a logic Low at pin 16 of Connector J1 on the Disk Drive Board. If reading is not correct, check the Drive cable and check the Disk Drive Interface on the Computer System Board. If reading is correct, check for a logic High at pin 3 of Connector J7. If reading is not correct, check the Drive Controller IC (U3). If reading is correct, check Connector J7 for good connections and check the Drive Motor Control Board.

### STEPPING MOTOR

Head position motor not working. Type in and run the following Basic program. The program continuously alternates the head between Tracks 00 and 16.

## TROUBLESHOOTING (Continued)

### DRIVE A

```
10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 OUT T=1 TO 500:NEXT T
50 OUT 1010,20
60 OUT 1013,15:S=INP(1012)
70 OUT 1013,1:S=INP(1012)
80 OUT 1013,16:S=INP(1012)
90 FOR T=1 TO 500:NEXT T
100 GOTO 10
```

### DRIVE B

```
10 OUT 1014,128:OUT 1010,33:OUT 1010,37
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 OUT T=1 TO 500:NEXT T
```

```
50 OUT 1010,37
60 OUT 1013,15:S=INP(1012)
70 OUT 1013,1:S=INP(1012)
80 OUT 1013,16:S=INP(1012)
90 FOR T=1 TO 500:NEXT T
100 GOTO 10
```

While the program is running, check for pulses at pins 18 and 20 of Connector J1. If pulses are missing, check the Drive cable and check the Disk Drive Interface circuit on the Computer system Board. If pulses are present, check for pulses at pins 4 thru 7 of Motor Driver IC (U7). If pulses are missing, check Drive Controller IC (U3). If pulses are present, check for pulses at pins 10 thru 13 of IC U7. If pulses are missing, check IC U7, Capacitors C37 and C38, Connector J6, and check the Stepping Motor (M1) windings for continuity.

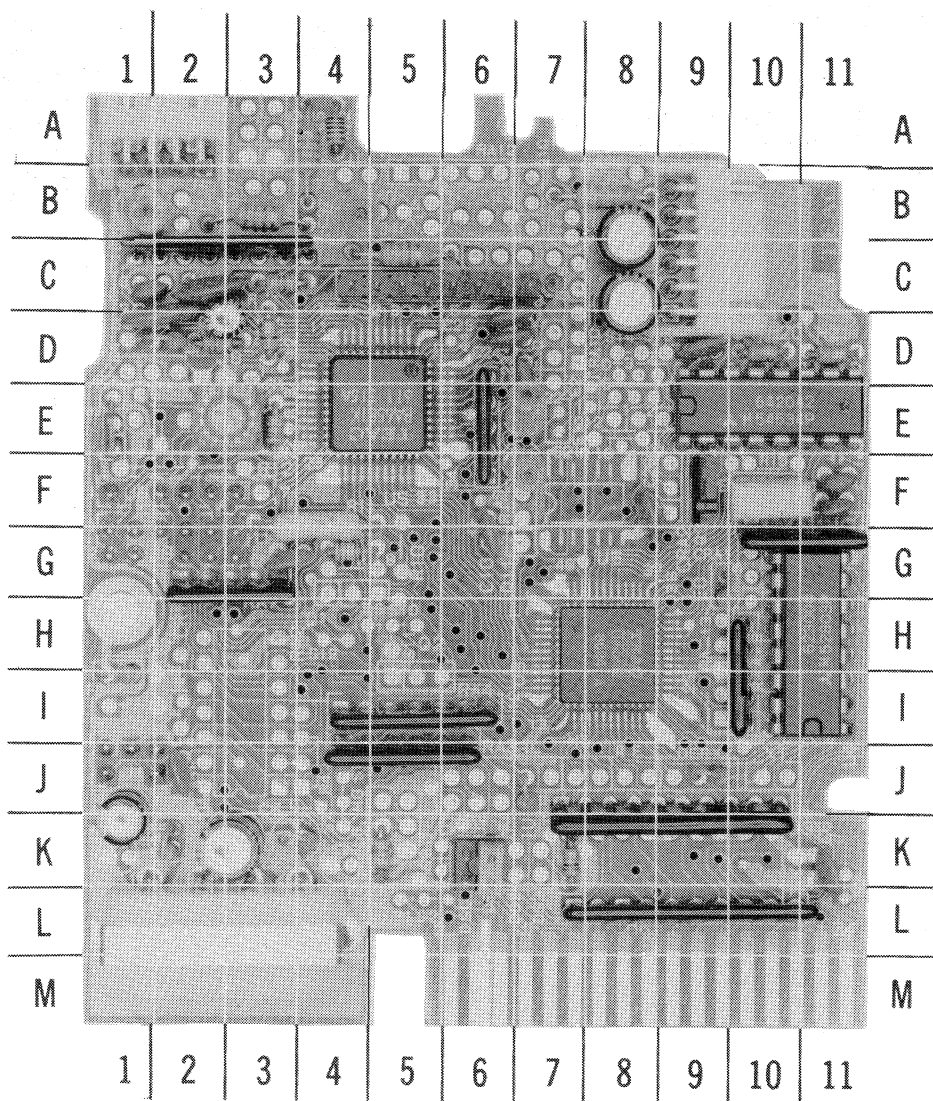
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# GridTrace LOCATION GUIDE

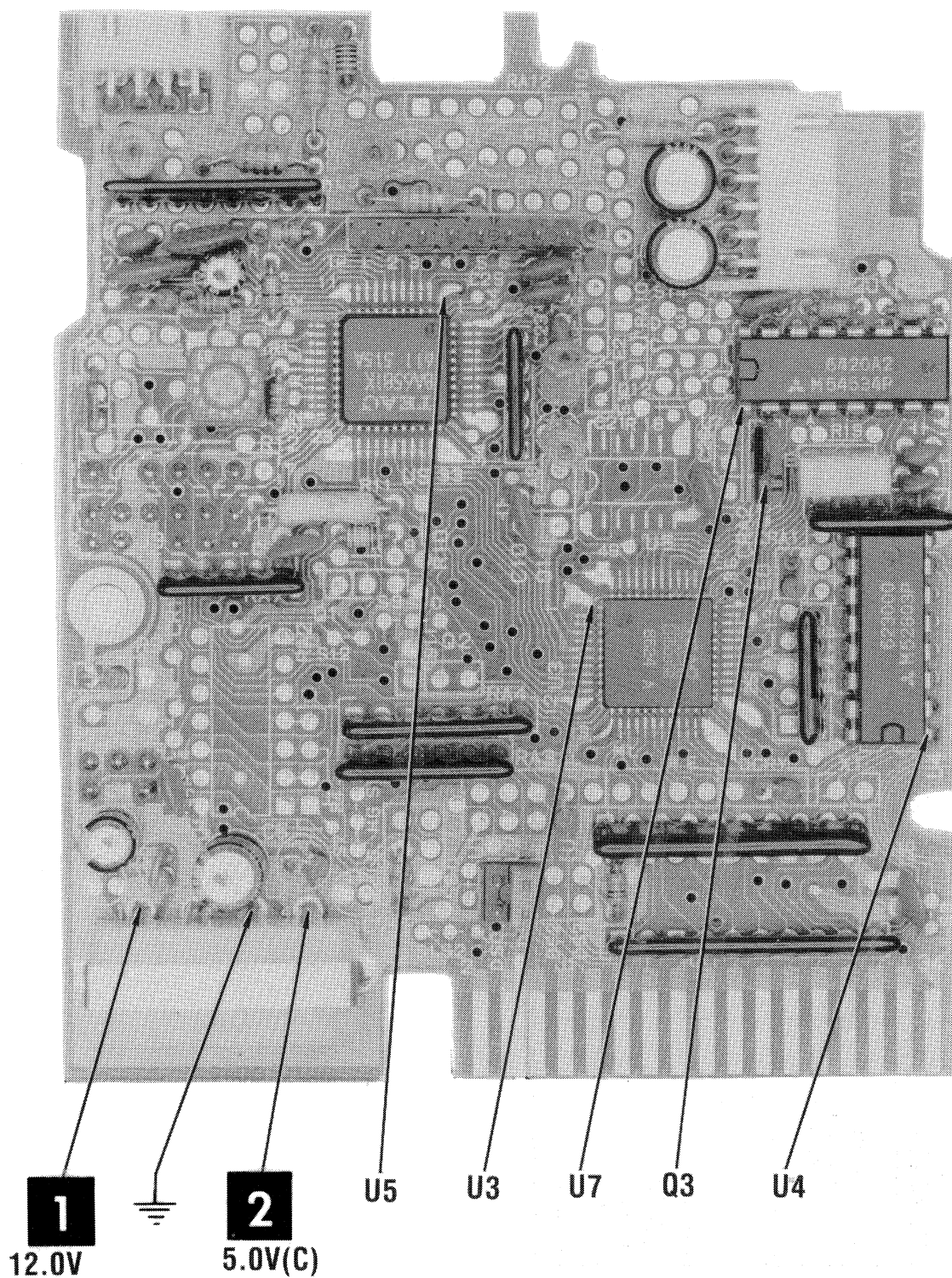
C2	K-1
C4	J-3
C5	K-3
C6	K-11
C9	G-3
C10	G-6
C13	F-11
C14	F-11
C17	D-2
C18	C-1
C19	D-2
C20	C-2
C21	F-7
C22	E-7
C23	D-7
C24	D-6
C25	D-6
C26	F-8
C28	D-9
C29	B-1
C32	B-4
C37	C-8
C38	B-8
CRA3	E-1
DS0	K-6
DS1	K-6
J1	M-8
J2	L-3
J4	J-1
J5	F-1
J6	C-10
J7	A-2
J9	G-1
L3	C-5
L4	B-3
L5	A-4
Q3	F-9
R1	E-3
R5	K-5
R6	K-7
R9	G-4
R11	F-4
R13	E-3
R14	D-2
R15	D-3
R16	C-3
R20	D-10
R21	D-11
R22	A-4
R23	B-8
RA1	L-9
RA3	J-5
RA4	I-5
RA5	K-9
RA6	I-10
RA7	G-3
RA8	G-11
RA9	E-6
RA11	C-2
TP1	C-4
TP2	C-5
TP3	C-5
TP4	C-5
TP5	C-6
TP6	C-6
TP7	C-6
TP8	C-7
U3	H-8
U4	H-11
U5	E-5
U7	E-10
Y1	F-10



## MAIN BOARD

A Howard W. Sams **GRIDTRACE™** Photo

# **CSCS21-A** TANDY MODEL 1000EX



NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.						NOTES
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.		
DISK DRIVE							USED SOME VERSIONS
CRA3	M2163						
Q3	DTA144EF						
U3	LH5060B						
U4	M52803P						
U5	BA6581K						
U6							
U7	M54534P	NTE2072	ECG2072				

## PARTS LIST AND DESCRIPTION (Continued)

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

### ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
	DISK DRIVE	
C37	6.8 25V NP	
C38	6.8 25V NP	

ITEM No.	RATING	MFGR. PART No.

### CAPACITORS

ITEM No.	RATING	MFGR. PART No.
	DISK DRIVE	
C21	100pF 500V 2%	
C29	.0022 500V 2%	
C32	.0015 500V 2%	

ITEM No.	RATING	MFGR. PART No.

### COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
	DISK DRIVE	
L3	Peaking	
L4	Peaking	
L5	Peaking	

ITEM No.	FUNCTION	MFGR. PART No.

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

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
	DISK DRIVE			
R1	Balance	20K		

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
	DISK DRIVE			
R9	2670 1% 1/8W Carbon Film			
R22	200 1% 1/8W Carbon Film			
RA1	Resistor Network	(1)		
RA3	Resistor Network	(2)		
RA4	Resistor Network	(3)		
RA5	Resistor Network	(4)		
RA6	Resistor Network	(4)		
RA7	Resistor Network	(5)		
RA8	Resistor Network	(6)		
RA9	Resistor Network	(7)		
RA11	Resistor Network	(8)		

- (1) 1000 5% x 9  
 (2) 10K x 2, 56K x 2  
 (3) 56K, 10K, 1000, 2200 and 4700 x 2  
 (4) 10K x 4, 56K x 4

- (5) 18K x 4  
 (6) 56K x 2, 1M x 1  
 (7) 22K, 39K, 15K, 150  
 (8) 150 x 2, 2000 x 2, 390

TANDY  
MODEL 1000EX

## PARTS LIST AND DESCRIPTION (Continued)

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

### MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
LED51	LED		Activity, Red
M1	Motor		Stepping
M2	Sensor		Track 00
M3	Motor		Drive
M4	Head		Read/Write/Erase
PQ51	Sensor		Index
PQ52	Sensor		Write Protect

### SCHEMATIC NOTES

- ▽ Isolated ground.
- \* Circuitry not used in some versions
- Circuitry used in some versions
- See parts list
- ⊕ Ground
- ⏏ Chassis

Voltages, waveforms and logic readings for the Disk Drive Interface and Disk Drive taken while running the following Basic program. Readings shown were taken when the Disk Drive Head was not moving unless noted.

NOTE: Insert a formatted diskette (not write protected) in Drive A before running the program.

```
10 OPEN "A:SAMS.DAT" FOR OUTPUT AS #1
20 FOR X=1 TO 300
30 PRINT #1, "HOWARD W SAMS"
40 NEXT X
50 CLOSE #1
60 GOTO 10
```

- (1) Probe Indicates P when head is moving.
- (2) Probe Indicates L when head 0 is selected, H when 1 is selected.
- (3) Probe Indicates H when head 0 is selected, L when head 1 is selected.
- (4) Probe Indicates H when head is on track 00 and L when off track 00.
- (5) Probe Indicates L when head is on track 00 and H when off track 00.
- (6) Probe Indicates H when head is moving in and L when head is moving out from the center of the diskette.
- (7) Probe Indicates L when head is moving in and H when head is moving out from the center of the diskette.
- (8) Probe Indicates H when head is moving.
- (9) Probe Indicates L when head is moving.
- (10) Probe Indicates H when Drive Motor is off.

- (11) Probe Indicates L when Drive Motor is off.
- (12) Probe Indicates L if diskette is write protected.
- (13) Probe Indicates H if diskette is write protected.
- (14) Probe Indicates voltage varies when head is moving.

Voltages measured with digital meter.

Waveforms and voltages taken from ground, unless noted otherwise.

Supply voltage maintained as shown at input.

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 1/2W 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 lights On)

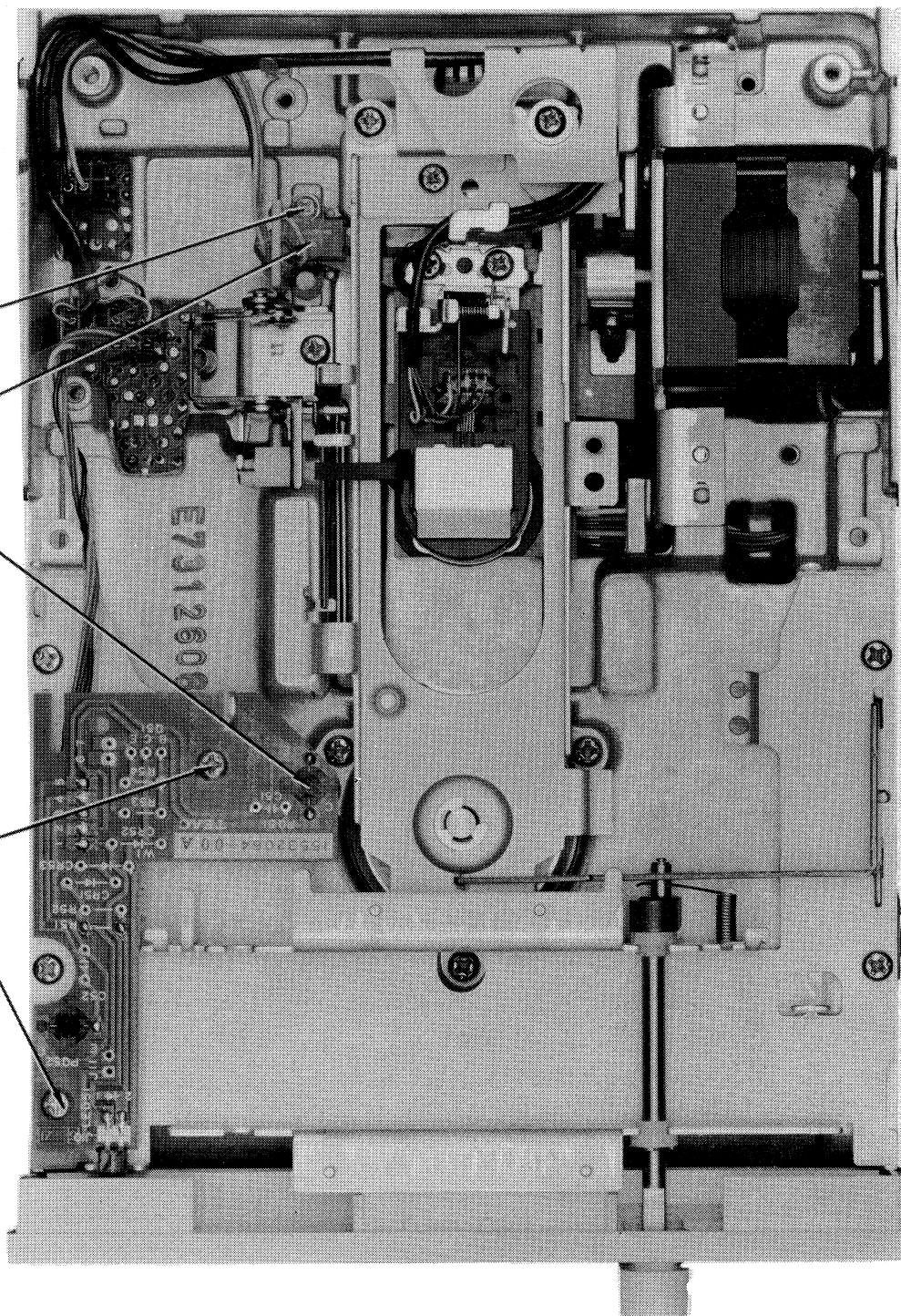
**TANDY  
MODEL 1000EX**

**TRACK 00  
SCREW**

**M2**

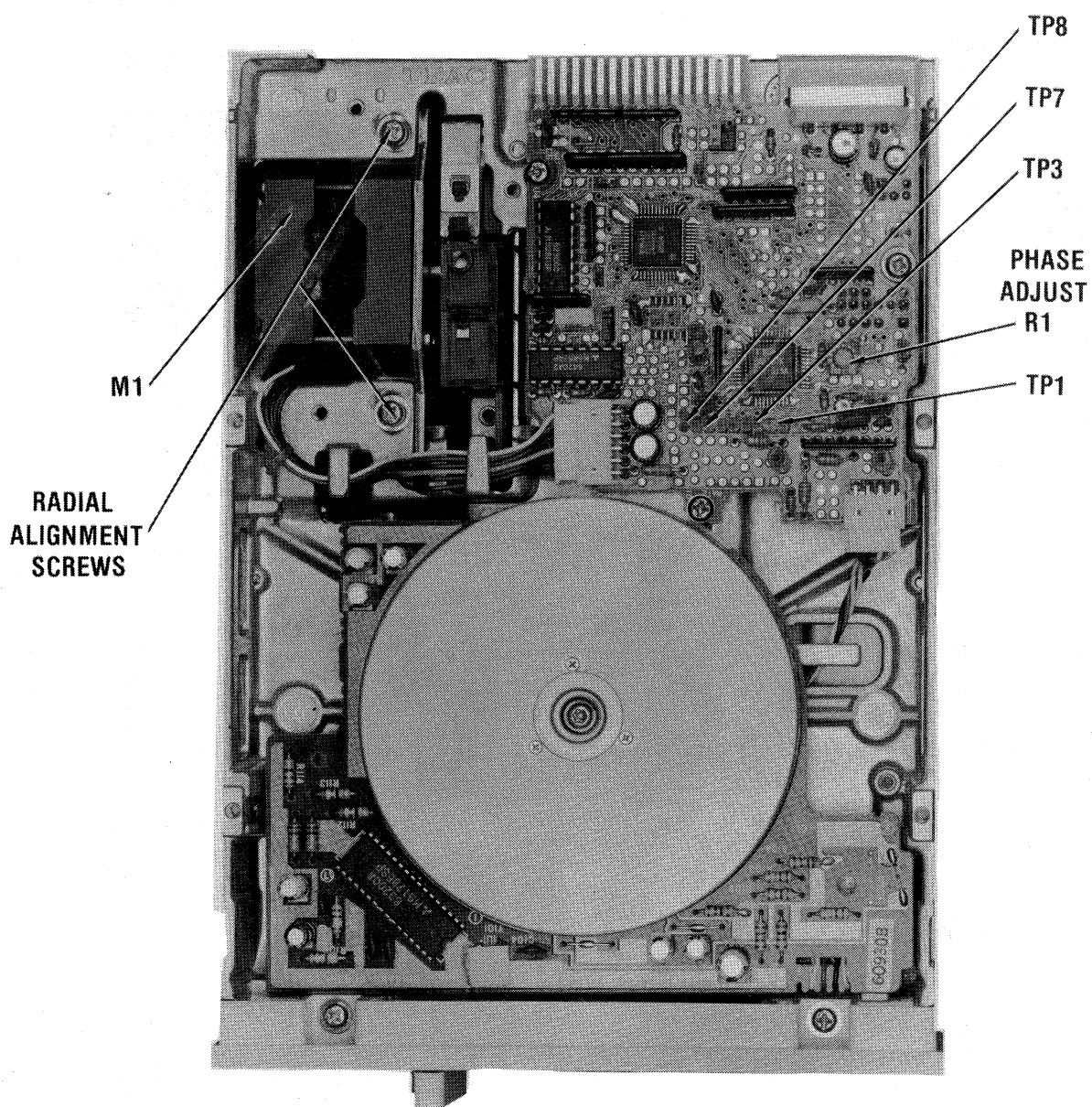
**PQ51**

**INDEX  
SENSOR  
SCREWS**



**CHASSIS-TOP VIEW**





**CHASSIS - BOTTOM VIEW**

## ALIGNMENT

### EQUIPMENT REQUIRED

A test program or a Disk Drive Tester is required which will turn On the Disk Drive, select side 0 or 1 and step the head to the track specified in the alignment procedures. Use a Dysan Analog Alignment Diskette 224/2A when an Alignment Diskette is specified in the alignment procedures. NOTE: This alignment diskette has only alignment patterns on it and does not contain any alignment programs.

### DRIVE TRACK PROGRAM

The following Basic programs can be used to step the Disk Drive head to the Track specified by the user. To stop the program, press the Ctrl and Break keys.

NOTE: The programs select side 0 only.

Operates Drive A

```
10 CLS
20 OUT 1014,128:OUT 1010,16:OUT 1010,20
30 OUT 1013,7:S=INP(1012)
40 OUT 1013,1:S=INP(1012)
50 INPUT "ENTER TRACK NUMBER "; TR
60 IF TR>40 THEN 50
70 OUT 1010,20
80 OUT 1013,15:S=INP(1012)
90 OUT 1013,1:S=INP(1012)
100 OUT 1013,TR:S=INP(1012)
110 FOR T=1 TO 400:NEXT T
120 PRINT"PRESS ANY KEY TO STOP"
130 A$=INKEY$:OUT 1010,20:IF A$="" THEN 130
ELSE 50
```

Operates Drive B

```
10 CLS
20 OUT 1014,128:OUT 1010,33:OUT 1010,37
30 OUT 1013,7:S=INP(1012)
40 OUT 1013,1:S=INP(1012)
50 INPUT "ENTER TRACK NUMBER ";TR
60 IF TR>40 THEN 50
70 OUT 1010,37
80 OUT 1013,15:S=INP(1012)
90 OUT 1013,1:S=INP(1012)
100 OUT 1013,TR:S=INP(1012)
110 FOR T=1 TO 400:NEXT T
120 PRINT"PRESS ANY KEY TO STOP"
130 A$=INKEY$:OUT 1010,37:IF A$="" THEN 130
ELSE 50
```

### SPINDLE SPEED CHECK

If a Disk Drive Tester which provides a readout of the speed in rpm is being used, check for a speed of 300 rpm  $\pm 4.5$  rpm.

If a Disk Drive Tester is not available, center and paste a strobe pattern on the Drive motor on the bottom of the Disk Drive, see Figure 1. Insert a diskette into the Drive and close the door. Type in and run the program listed under "Continuous Operation of Disk Drive" to keep the Disk Drive running. Use the outside pattern when 60 cycle fluorescent lighting is used or the inside pattern for 50 cycle lights.

The speed is correct if the pattern appears to stand still.

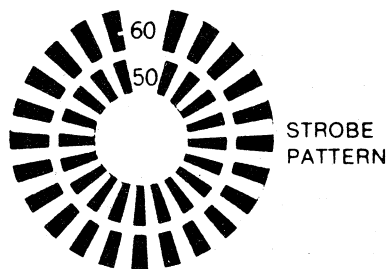


Figure 1

### RADIAL HEAD ALIGNMENT

Connect the channel A input of a dual trace scope to TP7, channel B to TP8, and the external trigger input to TP1. Connect ground lead to TP6. Set the scope to add mode with one channel inverted, the sweep time to 20mSec and the voltage range to .2V. Set both scope inputs to AC. Insert the Alignment Diskette into the Disk Drive and close the door. Turn On the Disk Drive and step the head to track 16, Side 0. The cats-eye pattern shown in Figure 2 should be displayed on the scope.

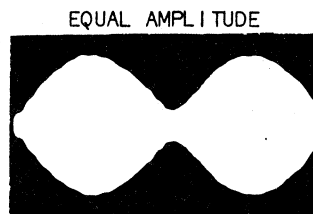


Figure 2

The amplitude of the two lobes displayed must be within 70% of each other. If the lobes are out of tolerance, loosen two screws holding Stepping Motor (M1). Adjust Motor until the two lobes are equal in amplitude and tighten Motor mount screws. Check the adjustment by stepping the head to Track 39 and back to Track 16, then to Track 00 and back to Track 16, checking the lobes each time the head is on Track 16. Check the Track 00 Stop and Detector adjustments after performing the Radial Head Alignment. Select side 1 and check Radial alignment of Head 1 using the above procedures.

### TRACK 00 SENSOR

Connect a scope to TP8 and set the sweep time to 20uSec. Set the voltage range to .2V. Insert the Alignment Diskette into the Disk Drive and close the door. Turn On the Disk Drive and set the Head to Track 00. A 125KHz sine wave should be displayed on the scope.

TANDY  
MODEL 1000EX

## ALIGNMENT (Continued)

### AZIMUTH CHECK

If the 125kHz signal is not present, step the head forward or back until the 125kHz signal is present. When the 125kHz signal is present on the scope, the head is on Track 00.

Connect the Input of a voltmeter to TP3. Check for 5V when the Head is on Track 00 and 0V when the Head is on Track 02. If the readings are not correct, set the Head to Track 01, loosen the Track 00 Sensor (M2) screw (see Disk Drive Mechanical Photo) on the top of the Disk Drive and adjust the detector until the voltmeter reading jumps from 0V to 5V. Tighten the Track 00 screw and recheck the Track 00 Sensor adjustment.

### INDEX SENSOR ADJUSTMENT

Connect the channel A Input of a dual trace scope to TP8, channel B Input to TP1 (Index pulse) and the scope ground to TP6. Set the scope display to channel A with the voltage range set to 20mV and the sweep time set to 50uS. Set the channel B input to noninverting mode and trigger the scope on channel B with the trigger set to negative slope.

Insert the Alignment Diskette in the Disk Drive and close the door. Turn On Disk Drive, select side 0 and set the head to track 01. Confirm that the leading edge of the burst occurs 200uS  $\pm$  200uS after the leading edge of the Index pulse, see Figure 3. If the Index Sensor (PQ51) is out of adjustment, loosen two screws holding the board with the Index detector on the top of the Disk Drive and adjust the Board for 200uS  $\pm$  200uS, see Disk Drive Mechanical, Top View Photo. If side 0 checks good, select side 1 and repeat the above procedure to check Head 1.

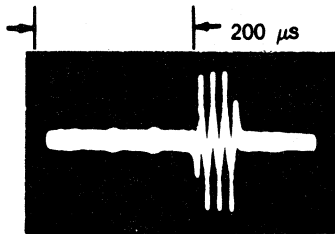


Figure 3

Connect the channel A Input of a dual trace scope to TP7, channel B Input to TP8, external trigger Input to TP1 and connect the scope ground to TP6. Set the scope to add mode with channel B inverted, sweep time to .5ms, AC Input, trigger to negative slope and voltage to .1V range.

Insert the Alignment Diskette, turn on the Disk Drive, select side 0 and set the head to track 34. Confirm that the pattern appears as shown in Figure 4. The amplitude of bursts 1 and 4 must be equal to or less than the amplitudes of bursts 2 and 3.

If the azimuth of Head 0 checks good, select side 1 and repeat the above procedure to check the azimuth of Head 1.

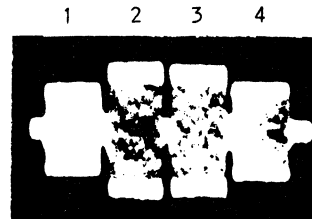


Figure 4

### READ CIRCUIT ADJUSTMENT

To do this adjustment a Disk Drive Tester or program is required that will continuously write a 1F (62.5KHz) pattern on a blank diskette inserted in the Drive.

Connect the Input of a scope to pin 3 of IC U4 (Read Data Line). Set the sweep time to 2u Sec, voltage range to 2V and trigger on negative slope. Insert a BLANK diskette in the Drive and close the Drive door. Continuously write a 1F pattern to the diskette. Two pulses should appear on the scope screen. If the Phase Adj Control (R1) is out of adjustment, the second pulse will appear to be two pulses out of phase, see Figure 5. If R1 is out of adjustment, adjust it until the second pulse appears to be one pulse, see Figure 6.

2 pulses



Figure 5

1 pulse



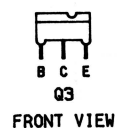
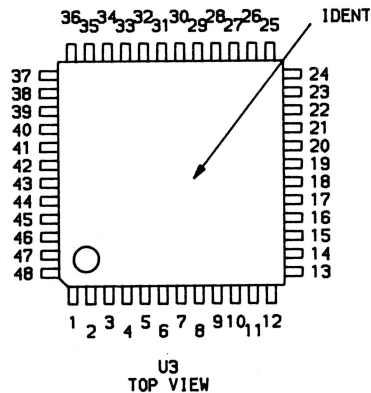
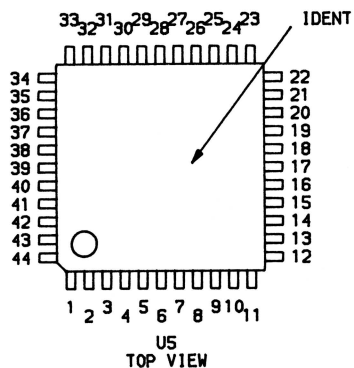
Figure 6

# LOGIC CHART

## FLOPPY DISK DRIVE

PIN NO.	IC U3	PIN NO.	IC U3	PIN NO.	IC U3	PIN NO.	IC U4	IC U5	PIN NO.	IC U5
1	L(13)	21	P	41	L(1)	1	L		21	
2	H	22	L(4)	42	H(1)	2	P		22	
3	L	23	L(13)	43	L(1)	3	P		23	
4	*	24	H	44	H(1)	4	L(13)		24	
5	H	25	H	45	H	5	H(12)		25	
6	L	26	L	46	*(9)	6	H		26	
7	H	27	L	47	H	7	L		27	H
8	H	28	L	48	L(4)	8	L		28	P
9	P	29	L			9	L		29	P
10	P	30	L			10	H		30	P
11	L(8)	31	H			11	P		31	H(2)
12	H(1)	32	L			12	P		32	H
13	H	33	L			13	H(5)		33	P
14	H	34	L			14	L(4)			
15	L(10)	35	H			15	L			
16	L	36	P			16	H			
17	H(7)	37	P							
18	H(1)	38	H							
19	P	39	P							
20	L	40	H(11)							

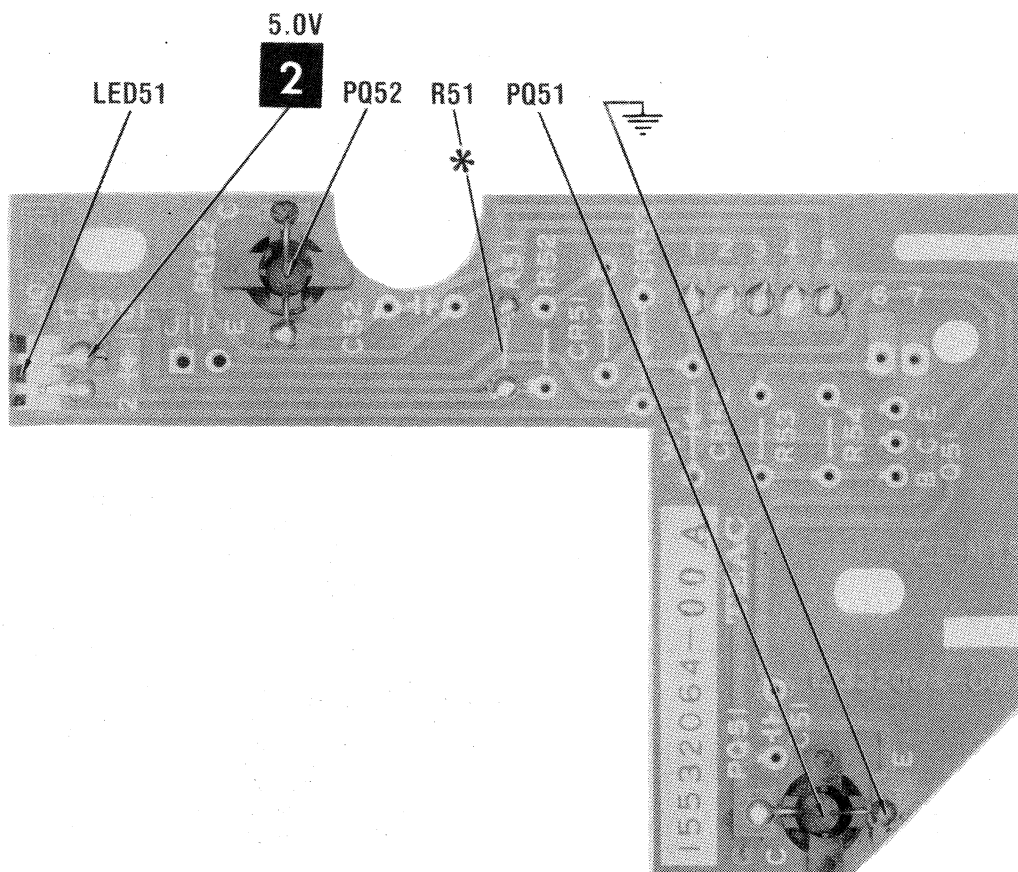
## TERMINAL GUIDES





## SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Disk Drive 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 with AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. The Disk Drive is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Disk Drive cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.



**SENSOR BOARD**

**\*LOCATED OTHER SIDE OF BOARD**

TANDY  
MODEL 1000EX

CSCS21



CSCS21

TANDY  
MODEL 1000EX

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# SAMS<sup>™</sup>

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The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co. 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. by the manufacturers of the particular type of replacement part listed.

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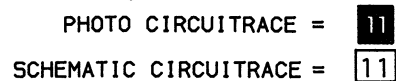




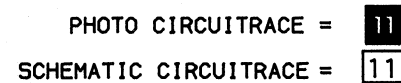


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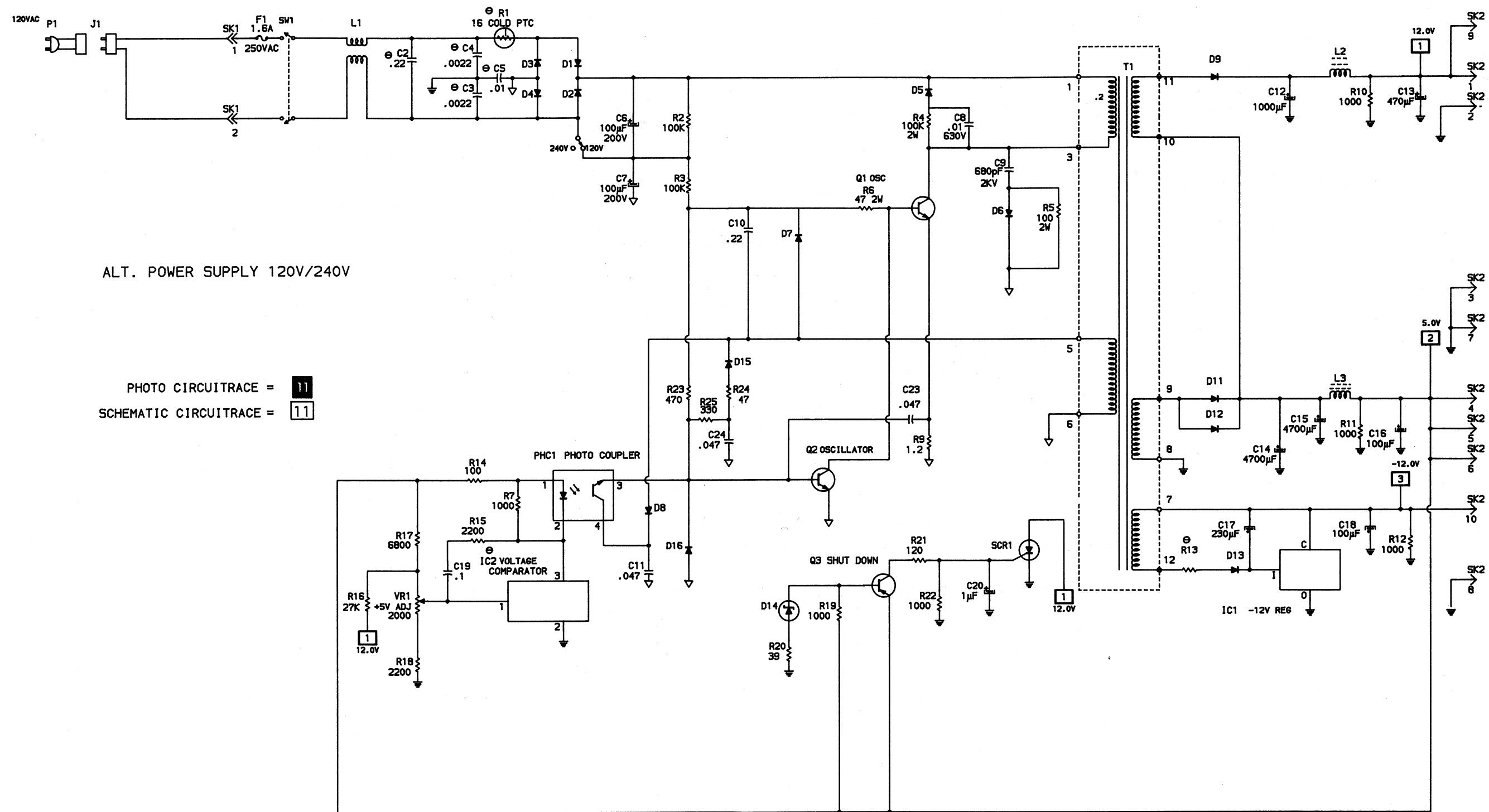




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ALT. POWER SUPPLY 120V/240V

PHOTO CIRCUITRACE = 11  
SCHEMATIC CIRCUITRACE = 11

TANDY  
MODEL 100EX

A PHOTOFAC STANDARD NOTATION SCHEMATIC

WITH CIRCUITRACE

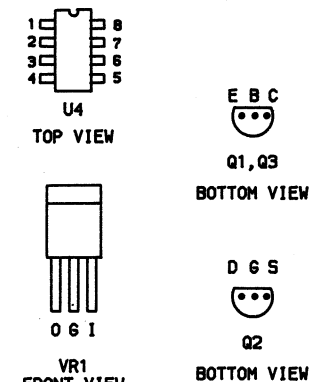
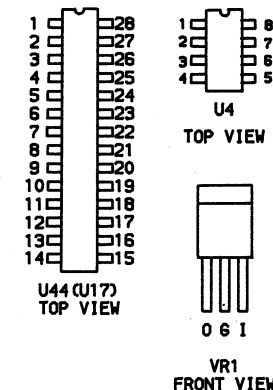
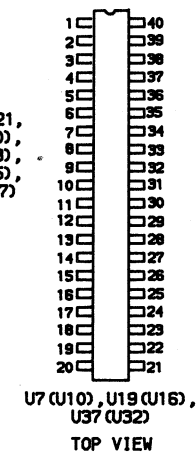
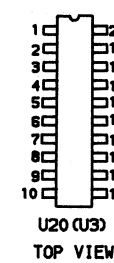
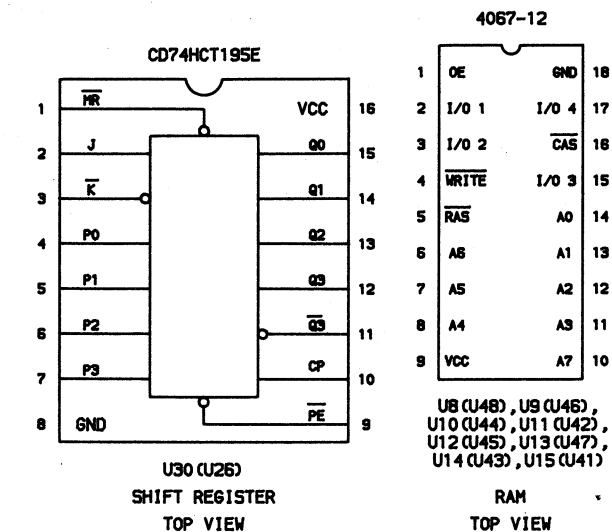
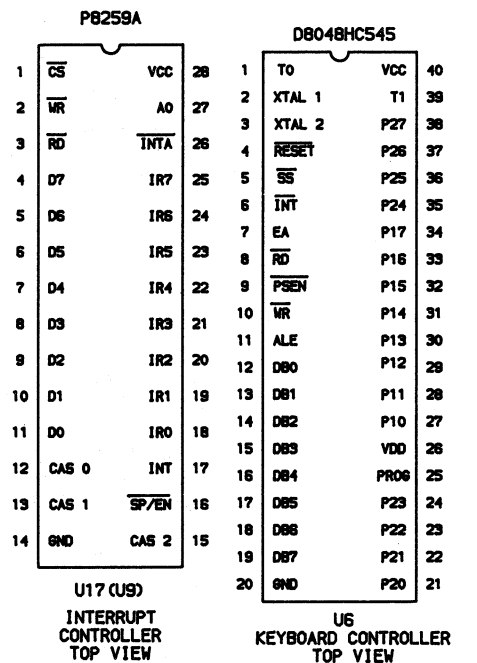
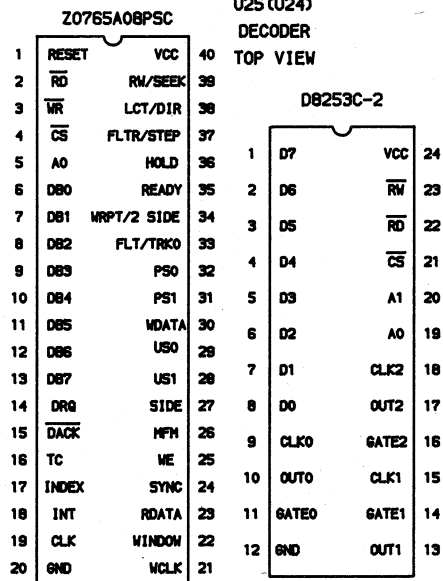
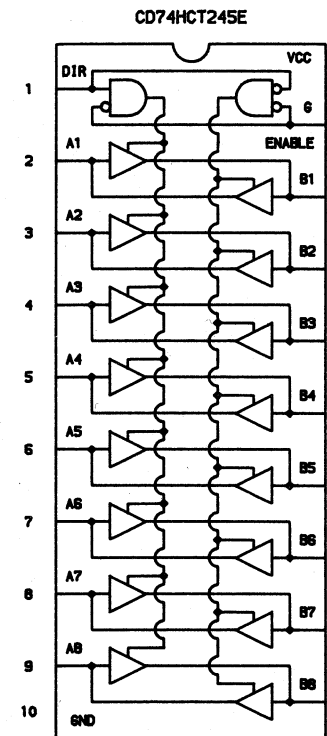
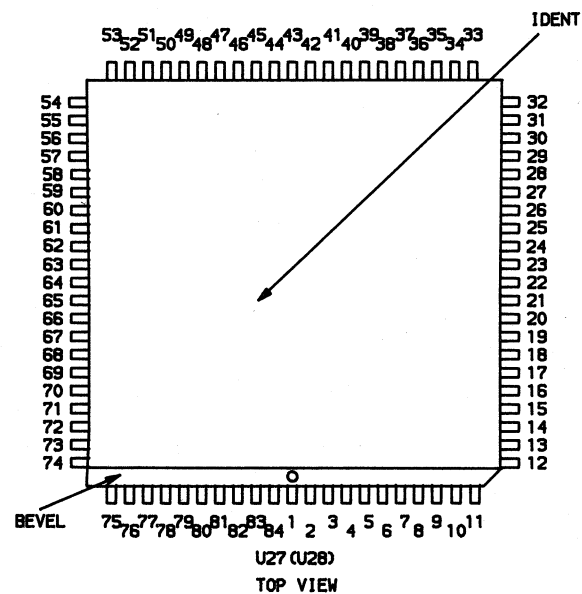
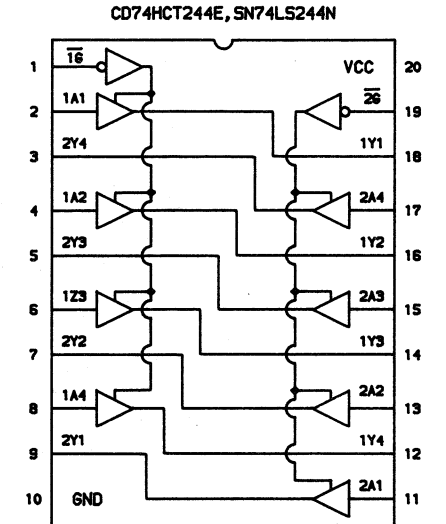
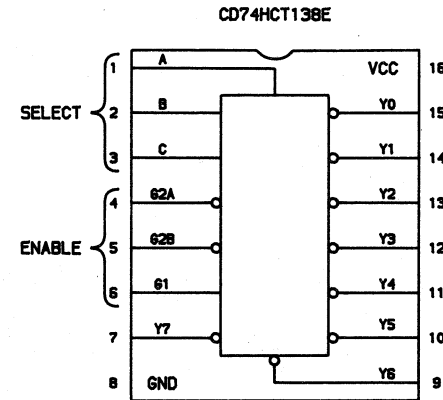
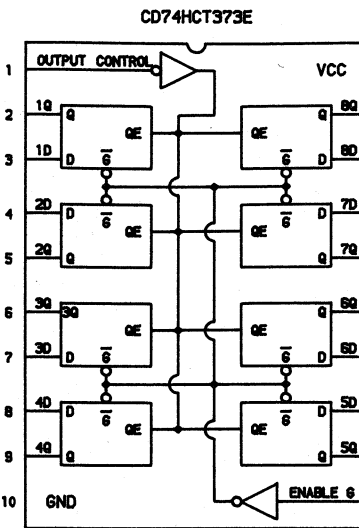
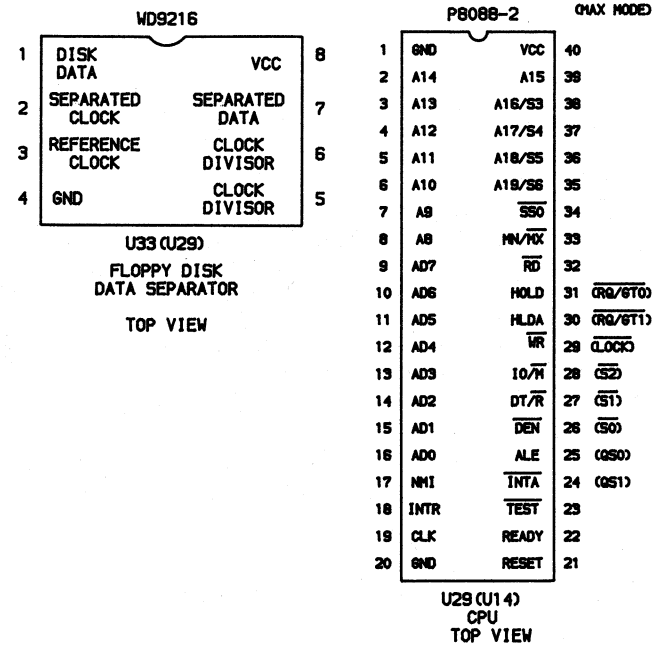
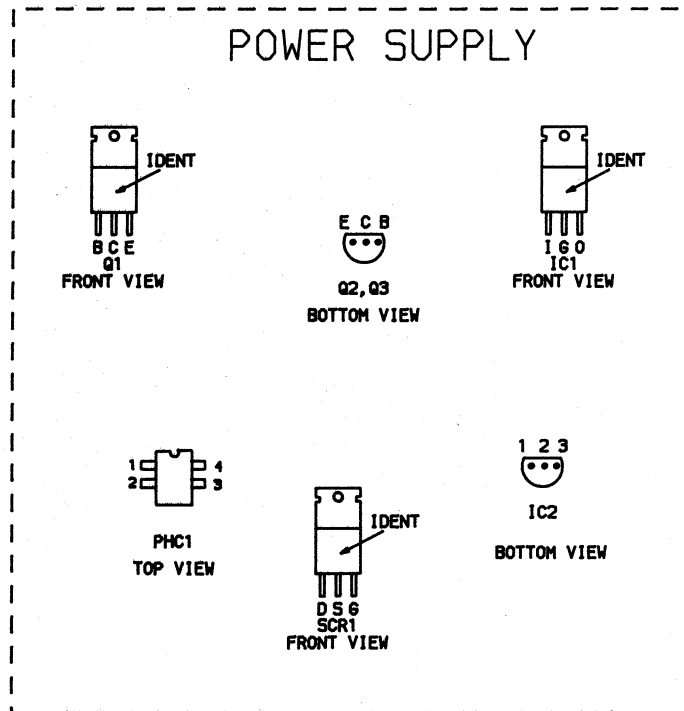
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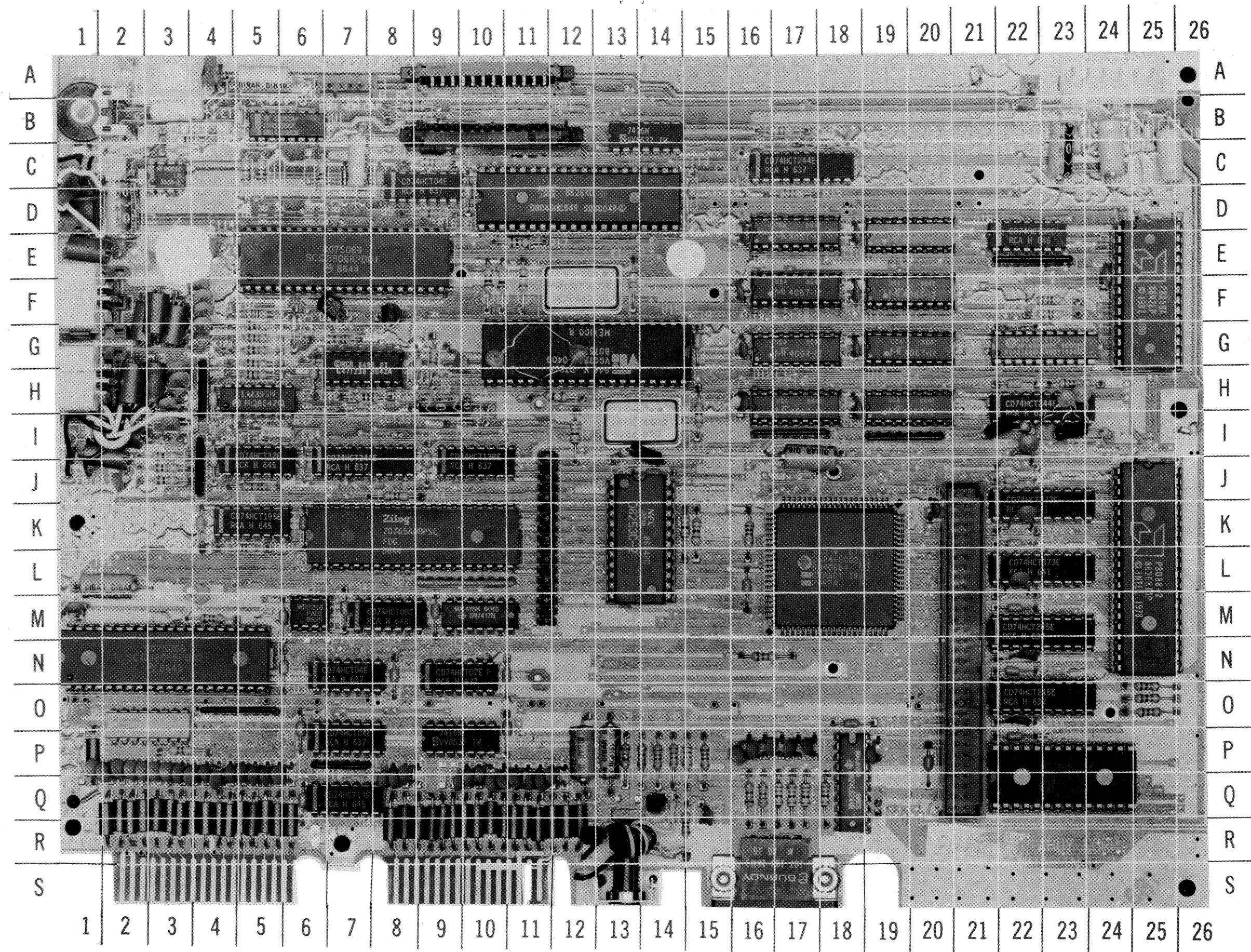
ALTERNATE POWER SUPPLY

ALTERNATE POWER SUPPLY



# IC PINOUTS & TERMINAL GUIDES





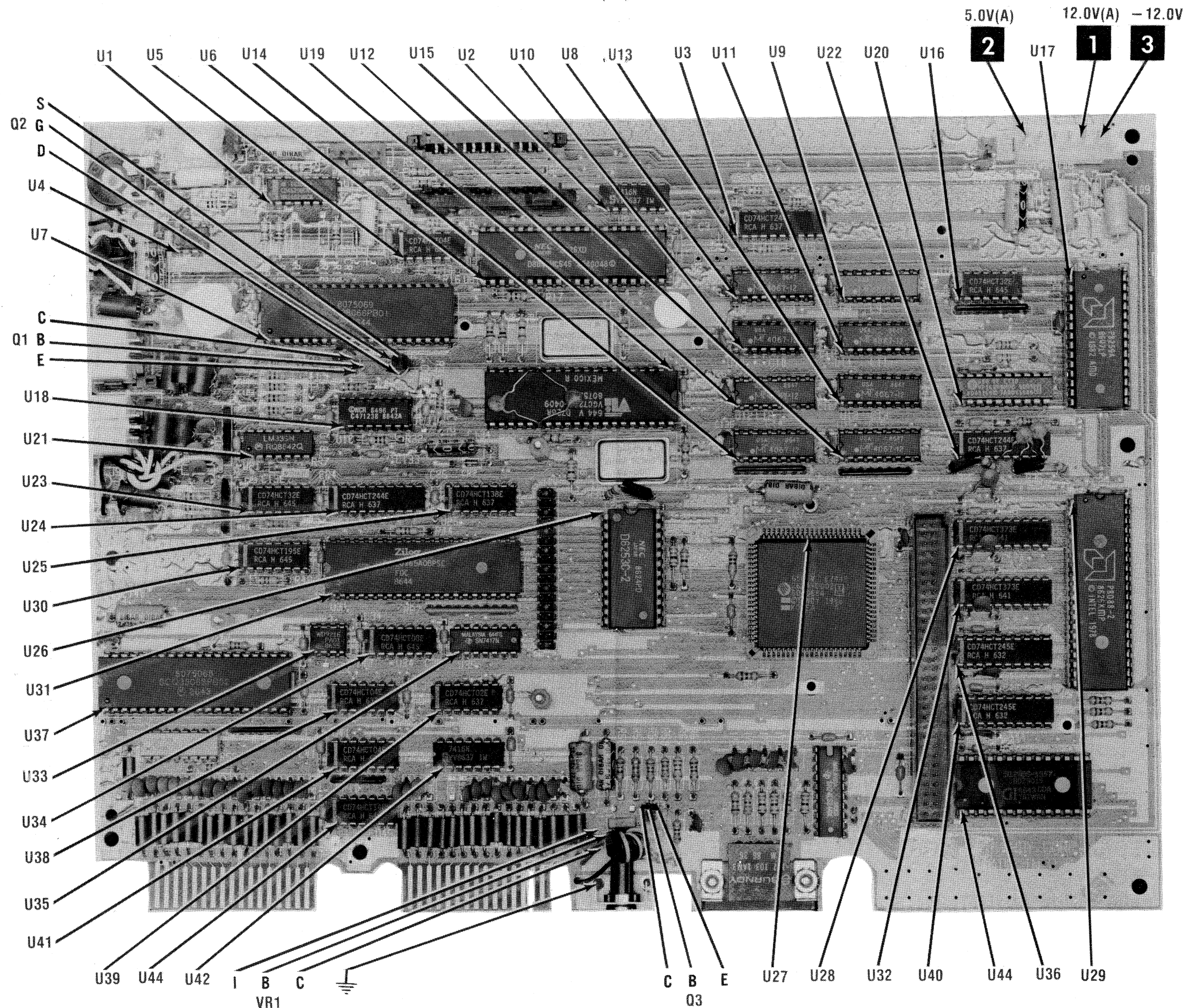
TANDY  
MODEL 1000EX



# SYSTEM BOARD GridTrace LOCATION GUIDE

C1	B-5	C134	H-9	FB20	Q-4	R30	G-7	U37	N-3
C3	C-16	C135	H-16	FB21	Q-4	R31	G-9	U38	N-7
C4	C-3	C136	H-18	FB22	Q-4	R32	H-7	U39	N-9
C5	C-8	C137	J-2	FB23	Q-3	R33	H-12	U40	O-23
C6	D-10	C138	I-17	FB24	Q-5	R34	I-15	U41	P-7
C7	E-4	C139	K-20	FB25	Q-5	R35	I-22	U42	P-9
C17	D-25	C140	L-2	FB26	Q-6	R36	I-24	U43	Q-18
C18	H-6	C141	M-1	FB27	Q-6	R37	I-5	U44	Q-23
C19	G-15	C143	P-1	FB28	R-8	R38	I-12	U45	Q-7
C20	G-22	C144	P-2	FB29	R-8	R39	I-13	VR1	R-12
C21	H-4	C145	P-2	FB30	R-9	R40	I-3	Y1	F-12
C22	H-22	C146	P-2	FB31	R-9	R41	J-3	Y2	I-14
C23	I-4	C147	P-2	FB32	R-9	R42	J-3		
C24	J-6	C148	P-3	FB33	R-9	R43	J-5		
C25	I-9	C149	P-3	FB34	R-10	R44	J-8		
C26	J-14	C150	P-3	FB35	R-10	R45	K-15		
C27	L-16	C151	P-3	FB36	R-10	R46	K-15		
C28	J-22	C152	P-4	FB37	R-10	R47	K-16		
C28A	I-22	C153	Q-4	FB38	R-11	R48	K-5		
C29	J-25	C154	P-4	FB39	R-11	R49	M-4		
C30	K-4	C155	P-5	FB40	K-11	R50	N-16		
C31	K-6	C156	P-5	FB41	R-12	R51	O-25		
C32	K-22	C157	P-5	FB42	R-12	R52	O-25		
C32A	K-22	C158	P-5	FB43	R-12	R53	O-25		
C33	M-6	C159	P-8	FB44	R-13	R55	P-3		
C34	M-7	C160	Q-8	FB45	D-1	R56	P-13		
C35	M-9	C161	Q-8	FB50	I-22	R57	P-14		
C36	M-22	C164	Q-9	FB51	I-23	R58	P-14		
C36A	L-22	C165	Q-10	FB52	I-14	R59	P-14		
C37	N-6	C166	Q-10	J1	A-4	R60	P-15		
C38	N-8	C167	Q-10	J2	A-7	R61	P-15		
C39	N-10	C168	Q-10	J3	A-10	R62	Q-16		
C40	N-22	C169	Q-11	J4	A-22	R63	Q-16		
C40A	N-22	C170	Q-11	J5	A-24	R64	Q-17		
C41	O-6	C171	Q-11	J6	B-10	R65	Q-17		
C42	O-11	C172	Q-12	J7	D-1	R66	Q-17		
C43	O-18	C173	P-12	J8	F-1	R67	Q-18		
C44	O-22	C174	P-13	J9	H-1	R68	R-15		
C44A	O-22	C175	P-16	J10	K-11	U1	B-6		
C45	Q-6	C176	P-16	J11	N-21	U2	B-14		
C100	A-2	C177	P-16	J12	S-4	U3	C-17		
C101	B-3	C178	P-17	J13	S-10	U4	C-3		
C102	A-5	C179	P-17	J14	S-13	U5	C-9		
C103	B-22	C180	P-19	J15	S-17	U6	D-12		
C104	C-23	C181	P-20	Q1	F-7	U7	E-7		
C105	B-23	C182	Q-13	Q2	F-8	U8	D-17		
C106	C-24	C183	Q-15	Q3	Q-14	U9	E-20		
C107	B-25	C196	G-12	R1	B-1	U10	F-17		
C108	B-25	C197	G-10	R2	B-3	U11	F-20		
C109	B-25	C198	H-23	R3	B-3	U12	G-17		
C110	C-2	C199	H-23	R4	B-5	U13	G-20		
C110A	C-1	CR1	C-7	R5	B-8	U14	H-17		
C111	C-7	CR2	I-10	R6	B-9	U15	H-20		
C112	D-2	CR3	F-6	R7	B-17	U16	D-22		
C113	D-15	E1	Q-19	R8	C-18	U17	F-25		
C114	E-4	E2	Q-19	R9	C-5	U18	G-7		
C115	D-16	FB1	E-1	R10.	C-5	U19	G-13		
C116	E-18	FB2	F-2	R13	C-6	U20	G-23		
C117	E-24	FB3	F-3	R14	C-9	U21	H-5		
C118	F-16	FB4	F-3	R15	D-17	U22	H-22		
C119	F-18	FB5	H-2	R16	D-9	U23	J-5		
C120	F-4	FB6	H-3	R17	E-11	U24	J-7		
C121	F-4	FB8	I-2	R18	F-10	U25	J-10		
C122	F-4	FB9	I-2	R19	F-10	U26	K-19		
C123	G-4	FB10	I-2	R20	E-11	U27	L-18		
C124	G-9	FB11	P-1	R21	F-13	U28	K-23		
C125	G-9	FB12	Q-2	R22	F-23	U29	L-25		
C126	G-16	FB13	Q-2	R23	F-23	U30	K-5		
C128	H-3	FB14	Q-2	R24	F-5	U31	K-8		
C129	H-3	FB15	Q-2	R25	G-5	U32	L-23		
C130	H-3	FB16	Q-3	R26	G-5	U33	M-6		
C131	I-3	FB17	Q-3	R27	G-5	U34	M-8		
C132	I-5	FB18	Q-3	R28	G-5	U35	M-10		
C133	H-7	FB19	Q-3	R29	H-5	U36	M-23		

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NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

## TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

### TEST EQUIPMENT (COMPUTERFACTS)

Equipment	B & K Precision Equipment No.	Sencore Equipment No.	Notes
OSCILLOSCOPE	1570A,1590A,1596	SC61	
LOGIC PROBE	DP51,DP21		
LOGIC PULSER	DP101,DP31		
DIGITAL VOM	2830,2806	DVM37,DVM56,SC61	
ANALOG VOM	277,111,116		
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	
COLOR BAR GENERATOR	1211A,1251,1260,1249	CG25,VA62	
RGB GENERATOR	1260,1249		
FUNCTION GENERATOR	3020,3011,3030		
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44 PR-28(HV)	HP200	
TEMPERATURE PROBE	TP-28,TP-30		
CRT ANALYZER	467,470	CR70	
DIGITAL IC TESTER	560,550,552		
CAPACITANCE ANALYZER		LC53,LC75,LC76 LC77	
INDUCTANCE ANALYZER		LC53,LC75,LC76 LC77	

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## TROUBLESHOOTING

### POWER SUPPLY

NOTE: Do not operate the Power Supply without a load. A #1129 lamp may be used as a load for the 5.0V Source and a #93 lamp used for the 12.0V Source. Use an Isolation Transformer with a stepdown control when servicing the Power Supply. Disconnect the Power Supply from the System Board and Disk Drives to avoid possible damage to the System from high voltages that may be produced while servicing Power Supply.

The Power Supply has a shutdown circuit, Zener Diode D12, Overvoltage Transistor (Q3) and Shutdown SCR (SCR1). The circuit will shut down the Power Supply if the 5.0V Source goes too high. The shutdown can be defeated by removing shutdown SCR (SCR1) from the circuit.

WARNING: Defeating shutdown may allow high voltages and currents to occur that may do further damage to Power Supply. Use a current limiting voltage stepdown AC Power Supply to supply AC power to the defective Power Supply when shutdown is defeated.

When shutdown occurs, the charge on Capacitor C17 will keep the Power Supply in shutdown if it is turned Off and immediately turned back On. Turn the Power Supply Off and wait at least two minutes before turning it back On to allow the charge on Capacitor C17 to discharge.

Power Supply Dead. Check Fuse F1. If F1 is open, check for possible shorts at Diode D1 and check for a possible shorted Oscillator Transistor (Q1). If Fuse F1 is good, apply AC power and check for 120V AC across the AC input pins of Diode D1. If 120V AC is missing, check Coil L1, Thermistor R1, Switch SW1 and Connector SK1. If 120V AC is present, check for 164V at the collector of Transistor Q1. If 164V is missing, check Diode D1, Thermistor R1 and check the winding on Transformer T1 from pin 1 to pin 3 for continuity. If 164V is present, check the waveform at the base of Transistor Q1. If the waveform is missing, check the voltages and components associated with Regulator Transistor (Q2) and Transistor Q1 and check the winding on Transformer T1 from pin 5 to pin 6 for continuity.

No -12.0V at pin 10 of Connector SK2. Check the winding on Transformer T1 from pin 7 to pin 12 for continuity and check the -12V Regulator IC (IC1), Diode D11, Capacitors C14, C15 and Resistor R11.

No 12.0V at pin 1 of Connector SK2. Check the winding on Transformer T1 from pin 10 to pin 11 for continuity and check Diode D6, Coil L2 and Capacitors C9 and C10.

No 5.0V at pin 4 of Connector SK2. Check the winding on Transformer T1 from pin 8 to pin 9 for continuity and check Diodes D9, D10, Capacitors C11 thru C13 and Coil L3.



## TROUBLESHOOTING (Continued)

### MICROPROCESSOR (CPU) OPERATION

Microprocessor IC (U29) not working. Check for a 7.159MHz waveform at pin 19 of IC U29. If the waveform is missing, refer to the "Oscillators and Dividers" section of this Troubleshooting guide. If the waveform checks good, check the logic reading at pin 21 (Reset) of IC U29 while turning the Computer On. The reading should be High when the Computer is turned On, then go Low. If the reading is not correct, check the logic reading at pin 21 of IC U19 while turning the Computer On. The reading should be High when the Computer is turned On, then go Low. If the reading is not correct, check Capacitors C124 and C134, Diode CR2 and Resistor R31. If the reading is correct at pin 21 of IC U19, check IC U19.

### OSCILLATORS AND DIVIDERS

Verify Oscillator Modules (Y1 and Y2) are working properly by checking for a 28.636MHz signal at pin 27 and 16.0MHz signal at pin 14 of IC U19. If the 28.636MHz signal is missing or frequency is not correct, check Oscillator Module Y1. If the 16.0MHz signal is missing or frequency is not correct, check Oscillator Module Y2.

If the Oscillator Modules check good, check the dividers in IC U19 by checking for a 1.193MHz signal at pin 3, 8.0MHz signal at pin 11, 14.318MHz signal at pin 12, 3.5795MHz signal at pin 13, 7.16MHz (4.77MHz in normal speed mode) signal at pin 16, 500KHz signal at pin 38 and 4.0MHz signal at pin 39 of IC U19. If any of the signals are not correct, check IC U19.

### KEYBOARD

Keyboard does not function. Check Connectors J3, J6 and the Keyboard ribbon cables. If connectors and cables are good, check the logic reading at pin 4 of Keyboard Controller IC (U6) while turning Computer On. The reading should be Low when Computer is turned On, then immediately go High and stay High. If reading is not correct, check Capacitor C111, Diode CR1 and Resistor R16. If reading is correct, check for 4.77MHz clock waveform at pin 17 of IC U19. If waveform is missing, check IC U19. If waveform is present, check for a 4.77MHz signal at pin 4 of IC U5. If the signal is missing, check IC U5 and Resistor R20. If the signal is present, check for a logic High at pin 3 of Interface IC (U7). If reading is not correct, check IC U7. If reading is correct, check for a logic Low at pin 12 of IC U5. If reading is not correct, check IC U5. If reading is correct, check for pulses at pins 37 and 38 of Keyboard Controller IC (U6) while pressing a Key. If pulses are missing at either pin, check IC U6. If pulses are present, check for pulses at pin 8 of IC U5. If pulses are missing, check IC U5. If pulses are present, check IC U7.

### SOUND

No Sound. If there is no sound from the Internal speaker, check the setting of the Volume

Control (R1). The Control should be set to Maximum clockwise for Maximum volume.

If the Control is set properly, type in and run the following Basic program:

```
10 PRINT CHR$(7): GOTO 10
```

The program produces a continuous audio tone of about 1100 Hertz. While the program is running, check for pulses at pin 13 of IC U25. If pulses are missing, check IC U25. If pulses are present, check for pulses at pin 6 of IC U23. If pulses are missing, check IC U23. If pulses are present, check for pulses at pin 13 of IC U19. If pulses are missing, check IC U19. If pulses are present, check for the waveform shown in Figure A at pin 7 of IC U18. If the waveform is missing, check IC U18. If the waveform is present, check for a logic High at pins 26 and 27 and logic Low at pin 28 of IC U7. If any of the readings are not correct, check IC U7. If the readings are correct, check for a logic High at pin 2 of IC U38. If the reading is not correct, check IC U38. If the reading is correct, check for the waveform shown in Figure A at pin 10 of IC U1. If the waveform is missing

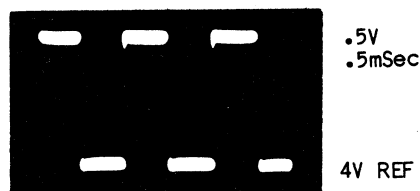


Figure A

check IC U1. If the waveform is good at IC U1, check for the waveform shown in Figure C at pin 5 of IC U4 (with Volume Control R1 set at Maximum volume). If the waveform is missing, check the voltages and components associated with IC U4. If the waveform checks good, check Capacitor C112, Connector J1 and Speaker SP1.

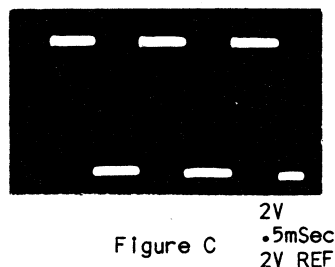


Figure C

### NORMAL/TURBO CPU CLOCK

To check the CPU clock switching circuits, type in and run the following program:

```
10 OUT 98,32: PRINT "NORMAL (4.77MHz)"
20 AS=INKEY$: IF AS="" THEN 20
30 OUT 98,40: PRINT "TURBO (7.16MHz)"
40 AS=INKEY$: IF AS="" THEN 40 ELSE 10
```

The program changes the clock speed each time a key is pressed. Set the speed to "Normal"

## TROUBLESHOOTING (Continued)

and check for a logic Low at pin 2 and a frequency of 4.77MHz at pin 16 of IC U19. Then set the speed to "Turbo" and check for a logic High at pin 2 and a frequency of 7.16MHz at pin 16 of IC U19. If the readings are not correct at pin 2, check IC U7. If the frequency does not switch at pin 16, check IC U19.

### PARALLEL PORT

Parallel Port does not work. Check Connector J13 for good connections. If the connector checks good, disconnect any equipment connected to Connector J13 and type in and run the following Basic program:

```
10 CLS
20 LOCATE 1,1
30 OUT 888,0:OUT 890,0
40 PRINT"A=";INP(888)
50 PRINT"B=";(INP(889) AND 248)
60 PRINT"C=";INP(890)
70 OUT 888,255:OUT 890,255
80 PRINT"D=";INP(888)
90 PRINT"E=";(INP(889) AND 248)
100 PRINT"F=";INP(890)
110 GOTO 20
```

The program continuously checks the Parallel Port circuits and displays six numbers (A thru F) on the Monitor screen. With nothing connected to Connector J13, the following numbers should appear on the Monitor screen:

```
A=0
B=88
C=203
D=255
E=88
F=244
```

Make a parallel loopback test plug by connecting together pins 17, 19, 21 and 28 of a 34-pin female edge connector. Connect the test plug to Connector J13 and run the above program. The following numbers should appear on the Monitor screen:

```
A=0
B=144
C=203
D=255
E=88
F=244
```

If any of the numbers are not correct, check for pulses at pin 15 of IC U25 while the above program is running. If pulses are missing, check IC U25. If pulses are present, check IC U37, Capacitors C148 thru C158 and C143 thru C146 and Resistor Packs RP8 and RP9.

### JOYSTICK PORTS

Joystick Ports do not work. Type in and run the following Basic program:

```
10 CLS
20 LOCATE 2,2
30 OUT 512,255
40 PRINT INP(513)
50 GOTO 20
```

The program displays the number 240 on the Monitor screen when Joystick Connectors J8 or J9 are not being used. The number will change when pin 1 or 2 of Connector J8 or J9 is connected to 5.0V or when pin 4 or 6 of Connector J8 or J9 is connected to ground. Use the following charts to determine what the number will be.

Connected To 5.0V	Number	Connected To Ground	Number
J8-1	244	J8-4	176
J8-2	240	J8-6	112
J9-1	241	J9-4	224
J9-2	242	J9-6	208

If the numbers are not correct, make the following checks while the above program is running. Check for pulses at pin 12 of IC U25. If pulses are missing, check IC U25. If pulses are present, check for pulses at pins 8 and 11 of IC U23. If pulses are missing, check IC U23. If pulses are present, check for pulses at pin 12 of IC U45. If pulses are missing, check IC U45. If pulses are present, check for the waveform shown in Figure D at pin 4 of IC U21. If waveform is not correct, check Transistors Q1 and Q2, Zener Diode CR3, Capacitor C132 and Resistors R24, R30 and R37. If waveform is correct, connect pins 1 and 2 of



Figure D

Connectors J8 and J9 to 5.0V and check for pulses at pins 1, 2, 13, and 14 of IC U21. If pulses are missing, check the voltages and components associated with IC U21. If pulses are present, check IC U24, Capacitors C122, C123, C128 and C129 and Resistor Packs RP3 and RP4.

### USING A PRINTER FOR DISPLAY

If there is a defect in the CRT Controller Board, information that is normally displayed on the Monitor screen may not be visible or readable. In such cases, it may be possible to send the Monitor screen information to a Printer that is connected to the Computer. While the Computer is in MS-DOS or GWBasic, the Printer output can be turned On by pressing the Print Key. The Monitor screen information will continue to be printed out until the Print Key is pressed again to turn the Printer Off. It is also possible to get a printout of the entire screen display by holding the Shift Key down and pressing the Print Key.

Any Basic program that uses the PRINT command to send information to the Monitor screen can be made to send the information to a Printer by changing the PRINT command to LPRINT.

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## TROUBLESHOOTING (Continued)

### VIDEO

No Video. Check waveforms at pins 2, 6, 8 and 11 of IC U43. If any waveforms are missing, check IC U27. If waveforms are good, check waveform at the base of Video Amp Transistor (Q3). If waveform is missing or not correct, check IC U43 and Resistors R58, R60, R62 and R63. If waveform is good, check the voltages and components associated with Transistor Q3.

### VIDEO SYNC

No vertical or horizontal sync on an RGB Monitor. Check for vertical waveform at pin 17 and a horizontal waveform at pin 15 of IC U43. If either waveform is missing, check IC U27. If waveforms are good, check IC U43, Capacitors C117 and C175 and check pins 8 and 9 of Connector J16 for good connections.

No vertical and horizontal sync on a Monitor connected to the Composite Video Jack (J15). Check composite sync waveform at pin 11 of IC U43. If waveform is missing, check IC U27. If waveform is present, check for sync pulses in waveform at the base of Video Amp Transistor (Q3). If pulses are missing, check IC U43 and Resistor R62. If sync pulses are present, check Transistor Q3, Capacitor C183, Resistor R68 and Jack J14.

### VIDEO HIGHLIGHT

No Highlight. Type in and run the following Basic program:

```
10 DEF SEG=&HB00
20 FOR X=0 TO 4000 STEP 2
30 POKE X,42:POKE X+1,8
40 NEXT X
50 GOTO 50
```

The program fills the Monitor screen with highlighted characters. While the program is running, check for pulses at pins 4 and 16 of IC U43. If pulses are missing at pin 4, check IC U27. If pulses are present at pin 4 and missing at pin 16, check IC U43. If pulses

are present at pin 16, check Resistors R61 and R67 and Capacitor C176.

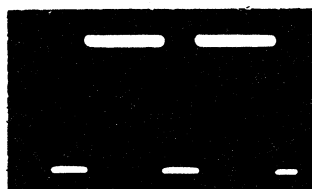
### COLOR

No color or some colors missing. Type in and run the following Basic program:

NOTE: Put four spaces between the quotes in line 70.

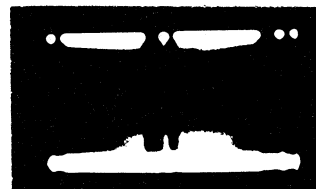
```
10 DATA 9, 10, 12
20 SCREEN 0,1:WIDTH 80
30 KEY OFF:CLS
40 FOR Y=1 TO 3
50 READ C:COLOR 0,C
60 FOR X=1 TO 160
70 PRINT " ";
80 NEXT X:NEXT Y
90 GOTO 90
```

The program puts blue, green and red horizontal bars on the Monitor screen. While the program is running, check for the waveform shown in Figure E at pins 2, 6, 8, 12, 14 and 18 and the waveform shown in Figure F at pins 7 and 13 of IC U43.



5V  
20uSec  
0V REF

Figure E



5V  
20uSec  
0V REF

Figure F

If waveforms are missing at pin 2, 6, 8 or 13 of IC U43, check IC U27. If waveforms are present at pins 2, 6, 8 and 13 and missing at pins 7, 12, 14 and 18, check IC U43. If waveforms are good at pins 7, 12, 14 and 18, check Resistors R63 thru R66, R58, R60 and Capacitors C176, C177 and C178.

## TROUBLESHOOTING (Continued)

### DISK DRIVE INTERFACE

**WARNING:** It is possible for a defective Disk Drive to write on or erase information on a diskette, even if the diskette is write protected. Check the Disk Drive by first using a diskette that has programs that have been backed up on another diskette. Do not leave the alignment diskette in the drive while checking voltages and waveforms unless specified in the alignment procedures. The test equipment may cause the Disk Drive circuits to erase sections of the alignment diskette even if the diskette is write protected.

Check all setup jumpers and switches for correct positions and check all interconnecting cables for good connections.

### WILL NOT READ

Insert a diskette containing data in Disk Drive A and close the door. Type in and run the following Basic program to keep the Disk Drive running in read mode.

```
10 CLS
20 OUT 1014,128:OUT 1010,16:OUT 1010,20
30 OUT 1013,74:S=INP(1012)
40 OUT 1013,Y:S=INP(1012)
50 FOR X=1 TO 7
60 S=INP(1013):S=INP(1012):PRINT S
70 NEXT X:LOCATE 1,1
80 IF Y=1 THEN Y=5 ELSE Y=1
90 GOTO 20
```

The program displays seven numbers on the Monitor screen. The numbers should change when a diskette with data on it is inserted in the Drive and the Drive door closed while the above program is running.

If the numbers do not change, make the following checks, while the program is running with a diskette in the Drive. Check for Index pulses at pin 17 of Floppy Disk Controller IC (U31). If pulses are missing, refer to the "Index Sensor" section of this Troubleshooting guide. If pulses are present, check for a logic Low at pin 5 and logic High at pin 6 of IC U42. If reading is not correct at pin 5, check IC U31. If reading is correct at pin 5 and not correct at pin 6, check IC U42. If readings are correct at IC U42, check for pulses at pins 31 and pin 10 of IC U45. If pulses are missing at pin 3, check pin 30 of Connector J10 and the Drive cable. If connector and cable are good, refer to the "Disk Drive" Troubleshooting in the Disk Drive Folder.

If pulses are present at pin 3 of IC U45 and missing at pin 10, check IC U45. If pulses are present at pin 10, check for pulses at pins 4, 19 and 26 of IC U31. If pulses are missing at pins 4 or 19, check IC U19. If pulses are present at pins 4 and 19 and missing at pin 26, check IC U31. If pulses are present at pin 26, check for pulses at pin 10 of IC U38. If pulses are missing, check IC U38. If pulses are present, check for pulses at pins 2 and 7 of IC U33. If pulses are missing, check IC U33 and Capacitor C137. If

pulses are present, check for pulses at pins 12 of IC U38. If pulses are missing, check IC U38. If pulses are present, check IC U31.

### WILL NOT WRITE

Insert a blank diskette into the Disk Drive and close the door. Type in and run the following Basic program which writes continuously to the Diskette and displays a number on the upper left corner of the Monitor screen. The number should be 0 when the Diskette is not write protected and change to 2 when a write protected Diskette is inserted into the Drive. If the numbers are not correct, refer to the "Write Protect Does Not function" section of this Troubleshooting guide.

```
10 CLS
20 OUT 1014,128:OUT 1010,16:OUT 1010,20
30 S=INP(1012)
40 OUT 1013,77:S=INP(1012)
50 OUT 1013,Y:S=INP(1012)
60 OUT 1013,1:S=INP(1012)
70 OUT 1013,12:S=INP(1012)
80 OUT 1013,12:S=INP(1012)
90 OUT 1013,0:S=INP(1012)
100 S=INP(1013):S=INP(1012)
110 PRINT INP(1013) AND 2:S=INP(1012)
120 FOR X=1 TO 5
130 S=INP(1013):S=INP(1012)
140 NEXT X:LOCATE 1,1
150 IF Y=1 THEN Y=5 ELSE Y=1
160 GOTO 20
```

**NOTE:** This program will not write to the diskette if the diskette index sensor circuits are not working. Check for index pulses at pin 6 of Buffer IC U45 while the Drive is running with a blank diskette inserted. If pulses are missing, refer to the "Index Sensor" section of this Troubleshooting guide.

While the above program is running, check for pulses at pins 4, 19, 25, 30, 31 and 32 of Floppy Disk Controller IC U31. If pulses are missing at pins 4 or 19, check IC U19. If pulses are present at pins 4 and 19 and missing at pins 25, 30 31 or 32, check IC U31. If all readings are correct, check for pulses at pin 8 of IC U38. If pulses are missing, check IC U38. If pulses are present, check for pulses at pin 1 of IC U39. If pulses are missing, check IC U39. If pulses are present, check for pulses at pins 9 and 8 of IC U42. If pulses are missing at pin 9, check IC U30. If pulses are present at pin 9 and missing at pin 8, check IC U42. If pulses are present at pin 8, check pin 22 of Connector J10 for good connections and check the Drive cable. If the connector and cable check good, refer to the "Disk Drive Troubleshooting" in the Disk Drive Folder.

### WRITE PROTECT DOES NOT FUNCTION

Type in and run the program listed under the "Will Not Write" section of this Troubleshooting guide. The program will display the number 0 on the left upper corner of the Monitor screen if a diskette that is not write protected is inserted into the Drive and the number 2 if the diskette is write protected.

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## TROUBLESHOOTING (Continued)

**WARNING:** This program also writes on the diskette. Do not use a diskette that has data on it that is important. Insert a blank write protected diskette into the Drive and close the door.

If the numbers on the Monitor screen are not correct, make the following checks with a blank write protected diskette in the Drive and the program running.

Check for a logic Low at pin 1 and logic High at pin 2 of IC U41. If reading is not correct at pin 1, check pin 28 of Connector J10 for good connections and check the Drive cable. If the connector and cable check good, refer to the "Disk Drive Troubleshooting" in the Disk Drive Folder. If reading is correct at pin 3 of IC U41 and not correct at pin 4, check IC U41. If reading is correct at pin 4 and the number on the Monitor screen is not correct, check the Floppy Disk Controller IC (U31).

### INDEX SENSOR

To check the Index Detector circuits, insert a diskette into Drive A and close the door. Type in and run the following Basic program to keep the drive running or make all checks when the Drive starts running after turning the Computer On.

```
10 OUT 1014,128:OUT 1010,20:GOTO 10
```

While the Drive is running, check for pulses at pins 5 and 6 of IC U45. If pulses are missing at pin 5, check pin 8 of Connector J10 for good connections and check the Drive cable. If pulses are present at pin 5 and missing at pin 6, check IC U45.

### TRACK 00 SENSOR

Disk Drive Head bangs against the Track 00 stop. Type in and run the following Basic program to check the Track 00 detector circuits. The program will step the Head back to Track 00 and display the number 16 on the Monitor screen to indicate the head is on Track 00. If the head is manually pushed off Track 00, the number should change to the number 0.

#### DRIVE A

```
10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 FOR T=1 TO 500:NEXT T
50 OUT 1014,128:OUT 1010,16:OUT 1010,20
60 S=INP(1012)
70 OUT 1013,4:S=INP(1012)
80 OUT 1013,2:S=INP(1012)
90 CLS:PRINT INP(1013) AND 16:S=INP(1012)
100 GOTO 40
```

If the numbers are not correct on the Monitor screen, check (while program is running) for a logic Low at pin 1 of IC U45 when the head is On Track 00 and logic High when the head is Off Track 00. If readings are not correct, check pin 26 of Connector J10 for good connections and check the Drive cable. If readings

are correct, check for a logic High at pin 2 of IC U45 with the head On Track 00 and logic Low with the head Off Track 00. If readings are not correct, check IC U45. If readings are correct, check for a logic High with momentary pulses at pin 39 of Floppy Disk Controller IC (U31). If reading is not correct, check IC U31. If reading is correct, check for a logic High with momentary pulses at pin 3 of IC U34 when the head is On Track 00 and logic Low when the head is Off Track 00. If readings are not correct, check IC U34. If readings are correct, check IC U31.

### DRIVE SELECT AND DRIVE MOTOR

Drive A not being selected or Drive A and Drive B Motors do not turn On. Type in and run the following Basic program:

```
10 OUT 1014,128:OUT 1010,20:GOTO 10
```

While the program is running, check for a logic Low at pins 30 and 34 of Interface IC (U7) and pins 2 and 6 of IC U35. If readings are not correct at pins 30 or 34, check IC U7. If readings are correct at pins 30 and 34 and not correct at pins 2 or 6, check IC U35. If readings are all correct, check pins 10 and 16 of Connector J10 for good connections and check the Drive cable. If the connector and cable check good, refer to the "Disk Drive Troubleshooting" in the Disk Drive Folder.

Drive B not being selected. Type in and run the following Basic program:

```
10 OUT 1014,128:OUT 1010,37:GOTO 10
```

While the program is running, check for a logic Low at pin 3 and 4 of IC U35. If reading is not correct at pin 3, check IC U7. If reading is correct at pin 3 and not correct at pin 4, check IC U35. If reading is correct at pin 4, check pin 29 of Connector J13 for good connections and check the Drive cable. If the connector and cable check good, refer to the "Disk Drive Troubleshooting" in the Disk Drive Folder.

### HEAD POSITION MOTOR

Head position motor not working. Type in and run the following Basic program. The program continuously alternates the head on Drive A between tracks 00 and 16.

#### DRIVE B

```
10 OUT 1014,128:OUT 1010,16:OUT 1010,20
20 OUT 1013,7:S=INP(1012)
30 OUT 1013,1:S=INP(1012)
40 OUT T=1 TO 500:NEXT T
50 OUT 1010,20
60 OUT 1013,15:S=INP(1012)
70 OUT 1013,1:S=INP(1012)
80 OUT 1013,16:S=INP(1012)
90 FOR T=1 TO 500:NEXT T
100 GOTO 10
```

While the program is running, check for pulses at pins 37, 38 and 39 of Floppy Disk Controller IC (U31). If pulses are missing, check IC



## TROUBLESHOOTING (Continued)

U31. If pulses are present, check for pulses at pin 11 of IC U34. If pulses are missing, check IC U34. If pulses are present, check for pulses at pin 2 and 4 of IC U42. If pulses are missing, check IC U42. If pulses

are present, check pins 18 and 20 of Connector J10 for good connections and check the Drive cable. If the connector and cable check good, refer to the "Disk Drive Troubleshooting" in the Disk Drive Folder.

### LINE DEFINITIONS

**A0 THRU A19** ..... Address Bits 0 Thru 19  
**AA0** ..... Encoded I/O Select  
**AEN** ..... Address Enable  
**AKBDRST** ..... Keyboard Reset  
**ALE** ..... Address Latch Enable  
**AMTRON** ..... Motor On, Disk Drive A  
**ASIDSEL** ..... Disk Side Select, Disk Drive A  
**AUDIOIN** ..... Peripheral Use of Internal Speaker  
**BA1** ..... Encoded I/O Select  
**BANKSEL** ..... Memory Bank Select  
**BMTRON** ..... Motor On, Disk Drive B  
**BREQ** ..... Bus Request  
**BRESET** ..... Buffered Reset  
**BSIDSEL** ..... Side Select, Disk Drive B  
**BUFDIR** ..... Buffer Data Direction  
**BUFENB** ..... Buffer Enable  
**CA2** ..... Encoded I/O Select  
**CAS** ..... Column Address Strobe, Memory  
**CDIR** ..... Disk Drive Read/Write Head Direction  
**CLK** ..... Clock Timing Pulses  
**CLK358** ..... Clock  
**CLK477M** ..... Clock  
**CLK8M** ..... Clock  
**CLKY** ..... Clock  
**CPUA08 THRU CPUA19** ..... Address Bits 8 Thru 19  
**CPUA0 THRU CPUAD7** ..... Data Bits 0 Thru 7  
**CPUCLK** ..... CPU Clock  
**D0 THRU D7** ..... Data Bits 0 Thru 7  
**D4CLK** ..... Clock Pulse, 477MHZ  
**DEN** ..... Data Enable  
**DMA/INTE** ..... Direct Memory Access Request/Floppy Disk Controller Enable  
**DMATC** ..... Direct Memory Access Terminal Count  
**DORCLK** ..... Decode Latch Timing Signal  
**DRQ** ..... Data Request  
**DS0, DS1** ..... Disk Select 0, Disk Select 1  
**DSEXT** ..... Disk Select B  
**DSINT** ..... Disk Select A  
**ENBNMI** ..... Enable Non-Maskable Interrupt  
**FAST** ..... Clock Timing Select  
**FDCCHP** ..... Floppy Disk Controller Chip Select  
**FDCCLK** ..... Floppy Disk Controller Clock  
**FDCCS8** ..... Floppy Disk Controller Chip Select  
**FDCDACK** ..... Floppy Disk Controller DMA Acknowledge  
**FDCDMRQ** ..... Floppy Disk Controller DMA Request  
**FDCINT** ..... Floppy Disk Controller Interrupt  
**FDCRST** ..... Floppy Disk Controller Reset  
**FDCTC** ..... Floppy Disk Controller Terminal Count  
**FDCWCK** ..... Floppy Disk Controller Timing Pulse  
**FDMARQ** ..... Floppy Disk Controller Memory Access Request  
**INDEX** ..... Index Sensor  
**INT** ..... Interrupt  
**INTA** ..... Interrupt Acknowledge  
**INTCS** ..... Interrupt Controller Chip Select  
**IOD0 THRU IOD7** ..... Data Bits 0 Thru 7  
**IOR** ..... Input/Output Read

**IR2, IR3, IR4** ..... Interrupt Requests 2, 3, 4  
**JOYSTKS** ..... Joy Sticks  
**KDBBUSY** ..... Keyboard Busy  
**KBDCLK** ..... Keyboard Clock  
**KBDATA** ..... Keyboard Data  
**KBDINT** ..... Keyboard Interrupt  
**LIO** ..... Input/Output Read  
**LIO** ..... Input/Output Write  
**M/I/O** ..... Select, Distinguishes Memory Or I/O  
**MA0 THRU MA7** ..... Memory Address Bits 0 Thru 7  
**MEMIOS** ..... Memory/Input-Output Select  
**MEMR** ..... Memory Read  
**MEMW** ..... Memory Write  
**MTRON** ..... Motor On, Disk Drive  
**NMI** ..... Non-Maskable Interrupt  
**NMIEN** ..... Non-maskable Interrupt Enable  
**OSC** ..... Oscillator  
**PFAULT** ..... Parallel Port Fault State  
**PIOCS** ..... Input/Output Chip Select  
**PPACK** ..... Parallel Port Acknowledge  
**PPAUTOF** ..... Parallel Port Automatic Feed  
**PPBUSY** ..... Parallel Port Busy  
**PPDATA0 THRU PPDATA7** ..... Parallel Port Data Bits 0 Thru 7  
**PPI/TIM** ..... Video Signal Timing  
**PPINIT** ..... Parallel Port Initialize, Set Up Sequence  
**PPPAEM** ..... Parallel Port Paper Empty Sensor  
**PPSTROB** ..... Parallel Port Timing Strobe  
**PRINTCS** ..... Chip Select  
**PSEL** ..... Port Select  
**RAS** ..... Row Address Strobe  
**RDDATA** ..... Read Data  
**RDYIN** ..... Ready  
**READY** ..... Ready, Current Bus Cycle Is To Be Completed  
**REFRESH** ..... Refresh Dynamic Memory Pulses  
**RESET** ..... Reset  
**RFSH** ..... Refresh Address For Dynamic Memory  
**RQ/GT** ..... Request/Grant, Bus Control  
**S0, S1, S2** ..... I/O Access Control Status Bits 0, 1, 2  
**SIDSEL** ..... Floppy Disk Side Select  
**SNDCNTL0, SNDCNTL1, SNDCNTL2** ..... Sound Control Bits 0, 1, 2  
**STEP** ..... Stepper Motor  
**SYSRST** ..... System Reset  
**TAKO** ..... Disk Drive, Track 00 Sensor  
**TC** ..... Terminal Count  
**TMRCS** ..... Timer Chip Select  
**TMRINT** ..... Timer Interrupt Request  
**V SYNC** ..... Vertical Sync  
**VIDWAITB** ..... Video Wait  
**WEN** ..... Write Enable  
**WEX0, WEX1** ..... Write Enable  
**WEY0, WEY1** ..... Write Enable  
**WRDATA** ..... Write Data  
**WRPAT** ..... Write Protect, Overwrite Protection  
**XMD0 THRU XMD7** ..... External Memory Data Bits 0 Thru 7  
**YMD0 THRU YMD7** ..... External Memory Data Bits 0 Thru 7

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## 20 PARTS LIST AND DESCRIPTION

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
MAIN BOARD						
CR1,2	1N4148	NTE519	ECG519	SK3100/519	103-131	
	8150148	NTE519	ECG519	SK3100/519	103-131	
CR3	1N5235	NTE5014A	ECG5014A	SK6A8/5014A	103-Z9009	
	8150235	NTE5014A	ECG5014A	SK6A8/5014A	103-Z9009	
Q1	2N3906	NTE159	ECG159	SK3466/159	121-Z9003 *	
	8100906	NTE159	ECG159	SK3466/159	121-Z9003 *	
Q2	VN0104					
	VN0104A					
Q3	8190104					
	2N3904	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A *	
	8110904	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A *	
U1	CD4529BQN	NTE4529B	ECG4529B	SK4529B		
	14529	NTE4529B	ECG4529B	SK4529B		
	8030529	NTE4529B	ECG4529B	SK4529B		
U2	7416N	NTE7416	ECG7416	SK7416	HE-443-73	
	7416	NTE7416	ECG7416	SK7416	HE-443-73	
	8000016	NTE7416	ECG7416	SK7416	HE-443-73	
U3 [U12]	CD74HCT244E					
	74HCT244					
	8026244					
U4	LM386N-1	NTE823	ECG823	SK9210/823		
	LM386	NTE823	ECG823	SK9210/823		
	8050386	NTE823	ECG823	SK9210/823		
U5	CD74HCT04E					
	74HCT04					
	8026004					
U6	D8048HC545					
	8048					
	8040048					

## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U7 [U10]	SCQ38068PB01					
U8 [U48]	8075069					
U9 [U46]	4067-12					
	8040464					
	4067-12					
	8040464					
U10 [U44]	4067-12					
	8040464					
U11 [U42]	4067-12					
	8040464					
U12 [U45]	4067-12					
	8040464					
U13 [U47]	4067-12					
	8040464					
U14 [U43]	4067-12					
	8040464					
U15 [U41]	4067-12					
	8040464					
U16 [U39]	CD74HCT32E			SK7CT32		
	74HCT32			SK7CT32		
	8026032			SK7CT32		
U17 [U9]	P8259A				HE-443-1012	
	8259A				HE-443-1012	
	8040259				HE-443-1012	
U18 [U15]	8496PT					
	76496					
	8040496					
U19 [U16]	VGC7205-0409					
	8075306					
U20 [U3]	VP16RP8MPC					
U21	LM339N	NTE834	ECG834	SK3569/834	221-121	
	LM339	NTE834	ECG834	SK3569/834	221-121	

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## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U22 [U18]	CD74HCT244E 74HCT244 8026244					
U23 [U22]	CD74HCT32E 74HCT32 8026032			SK7CT32 SK7CT32 SK7CT32		
U24 [U23]	CD74HCT244E 74HCT244 8026244					
U25 [U24]	CD74HCT138E 74HCT138 8026138			SK7CT138 SK7CT138 SK7CT138		
U26 [U7]	D8253C-2 8253-5 8040253				HE-443-1066 HE-443-1066 HE-443-1066	
U27 [U28]	E744B 8040684					
U28 [U19]	CD74HCT373E HCT373 8026373					
U29 [U14]	P8088-2 8088 8041088					
U30 [U26]	CD74HCT195E 74HCT195 8026195			SK7CT195 SK7CT195 SK7CT195		
U31 [U27]	Z0765A08PSC UPD765 8040272				HE-443-944 HE-443-944 HE-443-944	
U32 [U20]	CD74HCT373E HCT373 8026373					

## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFG. PART No./TYPE No.					
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U33 [U29]	WD9216 9216 8040216 CD74HCT08E 74HCT08 8026008			SK7CT08 SK7CT08 SK7CT08		
U35 [U31]	SN7417N 7417 8000017 CD74HCT245E 74HCT245 8026245	NTE7417 NTE7417 NTE7417	EOG7417 EOG7417 EOG7417	SK7417 SK7417 SK7417	HE-443-72 HE-443-72 HE-443-72	
U36 [U13]						
U37 [U32] U38 [U33]	SCQ38068PB02 CD74HCT04E 74HCT04 8026004 CD74HCT02E 74HCT02 8026002			SK7CT04 SK7CT04 SK7CT04 SK7CT02 SK7CT02 SK7CT02		
U40 [U11]	CD74HCT245E 74HCT245 8026245 CD74HCT04E 74HCT04 8026004			SK7CT04 SK7CT04 SK7CT04		
U41 [U35]						
U42 [U36]	7416N 7416 8000016 SN74LS244N 74LS244 8020244 8079015	NTE7416 NTE7416 NTE7416 NTE74LS244 NTE74LS244 NTE74LS244	EOG7416 EOG7416 EOG7416 EOG74LS244 EOG74LS244 EOG74LS244	SK7416 SK7416 SK7416 SK74LS244 SK74LS244 SK74LS244	HE-443-73 HE-443-73 HE-443-73 HE-443-791 HE-443-791 HE-443-791	
U43 [U38]						
U44 [U17]						

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## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./TYPE No.					
		NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
U45 [U37]	QD74HCT14E 74HCT14			SK7CT14		
VR1	8026014 78L05A 78L05 8052805	NTE977 NTE977 NTE977	ECG977 ECG977 ECG977	SK7CT14 SK7CT14 SK7CT14 SK3462/977 SK3462/977 SK3462/977	221-Z9044 221-Z9044 221-Z9044	
POWER SUPPLY						
D1	S1VB40 DBA10E	NTE168 NTE168	ECG168 ECG168	SK3648/168 SK3648/168	212-Z9001 212-Z9001	
D2, 3, 4	F1-06 V19G	NTE558 NTE519 NTE519	ECG558 ECG519 ECG519	SK3998/558 SK3100/519 SK3100/519	103-131 103-131	
D5	DS446 1S954					
D6	RK44 D3S4M	NTE580 NTE580	ECG580 ECG580	SK5036/580 SK5036/580	212-Z9000 212-Z9000	
D9, 10	RK43 D3S3M	NTE580 NTE580	ECG580 ECG580	SK5036/580 SK5036/580	212-Z9000 212-Z9000	
D11	F1-06					
D12	6B2 HZ6B2	NTE137A NTE136A	ECG137A ECG136A	SK6V2/137A SK5V6/136A	103-Z9008 103-Z9007	
D13	DS446 1S954	NTE519 NTE519	ECG519 ECG519	SK3100/519 SK3100/519	103-131 103-131	
D14						USED SOME VERSIONS
IC1	L78M12 NJM78M12	NTE966 NTE966	ECG966 ECG966	SK3592/966 SK3592/966	HE-442-674 HE-442-674	
IC2	TL431C TL431CLPB UA431AWC [UA431AWC]					

## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	MFGR. PART No./ TYPE No.	NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	NOTES
PHC1	P521 TLP521-1 PC817					
Q1	2SC3039 2SC3832 2SC2827	NTE379	ECG379	SK9085/379	121-Z9111	
Q2	2SD1207 2SC2655	NTE293	ECG293	SK3849/293	121-Z9066	
Q3	2SA1318S 2SA1318 2SA1015	NTE290A	ECG290A	SK9132	121-Z9003 *	
SCR1	RA5E DRS5E 5P4M CR6AM8					

\* Lead configuration may vary from original.

## WIRING DATA

Shielded Hook-up Wire (Disk Drive Heads).. Use BELDEN No. 9534 (Four-Conductor)  
General-use Unshielded Hook-up Wire..... Use BELDEN No. 8529 (Solid) Available in 13 Colors  
8522 (Stranded) Available in 13 Colors

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## PARTS LIST AND DESCRIPTION (Continued)

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

### ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C132 (C127)	.22 63V 10%	

### CAPACITORS

ITEM No.	RATING	MFGR. PART No.
	POWER SUPPLY	
C1	.1 250VAC 20%	XE-104
C2	.1 250VAC 20%	XE-104
C3	.01 400VAC	DE7150FZ103PVA1-KC CS17-F2GA103ZYAS
C5	.01 400VAC	CF921L2J103K MDD22J103K
C20	.0022 400VAC	DE7100F222MVA1-KC CS13-E2GA222MYAS
C21	.0022 400VAC	DE7100F222MVA1-KC CS13-E2GA222MYAS

ITEM No.	RATING	MFGR. PART No.
	ALT POWER SUPPLY	
C2	.22 250VAC	XE-224
C3	.0022 400VAC	DE7100F222MVA1-KC CS13-E2GA222MYAS
C4	.0022 400VAC	DE7100F222MVA1-KC CS13-E2GA222MYAS
C5	.01 400VAC	DE7150FZ103PVA1-KC

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

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
R1	MAIN BOARD Volume	1000	8279209	
VR1	POWER SUPPLY 5V Adjust	2200 2000	V6EK-PVC(1S)202B H0615-222B	
VR1	POWER SUPPLY ALT +5V Adjust	2000	V6EK-PV(1S)202B H0615-222B	

### COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
L1	AC Filter	T0-9301		
L2	RF Choke	T0-9177		
L3	RF Choke	T0-9177		
T1	Switching	T0-4338		

## PARTS LIST AND DESCRIPTION (Continued)

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

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R24 (R22)	MAIN BOARD 82.5K 1% 1/8W Carbon Film			
RP1	Resistor Network	(1)		
RP2 (RP8)	Resistor Network	(2)		
RP3 (RP2)	Resistor Network	(3)		
RP4 (RP3)	Resistor Network	(4)		
RP5 (RP9)	Resistor Network	(2)		
RP6 (RP10)	Resistor Network	(2)		
RP7 (RP4)	Resistor Network	(5)		
RP8 (RP5)	Resistor Network	(6)		
RP9 (RP6)	Resistor Network	(7)		
RP10 (RP7)	Resistor Network	(8)		
	POWER SUPPLY			
R1	PTC 8 Cold	115-080-42308 8D-11 NTH9D160LA		
R8	.68 5% 3W Metal Film .68 5% 3W Carbon Film	SPR3B		
	ALT POWER SUPPLY			
R1	PTC 16 Cold	16D-13 117-160-45202 NTH13D160LA		
R9 R13	1.2 5% 3W Carbon Composition 1 5% 1/4W Fusing	SPR3B1.20HMSJ RF25SLOHMSJ	3W1D2	

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- |              |              |
|--------------|--------------|
| (1) 33K x 9  | (5) 10K x 9  |
| (2) 33 x 4   | (6) 33 x 8   |
| (3) 10K x 5  | (7) 4700 x 7 |
| (4) 1000 x 5 | (8) 150 x 5  |

### FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	POWER SUPPLY 1.6 Amp @ 250VAC Fast Acting	MT41.6A250V	P#5722113 (1)	
F1	ALT POWER SUPPLY 1.6 Amp @ 250VAC Fast Acting	MT41.6A250V	P#5722113 (1)	

(1) Two used for each fuse.

## PARTS LIST AND DESCRIPTION (Continued)

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

### SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA		NOTES
		MFR. PART No.	QUAM PART No.	
SP1	2-1/4" Square 8 Ohms CM			

### MISCELLANEOUS

ITEM No.	PART NAME	MFR. PART No.	NOTES
FB1 thru FB45	Ferrite Bead		
FB50	Ferrite Bead		
FB51	Ferrite Bead		
FB52	Ferrite Bead		
L1	LED		CAPS, Green
L2	LED		Number Lock, Green
SW1	Switch		Power
Y1	Oscillator		16MHz
Y2	Oscillator		28.636MHz

# GENERAL OPERATING INSTRUCTIONS

## BOOT UP

Insert a bootable diskette into Disk Drive A and turn On the Computer. The Computer will automatically boot up using the diskette in Disk Drive A. If a MS-DOS (Microsoft Disk Operating System) diskette is used, the Computer will display the date and time and ask for a new date and time. After date and time have been entered, the version of DOS will be displayed on the Monitor screen along with an A which indicates the DOS is running.

If Function Key F3 is pressed immediately after the Computer beeps when turned On, the Computer will boot up from a diskette inserted in Drive B.

## MS-DOS

For a list of file names on the diskette in the current Disk Drive, type DIR and press the ENTER key. To specify Disk Drive that is not current (default), use DIR A: for Disk Drive A or DIR B: for Disk Drive B.

To return to MS-DOS from Basic, type SYSTEM and press the ENTER key.

To load a (System) program from a diskette while in DOS, type the program name and press the ENTER key.

A blank diskette must be formatted before it can be used to save information which is in memory. A formatted diskette must contain a DOS or a Start-up program before the Computer will boot up using that diskette.

Insert a diskette containing a "Format Program" into Disk Drive A. Type FORMAT and press the ENTER key. Follow instructions on the Monitor screen to format the unformatted diskette. NOTE: Formatting a diskette will wipe out any programs previously placed on the diskette. The Computer automatically defaults to Disk Drive A if the destination Disk Drive is not specified. Be sure to specify the destination Disk Drive of the diskette to be formatted or the original diskette may be ruined by the default action. Type a space after the word FORMAT, then the Drive letter followed by a colon to specify a different Drive (FORMAT B:).

## BASIC

When turned On, the Computer will come up in MS-DOS as long as the MS-DOS diskette is in Drive A. The version of MS-DOS will appear at the top of the screen.

The manufacturer also supplies Disk Basic on diskette. To load Disk Basic, first boot up

DOS. Insert a diskette with Disk Basic program on it. Type BASIC and press the RETURN key or type BASICA and press the RETURN key to load Disk Basic. To return to DOS from Basic, type SYSTEM and press the ENTER key.

To view a list and the names of programs on a diskette in the current Drive, type FILES and press the ENTER key. Type FILES "B:" and press the ENTER key to list programs from Disk Drive B. Type FILES "A:" to list programs from Disk Drive A if it is not the current (default) drive.

To load a program in Disk Basic or Advanced Disk Basic from the diskette, type LOAD, the program name enclosed in quotes, and press the ENTER key.

To save a program, type SAVE, the program name enclosed in quotes and press the ENTER key.

To run a program from any Basic mode, type RUN and press the ENTER key. To stop a program, press the CTRL and BREAK keys at the same time. NOTE: Some programs will disable or not recognize the CTRL and BREAK keys to prevent the user stopping the program while it is running.

## RESETTING COMPUTER

Press the CTRL, ALT and DEL keys, all three at the same time, to reset the Computer.

## CHANGING OPERATING MODES

The Video, Disk Drive and CPU speed modes can be changed by pressing Functions Keys F1 thru F4 immediately after the Computer beeps when it is turned On. Use the following chart to determine the function of each Key:

- F1 - Changes the Video mode to Monochrome mode. (Computer normally comes up in Color Graphics mode.)
- F2 - Changes the Video mode to TV mode.
- F3 - Swaps Disk Drive references. Drive A becomes Drive B and Drive B becomes Drive A. The computer will boot up from the top Drive (normally Drive B).
- F4 - Changes CPU speed to 4.77MHz. The Computer normally comes up with a CPU speed of 7.16 MHz.

## VOLUME CONTROL

A Volume Control (R1) is provided on the Main System Board to set the volume of the internal speaker. The control is located on right bottom side of cabinet.

TANDY  
MODEL 1000EX



# LOGIC CHART

## SYSTEM BOARD

PIN NO.	IC U1	IC U2	IC U3	IC U5	IC U6	PIN NO.	IC U6	PIN NO.	IC U7	PIN NO.	IC U7	PIN NO.	IC U8
1	H	L	L	P	L	21	P	1	L(2)	21	H	1	P
2	L	H	H	P	P	22	P	2	H(2)	22	H	2	P
3	L	L	P	P	P	23	P	3	H(2)	23	H	3	P
4	*	H	P	P	H	24	P	4	L(2)	24	H	4	H
5	H	L	P	L	H	25	H	5	L	25	H	5	P
6	L	*	P	H	L(2)	26	H	6	L	26	L	6	P
7	L	L	P	L	L	27	P	7	P	27	L	7	P
8	L	*	P	L(2)	P	28	P	8	P	28	L	8	P
9	L	L	L	H(2)	H	29	P	9	P	29		9	H
10		H	L	H	H	30	P	10	P	30		10	P
11		L	L	L	P	31	P	11	P	31		11	P
12		*	P	L(2)	H	32	P	12	P	32		12	P
13	H	L	P	H(2)	H	33	P	13	P	33		13	P
14	H	H	P	H	H	34	P	14	P	34		14	P
15	H		P		H	35	L	15	H	35	L	15	P
16	H		P		H	36	L	16	P	36	L	16	P
17			P		H	37	H(2)	17	P	37	H	17	P
18			H		H	38	H(2)	18	H	38	L	18	L
19			L		H	39	L	19		39	L		
20			H		L	40	H	20	L	40	H		

PIN NO.	IC U9	IC U10	IC U11	IC U12	IC U13	IC U14	IC U15	IC U16	IC U17	PIN NO.	IC U17	PIN NO.	IC U18
1	P	P	P	P	P	P	P	P	P	21	H	1	P
2	P	P	P	P	P	P	P	P	P	22	H	2	P
3	P	P	P	P	P	P	P	P	H	23	P	3	P
4	H	P	P	H	H	P	P	P	P	24	L	4	P
5	P	P	P	P	P	P	P	P	P	25	H	5	P
6	P	P	P	P	P	P	P	P	P	26	P	6	H
7	P	P	P	P	P	P	P	L	P	27	P	7	H
8	P	P	P	P	P	P	P	H	P	28	H	8	L
9	H	H	H	H	H	H	H	P	P			9	L
10	P	P	P	P	P	P	P	P	P			10	P
11	P	P	P	P	P	P	P	H	P			11	P
12	P	P	P	P	P	P	P	P	L			12	P
13	P	P	P	P	P	P	P	P	L			13	P
14	P	P	P	P	P	P	P	H	L			14	P
15	P	P	P	P	P	P	P		P			15	P
16	P	P	P	P	P	P	P		*			16	H
17	P	P	P	P	P	P	P		P				
18	L	L	L	L	L	L	L		P				
19									L				
20									H				

# LOGIC CHART (Continued)

## SYSTEM BOARD

PIN NO.	IC U19	PIN NO.	IC U19	PIN NO.	IC U20	IC U22	IC U23	IC U24	IC U25	IC U26	PIN NO.	IC U26
1	P	21	H	1	P	L	L	H	P	P	21	H
2	H	22	L	2	P	P	L	H	H	P	22	H
3	P	23	P	3	P	L	L	P	H	P	23	P
4	L	24	P	4	P	P	P	H	L	P	24	H
5	L	25	H	5	P	P	H	P	P	P		
6	P	26	L	6	P	P	H	L	H	P		
7	P	27	P	7	H	P	L	P	P	P		
8	P	29	L	8	H	P	H	L	L	P		
9	P	29	P	9	H	L	H	P	P	P		
10	H	30	P	10	L	L	H	L	H	P		
11	P	31	P	11	L	L	H	L	H	H		
12	P	32	P	12	L	P	H	P	H	L		
13	P	33	P	13	P	P	P	L	H	P		
14	P	34	P	14	P	P	H	P	H	H		
15	H	35	H	15	L	P		H	H	P		
16	P	36	H	16	P	P		P	H	L		
17	P	37	H	17	P	L		H		H		
18	P	38	P	18	P	P		P		P		
19	P	39	P	19	H	L		H		P		
20	P	40	H	20	H	H		H		P		

PIN NO.	IC U27	PIN NO.	IC U27	PIN NO.	IC U27	PIN NO.	IC U27	PIN NO.	IC U27	PIN NO.	IC U28	IC U29	PIN NO.	IC U29
1	L	21	P	41	L	61	P	81	P	1	L	L	21	L
2	P	22	H	42	P	62	P	82	P	2	P	P	22	P
3	P	23	P	43	L	63	P	83	P	3	P	P	23	L
4	P	24	P	44	P	64	P	84	P	4	P	P	24	P
5	P	25	P	45	P	65	P			5	P	P	25	P
6	P	26	H	46	P	66	P			6	P	P	26	P
7	P	27	P	47	P	67	P			7	P	P	27	P
8	P	28	P	48	P	68	P			8	P	P	28	P
9	P	29	H	49	P	69	P			9	P	P	29	P
10	P	30	H	50	P	70	P			10	L	P	30	H
11	P	31	P	51	P	71	P			11	P	P	31	H
12	P	32	L	52	P	72	P			12	P	P	32	P
13	P	33	H	53	P	73	P			13	P	P	33	L
14	P	34	P	54	P	74	P			14	P	P	34	H
15	P	35	H	55	P	75	P			15	P	P	35	P
16	H	36	L	56	P	76	P			16	P	P	36	P
17	P	37	P	57	P	77	P			17	P	L	37	P
18	P	38	P	58	P	78	P			18	P	P	38	P
19	P	39	P	59	P	79	P			19	P	P	39	P
20	P	40	P	60	P	80	P			20	H	L	40	H

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MODEL 1000EX

# LOGIC CHART (Continued)

## SYSTEM BOARD

PIN NO.	IC U32	IC U35	IC U36	IC U37	PIN NO.	IC U37	PIN NO.	IC U38	IC U39
1	P		P	H	21	H	1	L	
2	P		P	L	22	L	2	H	
3	P		P	P	23	H	3	L	
4	P		P	P	24	L	4	H	H
5	P		P	H	25	L	5		L
6	P		P	L	28	H	6		L
7	P		P	H	27	*	7		L
8	P		P	L	28	H	8		L
9	P		P	H	29	H	9		L
10	L	P	L	L	30	P	10		H
11	P	P	P	H	31	H	11		L
12	P	L	P	L	32	P	12		L
13	P	L	P	H	33	P	13		H
14	P	H	P	H	34	P	14		H
15	P		P	L	35	P	15		
16	P		P	H	36	P	16		
17	P		P	H	37	P	17		
18	P		P	L	38	P	18		
19	P		P	H	39	P	19		
20	H		H	L	40	H	20		

IC U40	IC U41	IC U42	IC U43	IC U44	PIN NO.	IC U44	PIN NO.	IC U45
P			L	H	21	P	1	
P			P	P	22	L	2	
P	P		P	P	23	P	3	
P	P		L	P	24	P	4	
P	L		P	P	25	P	5	
P	H		P	P	26	P	6	
P	L		P	P	27	P	7	
P	H		P	P	28	H	8	H
P	L		P	P			9	L
L	H	*	L	P			10	
P	L	L	P	P			11	
P	H	*	P	P			12	L
P	L	L	P	P			13	H
P	H	H	P	L			14	H
P			P	P				
P			L	P				
P			P	P				
P			L	P				
H			H	P				

# LOGIC CHART (Continued)

## DISK DRIVE INTERFACE-SYSTEM BOARD

PIN NO.	IC U2	PIN NO.	IC U7	PIN NO.	IC U30	PIN NO.	IC U31	PIN NO.	IC U31
1		29	H	1	P	1	L	21	P
2		30	L	2	L	2	P	22	P
3		31	P	3	L	3	P	23	P
4		32	L	4	P	4	P	24	P
5		33	H	5	P	5	P	25	P
6		34	H	6	P	6	P	26	H
7				7	L	7	P	27	P
8				8	L	8	P	28	L(1)
9				9	P	9	P	29	L(1)
10	H			10	P	10	P	30	P
11	L			11	P	11	P	31	P
12	L			12	P	12	P	32	P
13	H			13	P	13	P	33	L(4)
14				14	P	14	L	34	L
15				15	P	15	H	35	H
16				16	H	16	P	36	H(1)
17						17	P	37	P
18						18	P	38	L(6)
19						19	P	39	L(1)
20						20	L	40	H

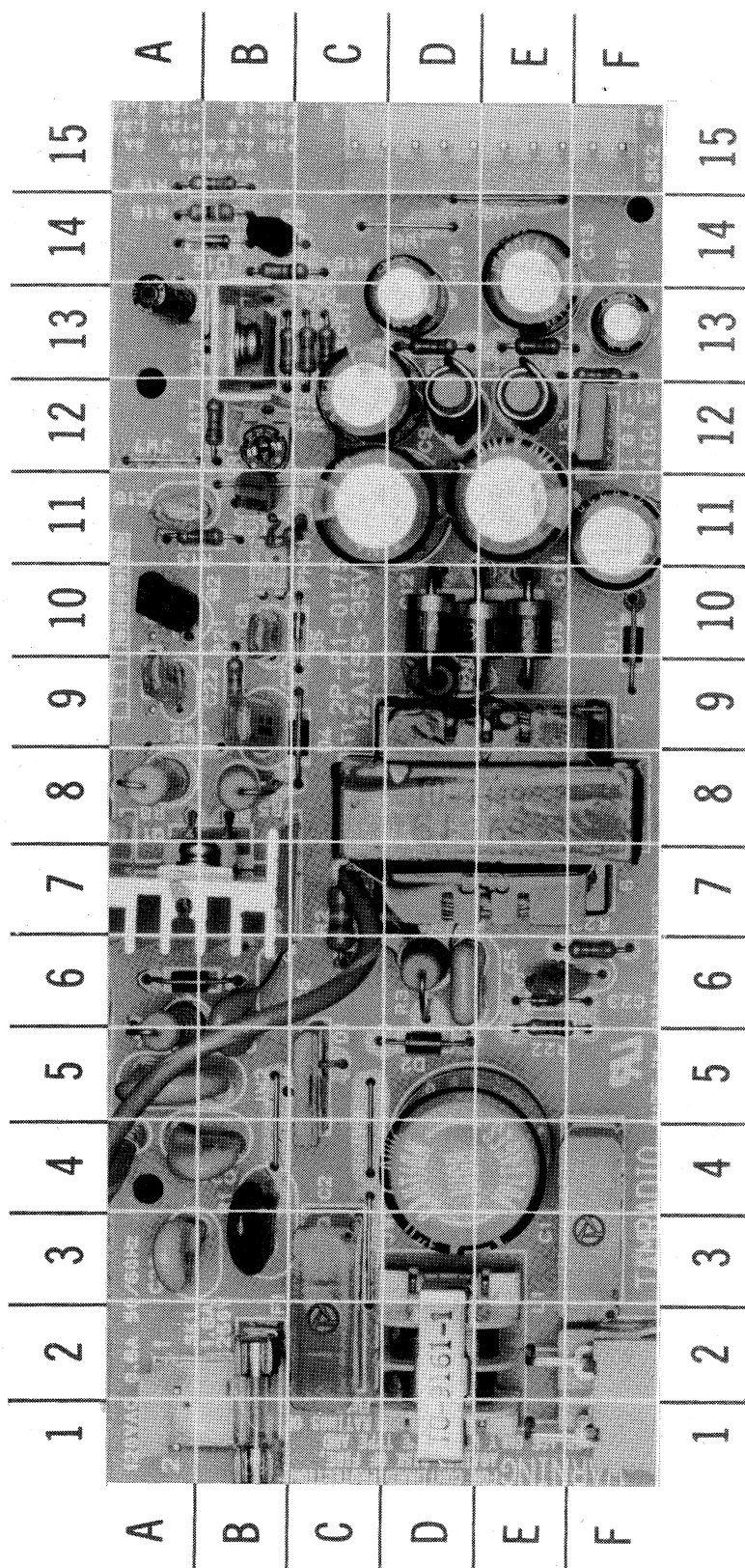
  

PIN NO.	IC U33	IC U34	IC U35	IC U38	IC U39	IC U41	IC U42	IC U45
1	P	L(4)	L		P	H	L(6)	L(5)
2	P	L(1)	L		P	L	H(7)	H(4)
3	P	L(4)	H		P		L(1)	P
4	L	P	*				H(1)	P
5	L	H	L	H			P	P
6	L	P	L	L			P	P
7	P	L	L	L			L	L
8	H	L	L	P			P	
9		P	L	P			P	
10		L		L				P
11		L		H				P
12		L(1)		P				
13		P		P				
14		H		H				

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MODEL 1000EX

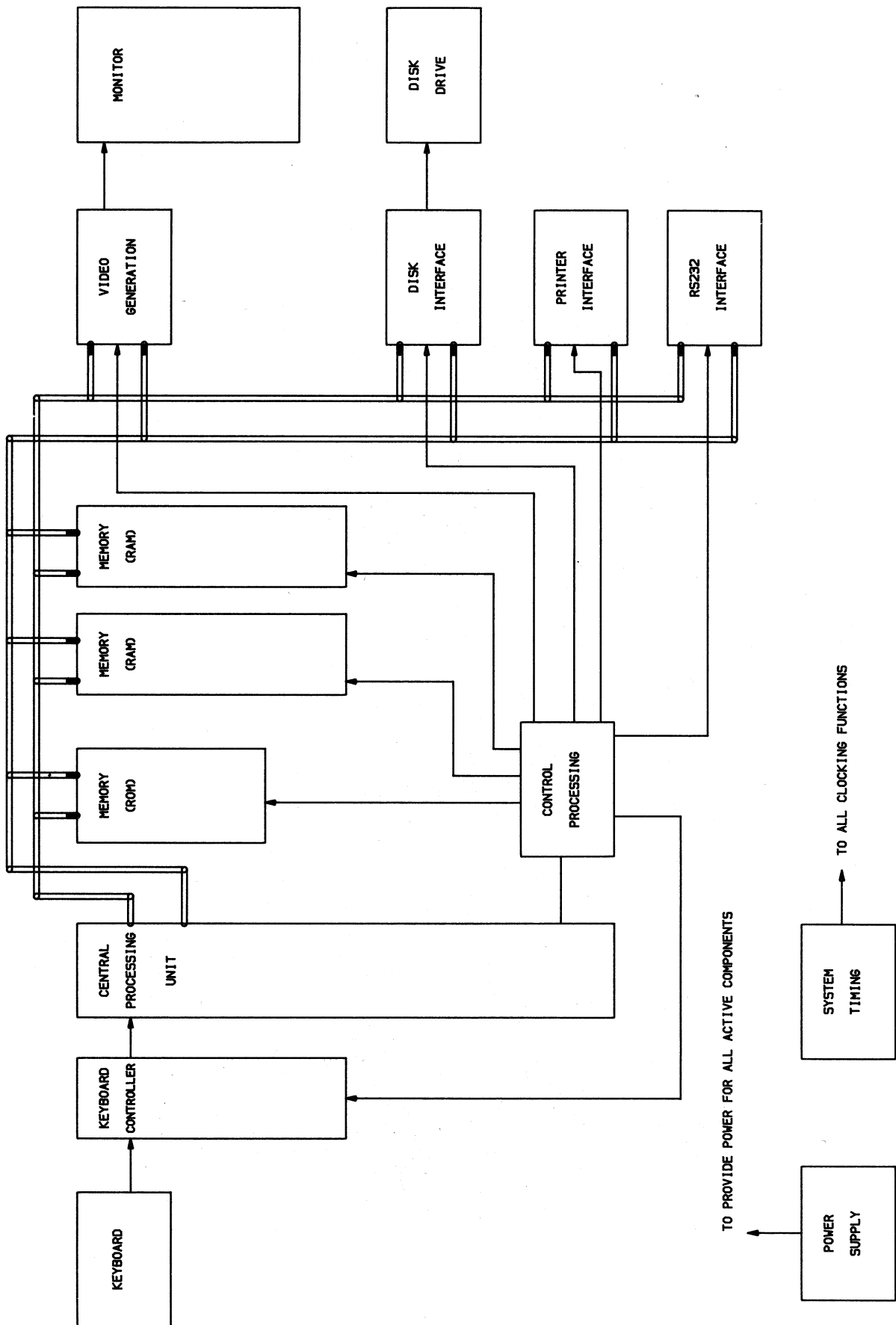
# GridTrace LOCATION GUIDE

C1	F-3
C2	C-2
C3	A-5
C4	D-4
C5	D-6
C6	B-6
C7	B-9
C8	B-10
C9	C-12
C10	D-13
C11	E-11
C12	C-11
C13	E-14
C14	F-11
C15	F-13
C16	A-11
C17	A-13
C20	A-3
C21	E-4
C22	A-9
C23	E-6
D1	C-5
D2	D-5
D3	A-6
D4	C-9
D5	C-10
D6	D-10
D9	E-10
D10	E-10
D11	F-10
D12	B-14
D13	E-6
F1	B-1
IC1	F-12
IC2	B-11
L1	D-2
L2	D-12
L3	E-12
L4	D-9
PHC1	B-10
Q1	A-7
Q2	A-10
Q3	B-14
R1	B-3
R2	C-7
R3	D-6
R4	A-5
R5	B-8
R6	B-11
R8	A-8
R9	D-13
R10	E-13
R11	F-13
R12	C-13
R13	A-11
R14	B-13
R15	C-13
R16	B-14
R17	B-12
R18	B-14
R19	B-15
R20	B-13
R21	B-9
R22	E-5
R23	F-6
SCR1	B-13
SK1	A-1
SK2	E-15
SW1	F-1
T1	E-8
VR1	B-12

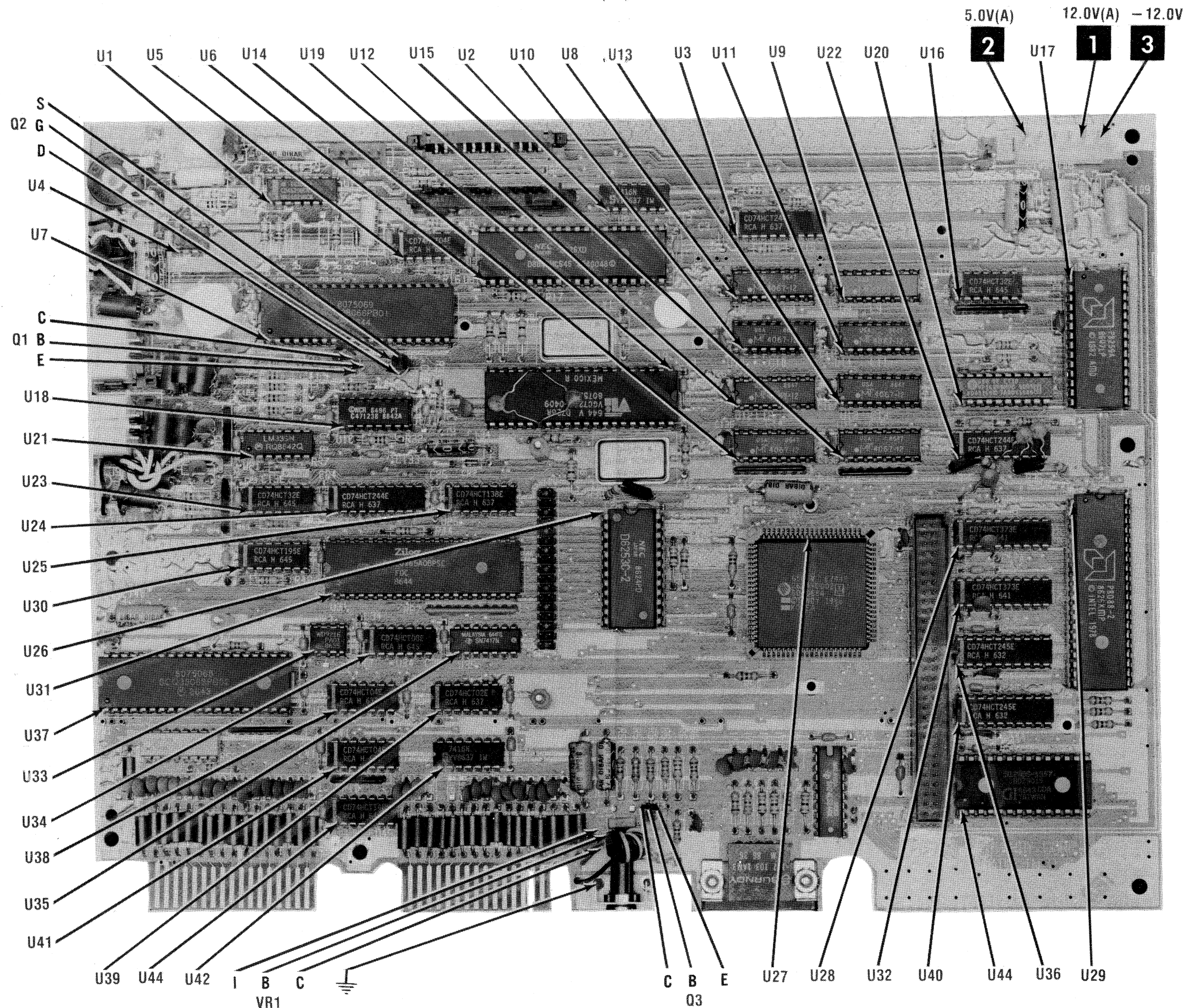








**BLOCK DIAGRAM**



NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

## SCHEMATIC NOTES

- ▽ Isolated ground.
- X— Circuitry not used in some versions
- Circuitry used in some versions
  - See parts list
- ⊕ Ground
- /// Chassis

Voltages, logic reading and waveforms taken with Computer in Power Up mode. No diskette in Disk Drive. No keys depressed unless otherwise noted.

(2) Probe Indicates P when a Key is pressed.

Voltages measured with digital meter.

Waveforms and voltages taken from ground, unless noted otherwise.

Supply voltage maintained as shown at input.

Controls adjusted for normal operation.

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

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

Resistors are 1/2W or less, 5% unless noted.

Value in ( ) used in some versions.

Measurements with switching as shown, unless noted.

### DISK DRIVE INTERFACE AND DISK DRIVE NOTES

Voltages, waveforms and logic readings for the Disk Drive Interface and Disk Drive taken while running the following Basic program. Readings shown were taken when the Disk Drive Head was not moving unless noted.

```
10 OPEN "A:SAMS.DAT" FOR OUTPUT AS #1
20 FOR X=1 TO 300
30 PRINT #1, "HOWARD W SAMS"
40 NEXT X
50 CLOSE #1
60 GOTO 10
```

\*NOTE: Insert a formatted diskette (not write protected) in Drive A before running the program.

- (1) Probe indicates P when head is moving.
- (4) Probe indicates H when head is on track 00 and L when off track 00.
- (5) Probe indicates L when head is on track 00 and H when off track 00.
- (6) Probe indicates H when head is moving in and L when head is moving out from the center of the diskette.
- (7) Probe indicates L when head is moving in and H when head is moving out from the center of the diskette.

## DISASSEMBLY INSTRUCTIONS

### CABINET TOP REMOVAL

Remove six screws from bottom of Computer. Turn Computer right side up and remove option cover (press down on front of cover and slide it back). Remove two screws from left side of option compartment. Lift cabinet top off.

### DISK DRIVE REMOVAL

Remove cabinet top. Remove one screw holding ground strap to side of Drive. Disconnect two connectors at rear of Drive. Remove three screws holding Drive to cabinet bottom and remove Drive.

### SYSTEM BOARD REMOVAL

Remove cabinet top and Disk Drive. Pull Volume Control knob Off. Disconnect three Keyboard Connectors (pull up Ribbon Connector top before pulling ribbon cable out), Power Supply Connector and Fan Connectors. Remove

four nuts holding shield and remove three screws holding shield under right side of System Board. Lift shield up and push over to left. Remove four screws holding board to cabinet bottom. Remove two screws holding Monitor Connector (J15) to cabinet rear. Lift System Board out of cabinet.

### POWER SUPPLY REMOVAL

Remove cabinet top. Disconnect Connectors SK1 and SK2 from Power Supply Board. Remove two screws from right side of board and remove from cabinet.

### KEYBOARD REMOVAL

Remove cabinet top. Disconnect three Keyboard Connectors (pull up Ribbon Connector top before pulling ribbon cable out) from System Board. Remove one screw from each side of Keyboard and remove Keyboard from cabinet.

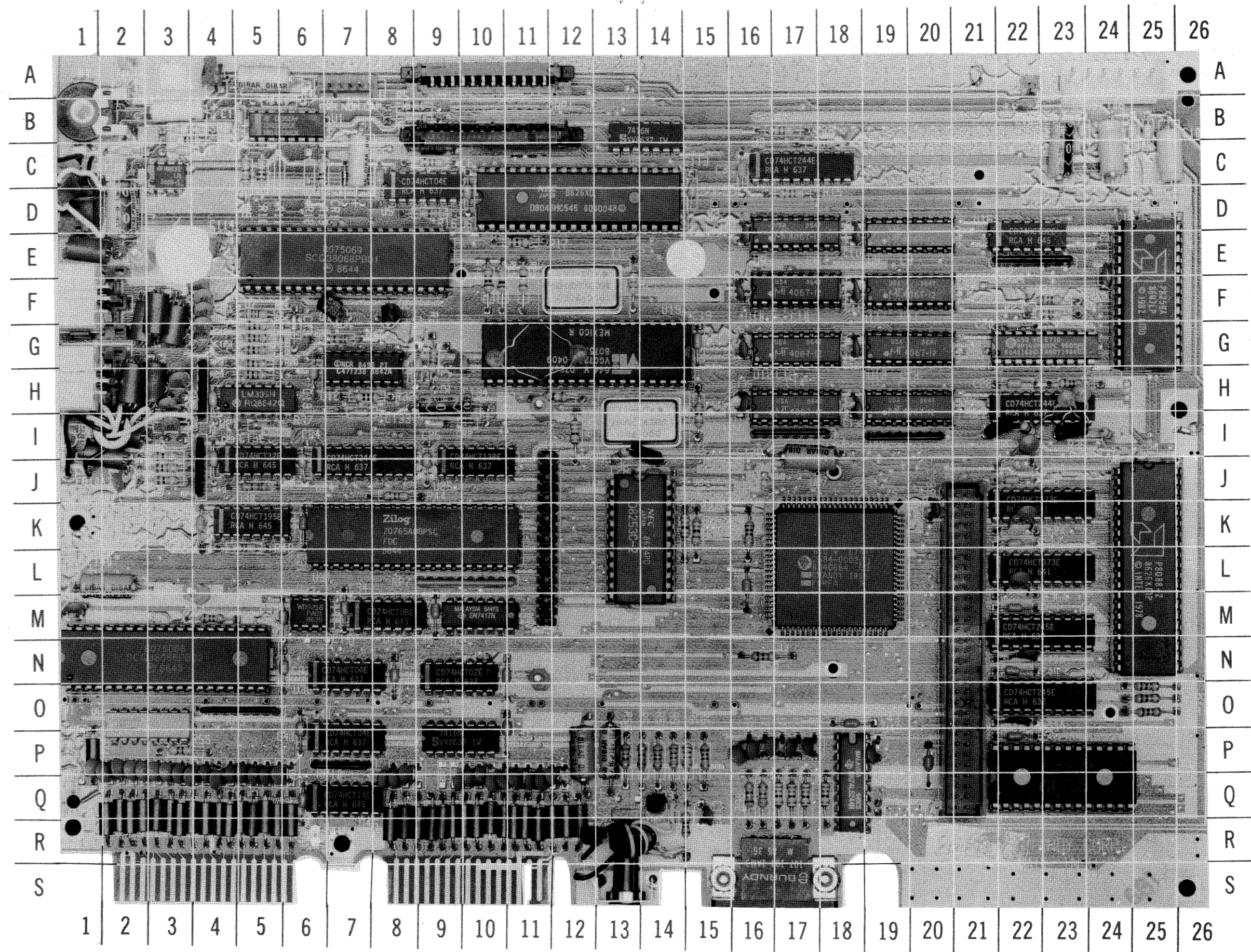
## MISCELLANEOUS ADJUSTMENTS

### POWER SUPPLY

#### 5V ADJUSTMENT

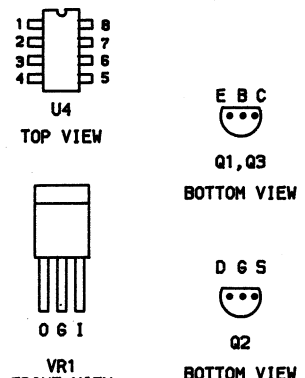
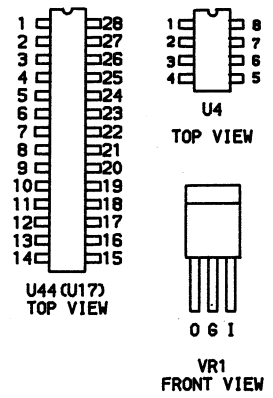
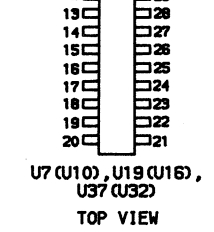
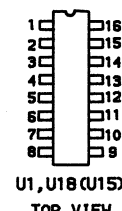
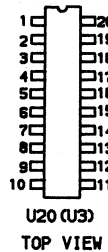
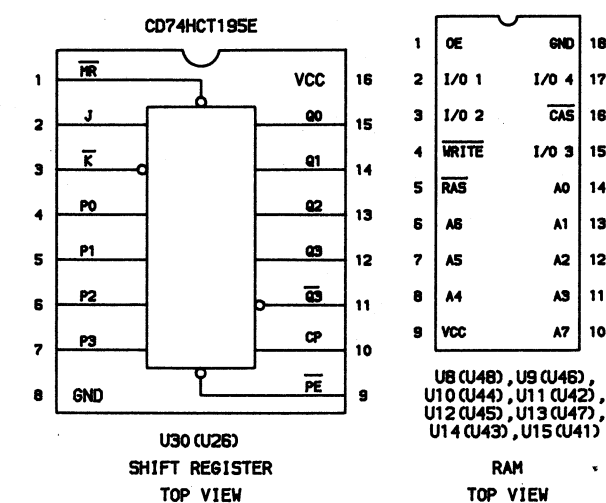
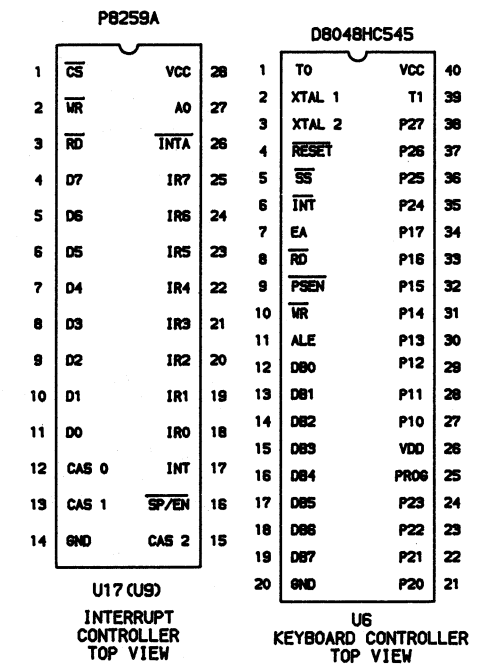
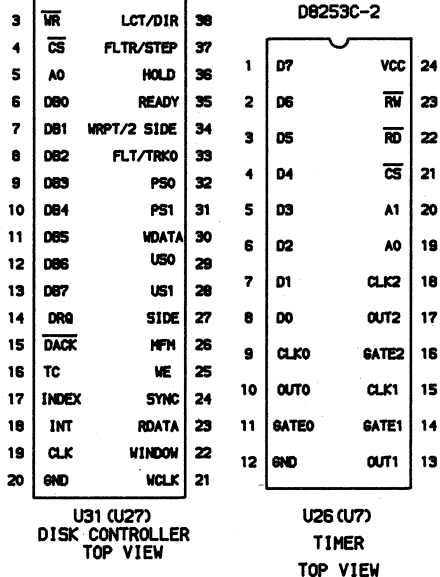
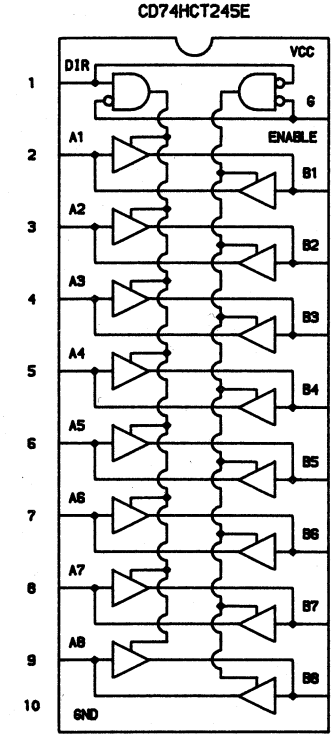
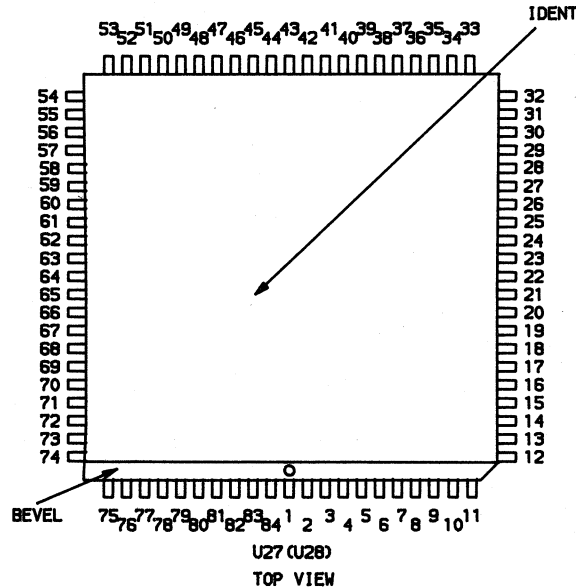
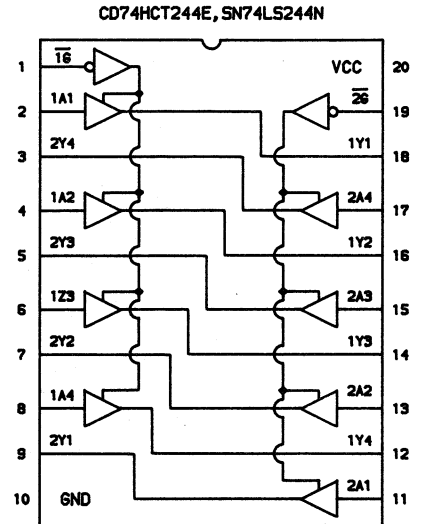
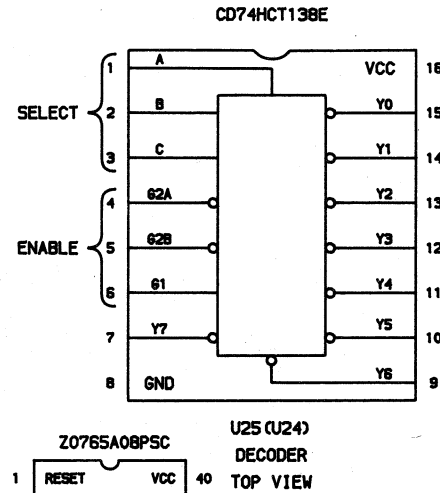
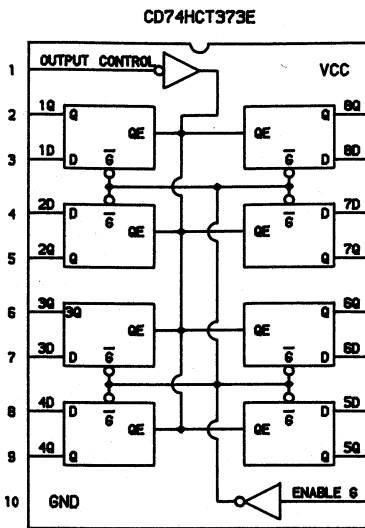
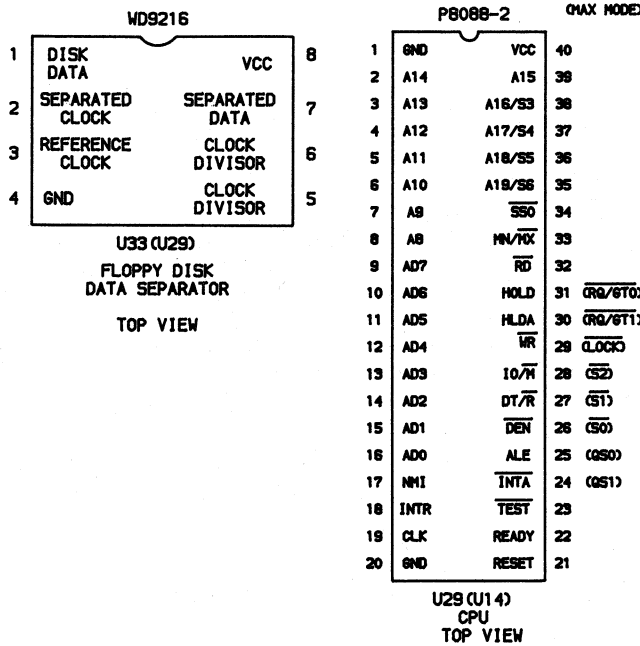
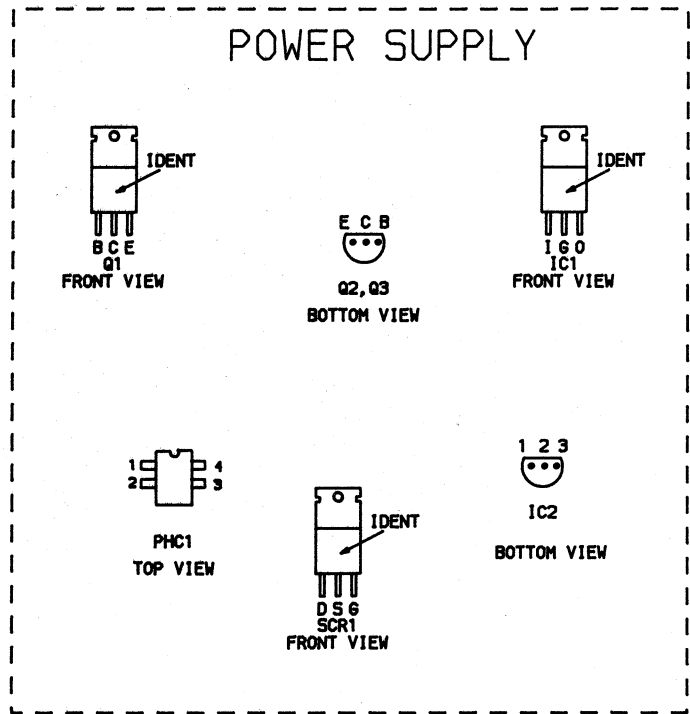
Connect input of a voltmeter to 5.0V source (pin 4 of Connector SK2). Turn Computer On and adjust 5V Adjust Control (VR1) for 5.0V.





TANDY  
MODEL 1000EX

IC PINOUTS & TERMINAL GUIDES

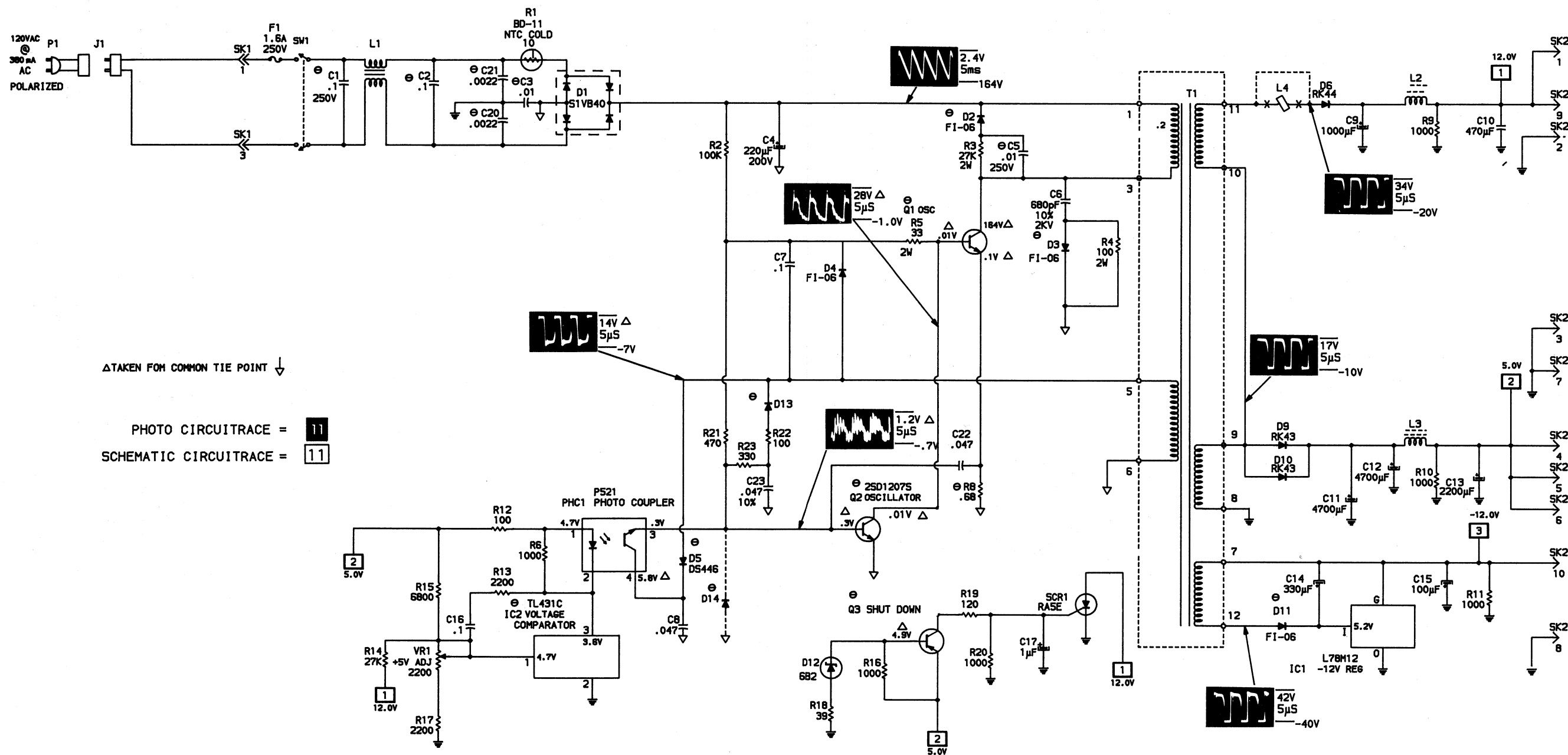


CSCS21  
MODEL 100EX  
TANDY









A PHOTOFAC STANDARD NOTATION SCHEMATIC  
WITH **CIRCUITRACE**

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## SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the Computer system 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 Computer system AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This Computer system is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The Computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover or obstruct these vents.
12. 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.
13. Never expose the Computer system to water. If exposed to water, turn the unit Off. Do not place the Computer system near possible water sources.
14. Never leave the Computer system unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning Computer system.
17. Never use liquids or aerosols directly on the Computer system. Spray on cloth and then apply to the Computer system cabinet. Make sure the Computer system is disconnected from the AC power line.

TANDY  
MODEL 1000EX

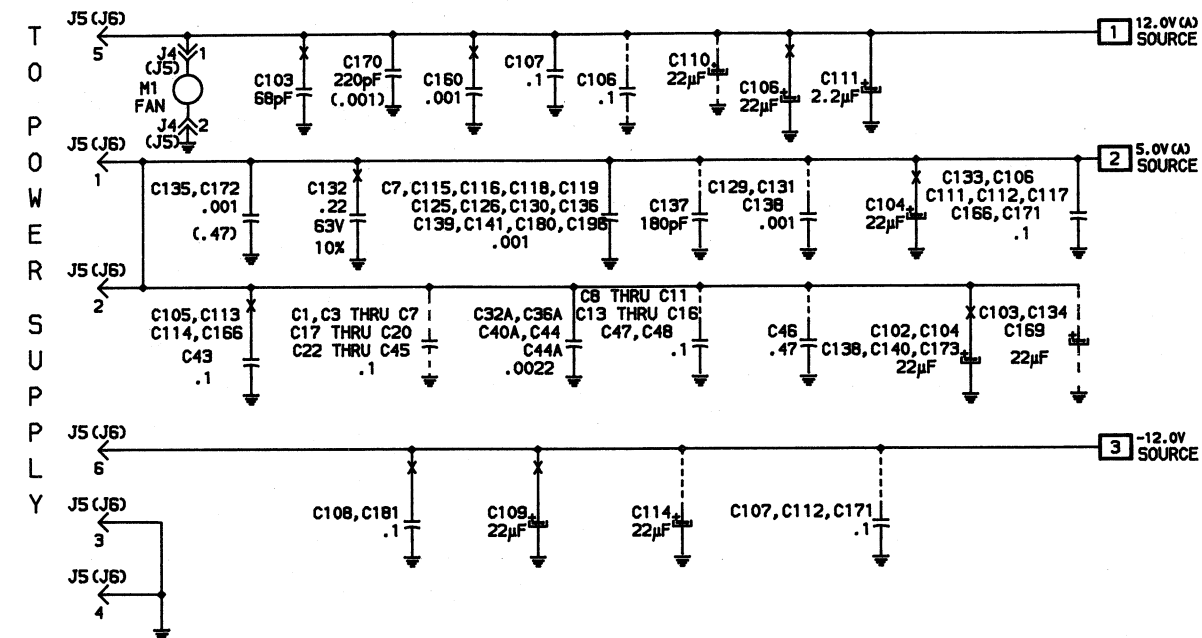
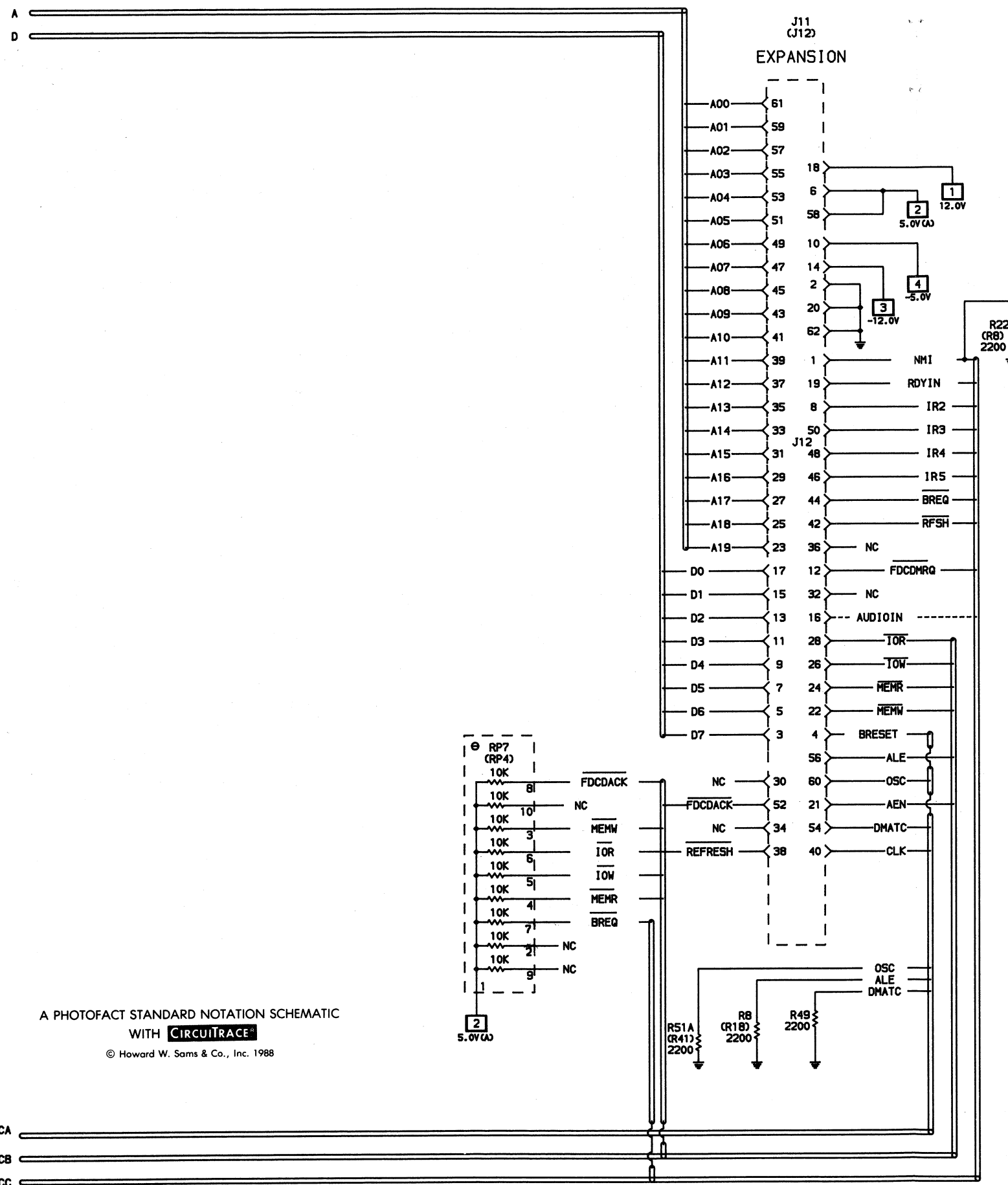


PHOTO CIRCUITRACE = 11  
SCHEMATIC CIRCUITRACE = 11



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