

# COMPUTERFACTS™

TECHNICAL SERVICE DATA

## RADIO SHACK® TRS-80 MODEL 4 GATE ARRAY VERSION 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 malfunctions.

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

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

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

## TEST EQUIPMENT AND TOOLS

### TEST EQUIPMENT

Digital Volt/Ohm Meter  
Logic Probe

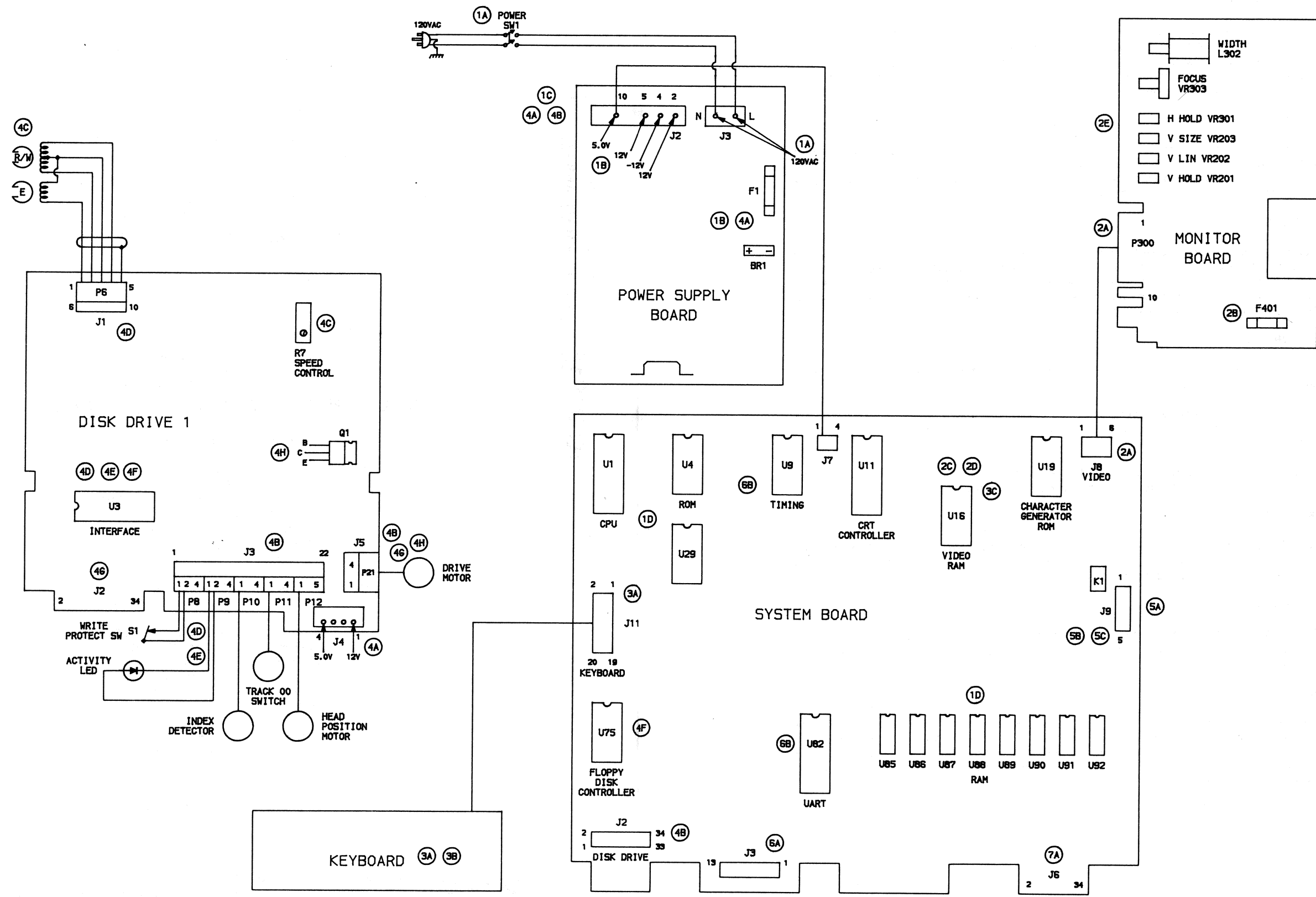
### TOOLS

Low Wattage Soldering Iron  
Desoldering Equipment  
Head Cleaning Equipment  
Switch Cleaner (non-spray type)  
Phillips Screwdriver  
Flat Blade Screwdriver

## REPLACEMENT PARTS AND DESCRIPTION

IDENT.	PART NO.	DESCRIPTION
DISK DRIVE		
M2		Drive Motor Belt, Drive
U3		IC, Interface, ULA1045E
POWER SUPPLY BOARD		
BR1	8160402	Bridge Rectifier, 2A,
F1	8479104	Fuse, 3A @250V
SYSTEM BOARD		
K1	8429105	Relay, 12V, 2A
U1	8047880	IC, CPU, Z80A
U4	8075369	IC, ROM B/C, MCM68364
U9	8040541	IC, Timing Array
U11	8040045	IC, CRT Controller, 68A045
U16	8040166	IC, Video RAM, 4016
U19	8049007	IC, Character Generator ROM, MCM68A316E
U29	8075364	IC, ROM MCM68364
U75	8040773	IC, Floppy Disk Controller, WD1773
U82	8040545	IC, UART,
U85	8040665	IC, RAM, MCM6665
thru		
U92		
MONITOR		
F401	251000790A	Fuse, 2A @250V

PRELIMINARY SERVICE CHECKS (Continued)



RADIO SHACK  
MODEL 4 GATE ARRAY

# PRELIMINARY SERVICE CHECKS (Continued)

## GENERAL OPERATING INSTRUCTIONS

### POWER UP SEQUENCE

1. Turn On all peripherals.
2. With no diskettes in the Disk Drives, turn On the Computer.
3. Insert a TRS-80 Disk Operating System diskette in Disk Drive 0. Close the drive door and press the RESET button. The Computer display will ask for the Date and Time. After the Date and Time are entered, the Computer will display TRSDOS Ready on Monitor screen. Note: If no Disk Drives are installed, press BREAK and RESET buttons and the Computer will display CASS? on the Monitor screen. Type L to get 500 Baud Cassette operation or H to get 1500 Baud. The Computer will then ask for Memory Size?, press the ENTER key and the Computer will come up ready to program in Basic.

### RESET

Hold the BREAK key down and press the RESET button to reset the Computer to Cassette Basic. If Disk Drives are installed, press the RESET button only, to reboot the Computer from a system diskette in Disk Drive 0.

### DISK OPERATING SYSTEM (TRSDOS)

Type DIR and press the ENTER key to display the directory of the diskette in Disk Drive 0. If the directory of a diskette other than Drive 0 is desired, type DIR: and the Disk Drive number desired (example DIR:1 for Drive 1).

To load a program from a diskette while in DOS, type the program name and press the ENTER key. Use a colon and the number of the Drive after the program name to load a program from any Disk Drive other than Drive 0. NOTE: Programs written in Basic cannot be loaded while in DOS. See the "BASIC" section of the "General Operating Instructions" for instructions on loading programs written in Basic.

To display a list of special programs on the system diskette type LIB and press the ENTER key.

### BASIC

To load Disk Basic into the Computer, boot up on DOS, put a diskette in Drive 0 with Disk Basic on it, type BASIC and press the ENTER key. To go from Disk Basic back to DOS, type SYSTEM and press the ENTER key.

To display the directory of the diskette in Disk Drive 0 type SYSTEM "DIR" and press the ENTER key. For Disk Drive 1 type SYSTEM "DIR:1" and press the ENTER key.

To load a program from a diskette in Disk Drive 0, type LOAD and the program name enclosed in quotes and press the ENTER key. To load a program from a Disk Drive other than Disk Drive 0 add a colon and the Disk Drive number at the end of the program name. Example LOAD "SAMS:1"

To save a program to a diskette in Disk Drive 0, type SAVE and the program name enclosed in quotes and press the ENTER key. To save a program to a diskette in a Disk Drive other than Disk Drive 0, add a colon and the Disk Drive number at the end of the program name. Example SAVE "SAMS:1".

### USING A BLANK DISKETTE

A blank diskette must be either formatted or have the DOS copied to it before it can be used to save data. NOTE: Disk Drive 0 must always contain a diskette with DOS on it. A formatted diskette may be used in Disk Drives 1, 2, or 3.

To copy DOS on a diskette, load DOS into the Computer, put a diskette in Disk Drive 0 with the BACKUP program on it, type BACKUP and press the ENTER key. Follow the instructions displayed on the Monitor screen.

To format a diskette, load DOS into the Computer, put a diskette in Disk Drive 0 with the FORMAT program on it, type FORMAT and press the ENTER key. Follow the instructions displayed on the Monitor screen.

### CASSETTE OPERATION

To load a program from Cassette tape, type CLOAD (with or without the program name enclosed in quotes), put the recorder in play mode and press the ENTER key.

To save a program to Cassette tape, type CSAVE (with or without the program name enclosed in quotes), put the recorder in record mode and press the ENTER key.

# 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 120V AC from pin L to pin N of Connector J3 on the Power Supply board. If 120V AC is missing check the AC cord and Power Switch (SW1).
- (B) Check for 5V at pin 10, 12V at pins 5 and 2 and – 12V at pin 4 of Connector J2 on the Power Supply board. If the voltages are missing, check Fuse F1. If F1 is bad, replace and check for shorts at Bridge Rectifier BR1 before turning On Computer. If shorts are present, replace or repair the Power Supply.
- (C) If Fuse F1 is good, disconnect Connector J2. Recheck the source voltages at Connector J2. If the voltages return to normal, replace or troubleshoot the System board.
- (D) Check the CPU IC (U1), ROM IC's (U4 and U29), RAM IC's (U85 thru U92) by substitution.

### 2 VIDEO DISPLAY

- (A) No Video. Check Connector J8 on the System board and Connector P300 on the Monitor board for good connections.
- (B) Check Fuse F401 on the Monitor board.
- (C) Check the Character Generator ROM IC (U19), Video RAM IC (U16) and CRT Controller IC (U11) by substitution.
- (D) Characters are not correct on the Monitor screen. Check the Character Generator ROM IC (U19) and Video RAM IC (U16) by substitution.
- (E) Display size is not correct or display is unstable. Check Vertical Size, Width, Vertical and Horizontal Hold adjustments, see "Miscellaneous Adjustments".

### 3 KEYBOARD

- (A) Keyboard is dead or one group of keys does not work. Check the Keyboard ribbon cable for open circuits and Connector J11 for good connections.
- (B) One key does not work or is erratic, clean the bad key with contact cleaner.
- (C) Wrong character appears on the Monitor screen when a key is pressed. Check the Character Generator ROM IC (U19) and Video RAM IC (U16) by substitution.

### 4 DISK DRIVE AND INTERFACE

- (A) Disk Drives are dead. Check for 12V at pin 1 and 5V at pin 4 of Connector J4 on the Disk Drives. If the voltages are missing, check Connector J2 on the Power Supply Board for good connection and Fuse F1. If F1 is bad, replace and check for shorts at Bridge Rectifier (BR1) before turning On Computer. If shorts are present, replace or repair the Power Supply.

#### WARNING

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

- (B) Disk Drive operation is erratic. Check Connector J2 on the System Board and J1, J2, J3 and J5 on Disk Drive boards for good connections.
- (C) Clean the head and check the Spindle Speed Adjustment (R7), see "Miscellaneous Adjustments".
- (D) Will not write. Check Connector P6 on Disk Drive for good connections. Check for continuity at pins 1 and 2 of Connector P8 on the Disk Drive. If it checks open, check Write Protect Switch (S1). If there is continuity between pins 1 and 2 of Connector P8, check Interface IC (U3) by substitution.
- (E) Writes on write protected diskette. Insert a write protected diskette in the Disk Drive and check the Write Protect Switch (S1) for shorted or sticking contacts with an ohmmeter from pin 1 to pin 2 of Connector P8. If there is no short between pins 1 and 2 of Connector P8, check Interface IC (U3) by substitution.
- (F) Will not read or write. Check Interface IC (U3) on the Disk Drive board by substitution. Also check Floppy Disk Controller IC (U75) on the System board by substitution.
- (G) Disk Drive will not run. Check Connectors J2, J5 and P21 on the Disk Drive board for good connections.
- (H) Check for possible broken or binding Drive Belt. Connect a jumper from collector to emitter of Driver Transistor (Q1) on the Drive board. If the Drive Motor does not start running, check the Drive Motor (M2) by substitution.



## PRELIMINARY SERVICE CHECKS (Continued)

### 5 CASSETTE

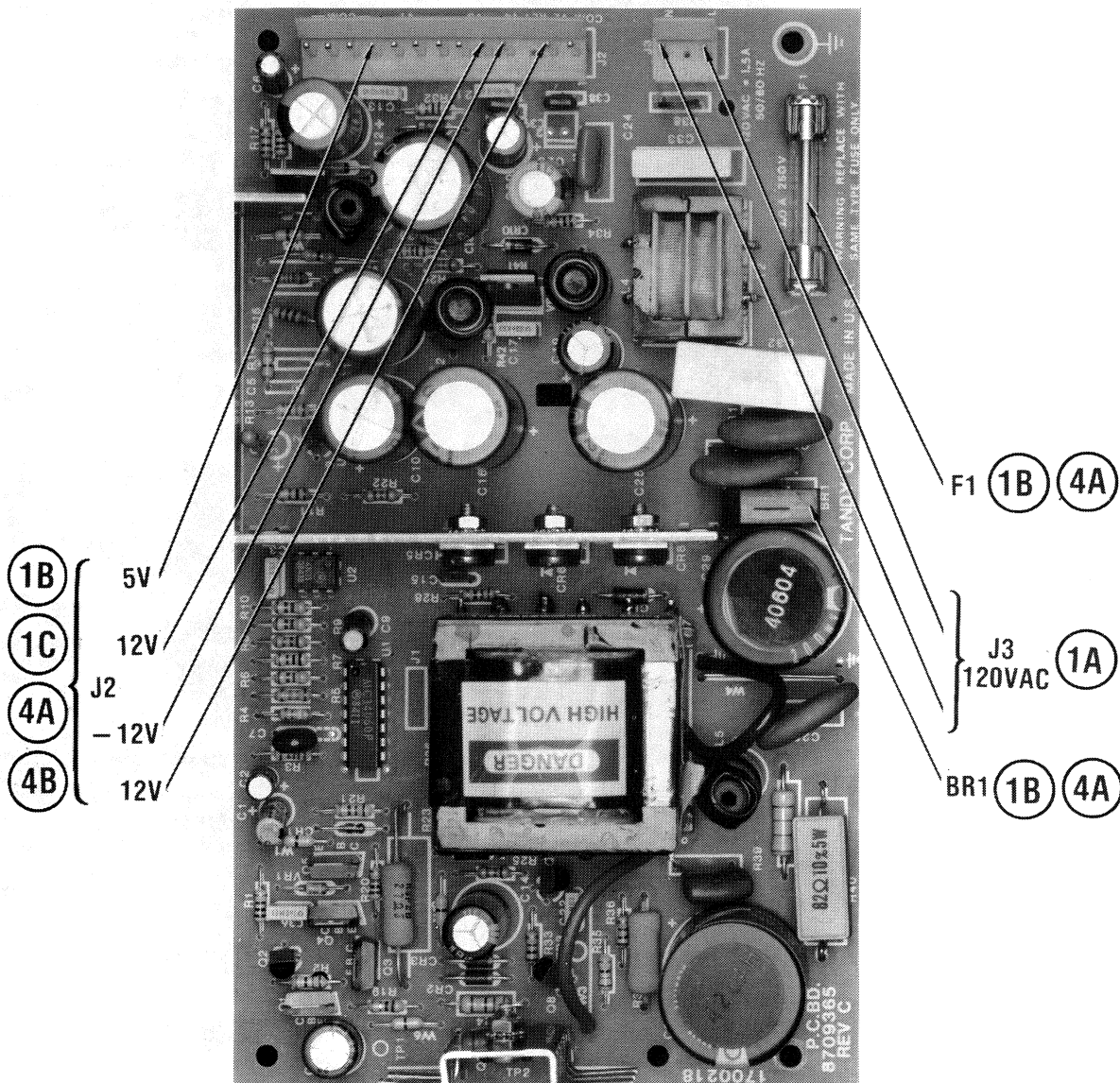
- (A) Cassette will not save or load. Check Connector J9 on the System board for good connections.
- (B) Cassette motor will not start running. Check Relay K1 contacts (pin 1 to pin 3 of Connector J9) for good connections while saving or loading a program.
- (C) Cassette motor will not stop running. Check Relay K1 contacts (pin 1 to pin 3 of Connector J9) for shorted contacts.

### 6 SERIAL PORT

- (A) Serial port does not work. Check Connector J3 on the System board for good connections.
- (B) Check Timing IC (U9) and UART IC (U82) by substitution.

### 7 PRINTER PORT

- (A) Printer does not work. Check Connector J6 on the System board for good connections.

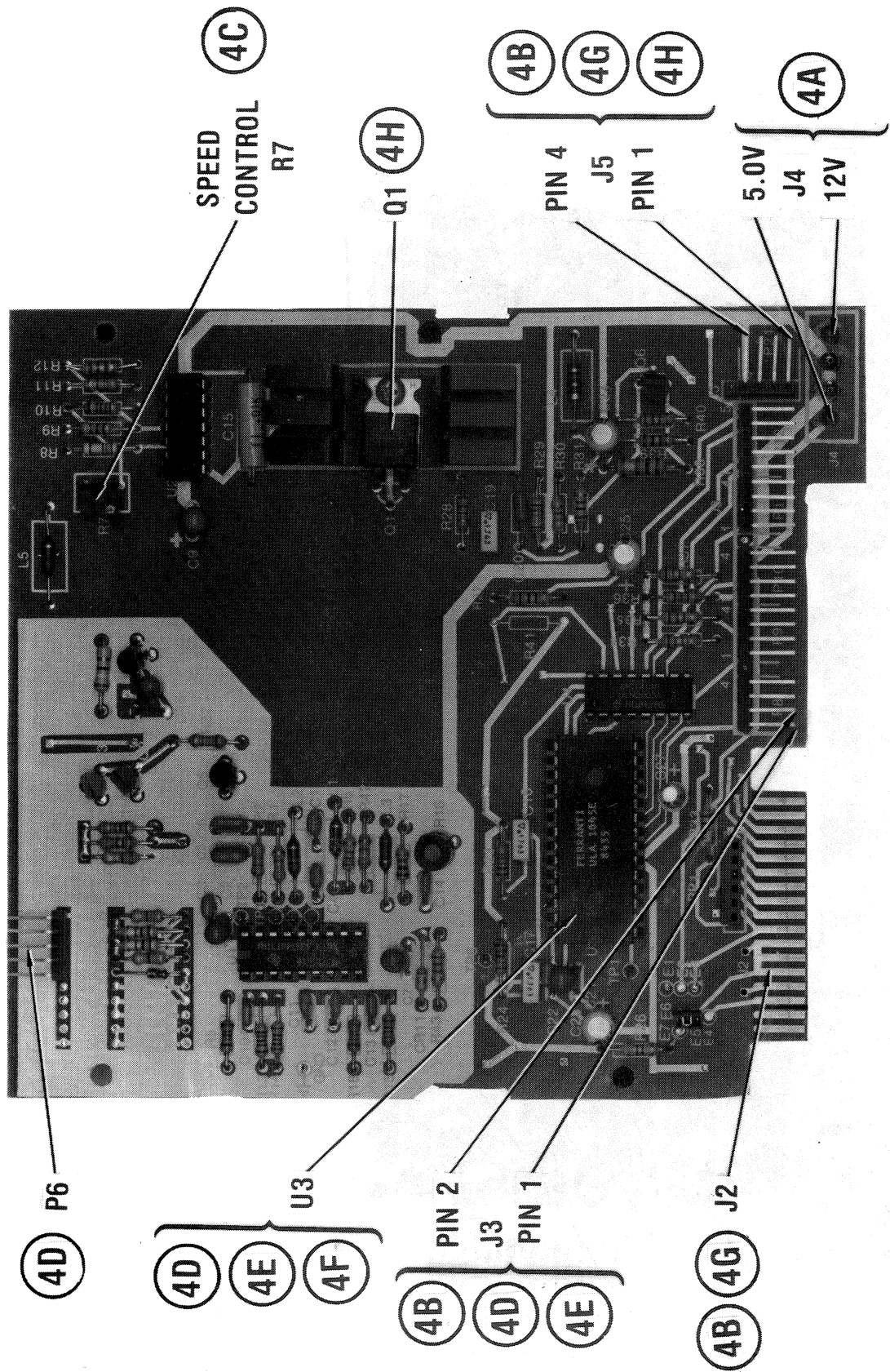


**CSCS13**  
RADIO SHACK  
MODEL 4 GATE ARRAY

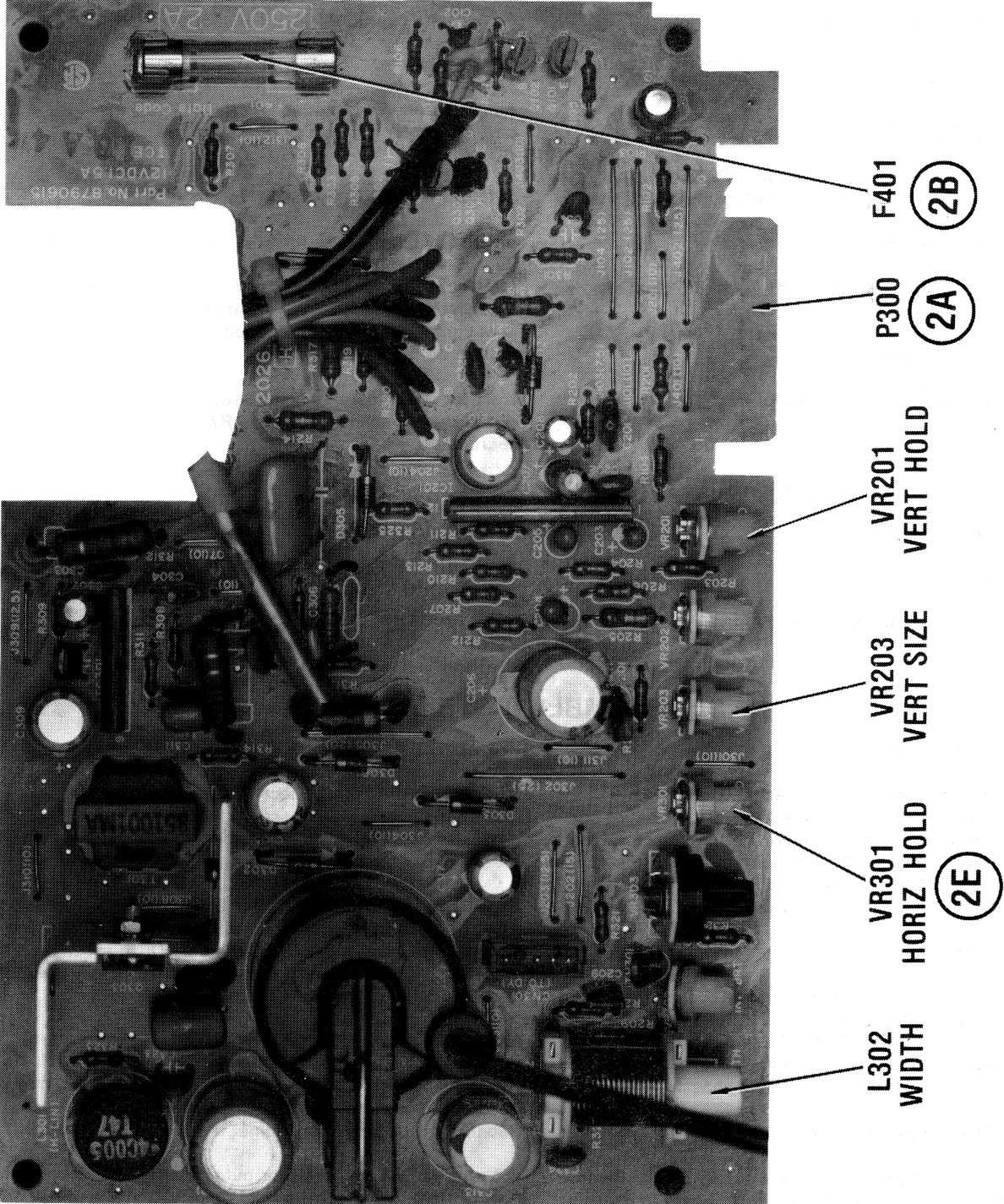




PRELIMINARY SERVICE CHECKS (Continued)



PRELIMINARY SERVICE CHECKS (Continued)



RADIO SHACK  
MODEL 4 GATE ARRAY



# PRELIMINARY SERVICE CHECKS (Continued)

## MISCELLANEOUS ADJUSTMENTS

TOOLS GC ELECTRONICS  
L302 9440, 8282, 8606

### VERTICAL SIZE ADJUSTMENT

Adjust the Vertical Size Control (VR203) for a display height of about 6 inches.

### VERTICAL LINEARITY

Adjust Vertical Linearity Control (VR202) so that the character size matches at the top and bottom of the screen.

### VERTICAL POSITION

Move jumper from JP12 to JP11 to move character on screen upward.

### HORIZONTAL LINEARITY

Adjust magnets located on yoke for best linearity.

### WIDTH

Note: Check the Horizontal Linearity adjustment before doing the width adjustment. Adjust the Width Coil (L302) for a display width of about 8 inches.

### HORIZONTAL HOLD

Adjust the Horizontal Hold Control (VR301) for a stable display.

### FOCUS

Adjust the Focus Control (VR303) for best focus.

### CENTERING

Adjust the two magnetic rings located on the yoke rear cover to center the display on the screen.

### SPINDLE SPEED ADJUSTMENT

Insert a blank diskette into the Disk Drive and close the door. Turn the Disk Drive on its side so the pattern wheel on the flywheel is visible. Adjust the Speed Control (R7) until the 60Hz pattern appears to stand still under a 60Hz fluorescent light. If 50Hz fluorescent lighting is used, use the 50Hz pattern on the pattern wheel.

If a Disk Drive Tester is being used, which provides a read-out of the speed in rpm, adjust (R7) for a speed of 300rpm  $\pm$  5rpm.

## DISASSEMBLY INSTRUCTIONS

### CABINET REMOVAL

Place Computer on its side. Remove ten screws from cabinet bottom. Carefully place Computer in upright position. Remove one remaining screw from rear of cabinet. Very carefully remove CRT and cabinet top, lifting straight up and setting it aside to the left (if facing CRT). Be careful not to exceed the length of the video cable.

### BOARD REMOVAL

Remove six screws holding metal shield over System board at rear of Computer. Remove shield from System board. Remove eight screws holding System board to chassis. Disconnect Connectors J2, J3 thru J7, J8, J9, and J11 on System board and remove board from chassis.

### POWER SUPPLY BOARD REMOVAL

Disconnect connectors from power supply board. Remove four screws holding main Power Supply board to chassis.

### DISK DRIVES REMOVAL

TOP DISK DRIVE: Disconnect ribbon cable from rear of Disk Drive board. Remove four screws, two on each side holding Drive assembly to chassis. Disconnect Connector J1 from Power Supply board. Disk Drive may now be removed.

BOTTOM DISK DRIVE: Disconnect ribbon cable from rear of Disk Drive board. Remove Power Supply board. Remove four screws, two on each side holding Drive assembly to chassis. Disconnect Connector P1. Disk Drive may now be removed out the front of chassis.

### MONITOR BOARD REMOVAL

Disconnect CRT socket, HV anode lead, Deflection Yoke leads, and ground lead. Remove four screws holding Monitor board to side of cabinet top.

To remove CRT, remove four nuts holding CRT to cabinet front. Note: Make sure to hold on to CRT while removing nuts to avoid breaking CRT.

# **PRELIMINARY SERVICE CHECKS (Continued)**

## **PREVENTATIVE MAINTENANCE**

### **ENVIRONMENT**

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

### **ELECTRICAL POWER**

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

### **KEYBOARD**

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

### **DISK DRIVES**

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

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

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

### **PRINTERS**

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

### **STATIC ELECTRICITY**

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

### **MONITOR**

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

DISK DRIVE

See Folder CSCS13-A

MONITOR

See Folder CSCS13-B

KEYBOARD, POWER SUPPLY,  
SYSTEM BOARD



RADIO SHACK  
MODEL 4 GATE ARRAY  
CSCS13

CSCS13  
MODEL 4 GATE ARRAY  
RADIO SHACK

SAFETY PRECAUTIONS

SEE PAGE 23.

PRELIMINARY SERVICE CHECKS

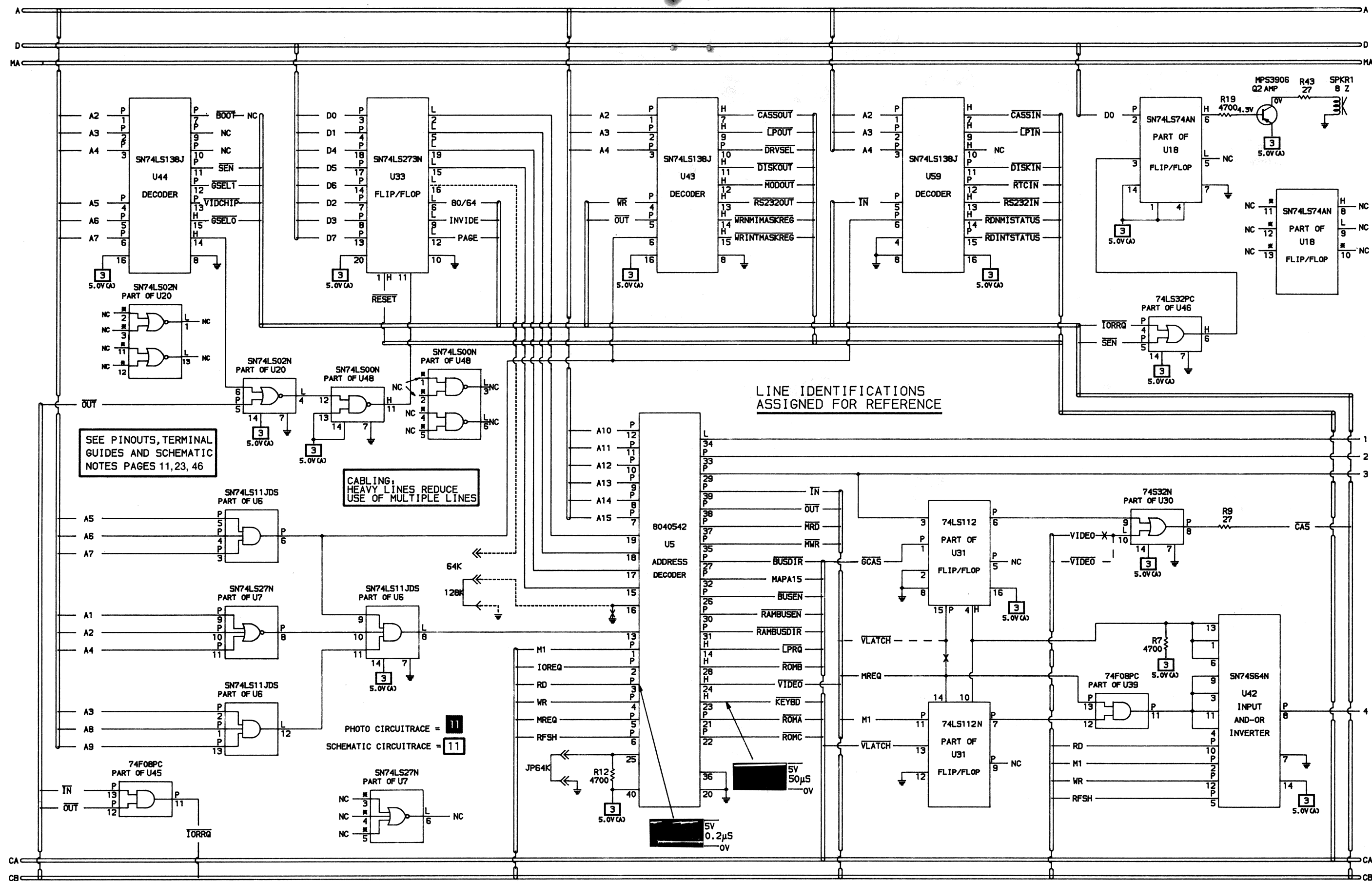
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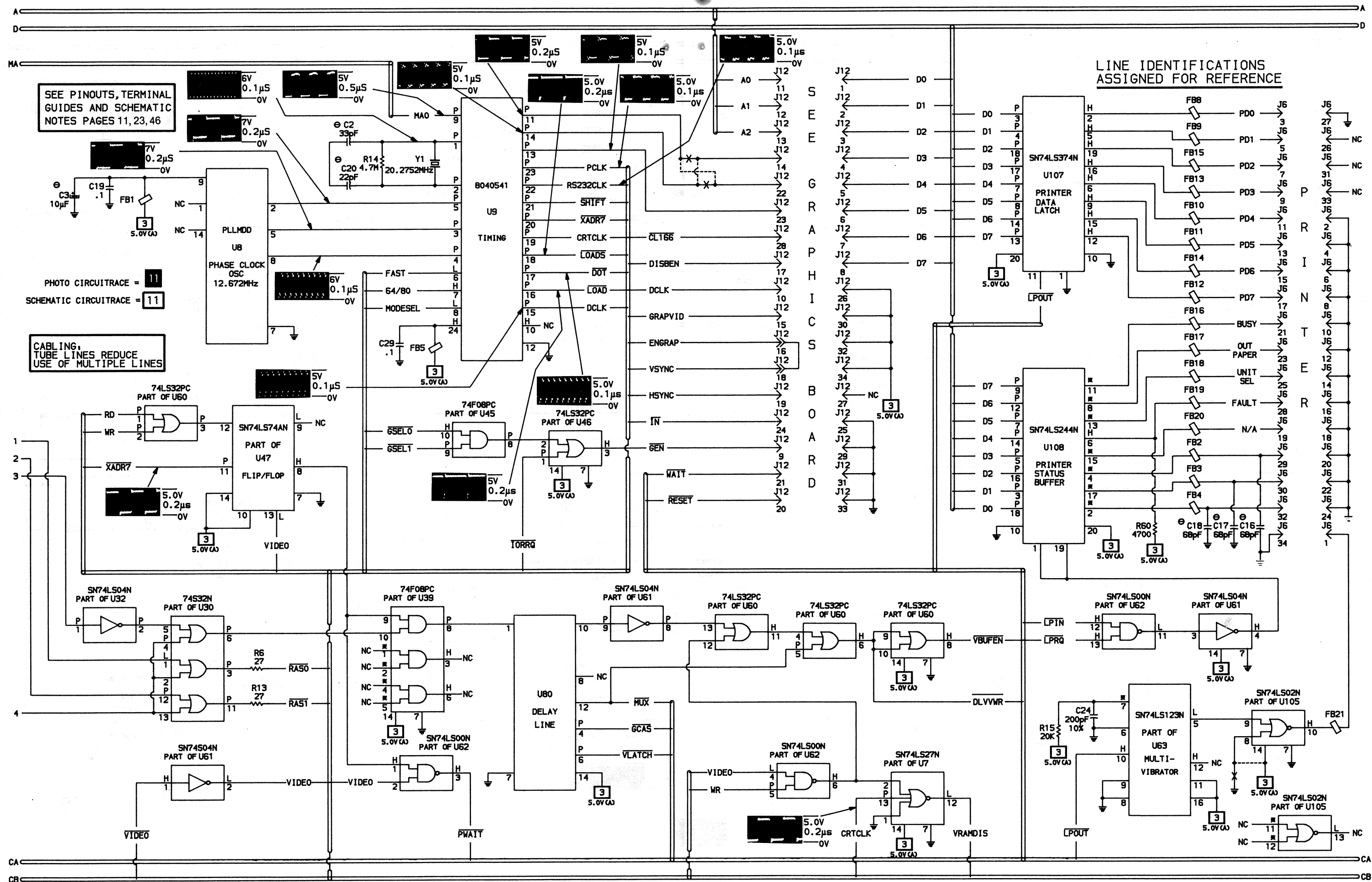
**CSCS13**  
RADIO SHACK  
MODEL 4 GATE ARRAY

A PHOTOFACIT STANDARD NOTATION SCHEMATIC

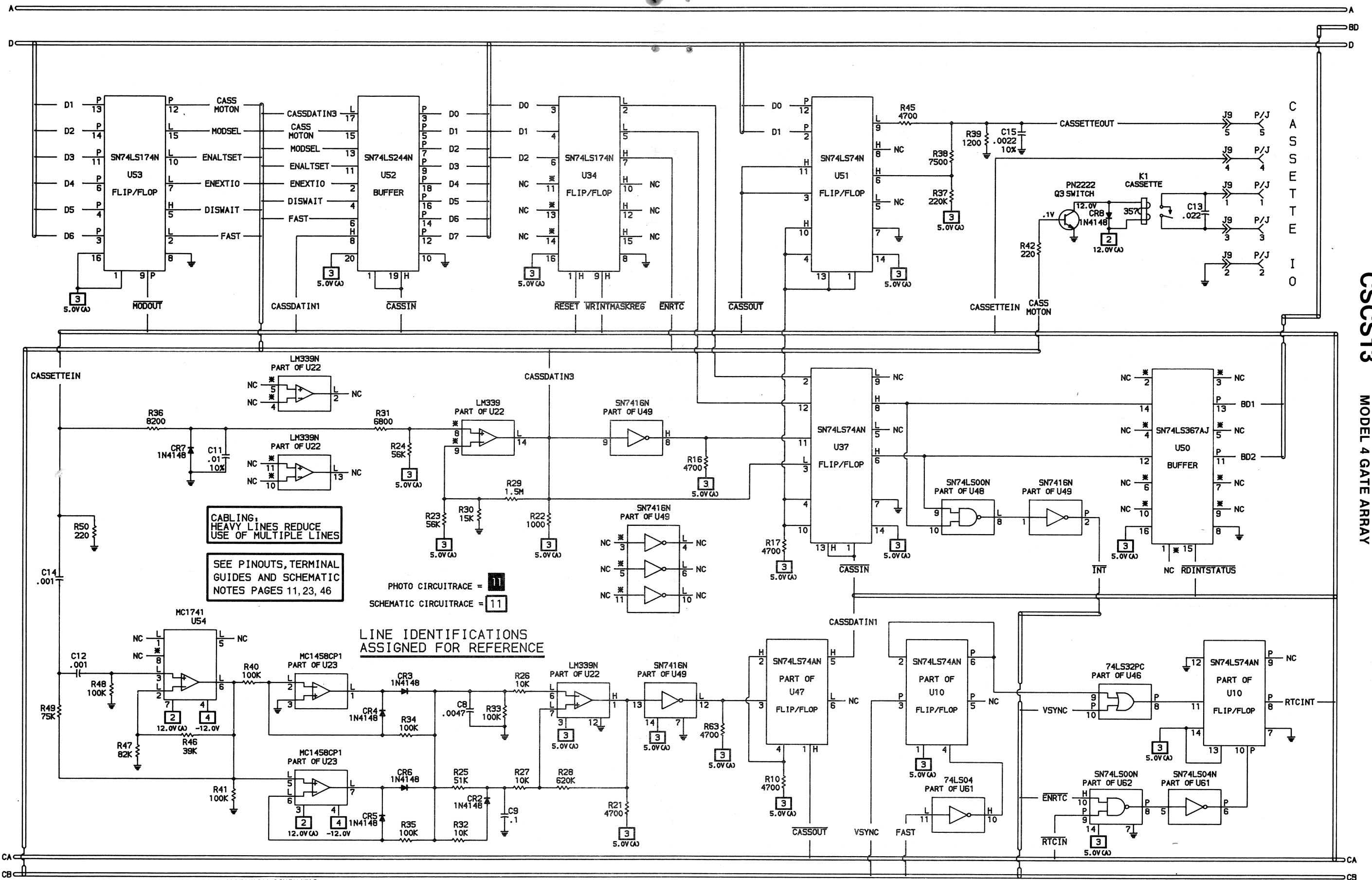
WITH **CIRCUITRACE**  
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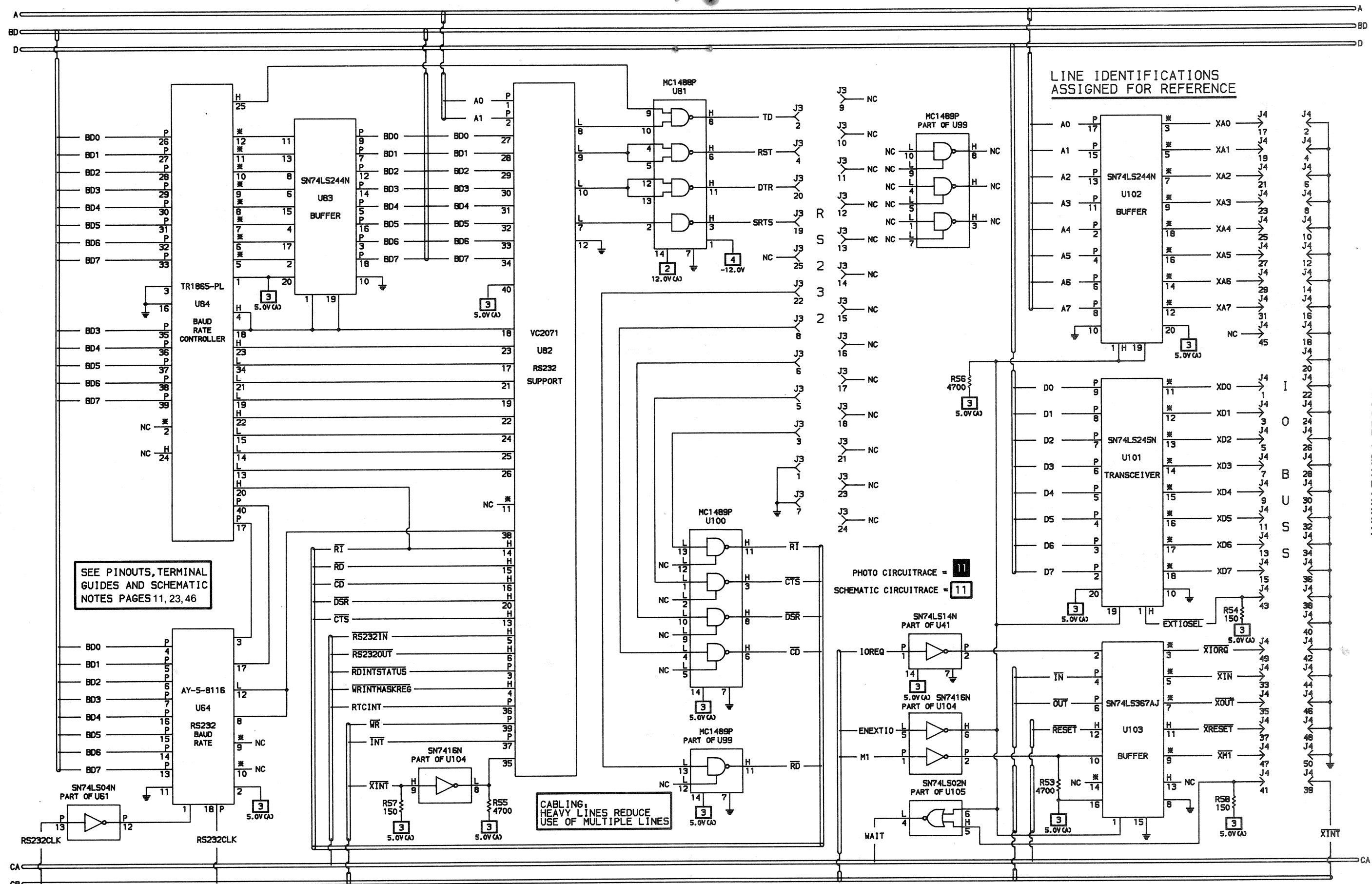
SYSTEM BOARD

SYSTEM BOARD



# RADIO SHACK MODEL 4 GATE ARRAY





RADIO SHACK  
MODEL 4 GATE ARRAY

A PHOTOFAC STANDARD NOTATION SCHEMATIC

WITH **CIRCUITTRACE**

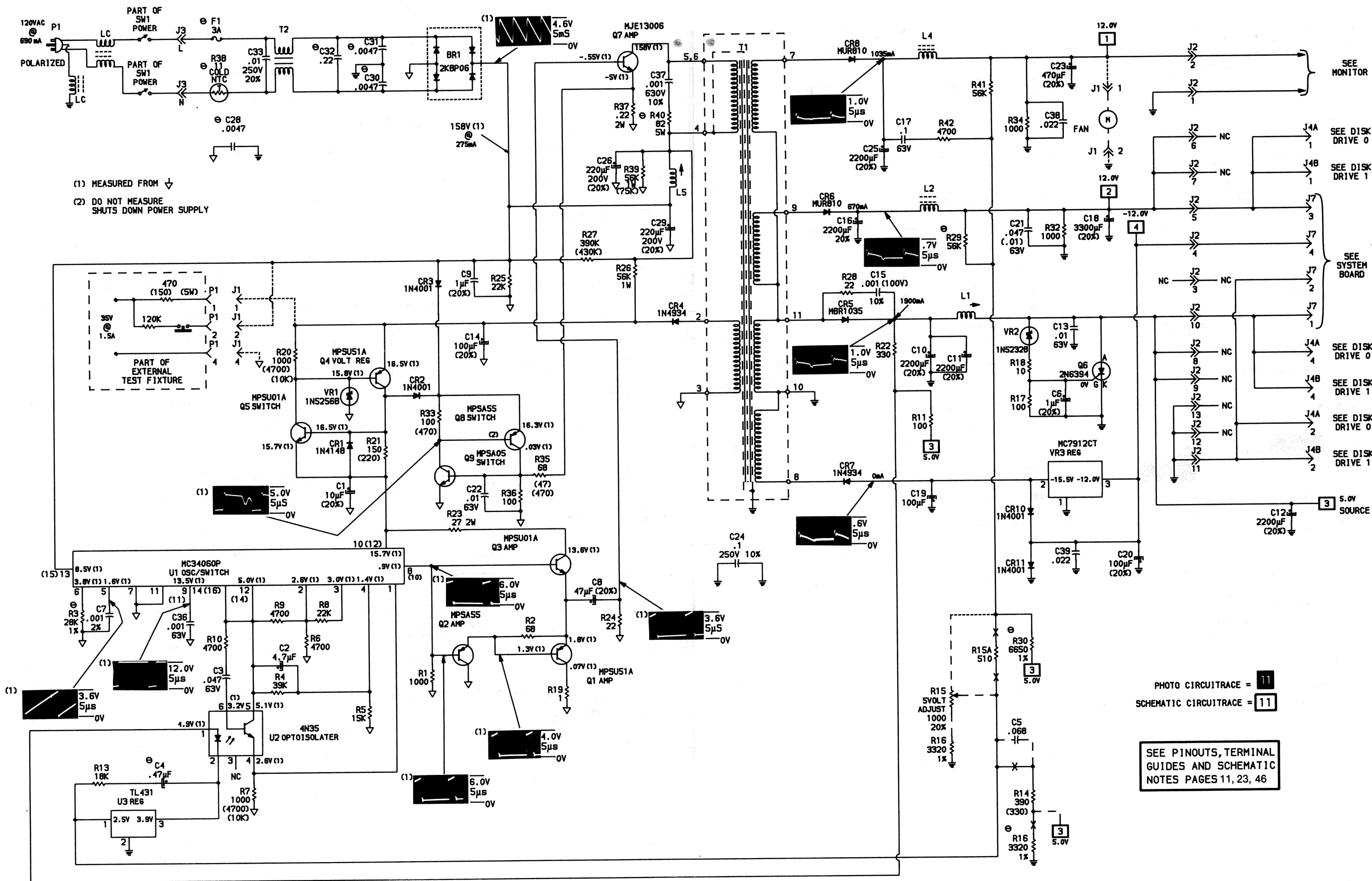
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SYSTEM BOARD

SYSTEM BOARD





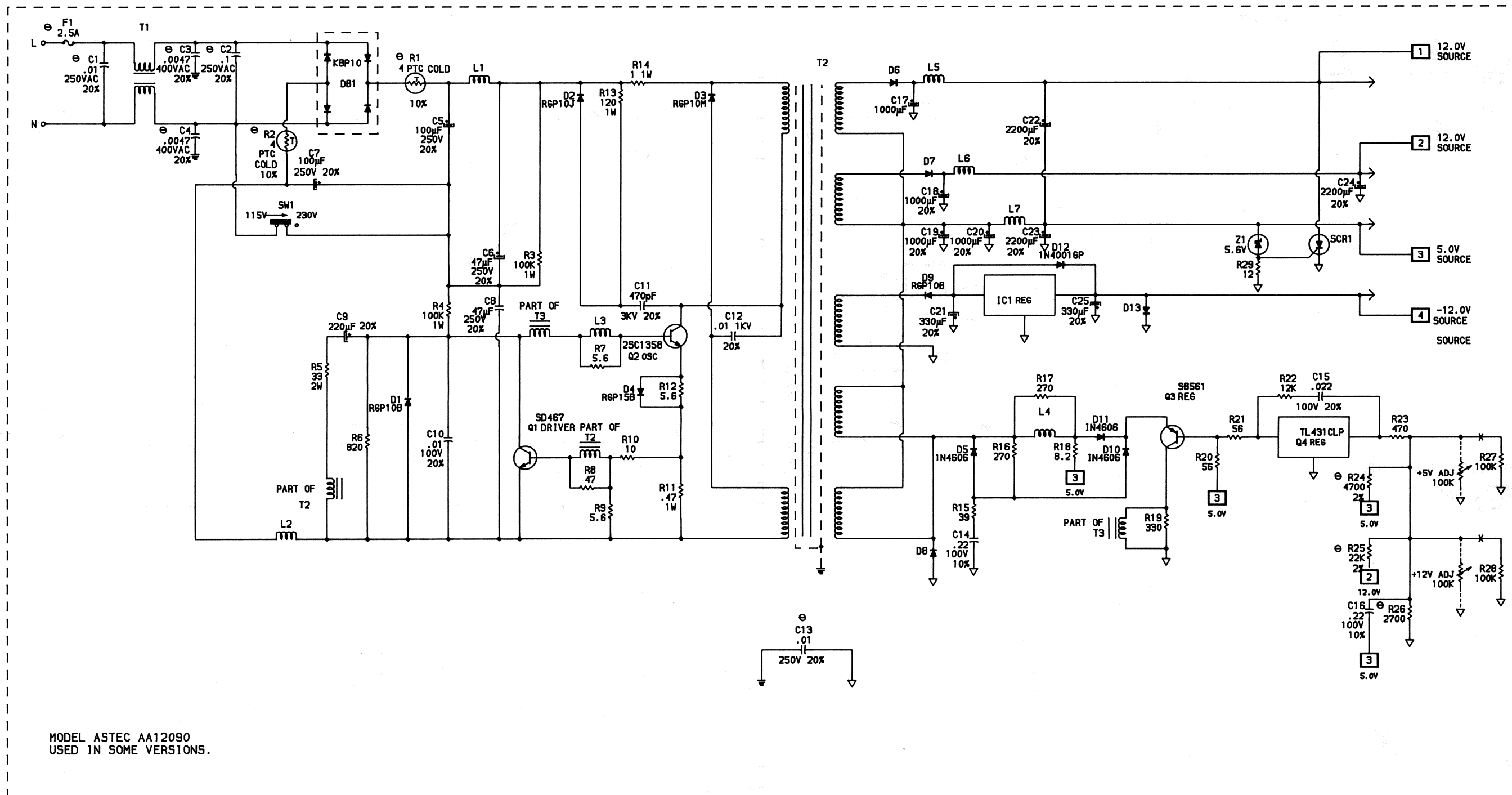


A PHOTOFAC STANDARD NOTATION SCHEMATIC

WITH **CIRCUITRACE™**

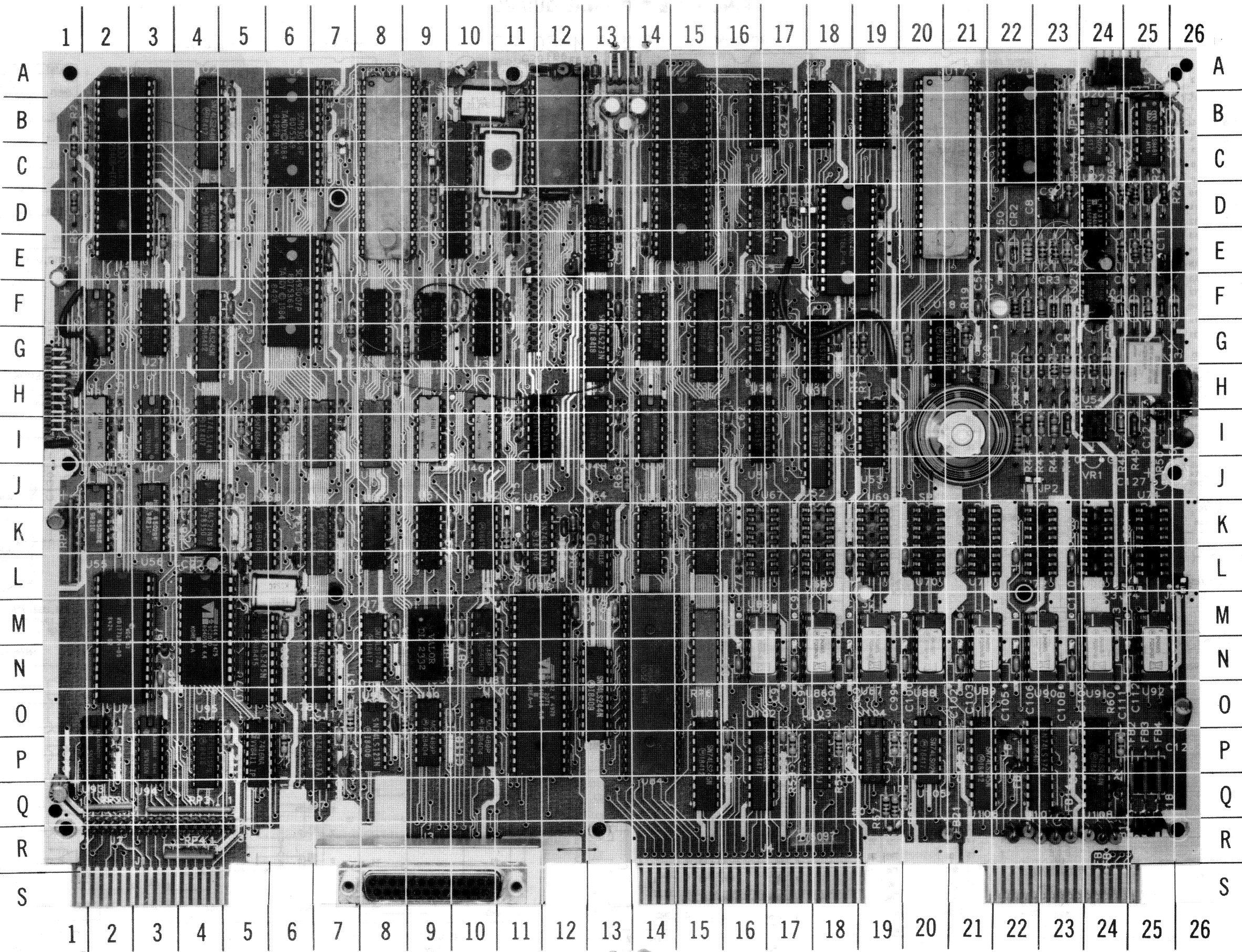
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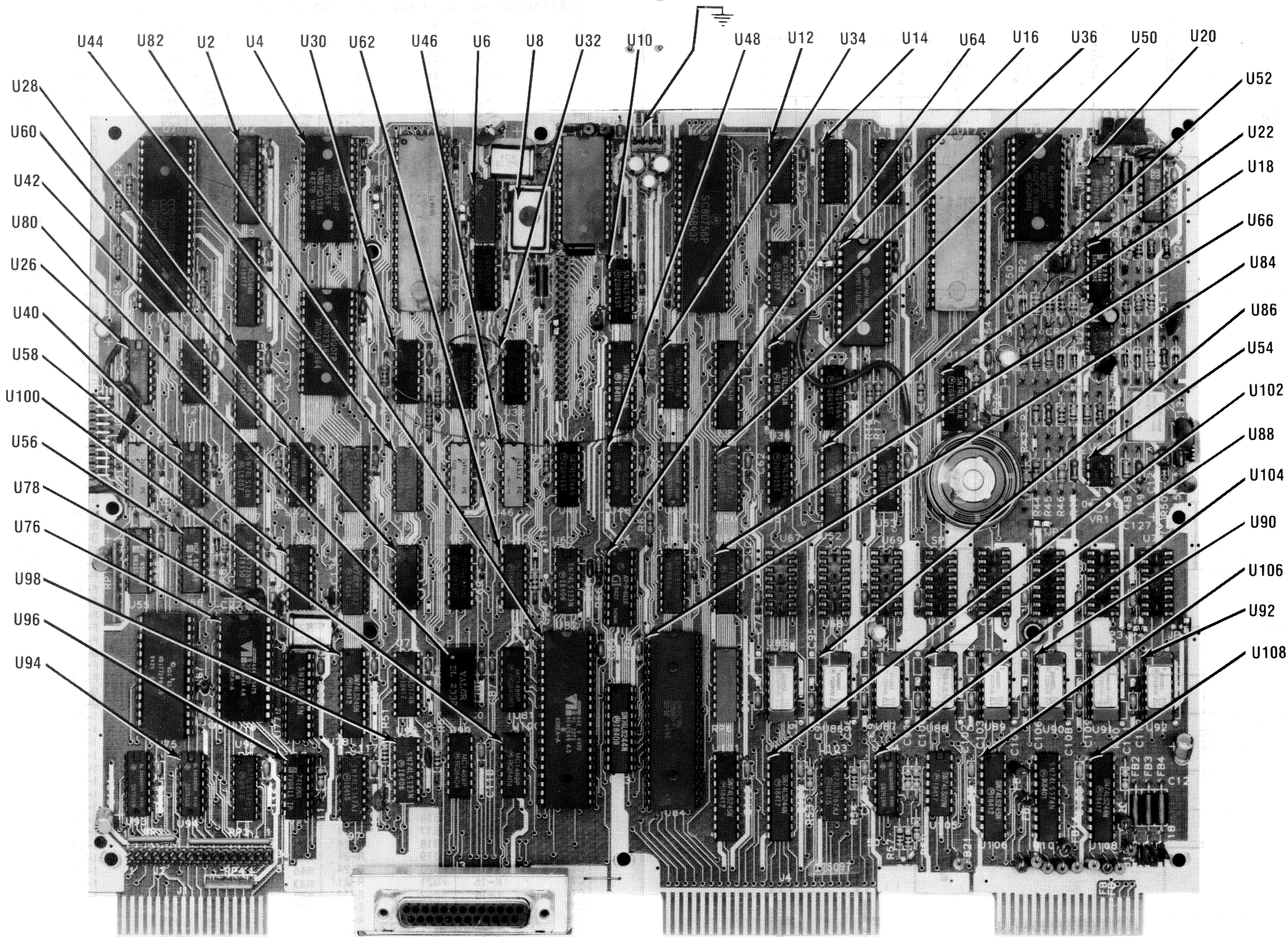
RADIO SHACK  
MODEL 4 GATE ARRAY

# SYSTEM BOARD GridTrace LOCATION GUIDE

C2	A-10	C80	L-23	J7	A-13	R54	P-18	U59	K-7
C3	D-12	C81	L-25	J8	A-24	R55	P-19	U60	K-8
C4	B-13	C82	N-3	J9	H-26	R56	P-20	U61	K-9
C5	B-14	C83	M-6	J11	H-1	R57	Q-19	U62	K-10
C6	B-13	C84	M-7	J12	E-11	R58	Q-19	U63	K-11
C7	F-22	C85	M-8	JP1	J-22	R59	Q-20	U64	K-13
C8	D-23	C86	M-10	JP2	J-23	R60	P-24	U65	K-14
C9	D-23	C87	M-10	JP3	L-24	R61	J-2	U66	K-15
C10	E-24	C88	L-11	JP4	L-25	R63	J-13	U75	M-2
C11	E-25	C89	M-12	JP5	L-26	R64	E-3	U76	M-4
C12	I-25	C90	M-13	JP6	L-26	R65	D-24	U77	N-5
C13	H-26	C91	N-16	JP7	H-1	R66	K-12	U78	N-7
C14	I-26	C94	N-17	JP8	C-7	R67	N-3	U79	N-8
C15	I-25	C97	N-18	JP9	B-7	RP1	K-1	U80	N-9
C16	R-25	C100	N-20	JP11	D-17	RP2	Q-2	U81	N-10
C17	R-25	C103	N-21	JP12	D-17	RP3	Q-4	U82	N-11
C18	R-25	C106	N-22	JP13	B-23	RP4	R-4	U83	O-13
C19	D-11	C109	N-23	JP14	C-23	RP6	N-15	U84	N-14
C20	A-12	C112	N-25	JP15	E-11	SPKR1	I-21	U85	N-16
C21	I-1	C115	O-2	JP64K	C-9	U1	C-2	U86	N-18
C22	K-4	C116	P-5	K1	H-25	U2	B-4	U87	N-19
C24	L-11	C117	P-7	L1	B-24	U3	D-4	U88	N-20
C25	L-4	C118	O-10	Q2	H-21	U4	B-6	U89	N-21
C26	O-8	C119	P-16	Q3	F-24	U5	C-8	U90	N-23
C27	A-7	C120	P-17	R2	C-1	U6	C-10	U91	N-24
C28	A-9	C121	P-18	R3	B-2	U7	D-10	U92	N-25
C29	A-13	C122	P-21	R5	D-1	U8	C-11	U93	P-2
C30	E-2	C123	P-23	R6	G-7	U9	B-12	U94	P-3
C31	F-4	C124	P-7	R7	I-5	U10	E-13	U95	P-4
C32	F-5	C125	B-25	R8	J-4	U11	C-15	U96	P-5
C33	D-5	C126	A-26	R9	H-8	U12	B-16	U97	P-7
C34	E-7	C128	O-26	R10	I-11	U13	D-16	U98	P-8
C35	F-8	C129	E-1	R11	D-6	U14	B-18	U99	P-9
C36	F-10	C130	K-1	R12	D-9	U15	B-19	U100	P-10
C37	F-11	C131	Q-1	R13	G-9	U16	D-18	U101	P-15
C38	D-13	C132	M-19	R14	B-11	U17	C-21	U102	P-16
C39	F-13	C133	L-5	R15	K-11	U18	G-20	U103	P-18
C40	D-10	C134	L-6	R16	G-18	U19	B-22	U104	P-19
C41	B-10	C261	A-5	R17	G-19	U20	B-24	U105	P-20
C42	B-17	CR1	J-4	R18	G-20	U21	B-25	U106	P-21
C43	B-19	CR2	E-22	R19	G-21	U22	D-24	U107	P-23
C44	B-21	CR3	F-23	R21	D-23	U23	F-24	U108	P-24
C45	B-23	CR4	F-23	R22	D-25	U26	F-2	Y1	B-10
C46	B-26	CR5	F-24	R23	D-25	U27	F-3	Y2	L-6
C47	D-17	CR6	F-25	R24	D-25	U28	F-4		
C48	E-14	CR7	F-26	R25	E-22	U29	F-6		
C49	D-19	CR8	E-24	R26	E-23	U30	F-8		
C50	E-22	FB1	D-11	R27	E-23	U31	F-9		
C51	F-16	FB2	P-25	R28	E-23	U32	F-10		
C52	F-17	FB3	P-25	R29	E-24	U33	G-13		
C53	G-18	FB4	P-25	R30	E-25	U34	F-14		
C54	F-21	FB5	C-13	R31	E-25	U35	F-15		
C55	H-2	FB6	A-12	R32	F-22	U36	G-16		
C56	H-4	FB7	A-12	R33	F-22	U37	G-18		
C58	I-6	FB8	P-22	R34	F-23	U39	I-2		
C59	I-7	FB9	P-22	R35	F-25	U40	I-3		
C61	I-13	FB10	R-22	R36	F-25	U41	I-4		
C62	I-16	FB11	R-23	R37	G-22	U42	I-5		
C63	I-18	FB12	R-23	R38	H-23	U43	I-7		
C64	I-19	FB13	R-23	R39	H-23	U44	I-8		
C65	J-2	FB14	Q-23	R40	H-23	U45	I-9		
C66	J-5	FB15	R-22	R41	H-24	U46	I-10		
C67	L-5	FB16	R-24	R42	H-24	U47	I-12		
C68	K-7	FB17	R-24	R43	I-22	U48	I-13		
C69	K-10	FB18	R-24	R44	I-22	U49	I-14		
C70	K-12	FB19	R-24	R45	I-23	U50	I-15		
C72	K-14	FB20	Q-24	R46	I-23	U51	I-16		
C73	K-16	FB21	R-21	R47	I-23	U52	I-18		
C74	L-16	FB22	E-12	R48	I-24	U53	I-19		
C75	L-17	J1	S-3	R49	I-25	U54	I-24		
C76	L-18	J2	R-2	R50	I-25	U55	K-2		
C77	L-20	J3	S-9	R51	O-7	U56	K-3		
C78	L-21	J4	S-16	R52	O-8	U57	K-4		
C79	L-22	J6	S-23	R53	P-17	U58	K-5		

**CSCS13**  
RADIO SHACK  
MODEL 4 GATE ARRAY



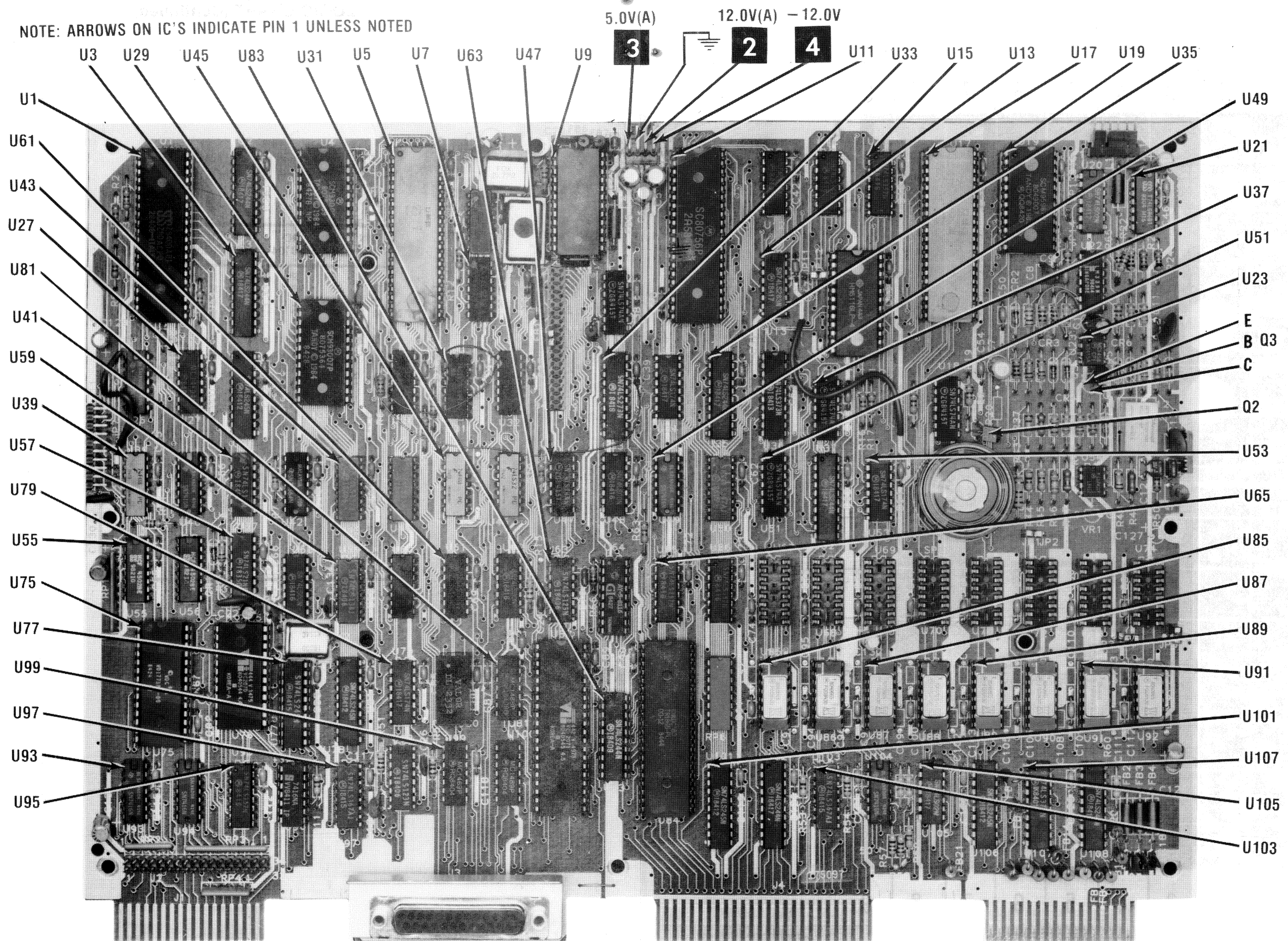


NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED

RADIO SHACK  
MODEL 4 GATE ARRAY

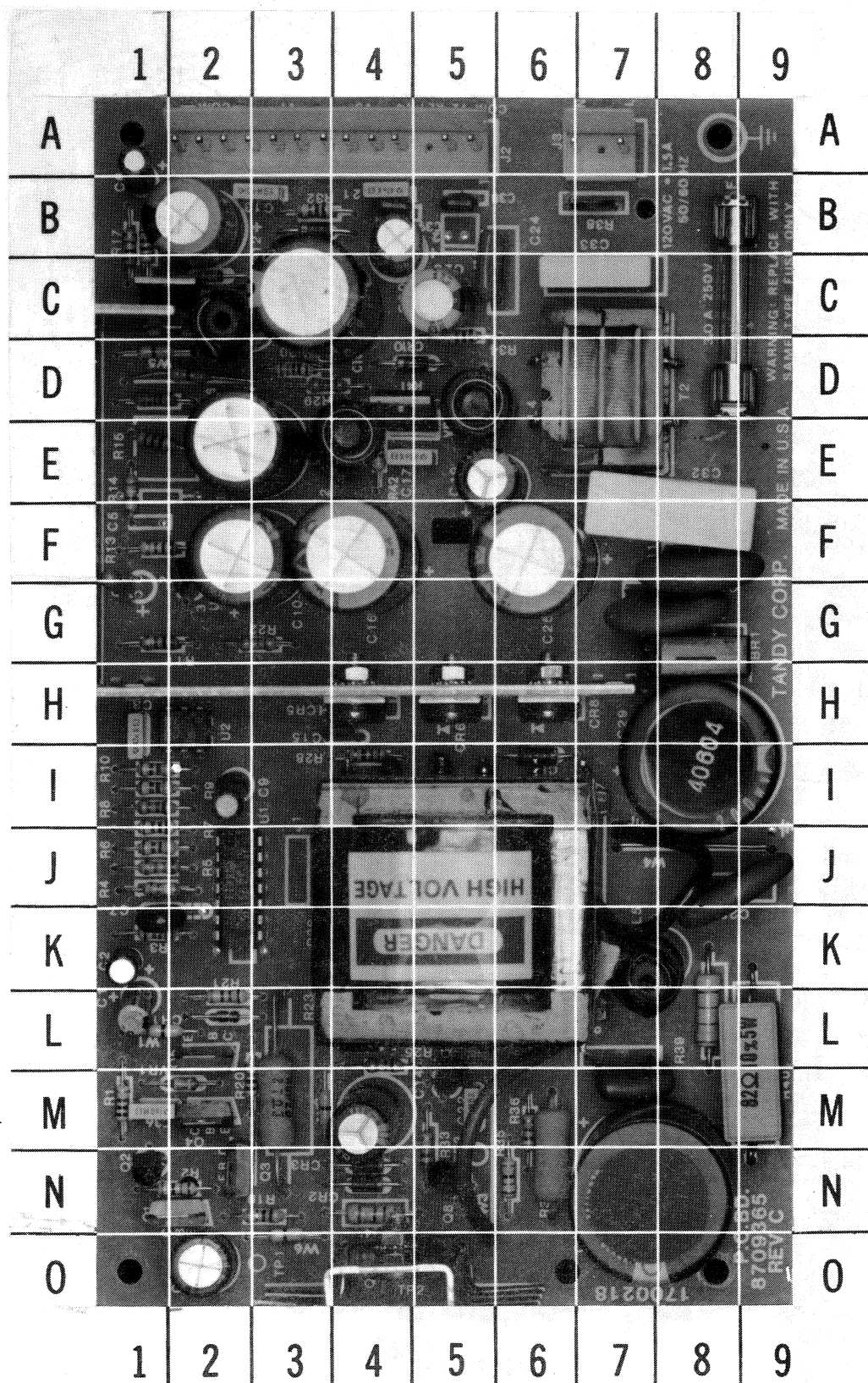


NOTE: ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED



**CSCS13**  
RADIO SHACK  
MODEL 4 GATE ARRAY

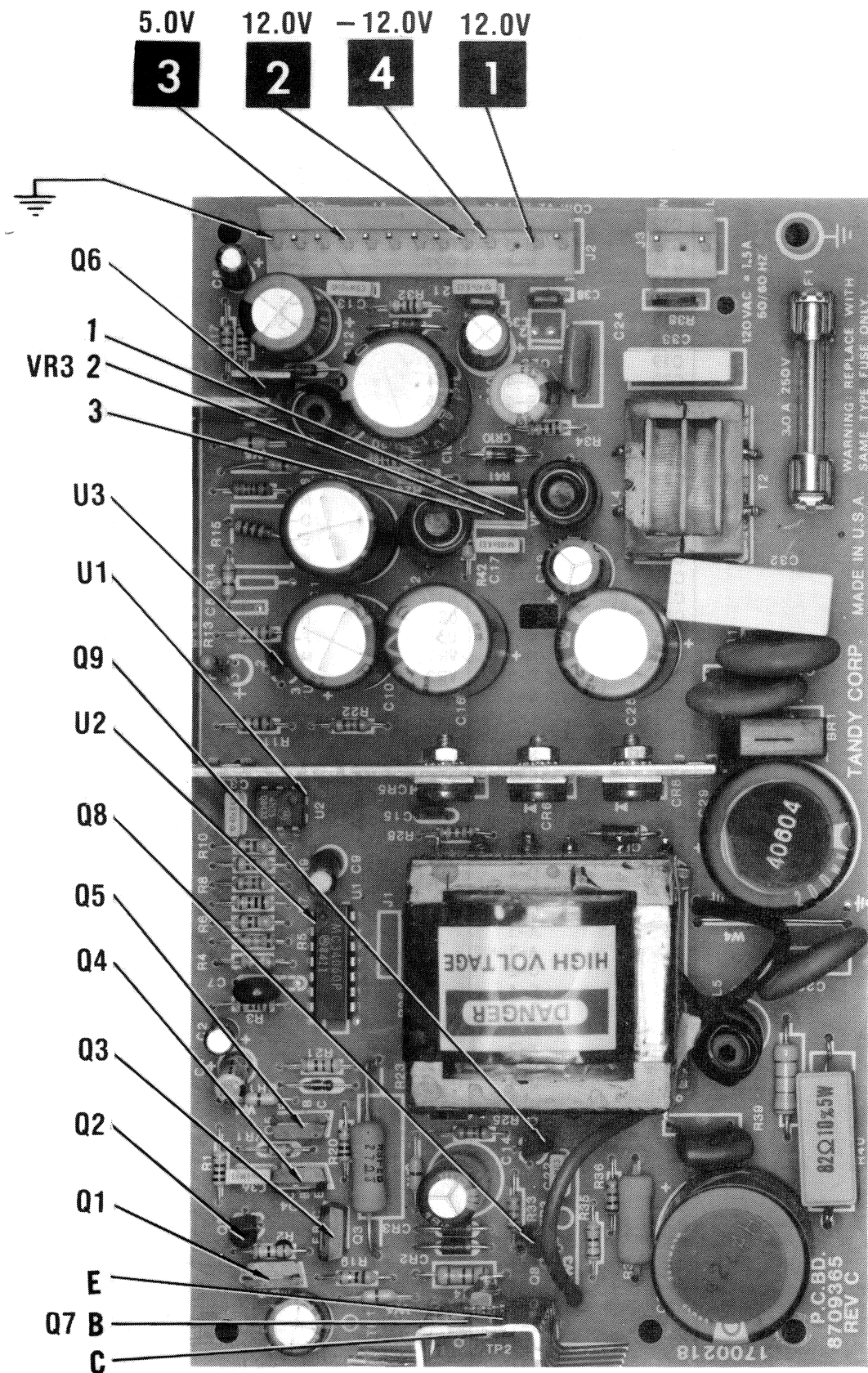




# POWER SUPPLY GridTrace LOCATION GUIDE

BR 1	G-8	R14	E-1
C1	L-1	R15A	E-1
C2	K-1	R16	D-1
C3	H-1	R17	B-1
C4	G-1	R18	B-1
C6	A-1	R19	N-3
C7	K-1	R20	M-2
C8	O-2	R21	L-2
C9	I-2	R22	G-3
C10	F-2	R23	M-3
C11	E-2	R24	N-4
C12	B-2	R25	L-4
C13	B-3	R26	K-4
C14	M-4	R27	K-4
C15	H-4	R28	I-4
C16	F-4	R29	D-3
C17	E-4	R30	D-3
C18	C-3	R32	B-3
C19	E-5	R33	M-5
C20	B-4	R34	C-5
C21	B-4	R35	N-6
C22	M-5	R36	M-6
C23	C-5	R37	N-6
C24	C-5	R38	B-7
C25	F-6	R39	L-8
C26	N-7	R40	M-9
C28	J-9	R41	D-4
C29	I-8	R42	E-4
C30	G-8	T1	K-5
C31	F-8	T2	D-7
C32	F-8	U1	J-2
C33	C-7	U2	H-2
C36	M-1	U3	F-2
C37	M-7	VR1	M-2
C38	B-5	VR2	C-2
C39	B-4	VR3	D-4
CR1	L-2		
CR2	N-4		
CR3	N-4		
CR4	L-4		
CR5	H-4		
CR6	H-5		
CR7	I-6		
CR8	H-6		
CR10	D-4		
CR11	B-5		
F1	C-8		
J2	A-3		
J3	A-7		
L1	C-2		
L2	E-4		
L4	D-5		
L5	K-7		
Q1	N-2		
Q2	N-1		
Q3	N-2		
Q4	M-2		
Q5	L-2		
Q6	C-1		
Q7	O-4		
Q8	N-5		
Q9	M-5		
R1	M-1		
R2	N-2		
R3	K-1		
R4	J-1		
R5	J-1		
R6	J-1		
R7	I-1		
R8	I-1		
R9	I-1		
R10	I-1		
R11	G-1		
R13	F-1		

**CSCS13**  
RADIO SHACK  
MODEL 4 GATE ARRAY



# CSCS13

RADIO SHACK  
MODEL 4 GATE ARRAY

CONTRAST  
VR305

BRIGHTNESS  
VR304

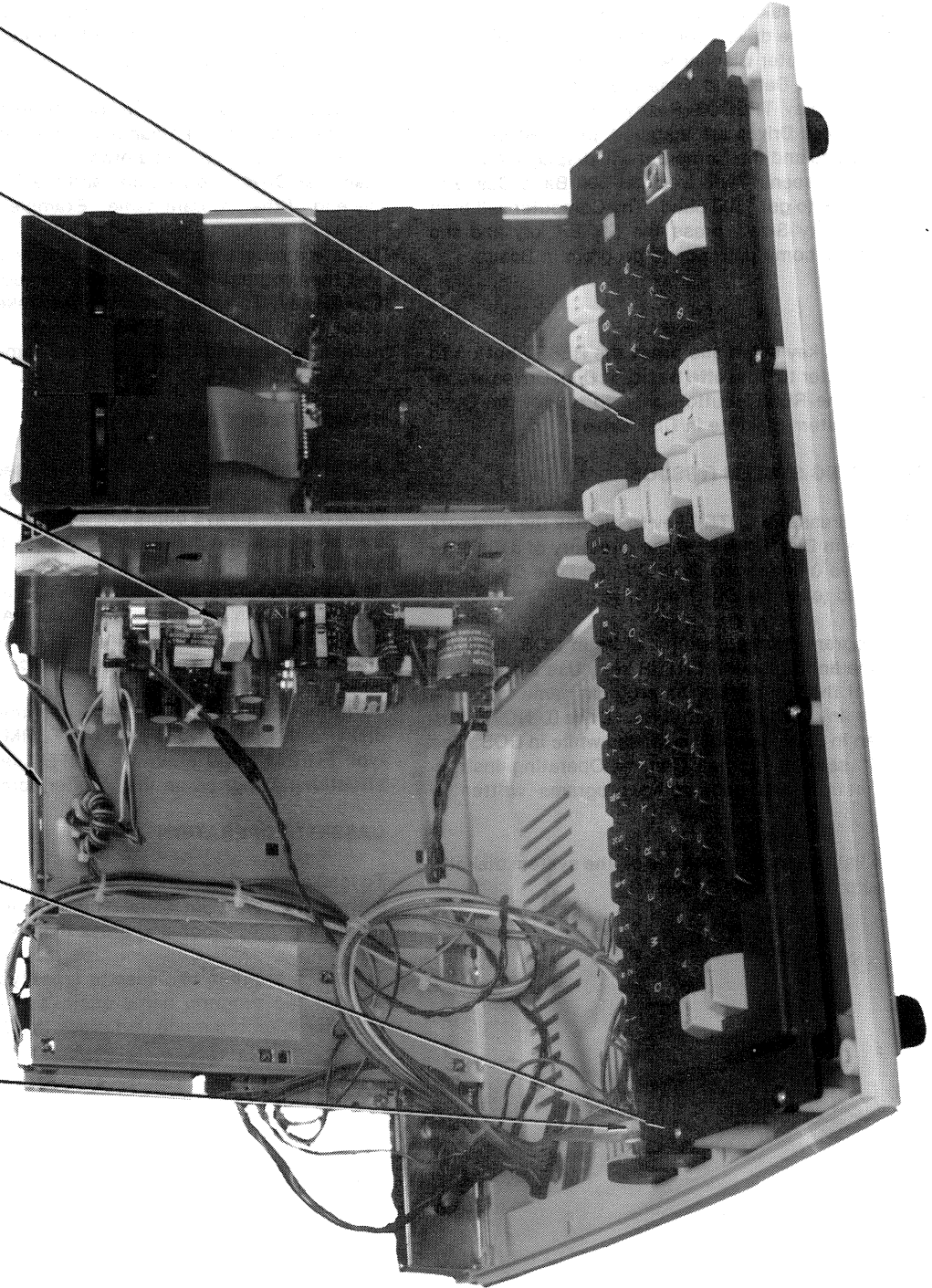
SYSTEM  
BOARD

POWER  
SUPPLY  
BOARD

DISK  
DRIVE  
BOARD

DISK  
DRIVE  
BOARD

KEYBOARD



CHASSIS-TOP VIEW

# GENERAL OPERATING INSTRUCTIONS

## POWER UP SEQUENCE

1. Turn On all peripherals.
2. With no diskettes in the Disk Drives, turn On the Computer.
3. Insert a TRS-80 Disk Operating System diskette in Disk Drive 0. Close the drive door and press the RESET button. The Computer display will ask for the Date and Time. After the Date and Time are entered, the Computer will display TRSDOS Ready on Monitor screen. Note: If no Disk Drives are installed, press BREAK and RESET buttons and the Computer will display CASS? on the Monitor screen. Type L to get 500 Baud Cassette operation or H to get 1500 Baud. The Computer will then ask for Memory Size?, press the ENTER key and the Computer will come up ready to program in Basic.

## RESET

Hold the BREAK key down and press the RESET button to reset the Computer to Cassette Basic. If Disk Drives are installed, press the RESET button only, to reboot the Computer from a system diskette in Disk Drive 0.

## DISK OPERATING SYSTEM (TRSDOS)

Type DIR and press the ENTER key to display the directory of the diskette in Disk Drive 0. If the directory of a diskette other than Drive 0 is desired, type DIR: and the Disk Drive number desired (example DIR:1 for Drive 1).

To load a program from a diskette while in DOS, type the program name and press the ENTER key. Use a colon and the number of the Drive after the program name to load a program from any Disk Drive other than Drive 0. NOTE: Programs written in Basic cannot be loaded while in DOS. See the "BASIC" section of the "General Operating Instructions" for instructions on loading programs written in Basic.

To display a list of special programs on the system diskette type LIB and press the ENTER key.

## BASIC

To load Disk Basic into the Computer, boot up on DOS, put a diskette in Drive 0 with Disk Basic on it, type BASIC and press the ENTER key. To go from Disk Basic back to DOS, type SYSTEM and press the ENTER key.

To display the directory of the diskette in Disk Drive 0 type SYSTEM "DIR" and press the ENTER key. For Disk Drive 1 type SYSTEM "DIR:1" and press the ENTER key.

To load a program from a diskette in Disk Drive 0, type LOAD and the program name enclosed in quotes and press the ENTER key. To load a program from a Disk Drive other than Disk Drive 0 add a colon and the Disk Drive number at the end of the program name. Example LOAD "SAMS:1"

To save a program to a diskette in Disk Drive 0, type SAVE and the program name enclosed in quotes and press the ENTER key. To save a program to a diskette in a Disk Drive other than Disk Drive 0, add a colon and the Disk Drive number at the end of the program name. Example SAVE "SAMS:1".

## USING A BLANK DISKETTE

A blank diskette must be either formatted or have the DOS copied to it before it can be used to save data. NOTE: Disk Drive 0 must always contain a diskette with DOS on it. A formatted diskette may be used in Disk Drives 1, 2, or 3.

To copy DOS on a diskette, load DOS into the Computer, put a diskette in Disk Drive 0 with the BACKUP program on it, type BACKUP and press the ENTER key. Follow the instructions displayed on the Monitor screen.

To format a diskette, load DOS into the Computer, put a diskette in Disk Drive 0 with the FORMAT program on it, type FORMAT and press the ENTER key. Follow the instructions displayed on the Monitor screen.

## CASSETTE OPERATION

To load a program from Cassette tape, type CLOAD (with or without the program name enclosed in quotes), put the recorder in play mode and press the ENTER key.

To save a program to Cassette tape, type CSAVE (with or without the program name enclosed in quotes), put the recorder in record mode and press the ENTER key.



## MISCELLANEOUS ADJUSTMENTS

### SPINDLE SPEED ADJUSTMENT

Insert a blank diskette into the Disk Drive and close the door. Turn the Disk Drive on its side so the pattern wheel on the flywheel is visible. Adjust the Speed Control (R7) until the 60Hz pattern appears to stand still under a 60Hz fluorescent light. If 50Hz fluorescent lighting is used, use the 50Hz pattern on the pattern wheel.

If a Disk Drive Tester is being used, which provides a read-out of the speed in rpm, adjust (R7) for a speed of 300rpm  $\pm$  5rpm.

## DISASSEMBLY INSTRUCTIONS

### CABINET REMOVAL

Place Computer on its side. Remove ten screws from cabinet bottom. Carefully place Computer in upright position. Remove one remaining screw from rear of cabinet. Very carefully remove CRT and cabinet top, lifting straight up and setting it aside to the left (if facing CRT). Be careful not to exceed the length of the video cable.

### BOARD REMOVAL

Remove six screws holding metal shield over System board at rear of Computer. Remove shield from System board. Remove eight screws holding System board to chassis. Disconnect Connectors J2, J3 thru J7, J8, J9, and J11 on System board and remove board from chassis.

### POWER SUPPLY BOARD REMOVAL

Disconnect connectors from power supply board. Remove four screws holding main Power Supply board to chassis.

### DISK DRIVES REMOVAL

**TOP DISK DRIVE:** Disconnect ribbon cable from rear of Disk Drive board. Remove four screws, two on each side holding Drive assembly to chassis. Disconnect Connector J1 from Power Supply board. Disk Drive may now be removed.

**BOTTOM DISK DRIVE:** Disconnect ribbon cable from rear of Disk Drive board. Remove Power Supply board. Remove four screws, two on each side holding Drive assembly to chassis. Disconnect Connector P1. Disk Drive may now be removed out the front of chassis.

### MONITOR BOARD REMOVAL

Disconnect CRT socket, HV anode lead, Deflection Yoke leads, and ground lead. Remove four screws holding Monitor board to side of cabinet top.

To remove CRT, remove four nuts holding CRT to cabinet front. Note: Make sure to hold on to CRT while removing nuts to avoid breaking CRT.

## LINE DEFINITIONS

A0 THRU A15	ADDRESS
BD0 THRU BD7	BAUD DATA BITS 0 THRU 7
BUSDIR	BUS DIRECTION
BUSEN	BUS ENABLE
BUSY	PRINTER BUSY
CAS	COLUMN ADDRESS STROBE
CASS MOTON	CASSETTE MOTOR ON
CASSDATIN1,3	CASSETTE DATA IN
CASSIN	CASSETTE IN
CASSOUT	CASSETTE OUT
CD	CARRIER DETECT
CL166	INHIBITS DATA IN SERIAL REGISTER
CRTCLK	CRT CONTROLLER CLOCK
CTS	CLEAR TO SEND
D0 THRU D7	DATA
CLK	DOT CLOCK, REFERENCE TIMING CLOCK
DIRE	STEPPER MOTOR DIRECTION, EXTERNAL DRIVE
DIRI	STEPPER MOTOR DIRECTION, INTERNAL DRIVE
DISBEN	DISPLAY ENABLE
DISKIN	DISK DATA INCOMING
DISKOUT	DISK DATA OUTGOING
DISKOUT	DISK OUT
DISWAIT	DISABLE WAIT
DLYVWR	DELAYED VIDEO WRITE
DOT	DOTS
DP0 THRU DP7	DATA PROCESSOR BITS 0 THRU 7
DRVSEL	DRIVE SELECT
DS0 THRU DS3	DRIVE SELECT 0 THRU 3
DSR	DATA SET READY
DTR	DATA TERMINAL READY
ENALTSET	ENABLE ALTERNATE CHARACTER SET
ENEXTIO	ENABLE EXTERNAL I/O
ENGRAF	ENABLE GRAPHIC
FAST	REAL TIME CLOCK DOUBLED
FAULT	PRINTER IN FAULT STATE
GEN	GRAPHICS ENABLE
GRAVID	GRAPHICS VIDEO
GSEL0	GRAPHIC SELECT 0
GSEL1	GRAPHIC SELECT 1
HSYNC	HORIZONTAL SYNC
IN	DECODE PORT INPUT SIGNALS
INT	INTERRUPT
INVIDE	INVERSE VIDEO CHARACTER
IOREQ	INPUT/OUTPUT REQUEST
IPE	INDEX PULSE, EXTERNAL DRIVE
IPI	INDEX PULSE, INTERNAL DRIVE
KYBD	KEYBOARD
LPIN	LINE PRINTER IN
LPOUT	LINE PRINTER OUT
LPRQ	LINE PRINTER REQUEST
M1	MACHINE CYCLE 1
MA0 THRU MA10	REFRESH MEMORY ADDRESS
MODESEL	OPERATING MODE SELECT
MOTONE	MOTOR ON, EXTERNAL DISK
MOTONI	MOTOR ON, INTERNAL DISK
MRD	MEMORY READ
MREQ	MEMORY REQUEST
MUX	MULTIPLEXER

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MWR ..... MEMORY WRITE
NMI ..... NON MASKABLE INTERRUPT
OUT ... CRT CONTROLLER ENABLE AND READ/WRITE
OUT PAPER ..... PRINTER OUT OF PAPER
PCLK ..... PROCESSOR CLOCK
PD0 THRU PD7 ..... PRINTER DATA, BITS 0 THRU 7
PWAIT ..... PROCESSOR WAIT
RA0 THRU RA3 ..... ROW ADDRESS, CHARACTER
                                GENERATOR
RAMBUSDIR ..... RAM BUS DIRECTION
RAMBUSEN ..... RAM BUS ENABLE
RAS0 ..... ROW ADDRESS STROBE 0
RAS1 ..... ROW ADDRESS STROBE 1
RD ..... READ
RD0 THRU RD7 ..... RAM DATA BITS 0 THRU 7
RDE ..... READ, EXTERNAL DISK
RDI ..... READ, INTERNAL DISK
RDINTSTATUS ..... READ INTERRUPT STATUS
RDNMISTATUS ... READ NONMASKABLE INTERRUPT
                                STATUS
RESET ..... RESET
RFSH ..... REFRESH SIGNAL
RMA0 THRU RMA7 ..... RAM MEMORY ADDRESS BITS 0
                                THRU 7
ROMA ..... READ ONLY MEMORY A ENABLE
ROMB ..... READ ONLY MEMORY B ENABLE
ROMC ..... READ ONLY MEMORY C ENABLE
RS232CLK ..... RS232 CLOCK
RS232IN ..... RS232 IN
RS232OUT ..... RS232 OUT
SEN ..... SOUND ENABLE
TD ..... TRANSMIT DATA
TRKOE ..... TRACK 0, EXTERNAL DISK
TRKOI ..... TRACK 0, INTERNAL DISK
UNIT SEL ..... UNIT SELECT
VBUFEN ..... VIDEO BUFFER ENABLE
VD0 THRU VD7 ..... VIDEO DATA BITS 0 THRU 7
VIDCHIP ..... CRT CONTROLLER CHIP SELECT
VIDEO ..... VIDEO
VLATCH ..... VIDEO LATCH
VRAMDIS ..... VIDEO RAM DISABLE
VSYNC ..... VERTICAL SYNC
WAIT ..... WAIT, I/O OR MEMORY NOT READY
WGI ..... WRITE GATE, INTERNAL DRIVE
WPRTE ..... WRITE PROTECT EXTERNAL DISK
WPRTI ..... WRITE PROTECT INTERNAL DISK
WR ..... WRITE
WRINTMASKREG WRITE INTERRUPT MASK REGISTER
WRNMIMASKREG WRITE NONMASKABLE INTERRUPT
                                MASK REGISTER
XA0 THRU XA7 ..... I/O ADDRESS
XADR7 ..... TIMING SYNCHRONIZATION
XD0 THRU XD7 ..... I/O DATA
XINT ..... I/O INTERRUPT
XM1 ..... I/O MACHINE CYCLE 1
XRESET ..... I/O RESET
64/80 ..... LIGHT PEN STROBE

```

## 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. Periodically examine the AC power cord for damaged or cracked insulation.
10. The computer system cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
11. 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.
12. 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.
13. 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.
14. Do not allow anything to rest on AC power cord.
15. Unplug AC power cord from outlet before cleaning computer system.
16. 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.

## SCHEMATIC NOTES

—\*— Circuitry not used in some versions

--- Circuitry used in some versions

⊙ See parts list

⊕ Ground

⏏ Chassis

▽ Common tie point

Waveforms and voltages taken from ground, unless noted otherwise.

Voltages, Waveforms and Logic probe readings taken with Computer turned On, no keys pressed, unless otherwise noted.

Voltages, Waveforms and Logic Probe readings for Disk Drives and ICs U58, U75, U76, U77, U78, U79, U93, U94, U95, U96, U97 and U98 on System Board taken while running the following Basic program.

10 OPEN "O",1, "SAMS"

20 FOR X= 1 TO 300

30 PRINT #1, "THIS IS A TEST"

40 NEXT X

50 CLOSE 1

60 GOTO 10

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

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

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

Supply voltages maintained as shown at input.

Voltages measured with digital meter, no signal.

Controls adjusted for normal operation.

Terminal identification may not be found on unit.

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

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

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

Value in ( ) used in some versions.

Measurements with switching as shown, unless noted.

CSCS13  
RADIO SHACK  
MODEL 4 GATE ARRAY

2 PARTS LIST AND DESCRIPTION

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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
CR1 thru CR8 Q2 Q3 U1 U2, U3 U4 U5	SYSTEM BOARD 1N4148 MPS3906 PN2222 Z80A SN74LS244N SCM93008P 8040542		NTE519	ECG519	SK3100/519	103-131	
			NTE159 NTE123AP	ECG159 ECG123AP	SK3466/159 SK3854/123AP	121-Z9003 121-Z9000A	
			NTE3880 NTE74LS244	ECG3880 ECG74LS244	SK2880/3880 SK74LS244	HE-443-881 HE-443-791	
			NTE74LS11 NTE74LS27	ECG74LS11 ECG74LS27	SK74LS11 SK74LS27	HE-443-864 HE-443-800	
			NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
U11 U12 U13 U14, 15 U16	SN74LS11JDS SN74LS27N 8040541 SN74LS74AN SC80756P SN74LS157N SN74LS283N SAME AS U12 HM6116LP-4		NTE74LS157 NTE74LS283	ECG74LS157 ECG74LS283	SK74LS157	HE-443-799 HE-443-855	
			NTE2128	ECG2128			
			NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
			NTE74LS02 NTE74LS86	ECG74LS02 ECG74LS86	SK74LS02 SK74LS86	HE-443-779 HE-443-891	
			NTE834 NTE778A NTE7416	ECG834 ECG778A ECG7416	SK3569/834 SK3465/778A SK7416	221-121 221-Z9034 HE-443-73	
U22 U23 U26 U27 U28	LM339N MC1458CP1 SN7416N MC74F04N SN74LS245N		NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	

PARTS LIST AND DESCRIPTION (Continued)

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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
U29	SQM93007P 74S32N 74S112N SN74LS04N SN74LS273N		NTE74LS32	ECG74LS32	SK74LS32	HE-443-875	
U30			NTE74S112	ECG74S112	SK74S112		
U31			NTE74LS04	ECG74LS04	SK74LS04	HE-443-755	
U32			NTE74LS273	ECG74LS273	SK74LS273	HE-443-805	
U33							
U34	SN74LS174N SN74LS244N SN74LS373N SN74LS74AN 74F08PC		NTE74LS174	ECG74LS174	SK74LS174	HE-443-879	
U35			NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U36			NTE74LS373	ECG74LS373	SK74LS373	HE-443-867	
U37			NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
U39							
U40	SN7416N SN74LS14N SN74S64N SN74LS138J 74F08PC		NTE7416	ECG7416	SK7416	HE-443-73	
U41			NTE74LS14	ECG74LS14	SK74LS14	HE-443-872	
U42			NTE74S64	ECG74S64			
U43, 44			NTE74LS138	ECG74LS138	SK74LS138	HE-443-877	
U45							
U46	74LS32PC SN74LS74AN SN74LS00N SN7416N SN74LS367AJ		NTE74LS32	ECG74LS32	SK74LS32	HE-443-875	
U47			NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
U48			NTE74LS00	ECG74LS00	SK74LS00	HE-443-728	
U49			NTE7416	ECG7416	SK7416	HE-443-73	
U50			NTE74LS367	ECG74LS367	SK74LS367	HE-443-857	
U51	SN74LS74AN SN74LS244N SN74LS174N MC1741CP1 HCF4502BE		NTE74LS74A	ECG74LS74A	SK74LS74A	HE-443-730	
U52			NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U53			NTE74LS174	ECG74LS174	SK74LS174	HE-443-879	
U54			NTE941M	ECG941M	SK3552/941M	HE-442-22	
U55, 56			NTE4502B	ECG4502B	SK4502B		
U57	SN74LS21NDS SN74LS00N SN74LS138J 74LS32PC SN74LS04N SN74LS00N		NTE74LS21	ECG74LS21		HE-443-728	
U58			NTE74LS00	ECG74LS00	SK74LS00	HE-443-877	
U59			NTE74LS138	ECG74LS138	SK74LS138	HE-443-875	
U60			NTE74LS32	ECG74LS32	SK74LS32	HE-443-755	
U61			NTE74LS04	ECG74LS04	SK74LS04	HE-443-728	
U62			NTE74LS00	ECG74LS00	SK74LS00		



## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
U63	SN74LS123N		NTE74LS123	ECG74LS123	SK74LS123	HE-443-942	(1)
U64	AY-5-8116						
U65,66	SN74LS157N		NTE74LS157	ECG74LS157	SK74LS157	HE-443-799	
U67 thru U74							
U75	WD1773PH-00						(1)
U76	VC2070						
	(8040544)						
U77,78	SN74LS245N		NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U79	SN74LS174N		NTE74LS174	ECG74LS174	SK74LS174	HE-443-879	(1)
U81	MC1488P		NTE75188	ECG75188	SK5188/75188	HE-443-794	
U82	VC2071						
	(8040545)						
U83	SN74LS244N		NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	(1)
U84	TR1865-PL						
U85 thru U92	8040665						
U93,94	SN7416N		NTE7416	ECG7416	SK7416	HE-443-73	(1)
U95	SN74LS157N		NTE74LS157	ECG74LS157	SK74LS157	HE-443-799	
U96	7416NA		NTE7416	ECG7416	SK7416	HE-443-73	
U97	SN74LS367AJ		NTE74LS367	ECG74LS367	SK74LS367	HE-443-857	
U98	SN74LS123N		NTE74LS123	ECG74LS123	SK74LS123	HE-443-942	(1)
U99,100	MC1489P		NTE75189	ECG75189	SK5189/75189	HE-443-795	
U101	SN74LS245N		NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U102	SN74LS244N		NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
U103	SN74LS367AJ		NTE74LS367	ECG74LS367	SK74LS367	HE-443-857	(1)
U104	SN7416N		NTE7416	ECG7416	SK7416	HE-443-73	
U105	SN74LS02N		NTE74LS02	ECG74LS02	SK74LS02	HE-443-779	
U106	SN74LS245N		NTE74LS245	ECG74LS245	SK74LS245	HE-443-885	
U107	SN74LS374N		NTE74LS374	ECG74LS374	SK74LS374	HE-443-863	(1)
U108	SN74LS244N		NTE74LS244	ECG74LS244	SK74LS244	HE-443-791	
VRI			NTE1917	ECG1917	SK9219/1917	HE-442-665	

(1) Used in some versions.

## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA				NOTES	
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.		
BR1 CR1 CR2,3 CR4 CR5	<b>POWER SUPPLY</b>		NTE169	ECG169	SK3678/169	212-Z9001		
			NTE519	ECG519	SK3100/519	103-131		
			NTE116	ECG116	SK3311	212-76-02		
			NTE552	ECG552	SK9000/552	103-287		
			NTE552	ECG552	SK9000/552	103-287		
CR6 CR7 CR8	MUR810 1N4934 MUR810		NTE116	ECG116	SK3311	212-76-02		
			NTE189	ECG189	SK3200/189	121-Z9053		
			NTE159	ECG159	SK3466/159	121-Z9003		
Q1	MPSA55 MPSU01A MPSU51A		NTE188	ECG188	SK3199/188	121-Z9036		
			NTE189	ECG189	SK3200/189	121-Z9053		
			NTE188	ECG188	SK3199/188	121-Z9036		
Q2 Q3 Q4 Q5 Q6	2N6394		NTE550	ECG550	SK6650/550			
			NTE379	ECG379	SK9085/379	121-Z9111		
			NTE159	ECG159	SK3466/159	121-Z9003		
Q7 Q8 Q9	MJE13006 MPSA55 MPSA05		NTE194	ECG194	SK3275/194	121-881		
			NTE3041	ECG3041	SK2041/3041			
			NTE5084A	ECG5084A	SK30V/5084A	103-Z9024		
U1 U2	MC34060P 4N35		NTE136A	ECG136A	SK5V6/136A	103-Z9007		
			NTE967	ECG967	SK3673/967	HE-442-675		
U3 VR1 VR2 VR3	TL431 1N5256B 1N5232B MC7912CT							

**CSCS13**

**RADIO SHACK  
MODEL 4 GATE ARRAY**

PARTS LIST AND DESCRIPTION (Continued)

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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
ALTERNATE POWER SUPPLY NO. 8790043 (ASTEC AA12090)							
D1	RG10B		NTE552	ECG552	SK9000/552	103-287	(5)
D2	RG10J		NTE552	ECG552	SK9000/552	103-287	
D3	RG10M		NTE558	ECG558	SK3998/558		
D4	RG15B		NTE580	ECG580	SK5036/580	103-316-04	
D5	1N4506		NTE177	ECG177	SK9091/177	103-131	
D6 thru			NTE580	ECG580	SK5036/580	103-316-04	
D8							
D9	RG10B		NTE552	ECG552	SK9000/552	103-287	
D10, 11	1N4506		NTE177	ECG177	SK9091/177	103-131	
D12	1N4001GP		NTE116	ECG116	SK3311	212-76-02	
D13			NTE116	ECG116	SK3311	212-76-02	
DB1	KBP10		NTE170	ECG170	SK3649/170	212-Z9002	
IC1							
SCR1							
Q1	SD467						
Q2	2SC1358		NTE238	ECG165	SK3710/238	121-Z9001	
Q3	SB561						
Q4	TL431CLP						
Z1	5.6V		NTE136A	ECG136A	SK5V6/136A	103-Z9007	

(5) Use existing hardware.

## PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
ALTERNATE POWER SUPPLY NO. 8790021 (ASTEC AA11320)							
D1	RG10A		NTE552	ECG552	SK5014	103-287	(5)
D2	RG10D		NTE552	ECG552	SK5014	103-287	
D3	RG10J		NTE552	ECG552	SK9000/552	103-287	
D4 thru D6	RG3B		NTE580	ECG580	SK5036/580	103-316-04	
D7	RG15B		NTE580	ECG580	SK5036/580	103-316-04	
D8 thru D10	1N4606		NTE177	ECG177	SK9091/177	103-131	
D11	1N4001		NTE116	ECG116	SK3311	212-76-02	
DB1	W06		NTE5305	ECG5305	SK3676/5305	212-Z9002	
IC1	0100 TL431CLP						
Q1	2SC120-O		NTE289A	ECG289A	SK3849/293	921-1114	
Q2	PE8050B		NTE293*	ECG293*	SK3849/293*	121-Z9066*	
	2SC2502		NTE379	ECG379	SK9085/379	121-Z9111	
Q3	2SA950Y		NTE290A	ECG290A	SK3841/294	121-Z9003*	
SCR1	PE8550B		NTE294*	ECG294*	SK3841/294*	121-Z9067*	
	2N6395		NTE5552	ECG5552	SK3574		
	C122F		NTE5461	ECG5461	SK9290/5461		
Z1	6B1		NTE137A	ECG137A	SK6V2/137A	103-Z9008	
	5.6V		NTE136A	ECG136A	SK5V6/136A	103-Z9007	

\* Lead configuration may vary from original.

(5) Use existing hardware.

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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.
<b>POWER SUPPLY</b>		
C4	.47 50V 10%	8394474

ITEM No.	RATING	MFGR. PART No.
<b>SYSTEM BOARD</b>		
C3	10 20V 20%	8336102

### CAPACITORS

ITEM No.	RATING	MFGR. PART No.
<b>POWER SUPPLY</b>		
C28	.0047 125VAC 20%	8393106
	.01 250VAC	8393106 (1)
C30	.0047 125VAC 20%	8303475
C31	.0047 125VAC 20%	8303475
C32	.22 250VAC 20%	
	.1 250VAC	8394106 (1)
<b>ALTERNATE POWER SUPPLY NO. 8790021 (ASTEC AA11320)</b>		
C1	.0022 250V AC	
C3	.0022 250V AC	
C20	.0039 400V AC	
C21	.1 250V AC	

ITEM No.	RATING	MFGR. PART No.
<b>ALTERNATE POWER SUPPLY NO. 8790043 (ASTEC AA12090)</b>		
C1	.01 20% 250V AC	068-10300010-220
C2	.1 20% 250V AC	068-10400010-220
C3	.0047 20% 400V AC	055-47220001-189
C4	.0047 20% 400V AC	055-47220001-189
C13	.01 20% 250V AC	068-10300010-220
<b>SYSTEM BOARD</b>		
C2	33pF 50V NPO	8300335
C16	68pF 50V 5% NPO	8300683
C17	68pF 50V 5% NPO	8300683
C18	68pF 50V 5% NPO	8300683
C20	22pF 50V NPO	8300224
C133	22pF 50V NPO	8300224
C134	22pF 50V NPO	8300224

(1) Used in some versions.

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
<b>POWER SUPPLY</b>				
R3	28K 1% 1/4W Metal Film	8200328		
R16	3320 1% 1/4W Metal Film			
	3310 1% 1/4W	8200232 (1)		
R29	28K 1% 1/4W	8200328 (1)		
R30	6650 1% 1/4W Metal Film	8200266		
R38	11 Cold NTC Thermistor	8298016		
R40	82 10% 5W Wire Wound		5W082	
<b>ALTERNATE POWER SUPPLY NO. 8790021 (ASTEC AA11320)</b>				
R21,22	2700 2% Metal Film			
R25	2 5% Fusible			
<b>ALTERNATE POWER SUPPLY NO. 8790043 (ASTEC AA12090)</b>				
R1,R2	4 10% Thermistor	258-4097		
		0015-152		
R24	4700 2% 1/4W Metal Film	247-4701	QW247	
		5022-189		
R25	22K 2% 1/4W Metal Film	247-2202	QW322	
		5022-189		
R26	2700 1% 1/4W Metal Film	247-2701		
		4022-189		
<b>SYSTEM BOARD</b>				
RP1	Resistor Network	8290182		
RP2	Resistor Network	8290012		
RP3	Resistor Network	8290013		
RP4	Resistor Network	8290012		
RP6	Resistor Network	8290027		



## PARTS LIST AND DESCRIPTION (Continued)

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

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

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
<b>POWER SUPPLY</b>				
R15	5V Adjust	1000	8275211	

### COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
<b>POWER SUPPLY</b>				
LC	Line Choke			
L1	Choke	8419006		
L2	Choke	8419008		
L4	Choke	8419008		
L5	Choke	8419009		
T1	Power Transformer	8790046		
T2	Line Choke	8790045		
<b>ALTERNATE POWER SUPPLY NO. 8790021 (ASTEC AA11320)</b>				
L1	Line Choke			
L2	Choke			
L3	Choke 1.5mH			
L4	Choke			
L5	Choke			
L6	Choke			
T1	Regulator			
T2	Power			
<b>ALTERNATE POWER SUPPLY NO. 8790043 (ASTEC AA12090)</b>				
L1	Choke	024-00000110-484		
L2	Choke	124-00000110-484		
L3	Choke 2.2uH	328-00100030-124		
L4	Choke 1.5mH	328-00100010-124		
L5	Choke	852-20100180-264		
L6	Choke	852-20100180-264		
L7	Filter Choke	852-10100370-264		
T1	Line Filter	852-20200120-264		
T2	Power	852-10201340-000		
T3	Control	852-10201510-000		

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### FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
POWER SUPPLY				
F1	3A @ 250V Fast Acting	8479104		

PARTS LIST AND DESCRIPTION (Continued)

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

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
KEYBOARD			
SW2	Switch		Reset
SW3	Switch		Keyboard
Thru			
SW71	Keyboard	8790524	Complete Assembly
	POWER SUPPLY		
SW1	Switch	8489030	Power
POWER SUPPLY			
FB1	Ferrite Bead	8419013	
Thru			
FB22			
K1	Relay	8429105	Cassette
L1	Ferrite Bead	8419013	
U80	Delay Line	8429020	
Y1	Crystal	8409031	20.2752MHz
Y2	Crystal	8409038	16MHz
	PC Board	8709523	System, Model 4 Gate Array Version
	Cabinet Feet	8590098	RUSSELL Industries Replacement REC-2197S (4 required)

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

ITEM	PART No.	ITEM	PART No.
Cabinet Top	8719104	Keyboard Bezel	8719164
Cabinet Bottom	8719265	Knob, Thumbwheel	8719112

WIRING DATA

Shielded Hook-up Wire .....	Use BELDEN No. 8401 or 8421 (Single-Conductor)
	8208 (Two-Conductor)
General-use Unshielded Hook-up Wire .....	Use BELDEN No. 8529 (Solid) Available in 13 Colors
	8522 (Stranded) Available in 13 Colors

## 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.

Equipment Name	B & K Precision Equipment No.	Sencore Equipment No.
OSCILLOSCOPE	1570A,1590A,1596	SC61
LOGIC PROBE	DP51	
LOGIC PULSER	DP101	
DIGITAL VOM	2830	DVM37,DVM56,SC61
ANALOG VOM	277	
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57
FREQUENCY COUNTER	1803,1805	FC71,SC61
COLOR BAR GENERATOR	1211A,1248,1251,1260	CG25,VA62
RGB GENERATOR	1260	
FUNCTION GENERATOR	3020	
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44	HP200
TEMPERATURE PROBE	TP-28	
CRT ANALYZER	467,470	CR70

## TROUBLESHOOTING

### POWER SUPPLY

NOTE: Use an isolation transformer when servicing the power supply. Disconnect Connector J2 to avoid possible damage to the Computer from high voltages that may be produced while servicing the power supply.

Check Fuse F1. If F1 is open check for shorts at Bridge Rectifier (BR1). Check for a possible shorted Amp Transistor (Q7). If F1 is good apply 120V AC power and check for 120V AC across Capacitor C92. If 120V AC is missing check Line Choke (T2) and Resistor R38, Power Switch (SW1) and check Connector J3 for good connections. If 120V AC is present at Capacitor C92, check for 163V at the cathode of BR1 (use emitter of Transistor Q9 as reference). If 163V is missing, check Bridge Rectifier (BR1). If 163V is present, check waveforms at base of Switch Transistor (Q8), Amp Transistors (Q1 and Q2) and pins 5 and 9 of Oscillator/Switch IC (U1) to determine if power supply is oscillating. If power supply is not oscillating check voltages and components associated with Transistors Q1 thru Q5, Q8, Q9 and IC U1. Check for possible open windings of Power Transformer (T1). Check Diodes VR1 and CR1.

If power supply is oscillating, check source voltages at Connector J2 (12V at pins 2 and 5, - 12V at pin 4 and 5V at pin 10). If the 5V is not regulated check voltages and components associated with Regulator SCR (Q6). Check Zener Diode VR2 and check Transformer T1 for possible open windings. If the 12V source at pin 2 of J2 is missing check Diode CR8 and Coil L4. If the 12V source at pin 5 of J2 is missing, check Diode CR6 and Coil L2. Also check Electrolytics C23 and C18. If the 5V source is missing, check Diode CR5, Coil L1 and Electrolytics C10 and C11. If the - 12V source is missing check Diode CR7, and Electrolytics C19. Check Regulator IC (VR3).

### MICROPROCESSOR (CPU) OPERATION

Check operation of the CPU reset (pin 26 of U1) with a logic probe while turning On Computer or while pressing the Reset Switch (RL1). The logic reading should be logic Low for about .1 second then go logic High and stay High. If the logic reading is correct when turning On the Computer but not correct when pressing the Reset, check the Reset Switch (RL1), Capacitors C22 and C25, and Resistor R61. If the logic reading is not correct when turning On Computer or when pressing the Reset, check Resistor R66, Capacitor C70 and check ICs U41 and U63 by substitution.

If the CPU Reset pin is operating properly, check the 4.05504MHz clock waveform at pin 6 of IC U1. If the clock waveform is missing refer to the "Clock and Divider" section of this Troubleshooting guide.

If the clock waveform is present check pins 17, 24 and 25 of IC U1 for problems that could keep the CPU IC (U1) from operating properly. Pins 17, 24 and 25 should measure a logic High.

Check the logic readings on the address pins (pins 1 thru 5 and 30 thru 40 of IC U1) and data pins (pins 7 thru 10 and 12 thru 15 of IC U1) while holding the RESET button down. All the pins should read a logic open. If any of the pins read logic High or Low, check, by substitution, the IC's connected to the pin with the bad logic reading.

Check for a High logic reading on pins 19 thru 23 of IC U1 while holding the RESET button down. If any of the logic readings are not correct check IC U1 by substitution.

Check for pulses on Data pins (pins 7 thru 10 and 12 thru 15 of IC U1) immediately after turning On the Computer. If pulses appear then suddenly stop, check for problems at ROM IC's (U4 and U29) and RAM IC's (U85 thru U92).

## TROUBLESHOOTING (Continued)

### CLOCK AND DIVIDERS

Check for a clock frequency of 20.2752MHz at pin 1 of Timing IC (U9). If clock is off frequency or is not working, check Capacitors C2, C20, Resistor R14, Crystal Y1 and IC U9.

Check waveforms around IC U9. If waveforms are not correct or missing check IC U9.

### KEYBOARD

If the Keyboard is dead check the ribbon cable going from the Keyboard to the System board for open circuits and check the Keyboard Connectors for good connections. If the Keyboard cable checks good, check for pulses at pin 7 of Address Decoder IC (U5). If pulses are missing check IC U5 by substitution.

If one group of Keys do not work check Input Buffer (IC's U26 and U40) and Output Buffer IC's U55 and U56 that are connected to the Keys that do not work. Also check the Keyboard cable for open circuits and Keyboard Connectors for good connections.

If one Key does not work, check the Key contacts with an ohmmeter. If a Key is erratic in operation, clean the contacts of the Key.

If a wrong character is displayed on the Monitor screen when a Key is pressed, check the Video RAM IC (U16), see the "Video" section of this Troubleshooting guide and check Character Generator ROM IC (U19) by substitution.

### VIDEO

No video. Check Connector J8 on the System board and Connector P300 on the Video Monitor board for a good connection.

Check video waveform at pin 19 of Video Array IC (U17) on the System board. If waveform is present, check voltages and components associated with IC U20 on the System board and Transistors Q101, Q102 and Q103 on the Monitor board and check the CRT. If the waveform is missing at pin 19 of U17, check waveforms at pins 15 and 17 of IC U17. Check for pulses at pins 1 thru 3 and pins 26 thru 39 of IC U17. If the waveforms and pulses are good on IC U17, check IC U17 by substitution.

Check the waveforms at pins 18 and 35 thru 38 of CRT Controller IC U11. If waveforms are missing check IC U11 by substitution. If the wrong character appears on the Monitor screen when a key is pressed, check Adder IC (U13) and Character Generator ROM IC (U19) and Video RAM IC (U16) by substitution.

### VIDEO SYNC

If there is no vertical sync, check waveform at pin 40 of CRT Controller IC (U11). If waveform is present, check voltages and components associated with Vertical Amp/Output IC (IC201) on the Monitor board. If waveform is missing on pin 40 of IC U11, check IC U11 by substitution.

If there is no horizontal sync, check waveform at pin 39 of IC U11. If waveform is present, check the voltages and components associated with Horizontal Amp Transistors (Q301, Q302) and Horizontal Amp/Driver IC (IC301) on the Monitor board. If the waveform is missing on pin 39 of IC U11, check IC U11 by substitution.

### CASSETTE

Cassette motor is not being turned On. Type in and run the following Basic program.

```
10 OUT 236,2: OUT 236,0: GOTO 10
```

While the program is running, check for pulses at pins 9 and 12 of Flip/Flop IC (U53). If pulses are missing at pin 9 of IC U53, check Decoder IC (U43) by substitution. If pulses are present at pin 9 and missing at pin 12 of IC U53, check IC U53 by substitution. If pulses are present at pin 12 of IC U53 check Switch Transistor (Q3) and Cassette Relay (K1).

Cassette motor will not turn Off. Check Relay K1 for sticking contacts.

Computer will not save programs to tape. Type in and run the following Basic program:

```
10 CSAVE "$": GOTO 10
```

While the program is running, check for pulses at pins 3, 9 and 11 of Flip/Flop IC (U51). If pulses are missing check Decoder IC (U43) by substitution. If pulses are present at pins 3 and 11 of IC U51 but missing on pin 9 of IC U51, check IC U51 by substitution.

Computer will not load programs from tape at 500 baud speed. Inject a 2V cassette I/O peak to peak 1kHz square wave at pin 4 of Cassette I/O (J9) and check the waveform (see Figure 11) at pin 6 of IC U54. If waveform is missing check voltages and components associated with pin 2, 3, and 6 of IC U54. If waveform is good check for waveform at pin 6 of IC U22 (see Figure 12). If waveform is missing check voltages and components associated with pins 1, 2, and 3 of IC U23. If waveform is good check the waveform on pin 3 of Flip/Flop IC (U47) (see Figure 13). If waveform is missing check voltages and components associated with pins 1, 6, and 7 of IC U22 and pins 12 and 13 of IC U49. If waveform is good type in and run the following Basic program:

```
10 OUT 255,3: X = INP(255): GOTO 10
```

While the program is running (do not disconnect the 1kHz signal), check for pulses on pin 5 of IC U47 (see Figure 14). If pulses are missing check Flip/Flop IC (U47) and check for pulses on pin 4 of IC U47. If pulses are missing check Decoder IC (U43).

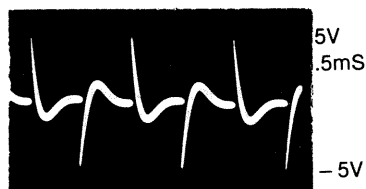


Figure 11



Figure 12

## TROUBLESHOOTING (Continued)

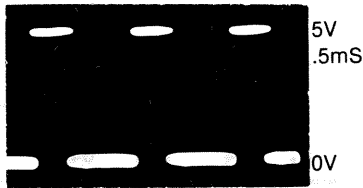


Figure 13

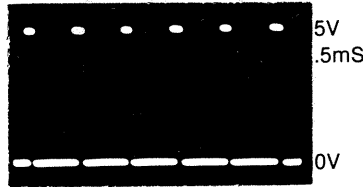


Figure 14

Computer will not load programs from tape at 1500 baud speed. Inject a 2V peak to peak 10kHz square wave at pin 4 of Cassette I/O (J9). Check for pulses at pin 11 of Flip/Flop IC (U37). If pulses are missing check voltages and components associated with pins 8, 9, and 14 of IC U22 and pins 8 and 9 of IC U49. If pulses are present type CLOAD. Check for pulses on pin 6 of IC U37. If pulses are missing check IC U37 and check for pulses on pin 1 of IC U37. If pulses are missing check Decoder IC (U59).

### LINE PRINTER PORT

To check operation of Printer Data Latch IC (U107) type in and run the following Basic program. Note: Do not connect a Printer to the printer port.

```
10 OUT 248,255: OUT 248,0: GOTO 10
```

Check for pulses at pin 1 of IC U107, if pulses are missing check Decoder IC (U43). Check for pulses on pins 2, 5, 6, 9, 12, 15, 16, 19 of IC U107, if pulses are missing check IC U107 by substitution.

To check the operation of the Printer Status Buffer IC (U108) type in and run the following Basic program. Note: Do not connect a Printer to the printer port.

```
10 X = INP(248)
20 PRINT "X = "; X
30 FOR T = 1 TO 200: NEXT T
40 GOTO 10
```

While the program is running, check for pulses at pin 1 of IC U108. If pulses are missing check IC's U62 and U61. If pulses are present on pin 1 of IC U108, connect a jumper from ground to the pin of IC U108 given in the chart below and note the value of X that appears on the Monitor screen. Note: Connect only one pin of IC U108 to ground at a time. Check to see if the number X is the same as given in the chart below. If any of the numbers are not correct check IC U108 by substitution.

U108 PIN #	VALUE OF X
2	254
4	251
6	239
8	191
11	127
13	223
15	247
17	253

### SERIAL PORT (RS-232)

To check the Serial port connect a 5V 5000Hz square wave from the TTL output of a function generator to pin 3 of RS232 Connector (J3). Type in and run the following Basic program.

```
10 OUT 233,85: X = INP(233): OUT 232,255
20 OUT 234,255: OUT 234,0: X = INP(234)
30 OUT 235,0: X = INP(235)
40 OUT 244,0: X = INP(224)
50 X = INP(232): PRINT "X = "; X
60 FOR T = 1 TO 50: NEXT T
70 GOTO 10
```

While the program is running check for pulses at pin 14 of RS232 Support IC (U82), if pulses are missing check IC U100. Check for pulses at pins 18, 20, 21, 22, 23, and 25 of IC U84. If pulses are missing check IC U84 by substitution. Check for pulses on pins 4, 5, 6, 7, 8, 9, 10, 13, 14 and 16 of IC U82. If pulses are missing check IC U82 by substitution.

Check for 4800Hz pulses at pins 3 & 17 of IC U64. If pulses are missing or the frequency is not correct check IC U64. NOTE: The above program sets the baud rate to 300 baud. To change the baud rate, change the number 85 in line 10 to the number given under the NUMBER column for the desired baud rate in the following chart. The frequency at pin 3 of IC U64 should change to the frequency given in the chart for the baud rate used.

BAUD RATE	NUMBER	FREQUENCY U64 Pins 3 & 17
600	102	9600Hz
1200	119	19.2kHz
2400	170	38.4kHz
4800	204	76.8kHz
9600	238	153.6kHz

To check the RS-232 input lines (pins 3, 5, 6, 8, and 22) of Connector J3, remove the 5000Hz signal. Use the following chart and connect 5V to the pin given for the ICs and observe the number X that appears on the Monitor screen. If the number is not the same as the number given in the chart check IC U100. NOTE: Connect only one pin at a time to 5V.

CONNECT 5V TO	X =
U100, pin 13	254
U100, pin 1	127
U100, pin 10	191
U100, pin 4	223
U99, pin 13	239

# LOGIC CHART

PIN NO.	IC U1	PIN NO.	IC U1	PIN NO.	IC U2	PIN NO.	IC U3	PIN NO.	IC U4	PIN NO.	IC U4	
1	P	21	P	1	L	1	L	1	P	21	P	
2	P	22	P	2	P	2	P	2	P	22	P	
3	P	23	H	3	P	3	P	3	P	23	P	
4	P	24	P	4	P	4	P	4	P	24	H	
5	P	25	H	5	P	5	P	5	P			
6	P	26	H	6	P	6	P	6	P			
7	P	27	P	7	P	7	P	7	P			
8	P	28	P	8	P	8	P	8	P			
9	P	29	L	9	P	9	P	9	P			
10	P	30	P	10	L	10	L	10	P			
11	H	31	P	11	P	11	P	11	P			
12	P	32	P	12	P	12	P	12	L			
13	P	33	P	13	P	13	P	13	P			
14	P	34	P	14	P	14	P	14	P			
15	P	35	P	15	P	15	P	15	P			
16	P	36	P	16	P	16	P	16	P			
17	H	37	P	17	P	17	P	17	P			
18	H	38	P	18	P	18	P	18	P			
19	P	39	P	19	L	19	L	19	P			
20	P	40	P	20	H	20	H	20	P			
PIN NO.	IC U5	PIN NO.	IC U5	PIN NO.	IC U6	IC U7	PIN NO.	IC U9	PIN NO.	IC U9	PIN NO.	IC U10
1	P	21	P	1	P	L	1	P	21	P	1	H
2	P	22	P	2	P	H	2	P	22	P	2	P
3	P	23	H	3	P	*	3	P	23	P	3	P
4	P	24	H	4	P	*	4	P	24	H	4	H
5	P	25	L	5	P	*	5	P			5	P
6	P	26	P	6	P	L	6	L			6	P
7	P	27	P	7	L	L	7	H			7	L
8	P	28	H	8	L	P	8	L			8	P
9	P	29	P	9	P	P	9	P			9	P
10	P	30	P	10	P	P	10	H			10	P
11	P	31	P	11	L	P	11	P			11	P
12	P	32	P	12	L	L	12	L			12	L
13	L	33	P	13	P	P	13	P			13	H
14	H	34	L	14	H	H	14	P			14	H
15	L	35	P				15	P				
16	L	36	L				16	P				
17	L	37	P				17	P				
18	L	38	P				18	P				
19	L	39	P				19	P				
20	L	40	H				20	P				



# LOGIC CHART (Continued)

PIN NO.	IC U11	PIN NO.	IC U11	PIN NO.	IC U12	IC U13	IC U14	IC U15	PIN NO.	IC U16	PIN NO.	IC U16
1	L	21	P	1	P	P	P	P	1	P	21	H
2	H	22	P	2	P	P	P	P	2	P	22	P
3	H	23	P	3	P	P	P	P	3	P	23	P
4	P	24	P	4	P	P	P	P	4	P	24	H
5	P	25	P	5	P	P	P	P	5	P		
6	P	26	P	6	P	P	P	P	6	P		
7	P	27	P	7	P	L	P	P	7	P		
8	P	28	P	8	L	L	L	L	8	P		
9	P	29	P	9	P	P	P	H	9	P		
10	P	30	P	10	P	P	P	H	10	P		
11	P	31	P	11	P	P	P	H	11	P		
12	P	32	P	12	P	P	P	P	12	L		
13	P	33	P	13	P	P	P	P	13	P		
14	P	34	L	14	P	P	P	P	14	P		
15	L	35	P	15	L	P	L	L	15	P		
16	L	36	P	16	H	H	H	H	16	P		
17	L	37	P						17	P		
18	P	38	P						18	L		
19	P	39	P						19	P		
20	H	40	P						20	L		

PIN NO.	IC U17	PIN NO.	IC U17	PIN NO.	IC U18	PIN NO.	IC U19	PIN NO.	IC U19	PIN NO.	IC U20	IC U21	IC U22	IC U23
1	P	21	P	1	H	1	P	21	H	1	L	P	H	L
2	P	22	P	2	P	2	P	22	P	2	*	H	L	L
3	P	23	P	3	H	3	P	23	P	3	*	P	H	L
4	P	24	H	4	H	4	P	24	H	4	L	L	*	L
5	P	25	L	5	L	5	P			5	P	P	*	L
6	P	26	P	6	H	6	P			6	H	P	L	L
7	P	27	P	7	L	7	P			7	L	L	L	H
8	P	28	P	8	H	8	P			8	L	H	*	
9	P	29	P	9	L	9	P			9	P	L	*	
10	P	30	P	10	*	10	P			10	P	H	*	
11	P	31	P	11	*	11	P			11	*	P	*	
12	P	32	P	12	*	12	L			12	*	P	L	
13	P	33	P	13	*	13	P			13	L	H	L	
14	P	34	P	14	H	14	P			14	H	H	L	
15	P	35	P			15	P							
16	H	36	P			16	P							
17	P	37	P			17	P							
18	*	38	P			18	L							
19	P	39	P			19	P							
20	L	40	H			20	P							

RADIO SHACK  
MODEL 4 GATE ARRAY

# LOGIC CHART (Continued)

PIN NO.	IC U26	IC U27	IC U28	PIN NO.	IC U29	PIN NO.	IC U29	PIN NO.	IC U30	IC U31	IC U32	IC U33	IC U34	IC U35
1	P	P	P	1	P	21	P	1	L	P	P	H	H	H
2	L	P	P	2	P	22	P	2	P	L	P	L	L	P
3	P	P	P	3	P	23	P	3	P	P	*	P	P	P
4	L	P	P	4	P	24	H	4	P	H	L	P	P	P
5	P	P	P	5	P			5	P	P	*	L	L	P
6	L	P	P	6	P			6	P	P	L	L	P	P
7	L	L	P	7	P			7	L	P	L	P	H	P
8	L	P	P	8	P			8	P	L	L	P	L	P
9	P	P	P	9	P			9	P	P	*	L	H	P
10	L	P	L	10	P			10	L	H	L	L	H	L
11	P	P	P	11	P			11	P	P	*	H	*	P
12	L	P	P	12	L			12	P	L	P	L	H	P
13	P	P	P	13	P			13	P	P	P	P	*	P
14	H	H	P	14	P			14	H	P	H	P	*	P
15			P	15	P			15		P		L	H	P
16			P	16	P			16		H		L	H	P
17			P	17	P			17				P		P
18			P	18	P			18				P		P
19			P	19	P			19				L		H
20			H	20	P			20				H		H
PIN NO.	IC U36	IC U37	IC U39	IC U40	IC U41	IC U42	IC U43	IC U44	IC U45	IC U46	IC U47	IC U48	IC U49	IC U50
1	H	H	*	*	P	H	P	P	P	P	H	*	L	*
2	P	L	*	L	P	P	P	P	H	P	H	*	P	*
3	P	L	H	*	H	P	P	P	P	H	L	L	*	*
4	P	H	*	L	L	P	P	P	P	P	H	*	L	*
5	P	L	*	*	L	P	P	P	H	P	H	*	*	*
6	P	H	H	L	H	H	P	P	P	H	L	L	L	*
7	P	L	L	L	L	L	H	P	L	L	L	L	L	*
8	P	H	P	L	L	P	L	L	P	P	H	L	H	L
9	P	L	H	*	*	P	H	P	P	P	L	H	L	*
10	L	H	P	L	L	P	P	P	H	P	H	H	L	*
11	P	H	P	P	*	P	H	P	P	H	P	H	*	P
12	P	L	P	L	L	P	H	P	P	H	P	L	L	H
13	P	H	P	P	*	H	H	P	P	P	L	H	H	P
14	P	H	H	H	H	H	H	H	H	H	H	H	H	H
15	P						H	H						P
16	P						H	H						H
17	P													
18	P													
19	P													
20	H													

# LOGIC CHART (Continued)

PIN NO.	IC U51	IC U52	IC U53	IC U54	IC U55	IC U56	IC U57	IC U58	IC U59	IC U60	IC U61	IC U62	IC U63	IC U64
1	H	H	H	L	H	*	H	*	P	P	H	H	L	P
2	P	L	L	L	P	*	H	*	P	P	L	L	H	H
3	H	P	P	L	H	H	*	L	P	P	L	H	H	P
4	H	H	P	L	H	H	H	P	L	H	H	L	H	P
5	L	P	H	L	P	P	H	P	P	P	P	P	L	P
6	H	L	P	L	H	*	H	P	P	H	P	H	L	P
7	L	P	L	H	P	*	L	L	H	L	L	L	*	P
8	H	H	H	*	L	L	P	P	L	H	P	P	L	L
9	L	P	P		P	*	H	P	H	H	P	P	L	*
10	H	L	L		H	*	P	P	H	H	H	H	H	*
11	H	L	P		P	*	*	L	P	H	L	L	H	L
12	P	P	P		H	H	H	H	P	H	P	H	H	L
13	H	L	P		H	*	P	H	H	P	P	H	L	P
14	H	P	P		P	P	H	H	H	H	H	H	L	P
15		P	L		H	H			P				*	P
16		P	H		H	H			H				H	P
17		L												P
18		P												P
19		H												
20		H												
PIN NO.	IC U65	IC U66	IC U75	PIN NO.	IC U75	PIN NO.	IC U76	PIN NO.	IC U76	PIN NO.	IC U77	IC U78	IC U79	IC U81
1	P	P	P	21	P	1	P	21	H	1	P	P	H	L
2	P	P	P	22	P	2	P	22	P	2	P	P	H	L
3	P	P	P	23	H	3	H(1)	23	P	3	P	P	P	H
4	P	P	P	24	P	4	L	24	H	4	P	P	P	L
5	P	P	P	25	H	5	P			5	P	P	L	L
6	P	P	P	26	L	6	P			6	P	P	P	H
7	P	P	P	27	P	7	P			7	P	P	L	L
8	L	L	P	28	P	8	P			8	P	P	L	H
9	P	P	P			9	P			9	P	P	P	H
10	P	P	P			10	P			10	L	L	L	L
11	P	P	P			11	P			11	P	P	P	H
12	P	P	P			12	L			12	P	P	L	L
13	P	P	H			13	H			13	P	P	P	L
14	P	P	L			14	P			14	P	P	P	H
15	L	L	H			15	P			15	P	P	H	
16	H	H	L(1)			16	H			16	P	P	H	
17			L(5)			17	P			17	P	P		
18			P			18	P			18	P	P		
19			P			19	P			19	P	L		
20			P			20	L			20	H	H		

RADIO SHACK  
MODEL 4 GATE ARRAY

- (1) Probe indicates P when Head Position Motor is operating.
- (5) Probe indicates H when Head is moving in and L when Head is moving out from center of diskette.

## LOGIC CHART (Continued)

PIN NO.	IC U82	PIN NO.	IC U82	PIN NO.	IC U83	PIN NO.	IC U84	PIN NO.	IC U84	PIN NO.	IC U85	IC U86	IC U87	IC U88
1	P	21	L	1	H	1	H	21	L	1	H	H	H	H
2	P	22	H	2	*	2	*	22	H	2	P	P	P	P
3	P	23	H	3	P	3	L	23	H	3	P	P	P	P
4	H	24	L	4	*	4	H	24	H	4	P	P	P	P
5	H	25	L	5	P	5	*	25	H	5	P	P	P	P
6	H	26	L	5	*	6	*	26	P	6	P	P	P	P
7	L	27	P	7	P	7	*	27	P	7	P	P	P	P
8	L	28	P	8	*	8	*	28	P	8	H	H	H	H
9	L	29	P	9	P	9	*	29	P	9	P	P	P	P
10	L	30	P	10	L	10	*	30	P	10	P	P	P	P
11	*	31	P	11	*	11	*	31	P	11	P	P	P	P
12	L	32	P	12	P	12	*	32	P	12	P	P	P	P
13	H	33	P	13	*	13	L	33	P	13	P	P	P	P
14	H	34	P	14	P	14	L	34	L	14	P	P	P	P
15	H	35	L	15	*	15	L	35	P	15	P	P	P	P
16	H	36	P	16	P	16	L	36	P	16	L	L	L	L
17	L	37	P	17	*	17	P	37	P					
18	H	38	L	18	P	18	H	38	P					
19	L	39	P	19	H	19	L	39	P					
20	H	40	H	20	H	20	H	40	P					

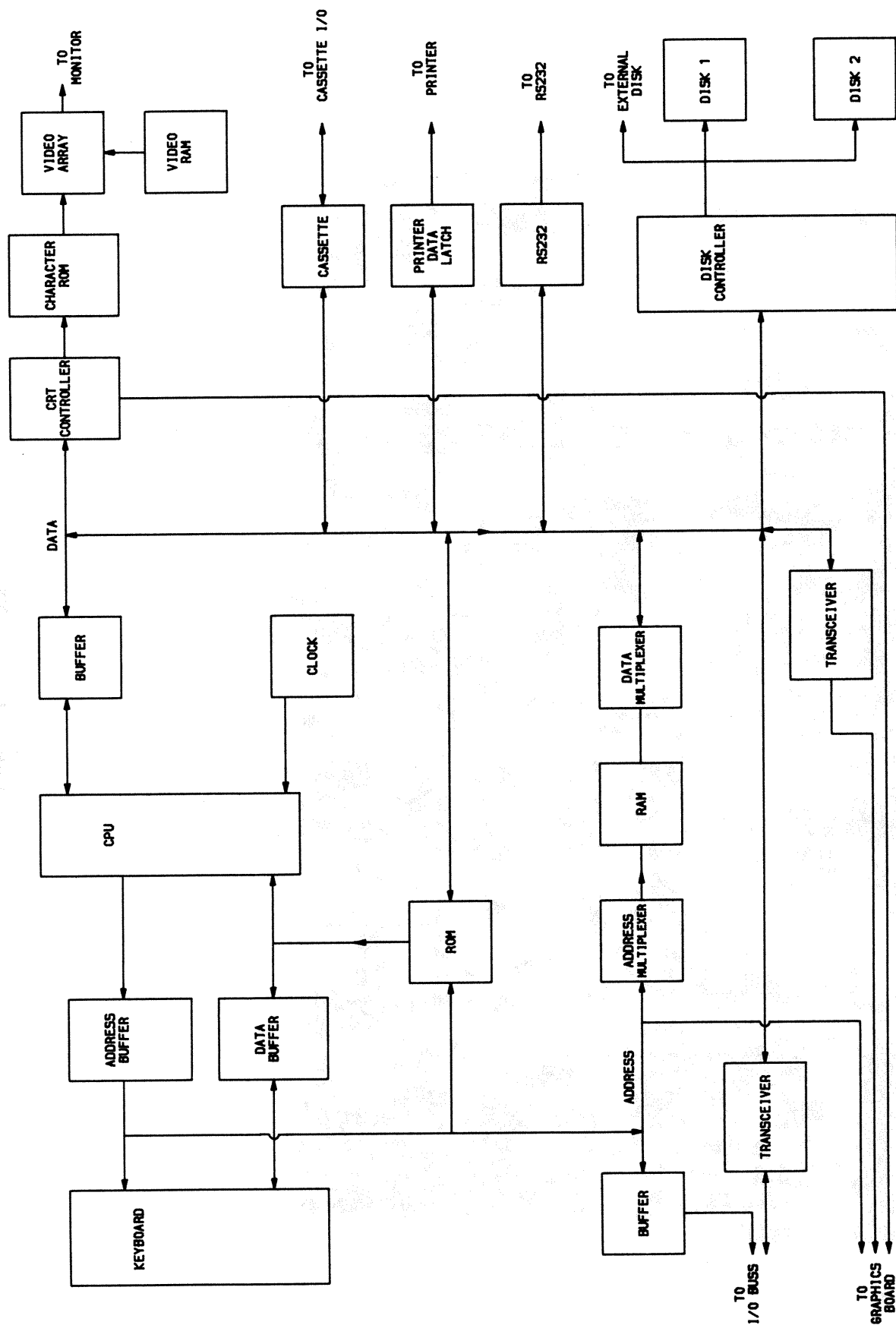
PIN NO.	IC U89	IC U90	IC U91	IC U92	IC U93	IC U94	IC U95	IC U96	IC U97	IC U98	IC U99	IC U100	IC U101	IC U102
1	H	H	H	H	L	P	L	P	L	L	L	L	H	H
2	P	P	P	P	*	P	P	P	L(1)	P	L	L	P	P
3	P	P	P	P	L	L(5)	H	P	L(1)	H	L	H	P	*
4	P	P	P	P	*	*(1)	P	P	L(5)	H	L	L	P	P
5	P	P	P	P	L	L(1)	H	L	L(5)	P	L	L	P	*
6	P	P	P	P	*	H(1)	H	*	P	L	H	H	P	P
7	P	P	P	P	L	L	H	L	P	P	L	L	P	*
8	H	H	H	H	L	*(1)	L	H	L	L	H	H	P	P
9	P	P	P	P	H	L(1)	P	L	H	P	L	L	P	*
10	P	P	P	P	L	H(2)	H	P	*	H	L	L	L	L
11	P	P	P	P	H	L(5)	P	P	*	H	H	H	*	P
12	P	P	P	P	L	P	H	P	*	P	L	L	*	*
13	P	P	P	P	H	P	H	P	*	P	L	L	*	P
14	P	P	P	P	H	H	H	H	*	L	H	H	*	*
15	P	P	P	P			L		*	*			*	P
16	L	L	L	L			H		H	H			*	*
17													*	P
18													*	*
19													H	H
20													H	H

- (1) Probe indicates P when Head Position Motor is operating.
- (2) Probe indicates L when Head is moving in and H when Head is moving out from center of diskette.
- (5) Probe indicates H when Head is moving in and L when Head is moving out from center of diskette.

# LOGIC CHART (Continued)

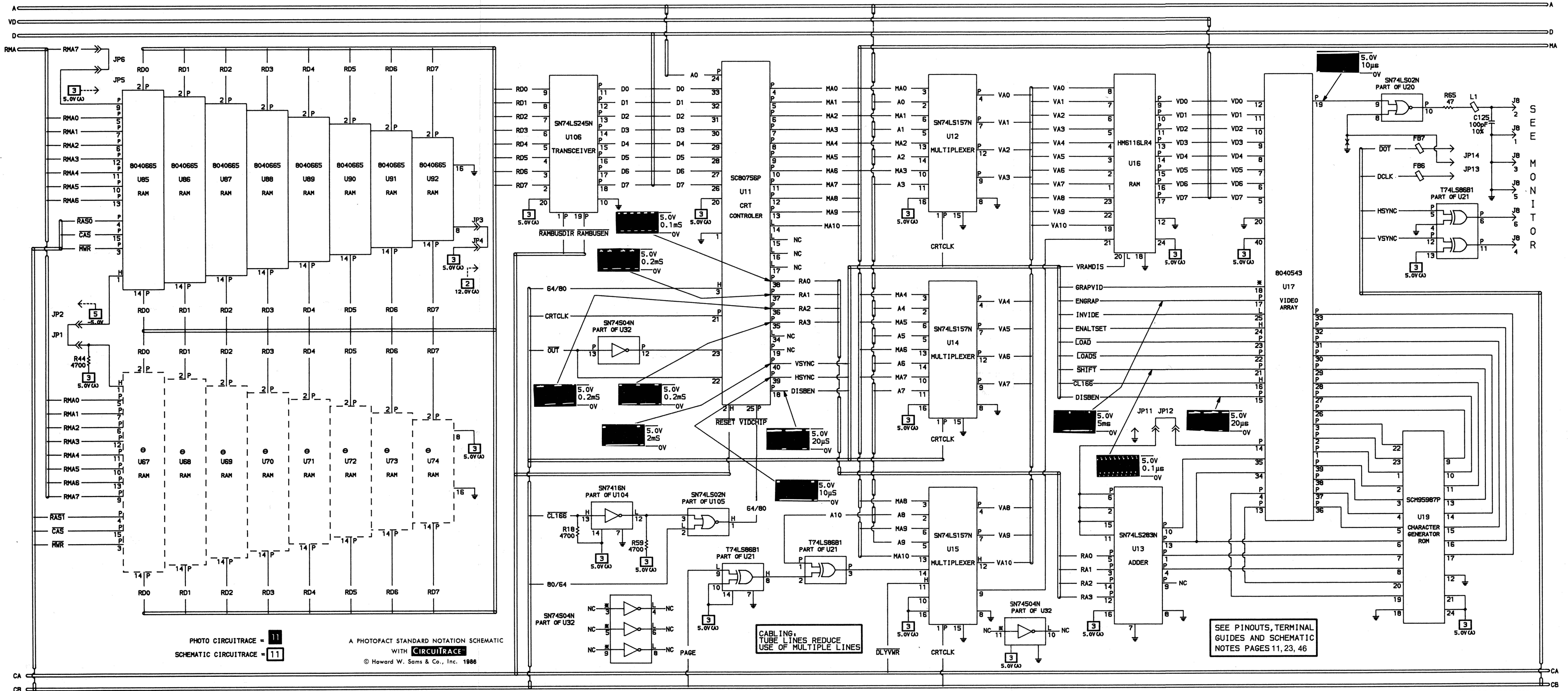
PIN No.	IC U103	IC U104	IC U105	IC U106	IC U107	IC U108
1	H	P	H	P	L	H
2	P	P	L	P	H	*
3	*	L	L	P	P	P
4	P	P	L	P	P	*
5	*	L	H	P	H	P
6	P	H	H	P	H	H
7	*	L	L	P	P	P
8	L	L	L	P	P	*
9	*	H	L	P	H	P
10	P	L	H	L	L	L
11	H	*	*	P	H	*
12	H	L	*	P	H	P
13	H	H	L	P	P	*
14	*	H	H	P	P	P
15	L			P	H	*
16	H			P	H	P
17				P	P	*
18				P	P	P
19				P	H	H
20				H	H	H

RADIO SHACK  
MODEL 4 GATE ARRAY



**BLOCK DIAGRAM**





### KEYBOARD, POWER SUPPLY, SYSTEM BOARD

See Folder CSCS13

### DISK DRIVE

See Folder CSCS13-A

RADIO SHACK  
MODEL 4 GATE ARRAY

CSCS13-B

### INDEX

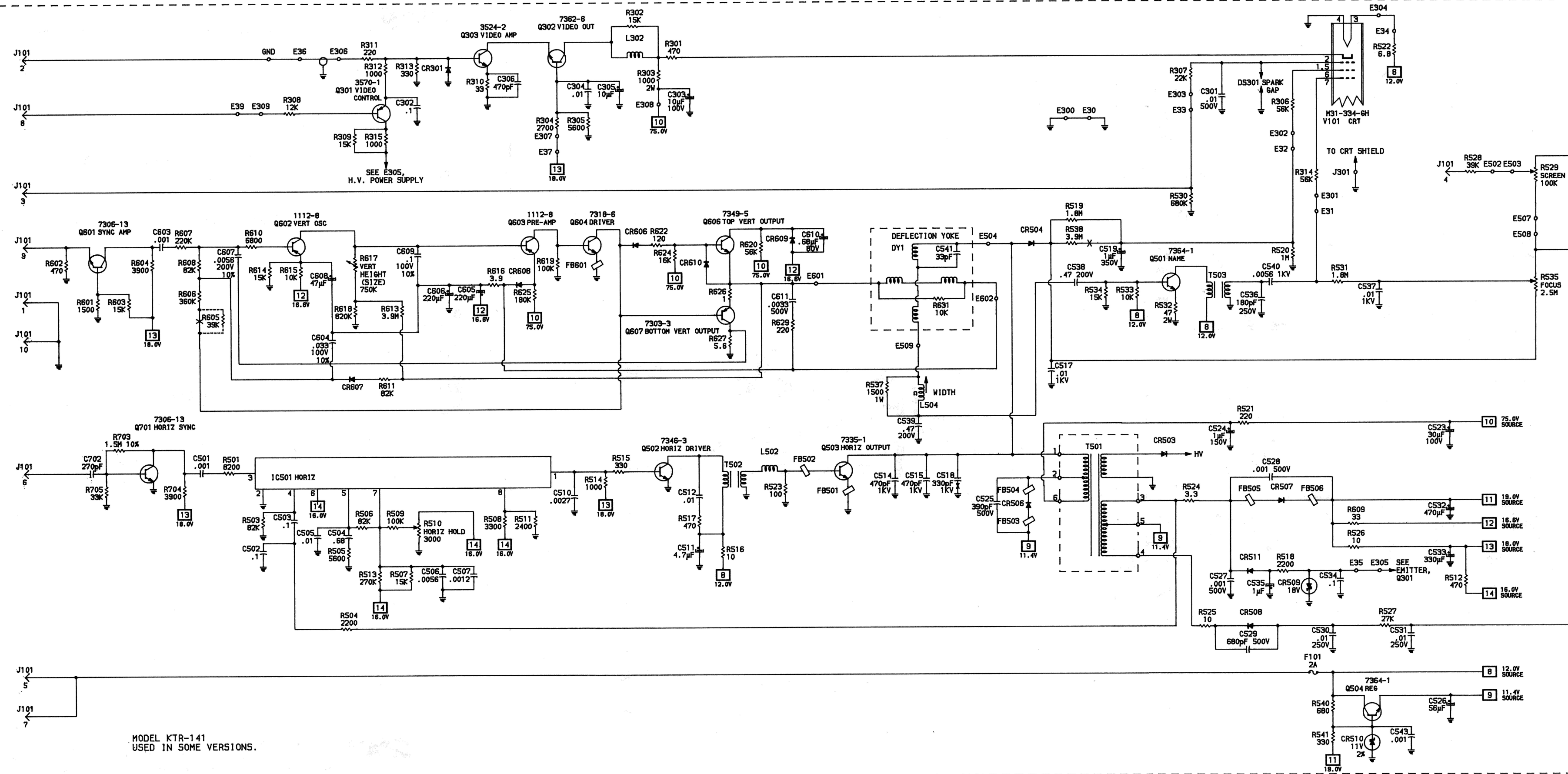
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GridTrace Location Guide		Photos (Continued)	
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IC Pinouts and Terminal Guides	2	Schematics	
Miscellaneous Adjustments	16	Main Board	2,3,4,17 thru 21
Parts List	7 thru 13	Schematic Notes	2
Photos			
CRT Board	6		

CSCS13-B

RADIO SHACK  
MODEL 4 GATE ARRAY

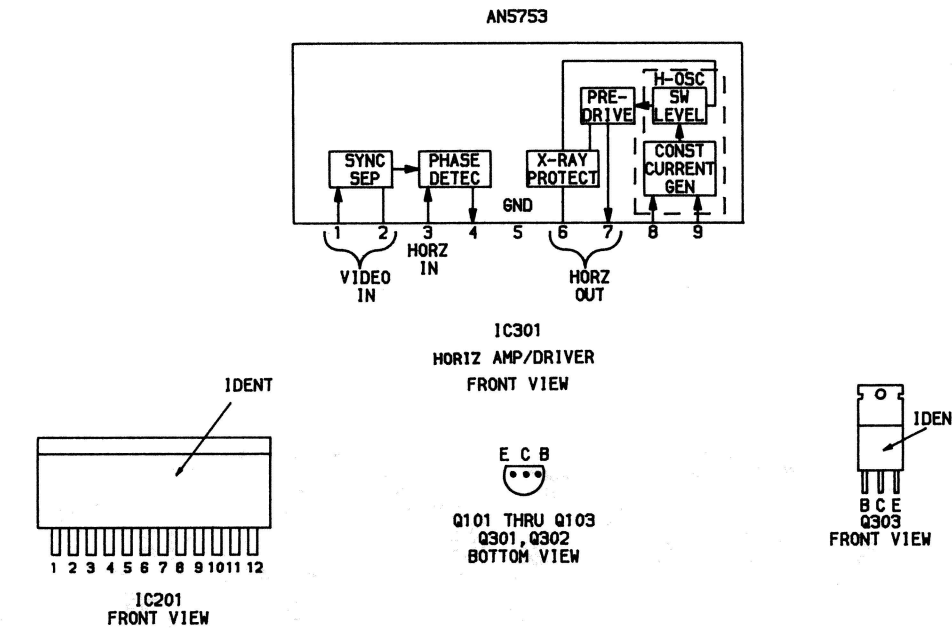
A PHOTOFACT STANDARD NOTATION SCHEMATIC  
WITH **CIRCUITRACE**

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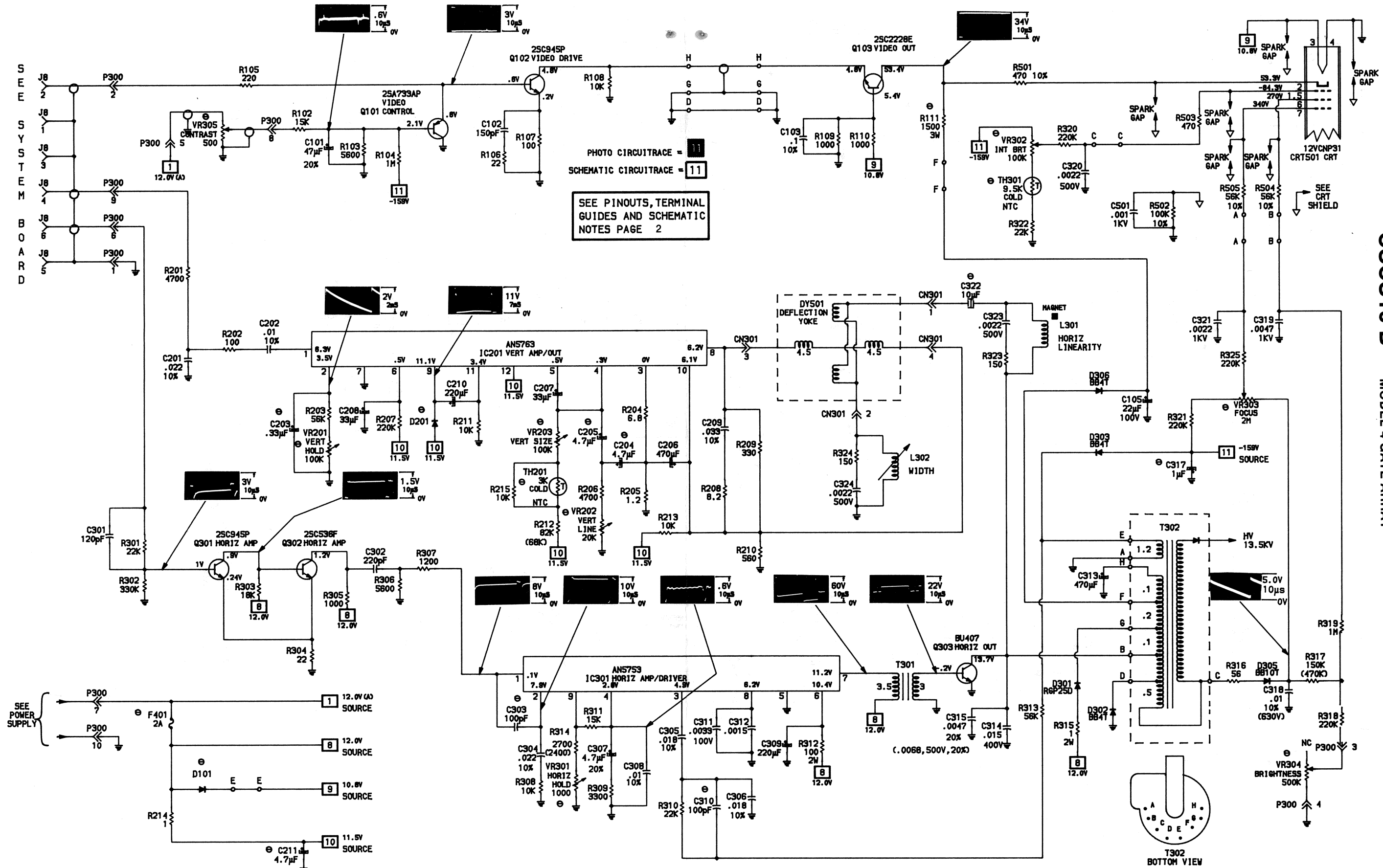
MODEL KTR-141  
USED IN SOME VERSIONS.

## IC PINOUTS & TERMINAL GUIDES



## SCHEMATIC NOTES

- Circuitry not used in some versions
  - - - Circuitry used in some versions
  - See parts list
  - ⊕ Ground
  - ⊞ Chassis
  - ▽ Common tie point
- Waveforms and voltages taken from ground, unless noted otherwise.
- Voltages, Waveforms and Logic probe readings taken with Computer turned On, no keys pressed, unless otherwise noted.
- Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on 0 reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7 cm. width with DC reference voltage given at the bottom line of each waveform.
- Time in  $\mu\text{sec. per cm.}$  given with p-p reading at the end of each waveform.
- Item numbers in rectangles appear in the alignment/adjustment instructions.
- Supply voltages maintained as shown at input.
- Voltages measured with digital meter, no signal.
- Controls adjusted for normal operation.
- Terminal identification may not be found on unit.
- Capacitors are 50 volts or less, 5% unless noted.
- Electrolytic capacitors are 50 volts or less, 20% unless noted.
- Resistors are  $\frac{1}{2}\text{W}$  or less, 5% unless noted.
- Value in ( ) used in some versions.
- Measurements with switching as shown, unless noted.



A PHOTOFAC STANDARD NOTATION SCHEMATIC

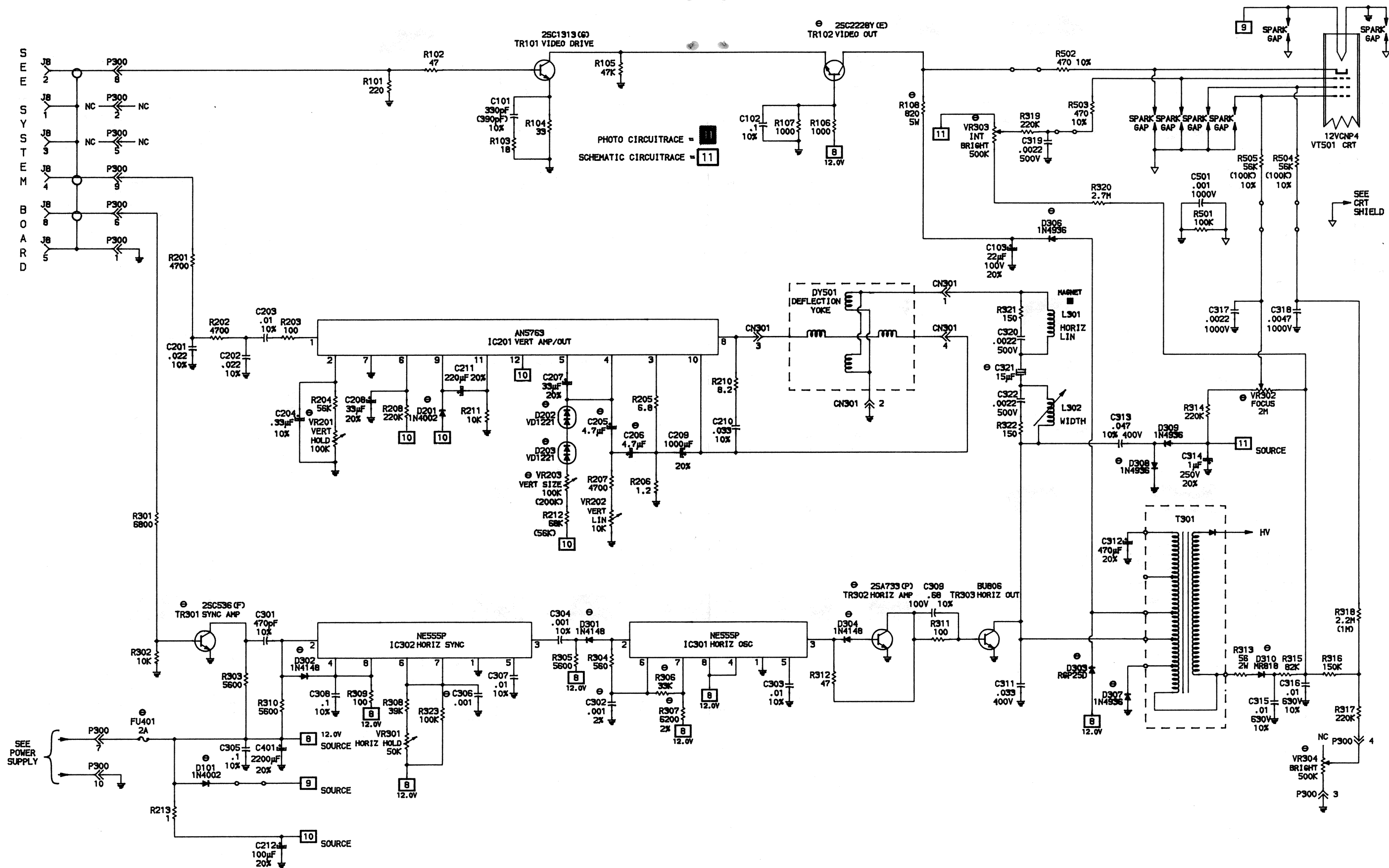
WITH CIRCUITRACE

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MONITOR NO. 8790615

MONITOR NO. 8790615

SEE  
SYSTEM  
BOARD

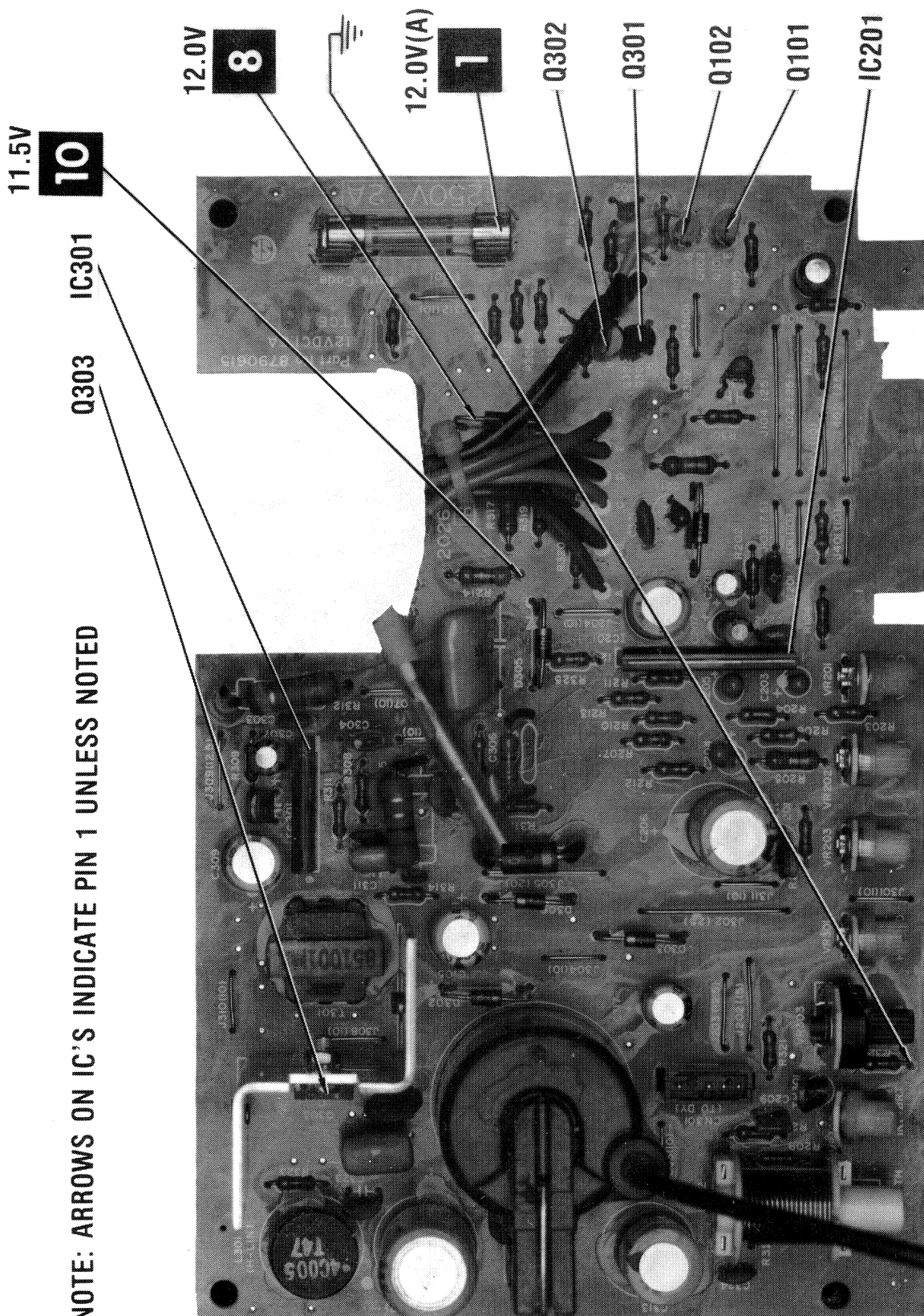


RADIO SHACK  
MODEL 4 GATE ARRAY

A PHOTOFACT STANDARD NOTATION SCHEMATIC  
WITH **CIRCUITRACE**  
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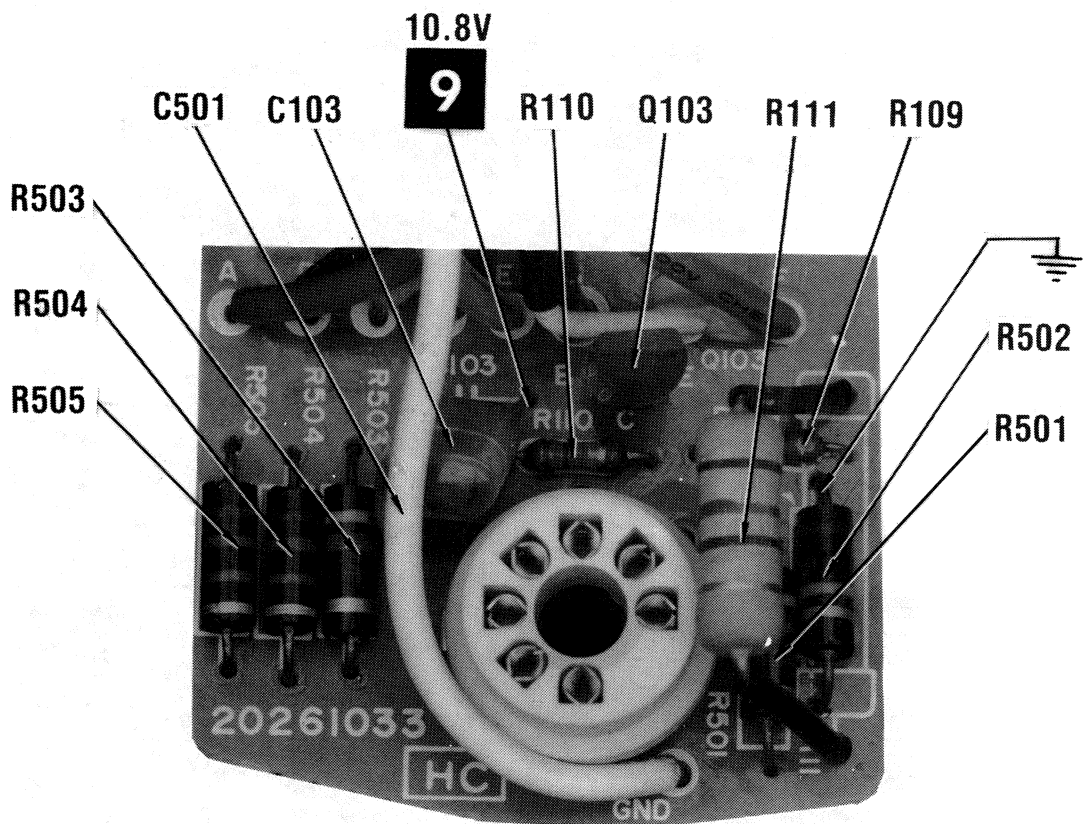
ALTERNATE MONITOR NO. 8790607 (TCE)





# **CSCS13-B** RADIO SHACK MODEL 4 GATE ARRAY





PARTS LIST AND DESCRIPTION

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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
D101, 201 D301 D302, 303 D305 D306	MONITOR NO. 8790615  RGP25D BB4T BB10T BB4T		NTE116 NTE580 NTE552 NTE506 NTE552	ECG116 ECG580 ECG552 ECG506 ECG552	SK3311 SK5036/580 SK9000/552 SK3998/506 SK9000/552	212-76-02 103-316-04 103-287 103-287 103-287	
IC201 IC301 Q101 Q102	AN5763 AN5753 2SA733AP 2SC945P		NTE290A NTE85	ECG1629 ECG290A ECG85	SK3114A/290A SK3124A/289A	121-Z9067* 121-972*	
Q103 Q301 Q302 Q303	2SC2228E 2SC945P (2S)C536F BU407		NTE399 NTE85 NTE85 NTE379	ECG399 ECG85 ECG85 ECG379	SK3866A/31 SK3124A/289A SK3245/199 SK9085/379	121-Z9045* 121-972* 121-972* 121-Z9111	

\* Lead configuration may vary from original.

## ∞ PARTS LIST AND DESCRIPTION (Continued)

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
ALTERNATE MONITOR (RCA KTR-141)							
CR301			NTE177	ECG177	SK9091/177	103-131	
CR504			NTE552	ECG552	SK9000/552	103-287	
CR506			NTE506	ECG506	SK3998/506	103-287	
CR507			NTE552	ECG552	SK9000/552	103-287	
CR508			NTE558	ECG558	SK3998/558		
CR509			NTE5077A	ECG5077A	SK18V/5077A	103-Z9022	
CR510							
CR511			NTE552	ECG552	SK9000/552	103-287	
CR606			NTE177	ECG177	SK9091/177	103-131	
CR607			NTE177	ECG177	SK9091/177	103-131	
CR608			NTE519	ECG519	SK3100/519	103-131	
CR609			NTE519	ECG519	SK3100/519	103-131	
CR610			NTE177	ECG177	SK9091/177	103-131	
IC501							
Q301	3570-1		NTE159	ECG159	SK3466/159	121-Z9003	
Q302	7362-6		NTE171	ECG171	SK3201/171	121-822	
Q303	3524-2		NTE107	ECG107	SK3293/107	121-522*	
Q501	7364-1		NTE196	ECG196	SK3054/196	121-987-03	
Q502	7346-3		NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q503	7335-1		NTE165	ECG165	SK3115/165	121-1029	
Q504	7364-1		NTE196	ECG196	SK3054/196	121-987-03	
Q601	7306-13		NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q602,603	1112-8		NTE159	ECG159	SK3466/159	121-Z9003	
Q604	7318-6		NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q606	7349-5		NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q607	7303-3		NTE159	ECG159	SK3466/159	121-Z9003	
Q701	7306-13		NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	

\* Lead configuration may vary from original.

PARTS LIST AND DESCRIPTION (Continued)

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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFG. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
ALTERNATE MONITOR NO. 8790607 (TCE)							
D101, 201	1N4002	D101, 201 D202, 203 D301, 302	NTE116	ECG116	SK3311	212-76-02	
	10E2		NTE116	ECG116	SK3313/116	212-76-02	
D202, 203	VD1221		NTE605	ECG605A	SK3864/605	103-Z9044	
	VD-1221		NTE605	ECG605A	SK3864/605	103-Z9044	
D301, 302	1N4148		NTE519	ECG519	SK3100/519	103-131	
	1T773N	NTE519	ECG519	SK3100/519	103-131		
D303	RG25D	D303 D304	NTE580	ECG580	SK5036/580	103-316-04	
	MR852		NTE552	ECG552	SK9000/552	103-287	
D304	1N4148		NTE519	ECG519	SK3100/519	103-131	
	1T773N		NTE519	ECG519	SK3100/519	103-131	
D306 thru D309	1N4936		NTE552	ECG552	SK9000/552	103-287	
	BB4	NTE552	ECG552	SK9000/552	103-287		
D310	MR818	D310 IC201 IC301, 302	NTE506	ECG506	SK3998/506	103-287	
	BB10		NTE552	ECG552	SK9000/552	103-287	
IC201	AN5763						
	NE555P						
IC301, 302	MC1455P1		NTE955M	ECG955M	SK3564/955M	221-Z9042	
	M51848P	NTE955M	ECG955M	SK3564/955M	221-Z9042		
TR101	2SC1313(G)	TR101 TR102 TR301 TR302 TR303	NTE199+	ECG199+	SK3245/199+	121-972*	
TR102	2SC2228Y(E)		NTE399	ECG399	SK3866A/31	121-Z9045*	
	2SC1573NC(Q)		NTE399	ECG399	SK9352/399	121-Z9045*	
TR301	2SC536(F)		NTE85	ECG85	SK3245/199	121-972*	
	LC945(P)						
TR302	2SA733(P)	TR302 TR303	NTE290A	ECG290A	SK3114A/290A	121-Z9067	
TR303	LA733(P) BU806		NTE2315	ECG2315			

\* Lead configuration may vary from original.  
+ Rotate 180° to conform with original lead configuration.

8 PARTS LIST AND DESCRIPTION (Continued)

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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
ALTERNATE MONITOR (RCA KTR131B,C)							
CR501,502			NTE177	ECG177	SK9091/177	103-131	
CR504 thru			NTE506	ECG506	SK3998/506	103-287	
CR506			NTE177	ECG177	SK9091/177	103-131	
CR606 thru							
CR610							
Q302		7362-3	NTE171	ECG171	SK3201/171	121-822	
Q501,502		7346-3	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q503		7335-1	NTE165	ECG165	SK3115/165	121-1029	
Q601		7306-8	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q602,603		1112-8	NTE159	ECG159	SK3466/159	121-Z9003	
Q604		7318-2	NTE194	ECG194	SK3479	121-881	
Q606		7349-2	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	
Q607		7303-1	NTE159	ECG159	SK3466/159	121-Z9003	
Q701		7306-7	NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	

PARTS LIST AND DESCRIPTION (Continued)

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

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
MONITOR NO. 8790615		
C203	.33 35V	CSEE J334KZ
C204	4.7 35V	CSEEJ475KZ
C205	4.7 35V	CSEE J475KZ
C211	4.7 20V	CSEEJ475KZ
C317	1 250V 20%	CEACR 105M
C322	10 25V 20% NP	CENCIA04MY

ITEM No.	RATING	MFGR. PART No.
ALTERNATE MONITOR NO. 8790607 (TCE)		
C205, C206	4.7 20% 35V	CS 15E475M
C321	15 20% 25V Non-Polar	

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
MONITOR NO. 8790615		
C303	100pF 5% NPO	
C310	100pF 5% NPO	
ALTERNATE MONITOR NO. 8790607 (TCE)		
C302	.001 2% 50V	CQ09S 1H102G
C306	.001 2% 50V	CQ09S 1H102G

ITEM No.	RATING	MFGR. PART No.
ALTERNATE MONITOR (RCA KTR131B,C)		
# C505	36pF (1)	
# C511	.47 10% 200V	
# C514	470pF 10% 1KV	
# C515	180pF 10% 1KV	
# C516	470pF 10% 1KV	

(1) Part of Deflection Yoke Ass'y.

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
MONITOR NO. 8790615				
R111	1500 5% 3W Metal Oxide	RN03P152J		
	100 5% 2W Metal Oxide	RN02P106J	2W110	22-4072
	1 5% 2W Metal Oxide	RN02P1R0J	2W1D0	
TH201	NTC 3K Cold	SDTH00007		
TH301	NTC 9.5K Cold	SDTH00008		
ALTERNATE MONITOR NO. 8790607 (TCE)				
R108	820 5% 5W Wire Wound	RT5P821J	5W182	
R306	33K 5% 1/2W Carbon Film	RD1/2MZ(S)333G	HW333	22-2257
R307	6200 2% 1/4W Carbon Film	RD1/2MZ(S)622G	HW262	
ALTERNATE MONITOR (RCA KTR131B,C)				
# R517	470 1/2W 5%			
# R519	3.3 1/2W 5% Flame Proof		HW3D3	
# R520	10 1/2W 5% Flame Proof		HW010	
# R522	6.8 1/2W 5% Flame Proof		HW6D8	
# R526	2 2W 5%			
# R527	10 1/2W 5% Flame Proof		HW010	
# R609	33 1/2W 5% Flame Proof		HW033	
# R631	6800 1/2W (1)			
# R632	6800 1/2W (1)			

(1) Part of Deflection Ass'y.

RADIO SHACK  
MODEL 4 GATE ARRAY



## PARTS LIST AND DESCRIPTION (Continued)

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

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

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
<b>MONITOR NO. 8790615</b>				
VR201	Vert Hold	100K	175110130A	
VR202	Vert Lin	20K	176910730A	
VR203	Vert Size	100K	175110100A	
VR301	Horiz Hold	1000	176910710A	
VR302	Int Brt	100K	175110130A	
VR303	Focus	2M	176910730A	
VR304	Brightness	500K	175110050A	
VR305	Contrast	500	176910670A	
<b>ALTERNATE MONITOR NO. 8790607 (TCE)</b>				
VR201	Vert Hold	100K	176910250A	
VR202	Vert Lin	10K	176910220A	
VR203	Vert Size	100K	176910250A	
VR301	Horiz Hold	200K	176910260A	
VR302	Focus	50K		
VR303	Int Bright	2M	176910400A	
VR304	Bright	500K	176910270A	
<b>ALTERNATE MONITOR (RCA KTR131B,C)</b>				
R524	Focus	2.5M		
R612	Vert Hold	200K		
R617	Vert Height (Size)	750K		

(1) On Unit Number

### COILS & TRANSFORMERS (Sweep Circuits)

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
<b>MONITOR NO. 8790615</b>				
DY501	Yoke	581510040A		
L301	Horiz Linearity	143410050A		
L302	Width	143310250A		
T301	Driver	10851001MA		
T302	Horiz Output	10801004YA		
<b>ALTERNATE MONITOR NO. 8790607 (TCE)</b>				
DY501	Yoke			
L301	Horiz Linearity	143410020A		
L302	Width	143310140A		
T301	Horiz Output	10801001YA		
<b>ALTERNATE MONITOR (RCA KTR131B,C)</b>				
# DY1	Yoke			
L301	Peaking (39uH)			
L302	Peaking (22uH)			
L501	Horiz Hold			
L502	Choke			
L504	Width			
# T501	Horiz Output			
T502	Horiz Driver			

# For SAFETY use only equivalent replacement part.

PARTS LIST AND DESCRIPTION (Continued)

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

MISCELLANEOUS

ITEM No.	PART NAME	MFG. PART No.	NOTES
<b>MONITOR NO. 8790615</b>			
CRT501	CRT	12VCNP31	
<b>ALTERNATE MONITOR NO. 8790607 (TCE)</b>			
VT501	CRT	12VCNP4	
<b>ALTERNATE MONITOR (RCA KTR131B,C)</b>			
FB501 thru FB506	Ferrite Bead		
FB601 thru V101	Ferrite Bead CRT	12VCLP4	
<b>ALTERNATE MONITOR (RCA KTR-141)</b>			
FB501 thru FB506	Ferrite Bead		
FB601 thru V101	Ferrite Bead CRT	M31-334-GH	

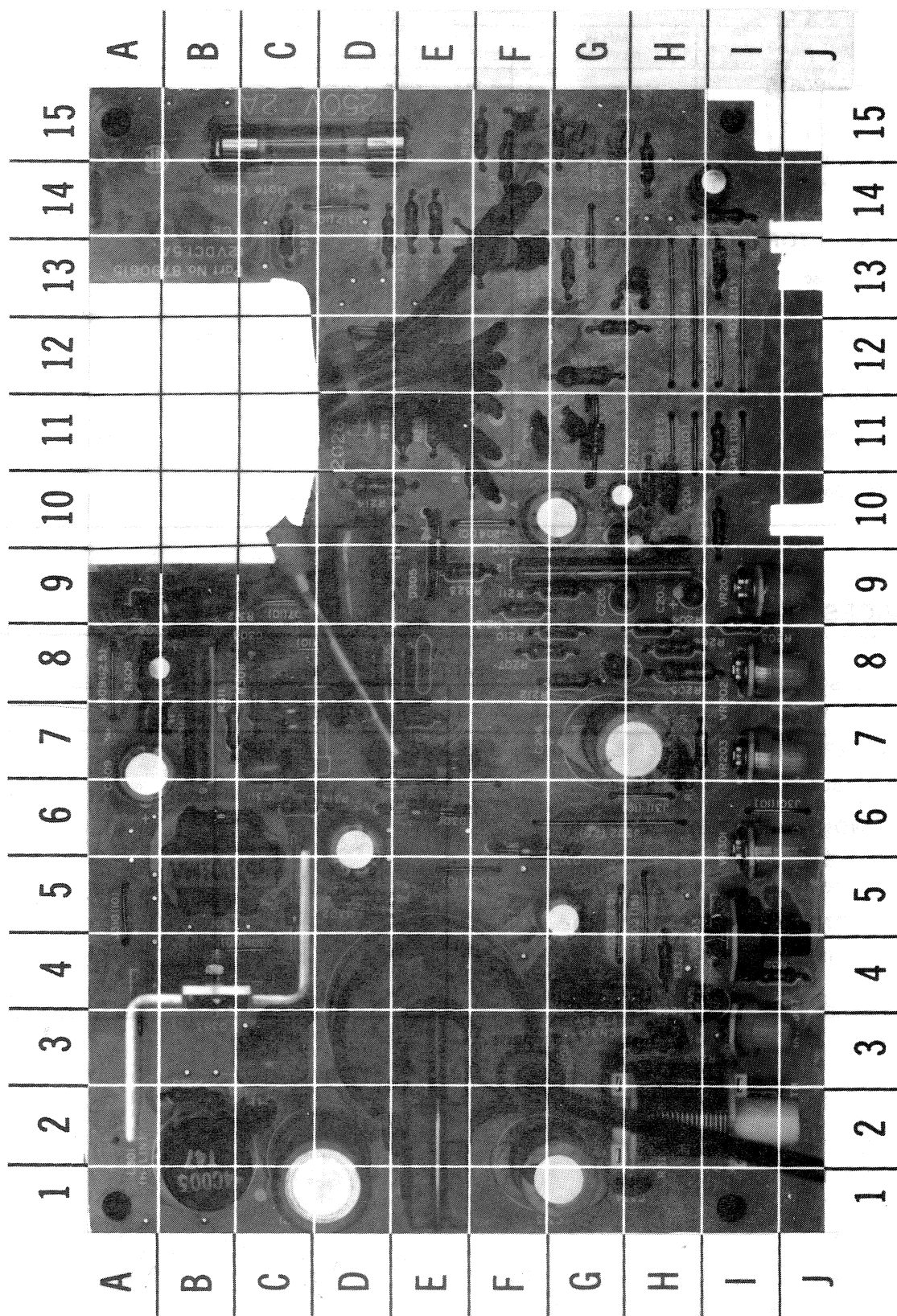
# For SAFETY use only equivalent replacement part.

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFG. PART NO.		NOTES
		DEVICE	HOLDER	
MONITOR NO. 8790615				
F401	2A @ 250V Fast Acting	251000790A		
ALTERNATE MONITOR NO. 8790607 (TCE)				
FU401	2A @ 250V	251000790A	197303080A	
ALTERNATE MONITOR (RCA KTR131B,C)				
F101	2A			

# For SAFETY use only equivalent replacement part.

RADIO SHACK  
MODEL 4 GATE ARRAY



# GridTrace LOCATION GUIDE

C101	I-14	R213	F-9
C102	F-15	R214	D-10
C105	D-6	R215	H-7
C201	H-10	R301	G-12
C202	H-10	R302	G-13
C203	H-9	R303	E-14
C204	G-8	R304	F-13
C205	H-9	R305	E-14
C206	H-7	R306	D-14
C207	H-10	R307	C-13
C208	G-10	R308	C-7
C209	H-3	R309	A-8
C210	G-10	R310	D-8
C211	G-11	R311	B-7
C301	H-13	R312	B-9
C302	F-13	R313	E-7
C303	B-8	R314	C-6
C304	C-8	R315	C-7
C305	C-7	R316	E-8
C306	D-8	R317	E-11
C307	A-8	R318	G-12
C308	A-7	R319	E-11
C309	A-7	R320	E-11
C310	D-7	R321	H-4
C311	C-7	R322	I-4
C312	C-7	R323	B-2
C313	G-1	R324	H-2
C314	C-3	R325	E-9
C315	C-3	T301	B-5
C317	G-15	T302	E-3
C318	D-9	TH201	H-7
C319	E-12	TH301	H-4
C320	E-11	VR201	I-9
C321	F-11	VR202	I-8
C322	D-1	VR203	I-7
C323	C-2	VR301	I-6
C324	H-1	VR302	I-3
CN301	G-4	VR303	I-4
D101	D-12		
D201	G-11		
D301	E-7		
D302	D-5		
D303	F-6		
D305	E-9		
D306	E-6		
F401	C-15		
IC201	G-9		
IC301	B-7		
L301	B-1		
L302	H-2		
Q101	G-15		
Q102	G-15		
Q301	F-13		
Q302	F-13		
Q303	B-4		
R102	I-13		
R103	I-14		
R104	I-10		
R105	H-14		
R106	F-15		
R107	G-15		
R108	F-14		
R201	I-11		
R202	H-10		
R203	I-9		
R204	H-8		
R205	H-8		
R206	H-8		
R207	F-8		
R208	H-3		
R209	H-2		
R210	G-8		
R211	G-9		
R212	G-8		

RADIO SHACK  
MODEL 4 GATE ARRAY

## MISCELLANEOUS ADJUSTMENTS

TOOLS      GC ELECTRONICS  
L302      9440, 8282, 8606

### VERTICAL SIZE ADJUSTMENT

Adjust the Vertical Size Control (VR203) for a display height of about 6 inches.

### VERTICAL LINEARITY

Adjust Vertical Linearity Control (VR202) so that the character size matches at the top and bottom of the screen.

### VERTICAL POSITION

Move jumper from JP12 to JP11 to move character on screen upward.

### HORIZONTAL LINEARITY

Adjust magnets located on yoke for best linearity.

### WIDTH

Note: Check the Horizontal Linearity adjustment before doing the width adjustment. Adjust the Width Coil (L302) for a display width of about 8 inches.

### HORIZONTAL HOLD

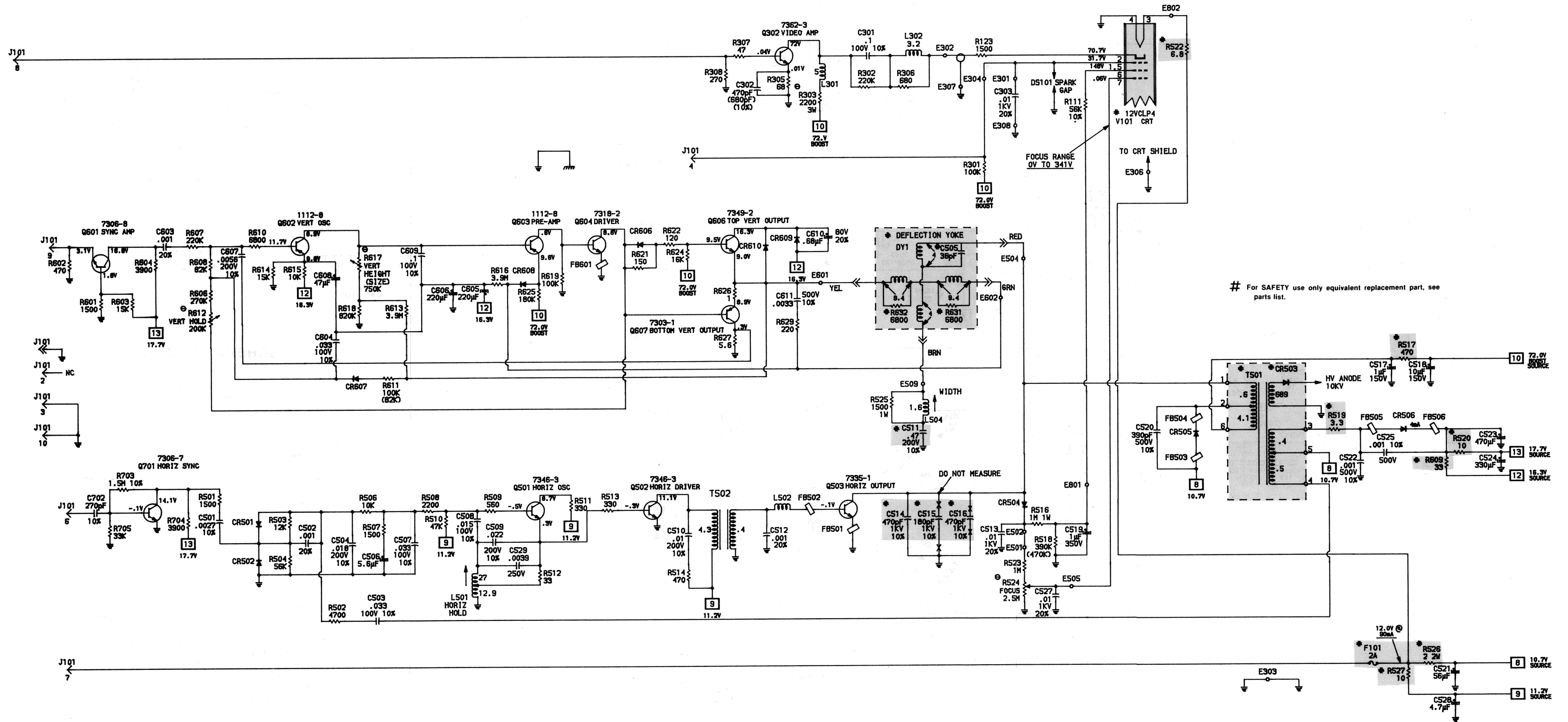
Adjust the Horizontal Hold Control (VR301) for a stable display.

### FOCUS

Adjust the Focus Control (VR303) for best focus.

### CENTERING

Adjust the two magnetic rings located on the yoke rear cover to center the display on the screen.



MODEL KTR131B,C  
USED IN SOME VERSIONS.

**KEYBOARD, POWER SUPPLY,  
SYSTEM BOARD**

See Folder CSCS13

**MONITOR**

See Folder CSCS13-B

**INDEX**

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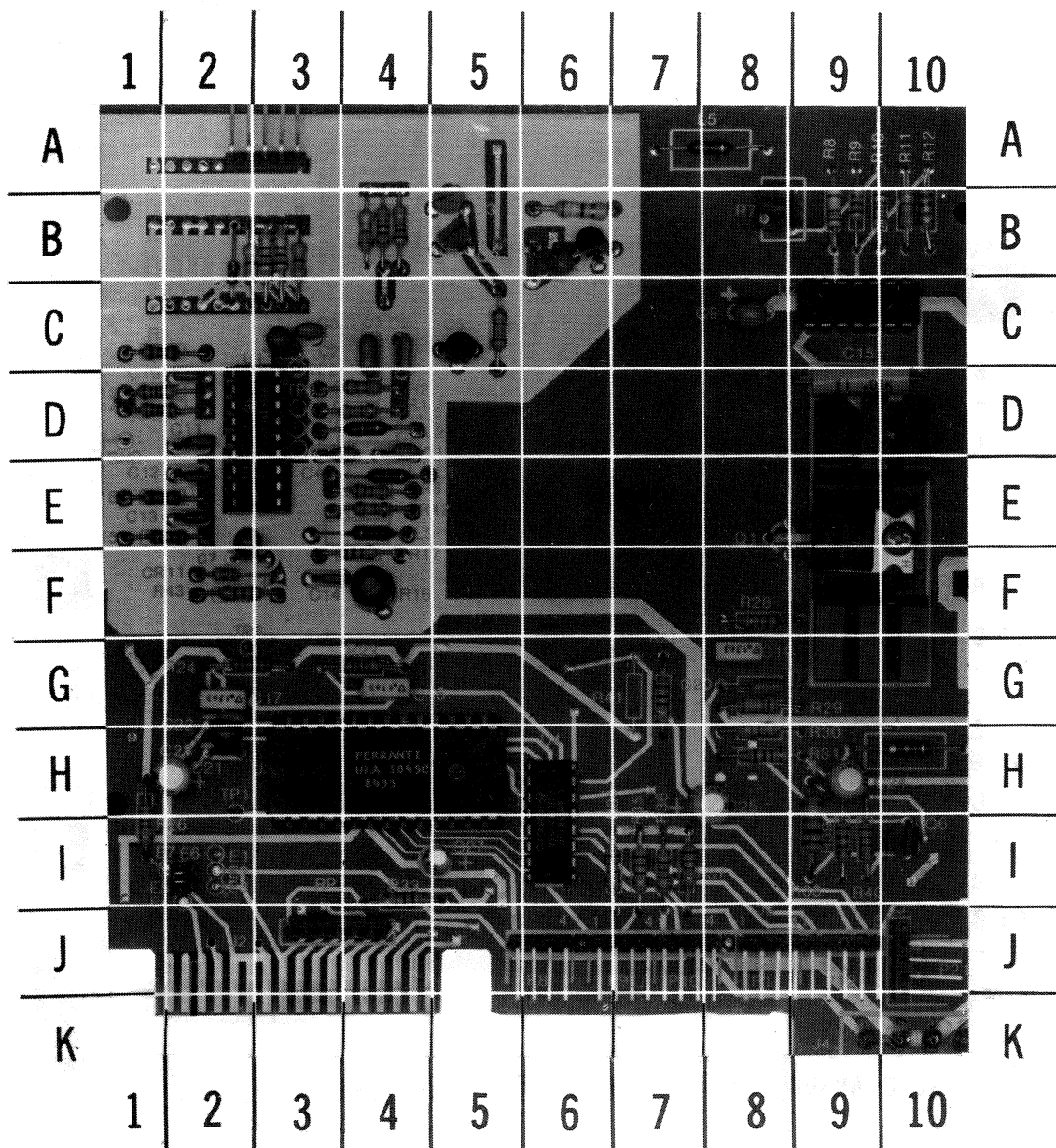




# RADIO SHACK MODEL 4 GATE ARRAY



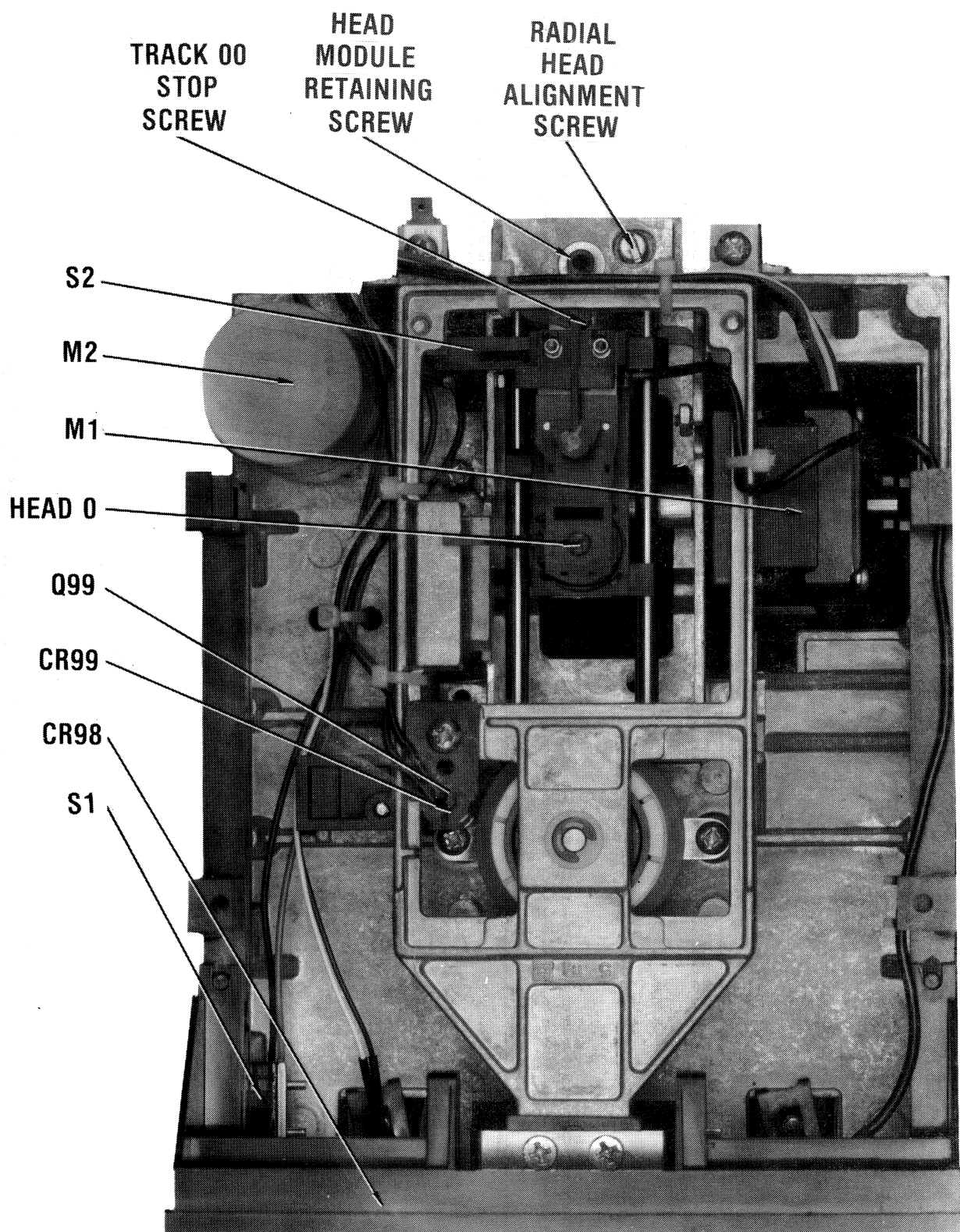
3



# MAIN BOARD GridTrace LOCATION GUIDE

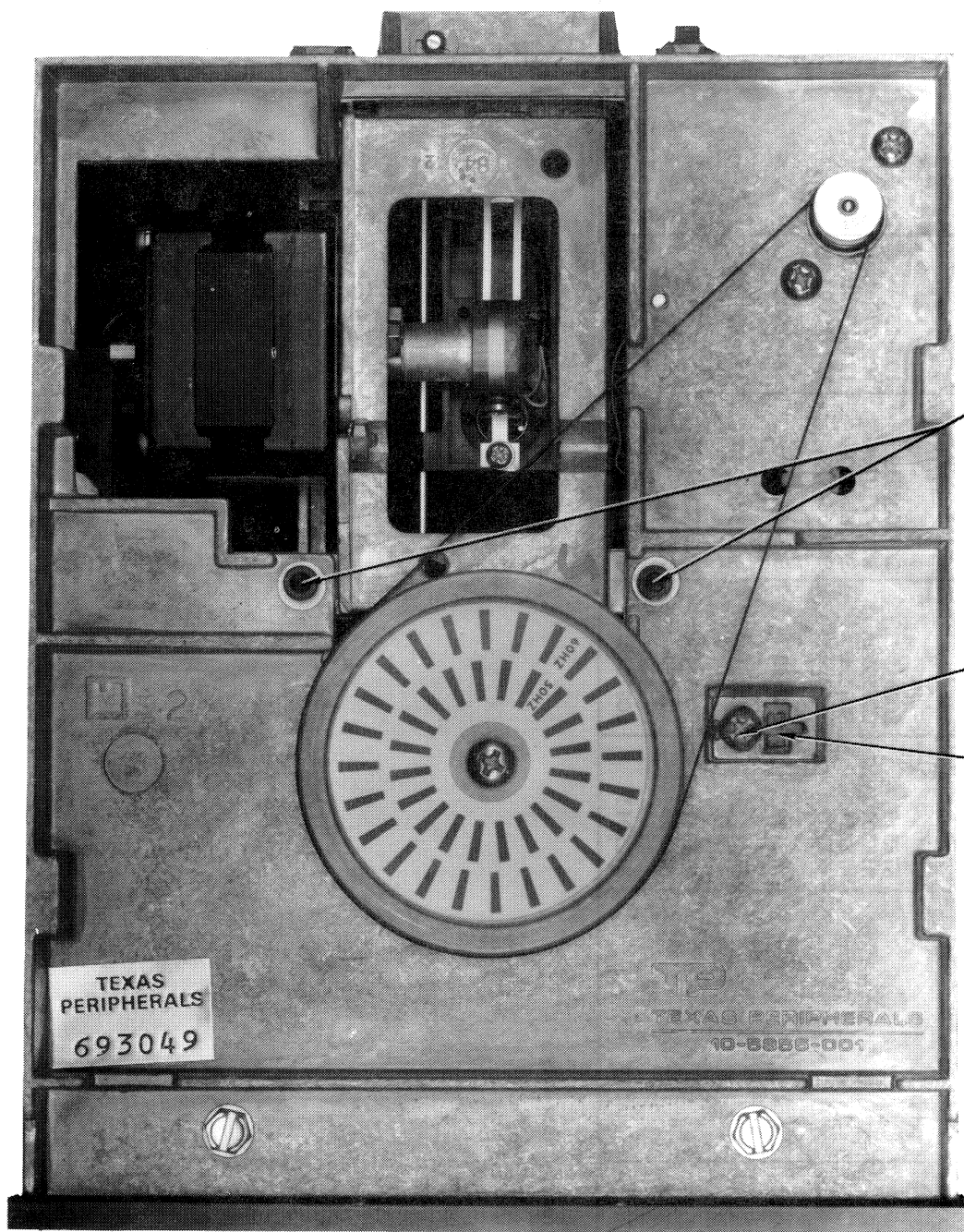
C1	D-4	R25	B-6
C2	C-3	R26	I-1
C3	C-3	R27	G-7
C4	D-4	R28	F-8
C5	C-4	R29	G-8
C6	C-4	R30	H-8
C7	E-2	R31	H-8
C9	B-8	R33	I-4
C10	D-2	R34	I-7
C11	D-2	R35	I-7
C12	E-2	R36	I-7
C13	E-2	R37	I-7
C14	F-3	R38	I-9
C15	D-9	R39	I-9
C16	G-4	R40	I-9
C17	G-2	R42	E-4
C18	B-6	R43	F-2
C19	G-8	RP1	J-3
C20	G-8	TP1	H-2
C21	H-2	TP2	C-3
C22	G-2	TP3	D-3
C23	H-2	TP4	D-3
C24	H-9	TP5	D-3
C25	H-8	TP6	G-2
C27	I-5	U1	D-3
CR6	B-2	U2	C-9
CR8	B-3	U3	H-3
CR9	B-3	U4	H-6
CR11	F-2		
E1	I-2		
E2	I-2		
E3	I-2		
E4	I-2		
E5	I-2		
E6	I-2		
E7	I-2		
J1	A-3		
J2	J-3		
J3	J-8		
J4	K-10		
J5	J-10		
L1	E-4		
L2	D-4		
L3	E-4		
L4	A-10		
L5	A-8		
Q1	E-9		
Q2	B-5		
Q3	B-5		
Q4	B-6		
Q5	C-5		
Q6	I-10		
R1	D-4		
R2	D-4		
R5	C-1		
R6	E-4		
R7	B-8		
R8	B-9		
R9	B-9		
R10	B-10		
R11	B-10		
R12	B-10		
R13	D-1		
R14	D-1		
R15	E-2		
R16	F-4		
R17	F-4		
R18	E-1		
R19	B-4		
R20	B-4		
R21	B-4		
R22	C-5		
R23	G-4		
R24	G-2		

**CSCS13-A**  
 RADIO SHACK  
 MODEL 4 GATE ARRAY



CHASSIS-TOP VIEW





**CS13-A**

**RADIO SHACK  
MODEL 4 GATE ARRAY**

**HEAD  
MODULE  
RETAINING  
SCREWS**

**INDEX  
SENSOR  
RETAINING  
SCREW**

**INDEX  
ADJUST**

**CHASSIS-BOTTOM VIEW**

## ∞ PARTS LIST AND DESCRIPTION

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

### SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
CR6	DISK DRIVE		NTE519	ECG519	SK3100/519	103-131	
CR11	1N4148		NTE5010A	ECG5010A	SK5A1/5010A	103-279-10	
Q1	1N751A		NTE261	ECG261	SK3180/263	121-Z9085	
Q2,3	T1P110		NTE159	ECG159	SK3466/159	121-Z9003	
Q4	2N3906						
Q5	FN2907		NTE159	ECG159	SK3466/159	121-Z9003	
Q6	2N4124		NTE123AP	ECG123AP	SK3854/123AP	121-Z9000A	(5)
Q99							
U1	MC3470N		NTE3470	ECG3470	SK7732/3470		
U2			NTE995	ECG995	SK9209/995		
U3	ULA1045E						
U4	ULN2003A		NTE2013	ECG2013	SK9093/2013		

(5) Part of Index Detector Assembly.

## PARTS LIST AND DESCRIPTION (Continued)

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

### ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C2	4.7 35V	
C7	4.7 35V	

### RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
R5	5620 1% 1/4W Metal Film		QW218	
R8	1800 2% 1/4W Carbon Film			
R10	3320 1% 1/4W Metal Film			
R13	15K 1% 1/4W Metal Film			
R14	15K 1% 1/4W Metal Film			
R15	5620 1% 1/4W Metal Film			
R18	5620 1% 1/4W Metal Film			
R20	8870 1% 1/4W Metal Film			
R21	8870 1% 1/4W Metal Film			
R23	8870 1% 1/4W Metal Film			
R24	21K 1% 1/4W Carbon Film		QW415	
R29	150K 2% 1/4W Metal Film			

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

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
R7	Speed	1000	M/E8026 (1)	(1) Number on unit.
R16	Peak Shift Compensation	50K		

### COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
L1	Peaking			
L2	Peaking			
L3	Peaking			
L4	Choke			
L5	Choke			

### MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
CR98	LED		Busy, Red Index Read/Write/Erase Head Position Drive Write Protect Track 00 Drive
CR99	Detector	995103011	
Head 0	Head	995234001	
M1	Motor	995304001	
M2	Motor	995102003	
S1	Switch	995223003	
S2	Switch	995222003	
	Belt	450007001	

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

ITEM	PART No.
DISK DRIVE	
Front Panel Assembly	995010603

RADIO SHACK  
MODEL 4 GATE ARRAY

## ALIGNMENT

### EQUIPMENT REQUIRED

A test program or a Disk Drive Tester is required which will turn On the Disk Drive 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.

### TEST SETUP

Connect a Disk Drive known to be operating properly to the Computer as Disk Drive 0. Connect the defective Disk Drive as Disk Drive 1. Use Disk Drive 0 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.

### SPINDLE SPEED ADJUSTMENT

Insert a blank diskette into the Disk Drive and close the door. Turn the Disk Drive on its side so the pattern wheel on the flywheel is visible. Adjust the Speed Control (R7) until the 60Hz pattern appears to stand still under a 60Hz fluorescent light. If 50Hz fluorescent lighting is used, use the 50Hz pattern on the pattern wheel.

If a Disk Drive Tester is being used, which provides a readout of the speed in rpm, adjust R7 for a speed of 300rpm  $\pm$  5rpm.

### SPEED VARIATION CHECK

Connect the input of a scope to TP6, pin 10 of IC U1. Set the scope sweep time to 2 $\mu$ Sec, trigger to positive slope and voltage range to 2V. Insert a blank diskette in Disk Drive and write a 125kHz (2F) pattern on any track, then read that track (or use an alignment diskette that has 125kHz pattern on one track). The leading edge of the third pulse should be 8 $\mu$ Sec  $\pm$  240nSec from the leading edge of the trigger pulse (the leading edge jitter of the third pulse should be less than 480nSec). See Figure 6.

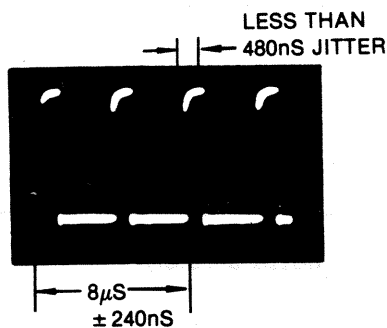


Figure 6

If the jitter is out of tolerance check the Disk Drive belt, Disk Drive motor (M2), motor speed control circuit (IC U2 and Transistors Q1 and Q6) and spindle mechanism.

### RADIAL HEAD ALIGNMENT (HEAD POSITION)

Connect the channel A input of a dual trace scope to TP2, channel B input to TP3, the external trigger input to pin 9 of IC U3 and connect the scope ground to Ground. Set the scope to add mode with channel B inverted, sweep time to 20ms, AC input, trigger to positive slope and voltage to .2V range. Insert the Alignment Diskette, turn On the Disk Drive and set the head to track 16. Observe the cats-eye pattern, see Figure 4. The lobes should be within 75% of each other. If the lobes are out of tolerance, loosen the two head module retaining screws on the bottom of the Disk Drive and one screw on the top next to the Radial Head Alignment screw, see Disk Drive Mechanical - Top View Photo. Turn the Radial Head Alignment Screw until the lobes are within 80% of each other and retighten the three retaining screws.

Move the head to track 39 and back to track 16, then to track 00 and back to track 16, verifying that the lobes are within tolerance when the head is on track 16.

### EQUAL AMPLITUDE

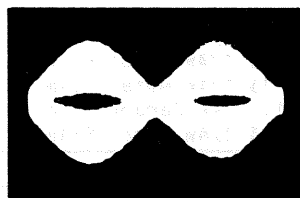


Figure 4

### TRACK 00 ADJUSTMENT

Insert the Alignment Diskette into the Disk Drive and close the door. Turn On the Disk Drive and set the head to track 16. Confirm that the head is on track 16 by observing the cats-eye pattern, see the "Radial Head Alignment" in this Alignment guide. If the cats-eye pattern is not correct, perform the Radial Head Alignment.

To adjust the Track 00 Switch (S2), set the head to Track 02. Loosen the retaining screw at the base of the Track 00 switch bracket and turn the Track 00 Switch Adjustment Screw Maximum counter-clockwise, see Disk Drive Mechanical Photo, Top View. Turn the screw clockwise until a "click" is heard and then turn the screw clockwise one half turn more. Retighten the Track 00 switch bracket retaining screw.

Verify the Track 00 Switch (S2) adjustment by setting the head on Track 03 and checking for 5.0V at pin 1 of Connector P11, then set the head back to Track 02, the reading at pin 1 of P11 should be 0V.

To adjust the Track 00 Stop Adjustment Screw, connect the input of a scope to TP6 and set the sweep time to 10 $\mu$ s and the voltage range to .5V. Insert the Alignment Diskette and close the door. Turn On the drive and set the head to Track 00. A 125kHz sine wave of about .6V peak to peak should appear on the scope. Turn the Track 00 Stop Adjustment Screw clockwise until the amplitude of the 125kHz signal just starts to decrease then turn the screw counterclockwise 1/2 turn, see Disk Drive Mechanical - Top View Photo. Apply a small amount of cement to the screw to keep it in place.

## ALIGNMENT (Continued)

### INDEX SENSOR ADJUSTMENT

Connect the channel A input of a dual trace scope to TP2, channel B input to pin 9 of IC U3 (index pulse) and the scope ground to Ground. Set the scope display to channel A with the voltage range set to 20mV and the sweep time to 50 $\mu$ s. Set the channel B input to noninverting mode and trigger the scope on channel B with the trigger set to positive slope.

Insert the Alignment Diskette in the Disk Drive and close the door. Turn On the Disk Drive and set the head to Track 01. Confirm that the leading edge of the burst occurs 200 $\mu$ s  $\pm$  50 $\mu$ s after the leading edge of the index pulse, see Figure 5. If the index sensor is out of adjustment, loosen the index sensor retaining screw on the bottom of the Disk Drive and use a flat blade screwdriver placed in the slots on the chassis and index sensor to adjust for 200 $\mu$ s  $\pm$  50 $\mu$ s, see Disk Drive Mechanical, Bottom View Photo.

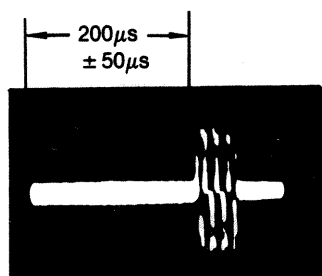


Figure 5

### AZIMUTH CHECK

Connect the channel A input of a dual trace scope to TP2, channel B input to TP3, external trigger input to pin 9 of IC U3 and connect the scope ground to Ground. Set the scope to add mode with channel B inverted, sweep time to .5ms, AC input, trigger to positive slope and voltage to .1V range.

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

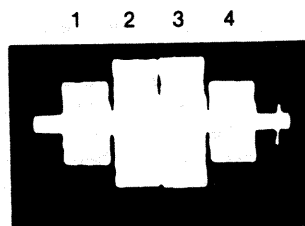


Figure 3

No adjustment is provided for the head azimuth. If the azimuth is out of tolerance, the head may need replacement.

### PEAK SHIFT COMPENSATION ADJUSTMENT

Insert a Diskette with a 125kHz (2F) pattern on Track 39, turn On the Disk Drive and set the head to Track 39. Connect scope to TP6. Adjust Peak Shift Compensation Control (R22) to center the second pulse between the first and third pulses with a maximum jitter of 240mSec, see Figure 15.



Figure 15

# TROUBLESHOOTING

## TEST SETUP

Connect a Disk Drive known to be operating properly to the Computer as Disk Drive 0. Connect the defective Disk Drive as Disk Drive 1. Use Disk Drive 0 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.

## 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 single sided non-abrasive cleaning diskette.

## CONTINUOUS OPERATION OF DISK DRIVE

The following Basic program will make Disk Drive 0 run continuously in the read mode. Change the number 1 in the program to number 2 to make Disk Drive 1 run continuously.

```
10 OUT 244,1: GOTO 10
```

## DRIVE OPERATION ERRATIC

If the Disk Drive operation is erratic, clean the drive head, see "Head Cleaning Instructions". Check the Disk Drive Motor Speed and Disk Drive Alignment, refer to the "Disk Drive Alignment".

## DISK DRIVE INTERFACE OSCILLATOR AND VCO OSCILLATOR

Verify that the drive oscillator is working by checking for 16MHz at pin 22 of IC U76 on the System board. If the 16MHz signal is missing check Crystal Y2, Capacitors C133 and C134, and IC U76.

Check for 16MHz at pin 14 of IC U76. If 16MHz is missing check IC U76.

## DRIVE SELECT MALFUNCTION

Verify the drive select circuit is working by using the program given in "Continuous Operation of Disk Drive" to keep the Disk Drive running. Check for a logic Low at pin 8 of IC U93 for Drive 0 and a logic Low at pin 6 of IC U93 for Drive 1. **NOTE:** If the Drive Motor does not turn On, refer to "Drive Motor Malfunctions" section of this Troubleshooting guide.

If the logic reading is not correct, check for a logic High on pin 9 of IC U93 for Drive 0 and pin 5 of IC U93 for Drive 1. If the logic readings are correct check IC U93. If the logic readings are not correct check IC U79.

If the Disk Drive Activity LED (CR98) does not turn On check pins 1 and 2 of P9 on Disk Drive board.

## WILL NOT READ

Verify the Index Detector circuit is working, refer to the "Index Detector" section of this Troubleshooting guide. Check the alignment of the Disk Drive, refer to the "Disk Drive Alignment." To check the operation of the read circuits, type in and run the following Basic program. Insert a diskette that has a 125kHz (2F) pattern on track 00 into the Disk Drive and close the door. **NOTE:** The Dysan 224/2A Analog Alignment Diskette has a 125kHz pattern on track 00. The program will turn On Drive 1, set the head to track 00, continuously read the track and display the number that is read, which should be 255. To turn On Drive 0, change OUT 244,2 in lines 10 and 30 to OUT 244,1. Press the Break key to stop the program.

```
10 OUT 244,2: OUT 240,3
```

```
20 FOR T = 1 TO 600: NEXT T
```

```
30 OUT 244,2: OUT 240,228: PRINT INP(243): GOTO 30
```

If the number displayed on the Monitor is not 255, check the waveform on pin 19 of Floppy Disk Controller IC (U75) on the System board, see Figure 7. If the waveform is correct check the logic readings on pins 1, 2, 5 thru 12 and 19 of IC U75.

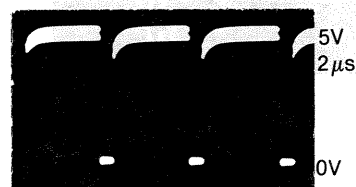


Figure 7

If the waveform is missing on pin 19 of IC U75, check the waveforms on pin 2 and 4 of Multiplexer IC (U95), see Figure 8.

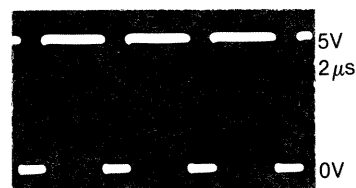


Figure 8

If the waveform is present at IC U95 check IC U98. If the waveform is missing on pin 4 and is present at pin 2 of IC U95 check for pulses on pins 9 and 12 of IC U95. If the pulses are present at pins 9 and 12 of IC U95, check IC U95. If waveform is missing on pin 2 of IC U95, check waveforms on pins 16 and 21 of Interface IC (U3) on Disk Drive board, see Figure 9. If waveform is present on pin 21 of IC U3 check the logic readings on pins 2 thru 5, 12, 13, 15, and 16 of IC U3.



Figure 9



## TROUBLESHOOTING (Continued)

If pin 7 of IC U3 does not check a logic High, refer to the "Write Protect Will Not Work" section of this Troubleshooting guide.

If pin 1 of IC U3 checks logic Low, check voltages and components associated with Read Amp IC (U1). Check the Read/Write Head for continuity at pins 2 and 4 of Connector P6 and check Connector P6 for good connections. Check the waveform on pin 21 of IC U3 while opening and closing the Drive Door. The waveform should change from random pulses when the door is open to 125kHz pulses (see Figure 9) when the Drive Door is closed. NOTE: The random pulses are present on pin 21 of IC U3 even when the Drive is not running. If the waveform does not change from random pulses when the Drive Door is open to 125kHz pulses when the Drive Door is closed check the components associated with IC U2. Check for pulses on pin 9 of IC U3. Check Connectors P10 and P21.

### WILL NOT WRITE

NOTE: Check the Read function before troubleshooting the write circuits. If the Read function is inoperative, refer to the "WILL NOT READ" section of this Troubleshooting guide.

Check Connectors J2 on the System board and J2 on the Disk Drive board for good connections. To check the write circuits, ground pin 12 of IC U94 on the System board. Use a Logic Pulser to inject pulses at pin 2 of Multivibrator IC (U98) on the System board. Use the following Basic program to keep Drive 1 running continuously. Change the number 2 after the comma to 1 to keep Drive 0 running.

```
10 OUT 244,2: GOTO 10
```

Check for write pulses on pin 10 of IC U96 on the System board. If pulses are missing at pin 10, check for pulses at pin 11 of IC U96. If pulses are present at pin 11 of IC U96, check IC U96 by substitution. If pulses are missing at pin 11 of IC U96, check for pulses on pins 9 and 12 of Multivibrator IC (U98). If pulses are present on pins 9 and 12 of IC U98, check IC U98 by substitution. If the pulses are missing on pin 9 of IC U98, check Multiplexer IC (U95) by substitution. If pulses are missing on pin 12 of IC U98, check IC's U75 and U76 by substitution.

If write pulses are present on pin 9 of IC U98, use a scope to check for write pulses on pins 25 and 26 of Interface IC (U3) on the Disk Drive board. If the write pulses are missing at pins 25 and 26 of IC U3, check IC U3 by substitution. If write pulses are present at pins 25 and 26 of IC U3, check Write Amp Transistors (Q2, Q3 and Q5). Check the Read/Write Head for continuity at pins 2 and 4 of Connector P6. Also check the Erase Head and associated components.

Check for a logic High on pin 13 of IC U3. If pin 13 of IC U3 is not High, refer to the "WRITE PROTECT WILL NOT WORK" section of this Troubleshooting guide. If the write circuits check good, check Floppy Disk Controller IC (U75) and IC U76 on the System board.

### WRITE PROTECT WILL NOT WORK

If a write protected diskette is being written on, use the following program to keep Drive 0 running continuously. Change the 1 after the comma to 2 to keep Drive 1 running.

```
10 OUT 244,1: GOTO 10
```

Insert a write protected diskette into the Disk Drive. Check for a logic Low on pin 7 of IC U3. If the logic reading is High check Write Protect Switch S1 for shorted or sticking contacts. If pin 7 of IC U3 is Low check Interface IC (U3) by substitution.

### DRIVE MOTOR MALFUNCTIONS

Check Connector J2 on the System board and Connectors P2 and P21 on Disk Drive board.

Type in and run the program listed in the "WRITE PROTECT WILL NOT WORK", section of this Troubleshooting guide. Check for a logic Low on pin 7 of Driver IC (U4). If logic level is wrong, check for logic High on pins 11 and 13 of IC U93 on the System board. If logic is High check for a logic Low on pin 12 of U93. If pin 12 of U93 is not logic Low, check IC U93. If logic level is not High on pin 13 of IC U93 check IC U76. If logic level is Low on pin 12 of IC U93 check Connector J2 on System board and P2 on Disk Drive board. If pin 7 of IC U4 on the Disk Drive board is logic Low, check for a logic High on pin 10 of IC U4. If pin 10 is not logic High check IC U4. If pin 10 of IC U4 is logic High check for the waveform shown in Figure 10 on pin 8 of IC U2.



Figure 10

If waveform is missing check IC U2 and associated circuits. If waveform is present check continuity of the Drive Motor (M2). Check for pulses on pin 11 of IC U2 and check voltages on Transistors Q1 and Q6.

### TRACK 00 DETECTOR

To verify the track 00 detector circuit is working, push the Disk Drive head away from track 00 before turning On the Computer. Connect a Logic Probe to pin 10 of Interface IC U3 on the Disk Drive board. Turn On the Computer. Type in and run the following Basic program. The program turns On Drive 1, moves the head back to track 00 and two numbers appear on the Monitor screen. The first number appears when the head is off track 00 and should be 2, the second number appears when the head is on track 00 and should be 6. Do not put a diskette in the Disk Drive.

```
10 OUT 244,2: PRINT INP(240): OUT 240,3  
20 FOR T = 1 TO 600: NEXT T: PRINT INP(240)
```

If the logic readings are not correct at pin 10 of IC U3, check for Low logic reading on pin 10 of IC U3 when the head is on track 00, 01 or 02. Check for a High logic reading when the head is on track 03 or higher. If the logic readings are not correct check P11 for good connections and check the Track 00 Switch (S2). While the program is running, check for a logic High, on pin 15 of IC U3, when the head is not on track 00 and a logic Low when the head is on track 00. If the logic readings are not correct check IC U3. If the logic readings are correct on pin 15 of IC U3, check for a High logic reading on pin 5 of IC U95 when the head is not on track 00, and a logic Low when the head is on track 00, when the program is running. If the logic readings are not correct, check Connector J2 on System board, and Connector J2 on the Disk Drive board.

## TROUBLESHOOTING (Continued)

### INDEX DETECTOR

To check the Index Detector type in and run the following Basic program. Connect a Logic Probe to pin 9 of IC U3 on the Disk Drive board.

```
10 OUT 244,2: PRINT INP(240): GOTO 10
```

This program will keep Disk Drive 1 running and continuously display a number on the Monitor screen. The number should be 6 and the logic probe should read logic Open with no diskette in the Disk Drive. The number should change to 4 and the logic probe should read Low when a 3 × 5 card is inserted in the Index Detector. If the Logic Probe readings are correct but the number that appears on the Monitor screen is not correct check IC U3. If the logic probe readings are not correct, insert a diskette into the Disk Drive and close the door.

Check for pulses on pin 9 of IC U3. If pulses are missing, check the Index Detector assembly, Connector P10 and Resistor R36.

### HEAD POSITION MOTOR MALFUNCTIONS

Check Connector J2 on the System board and Connectors J2 and P12 on the Disk Drive board for good connections.

The following Basic program can be used to keep the Head Position motor circuits operating while tests are being made. The program moves the head back and forth between track 00 and 40. Press the BREAK key to stop the program.

```
10 OUT 244,2: OUT 240,3
20 FOR T = 1 TO 700: NEXT T
30 OUT 244,2: OUT 243,40: OUT 240,19
40 FOR T = 1 TO 700: NEXT T: GOTO 10
```

NOTE: If the head stays at track 00 or track 40 and keeps hitting the stop, check the operation of the Track 00 Detector circuit, refer to the "Track 00 Detector" section of this Troubleshooting guide.

Check for stepping pulses on pin 4 of IC U3. If pulses are present check for pulses on pins 17 thru 20 of IC U3. If pulses are missing check IC U3. If pulses are present check for pulses on pins 11 thru 14 of IC U4. If pulses are missing check IC U4, if pulses are present check the Head Position Motor (M1) for continuity. If pulses are missing on pin 4 of IC U3 check for pulses on pin 5 of IC U94 on the System board. If pulses are present check IC U94. If pulses are missing check for pulses on pin 2 of Buffer IC (U97). If pulses are present check IC U97, if pulses are missing check Floppy Disk Controller IC (U75).

If the stepping pulses are good check for a logic High on pin 5 of IC U3 when the head goes to track 00, and a logic Low when the head goes to track 40. If the head does not move correctly check IC U3. Check for a logic Low on pin 5 of IC U97 on the System board when the head is moving to track 00 and a logic High when head is moving to track 40. If logic readings are correct check IC U94, if logic readings are not correct check IC U97.

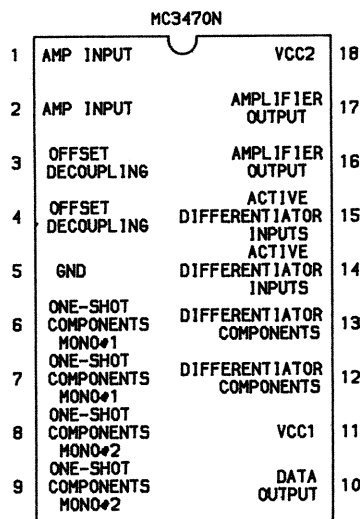
Check for a logic Low on pin 17 of IC U75 when head is moving to track 00 and a logic High when head is moving to track 40. If logic readings are correct check IC U97, if logic readings are not correct check IC U75.

## LOGIC CHART

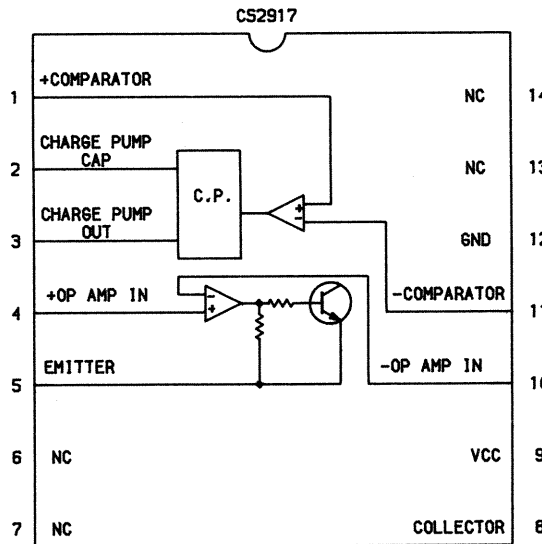
PIN NO.	IC U3	PIN NO.	IC U3	PIN NO.	IC U4
1	L	21	P	1	L
2	H(1)	22	H	2	H
3	H(1)	23	L(1)	3	L(5)
4	H(1)	24	L(1)	4	L(2)
5	L(2)	25	H	5	L(2)
6	L	26	H	6	L(5)
7	H(3)	27	H	7	L
8	L	28	H	8	L
9	P			9	H
10	H(4)			10	H(1)
11	P			11	H(1)
12	P			12	H(1)
13	H			13	H(1)
14	L			14	H(1)
15	H			15	L
16	P			16	*
17	L(5)				
18	L(2)				
19	L(2)				
20	L(5)				

- (1) Probe indicates P when Head Position Motor is operating.
- (2) Probe indicates L when Head is moving in and H when Head is moving out from center of diskette.
- (3) Probe indicates L if diskette is write protected.
- (4) Probe indicates L when Head is on Track 00, 01 or 02.
- (5) Probe indicates H when Head is moving in and L when Head is moving out from center of diskette.

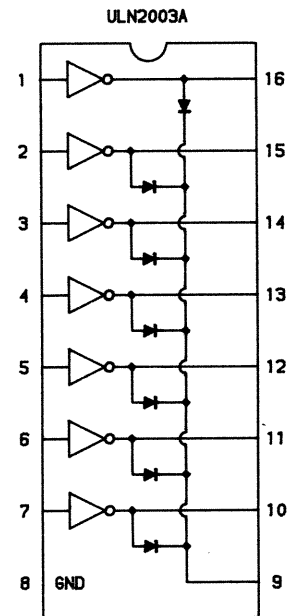
## IC PINOUTS & TERMINAL GUIDES



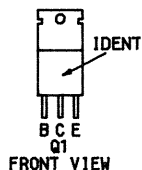
U1  
READ AMP  
TOP VIEW



U2  
FREQUENCY TO VOLTAGE CONVERTER  
TOP VIEW



U4  
DRIVER  
TOP VIEW



## SCHEMATIC NOTES

—X— Circuitry not used in some versions

--- Circuitry used in some versions

⊕ See parts list

⊕ Ground

Voltages measured with digital meter.

Waveforms and voltages are taken from ground, unless noted otherwise.

Voltages, Waveforms and Logic Probe readings for Disk Drive taken while running the following Basic program.

```
10 OPEN "O",1,"SAMS"
20 FOR X=1 TO 300
30 PRINT #1,"THIS IS A TEST"
40 NEXT X
50 CLOSE 1
60 GOTO 10
```

- (1) Probe indicates P when Head Position Motor is operating.
- (2) Probe indicates L when Head is moving in and H when Head is moving out from center of diskette.
- (3) Probe indicates L if diskette is write protected.
- (4) Probe indicates L when Head is on Track 00, 01 or 02.
- (5) Probe indicates H when Head is moving in and L when Head is moving out from center of diskette.

Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm width with DC reference voltage given at the bottom line of each waveform.

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

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 taken with switching as shown, unless noted.

**RADIO SHACK  
MODEL 4 GATE ARRAY**

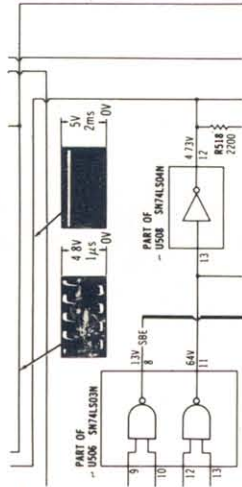




Remove staples and use cover for file folder.

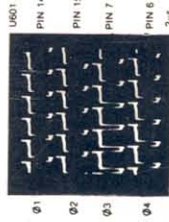
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- SAMS famous industry accepted standardized notation schematics containing CIRCUITRACE®, GRIDTRACE™, waveforms, voltages and stage identification.



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

TROUBLESHOOTING



MICROPROCESSOR CHIP (CPU) OPERATION

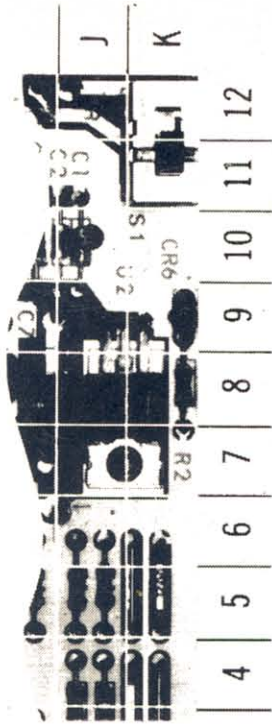
Verify the processor is functioning by observing the signals on the address lines (pins 10 thru 24 of IC U800) and the data lines (pins 41 thru 50) using a logic probe or a scope. If a logic probe is used, refer to the "Logic Chart" for the correct readings. If a scope is used, the waveforms on the address lines should be similar to Figure 1. The waveforms on the data lines should be similar to Figure 2.

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

LOGIC

PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100	PIN NO.	IC U100
1	P	21	P	1	L	1	L	1	L	1	L	1	L	1	L	1	L
2	P	22	P	2	P	2	P	2	P	2	P	2	P	2	P	2	P
3	P	23	P	3	H	3	H	3	H	3	H	3	H	3	H	3	H

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



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

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFR. PART No.	REPLACEMENT DATA						WORKMAN PART No.	ZENITH PART No.
			EGG PART No.	GENERAL ELECTRIC PART No.	MOTOROLA PART No.	NTE PART No.	RCA PART No.			
0102	15553	1149-2576	EGG519	GE-514	1N4935	NTS519	SK9091/177	WEP925/519	103-131	
0103	1N60FM	1149-2527	EGG109	1N60	1N4935	NTS116	SK3088	WEP134/109	103-20001	
0201	1N4004GP	1201-4205	EGG116	GE-504A	1N4935	NTS116	SK3132	WEP157	212-76-02	
0501	15553	1149-2576	EGG519	GE-514	1N4935	NTS519	SK9091/177	WEP925/519	103-131	

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