SAMS COMPUTERFACTS™ CC3

COMPUTER : COMMODORE VIC 20™

TECHNICAL SERVICE DATA FOR YOUR COMPUTER

CC3

COMMODORE VIC 20

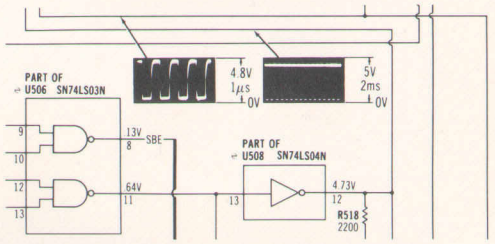
If seal is broken, nonreturnable.

SAMS

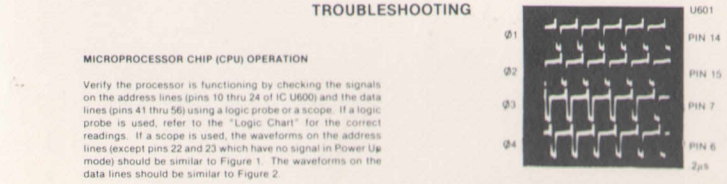
COMPUTERFACTS™ put easy to use, informative technical data right at your fingertips. Each edition includes specific service information on the individual component, along with some overall troubleshooting hints.

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

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



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


TROUBLESHOOTING

MICROPROCESSOR CHIP (CPU) OPERATION

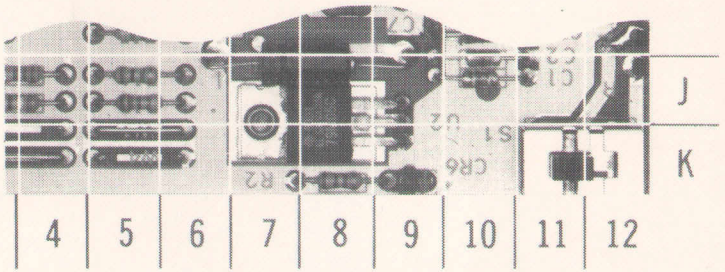
Verify the processor is functioning by checking the signals on the address lines (pins 10 thru 24 of IC U600) and the data lines (pins 41 thru 56) using a logic probe or a scope. If a logic probe is used, refer to the "Logic Chart" for the correct readings. If a scope is used, the waveforms on the address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

- 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.	MFGR. PART No.	REPLACEMENT DATA						
			ECG PART No.	GENERAL ELECTRIC PART No.	MOTOROLA PART No.	NTE PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
D102	1SS53	1149-2576	ECG519	GE-514	1N4935	NTE519	SK9091/177	WEP925/519	103-131
D103	1N60FM	1149-2527	ECG109	1N60		NTE109	SK3088	WEP134/109	103-Z9001
D201	1N4004GP	1201-4205	ECG116	GE-504A	1N4004	NTE116	SK3312	WEP157	212-76-02
D501 thru D503	1SS53	1149-2576	ECG519	GE-514	1N4935	NTE519	SK9091/177	WEP925/519	103-131

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



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

LOGIC

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

REVISION COVERED:

VIC 20™ REVISION C

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CC3
08903

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 hook-up before making service checks.

Disconnect all peripherals except the monitor from the computer to eliminate possible external malfunctions. However, problems involving the interaction between computer and a peripheral will require the connection of the device for voltage and logic readings.

Replacement or repair of the keyboard, main board, RF Modulator, or components may be necessary after the malfunction has been isolated.

CC3 COMMODORE MODEL VIC 20

GENERAL OPERATING INSTRUCTIONS

POWER UP

When the computer is turned On, it will come up ready to program in Commodore Basic.

See "Cassette Operation" for instructions on loading and saving programs.

To run a program, type RUN and press the RETURN key.

To stop a program press the RUN/STOP key.

Press the RUN/STOP key and RESTORE key at the same time to stop the program and reset the computer to the start condition, without losing the program.

CASSETTE OPERATION

Plug a Datassette cassette recorder into the six pin edge connector on the rear of the computer. Note: A regular cassette tape recorder will not work on the VIC 20.

To load a program, type LOAD, press the RETURN key and follow the instructions displayed on the Monitor screen.

To save a program, type SAVE, press the RETURN key and follow the instructions displayed on the screen.

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COMPUTERFACTS-OF-THE-MONTH SET NO. CF2 FOLDER CC3

PRELIMINARY SERVICE CHECKS (Continued)

SERVICE CHECKS

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

① RF MODULATOR CHECK

(a) Turn On computer and verify that the power indicator LED is lit. Note: If the power indicator is not lit, see "Power Supply Check" section.

(b) Verify that the channel select switch is set for the same channel as the monitor, channel 3 or 4.

(c) Verify that the antenna switch is in the Computer position.

(d) Check for bad connections, and improper hookup at the monitor and at the computer.

(e) If the computer still does not come up when turned On, check the RF Modulator (M2) by substitution.

② POWER SUPPLY CHECK

(a) Connect Power Supply (M1) to 120VAC. Check for 10.38VAC between pins 6 and 7 and 5VDC across pins 2 and 3 of the power connector (P7). If the voltages are incorrect, or not present, replace the power supply.

③ MAIN BOARD

(a) Check Fuse F1T1A.

(b) Check Power Switch with an ohmmeter.

(c) Check for 12.81V at Capacitor C39.

(d) Check for 4.99V at Coil L2.

(e) Computer does not power up when turned On. Check for pulses on pins 26 thru 33 of the Microprocessor IC (UE10). If the pulses are not present, check IC UE10 by substitution.

(f) No video (dark screen) or sound. Check the Graphics and Sound Generator ROM IC (UB7) by substitution.

(g) Screen comes up with black flashing squares appearing instead of characters. Check the Character Generator ROM IC (UD7) by substitution.

(h) Screen displays only the blue border and no information. Check ROM IC (UE11) by substitution.

(i) Screen display is snow only. Check ROM IC (UE12) by substitution.

(j) Keyboard does not operate, or the computer will not save or load a program to or from cassette. Check Interface IC (UAB1) by substitution.

(k) RUN/STOP and RESTORE keys do not operate when pushed at the same time, or the cassette motor won't run to save or load a program. Check Interface IC (UAB3) by substitution.

(l) Datassette cassette fails to operate. Check the logic readings at P2. Readings taken while loading a program.

④ KEYBOARD

Substitute the keyboard or locate the bad key and clean the contacts with switch cleaner.

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

Digital Volt/Ohm Meter
Logic Probe

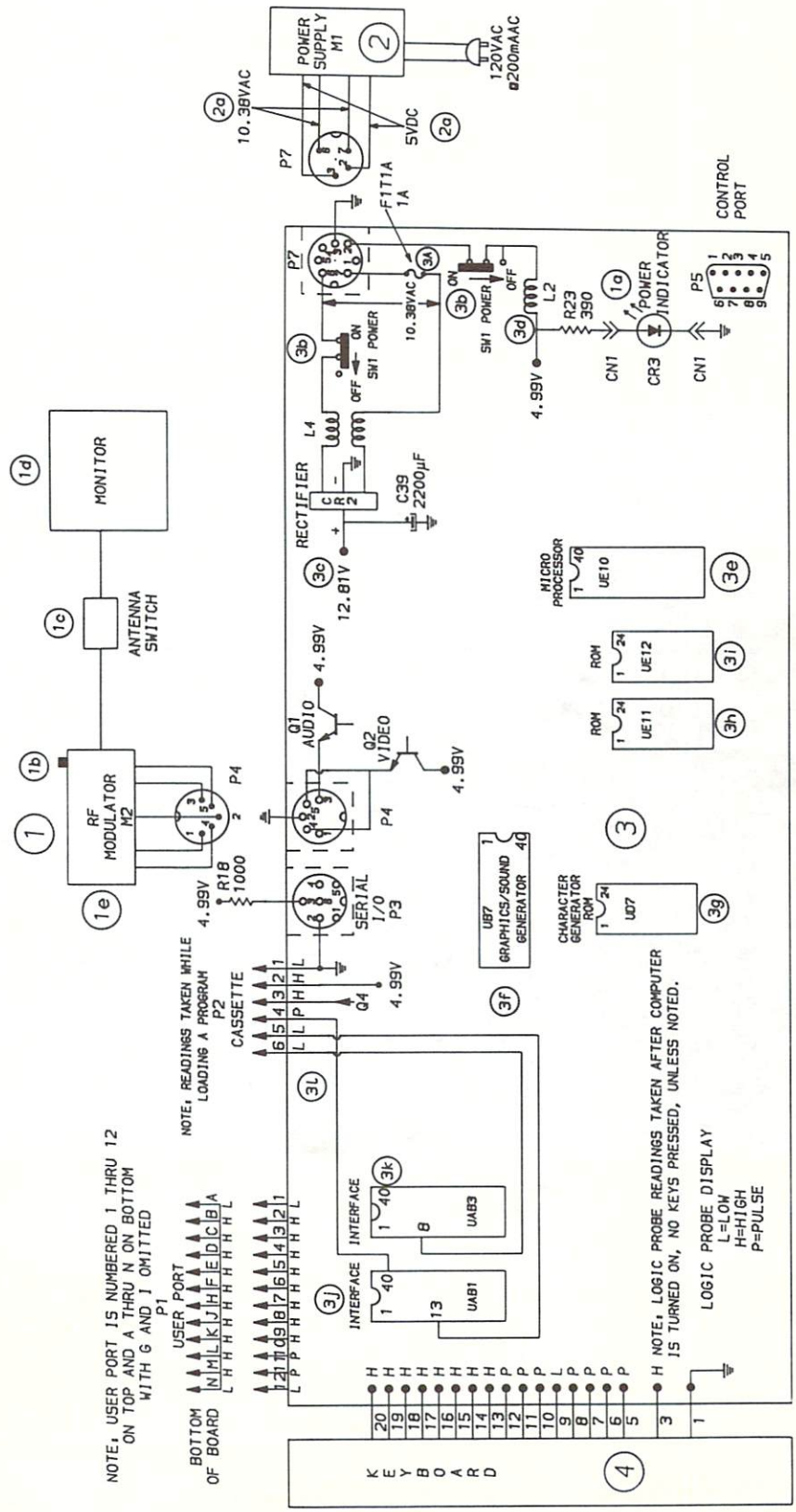
TOOLS

Phillips Screwdriver
Small Screwdriver
Soldering Iron
Switch Cleaner

REPLACEMENT PARTS

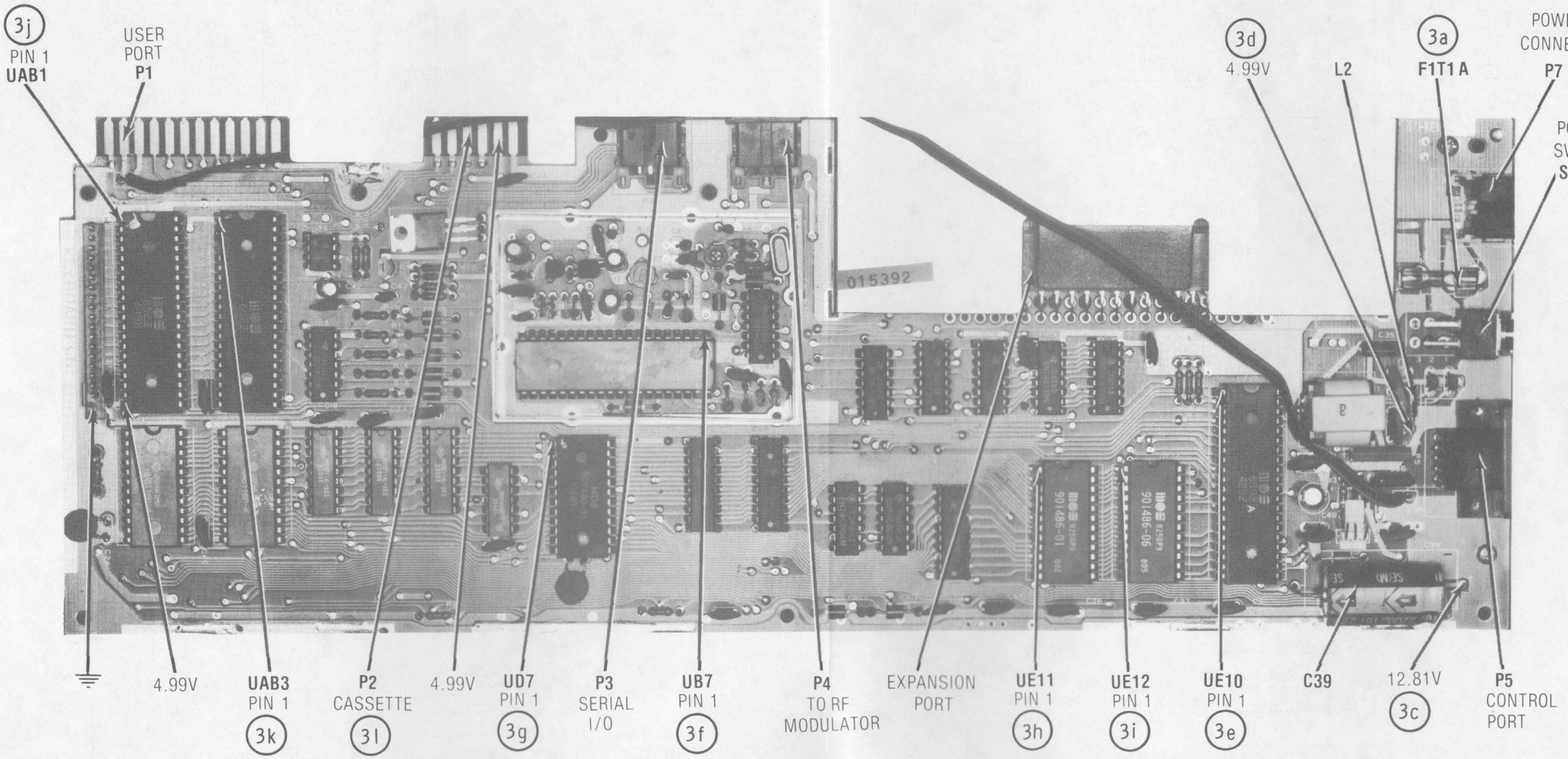
COMMODORE VIC 20 POWER SUPPLY
COMMODORE VIC 20 RF MODULE
COMMODORE VIC 20 SWITCH BLOCK

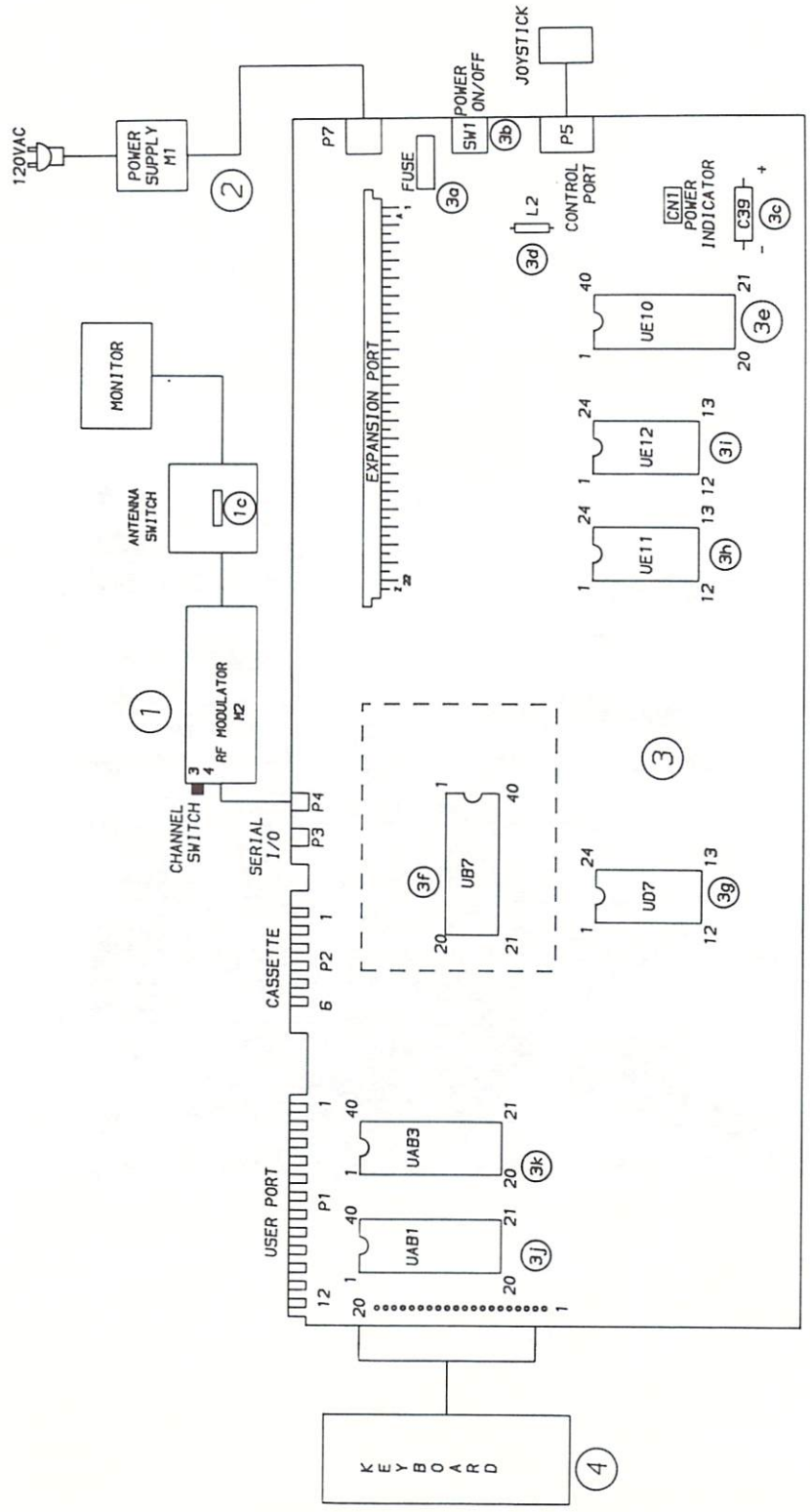
IC	TYPE NO.
UAB1	MPS6522
UAB3	MPS6522
UB7	MPS6560
UD7	901460-03
UE10	MPS6502A
UE11	8250P9
UE12	8250P9



INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)





PLACEMENT CHART

VI

PRELIMINARY SERVICE CHECKS (Continued)

DISASSEMBLY INSTRUCTIONS

CABINET REMOVAL

Remove Phillips screws 1, 2 and 3 from the cabinet bottom. Carefully lift the cabinet top up and back. The keyboard is attached to the cabinet top. Unplug the keyboard and LED power plugs and remove cabinet top. See Figure 1.

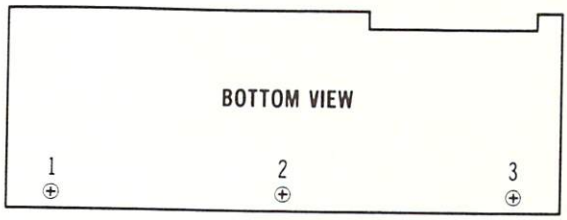


Figure 1

MAIN BOARD REMOVAL

Remove Phillips screws 1 thru 7 and lift the Main Board out of the cabinet bottom. To remove the shield, remove Phillips screws 8, 9 and 10 and unsolder the shield at points A thru G. See Figure 2.

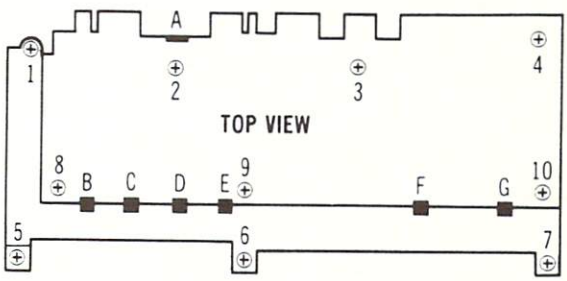


Figure 2

KEYBOARD REMOVAL

To remove the keyboard from the cabinet top, remove Phillips screws 1 thru 8 and lift the keyboard out of the cabinet. See Figure 3.

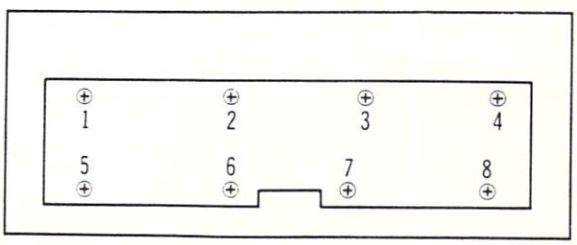


Figure 3

NOTES

CC3 COMMODORE MODEL VIC 20

CC3 COMMODORE MODEL VIC 20

PRELIMINARY SERVICE CHECKS

Enclosed

SAFETY PRECAUTIONS

See page 18.

INDEX

	Page
Adjustments	8
Block Diagram	15
Disassembly Instructions	21
General Operating Instructions	6
GridTrace Location Guide	
Main Board	4,17
Line Definitions	18
Logic Chart	13,14
Parts List	9 thru 12
Photos	
Main Board	4,5,16,17
Main Board-Shield Location	20
Schematics	
IC Pinouts & Terminal Guides	3
Main Board	2
Notes	19
Troubleshooting	6,7,8

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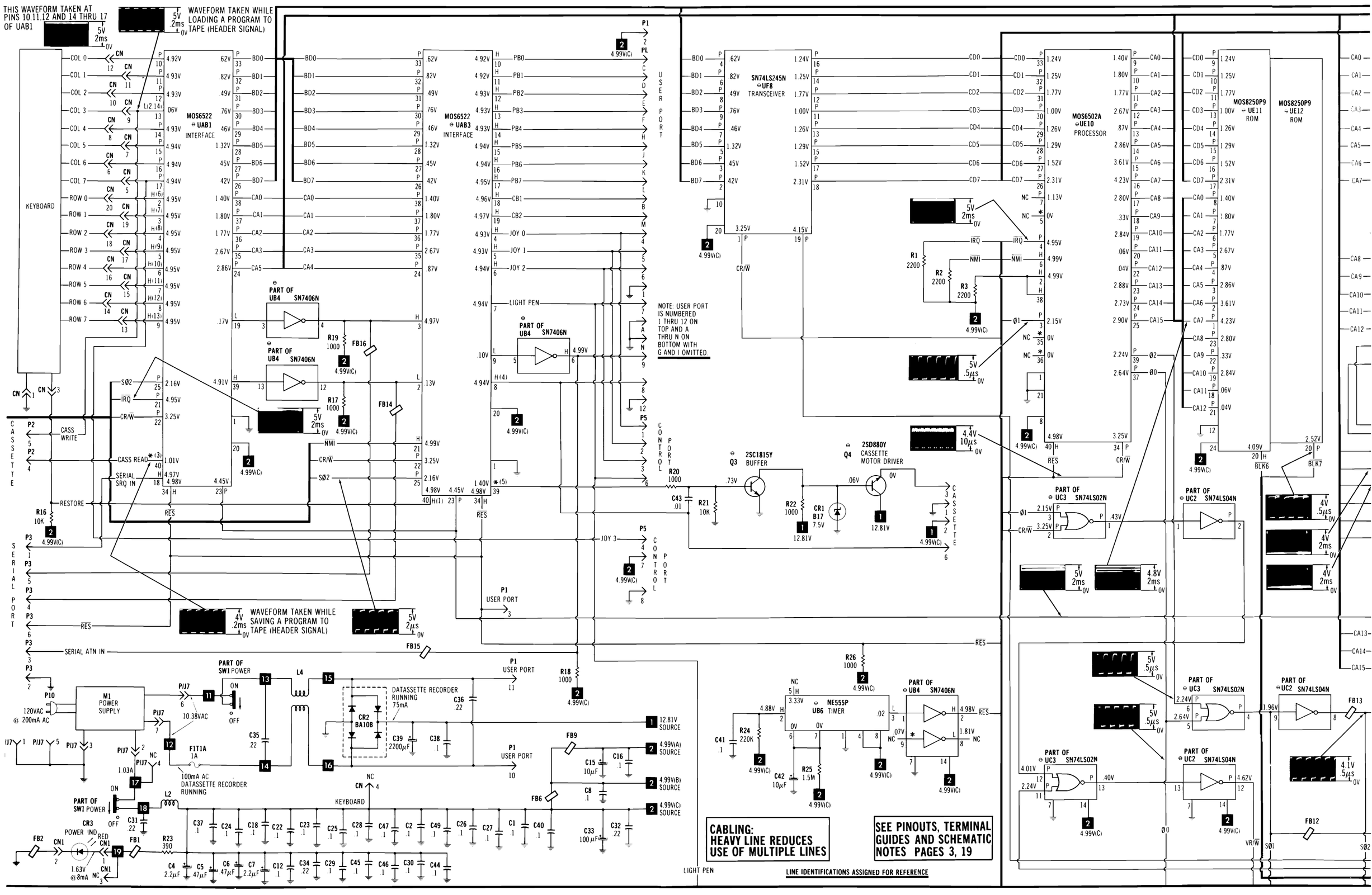

A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE™
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NOTE: P6 IS NUMBERED 1 THRU 22 ON TOP AND A THRU Z ON BOTTOM WITH G I O Q OMITTED

SEE LINE DEFINITIONS ON PAGE 18

IC PINOUTS & TERMINAL GUIDES

PIN OUTS

MOS6502A

1	VSS	$\overline{RES}$	40
2	RDY	Ø2 OUT	39
3	Ø1 OUT	S.O.	38
4	$\overline{IRQ}$	Ø0 IN	37
5	NC	NC	36
6	$\overline{NMI}$	NC	35
7	SYNC	R/$\overline{W}$	34
8	VCC	D0	33
9	A0	D1	32
10	A1	D2	31
11	A2	D3	30
12	A3	D4	29
13	A4	D5	28
14	A5	D6	27
15	A6	D7	26
16	A7	A15	25
17	A8	A14	24
18	A9	A13	23
19	A10	A12	22
20	A11	VSS	21

UE10
PROCESSOR
TOP VIEW

HM6116P-4

1	A7	VCC	24
2	A6	A8	23
3	A5	A9	22
4	A4	$\overline{W}$	21
5	A3	$\overline{OE}$	20
6	A2	A10	19
7	A1	$\overline{CS}$	18
8	A0	DQ8	17
9	DQ1	DQ7	16
10	DQ2	DQ6	15
11	DQ3	DQ5	14
12	VSS	DQ4	13

U14, U15
RAM
TOP VIEW

MOS6522

1	VSS	CA1	40
2	PA0	CA2	39
3	PA1	RS0	38
4	PA2	RS1	37
5	PA3	RS2	36
6	PA4	RS3	35
7	PA5	$\overline{RES}$	34
8	PA6	D0	33
9	PA7	D1	32
10	PB0	D2	31
11	PB1	D3	30
12	PB2	D4	29
13	PB3	D5	28
14	PB4	D6	27
15	PB5	D7	26
16	PB6	Ø2	25
17	PB7	CS1	24
18	CB1	$\overline{CS2}$	23
19	CB2	R/$\overline{W}$	22
20	VCC	$\overline{IRQ}$	21

UAB1, UAB3
INTERFACE
TOP VIEW

MOS6560-101

1	NC	VDD	40
2	VIDEO	Ø1 IN	39
3	VIDEO	Ø2 IN	38
4	R/$\overline{W}$	LIGHT PEN	37
5	D11	PØ2	36
6	D10	PØ1	35
7	D9	A13	34
8	D8	A12	33
9	D7	A11	32
10	D6	A10	31
11	D5	A9	30
12	D4	A8	29
13	D3	A7	28
14	D2	A6	27
15	D1	A5	26
16	D0	A4	25
17	POT X	A3	24
18	POT Y	A2	23
19	COMP SND	A1	22
20	VSS	A0	21

UB7
GRAPHICS AND
SOUND GENERATOR
TOP VIEW

MOS8250P9

1	A7	VCC	24
2	A6	A8	23
3	A5	A9	22
4	A4	A12	21
5	A3	$\overline{CS}$	20
6	A2	A10	19
7	A1	A11	18
8	A0	D7	17
9	D0	D6	16
10	D1	D5	15
11	D2	D4	14
12	VSS	D3	13

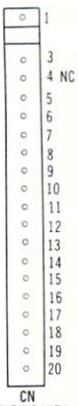
UE11, UE12
ROM
TOP VIEW

MOS901460-03

1	A7	VCC	24
2	A6	A8	23
3	A5	A9	22
4	A4	$\overline{CS2}$	21
5	A3	$\overline{CS}$	20
6	A2	A10	19
7	A1	A11	18
8	A0	D7	17
9	D0	D6	16
10	D1	D5	15
11	D2	D4	14
12	VSS	D3	13

UD7
CHARACTER
GENERATOR
ROM
TOP VIEW

CN1
PIN VIEW



CN
WIRING VIEW

CC3 COMMODORE MODEL VIC 20

MSM2114L-3RS

1	A6	VCC	18
2	A5	A7	17
3	A4	A8	16
4	A3	A9	15
5	A0	I/O1	14
6	A1	I/O2	13
7	A2	I/O3	12
8	$\overline{CS}$	I/O4	11
9	GND	$\overline{WE}$	10

UD2, UE1, UE2
RAM
TOP VIEW

NE555P

1	GND	VCC	8
2	TRIGGER	DIS-CHARGE	7
3	OUTPUT	THRES-HOLD	6
4	RESET	CONTROL VOLTAGE	5

UB6
TIMER
TOP VIEW

SN74LS138N

1	A0	VCC	16
2	A1	$\overline{O0}$	15
3	A2	$\overline{O1}$	14
4	$\overline{E1}$	$\overline{O2}$	13
5	$\overline{E2}$	$\overline{O3}$	12
6	$\overline{E3}$	$\overline{O4}$	11
7	$\overline{O7}$	$\overline{O5}$	10
8	GND	$\overline{O6}$	9

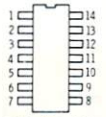
UC4, UC5, UC6
DECODER
TOP VIEW

SN74LS245N

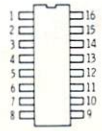
1	DIR	VCC	20
2	A1	B0	19
3	A2	B1	18
4	A3	B2	17
5	A4	B3	16
6	A5	B4	15
7	A6	B5	14
8	A7	B6	13
9	A8	B7	12
10	GND	B8	11

UD8, UE8, UF8
TRANSCEIVER
TOP VIEW

TERMINAL GUIDES

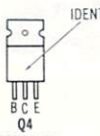


UB4, UB9, UC2
UC3, UD1, U13
TOP VIEW



UD9
TOP VIEW

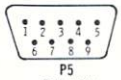
Q1 THRU Q3
TOP VIEW



Q4
FRONT VIEW

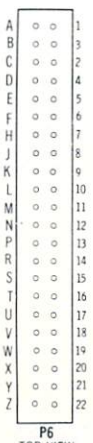
P3
FRONT VIEW

P4
FRONT VIEW



P5
PIN VIEW

P7
FRONT VIEW

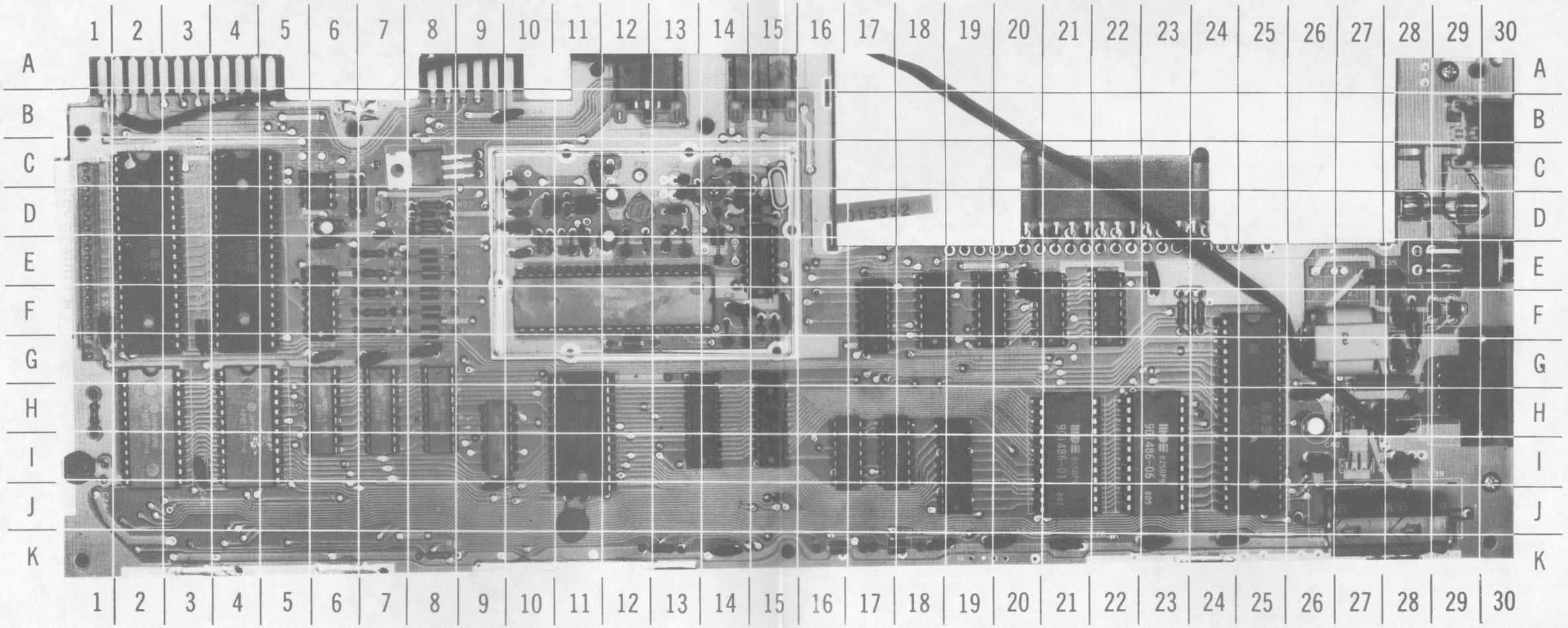


P6
TOP VIEW

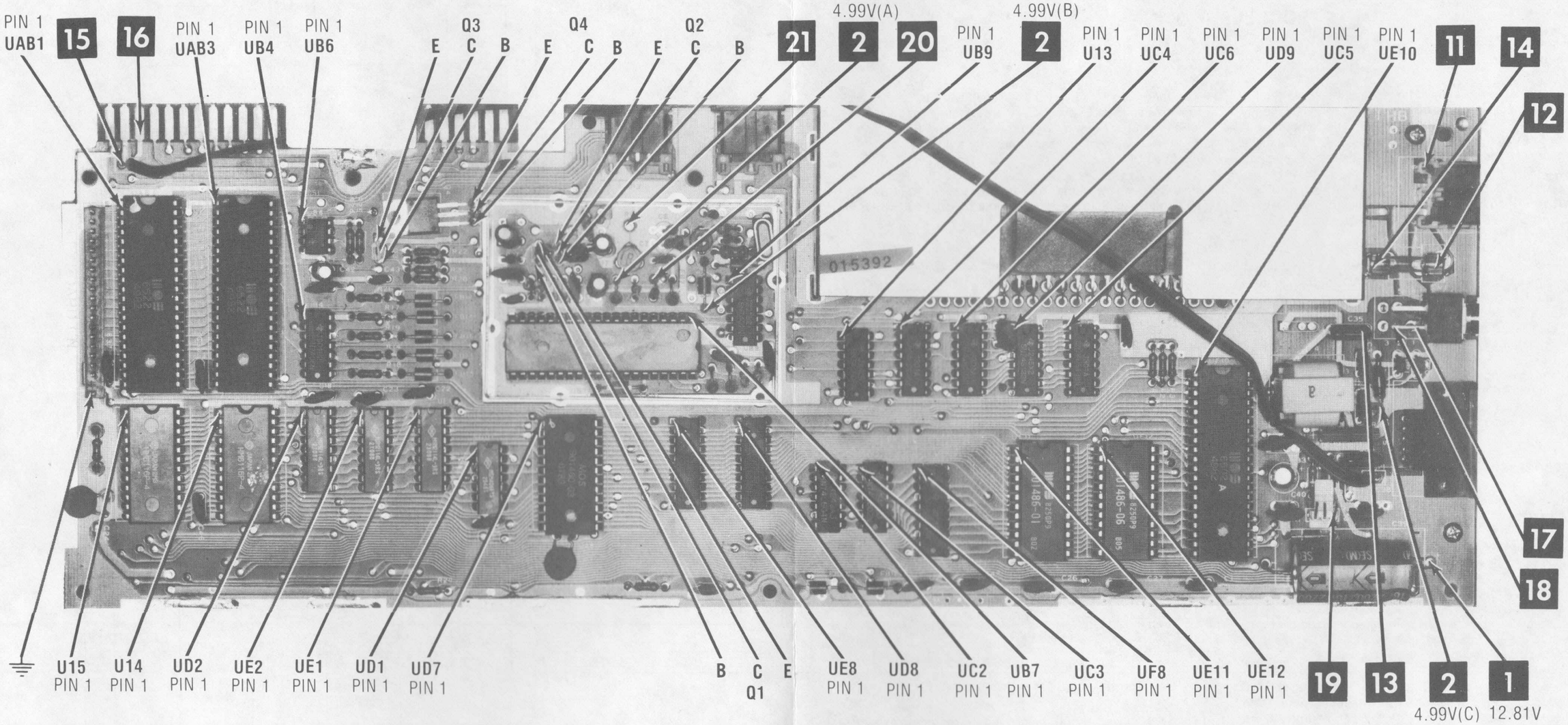
MAIN BOARD GridTrace LOCATION GUIDE

C1	K-24	C17	D-12	C33	H-26	C47	K-14	FB5	G-14	L4	G-27	R3	F-24	R18	F-7	SW1	E-30	UC6	F-19
C2	K-18	C18	G-6	C34	H-26	C48	C-14	FB6	E-14	P1	A-3	R5	C-14	R19	F-7	U13	F-17	UD1	I-9
C4	C-12	C20	F-29	C35	E-28	C49	K-20	FB7	E-13	P2	A-9	R6	D-14	R20	D-8	U14	H-4	UD2	H-6
C5	C-14	C21	F-29	C36	H-28	C50	D-13	FB9	E-12	P3	A-12	R7	F-15	R21	D-8	U15	H-2	UD7	H-11
C6	C-13	C22	G-8	C37	F-1	C51	F-15	FB10	G-12	P4	A-15	R8	E-10	R22	D-8	UAB1	E-2	UD8	H-15
C7	D-13	C23	G-7	C38	I-28	CN	E-1	FB11	F-8	P5	G-30	R9	E-12	R23	H-27	UAB3	E-4	UD9	F-21
C8	F-14	C24	I-1	C39	J-28	CN1	I-27	FB12	K-18	P6	C-22	R10	D-12	R24	D-6	UB4	F-6	UE1	H-8
C9	E-10	C25	J-9	C40	I-26	CR1	D-8	FB13	K-16	P7	B-30	R11	E-11	R25	D-7	UB6	D-6	UE2	H-7
C10	D-10	C26	K-21	C41	E-6	CR2	G-28	FB14	E-8	Q1	D-10	R12	E-11	R26	E-7	UB7	F-12	UE8	H-14
C11	D-10	C28	J-11	C42	D-6	F1T1A	D-29	FB15	F-8	Q2	D-11	R13	E-10	R27	D-10	UB9	E-15	UE10	H-25
C12	C-11	C29	E-23	C43	D-7	FB1	H-27	FB16	F-8	Q3	D-7	R14	F-7	R28	F-15	UC2	I-16	UE11	I-21
C13	D-13	C30	G-3	C44	B-10	FB2	J-27	FB17	E-8	Q4	C-8	R15	K-13	R29	K-8	UC3	I-17	UE12	I-25
C15	E-12	C31	F-28	C45	E-20	FB3	D-15	L1	D-15	R1	F-23	R16	H-11	R51	E-13	UC4	F-18	UF8	I-19
C16	E-11	C32	G-28	C46	I-3	FB4	G-15	L2	F-28	R2	F-24	R17	E-7	R52*	C-18	UC5	F-22	Y1	C-15

* Located on other side of board.



A Howard W. Sams GRIDTRACE™ Photo



MAIN BOARD

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MAIN BOARD

GENERAL OPERATING INSTRUCTIONS

POWER UP

When the computer is turned On, it will come up ready to program in Commodore Basic. See "Cassette Operation" for instructions on loading and saving programs. To run a program after it is loaded, type RUN and press the RETURN key. To stop a program press the RUN/STOP key. Pressing the RUN/STOP key and RESTORE key at the same time will stop the program and reset the computer to the start condition, without losing the program.

CASSETTE OPERATION

Plug the Datassette cassette recorder into the six pin edge connector on the rear of the computer. Note: A regular cassette tape recorder will not work on the VIC 20. To load a program, type LOAD, press the RETURN key and follow the instructions displayed on the Monitor screen. To save a program, type SAVE, press the RETURN key and follow the instructions displayed on the screen.

TROUBLESHOOTING

POWER SUPPLY

Computer does not power up at turn-on. While Power Supply (M1) remains plugged into a known good AC source, carefully disconnect the Power Supply Plug (P7) from the computer and check for 5.00V from pin 2 to pin 3 of Plug P7. If the voltage is missing, replace the Power Supply. If the voltage is present, check for 4.99V at Source 2.

If 4.99V is missing at Source 2, check On-Off Switch (SW1), Coil L2 and check for possible shorts to ground.

Datassette cassette motor does not run. While Power Supply (M1) remains plugged into a known good AC source, carefully disconnect the Power Supply Plug P7 from the computer and check for 10.38 VAC from pin 6 to pin 7 of Plug P7. If the voltage is missing, replace the Power Supply. If 10.38 VAC is present, check for 12.81V at Source 1.

If 12.81V is missing at Source 1, check the Bridge Rectifier (CR2), Line Filter (L4), Fuse F1T 1A and On-Off Switch (SW1). If 12.81V is present, refer to the "Cassette Save and Load" section of this Troubleshooting guide.

MICROPROCESSOR CHIP (CPU) OPERATION

To verify the processor is working, use a logic probe to check for pulses on the data lines (pins 26 thru 33 of IC UE10) and the address lines (pins 9 thru 20 and 22 thru 25 of IC UE10). If the processor is not working, check pin 40 of IC UE10 with the logic probe while the computer is turned Off and then On again.

The probe should read low for about two seconds after turn-on, then read high to reset the processor. If the probe reading is incorrect, check the voltages and components associated with the Reset IC (UB6). If the reading is correct, check for pulses on pin 4 and a high indication on pin 6 of IC UE10.

Should the reading on pin 4 of IC UAB1 or the reading on pin 6 of IC UAB3 be incorrect, check each IC by substituting a good IC. Check for pulses on pin 34 of IC UE10 and check the voltages on pins 2, 8 and 38 of IC UE10. Check the clock waveforms at pins 37 and 39 of IC UE10.

CRYSTAL OSCILLATOR

Verify that the crystal oscillator is operating by checking the waveform on pin 39 of IC UB7. Also, check the frequency with a frequency counter connected to pin 2 of IC UB9.

VIDEO

When there is no video, check for a .6V peak to peak video waveform at pin 4 of Socket P4. If the waveform is good, check the RF Modulator unit by substituting a good RF Modulator unit. If the waveform is absent, check for a video waveform at pin 2 of IC UB7.

For a missing waveform at pin 2, check IC UB7 by substituting a good IC and checking the 14.318MHz Oscillator operation.

If the waveform at pin 2 of IC UB7 is good, check the voltages and components associated with Transistor Q2 and check the adjustment of the Video Level Control (R10).

COLOR

No color. Check for a color waveform at pin 3 of IC UB7. If the waveform is missing at pin 3, check IC UB7 by substituting a good IC.

Colors are incorrect. Check the adjustments of the 14MHz Oscillator Trimmer (C48) and the Video Level Control (R10). Also , check IC UB7, Capacitors C35 and C36 and Diode CR3.

AUDIO

No sound. Type POKE 36878,15 and press the RETURN key. Then type POKE 36875,222 and press the RETURN key. Check for the waveform shown in Figure 1 at pin 19 of IC UB7.

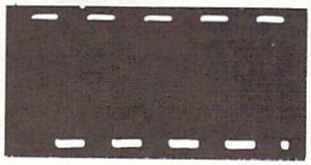

Figure 1

If the waveform is missing, check for possible shorts at pin 19 of IC UB7. Check IC UB7 by substituting a known good IC. If the waveform at pin 19 is good, check for a 1.8V peak to peak waveform at pin 3 of Socket P4.

For a missing waveform at pin 3, check the voltages and components associated with Transistor Q1. If the waveform at pin 3 is good, check the RF Modulator by substituting a good RF Modulator unit.

Type and enter the following program to check the volume control, three tone channels and noise channel features of IC UB7. When the program is run, three different tones and noise should be heard with the volume gradually increasing to MAXIMUM.

```
10 FOR X = 1 TO 15
20 POKE 36878,X
30 FOR Y = 36874 TO 36877
40 POKE Y, 222
50 FOR T = 1 TO 300: NEXT T
60 POKE Y, 0
70 NEXT Y: NEXT X
```

KEYBOARD

Keyboard is not working. Check the waveforms at pins 10, 11, 12 and 14 thru 17 of IC UAB1. If any of the waveforms are missing, check IC UAB1 by substituting a good IC. If the waveforms are good, check the operation of the keyboard. Using a Logic Probe, check the readings on pins 2 thru 9 and pin 13 of IC UAB1. See "Logic Chart".

For incorrect readings, check the keyboard connector and check the switches on the keyboard with an ohmmeter. If the readings are good, check IC UAB1 by substituting a good IC.

RESTORE key is not working. Check for 0V on pin 40 of IC UAB3 when the RESTORE key is pressed. If the voltage does not drop to 0V, check the pin 3 connection on the keyboard connector and check the RESTORE key switch with an ohmmeter. If the voltage checks good, check IC UAB3 by substituting a good IC.

JOYSTICK

Joystick is not working properly. Check the voltages on those pins associated with the particular joystick position as it is activated. See chart below. The voltage should go from about 5V to less than .5V.

IC	PIN	JOYSTICK POSITION
UAB1	17	RIGHT
UAB3	4	UP
UAB3	5	DOWN
UAB3	6	LEFT
UAB3	7	BUTTON

If any voltage is not correct, check the joystick switches and Plug P5. Also, check IC UAB1 or UAB3 by substituting a good IC.

If the voltages are correct, check IC UAB1 or UAB3 by substituting a good IC.

Check the operation of the joystick by loading and running a program that uses the joystick or type, enter and run the following program.

```
10 POKE 37139, 0
20 POKE 37154, 0
30 X = PEEK (37137)
40 Y = PEEK (37152)
50 PRINT "X = "; X, "Y = "; Y
60 FOR T = 1 TO 400: NEXT T
70 GOTO 30
```

The numbers for X and Y that appear on the monitor screen should be the same as those shown in the chart below for the appropriate joystick position.

JOYSTICK POSITION	X	Y
CENTER	254	255
UP	250	255
DOWN	246	255
LEFT	238	255
RIGHT	254	127
BUTTON	222	255

NOTE: Other numbers will appear if two switches on the joystick are closed at the same time.

PADDLES

Buttons on the paddles do not work. Check the voltages on pin 6 of IC UAB3 and pin 17 of IC UAB1 while the appropriate button is being pressed. The voltage should go from 5V to 0V when the button is pressed. If the voltage does not change, check the button switches and pins 3, 4 and 8 at Plug P5 for good connection. If the voltages are good, check IC's UAB1 and UAB3 by substituting good IC's.

Paddles do not work. Check the paddle inputs by connecting a 100K ohm resistor from pin 5 to pin 7 of Plug P5 and another 100K ohm resistor from pin 9 to pin 7 of Plug P5. Then, check for the waveform shown in Figure 2 at pins 17 and 18 of IC UB7.

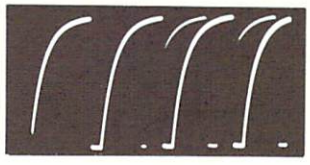

Figure 2

If the waveforms are good, check the paddles. Also, check for good connections at pins 5, 7 and 9 of Plug P5. If the waveforms are missing, check IC UB7 by substitution.

CASSETTE SAVE AND LOAD

Computer will not save a program to cassette tape. Check the waveform on pin 13 of IC UAB1 while saving a program to tape. If the waveform is missing, check IC UAB1 by substituting a good IC. If the waveform is present, check the connections at pin 5 of Plug P2.

TROUBLESHOOTING (Continued)

Computer will not load a program from cassette tape. Check the waveform on pin 40 of IC UAB1 while loading a program from tape. If the waveform is present at pin 40, check IC UAB1 by substituting a good IC. If the waveform is missing at pin 40, check the connection at pin 4 of Plug P2.

Datassette cassette motor will not start when the cassette recorder is put in Play or Record mode. Check the voltage on pin 8 of IC UAB3. The voltage on pin 8 should go from 5V to 0V when the recorder is put in Play or Record mode. If the voltage on pin 8 does not change, check the connection at pin 6 of Plug 2. If the voltage on pin 8 is good, check the voltage on pin 39 of IC UAB3.

The voltage on pin 39 should read about .05V when the recorder is put in Play or Record mode. If the voltage on pin 39 is incorrect, check IC UAB3 by substituting a good IC. If the voltage on pin 39 is good, check the voltages and components associated with Transistors Q3 and Q4. See the following chart for voltages with the recorder in Play or Record mode and the motor running. If 12.81V is missing from the collector of Transistor Q4, refer to the "Power Supply" section of this Troubleshooting guide.

	E	B	C
Q3	0V	.05V	6.86V
Q4	6.24V	6.86V	12.81V

Note: Voltages measured with Datassette cassette recorder in Play or Record mode, motor running.

ADJUSTMENTS

VIDEO LEVEL

Connect the input of a scope to pin 5 of Socket P4 and adjust the Video Level Control (R10) for a video level of .6V peak to peak.

14MHz OSCILLATOR

Connect the input of a frequency counter to pin 2 of IC UB9 and adjust the 14MHz Oscillator Trimmer for a frequency of 14.31818MHz.

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						
			ECG PART No.	GENERAL ELECTRIC PART No.	MOTOROLA PART No.	NTE PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
CR1	B17		ECG5015A	GEZD-7.5	1N5236B	NTE5015A	SK7A5/5015A	WEP1416/5015	103-Z9002
CR2	BA10B								
Q1	2SC1815Y		ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
	2SC1815		ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
Q2	2SC1959-O		ECG85	GE-210	2N4401*	NTE85	SK3124/289	WEP910/289	921-1114
Q3	2SC1815Y		ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
	2SC1815		ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
Q4	2SD880Y		ECG152	GE-66A	TIP41A	NTE152	SK3440/291	WEP745/152	121-987-03
	2SD880		ECG152	GE-66A	TIP41A	NTE152	SK3440/291	WEP745/152	121-987-03
U13	SN74LS08N		ECG74LS08		SN74LS08N	NTE74LS08	SK74LS08		HE-443-780
U14,15	HM6116P-4								
UAB1	MOS6522								
	MPS6522								
UAB3	MOS6522								
	MPS6522								
UB4	SN7406N		ECG7406	GE-7406		NTE7406	SK7406		HE-443-698
	7406		ECG7406	GE-7406		NTE7406	SK7406		HE-443-698
UB6	NE555P		ECG955M	GE IC-269	MC1455P1	NTE955M	SK3564/955M	WEP2119/955M	221-Z9042
	NE555		ECG955M	GE IC-269	MC1455P1	NTE955M	SK3564/955M	WEP2119/955M	221-Z9042
UB7	MOS6560-101								
	MPS6560								
UB9	SN7402N		ECG7402	GE-7402		NTE7402	SK7402	WEP7402/7402	HE-443-46
UC2	SN74LS04N		ECG74LS04		SN74LS04N	NTE74LS04	SK74LS04		HE-443-755
	74S04		ECG74S04			NTE74S04	SK74S04		HE-443-897
UC3	SN74LS02N		ECG74LS02		SN74LS02N	NTE74LS02	SK74LS02		HE-443-779
	74S02		ECG74S02			NTE74S02			
UC4,5 & 6	SN74LS138N		ECG74LS138		SN74LS138N	NTE74LS138	SK74LS138		HE-443-877
	74LS138		ECG74LS138		SN74LS138N	NTE74LS138	SK74LS138		HE-443-877
UD1	MSM4066RS		ECG4066B		MC14066BCP	NTE4066B	SK4066B	WEP4066B/4066B	905-369
	4066		ECG4066B		MC14066BCP	NTE4066B	SK4066B	WEP4066B/4066B	905-369
UD2	MSM2114L-3RS		ECG2114			NTE2114			HE-443-764

PARTS LIST AND DESCRIPTION (Continued)

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

SEMICONDUCTORS (Select replacement for best results) (cont)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA						
			ECG PART No.	GENERAL ELECTRIC PART No.	MOTOROLA PART No.	NTE PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
UD7	MOS901460-03								
UD8	SN74LS245N		ECG74LS245		SN74LS245N	NTE74LS245			HE-443-885
	74LS245		ECG74LS245		SN74LS245N	NTE74LS245			HE-443-885
UD9	SN74S133N		ECG74S133			NTE74S133			
	74LS133								
UE1,2	MSM2114L-3RS		ECG2114			NTE2114			HE-443-764
	MPS2114		ECG2114			NTE2114			HE-443-764
UE8	SN74LS245N		ECG74LS245		SN74LS245N	NTE74LS245			HE-443-885
	74LS245		ECG74LS245		SN74LS245N	NTE74LS245			HE-443-885
UE10	MOS6502A		ECG6502			NTE6502			
	MPS6502A		ECG6502			NTE6502			
UE11,12	MOS8205P9								
	MPS2364								
UF8	SN74LS245N		ECG74LS245		SN74LS245N	NTE74LS245			HE-443-885
	74LS245		ECG74LS245		SN74LS245N	NTE74LS245			HE-443-885

* Lead configuration may vary from original.

WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8529 (Solid) Available in 13 Colors
8522 (Stranded) Available in 13 Colors

PARTS LIST AND DESCRIPTION (Continued)

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

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C4	2.2 1%	
C5	.47 3%	
C6	.47 3%	
C7	2.2 1%	
C11	1 50V 20%	

ITEM No.	RATING	MFGR. PART No.
C15	10 16V 20%	
C17	10 16V 20%	
C33	100 16V 20%	
C39	2200 16V 20%	
C42	10 16V 20%	

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C1	.1 50V	
C2	.1 50V	
C8	.1 50V	
C9	.01 50V	
C10	.1 50V	
C12	.1 50V	
C13	220 50V 5%	
C16	.1 50V	
C18	.1 50V	
C20	.001 50V	
C21	.001 50V	
C22	.1 50V	
C23	.1 50V	
C24	.1 50V	
C25	.1 50V	
C26	.1 50V	
C27	.1 50V	
C28	.1 50V	
C29	.1 50V	

ITEM No.	RATING	MFGR. PART No.
C30	.1 50V	
C31	.22 25V	
C32	.22 25V	
C34	.22 25V	
C35	.22 100V 10%	
C36	.22 100V 10%	
C37	.1 50V	
C38	.1 50V	
C40	.1 50V	
C41	.1 50V	
C43	.01 50V	
C44	.1 50V	
C45	.1 50V	
C46	.1 50V	
C47	.1 50V	
C48	Trimmer 10-90pF	
C49	.1 50V	
C50	15 50V	
C51	.1 50V	

CONTROLS (All wattages ½ watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
R10	Video Level	1000		

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
L1	RF Choke	
L2	RF Choke	

ITEM No.	FUNCTION	MFGR. PART No.
L4	AC Filter	

PARTS LIST AND DESCRIPTION (Continued)

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

FUSE DEVICES

ITEM No.	DESCRIPTION	REPLACEMENT DATA				
		MFGR. PART No.		BUSS PART No.		NOTES
		DEVICE	HOLDER	DEVICE	HOLDER	
F1T1A	1A @ 250V Fast-Acting					

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
CR3	LED		1.63V @ 8mA, Red
FB1 thru FB7	Ferrite Bead		
FB9 thru FB17	Ferrite Bead		
M1	Power Supply	P/N251052-02	
M2	RF Modulator		
P10	Cord		AC Power
SW1	Switch		On-Off
Y1	Crystal		14.318MHz
	Antenna Switch	904778-01	Computer-TV
	Keyboard		

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

PIN NO.	IC U13	IC U14	IC U15	PIN NO.	IC UAB1	PIN NO.	IC UAB1	PIN NO.	IC UAB3	PIN NO.	IC UAB3	PIN NO.	IC UB4	IC UB6
1	L	P	P	1	L	21	P	1	L	21	H	1	L	L
2	L	P	P	2	H(6)	22	P	2	L	22	P	2	H	H
3	L	P	P	3	H(7)	23	P	3	H	23	P	3	L	L
4	P	P	P	4	H(8)	24	P	4	H	24	P	4	H	H
5	P	P	P	5	H(9)	25	P	5	H	25	P	5	L	H
6	P	P	P	6	H(10)	26	P	6	H	26	P	6	H	L
7	L	P	P	7	H(11)	27	P	7	H	27	P	7	L	L
8	P	P	P	8	H(12)	28	P	8	H(4)	28	P	8	L	H
9	H	P	P	9	H(13)	29	P	9	L	29	P	9	*	
10	P	P	P	10	P	30	P	10	H	30	P	10	P	
11	L	P	P	11	P	31	P	11	H	31	P	11	P	
12	L	L	L	12	P	32	P	12	H	32	P	12	L	
13	L	P	P	13	L (2,14)	33	P	13	H	33	P	13	H	
14	H	P	P	14	P	34	H	14	H	34	H	14	H	
15		P	P	15	P	35	P	15	H	35	P	15		
16		P	P	16	P	36	P	16	H	36	P	16		
17		P	P	17	P	37	P	17	H	37	P	17		
18		P	P	18	H	38	P	18	H	38	P	18		
19		P	P	19	L	39	H	19	H	39	*(5)	19		
20		P	P	20	H	40	*(3)	20	H	40	H(1)	20		
21		P	P									21		
22		P	P									22		
23		P	P									23		
24		H	H									24		

NOTE: Logic probe readings taken after computer turned on, no keys pressed, unless otherwise noted.

Logic Probe Display

L = Low
H = High
P = Pulse
* = Open (No lights on)

(1) Goes low when RESTORE key is pressed.
(2) Pulses appear while saving a program to cassette tape.
(3) Pulses appear while loading a program from cassette tape.
(4) Goes low when cassette recorder is put in Play or Record mode.
(5) Goes low to turn cassette recorder on.
(6) Pulses appear when ←, 1, 2, CTRL, Q, RUN/STOP, CMD or SPACE key is pressed.
(7) Pulses appear when 3, 4, W, E, SHIFT LOCK, A, S, LEFT SHIFT or Z key is pressed.
(8) Pulses appear when 5, 6, T, R, D, F, X or C key is pressed.
(9) Pulses appear when 7, 8, Y, U, G, H, V or B key is pressed.
(10) Pulses appear when 7, 9, 0, R, Y, I, O, G, J, K, N or M key is pressed.
(11) Pulses appear when +, −, P, @, L, :, . or COMMA key is pressed.
(12) Pulses appear when £, CLR/HOME, *, ↑, ;, =, / or RIGHT SHIFT key is pressed.
(13) Pulses appear when INST/DEL, RETURN, CRSR, CRSR, F1, F3, F5, or F7 key is pressed.
(14) Pulses appear for all keys except RESTORE.

LOGIC (Continued)

PIN NO.	IC UB7	PIN NO.	IC UB7	PIN NO.	IC UB9	IC UC2	IC UC3	IC UC4	IC UC5	IC UC6	IC UD1	IC UD2	IC UD7	IC UD8
1	*	21	P	1	P	P	P	P	P	P	P	P	P	L
2	P	22	P	2	P	P	P	P	P	P	P	P	P	P
3	P	23	P	3	P	P	P	P	P	P	P	P	P	P
4	P	24	P	4	P	P	P	P	L	P	P	P	P	P
5	P	25	P	5	*	P	P	L	L	P	P	P	P	P
6	P	26	P	6	*	P	P	P	P	P	P	P	P	P
7	P	27	P	7	L	L	L	P	P	H	L	P	P	P
8	P	28	P	8	P	P	P	L	L	L	P	P	P	P
9	P	29	P	9	P	P	P	H	H	H	P	L	P	P
10	P	30	P	10	P	P	P	P	H	P	P	P	P	L
11	P	31	P	11	P	P	P	P	P	P	P	P	P	P
12	P	32	P	12	P	P	P	H	H	H	P	P	L	P
13	P	33	P	13	P	P	P	P	H	H	P	P	P	P
14	P	34	P	14	H	H	H	P	H	H	H	P	P	P
15	P	35	P	15				P	P	H		P	P	P
16	P	36	P	16				H	H	H		P	P	P
17	L	37	H	17								P	P	P
18	L	38	P	18								H	P	P
19	H	39	P	19									P	P
20	L	40	H	20									P	H
				21									P	
				22									P	
				23									P	
				24									H	

PIN NO.	IC UD9	IC UE1	IC UE2	IC UE8	PIN NO.	IC UE 10	PIN NO.	IC UE 10	PIN NO.	IC UE11	IC UE12	IC UF8
1	H	P	P	L	1	L	21	L	1	P	P	P
2	H	P	P	P	2	H	22	P	2	P	P	P
3	P	P	P	P	3	P	23	P	3	P	P	P
4	P	P	P	P	4	P	24	P	4	P	P	P
5	H	P	P	P	5	*	25	P	5	P	P	P
6	H	P	P	P	6	H	26	P	6	P	P	P
7	P	P	P	P	7	P	27	P	7	P	P	P
8	L	P	P	P	8	H	28	P	8	P	P	P
9	P	L	L	H	9	P	29	P	9	P	P	P
10	H	P	P	L	10	P	30	P	10	P	P	L
11	P	P	P	*	11	P	31	P	11	P	P	P
12	H	P	P	P	12	P	32	P	12	L	L	P
13	H	P	P	P	13	P	33	P	13	P	P	P
14	H	P	P	P	14	P	34	P	14	P	P	P
15	H	P	P	P	15	P	35	*	15	P	P	P
16	H	P	P	P	16	P	36	*	16	P	P	P
17		P	P	P	17	P	37	P	17	P	P	P
18		H	H	P	18	P	38	H	18	P	P	P
19				P	19	P	39	P	19	P	P	P
20				H	20	P	40	H	20	H	P	H
21									21	P	P	
22									22	P	P	
23									23	P	P	
24									24	H	H	

NOTE: Logic probe readings taken after computer turned on, no keys pressed, unless otherwise noted.

Logic Probe Display

L = Low
H = High
P = Pulse
* = Open (No lights on)

KEYBOARD
INTERFACE
TRANSCEIVER
MICROPROCESSOR
TIMING
TO ALL CIRCUITS
CONTROL CIRCUITS
RAMS
USER PORT
ROMS
CASSETTE
SERIAL PORT
GRAPHICS AND SOUND GENERATOR
RF MODULATOR
CONTROL PORT
EXPANSION PORT

SEE PAGE 5

SEE PAGE 4

LINE DEFINITIONS

BD0 Thru BD7 ..... Basic Data Lines
BLK1 Thru BLK7 ..... Memory Blocks
CA0 Thru CA15 ..... Control Address Lines
CASS READ ..... Cassette Read
CASS WRITE ..... Cassette Write
CB1, CB2 ..... Port Control Lines
CD0 Thru CD7 ..... Control Data Lines
COL0 Thru COL7 ..... Keyboard Columns
CR/W ..... Control Read/Write
I/O ..... Input/Output
IRQ ..... Interrupt Request
JOY0 ..... Joystick 0
JOY1 ..... Joystick One
JOY2 ..... Joystick Two
JOY3 ..... Joystick Three
LIGHT PEN ..... Light Pen
NMI ..... Non-Maskable Interrupt
PB0 Thru PB7 ..... Port Data Lines
POT X ..... Potentiometer Grid X
POT Y ..... Potentiometer Grid Y
RAM1 Thru RAM3 ..... RAM Expansion Port Select
RES ..... Reset
RESTORE ..... Restore
ROW1 Thru ROW7 ..... Keyboard Rows
SØ1 ..... Select Phase One
SØ2 ..... Select Phase Two
SERIAL ATN IN ..... Serial Attention Input
SERIAL SRQ IN ..... Serial Select Request Input
VA0 Thru VA13 ..... Video Address Lines
VD8 Thru VD11 ..... Video Data Lines
VR/W ..... Video Read/Write
Ø0 ..... Phase 0
Ø1 ..... Phase One
Ø2 ..... Phase Two

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

SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the computer before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with computer 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 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 to water. If exposed to water turn the unit off. Do not place the computer near possible water sources.
13. Never leave the computer unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
14. Do not allow anything to rest on AC power cord.
15. Unplug AC power cord from outlet before cleaning computer.
16. Never use liquids or aerosols directly on the computer. Spray on cloth and then apply to the computer cabinet. Make sure the computer is disconnected from the AC power line.

SCHEMATIC NOTES

—✕— Circuitry not used in some versions
– – – Circuitry used in some versions
⊖ See parts list
⏚ Ground

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

Supply voltage maintained as shown at input.

Voltages measured with digital meter.

Voltages and Waveforms taken with computer in Power Up mode (Main title screen displayed) unless otherwise noted. Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "O" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 9 cm width with DC reference voltage given at the bottom line of each waveform. Time in μsec. per cm, given with p-p reading at the end of each waveform.

Terminal identification may not be found on unit.

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

Value in ( ) used in some versions.

NOTE: Logic probe readings taken after computer turned on, no keys pressed, unless otherwise noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No lights on)

(1) Goes low when RESTORE key is pressed.
(2) Pulses appear while saving a program to cassette tape.
(3) Pulses appear while loading a program from cassette tape.
(4) Goes low when cassette recorder is put in Play or Record mode.
(5) Goes low to turn cassette recorder on.
(6) Pulses appear when ←, 1, 2, CTRL, Q, RUN/STOP, CMD or SPACE key is pressed.
(7) Pulses appear when 3, 4, W, E, SHIFT LOCK, A, S, LEFT SHIFT or Z key is pressed.
(8) Pulses appear when 5, 6, T, R, D, F, X or C key is pressed.
(9) Pulses appear when 7, 8, Y, U, G, H, V or B key is pressed.
(10) Pulses appear when 7, 9, 0, R, Y, I, O, G, J, K, N or M key is pressed.
(11) Pulses appear when +, –, P, @, L, :, . or COMMA key is pressed.
(12) Pulses appear when £, CLR/HOME, *, ↑, ;, =, / or RIGHT SHIFT key is pressed.
(13) Pulses appear when INST/DEL, RETURN, CRSR →, CRSR ↓, F1, F3, F5, or F7 key is pressed.
(14) Pulses appear for all keys except RESTORE.

MAIN BOARD SHIELD LOCATION

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove Phillips screws 1, 2 and 3 from the cabinet bottom. Carefully lift the cabinet top up and back. The keyboard is attached to the cabinet top. Unplug the keyboard and LED power plugs and remove cabinet top. See Figure 1.

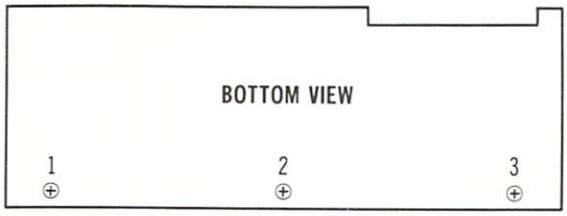

Figure 1

MAIN BOARD REMOVAL

Remove Phillips screws 1 thru 7 and lift the Main Board out of the cabinet bottom. To remove the shield, remove Phillips screws 8, 9 and 10 and unsolder the shield at points A thru G. See Figure 2.

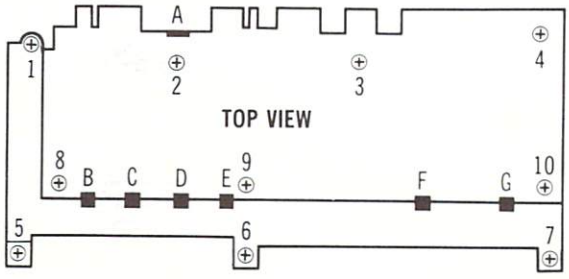

Figure 2

KEYBOARD REMOVAL

To remove the keyboard from the cabinet top, remove Phillips screws 1 thru 8 and lift the keyboard out of the cabinet. See Figure 3.

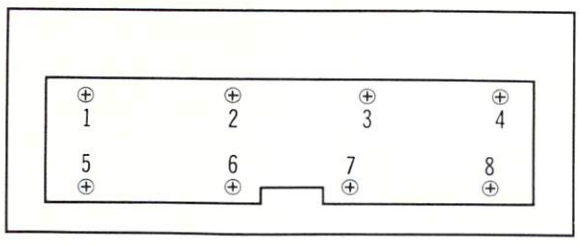

Figure 3