

**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.

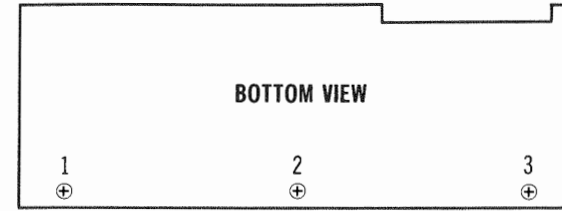


Figure 1

**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 remove the shield at points A thru G. See Figure 2.

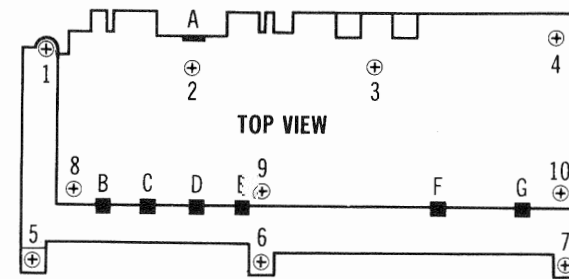


Figure 2

**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.

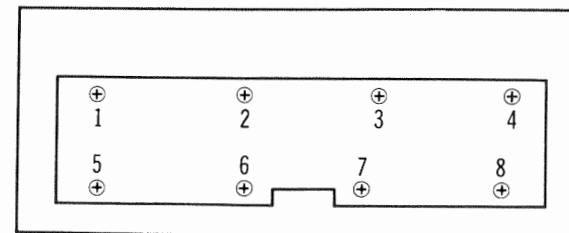
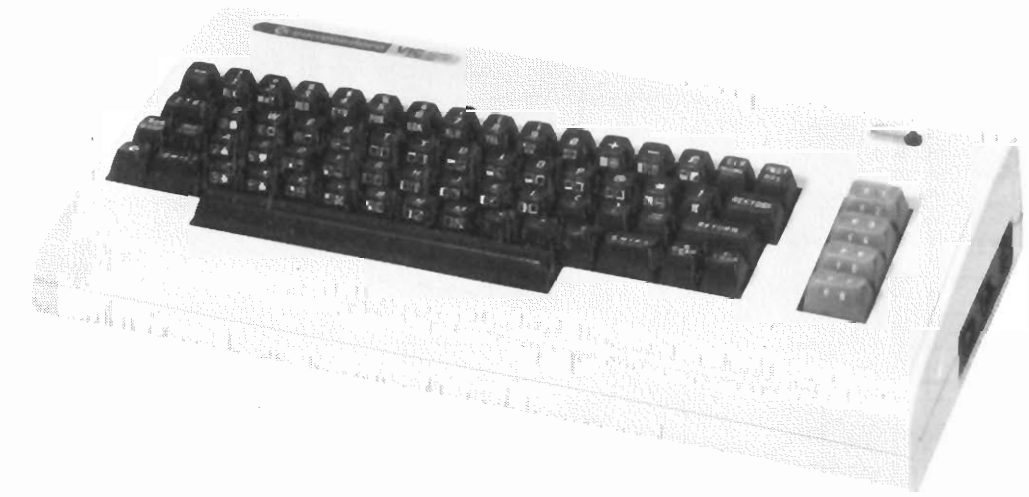


Figure 3

COMMODORE  
MODEL VIC 20 (EARLY VERSION)



COMMODORE  
MODEL VIC 20 (EARLY VERSION)

**PRELIMINARY SERVICE CHECKS**

ENCLOSED

**SAFETY PRECAUTIONS**

See page 18.

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## 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 "0" 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  $\mu$ sec. 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

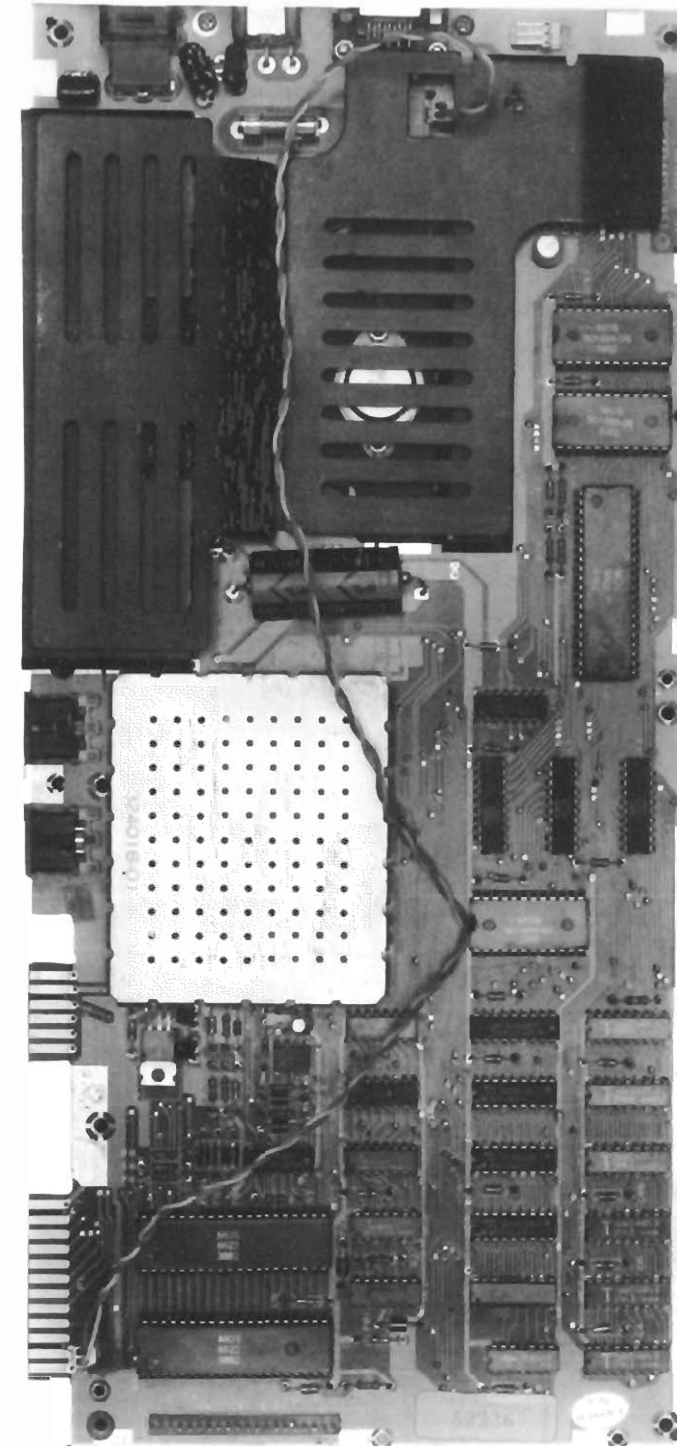
L = Low

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

## CABINET REMOVAL

Remove Phillips screws 1, 2 and 3. Carefully lift the cabinet top up and away from the cabinet bottom. Unplug power plugs and remove cabinet top.

## MAIN BOARD REMOVAL

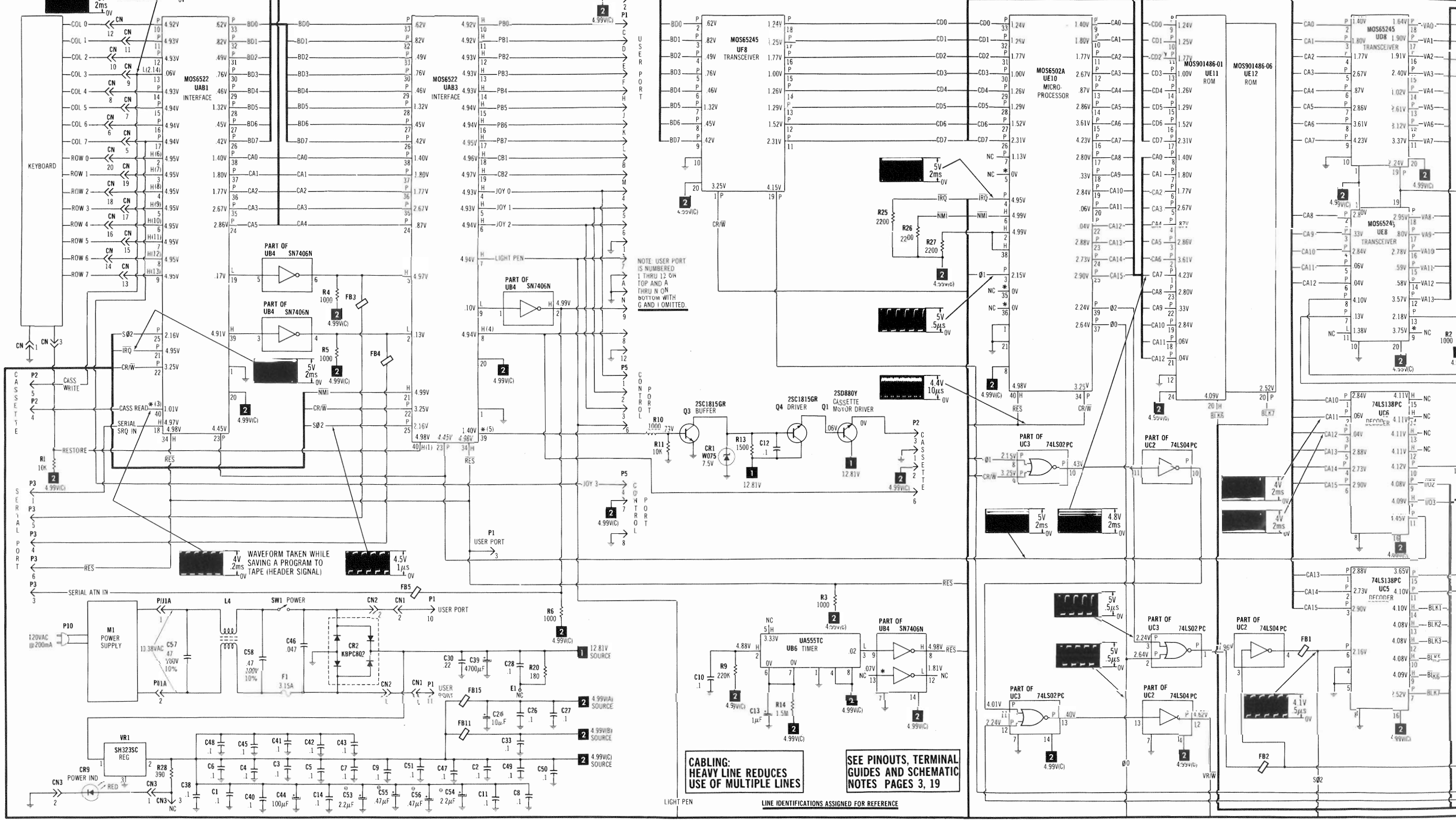
Remove Phillips screws 1 thru 7 around the perimeter of the cabinet bottom. To remove the main board, remove Phillips screws 8, 9 and 10 and remove the main board. See Figure 2.

## KEYBOARD REMOVAL

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

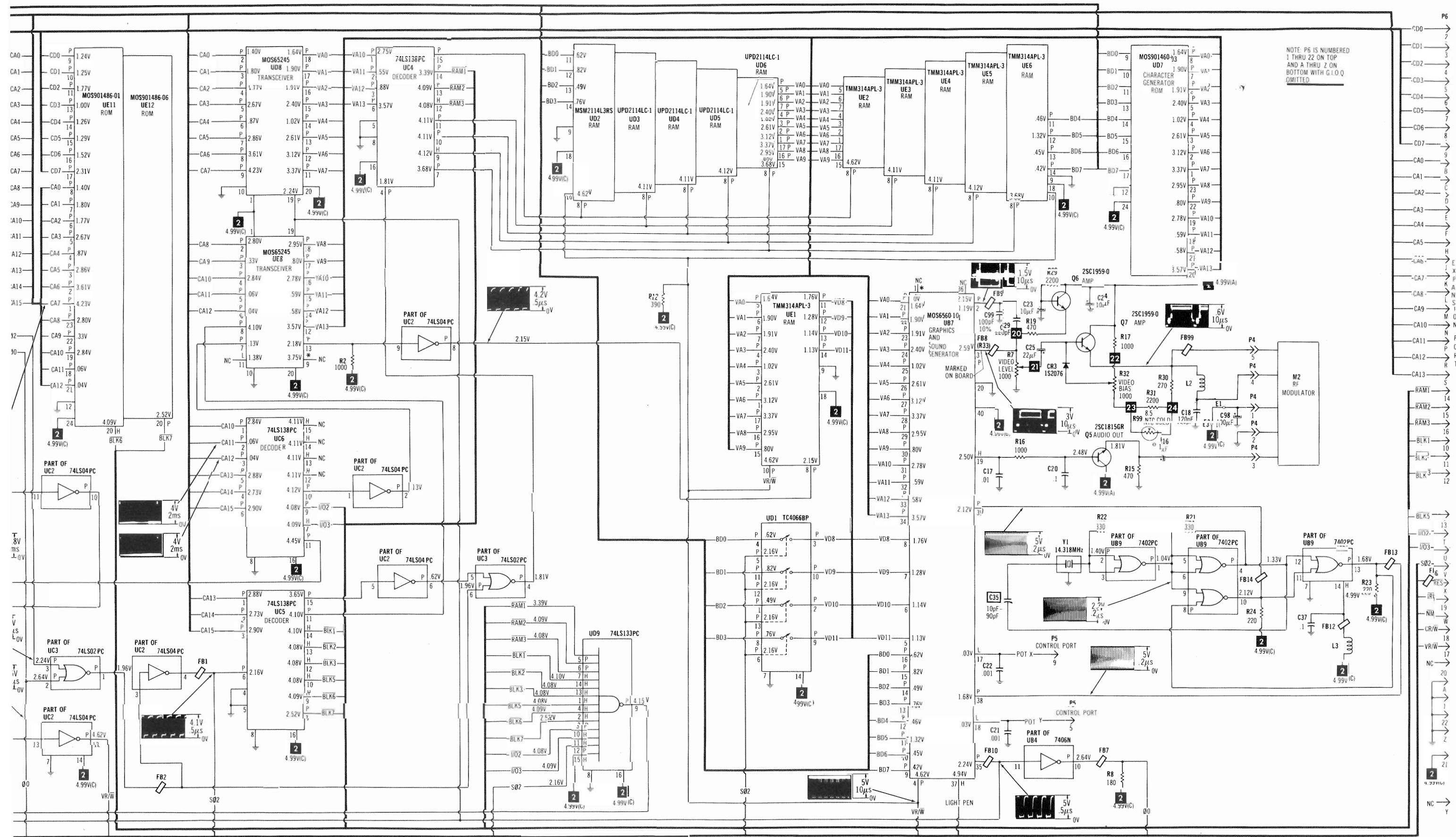
THIS WAVEFORM TAKEN AT PINS 10, 11, 12 AND 14 THRU 17 OF UAB1

WAVEFORM TAKEN WHILE LOADING A PROGRAM TO TAPE (HEADER SIGNAL)



CABLING: HEAVY LINE REDUCES USE OF MULTIPLE LINES

SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGES 3, 19



- P6 →
- CD0 →
- CD1 →
- CD2 →
- CD3 →
- CD4 →
- CD5 →
- CD6 →
- CD7 →
- CA0 →
- CA1 →
- CA2 →
- CA3 →
- CA4 →
- CA5 →
- CA6 →
- CA7 →
- CA8 →
- CA9 →
- CA10 →
- CA11 →
- CA12 →
- CA13 →
- RAM1 →
- RAM2 →
- RAM3 →
- BLK1 →
- BLK2 →
- BLK3 →
- BLK4 →
- BLK5 →
- BLK6 →
- BLK7 →
- BLK8 →
- BLK9 →
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- BLK94 →
- BLK95 →
- BLK96 →
- BLK97 →
- BLK98 →
- BLK99 →
- BLK100 →
- VR/W →
- S02 →
- FB1 →
- FB2 →
- FB3 →
- FB4 →
- FB5 →
- FB6 →
- FB7 →
- FB8 →
- FB9 →
- FB10 →
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- FB91 →
- FB92 →
- FB93 →
- FB94 →
- FB95 →
- FB96 →
- FB97 →
- FB98 →
- FB99 →
- FB100 →
- NC →
- Y →

SEE LINE DEFINITIONS ON PAGE 18

COMMODORE  
MODEL VIC 20 (EARLY VERSION)

# 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

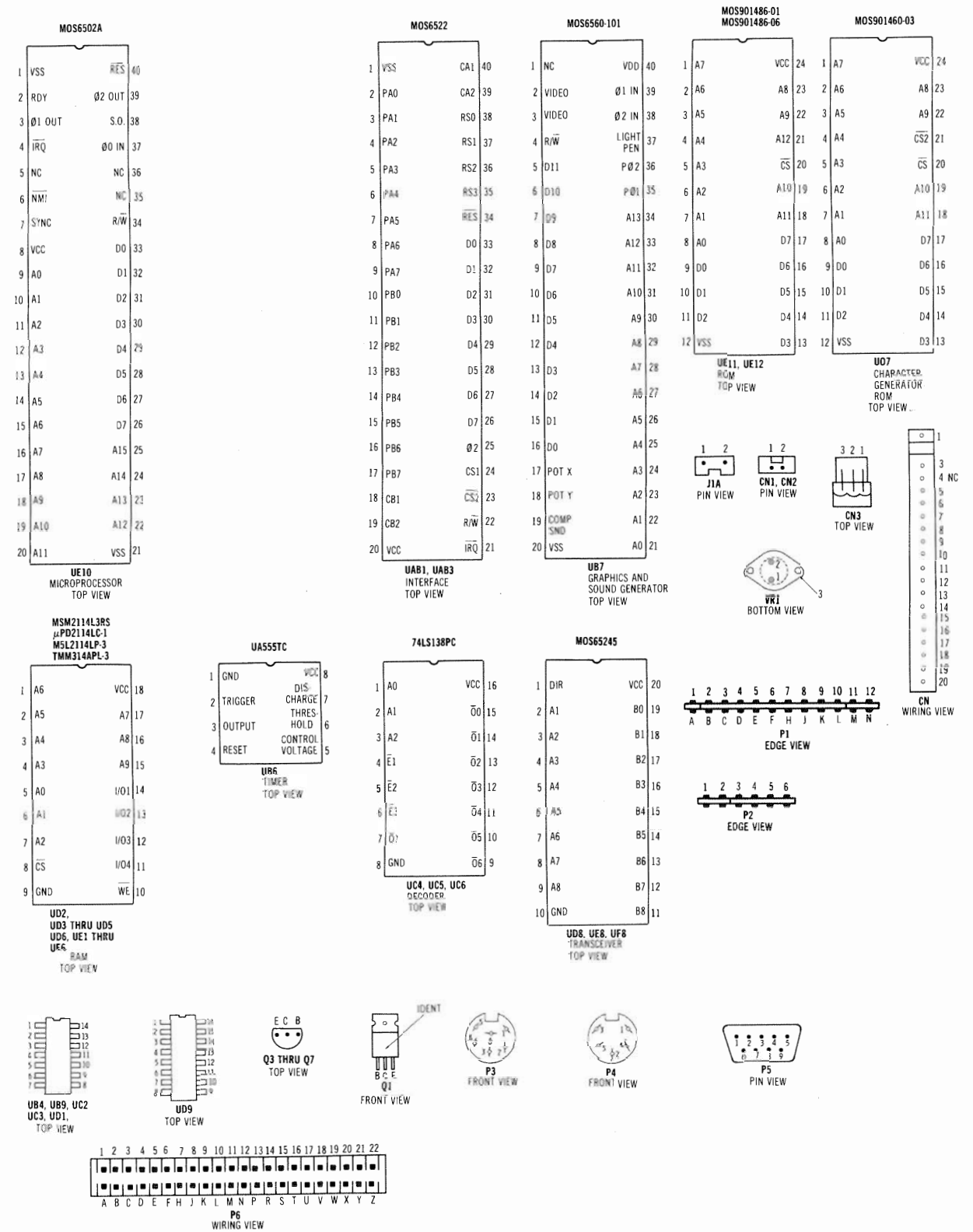
**PB0 Thru PB7** ..... Port Data Lines  
**POT X** ..... Potentiometer Grid X  
**POT Y** ..... Potentiometer Grid Y  
**RAM1 Thru RAM3** ..... RAM Expansion Port Select  
**RES** ..... Reset  
**RESTORE** ..... Restore  
**ROW1 Thru ROW7** ..... Keyboard Rows  
**SØ1** ..... Select Phase One  
**SØ2** ..... 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

- Use an isolation transformer for servicing.
- Maintain AC line voltage at rated input.
- 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.
- 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.
- Use a grounded-tip, low voltage soldering iron.
- Use an isolation (times 10) probe on scope.
- Do not remove or install boards, floppy disk drives, printers, or other peripherals with computer AC power On.
- Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
- Periodically examine the AC power cord for damaged or cracked insulation.
- The computer cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
- 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.
- Never expose the computer to water. If exposed to water turn the unit off. Do not place the computer near possible water sources.
- 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.
- Do not allow anything to rest on AC power cord.
- Unplug AC power cord from outlet before cleaning computer.
- 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.

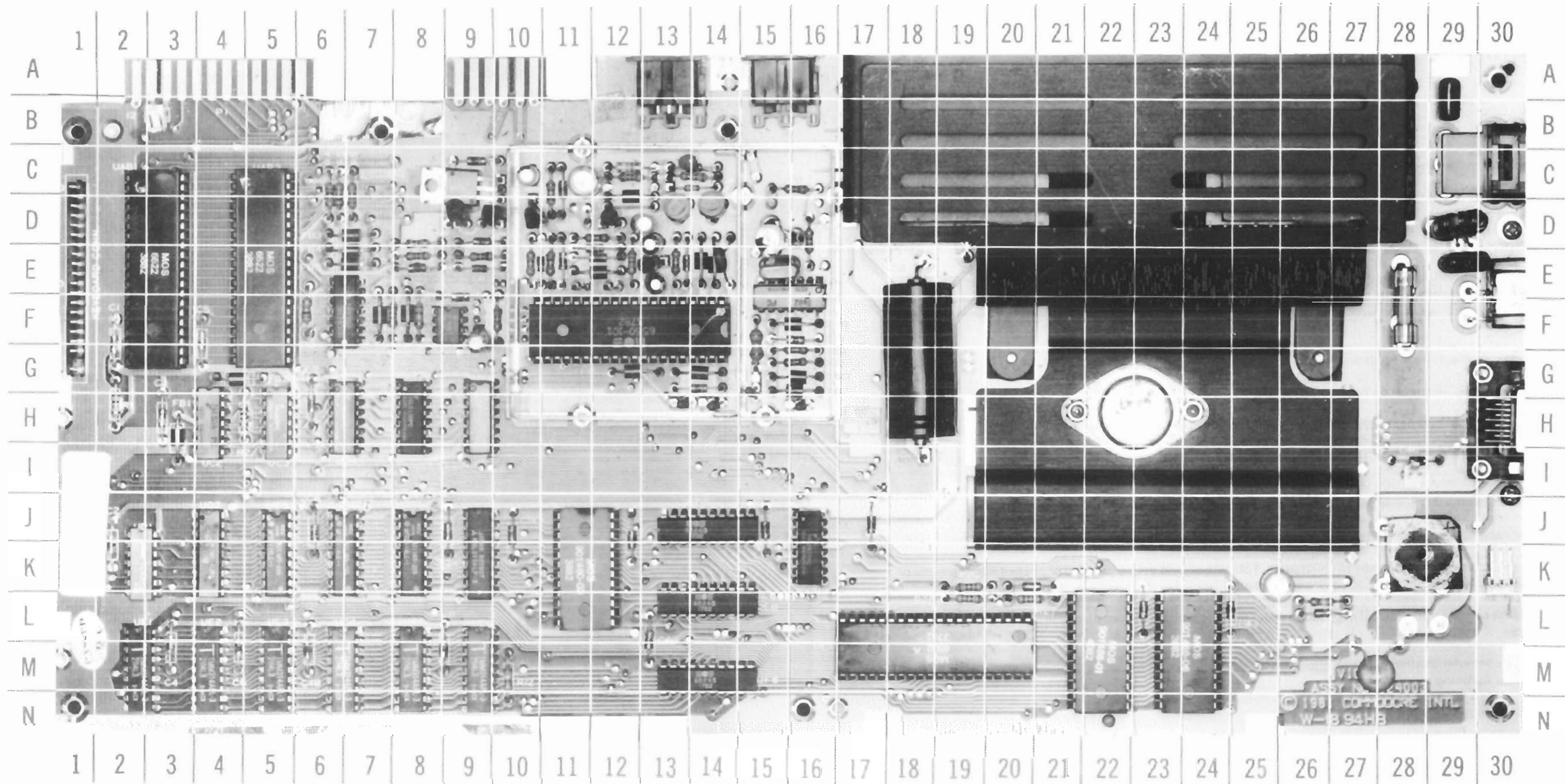
# IC PINOUTS & TERMINAL GUIDES



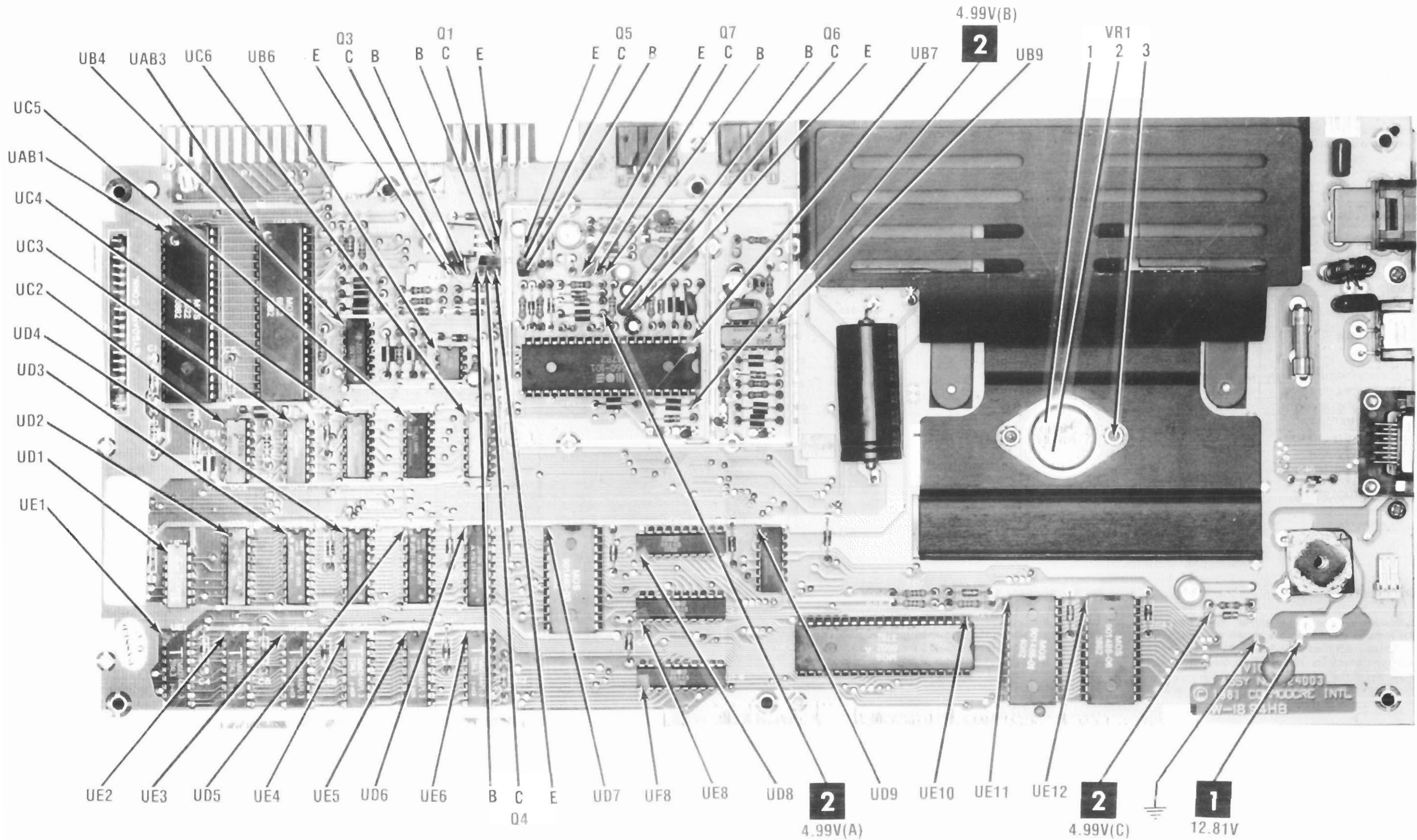
CC12  
 MODEL VIC 20 (EARLY VERSION)  
 COMMODORE

**MAIN BOARD GridTrace LOCATION GUIDE**

C1	F-2	C18	C-14	C39	F-18	C56	H-13	FB4	E-7	L4	D-29	R3	F-6	R20	C-11	UAB3	E-5	UD7	K-11
C2	K-2	C20	E-11	C40	L-13	C57	A-29	FB5	E-7	P1	A-4	R4	C-6	R21	C-16	UB4	F-7	UD8	J-14
C3	H-3	C21	E-12	C41	K-20	C58	E-29	FB6	F-7	P2	A-9	R5	C-6	R22	D-16	UB6	F-9	UD9	K-16
C4	M-3	C22	E-11	C42	L-23	C98	C-11	FB7	F-8	P3	A-13	R6	C-7	R23	G-16	UB7	F-12	UE1	M-2
C5	F-4	C23	E-13	C43	L-25	C99	E-14	FB8	E-14	P4	A-15	R7	D-13	R24	G-16	UB9	F-16	UE2	M-4
C6	M-4	C24	D-13	C44	K-26	CN	E-1	FB9	E-14	P5	H-30	R8	F-7	R25	L-19	UC2	H-4	UE3	M-5
C7	H-6	C25	D-13	C45	L-26	CN1	B-3	FB10	G-12	P6	A-23	R9	F-8	R26	K-19	UC3	H-5	UE4	M-7
C8	J-6	C26	E-12	C46	I-28	CN2	I-28	FB11	G-14	Q1	C-9	R10	D-8	R27	L-20	UC4	H-7	UE5	M-8
C9	E-8	C27	E-12	C47	C-9	CN3	K-30	FB12	F-16	Q2	H-23	R11	E-8	R28	L-26	UC5	H-8	UE6	M-9
C10	F-9	C28	C-11	C48	M-6	CR1	E-9	FB13	G-16	Q3	D-9	R12	M-10	R29	E-12	UC6	H-9	UE8	L-14
C11	M-9	C29	E-13	C49	J-9	CR2	K-28	FB14	G-16	Q4	D-9	R13	E-9	R30	C-12	UD1	K-2	UE10	M-18
C12	D-9	C30	M-27	C50	J-15	CR3	C-14	FB15	E-12	Q5	D-10	R14	F-10	R31	C-14	UD2	K-4	UE11	M-22
C13	F-9	C33	G-14	C51	J-17	F1	F-28	FB99	C-12	Q6	E-13	R15	E-10	R32	D-14	UD3	K-5	UE12	M-24
C14	J-10	C35	D-15	C53	G-15	FB1	H-3	J1A	C-30	Q7	D-12	R16	E-11	R99	C-13	UD4	K-7	UF8	M-14
C16	C-10	C37	F-16	C54	H-14	FB2	G-4	L2	C-12	R1	H-2	R17	D-12	SW1	E-30	UD5	K-8	Y1	E-15
C17	E-11	C38	J-12	C55	H-16	FB3	D-7	L3	F-15	R2	H-4	R19	E-13	UAB1	E-3	UD6	K-9		



**COMMODORE  
MODEL VIC 20 (EARLY VERSION)**



COMMODORE  
**CC12** MODEL VIC 20 (EARLY VERSION)

ARROWS ON IC'S INDICATE PIN 1 UNLESS NOTED.

## 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 Datasette 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.

### 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.	Simpson Equipment No.
OSCILLOSCOPE	1570A,1590A,1596	SC61	454
LOGIC PROBE	DP51		
LOGIC PULSER	DP101		
DIGITAL VOM	2830	DVM37,DVM56,SC61	463,467,470,474,467E
ANALOG VOM	277		260-7,160,165, 260-6XL,260-7P, 260-6XLP
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	710
COLOR BAR GENERATOR	1211A,1248,1251,1260	CG25,VA62	431
RGB GENERATOR	1260		
FUNCTION GENERATOR	3020		420A,420D
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44	HP200	248 00168,00411,00749
TEMPERATURE PROBE	TP-28		IR-10,00760,00758; 383,389,388
CRT ANALYZER	467,470	CR70	

### 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 (P1A) from the computer and check for 10.38V AC at the output of the Power Supply. 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 Regulator IC (VR1), and check for possible shorts to ground.

Datasette cassette motor does not run. While Power Supply (M1) remains plugged into a known good AC source, carefully disconnect the Power Supply Plug P1A from the computer and check for 10.38 VAC at Plug P1A. 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, check for 4.99V at Source 2 and check Regulator IC (VR1). Refer to the "Cassette Save and Load" section of this Troubleshooting guide.

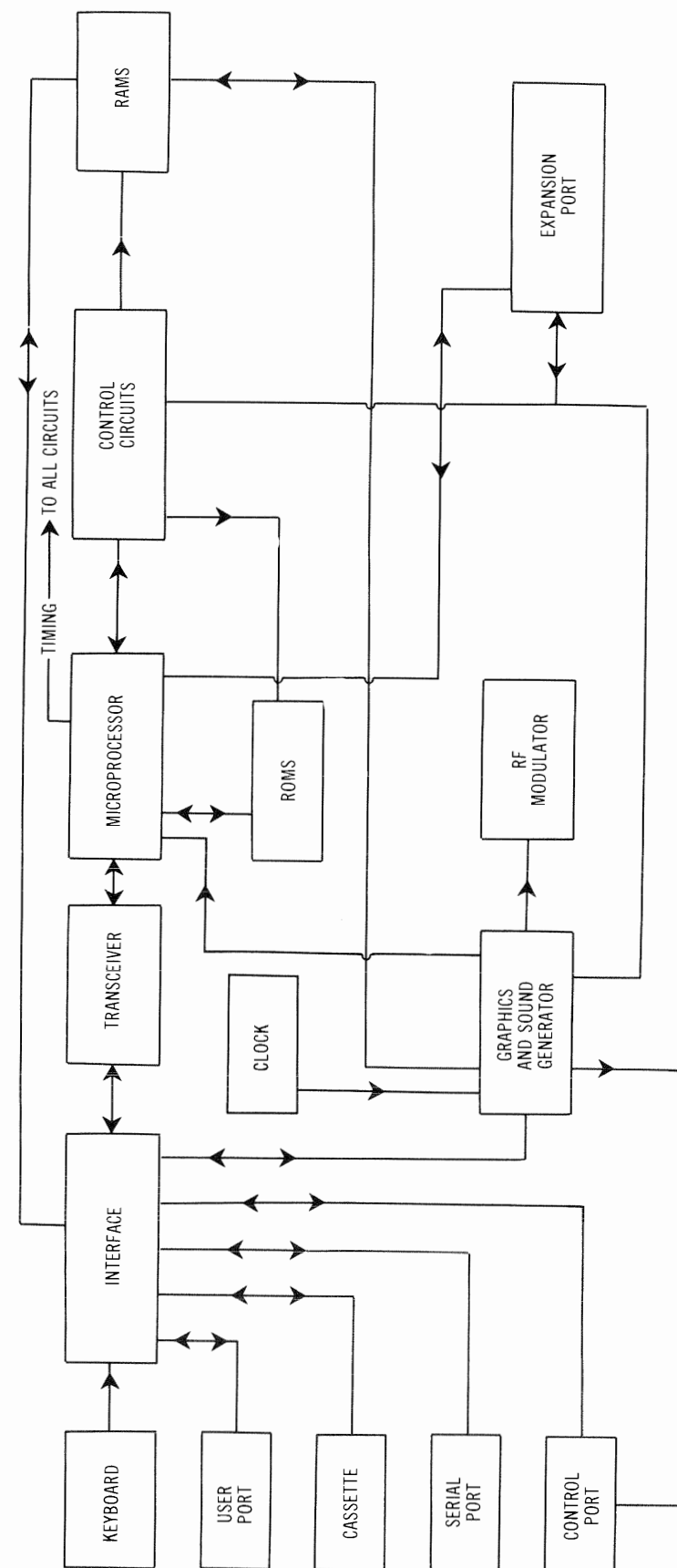
#### MICROPROCESSOR CHIP (CPU) OPERATION

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.

Datasette is a trademark of Commodore Business Machines, Inc.



COMMODORE  
MODEL VIC 20 (EARLY VERSION)

BLOCK DIAGRAM



**LOGIC (Continued)**

PIN NO.	IC UB9	IC UC2	IC UC3	IC UC4	IC UC5	IC UC6	IC UD1	IC UD2	IC UD3	IC UD4	IC UD5	IC UD6	IC UD7	IC UD8	IC UD9
1	P	P	P	P	P	P	P	P	P	P	P	P	P	H	H
2	P	P	P	P	P	P	P	P	P	P	P	P	P	P	H
3	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
4	P	P	P	P	L	P	P	P	P	P	P	P	P	P	H
5	P	P	P	L	L	P	P	P	P	P	P	P	P	P	P
6	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
7	L	L	L	P	P	H	L	P	P	P	P	P	P	P	H
8	P	P	P	L	L	L	P	P	P	P	P	P	P	P	L
9	P	P	P	H	H	P	P	L	L	L	L	L	P	P	P
10	P	P	P	P	H	P	P	P	P	P	P	P	P	L	H
11	P	P	P	P	P	P	P	P	P	P	P	P	P	P	H
12	P	P	P	H	H	H	P	P	P	P	P	P	L	P	P
13	P	P	P	P	H	H	P	P	P	P	P	P	P	P	H
14	H	H	H	P	H	H	H	P	P	P	P	P	P	P	H
15				P	P	H		P	P	P	P	P	P	P	H
16				H	H	H		P	P	P	P	P	P	P	H
17								P	P	P	P	P	P	P	
18								H	H	H	H	H	P	P	
19													P	P	
20													P	H	
21													P		
22													P		
23													P		
24													H		

PIN NO.	IC UE1	IC UE2	IC UE3	IC UE4	IC UE5	IC UE6	IC UE8	PIN NO.	IC UE10	PIN NO.	IC UE10	PIN NO.	IC UE11	IC UE12	IC UF8
1	P	P	P	P	P	P	H	1	L	21	L	1	P	P	P
2	P	P	P	P	P	P	P	2	H	22	P	2	P	P	P
3	P	P	P	P	P	P	P	3	P	23	P	3	P	P	P
4	P	P	P	P	P	P	P	4	P	24	P	4	P	P	P
5	P	P	P	P	P	P	P	5	*	25	P	5	P	P	P
6	P	P	P	P	P	P	P	6	H	26	P	6	P	P	P
7	P	P	P	P	P	P	P	7	P	27	P	7	P	P	P
8	P	P	P	P	P	P	P	8	H	28	P	8	P	P	P
9	L	L	L	L	L	L	*	9	P	29	P	9	P	P	P
10	P	P	P	P	P	P	L	10	P	30	P	10	P	P	L
11	P	P	P	P	P	P	L	11	P	31	P	11	P	P	P
12	P	P	P	P	P	P	P	12	P	32	P	12	L	L	P
13	P	P	P	P	P	P	P	13	P	33	P	13	P	P	P
14	P	P	P	P	P	P	P	14	P	34	P	14	P	P	P
15	P	P	P	P	P	P	P	15	P	35	*	15	P	P	P
16	P	P	P	P	P	P	P	16	P	36	*	16	P	P	P
17	P	P	P	P	P	P	P	17	P	37	P	17	P	P	P
18	H	H	H	H	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	P	P	
												22	P	P	
												23	P	P	
												24	H	H	

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

**TROUBLESHOOTING (Continued)**

**CRYSTAL OSCILLATOR**

Verify that the crystal oscillator is operating by checking the waveform on pin 39 of IC UB7. Also, check for a frequency of 14.31818MHz 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 missing, 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 Transistors Q6 and Q7 and check the adjustment of the Video Level Control (R7).

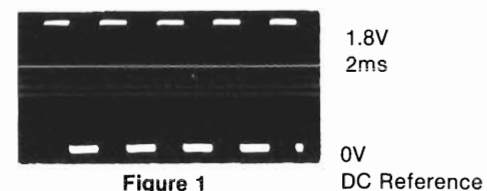
**COLOR**

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 36875,222 and press the RETURN key. Then type POKE 36878,15 and press the RETURN key. Check for the waveform shown in Figure 1 at pin 19 of IC UB7.



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 Q5. 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.

**CC12** MODEL VIC 20 (EARLY VERSION) **COMMODORE**

## TROUBLESHOOTING (Continued)

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.

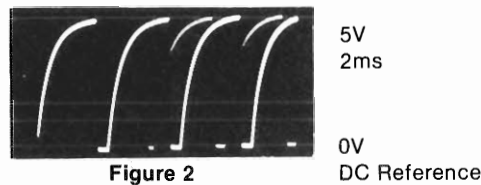


Figure 2

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.

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## ADJUSTMENTS

### VIDEO LEVEL

Connect the input of a scope to pin 5 of Socket P4 and adjust the Video Level Control (R7) for a video level of .6V peak to peak.

### 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.

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 Q1, 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
Q1	5.6V	7.3V	12.81V
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.

### 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.

## LOGIC

PIN NO.	IC UAB1	PIN NO.	IC UAB1	PIN NO.	IC UAB3	PIN NO.	IC UAB3	PIN NO.	IC UB4	IC UB6	PIN NO.	IC UB7	PIN NO.	IC UB7
1	L	21	P	1	L	21	H	1	L	L	1	*	21	P
2	H(6)	22	P	2	L	22	P	2	H	H	2	P	22	P
3	H(7)	23	P	3	H	23	P	3	H	L	3	P	23	P
4	H(8)	24	P	4	H	24	P	4	L	H	4	P	24	P
5	H(9)	25	P	5	H	25	P	5	L	H	5	P	25	P
6	H(10)	26	P	6	H	26	P	6	H	L	6	P	26	P
7	H(11)	27	P	7	H	27	P	7	L	L	7	P	27	P
8	H(12)	28	P	8	H(4)	28	P	8	H	H	8	P	28	P
9	H(13)	29	P	9	L	29	P	9	L		9	P	29	P
10	P	30	P	10	H	30	P	10	P		10	P	30	P
11	P	31	P	11	H	31	P	11	P		11	P	31	P
12	P	32	P	12	H	32	P	12	L		12	P	32	P
13	L(2,14)	33	P	13	H	33	P	13	*		13	P	33	P
14	P	34	H	14	H	34	H	14	H		14	P	34	P
15	P	35	P	15	H	35	P				15	P	35	P
16	P	36	P	16	H	36	P				16	P	36	P
17	P	37	P	17	H	37	P				17	L	37	H
18	H	38	P	18	H	38	P				18	L	38	P
19	L	39	H	19	H	39	*(5)				19	H	39	P
20	H	40	*(3)	20	H	40	H(1)				20	L	40	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)

- Goes low when RESTORE key is pressed.
- Pulses appear while saving a program to cassette tape.
- Pulses appear while loading a program from cassette tape.
- Goes low when cassette recorder is put in Play or Record mode.
- Goes low to turn cassette recorder on.

- Pulses appear when —, 1, 2, CTRL, Q, RUN/STOP, CMD or SPACE key is pressed.
- Pulses appear when 3, 4, W, E, SHIFT LOCK, A, S, LEFT SHIFT or Z key is pressed.
- Pulses appear when 5, 6, T, R, D, F, X or C key is pressed.
- Pulses appear when 7, 8, Y, U, G, H, V or B key is pressed.
- Pulses appear when 7, 9, 0, R, Y, I, O, G, J, K, N or M key is pressed.
- Pulses appear when +, —, P, @, L, :, . or COMMA key is pressed.
- Pulses appear when £, CLR/HOME, \*, !, ;, =, / or RIGHT SHIFT key is pressed.
- Pulses appear when INST/DEL, RETURN, CRSR, CRSR, F1, F3, F5, or F7 is pressed.
- Pulses appear for all keys except RESTORE.

COMMODORE  
MODEL VIC 20 (EARLY VERSION)

## PARTS LIST AND DESCRIPTION (Continued)

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

### MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
CR9 FB1 thru FB7 FB9 thru FB15 FB99 M1 M2 P10 SW1 Y1	LED Ferrite Bead  Ferrite Bead  Ferrite Bead Power Supply RF Modulator Cord Switch Crystal Antenna Switch Keyboard	   P/N251052-02      904778-01	1.63V @ 8mA, Red      AC Power On/Off 14.31818MHz Computer-TV

### FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	3.15A @ 250V Fast-Acting			

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

## 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					
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	ZENITH PART No.
CR1 CR2 CR3 Q1	W075 KBPC802 1S2076 2SD880Y		GEZD-7.5 GE-514 GE-66A	NTE015A NTE513 NTE119 NTE152	EC65015A EC65313 EC6519 EC6152	SK7A5/5015A SK3986/5313 SK3100/519 SK3440/291	WEP1416/5015 WEP925/519 WEP746/152	103-Z9002 103-131 121-987-03
Q3 thru Q5 Q6 7 UA01 UA03	2SC1815R  2SC1959-0 MOS6512 MOS6742		GE-62 GE-210	NTE85 NTE85	EC685 EC685	SK3124A/289A SK9229/85	WEP66/199 WEP910/289	121-Z9065 921-1114
UB4 UB6 UB7 UB9 UC2	SN7106N UA515TC MOS1560-101 7401PC 74LS04PC		GE-7406 GE 1C-269 GE-7402 74LS04	NTE7406 NTE955M NTE7402 NTE74LS04	ECG7406 ECG955M ECG7402 ECG74LS04	SK7406 SK3564/955M SK7402 SK74LS04	WEP2119/955M WEP7402/7402	HE-443-698 221-Z9042 HE-443-46 HE-443-755
UC3 UC4 thru UC6	74LS02PC 74LS138PC		74LS02 74LS138	NTE74LS02 NTE74LS138	ECG74LS02 ECG74LS138	SK74LS02 SK74LS138		HE-443-779 HE-443-877
UD1 UD2	TC4066BP MSM2114L3RS			NTE4066B NTE2114	ECG4066B ECG2114	SK4066B SK2214/2114	WEP4066B/4066B	905-369 HE-443-764
UD3 thru UD5 UD6 UD7 UD8	UPD2114LC-1  M5L2114LP-3 MOS901460-03 MOS65245		74LS133	NTE74LS133	ECG74LS133	SK74LS133		HE-443-764
UD9 UE1 thru UE6 UE8 UE10	74LS133PC TMM514APL-3 MOS65245 MOS6502A			NTE6502	ECG6502			

CC12

MODEL VIC 20 (EARLY VERSION)

COMMODORE

**10 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					ZENITH PART No.
			GENERAL ELECTRIC PART No.	NTE PART No.	ECG PART No.	RCA PART No.	WORKMAN PART No.	
UE11 UE12 UF8 VR1	MOS901486-01 MOS901486-06 MOS65245 SH323SC			NTE931	EC931	SK9067/931		HE-442-702

**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** Items Not Listed Are Normally Available At Local Distributors.

ITEM No.	RATING	MFR. PART No.
C13	1 50V 10%	
C16	1 50V 10%	
C53	2.2 1%	

ITEM No.	RATING	MFR. PART No.
C54	2.2 1%	
C55	.47 3%	
C56	.47 3%	

**CAPACITORS** Items Not Listed Are Normally Available At Local Distributors.

ITEM No.	RATING	MFR. PART No.
C35	10-90pF Trimmer	

ITEM No.	RATING	MFR. PART No.

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

ITEM NO.	FUNCTION	RESISTANCE	MFR. PART NO.	NOTES
R7	Video Level	1000		
R32	Video Bias	1000		

**COILS (RF-IF)**

ITEM No.	FUNCTION	MFR. PART No.
L2 L3	Peaking RF Choke	

ITEM No.	FUNCTION	MFR. PART No.
L4	Line Filter	

**COMMODORE  
MODEL VIC 20 (EARLY VERSION)**

**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.

**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.

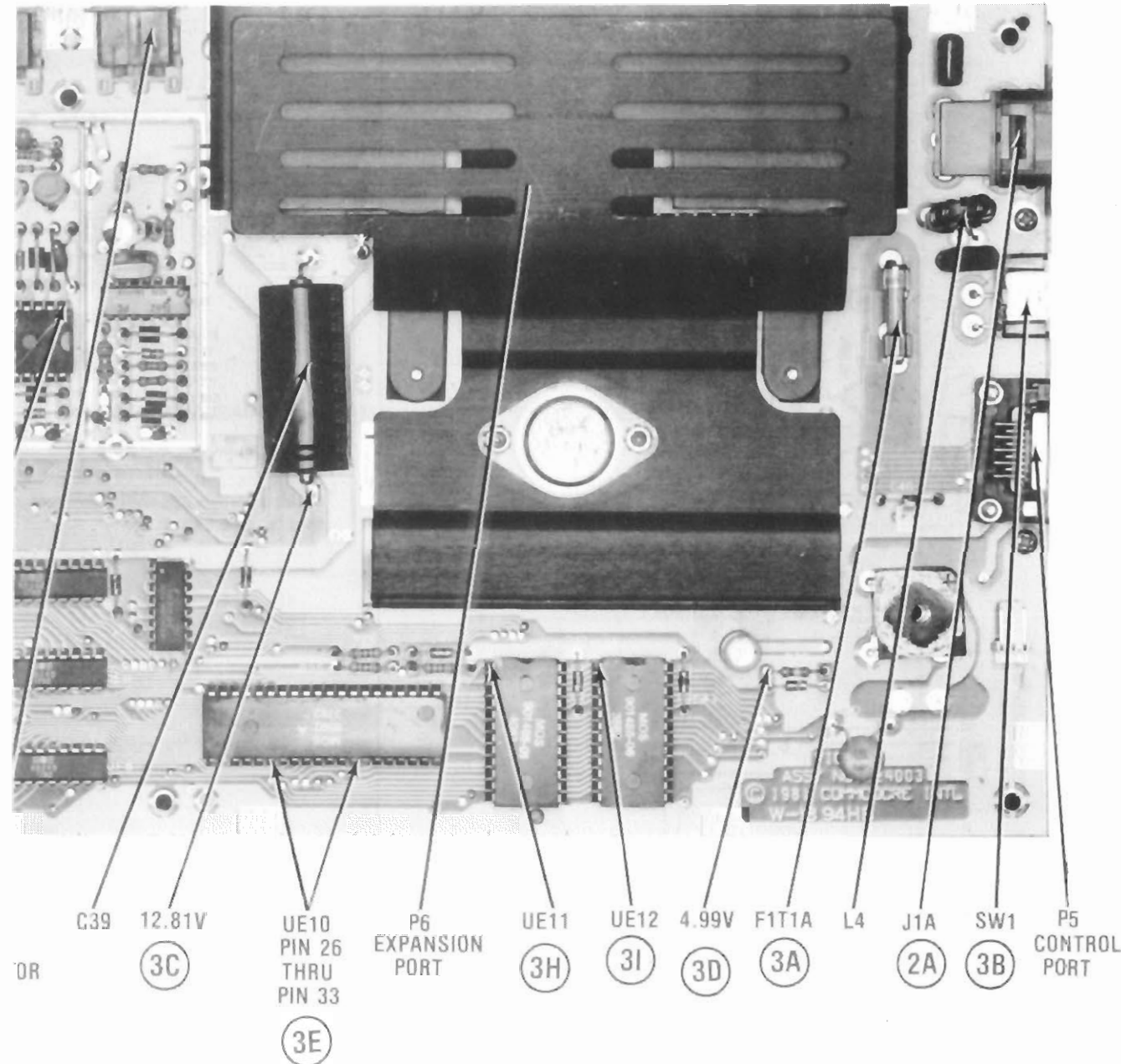
**CASSETTE OPERATION**

Plug a Datasette 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.

Datasette is a trademark of Commodore Business Machines, Inc.



MAIN BOARD

COMMODORE  
MODEL VIC 20 (EARLY VERSION)  
CC12  
MODEL VIC 20 (EARLY VERSION)

COMMODORE  
MODEL VIC 20 (EARLY VERSION)  
CC12  
MODEL VIC 20 (EARLY VERSION)

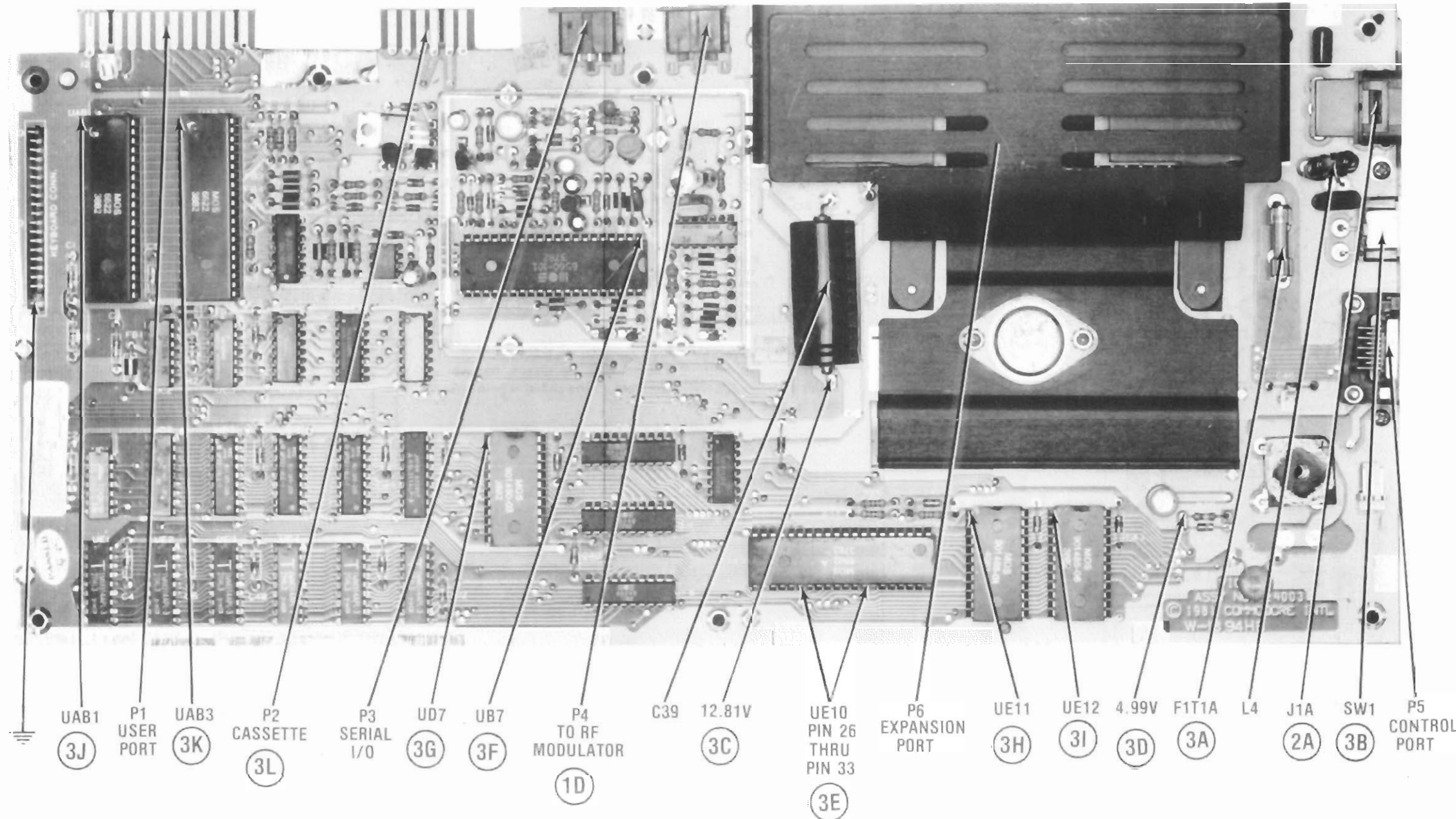
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PRELIMINARY SERVICE CHECKS (Continued)

PRELIMINARY SERVICE CHECKS (Continued)



MAIN BOARD

MAIN BOARD

**CC12** COMMODORE MODEL VIC-20 (EARLY VERSION)

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**POWER UP**

When the computer is turned

See "Cassette Operation" for

To run a program, type RUN :

To stop a program, press the

Press the RUN/STOP key and  
to the start condition, without

**CASSETTE OPERATION**

Plug a Datacassette cassette re  
regular cassette tape records

To load a program, type LOAD  
screen.

To save a program, type SAVE

Datasset

# PRELIMINARY SERVICE CHECKS (Continued)

## SERVICE CHECKS

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

### 1 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 hook-up 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 of the power connector (J1A). 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 R28.

- (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.

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## TEST EQUIPMENT AND TOOLS

### TEST EQUIPMENT

- Digital Volt/Ohm Meter
- Logic Probe

### TOOLS

- Phillips Screwdriver
- Small Screwdriver
- Soldering Iron
- Switch Cleaner

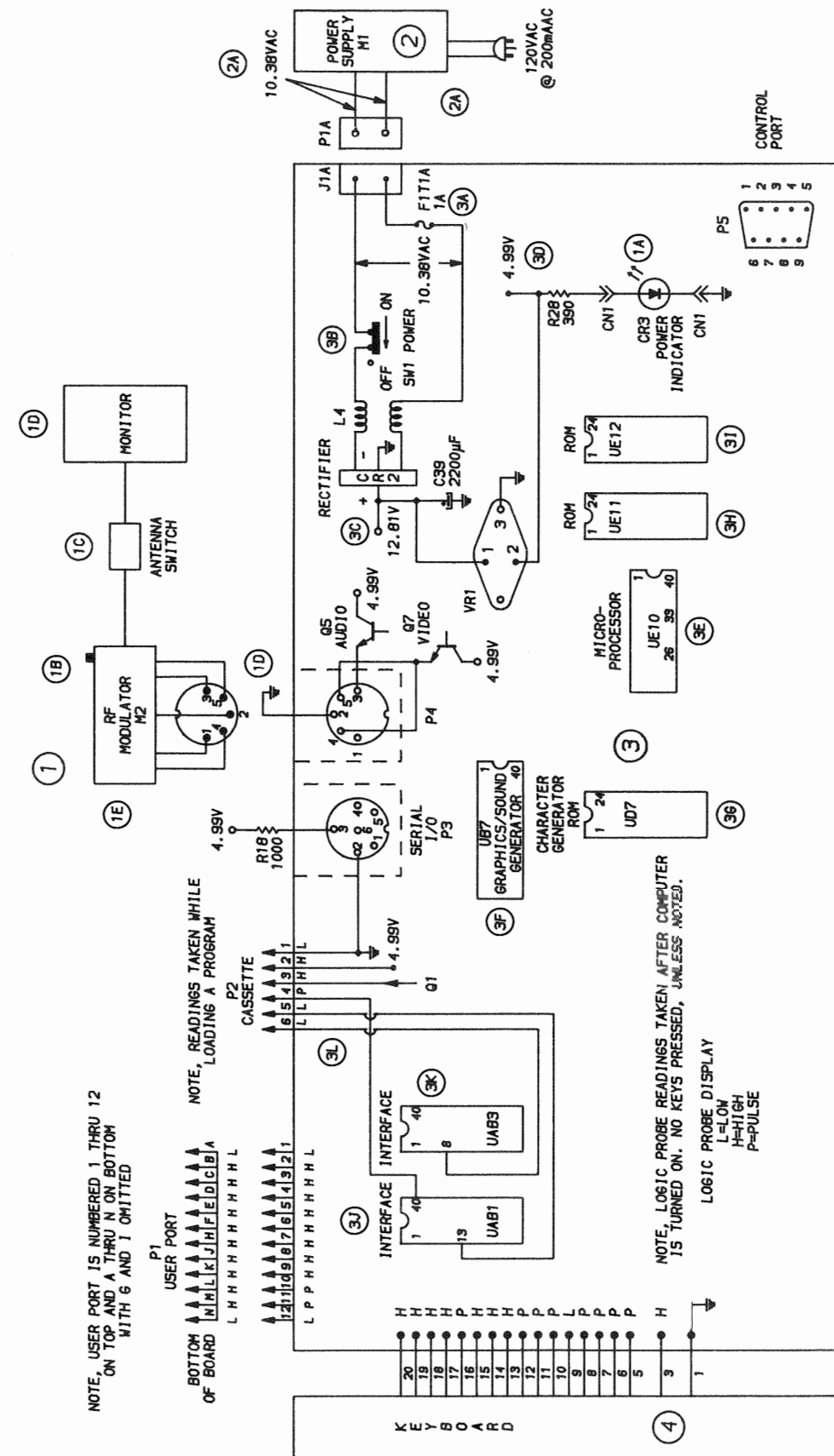
## REPLACEMENT PARTS

ITEM	PART NO.	DESCRIPTION
C39		Electrolytic Capacitor 4700µF, 16V
F1T1A		Fuse, 1A @ 250V, Fast Acting
M1	902502-02	Power Supply. Input 117VAC, 47-63Hz, 40W, Output 10VAC, 30VA
M2		RF Modulator
R28		Resistor, 390 ohms
SW1		Switch, Power
UAB1		IC, Interface, MOS6522
UAB3		IC, Interface, MOS6522
UB7		IC, Graphics and Sound Generator, MOS6560-101
UD7		IC, Character Generator ROM MOS901460-03
UE10		IC, Microprocessor, MOS6502A
UE11		IC, ROM, MOS901486-01
UE12		IC, ROM, MOS901486-06

# PRELIMINARY SERVICE CHECKS (Continued)

# PRELIMINARY SER

# DISASSEMBLY



### 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 power plugs and remove cabinet top. See Figure 1.

### MAIN BOARD REMOVAL

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

### KEYBOARD REMOVAL

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

INTERCONNECTING DIAGRAM

# E CHECKS (Continued)

## CHECKS

PHOTOS TO MATCH THE NUMBER IN THE DATA FOR SERVICE CHECKS TO BE PER-

- (E) Computer does not power up when turned On. Check for pulses on pins 26 thru 33 of the Micro-processor 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.

Datassette is a trademark of Commodore Business Machines, Inc.

## TEST EQUIPMENT AND TOOLS

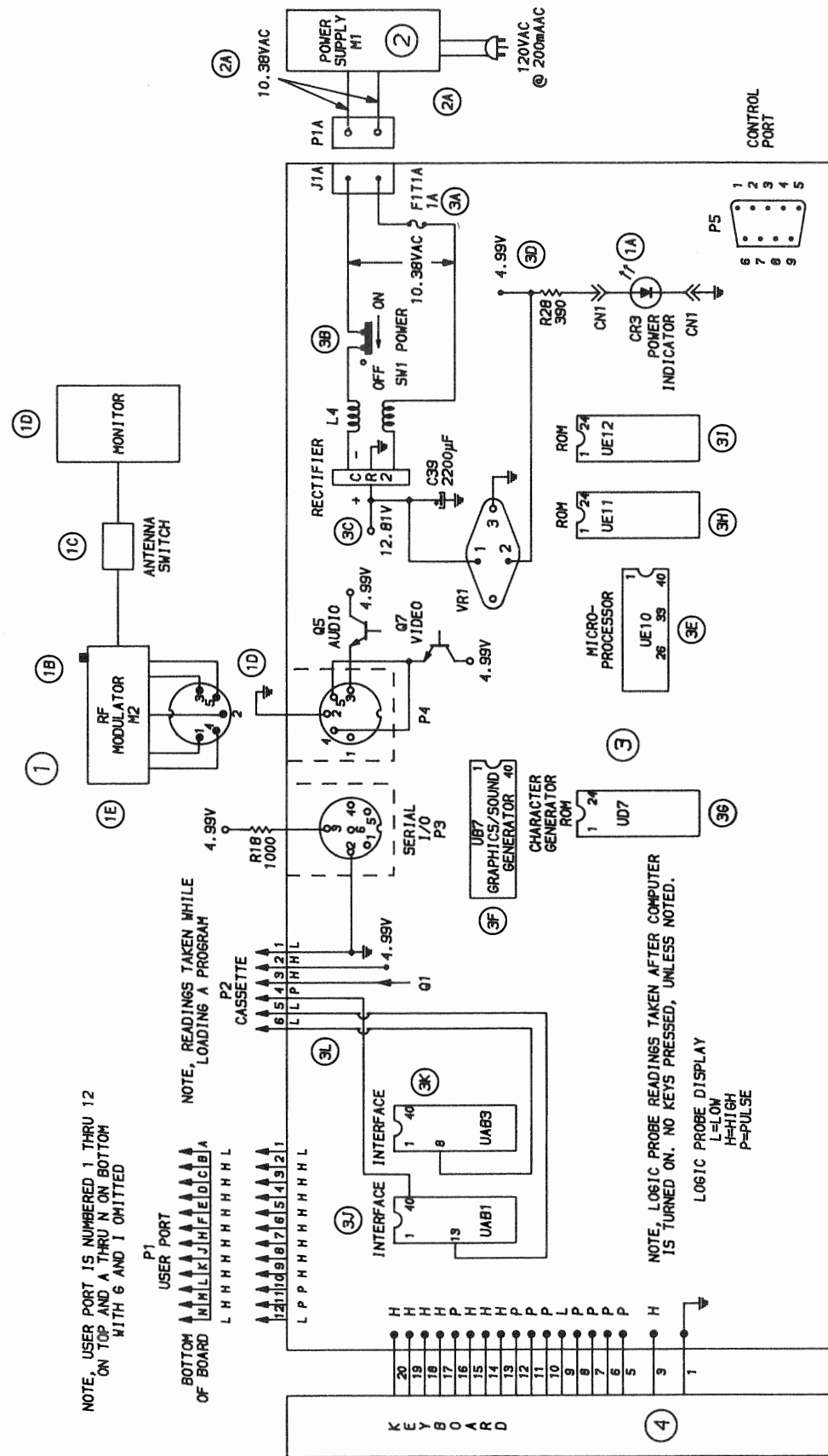
### TEST EQUIPMENT

Digital Volt/Ohm Meter  
Logic Probe

### TOOLS

Phillips Screwdriver  
Small Screwdriver  
Soldering Iron  
Switch Cleaner

# PRELIMINARY SERVICE CHECKS (Continued)



INTERCONNECTING DIAGRAM

# 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.

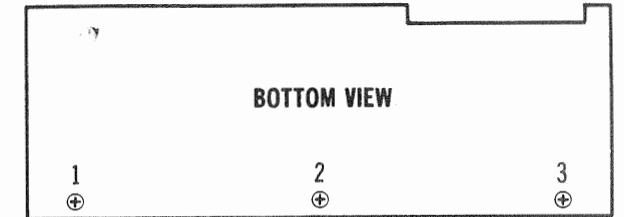


Figure 1

### 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 remove the shield at points A thru G. See Figure 2.

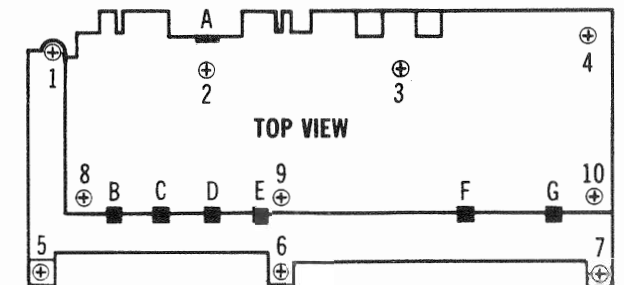


Figure 2

### 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.

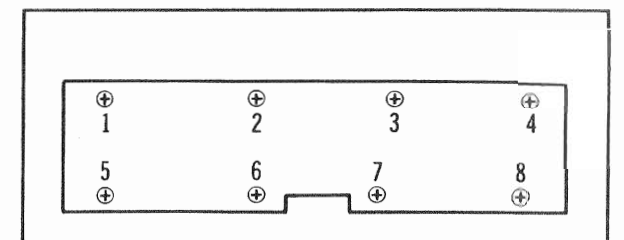


Figure 3