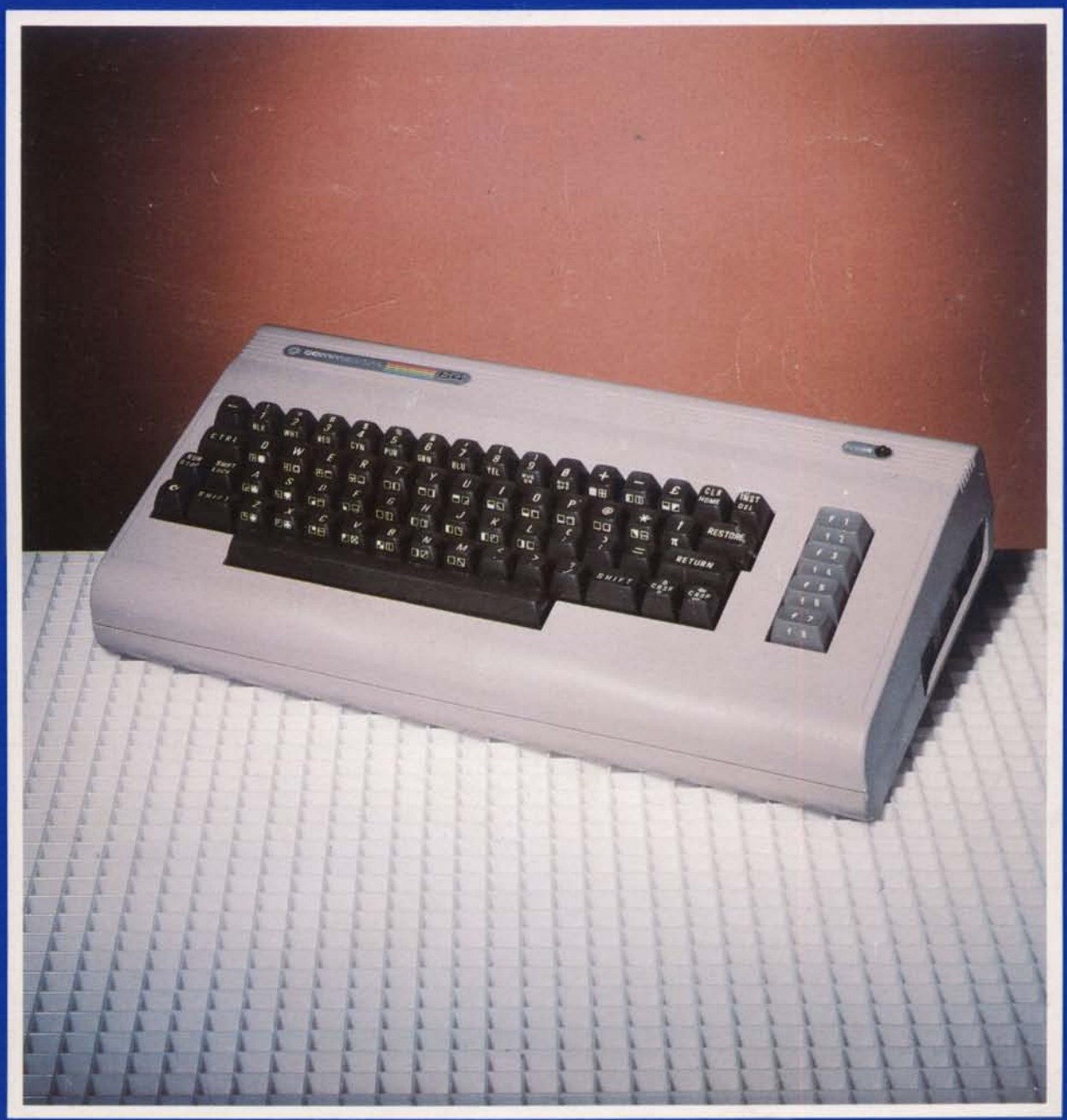
SAMS COMPUTERFACTS™ CC4

COMPUTER : COMMODORE 64™



TECHNICAL SERVICE DATA FOR YOUR COMPUTER

CC4 COMMODORE MODEL 64



CC4 COMMODORE MODEL 64

PRELIMINARY SERVICE CHECKS

ENCLOSED

SAFETY PRECAUTIONS

See Page 4.

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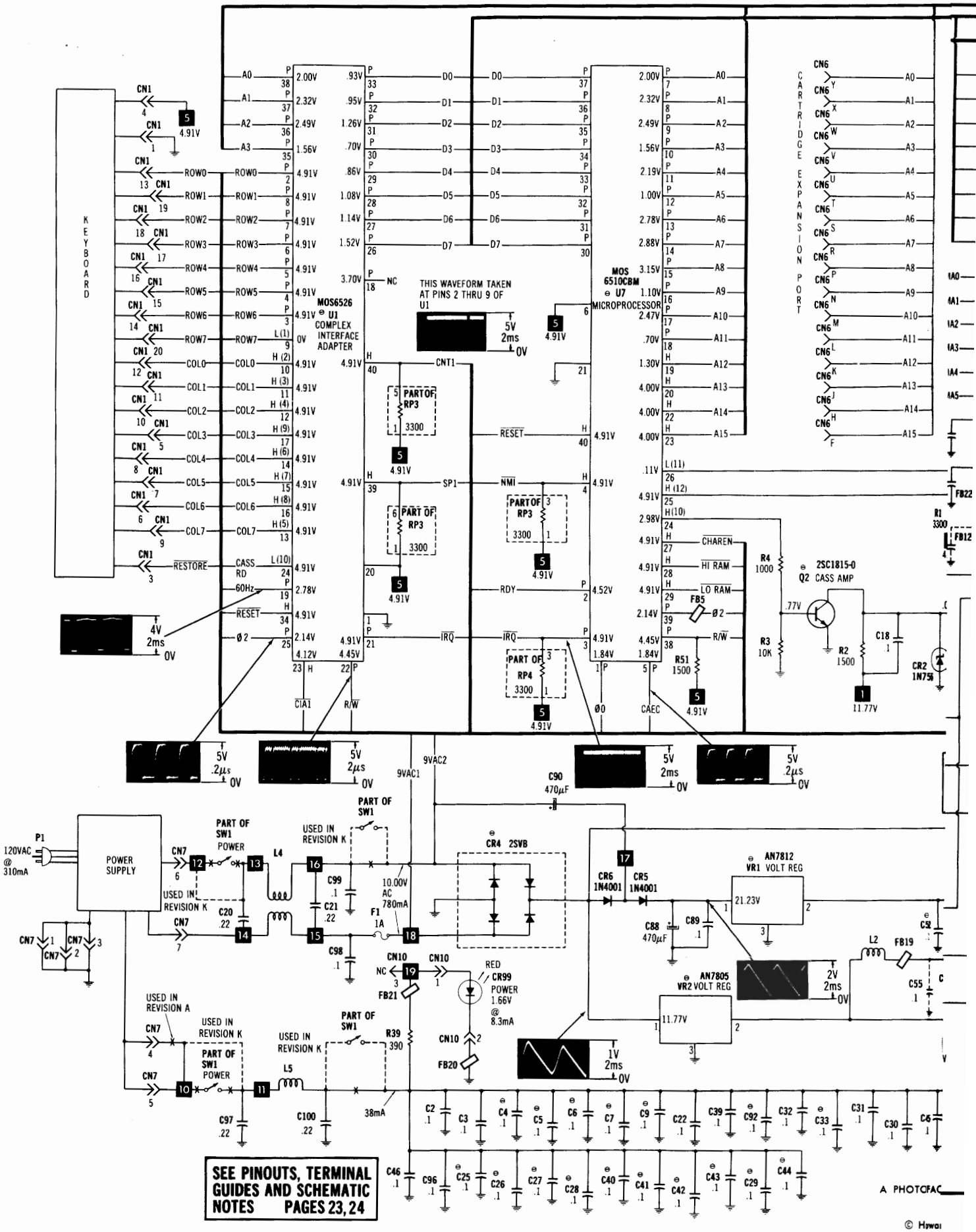
SAMS™ Howard W. Sams & Co., Inc.
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

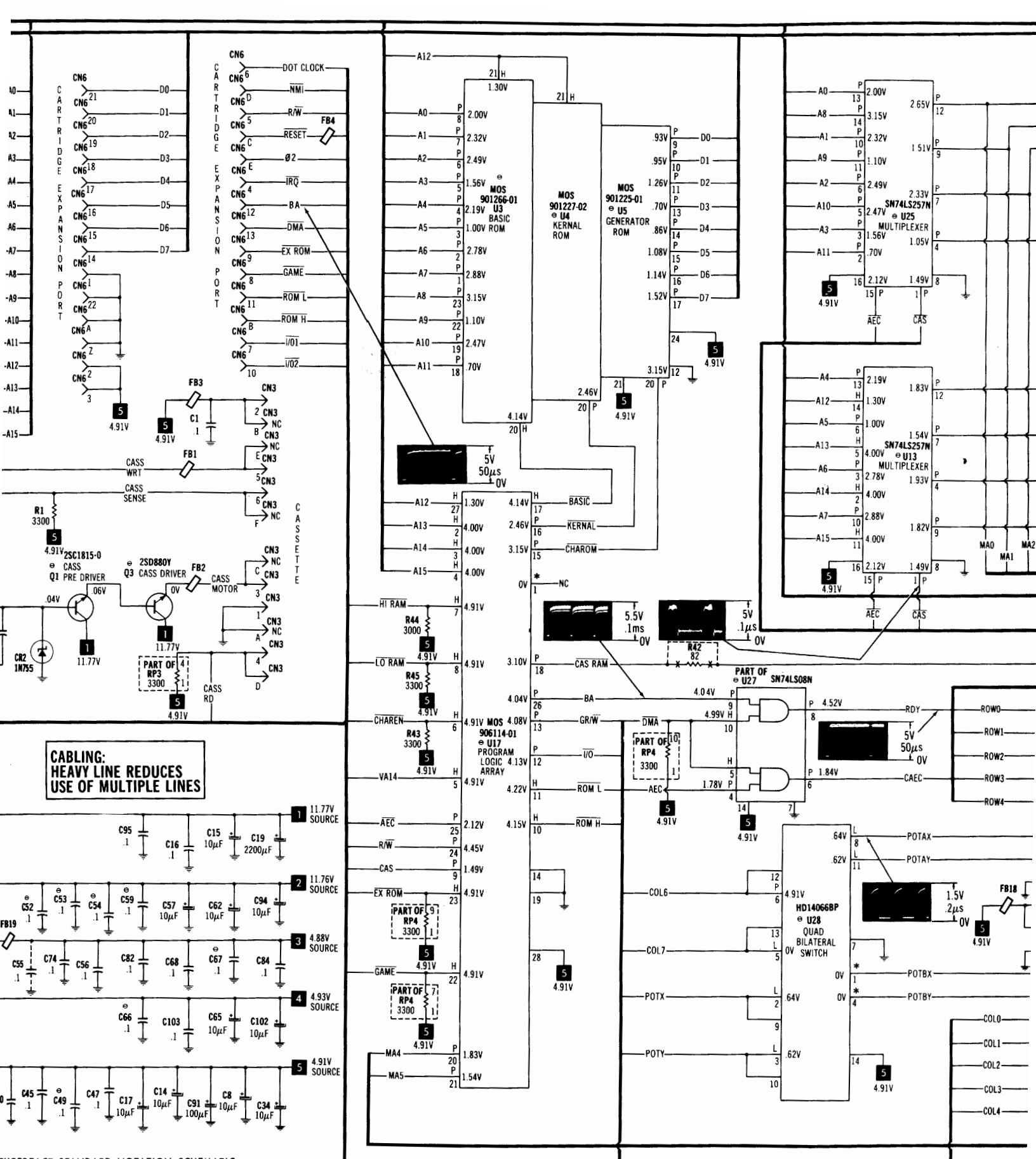
The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W.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

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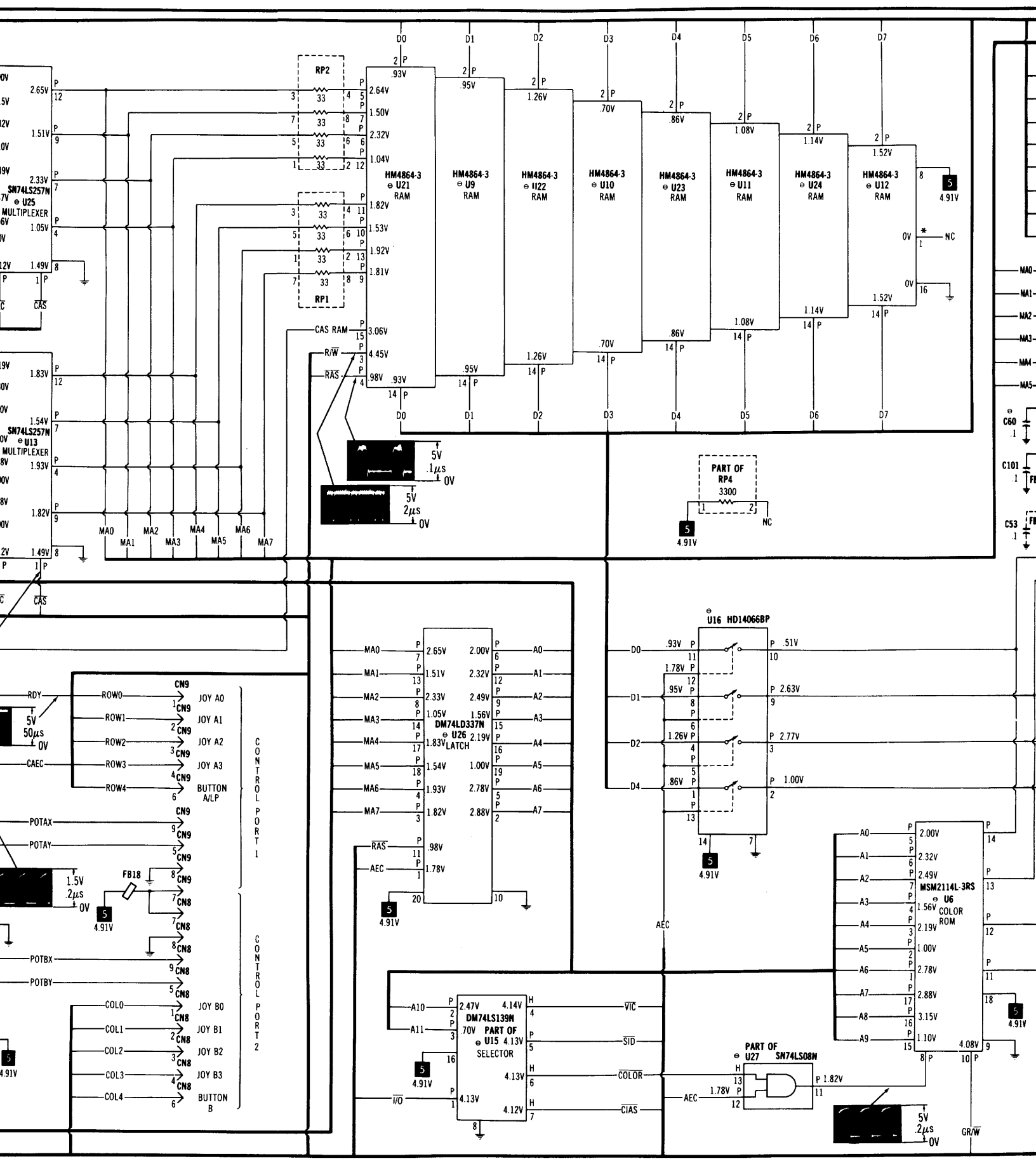

KEYBOARD
CARTRIDGE EXPANSION PORT
MOS6526 U1 COMPLEX INTERFACE ADAPTER
MOS 6510CBM U7 MICROPROCESSOR
THIS WAVEFORM TAKEN AT PINS 2 THRU 9 OF U1
PART OF RP3 3300
PART OF RP4 3300
2SC1815-O Q2 CASS AMP
POWER SUPPLY
120VAC @ 310mA
AN7812 VR1 VOLT REG
AN7805 VR2 VOLT REG
CR4 2SVB
CR6 1N4001
CR5 1N4001
CR99 POWER 1.66V @ 8.3mA
SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES PAGES 23,24



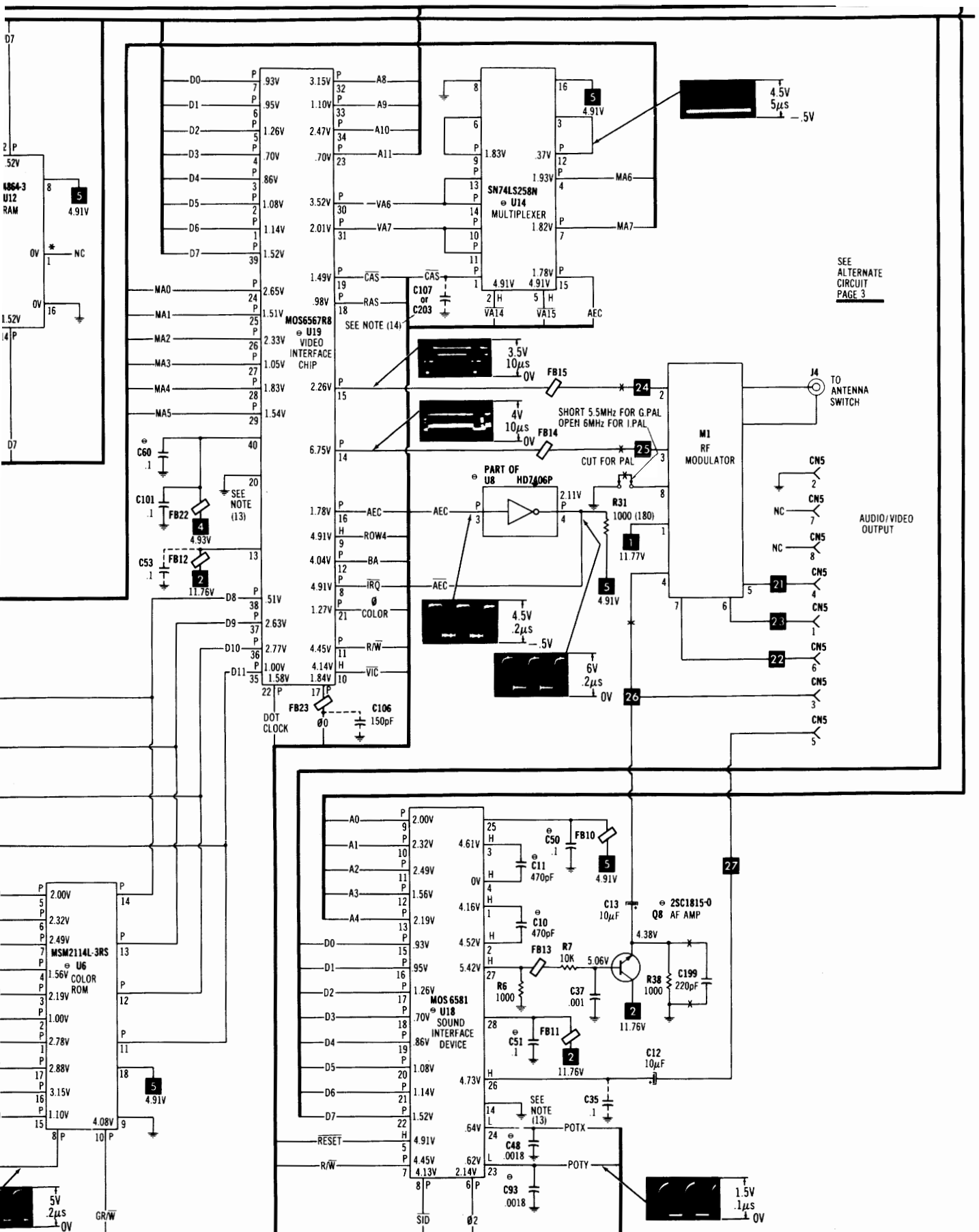
PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE

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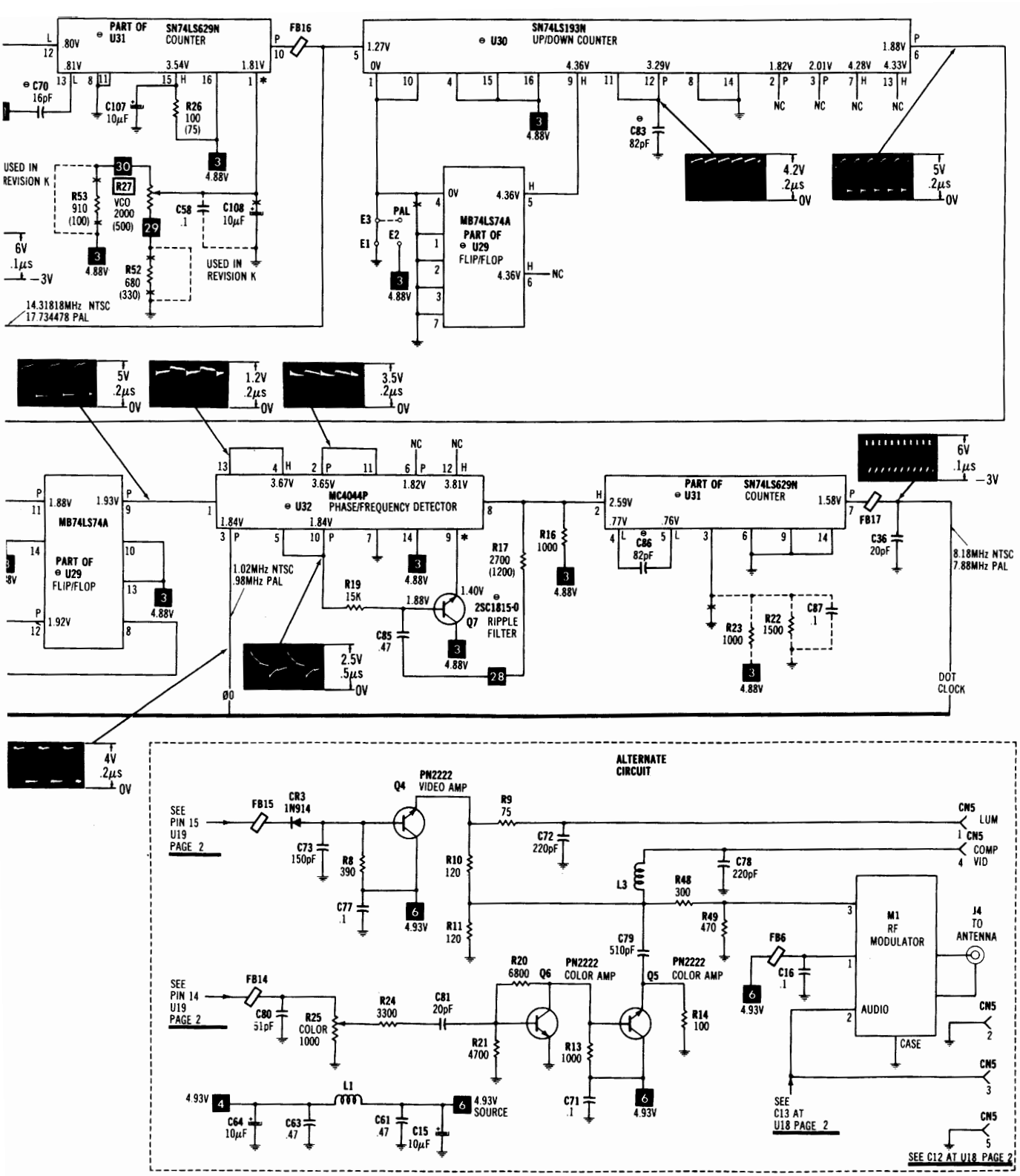
SEE LINE DEFINITIONS ON



E DEFINITIONS ON PAGE 21

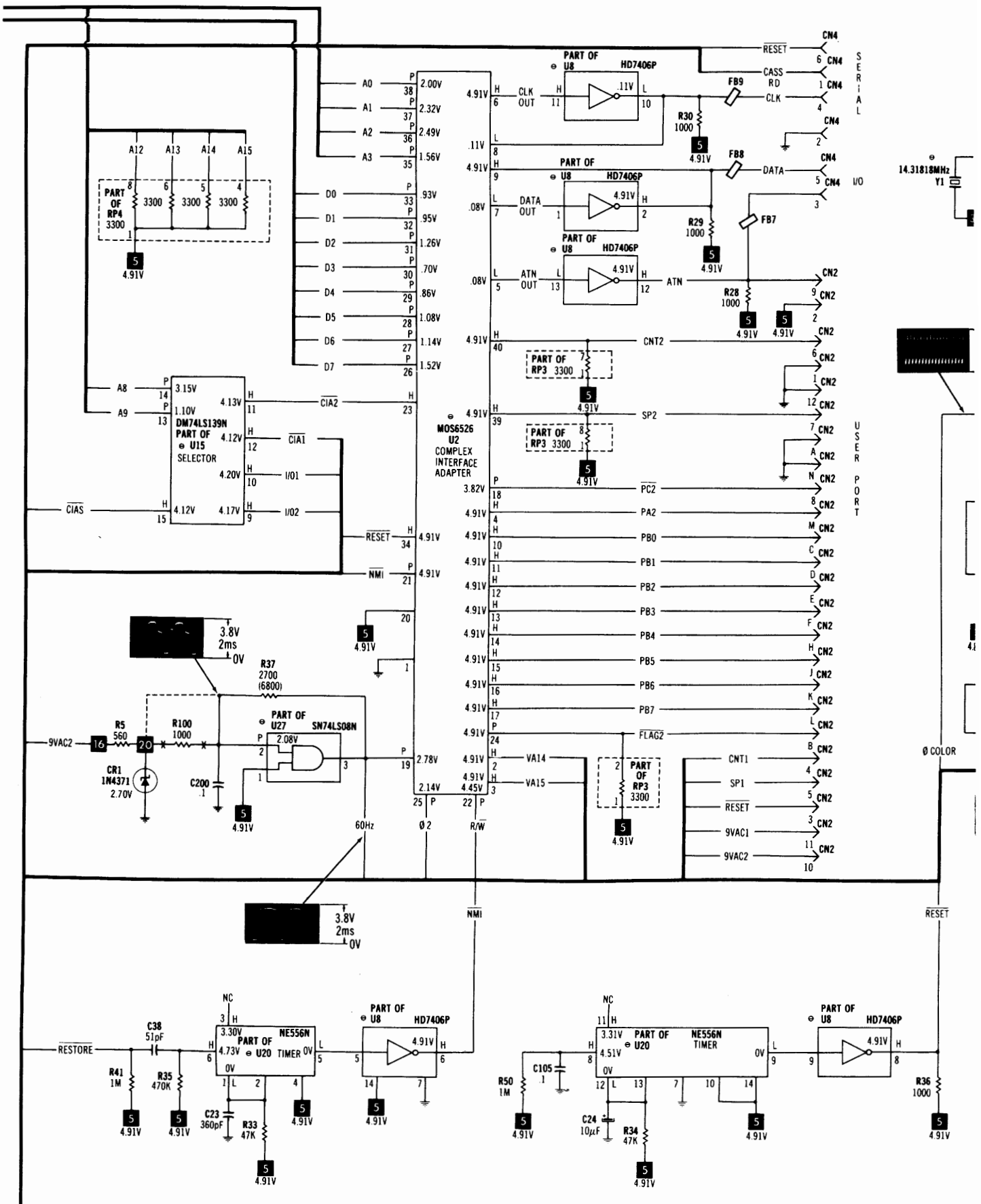


COMMODORE
MODEL 64



IITIONS ON PAGE 21

A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE
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SEE LINE DEFI

GENERAL OPERATING INSTRUCTIONS

POWER UP

When the computer is turned On, it will come up ready to program in Commodore Basic. See "Cassette Operation" and "Disk Operation" sections 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 a Datassette cassette recorder onto the six pin edge connector at the rear of the computer. Note: A regular tape recorder will not work on the Commodore 64. 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.

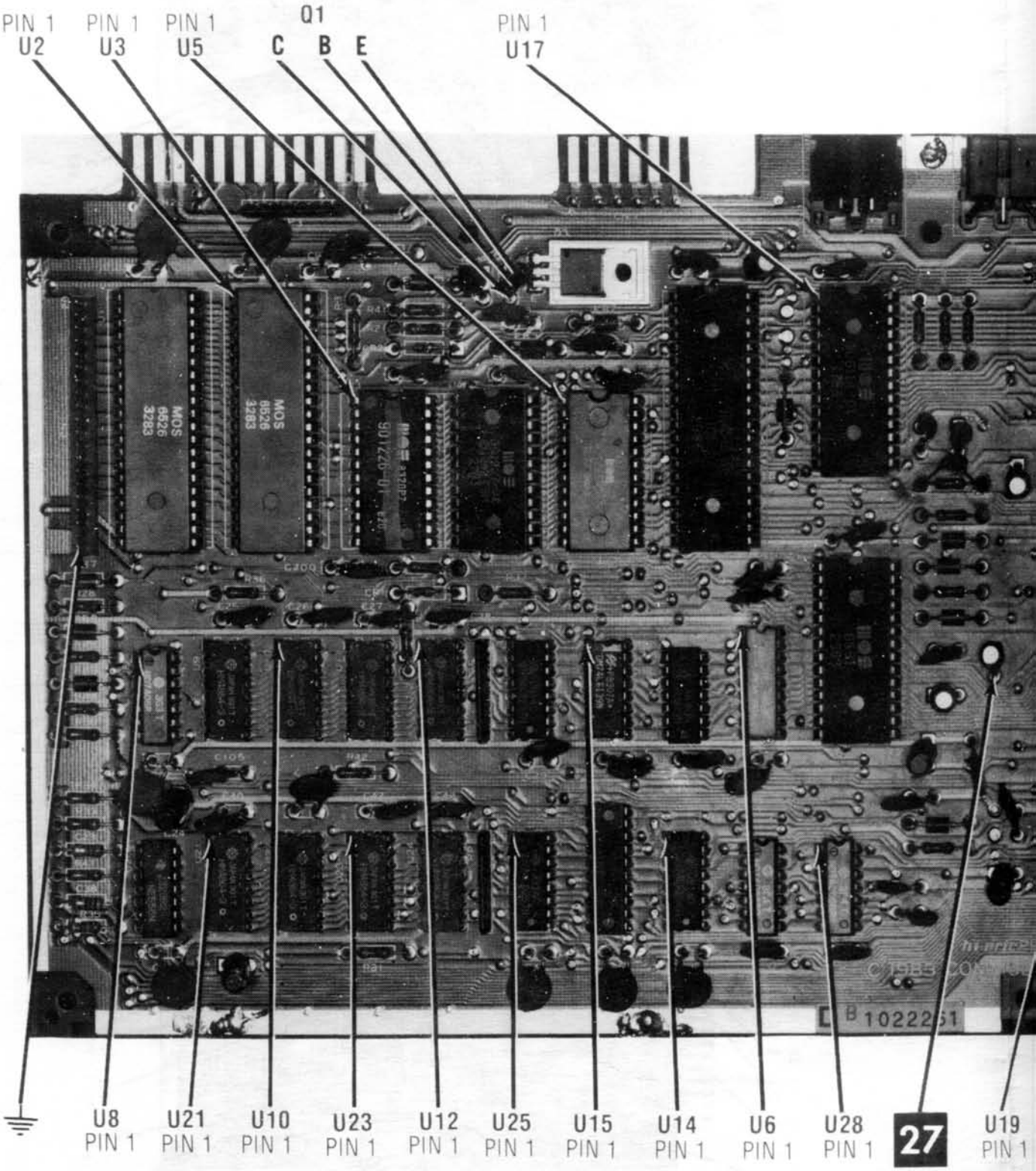
DISK OPERATION

Connect Disk Drive unit to the Serial I/O Port (CN4) located at the rear of the computer. Carefully insert the disk so that the label on the disk is facing up and the notch on the disk is on the left side. Once the disk is inserted, close the protective gate by pushing down on the gate lever. To load a program from the disk, type LOAD "PROGRAM NAME", 8. Press the RETURN key and follow the instructions displayed on the monitor. To SAVE a program, type SAVE "PROGRAM NAME", 8 and press the RETURN key. NOTE: 8 is the code for the disk.

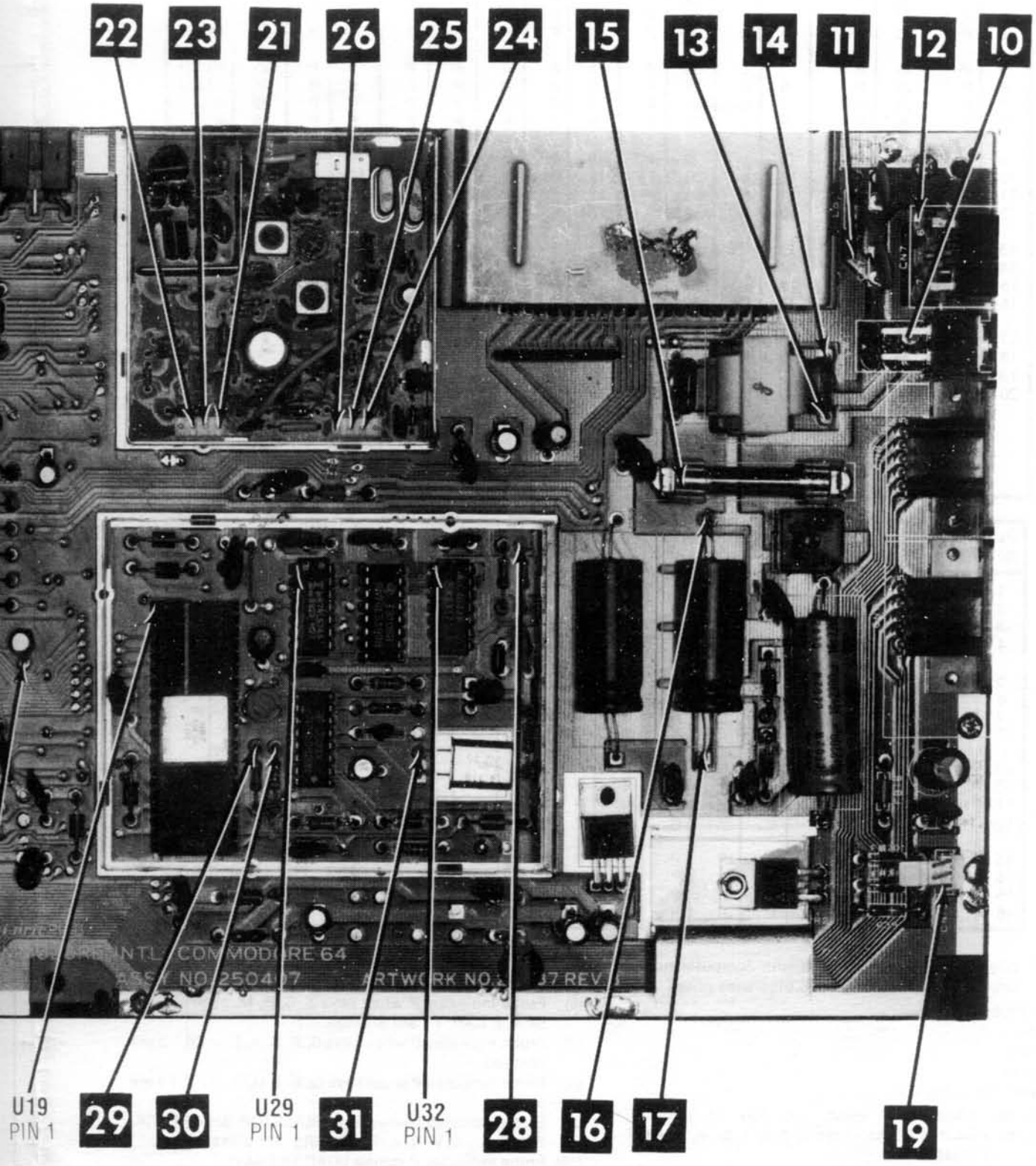
SAFETY PRECAUTIONS

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. This computer is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The computer cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the computer to water. If exposed to water, turn the unit off. Do not place the computer near possible water sources.
14. 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.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning computer.
17. 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.

CC4
COMMODORE
MODEL 64
A Howard W. Sams CIRCUITRACE® Photo
MAIN BOARD
5

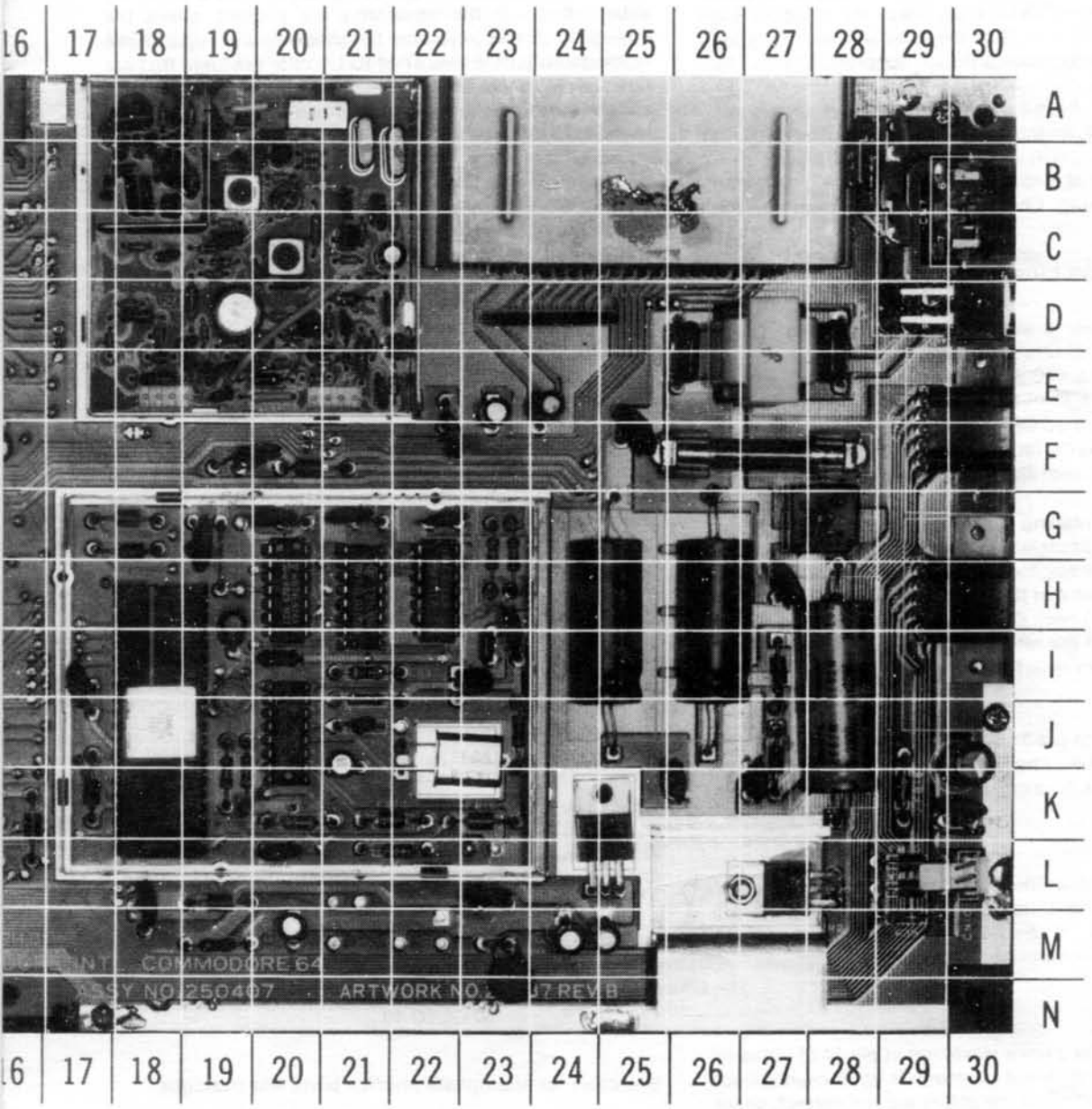


MAIN BOARD A Howard W. Sams CIRCUITRACE® Photo


22
23
21
26
25
24
15
13
14
11
12
10
U19
PIN 1
29
30
U29
PIN 1
31
U32
PIN 1
28
16
17
19

MAIN BOARD

E-1	L2	M-19	R26	I-21	R51	K-15	U13	I-8
A-4	L4	D-27	R27	J-19	R52	K-19	U14	L-11
A-10	L5	B-28	R28	H-1	R53	K-19	U15	I-9
A-13	Q1	C-8	R29	H-1	R100	H-6	U16	L-12
A-16	Q2	C-7	R30	I-1	RP3	B-5	U17	D-13
B-25	Q3	C-9	R31	M-6	SW1	D-30	U18	H-13
B-30	Q7	I-23	R33	K-1	U1	E-3	U19	I-18
F-30	Q8	E-15	R34	K-1	U2	E-4	U20	L-3
H-30	R1	B-6	R35	M-1	U3	F-6	U21	L-4
L-30	R2	D-7	R36	G-4	U4	F-8	U22	L-5
G-7	R3	C-6	R37	G-8	U5	F-9	U23	L-6
D-7	R4	C-7	R38	F-15	U6	I-12	U24	L-7
G-8	R5	G-7	R41	L-1	U7	E-11	U25	L-18
J-27	R6	G-15	R42	J-6	U8	I-3	U26	L-9
I-27	R7	F-15	R43	C-15	U9	I-4	U27	I-11
F-27	R16	J-23	R44	C-14	U10	I-5	U28	L-13
F-18	R17	G-23	R45	C-15	U11	I-6	U29	H-20
A-18	R19	G-23	R50	J-1	U12	I-7	U30	H-21
							U31	J-20
							U32	H-22
							Y1	J-23

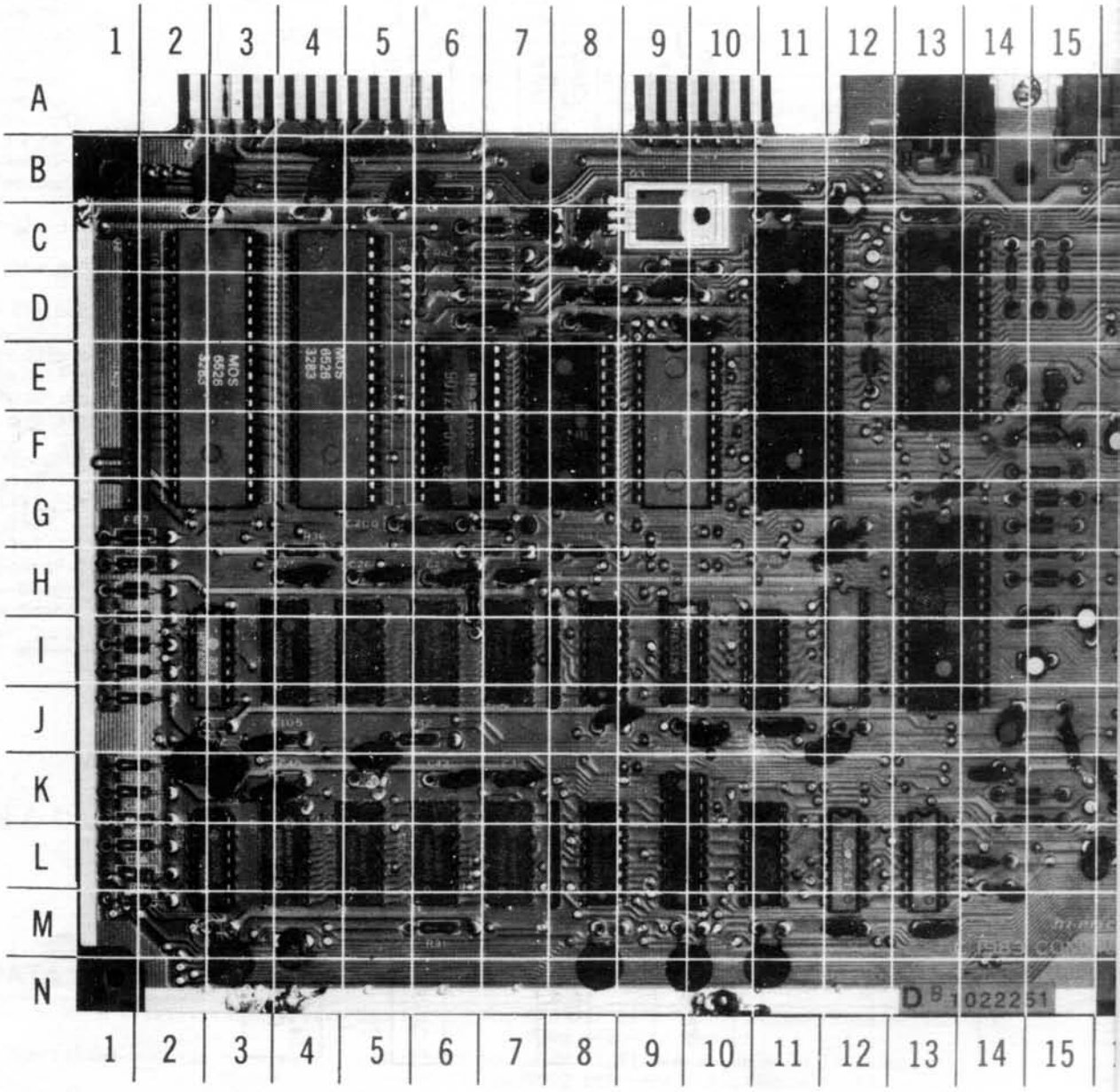


A Howard W. Sams GRIDTRACE™ Photo

MAIN BOARD

MAIN BOARD GridTrace LOCATION GUIDE

C1	D-9	C19	I-28	C38	L-1	C57	M-25	C91	J-30	CN1
C2	B-3	C20	D-28	C39	N-3	C59	L-23	C92	K-30	CN2
C3	B-4	C21	E-26	C40	K-4	C60	F-20	C93	L-14	CN3
C4	D-7	C22	J-2	C41	K-5	C62	I-15	C94	L-16	CN4
C5	D-8	C23	K-1	C42	K-6	C65	M-20	C95	K-27	CN5
C6	D-10	C24	K-3	C43	K-7	C66	L-20	C96	B-5	CN6
C7	J-12	C25	H-4	C44	N-8	C67	L-18	C97	C-29	CN7
C8	B-12	C26	H-5	C45	N-10	C68	I-20	C98	F-25	CN8
C9	B-11	C27	H-6	C46	J-11	C70	J-21	C99	H-27	CN9
C10	G-12	C28	H-7	C47	M-13	C74	G-21	C100	A-29	CN10
C11	H-12	C29	J-8	C48	M-14	C82	G-20	C101	G-19	CR1
C12	I-15	C30	M-11	C49	J-16	C83	I-21	C102	M-24	CR2
C13	F-16	C31	J-10	C50	K-14	C84	H-23	C103	M-23	CR4
C14	M-4	C32	M-12	C51	G-13	C85	I-23	C105	J-3	CR5
C15	E-3	C33	C-13	C52	H-15	C86	K-20	C107	J-21	CR6
C16	F-22	C34	J-14	C53	K-16	C88	H-25	C108	H-19	F1
C17	E-24	C36	L-22	C54	I-17	C89	K-26	C199	F-15	J1
C18	C-8	C37	G-14	C56	G-22	C90	H-26	C200	G-6	J4



MAIN BOARD

TROUBLESHOOTING

POWER SUPPLY

The 11.77V source at anode of CR6 is missing. Check Fuse F1. If fuse has opened, check Bridge Rectifier CR4, Capacitors C19 and C95, and Voltage Regulator VR2 for shorts.

If fuse is good, check for 10.00VAC across Capacitor C21. Check Coil L4 by measuring for 10.00VAC at pins 6 and 7 of Power Input (CN7). Check Power Switch (SW1) and connections at CN7. Replace Power Supply if voltage is not obtained.

The 11.76V source at pin 2 of Voltage Regulator VR1 is missing. Check VR1, Diode CR5, Capacitors C88, C89 and C90. If all these check good, replace Power Supply.

The 4.91V source at positive (+) end of Capacitor C91 is missing. Check Coil L5 for open circuit. If Coil L5 is good, check Power Switch (SW1). Also, check the 5V at pin 5 of Power Input (CN7) and that the connections are good. Voltage still missing, replace Power Supply.

The 4.93V source at pin 2 of Voltage Regulator VR2 is missing. Check VR2, Capacitors C65, C66, C102 and C103.

The 4.88V source at Capacitors C55, C56, C67, C68, C74, C82 or C84 is missing. Check Coil L2 and Voltage Regulator VR2.

MICROPROCESSOR CHIP (CPU) OPERATION

Verify the processor is working with a logic probe. Check for pulses on pins 30 thru 37, pins 7 thru 20, and pins 22 and 23 of Microprocessor IC (U7). If the Microprocessor is not working, check pin 40 of IC U7 with the logic probe, while the computer is turned OFF and back ON again. The logic probe should read Low for about two seconds after turn-on, then read High to reset the Microprocessor.

If the logic probe reading is not correct, check the voltages and components associated with the Timer IC (U20). If IC U20 is working, check for pulses on pin 3 of IC U7 and a High reading on pin 4 of IC U7. If the reading is not correct on pin 3 of IC U7, check Complex Interface Adapter IC (U1) by substitution. If the reading is not correct on pin 4 of IC U7, check Complex Interface Adapter IC (U2) by substitution.

Check for pulses on pin 38 of IC U7. Check for B+ voltage at pin 6 of IC U7. Also, check the voltages at pins 27, 28, and 29 of IC U7. Check for a clock waveform at pin 39 of IC U7.

VIDEO

No video. Check for a video waveform at pin 15 of Video Interface Chip IC (U19). If the waveform is present, check the RF Modulator unit. If the video waveform is not present, check IC U19 by substitution.

COLOR

No color. Check for a color waveform at pin 14 of Video Interface Chip IC (U19). If the waveform is not present, check IC U19 by substitution. If the colors are not correct, check the adjustment of the 14.31818 MHz Oscillator. See "Adjustment" section.

AUDIO

No sound. Type in and run the program below. Check for an audio signal at pin 27 of Sound Interface Device IC (U18). If there is no audio signal present, check IC U18 by substitution. If an audio signal is present, check the voltages and components associated with Transistor Q8.

```
10 POKE 54296, 15
20 POKE 54278, 248
30 POKE 54273, 17
40 POKE 54276, 17
```

KEYBOARD

Keyboard does not work. Check the waveforms at pins 2 thru 8 and pin 19 of Complex Interface Adapter IC (U1). If any of the waveforms are not present, check IC U1 by substitution. If the waveforms are present, check the operation of the keyboard by checking the logic probe readings on pins 9 thru 17 of IC U1. For readings that are not correct, check the keyboard Connector CN1, and the key switches on the keyboard for bad connections. If the keyboard still does not operate correctly, check IC U1 by substitution.

If the RESTORE key is not working, check for 0V on pin 3 of Connector CN1 when the RESTORE key is pressed. If the voltage does not drop to 0V, check for a bad connection at Connector CN1 and check the RESTORE key switch with an ohmmeter.

JOYSTICK

Joystick does not work properly. Check the voltages on the pins shown in the chart below, while the appropriate joystick position is activated. The voltage should go from about 5V to less than 0.5V. If any voltage is not correct, check the joystick switches, Connector CN9, and Complex Interface Adapter IC (U1) by substitution.

PORT 1			PORT 2		
IC	PIN	JOYSTICK POSITION	IC	PIN	JOYSTICK POSITION
U1	10	UP	U1	2	UP
U1	11	DOWN	U1	3	DOWN
U1	12	LEFT	U1	4	LEFT
U1	13	RIGHT	U1	5	RIGHT
U1	14	BUTTON	U1	6	BUTTON

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

```
10 P1 = PEEK (56320)
20 P2 = PEEK (56321)
30 PRINT P1, P2
40 FOR T = 1 TO 400: NEXT T
50 GOTO 10
```

See chart for appropriate joystick ports and positions.

JOYSTICK POSITION	PORT 1	PORT 2
CENTER	255	127
UP	254	126
DOWN	253	125
LEFT	251	123
RIGHT	247	119
BUTTON	239	111

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 pins 12 and 13 of Complex Interface Adapter IC (U1) while using Control Port 1 and pins 4 and 5 of IC U1 while using Control Port 2. The voltage should go from 5V to 0V when the appropriate button is pressed. If the voltage does not change, check the button switches with an ohmmeter. Check Connectors CN9 (Control Port 1), and CN8 (Control Port 2) for bad connections. If the voltages check good, check IC U1 by substitution.

If the paddles do not work, check waveforms at pins 23 and 24 of Sound Interface Device IC (U18). If the waveforms are correct, check IC U18 by substitution. If the waveforms are not correct, check the paddle controls and connections with an ohmmeter. If the controls and connections are good, check Quad Bilateral Switch IC (U28) by substitution.

CASSETTE SAVE AND LOAD

Computer will not save a program to a cassette tape. Check for pulses on pin 26 of Microprocessor IC (U7) with a logic probe, while saving a program to tape. If there are no pulses, check IC U7 by substitution. If the pulses are present, check the connections at pin 5 of Ccnnector CN3.

Computer will not load a program from a cassette tape. Check for pulses on pin 24 of Complex Interface Adapter IC (U1) with a logic probe, while loading a program from tape. If the pulses are present, check IC U1 by substitution. If the pulses are not present, check the connections at pin 4 of Connector CN3.

Datassette cassette motor will not start when the recorder is put in Play or Record mode. Check the voltage at pin 25 of IC U7. The voltage on pin 25 should drop from 4.96V to .02V when the Datassette cassette recorder is in the Play or Record mode.

If the voltage does not change, check the connection at pin 6 of Connector CN3. If the voltage is correct, check the voltage at pin 24 of IC U7. The voltage on pin 24 should drop from 2.98V to .08V when the Datassette cassette recorder is put in the Play or Record mode. If the voltage is good, check the voltages and components associated with Transistors Q1 thru Q3.

See the voltage chart below for voltages with the recorder in Play or Record mode.

	E	B	C
Q1	7.05V	7.67V	11.49V
Q2	0V	.07V	7.67V
Q3	6.45V	7.06V	11.49V

Note: Voltages taken with Datassette cassette recorder running.

ADJUSTMENT

14 MHz OSCILLATOR

Connect the input of a frequency counter to pin 10 of IC (U31). Adjust R27 for a frequency of 14.31818 MHz at pin 10.

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	1N4371	906103-02	ECG5002A		1N5223B	NTE5002A	SK2A7/5002A	WEP1402/5002	
CR2	1N755	900941-01	ECG5015A	GEZD-7.5	1N5236B	NTE5015A	SK7A5/5015A	WEP1416/5015	103-Z9002
CR3	1N914	900850-16	ECG177	GE-300	1N4935	NTE177	SK9091/177	WEP1062/177	103-131
CR4	2SVB	251026	ECG5312	GE-5312	MDA801	NTE5312	SK3985/5312	WEP1065	
	VM08	906129-01	ECG5332		MDA920A7	NTE5332	SK9230		
CR5,6	1N4001	900750-01	ECG116	GE-504A	1N4001	NTE116	SK3311	WEP154	212-76-02
Q1	2SC1815-0	902693-01	ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
	2N4401	902652-01	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q2	2SC1815-0	902693-01	ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
	2N3904	902658-01	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q3	2SD880Y	902694-01	ECG152	GE-66A	TIP41A	NTE152	SK3440/291	WEP745/152	121-987-03
	TIP29B	902653-01	ECG152	GE-66A	TIP29B	NTE152	SK3440/291	WEP745/152	121-987-03
Q4	PN2222	902686-01(1)	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q5	PN2222	902686-01(1)	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q6	PN2222	902686-01(1)	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q7	2SC1815-0	902693-01	ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
	PN2222A	902686-01(1)	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
Q8	2SC1815-0	902693-01	ECG85	GE-62	MPSA05*	NTE85	SK3124A/289A	WEP66/199	121-Z9065
	PN2222	902686-01(1)	ECG123AP	GE-123AP	MPSA05	NTE123AP	SK3854/123AP	WEP736/123A	121-Z9000A
U1,2	M0S6526	906108-01							
	6526	906108-01							
	6526A	906108-01							
U3	M0S901226-01	901226-01							
	2364A	906144-01 (1)(3)							
		906141-01 (1)(2)(4)							
U4	M0S901227-02	901227-02 (2)(4)							
	2364A	906145-02(3)							
		906145-01 (1)(3)							

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.
U5	M0S901225-01	901225-01 (2)(4)							
	2332A	906140-01 (1)(2)(4)							
		906143-01 (1)(3)							
	2332B	901225-01 (2)(4)							
		906143-02(3)							
U6	MSM2114L-3RS		ECG2114			NTE2114			HE-443-764
	2114-30L		ECG2114			NTE2114			HE-443-764
	2114L-30	901453-01							
U7	M0S6510CBM								
	6510A	906107-01							
U8	HD7406P		ECG7406	GE-7406		NTE7406	SK7406		HE-443-698
	7406N		ECG7406	GE-7406		NTE7406	SK7406		HE-443-698
	7406	901522-06	ECG7406	GE-7406		NTE7406	SK7406		HE-443-698
U9 thru	HM4864-3								
U12	4164-2	901505-01(5)							
U13	SN74LS257N		ECG74LS257		SN74LS257AN	NTE74LS257	SK74LS257		HE-443-802
	74LS257		ECG74LS257		SN74LS257AN	NTE74LS257	SK74LS257		HE-443-802
	74LS257N	901521-57	ECG74LS257		SN74LS257AN	NTE74LS257	SK74LS257		HE-443-802
U14	SN74LS258N		ECG74LS258		SN74LS258AN	NTE74LS258	SK74LS258		
	74LS258		ECG74LS258		SN74LS258AN	NTE74LS258	SK74LS258		
	74LS258N	901521-58	ECG74LS258		SN74LS258AN	NTE74LS258	SK74LS258		
U15	DM74LS139N		ECG74LS139		SN74LS139N	NTE74LS139			
	74LS139N		ECG74LS139		SN74LS139N	NTE74LS139			
	74LS239	901521-18							
U16	HD14066BP		ECG4066B		MC14066BCP	NTE4066B	SK4066B	WEP4066B/4066B	905-369
	4066		ECG4066B		MC14066BCP	NTE4066B	SK4066B	WEP4066B/4066B	905-369
		901502-01							
U17	M0S906114-01								
	82S100								
	82S100N/ 7700	906114-01 (2)(3)							
	93459	906114-06(4)							
	82S100N	906114-02 (1)(2)(3)							
	FPLA93459PC	901337-01 (1)(4)							

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.
U18	MOS6581								
	6581	906112-01							
U19	MOS6567R8								
	6567	906109-02 (2)(3)							
	6569	906111-01(4)							
U20	NE556N		ECG978		MC3456P	NTE978	SK3689/978		221-Z9152
	556		ECG978		MC3456P	NTE978	SK3689/978		221-Z9152
	NE556	901523-03	ECG978		MC3456P	NTE978	SK3689/978		221-Z9152
U21 thru	HM4864-3								
U24	4164-2	901505-01(5)							
U25	SN74LS257N		ECG74LS257		SN74LS257AN	NTE74LS257	SK74LS257		HE-443-802
	74LS257		ECG74LS257		SN74LS257AN	NTE74LS257	SK74LS257		HE-443-802
	74LS257N	901521-57	ECG74LS257		SN74LS257AN	NTE74LS257	SK74LS257		HE-443-802
U26	DM74LS373N		ECG74LS373		SN74LS373N	NTE74LS373			HE-443-867
	74LS373		ECG74LS373		SN74LS373N	NTE74LS373			HE-443-867
	74LS373N	901521-29	ECG74LS373		SN74LS373N	NTE74LS373			HE-443-867
U27	SN74LS08N		ECG74LS08		SN74LS08N	NTE74LS08	SK74LS08		HE-443-780
	74LS08		ECG74LS08		SN74LS08N	NTE74LS08	SK74LS08		HE-443-780
	74LS08N	901521-03	ECG74LS08		SN74LS08N	NTE74LS08	SK74LS08		HE-443-780
U28	HD14066BP		ECG4066B		MC14066BCP	NTE4066B	SK4066B	WEP4066B/4066B	905-369
	4066	901502-01	ECG4066B		MC14066BCP	NTE4066B	SK4066B	WEP4066B/4066B	905-369
U29	MB74LS74A		ECG74LS74A		SN74LS74AN	NTE74LS74A	SK74LS74		HE-443-730
	74LS74		ECG74LS74A		SN74LS74AN	NTE74LS74A	SK74LS74		HE-443-730
	74LS74AN	901521-06	ECG74LS74A		SN74LS74AN	NTE74LS74A	SK74LS74		HE-443-730
U30	SN74LS193N		ECG74LS193		SN74LS193N	NTE74LS193	SK74LS193		HE-443-815
	74LS193		ECG74LS193		SN74LS193N	NTE74LS193	SK74LS193		HE-443-815
	74LS193N	901521-26	ECG74LS193		SN74LS193N	NTE74LS193	SK74LS193		HE-443-815
U31	SN74LS629N		ECG74LS629			NTE74LS629			
	74LS629N	901521-68	ECG74LS629			NTE74LS629			
U32	MC4044P		ECG974		MC4044P		SK3965/974		
	MC4044		ECG974		MC4044P		SK3965/974		
	MC4044CP	906128-01	ECG974		MC4044P		SK3965/974		

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part No., 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.
VR1	AN7812		ECG966	GEVR-111	MC7812CT	NTE966	SK3592/966	WEP966L/966	HE-442-674
	MD7812CT		ECG966	GEVR-111	MC7812CT	NTE966	SK3592/966	WEP966L/966	HE-442-674
	MC7812CT	901527-01	ECG966	GEVR-111	MC7812CT	NTE966	SK3592/966	WEP966L/966	HE-442-674
VR2	AN7805		ECG960	GEVR-102	MC7805CT	NTE960	SK3591/960		221-Z9043
	7805		ECG960	GEVR-102	MC7805CT	NTE960	SK3591/960		221-Z9043
	MC7805CT	901527-02	ECG960	GEVR-102	MC7805CT	NTE960	SK3591/960		221-Z9043

Parts not noted are used in all applications.
* Lead configuration may vary from original.
(1) Revision N.
(2) NTSC or US version.
(3) JPN version.
(4) PAL version.
(5) Use only 901505-02 (150ns) Dynamic RAMs with U19 MOS6567 version R4. Do Not mix -01 with -02 RAMs on same P.C. Board.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C8	10 50V 20%	
	10 25V	900100-01(1)
C12	10 50V 20%	
	10 25V	900100-01(1)
C13	10 50V 20%	
	10 25V	900100-01(1)
C14	10 50V 20%	
	10 25V	900100-01(1)
C15	10 50V 20%	
	10 25V	900100-01(1)
C17	10 50V 20%	
	10 25V	900100-01(1)
C19	2200 16V	900101-33
C24	10 50V 20%	
	10 25V	900100-01(1)
C34	10 50V 20%	
	10 25V	900100-01(1)

ITEM No.	RATING	MFGR. PART No.
C57	10 50V 20%	
	10 25V	900100-01(1)
C62	10 50V 20%	
	10 25V	900100-01(1)
C64	10 25V	900100-01(1)
C65	10 50V 20%	
	10 25V	900100-01(1)
C88	470 50V 20%	900101-34
C90	470 50V 20%	900101-34
C91	100 16V	900100-40
C94	10 50V 20%	
	10 25V	900100-01(1)
C102	10 50V 20%	
	10 25V	900100-01(1)
C107	10 25V 20%	251079-16(2)
C108	10 25V 20%	251079-16(2)

(1) May use 10uF @ 25V, 20%, Part No. 251079-16.
(2) Revision B.

PARTS LIST AND DESCRIPTION (Continued)

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

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C1	.1 25V	251075-06
	.1	900461-28
C2	.1 25V	251075-06
	.1	900461-28
C3	.1 25V	251075-06
	.1	900461-28
C4	.1 25V	251075-06
	.47 50V	900464-36
C5	.1 25V	251075-06
	.1	900461-28
	.47 50V	900464-36
C6	.1 25V	251075-06
	.1	900461-28
	.47 50V	900464-36
C7	.1 25V	251075-06
	.1	900461-28
	.47 50V	900464-36
C9	.1 25V	251075-06
	.1	900461-28
	.47 50V	900464-36
C10	470 50V 5%	900462-53
	470 10%	251069-4
	470 10%	251078-39
	.0022	
C11	470 50V 5%	900462-53
	470 10%	251069-4
	470 10%	251078-39
	.0022	
C16	.1 25V	251075-06
	.1	900461-28
C18	.1 25V	251075-06
	.1	900461-28
C20	.22 100V 10%	
	.22 100V	900150-11
C21	.22 100V 10%	
	.22 100V	900150-11
C22	.1 25V	251075-06
	.1	900461-28
C23	360 50V 10%	251078-51
	360 50V	900462-50
C25	.1 25V	251075-06
	.22	900461-32
C26	.1 25V	251075-06
	.22	900461-32
C27	.1 25V	251075-06
	.22	900461-32
C28	.1 25V	251075-06
	.22	900461-32
C29	.1 25V	251075-06
	.47 50V	900464-36
C30	.1 25V	251075-06
	.1	900461-28
C31	.1 25V	251075-06
	.1	900461-28
C32	.1 25V	251075-06
	.1	900461-28
C33	.1 25V	251075-06
	.47	900464-36
C35	.1	900461-28
C36	20 NPO 50V 5%	251078-14
	20 50V	900462-20
C37	.001 50V	251069-8
	.001 50V	900462-61
C38	51 N750 50V 5%	251078-24
	51 50V	900462-30
C39	.1 25V	251075-06
	.1	900461-28

ITEM No.	RATING	MFGR. PART No.
C40	.1 25V	251075-06
	.22	900461-32
C41	.1 25V	251075-06
	.22	900461-32
C42	.1 25V	251075-06
	.22	900461-32
C43	.1 25V	251075-06
	.22	900461-32
C44	.1 25V	251075-06
	.47 50V	900464-36
C45	.1 25V	251075-06
	.1	900461-28
C46	.1 25V	251075-06
	.1	900461-28
C47	.1 25V	251075-06
	.1	900461-28
C48	.0018 50V 10%	251069-11
	.0018 10%	251078-45
	.0018 50V	900462-67
	.001	
C49	.1 25V	251075-06
	470 50V	900462-53
	470 10%	251078-39
C50	.1 25V	250175-06
	.22	900461-32
C51	.1 25V	250175-06
	.47	900464-36
C52	.1 25V	251075-06
	470 50V	900462-53
	470 10%	251078-39
C53	.1 25V	251075-06
	470 50V	900462-53
	470 10%	251078-39
C54	.1 25V	251075-06
	.22	900461-32
C55	.1	
	.1	900461-28
C56	.1 25V	251075-06
	.1	900461-28
C58	.1	
	.1	900461-28
C59	.1 25V	251075-06
	.22	900461-32
C60	.1 25V	251075-06
	.47 50V	900464-36
C61	.47 50V	900464-36
C63	.47 50V	900464-36
C66	.1 25V	251075-06
	.47 50V	900464-36
C67	.1 25V	251075-06
	.47 50V	900464-36
C68	.1 25V	251075-06
	.1	900461-28
C70	16 50V	251030-02
	10pF 50V 5%	900050-14
	15 5%	251030-01
C71	.1	900461-28
C72	220 50V	900462-45
C73	150 50V	900462-41
C74	.1 25V	251075-06
	.1	900461-28
C77	.1	900461-28
C78	220 50V	900462-45
C79	510	900462-54
C80	51	900462-30

PARTS LIST AND DESCRIPTION (Continued)

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

CAPACITORS (cont)

ITEM No.	RATING	MFGR. PART No.
C81	20	900462-20
C82	.1 25V	251075-06
	.1	900461-28
C83	82 50V 5%	251078-29
	33 50V 5%	900050-11
C84	.1 25V	251075-06
	.1	900461-28
C85	.47 50V	900016-01
	.47 50V	900464-36
C86	82 50V 5%	251078-29
	39 50V 5%	900050-17
C87	.1	900461-28
C89	.1 25V	251075-06
	.1	900461-28
C92	.1 25V	251075-06
	.22	900461-32
C93	.0018 50V 10%	251069-11
	.0018 10%	251078-45
	.0018 50V	900462-67
	.001	
C95	.1 25V	251075-06
	.1	900461-28

ITEM No.	RATING	MFGR. PART No.
C96	.1 25V	251075-06
	.1	900461-28
C97	.22 25V	251075-07
	.22 25V	900010-59
C98	.1 50V	251073-04
	.1 50V	900020-01
C99	.1 50V	251073-04
	.1 50V	900020-01
C100	.22 25V	251075-07
	.22 25V	900010-59
C101	.1 50V	251073-04
	.1 50V	900020-01
C103	.1 25V	251075-06
	.1	900461-28
C105	.1 25V	251075-06
	.1	900461-28
C106	150 50V	
C107	50	(1)
	220 10%	(2)
C199	220 50V 5%	
C200	.1 25V	251075-06
C203	220 10%	(2)

(1) Used with U19 (MOS6567 versions R4, R4T2).
(2) Used with U19 (MOS6569 version R1).

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

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
R25	Color	1000	902265-02	
	Color	500	902265-05	Revision B
R27	VCO	2000	902265-03	

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	WORKMAN PART No.	REMARKS
RP1	Resistor Network	902422-03(1)		
RP2	Resistor Network	902422-03(1)		
RP3	Resistor Network	902442-29(2)		
RP4	Resistor Network	902410-06(3)		

(1) Contains four (4) 33 5%
(2) Contains seven (7) 3300 5%
(3) Contains nine (9) 3300 5%

COILS (RF-IF)

ITEM No.	FUNCTION	MFGR. PART No.
L1	RF Choke (2.2uH)	901151-17
L2	RF Choke (2.2uH)	901151-17
L3	Peaking (3.0uH)	901151-21
L4	AC Line Choke	325559-02

ITEM No.	FUNCTION	MFGR. PART No.
L5	AC Line Choke	906127-01(1)
	RF Choke (1.2uH)	325570-01
	RF Choke (1.2uH)	901152-01(1)

(1) Revision N.

PARTS LIST AND DESCRIPTION (Continued)

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

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	1A @ 250V Fast Acting	903556-18	906102-01(1)	(1) Two used.
	1.25A @ 250V Slow-Blow	251184-02	906102-01(1)	

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
CN1	Connector	903345-20	20 pin, male, Keyboard
	Connector		20 pin, male, Keyboard (Revision N)
CN4	Connector	903361-01	6 pin, female, Serial I/O
CN5	Connector		8 pin, female, Audio/Video
	Connector	903362-01	5 pin, female, Audio/Video (Revision N)
CN6	Connector	906100-02	44 pin, female, Cartridge Expansion Port
CN7	Connector		7 pin, female, Power Input
	Connector	906130-01	7 pin, female, Power Input (Revision N)
CN8,9	Connector		9 pin, male, Control Port
	Connector		9 pin, male, Control Port (Revision N)
CN10	Connector	903302-13	3 pin, male, Power Indicator
	Connector		3 pin, male, Power Indicator (Revision N)
CR99	LED	980082	Power Indicator, Red 1.66V @ 8.3mA
FB1 thru 5	Ferrite Bead	903025-01	
FB7 thru 23	Ferrite Bead	903025-01	
FB6	Ferrite Bead	903025-01	(Revision N)
J4	Jack		RF Modulator
M1	RF Modulator	251080-01	8 pin (64)
	RF Modulator	326130-01	5 pin (64) (Revision N)
	RF Modulator	251019	JIS version (Revision B)
	RF Modulator	251025	PAL version (Revision B)
P1	Cord	903508-04	AC Power
SW1	Switch	904500-01	Power On/Off
Y1	Crystal		14.31818MHz
	Crystal	900558-01	14.31818MHz (Revision N)
	Crystal	251082	17.73447MHz, PAL version (Revision B)
	Crystal	906106-01	17.73447MHz, PAL version (Revision N)
	Keyboard	1001028-02	
	P.C. Board	250407-04	8 pin (Revision B)
	P.C. Board	326298-01	5 pin
	Power Supply	251053-02	

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

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
300-Ohm Input Lead	Use BELDEN No.	8225
75-Ohm Input Lead	Use BELDEN No.	8241

BLOCK DIAGRAM

LOGIC

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

PIN NO.	IC U8	IC U9	IC U10	IC U11	IC U12	IC U13	IC U14	IC U15	IC U16	PIN NO.	IC U17	PIN NO.	IC U17	PIN NO.	IC U18	PIN NO.	IC U18
1	L	*	*	*	*	P	P	P	P	1	*	15	P	1	H	15	P
2	H	P	P	P	P	H	H	P	P	2	H	16	P	2	H	16	P
3	P	P	P	P	P	P	P	P	P	3	H	17	H	3	H	17	P
4	P	P	P	P	P	P	P	H	P	4	H	18	P	4	H	18	P
5	L	P	P	P	P	H	H	P	P	5	H	19	L	5	H	19	P
6	H	P	P	P	P	P	P	H	P	6	H	20	P	6	P	20	P
7	L	P	P	P	P	P	P	H	L	7	H	21	P	7	P	21	P
8	H	H	H	H	H	L	L	L	P	8	H	22	H	8	P	22	P
9	L	P	P	P	P	P	P	H	P	9	P	23	H	9	P	23	L
10	L	P	P	P	P	P	P	H	P	10	H	24	P	10	P	24	L
11	H	P	P	P	P	H	P	H	P	11	H	25	P	11	P	25	H
12	H	P	P	P	P	P	P	H	P	12	P	26	P	12	P	26	H
13	L	P	P	P	P	P	P	P	P	13	P	27	H	13	P	27	H
14	H	P	P	P	P	H	P	P	H	14	L	28	H	14	L	28	H
15		P	P	P	P	P	P	H									
16		L	L	L	L	H	H	H									

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

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

(1) Probe indicates P when any key is pressed.
(2) Probe indicates P when keys 1, 3, 5, 7, 9, +, &, INST DEL are pressed.
(3) Probe indicates P when keys ←, W, R, Y, I, P, *, RETURN are pressed.
(4) Probe indicates P when keys CTRL, A, D, G, J, L,], CRSR→ are pressed.
(5) Probe indicates P when keys 2, 4, 6, 8, 0, -, CLR/HOME, F7 are pressed.
(6) Probe indicates P when keys Z, C, B, M, >, SHIFT (R), SPACE BAR, F1 are pressed.
(7) Probe indicates P when keys S, F, H, K, [, =, ■, F3 are pressed.
(8) Probe indicates P when keys Q, E, T, U, O, @, ↑, F5 are pressed.
(9) Probe indicates P when keys RUN/STOP, SHIFT LOCK, SHIFT (L), X, V, N, <, ?, ↑CRSR↓ are pressed.
(10) Probe indicates P during LOAD and SAVE.
(11) Probe indicates P during SAVE.
(12) Probe indicates L when PLAY or RECORD key is pressed.

LOGIC (Continued)

PIN NO.	IC U19	PIN NO.	IC U19	PIN NO.	IC U20	IC U21	IC U22	IC U23	IC U24	IC U25	IC U26	IC U27	IC U28	IC U29	IC U30	IC U31	IC U32
1	P	21	P	1	L	*	*	*	*	P	P	H	*	L	L	*	P
2	P	22	P	2	L	P	P	P	P	P	P	P	L	L	P	H	P
3	P	23	P	3	H	P	P	P	P	P	P	P	L	L	P	L	P
4	P	24	P	4	H	P	P	P	P	P	P	P	*	L	H	L	H
5	P	25	P	5	L	P	P	P	P	P	P	H	L	H	P	L	P
6	P	26	P	6	H	P	P	P	P	P	P	P	P	H	P	L	P
7	P	27	P	7	L	P	P	P	P	P	P	L	L	L	H	P	L
8	P	28	P	8	H	H	H	H	H	L	P	P	L	P	L	L	H
9	H	29	P	9	L	P	P	P	P	P	P	P	L	P	H	L	*
10	H	30	P	10	H	P	P	P	P	P	L	H	L	H	L	P	P
11	P	31	P	11	H	P	P	P	P	P	P	P	L	P	P	L	P
12	P	32	P	12	L	P	P	P	P	P	P	P	P	P	P	L	H
13	H	33	P	13	L	P	P	P	P	P	P	H	L	H	H	L	H
14	P	34	P	14	H	P	P	P	P	P	P	H	H	H	L	L	H
15	P	35	P	15		P	P	P	P	P	P				H	H	
16	P	36	P	16		L	L	L	L	H	P				H	H	
17	P	37	P								P						
18	P	38	P								P						
19	P	39	P								P						
20	L	40	H								H						

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

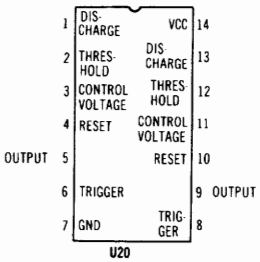
Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No lights On)

LINE DEFINITIONS

A0-A15 ..... Address Lines
AEC ..... Address Enable Control
ATN ..... Attention
BA ..... Bus Available
BASIC ..... Basic Interpreter Line
BUTTON A/LP ..... Control Port A Firebutton /Light Pen Connection
BUTTON B ..... Control Port B Firebutton Connection
CAS ..... Column Address Strobe
CAS RAM ..... Column Address Strobe RAM
CASS RD ..... Cassette Read
CASS SENSE ..... Cassette Sensor
CASS WRT ..... Cassette Write
CHAREN ..... Character Generator ROM Control Line
CHAROM ..... Character Generator ROM Control Line
CIA ..... Complex Interface Adapter
CIAS ..... Complex Interface Adapter Select
CLK ..... Clock
CNT ..... Counter
COL0-COL7 ..... Column Address Lines
COLOR ..... System Color
CS ..... Chip Select
D0-D7 ..... Data Lines
DATA ..... Serial Bus Data Line
DMA ..... Direct Memory Access
DOT CLOCK ..... System Timing
EX ROM ..... External ROM
FLAG2 ..... PC Data Transfer Control
GAME ..... Game I/O Line
GR/W ..... Graphics Read/Write
HI RAM ..... Kernal ROM Control Line
I/O ..... Input/Output
IRQ ..... Interrupt Request
JOYA0-A3 ..... Control Port 1 Joystick Connections
JOYB0-B3 ..... Control Port 2 Joystick Connections
KERNAL ..... Kernal ROM Control Line
LO RAM ..... Basic ROM Control Line
LP ..... Light Pen
MA0-MA7 ..... Multiplex Address Lines
NMI ..... Non-Maskable Interrupt
PA0-PA7 ..... User Port I/O Lines
PB0-PB7 ..... User Port I/O Lines
PC2 ..... User Port I/O Line
PLA ..... Program Logic Array
POTAX ..... Port 1 Potentiometer X
POTAY ..... Port 1 Potentiometer Y
POTBX ..... Port 2 Potentiometer X
POTBY ..... Port 2 Potentiometer Y
POTX,Y ..... Potentiometer X,Y
R/W ..... Read/Write
RAS ..... Row Address Strobe
RDY ..... Ready
RESET ..... Reset Computer
RESTORE ..... Pointer Reset to First Data Constant
ROM L ..... Active Low Decoded RAM/ROM Block Line
ROM H ..... Buffered Decoded RAM/ROM Block Line
ROW0-ROW7 ..... Row Address Lines
SID ..... Sound Interface Device
SP1,2 ..... Serial Port 1,2
VA6,7,14,15 ..... Video Address Lines
VIC ..... Video Interface Chip
Ø COLOR ..... Phase Color
Ø 0 ..... Phase 0
Ø 2 ..... Phase Two
9 VAC 1,2 ..... 60Hz Supply
60Hz ..... Time of Day Clock Sync

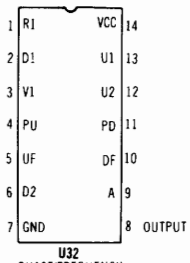
Any Bar above any alphabetical or numerical combination indicates line active in a low (0) state.

NE556N



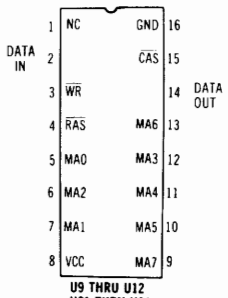
U20
TIMER
TOP VIEW

MC4044P



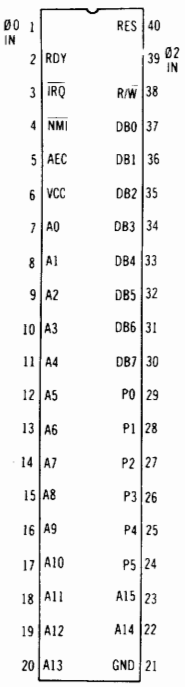
U32
PHASE/FREQUENCY DETECTOR
TOP VIEW

HM4864-3



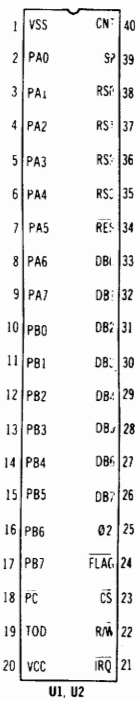
U9 THRU U12
U21 THRU U24
RAM
TOP VIEW

MOS6510CBM



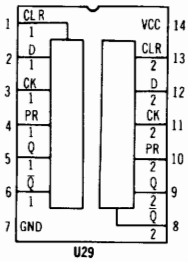
U7
MICROPROCESSOR
TOP VIEW

MOS6526



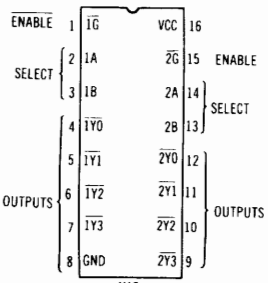
U1, U2
COMPLEX INTERFACE ADAPTER
TOP VIEW

MB74LS74A



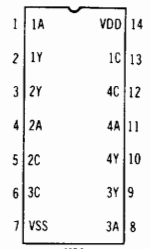
U29
DUAL D TYPE FLIP/FLOP WITH PRESET AND CLEAR
TOP VIEW

DM74LS139N



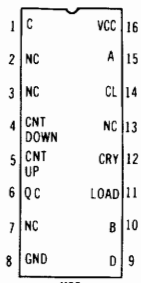
U15
DUAL 2 TO 4 LINE SELECTOR
TOP VIEW

HD14066



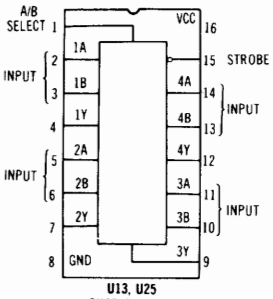
U28
QUAD BILATERAL SWITCH
TOP VIEW

SN74LS193N



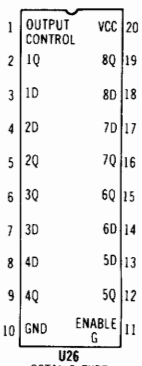
U30
TIMER
TOP VIEW

SN74LS257N



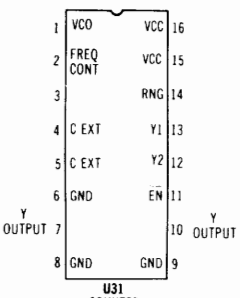
U13, U25
QUAD 2 TO 1 LINE THREE STATE MULTIPLEXER
TOP VIEW

DM74LS373



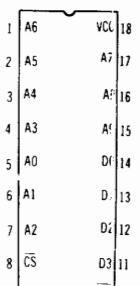
U26
OCTAL D TYPE THREE STATE LATCH
TOP VIEW

SN74LS629N



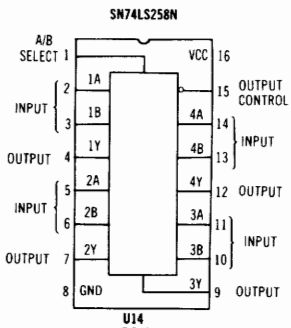
U31
COUNTER
TOP VIEW

MSM211L-3R3



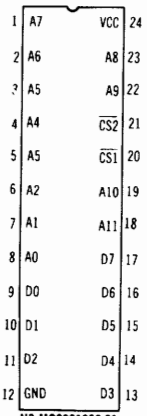
U6
COLOR ROM
TOP VIEW

SN74LS258N



U14
MULTIPLEXER
TOP VIEW

U3 MOS901226-01
U4 MOS901227-02
U5 MOS901225-01
ROM TOP VIEW





1 3 2
VR1, VR2
FRONT VIEW

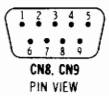


B C E
Q3
FRONT VIEW

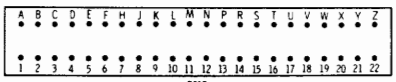


Q1, Q2, Q7, Q8
BOTTOM VIEW

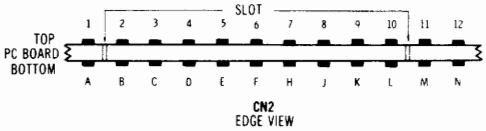
TERMINAL GUIDES



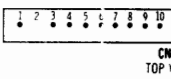
CN8, CN9
PIN VIEW

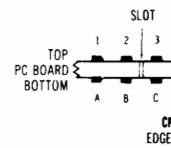


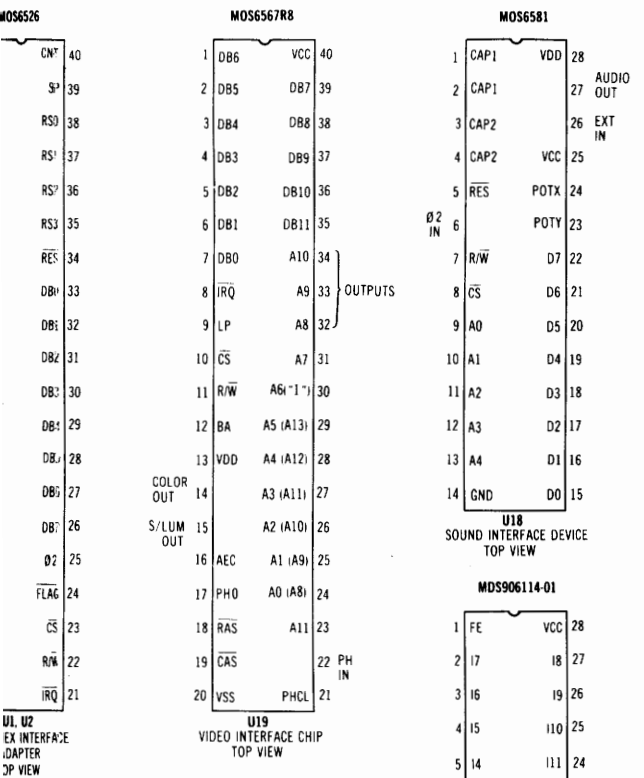
CN6
TOP VIEW

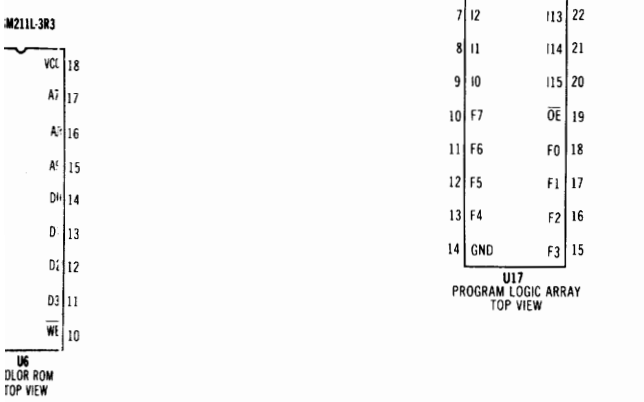


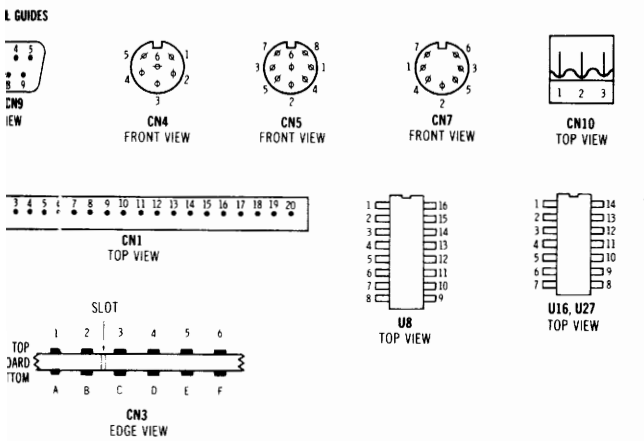
CN2
EDGE VIEW











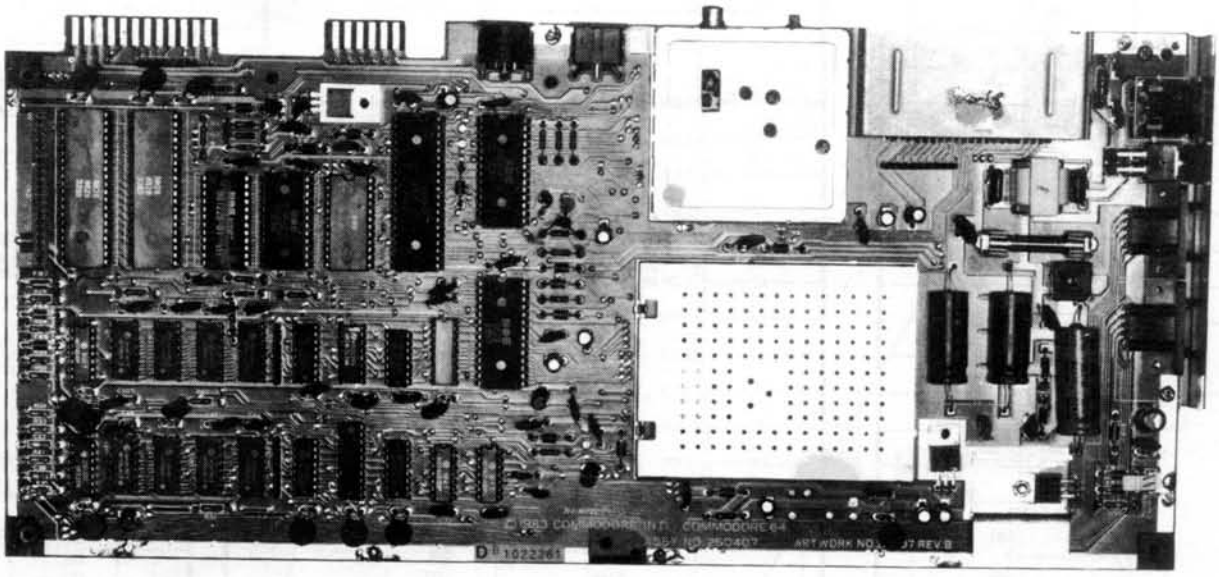
SCHEMATIC NOTES

—✕—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 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 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 ½W or less, 5% unless noted.
Value in ( ) used in some versions.

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

Logic Probe Display
L = Low
H = High
P = Pulse
✱ = Open (No lights On)

(1) Probe indicates P when any key is pressed.
(2) Probe indicates P when keys 1, 3, 5, 7, 9, +, &, INST DEL are pressed.
(3) Probe indicates P when keys ←, W, R, Y, I, P, ✱, RETURN are pressed.
(4) Probe indicates P when keys CTRL, A, D, G, J, L,], CRSR are pressed.
(5) Probe indicates P when keys 2, 4, 6, 8, 0, -, CLR/HOME, F7 are pressed.
(6) Probe indicates P when keys Z, C, B, M, >, SHIFT (R), SPACE BAR, F1 are pressed.
(7) Probe indicates P when keys S, F, H, K, [, =, ⬛, F3 are pressed.
(8) Probe indicates P when keys Q, E, T, U, O, @, ↑, F5 are pressed.
(9) Probe indicates P when keys RUN/STOP, SHIFT LOCK, SHIFT (L), X, V, N, <, ?, ↑ CRSR ↓ are pressed.
(10) Probe indicates P during LOAD and SAVE.
(11) Probe indicates P during SAVE.
(12) Probe indicates L when PLAY or RECORD key is pressed.
(13) Video Interface Chip and Sound Interface Device should have separate ground returns.
(14) C107 is 50pF when used with U19 (MOS6567 versions R4, R4T2).
C107 or C203 is 220pF when used with U19 (MOS6569 version R1).



MAIN BOARD-SHIELD LOCATION

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove three screws from cabinet bottom. Lift cabinet top and keyboard from cabinet bottom. Disconnect the keyboard connector and the power indicator connector from the main board.

MAIN BOARD REMOVAL

Unsolder copper strip on the top right side of the cardboard shield and carefully fold back shield. Remove seven screws holding main board to cabinet bottom. Unsolder grounding strip at all nine places on the main board. Remove shield and main board from cabinet bottom.

KEYBOARD REMOVAL

Remove eight screws holding keyboard to cabinet top. Lift keyboard assembly from cabinet top.

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.

CC4 COMMODORE MODEL 64

GENERAL OPERATING INSTRUCTIONS

POWER UP

When the computer is turned On, it will come up ready to program in Commodore Basic. See "Cassette Operation" or "Disk 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. 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 a Datassette cassette recorder onto the six pin edge connector at the rear of the computer. Note: A regular tape recorder will not work on the Commodore 64. 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.

DISK OPERATION

Connect Disk Drive Unit to the Serial Port located at the rear of the computer. Carefully insert the disk so that the label on the disk is facing up and the notch on the disk is on the left side. Once the disk is inserted, close the protective gate by pushing down on the gate lever. To load a program from the disk, type LOAD "PROGRAM NAME", 8. Press the RETURN key and follow the instructions displayed on the monitor. To SAVE a program, type SAVE "PROGRAM NAME", 8 and press the RETURN key. Note: 8 is the code for the disk.

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

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

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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 the power indicator LED is lit. Note: If the power indicator LED is not lit, see the "Power Supply Check" and "Main Board (Power Check)" sections.

(B) Verify the channel select switch is on the same channel as the monitor, channel 3 or 4.

(C) Verify the antenna switch is in 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 powered, check the voltages at the RF Modulator connection points. If the voltages are correct, substitute the RF Modulator.

② POWER SUPPLY CHECK

(A) Connect Power Supply to 120VAC. Disconnect power connector CN7 from computer. Check for 10.90VAC across pins 6 and 7 of CN7.

(B) Check for 5.08V across pins 2 and 4 of CN7. If the voltages are not present or are incorrect, replace the power supply.

③ MAIN BOARD (POWER CHECK)

(A) If the power indicator LED does not light when computer is powered, check the Fuse F1 and the Power Switch (SW1).

(B) Check for 11.77V at the Bridge Rectifier (CR4).

(C) Check for 4.93V at pin 2 of Voltage Regulator VR2.

(D) Check for 4.93V at Coil L2.

(E) Check for 4.91V at Coil L5.

(F) Check for 11.76V at pin 2 of Voltage Regulator VR1.

④ MAIN BOARD (PROCESSING)

(A) If the power supply checks normal and the computer does not come up when powered, verify Microprocessor IC (U7) is working by checking for pulses on pins 7 thru 20, 22, 23, and 30 thru 37.

(B) If the Microprocessor is working and the computer does not come up, check by substitution Kernal ROM IC (U4), Program Logic Array IC (U17) and Video Interface Chip IC (U19).

(C) No audio. Check Sound Interface Device IC (U18) by substitution.

(D) Disk Drive or Printer does not function properly. Check Complex Interface Adapter IC (U2) by substitution.

(E) Datassette cassette does not operate. Check Complex Interface Adapter IC (U1) by substitution.

(F) Audio/Video Port does not work. Check Sound Interface Device IC (U18), and Video Interface Chip IC (U19) by substitution.

(G) Keyboard does not operate. Check Complex Adapter IC (U1) by substitution. Also see "Keyboard" section.

(H) Modem does not operate. Check both Complex Interface Adapter IC's (U1 and U2) by substitution.

(I) Cartridge Port does not work. Check by substitution Program Logic Array IC (U17) and Kernal Rom IC (U4).

(J) Control Ports do not work. Check Complex Interface Adapter IC (U1) by substitution.

⑤ KEYBOARD

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

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT

Digital Volt/Ohm Meter
Logic Probe

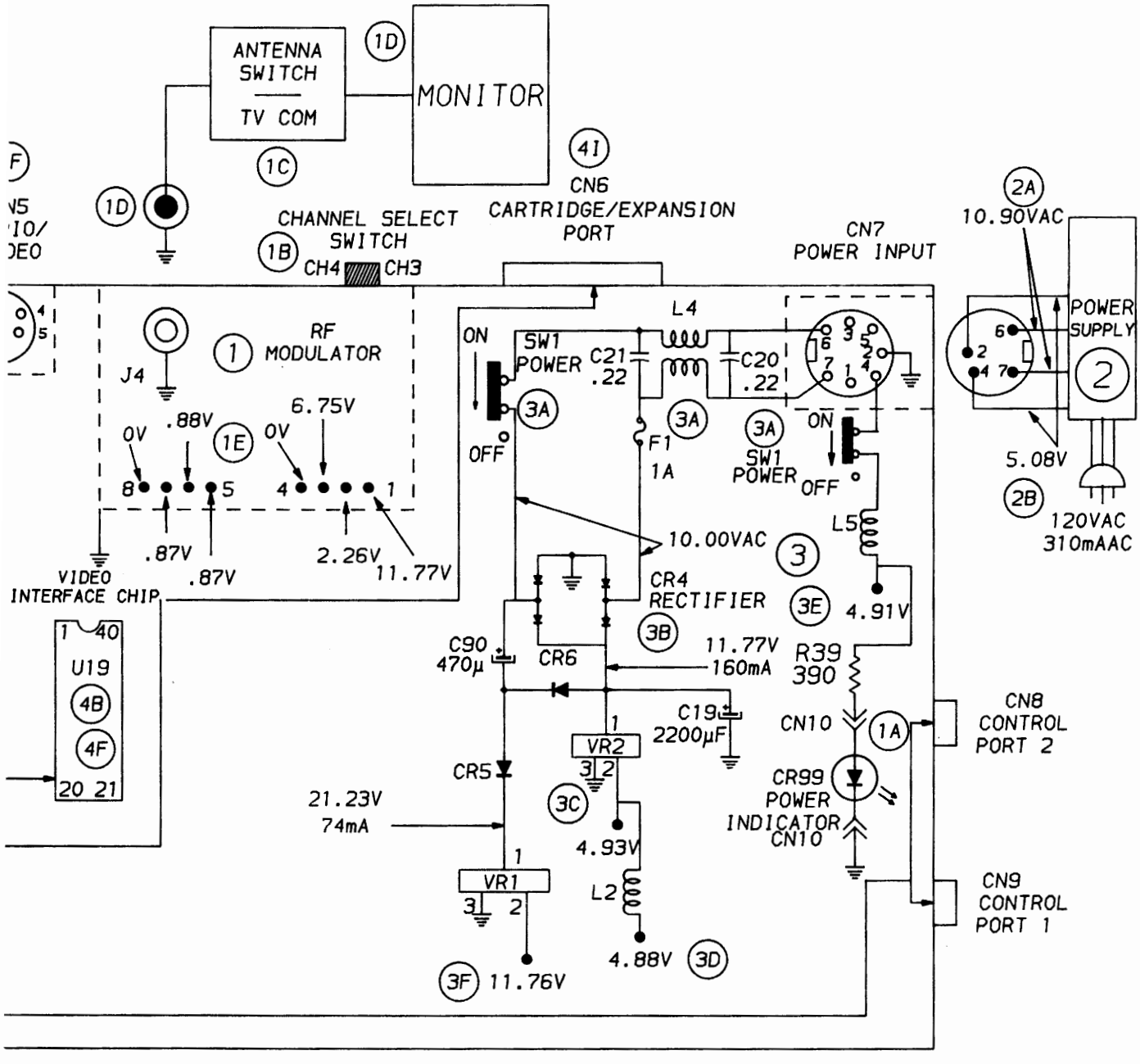
TOOLS

Small Screwdriver
Phillips Screwdriver
Soldering Iron
Desoldering Equipment
Switch Cleaner (non-spray type)

REPLACEMENT PARTS

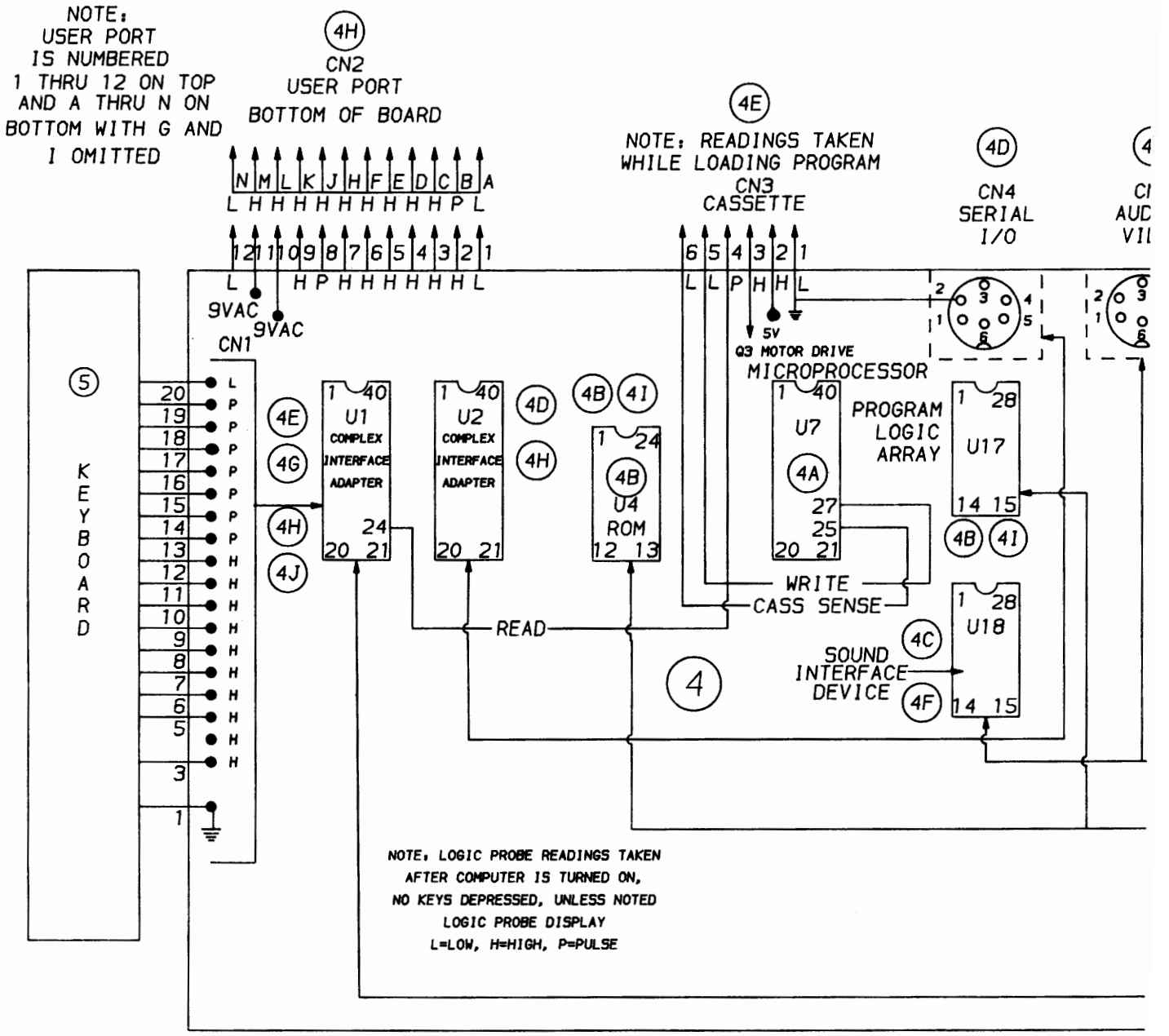
Power Supply for Commodore 64
Fuse 1A 250V 3AG
Bridge Rectifier CR4, Diodes CR5, CR6

IC	TYPE NO.	IC	TYPE NO.
U1	6526	U18	6581
U2	6526	U19	6567R8
U4	901227-02	VR1	AN7812
U7	6510CBM	VR2	AN7805
U17	906114-01		



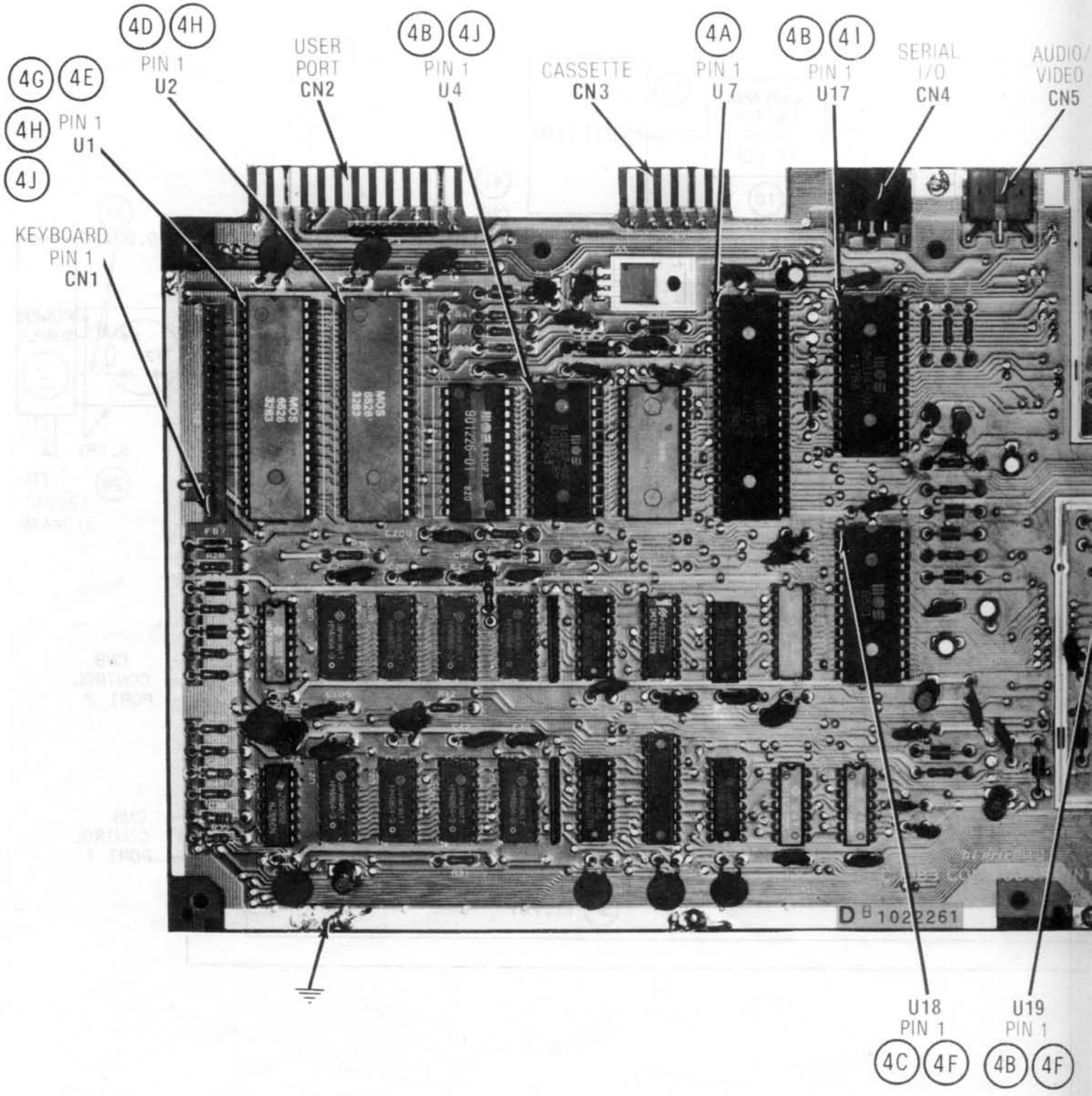
CC4 COMMODORE MODEL 64

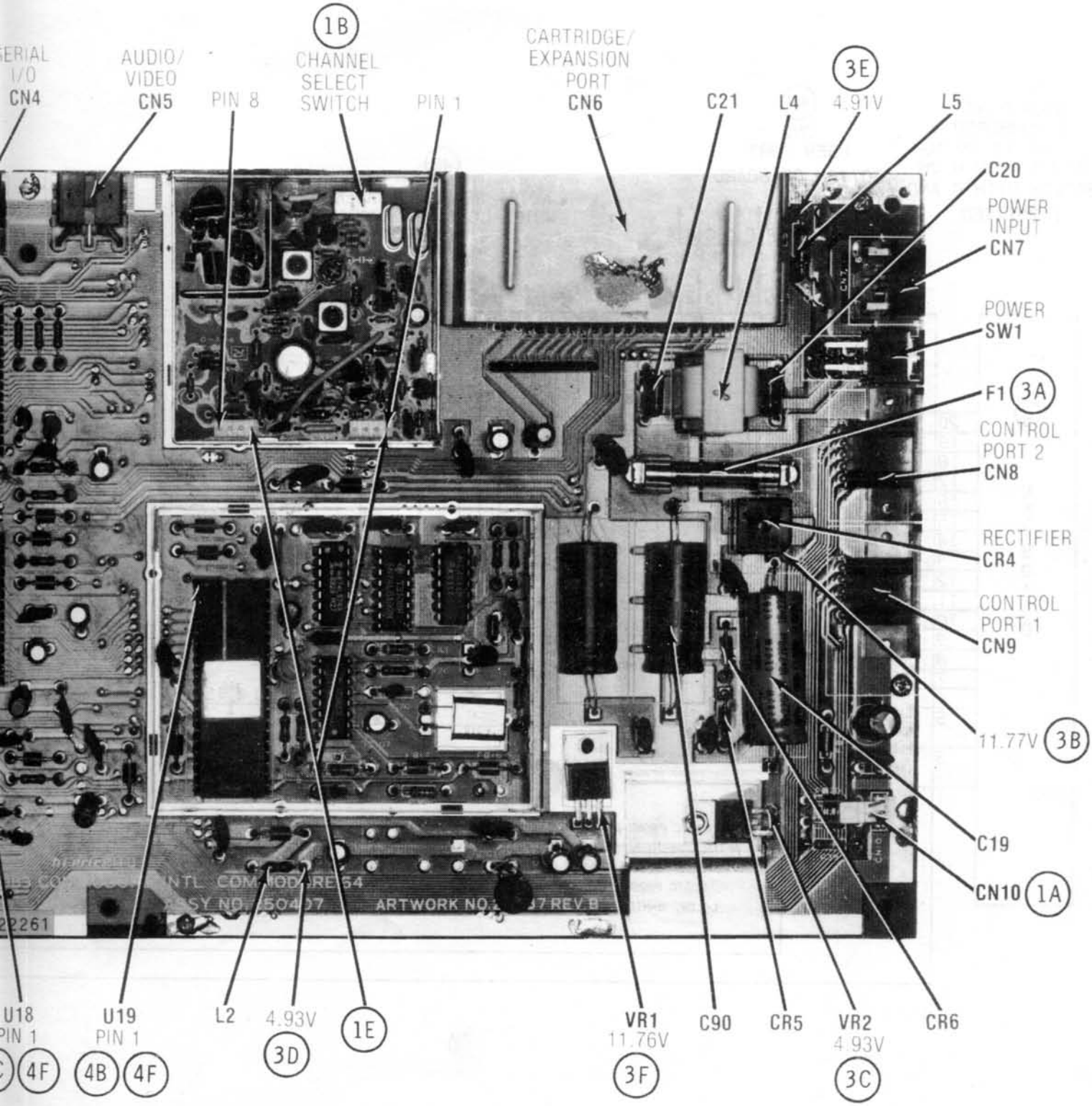
INTERCONNECTING DIAGRAM

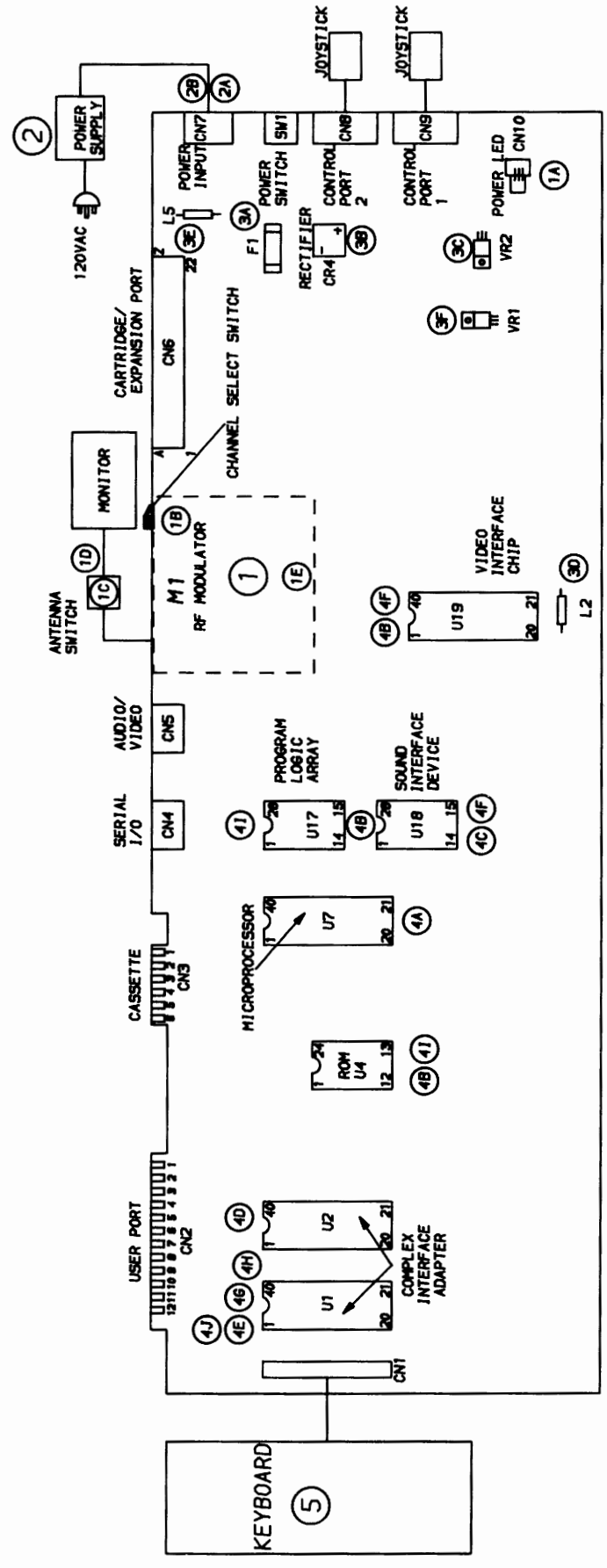


INTERCONNECTING DIAGRAM

PRELIMINARY SERVICE CHECKS (Continued)




SERIAL I/O CN4
AUDIO/ VIDEO CN5
PIN 8
1B
CHANNEL SELECT SWITCH
PIN 1
CARTRIDGE/ EXPANSION PORT CN6
C21
L4
3E
4.91V
L5
C20
POWER INPUT CN7
POWER SW1
F1
3A
CONTROL PORT 2 CN8
RECTIFIER CR4
CONTROL PORT 1 CN9
11.77V
3B
C19
CN10
1A
U18 PIN 1
4F
U19 PIN 1
4B
4F
L2
4.93V
3D
1E
VR1 11.76V
3F
C90
CR5
VR2 4.93V
3C
CR6


JOYSTICK
JOYSTICK
POWER SUPPLY
120VAC
POWER INPUT CN7
SW1
POWER SWITCH
CONTROL PORT 2
CN8
CONTROL PORT 1
CN9
POWER LED
CN10
L5
F1
RECTIFIER
CR4
VR2
VR1
CARTRIDGE/ EXPANSION PORT
CN6
CHANNEL SELECT SWITCH
MONITOR
M1
RF MODULATOR
ANTENNA SWITCH
VIDEO INTERFACE CHIP
U19
L2
AUDIO/ VIDEO
CN5
SERIAL I/O
CN4
PROGRAM LOGIC ARRAY
U17
SOUND INTERFACE DEVICE
U18
CASSETTE
CN3
MICROPROCESSOR
U7
ROM
U4
USER PORT
CN2
U2
U1
COMPLEX INTERFACE ADAPTER
CN1
KEYBOARD

PRELIMINARY SERVICE CHECKS (Continued)

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove three screws from cabinet bottom. Lift cabinet top and keyboard from cabinet bottom. Disconnect the keyboard connector and the power indicator connector from the main board.

MAIN BOARD REMOVAL

Unsolder copper strip from the top, right side of the cardboard shield and carefully fold back shield. Remove the seven screws holding main board to cabinet bottom. Unsolder grounding strip at all nine places on the main board. Remove shield and main board from cabinet bottom.

KEYBOARD REMOVAL

Remove eight screws holding the keyboard to cabinet top. Lift keyboard assembly from cabinet top.