Servicing Data

OHIO SCIENTIFIC

for

COMPUTER BOARDS 502, 505, 527, 540 & 542

as used in

Challenger Series

MODEL C4P
MODEL C4PMF

TABLE OF CONTENTS

Adjustments
- 502 Board (C4P) 48
- 505 Board (C4PMF) 77
- 540 Board (C4P/C4PMF) 43

Block Diagrams
- Body Block (C4P) 59,60
- Body Block (C4PMF) 63,64
- Skeleton Block (C4P) 1
- Skeleton Block (C4PMF) 2

Disassembly Instructions (C4P/C4PMF) 1

General Servicing/Safety Precautions (C4P/C4PMF) 1

Legends
- 502 Board (C4P) 91
- 505 Board (C4PMF) 91
- 527 Board (C4PMF) 92
- 540 Board (C4P/C4PMF) 92
- 542 Board (C4P/C4PMF) ..... Rear Cover

Parts List ..... 14 thru 26

Photos
- A15 Board (C4P) 62
- A15 Board (C4PMF) 78
- Board - Chassis Layout (C4P) 3
- Board - Chassis Layout (C4PMF) 4
- Chassis - Side View (C4P) 48
- Chassis - Side View (C4PMF) 83
- 502 Board (C4P) 49,50,52,53
- 505 Board (C4PMF) 79,80,81,82
- 527 Board (C4PMF) 89,90
- 540 Board (C4P/C4PMF) 44,45,46,47
- 542 Board (C4P/C4PMF) 27,28

Pinouts
- 502 Board (C4P) 51
- 505 Board (C4PMF) 65,66
- 527 Board (C4PMF) 83
- 540 Board (C4P/C4PMF) 32,33
- 542 Board (C4P/C4PMF) 31

Schematics
- A15 Board (C4P) 61
- 502 Board (C4P) 55,56,57,58
- 505 Board (C4PMF) 67,68,69,70,73,74,75,76
- 527 Board (C4PMF) ..... 84 thru 88
- 540 Board (C4P/C4PMF) ..... 35 thru 41
- 542 Board (C4P/C4PMF) 29,30

Schematic Notes ..... Rear Cover

Special Servicing Instructions
- C4P 3
- C4PMF 4

Troubleshooting Guide
- C4P 5,6,7,8
- C4PM ..... 9 thru 13

Waveforms
- 502 Board (C4P) 54
- 505 Board (C4PMF) 71,72,77
- 540 Board (C4P/C4PMF) 34,42,43

C4P/C4PMF — GENERAL SERVICING/SAFETY PRECAUTIONS

Use an isolation transformer for bench servicing.

Maintain line voltage at 120VAC.

Remove power from unit before removing or installing chips.

Use extreme caution when handling printed circuit boards. Ground yourself before handling boards.

Do not use a soldering device which has current flowing in its tip.

Use an isolation (times 10) probe on scope.

Do not remove or install boards or minifloppy with unit turned on.

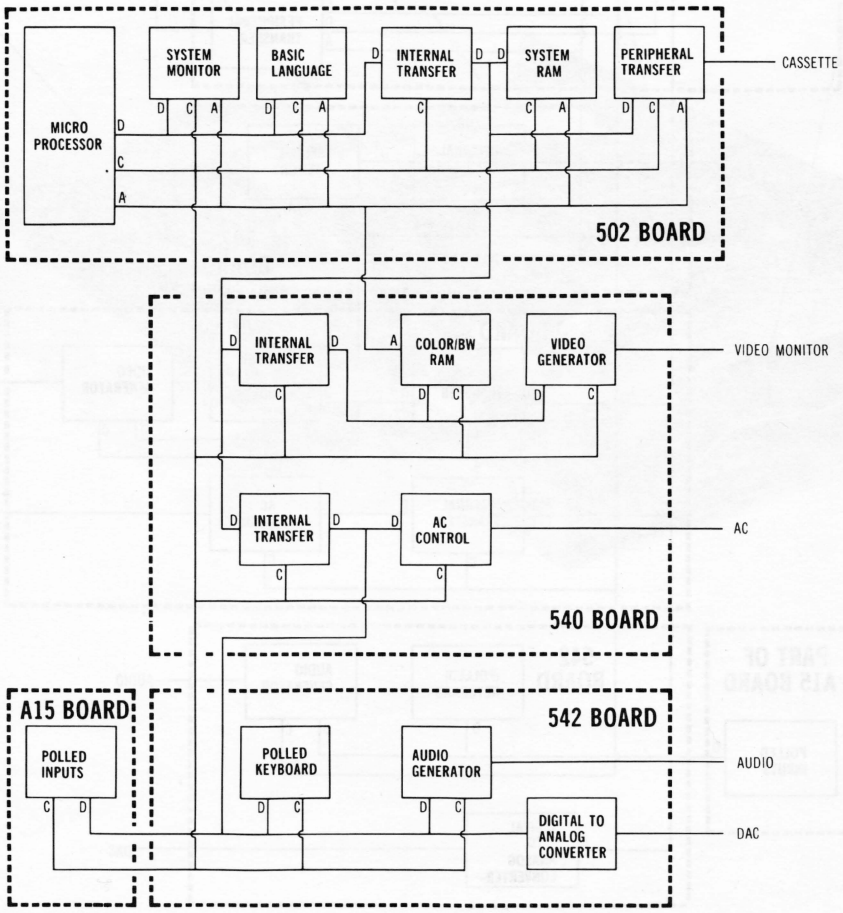
Install RAM in Chip Enable sequence only.

Caution: *Ground path on the boards is parallel to the B+ path on the opposite side of the board.*

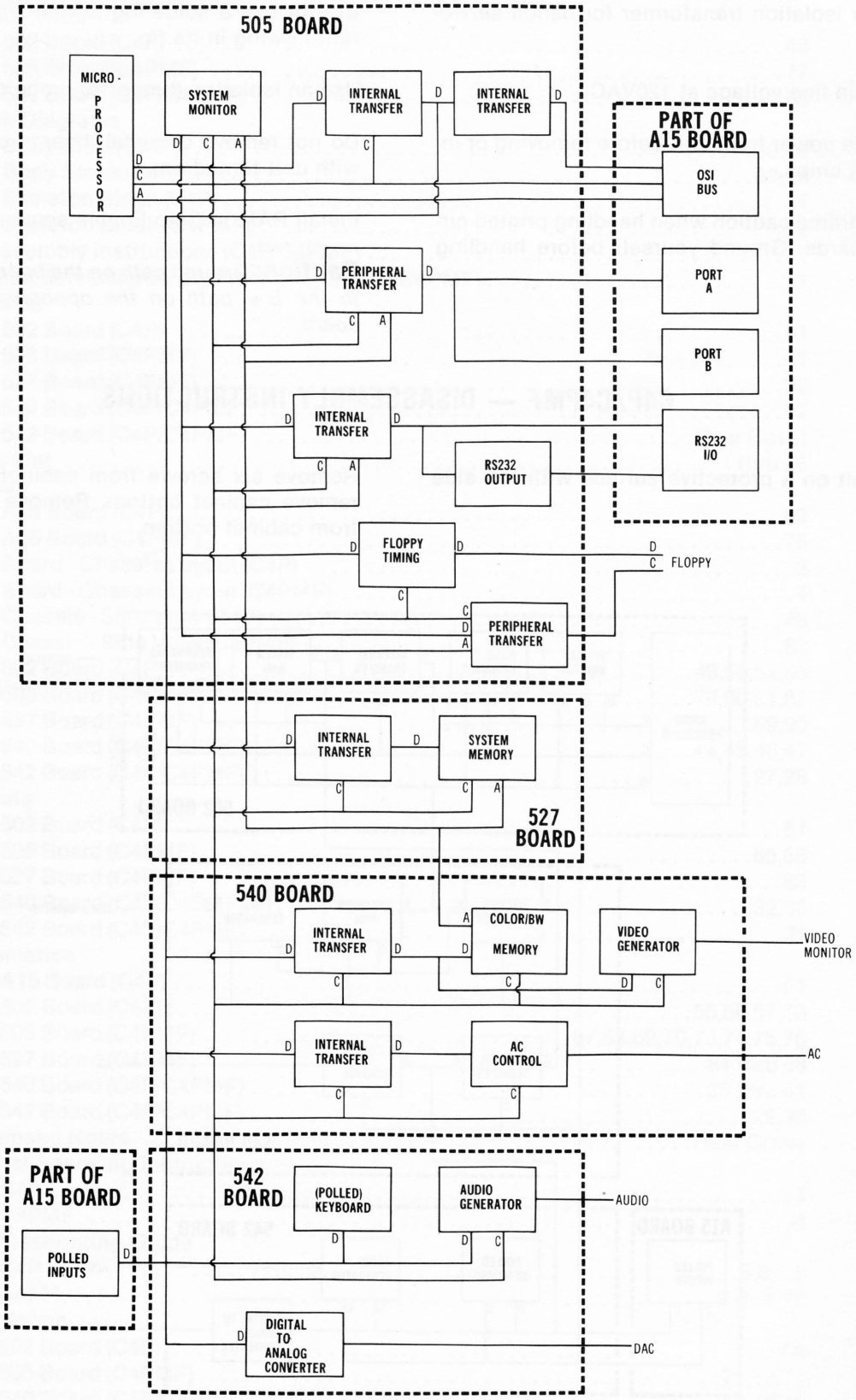
C4P/C4PMF — DISASSEMBLY INSTRUCTIONS

Lay unit on a protective surface with top side down.

Remove six screws from cabinet bottom and remove cabinet bottom. Remove ground lead from cabinet bottom.



C4P — SKELETON BLOCK

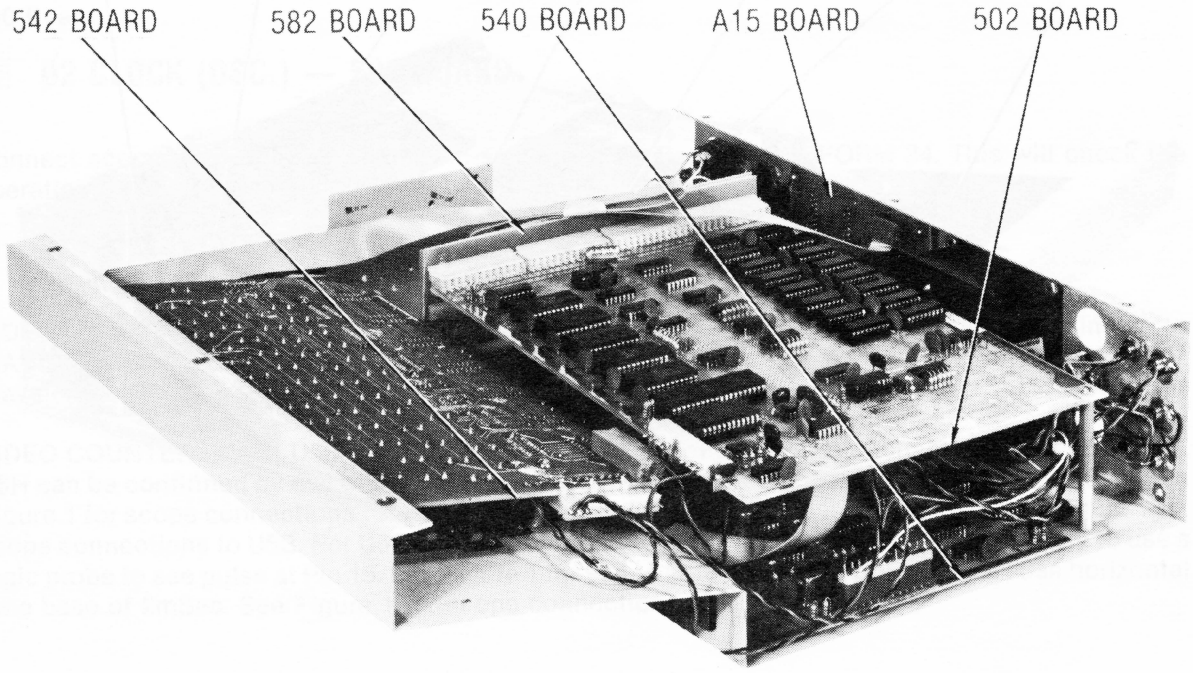


C4PMF SKELETON BLOCK

C4P SPECIAL SERVICING INSTRUCTIONS

For troubleshooting, the 502 and 540 boards can be interchanged for servicing.

NOTE: Care must be taken so that connectors on boards do not short to chassis or nearby boards.

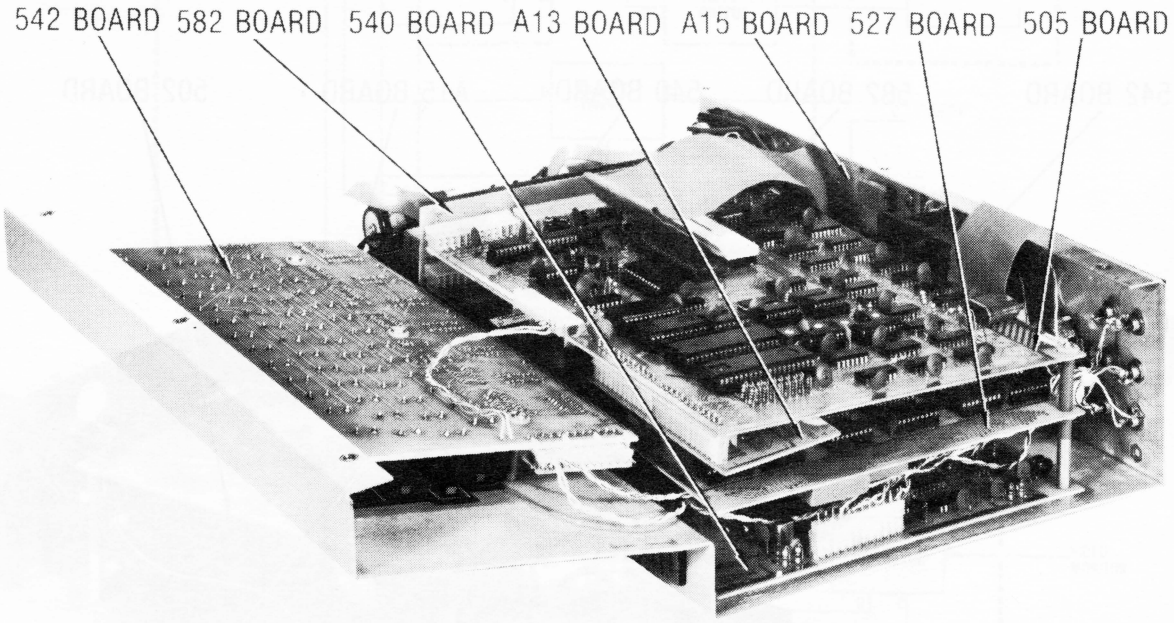


C4P — BOARD / CHASSIS LAYOUT

C4PMF SPECIAL SERVICING INSTRUCTIONS

For troubleshooting, the 505, 527, and 540 board can be interchanged for servicing.

NOTE: Care must be taken so that connectors on boards do not short to chassis or nearby boards.



C4PMF — BOARD / CHASSIS LAYOUT

C4P
TROUBLESHOOTING GUIDE
COLOR COORDINATED

See schematic for the colors matching those in this guide for circuitry to be checked.

When a portion of a chip function is being referred to for checking, this is indicated by the partial coloring of chip.

PRELIMINARY SETUP

"SHIFT LOCK" key must be depressed before any troubleshooting is attempted.
"BREAK" key must be depressed and then released.
Confirm power supply output of 5V DC.
These steps are necessary before computer will operate.

Ø0 CLOCK INPUT — 502 BOARD

Input of scope to U12, Pin 8. Output should be similar to WAVEFORM 35. This confirms operation of part of U12. The Ø0 clock is developed on the 540 Board and feeds to U12 Pin 9, on the 502 Board. If WAVEFORM 33 is missing at U12 Pin 9, it will be necessary to troubleshoot Ø0 clock source on the 540 Board.

Ø2 CLOCK (OSC.) — 502 BOARD

Connect scope to U4, Pin 39. Waveform should be similar to WAVEFORM 34. This will check the operation of the clock section of U4.

VIDEO SIGNALS — 540 BOARD

VIDEO OSCILLATOR CHECK: Connect scope to U3A, Pin 6. Waveform should be similar to WAVEFORM 14. To check operation of clock divider, connect scope to U3B, Pin 12 and Pin 9. Waveform should be similar to WAVEFORM 13 and 15 respectively.

VIDEO COUNTERS (U5D, U5B, U5F, U5H) CHECK: Timing and phase relationship of U5D, U5B, U5F, U5H can be confirmed by use of a dual trace scope. For U5D use horizontal time base of .5μSec. See Figure 1 for scope connections to U5D. For U5B use horizontal time base of 10μSec. See Figure 1 for scope connections to U5B. For U5F use horizontal time base of .2mSec. It may be necessary to use a logic probe to see pulse at Pin 15. See Figure 1 for scope connections to U5F. For U5H use horizontal time base of 2mSec. See Figure 1 for scope connections to U5H.

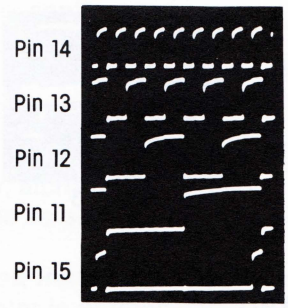


Figure 1

CL CLOCK CHECK: Connect scope to U3C, Pin 4. Output should be similar to WAVEFORM 14.

END BLANK CHECK: Connect scope to U3C, Pin 7. Output should be similar to WAVEFORM 17.

VIDEO ADDRESS DECODING CHECK: Check outputs of U5C, U5G, and U5E. See schematic for scope connections. Outputs should be similar to WAVEFORMS 7, 8, 9, 17, 22, 23, 24, 25, 28, 29, and 30. Check outputs of U5J and U5K. See schematic for scope connections. Outputs should be similar to WAVEFORMS 23, 24, 25, 28, 29, and 30. Timing and phase relationship of U5K and U5I can be confirmed by use of a dual trace scope. Set scope horizontal time base to 2mSec. See Figure 2 for scope connections and relationship of waveforms. This confirms operation of U5K, U5I, and associated circuitry.

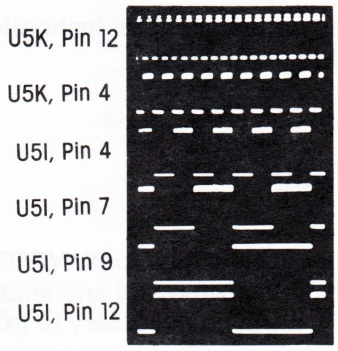


Figure 2

SYNC PULSE GENERATION — 540 BOARD

For horizontal sync, connect scope to Pin 12 of U4B. Output should be similar to WAVEFORM 26 and the negative pulse should be approximately 4.7μSec wide.

For vertical sync connect scope to Pin 12 of U4A. Output should be similar to WAVEFORM 27 and the negative pulse should be approximately 300μSec wide.

VIDEO MEMORY AND VIDEO DEVELOPMENT — 540 BOARD

The four memory chips U2C, U2D, U2E, and U2F are the B & W memory. U2C and U2F comprise memory for the top half of the monitor display, while U2D and U2E comprise memory for the bottom half of the monitor. The video information is fed thru U3F to ROM (U3E) to generate the dot pattern to be displayed. U3D then shifts this information serially to the Video Monitor (J21). See Figure 3 to compare timing of memory switch signal to video signal. Set horizontal time base on scope to 2mSec. This confirms operation of U2C, U2D, U2E, U2F, U3D, part of U3E, U3F, and associated circuitry.

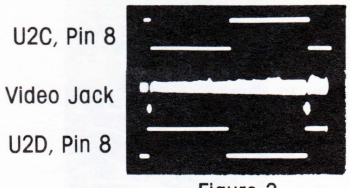


Figure 3

COLOR SIGNALS — 540 BOARD

To check X2 crystal oscillator (3.579545MHz), connect scope to U2A Pin 8. Output should be similar to WAVEFORM 11. This confirms operation of part of U2A, X2, and associated circuitry.

NOTE: U1B is used to generate the phase required to obtain the specific colors given in the operators manual. U1B must be replaced by original type to obtain proper color.

To check for color from memory, connect a logic probe to U1D, Pin 1. Enter machine language mode by depressing "BREAK", "M", ".", "D", "E", "0", "0". DE00 will appear in the left four positions of the six located in the top left hand of the monitor. Depress "/" and "01". The logic probe should indicate a low level. Enter "05", the logic probe should indicate a high level. Move logic probe to U1D, Pin 2. The logic probe should indicate a train of pulses. Enter "01", the logic probe should now indicate a low level. This confirms operation of part of U1F, U1G, U1E, U1D, and associated circuitry. Move logic probe to U1A, Pin 5. The logic probe should indicate a low level. Enter "05". The logic probe should indicate a train of pulses. This checks operation of part of U1A, U1D, and associated circuitry.

To check timing pulses that select background color, connect scope to U4A, Pin 4. Output should be similar to WAVEFORM 3 and the negative pulse should be approximately 8μSec wide.

"BYTES FREE" MEMORY CHECK — 502 BOARD

The ram circuitry check is built into the computer, as long as most all other circuitry is working.
To check ram circuitry, follow this procedure:

1. Press "BREAK".
2. Press "C".

Computer will ask "memory size". Ignore the question, press "RETURN".
Computer will ask "terminal width". Ignore the question, press "RETURN".
Computer will display XXXX BYTES free, etc.
If the "BYTES FREE" number does not represent the total number of your system, this will indicate what memory or associated circuitry has failed.
The following chart indicates the bytes free count and the chips involved.
To find the defective memory rams or associated circuitry, observe bytes free indication on screen.

Go to the chart and find the bytes free column to locate associated chips.

EXAMPLE 1: The computer is equipped with MEMORY totaling 7423 BYTES FREE.
The monitor screen indicates 5375 bytes free. Go to Chart 5375. Adjacent chips U35 and U44 are operating properly. This would indicate, then, that U34 and/or U43 and/or associated circuitry is malfunctioning.

EXAMPLE 2: The computer is equipped with MEMORY totaling 7423 BYTES FREE.
The monitor screen indicates 4362 bytes free. Go to chart. 4362 falls between 4351 and 5375. This indicates U35 and/or U44 and/or associated circuitry is malfunctioning.

NOTE: Chips adjacent to the next higher number of bytes free displayed on the monitor are the most likely defective device(s).

If above steps do not solve failure(s), continue.

CHIP SELECT LINES $\overline{\text{CS(0 thru 7)}}$ — 502 BOARD

To check chip select lines, bring the computer into machine language mode by depressing "BREAK", then "M". A six-character, alpha-numeric display will appear on the monitor. Use the first four characters for the address code as shown charted below. Connect logic probe to chip select line.
Press "." then enter address selected from chart. If operating properly a pulse should be indicated on logic probe when the last character is entered.

RAMS

BYTES FREE	CHIPS OR ASSOCIATED CIRCUITRY	MACHINE ADDRESS NUMBERS	
255	U40 U49	0000-03FF	502 BOARD
1279	U39 U48	0400-07FF	"
2303	U38 U47	0800-0BFF	"
3327	U37 U46	0C00-0FFF	"
.....			4K
4351	U36 U45	1000-13FF	502 BOARD
5375	U35 U44	1400-17FF	"
6399	U34 U43	1800-1BFF	"
7423	U33 U42	1C00-1FFF	"
.....			8K

AUDIO CASSETTE/TAPE SIGNAL CHECK — 502 BOARD

Clock signal needed to send data to cassette/tape should be similar to WAVEFORMS 36 and 37.

When storing a program going out to tape recorder, see WAVEFORMS 43, 44, and 45.

To confirm signal coming from cassette: While loading a program coming from the cassette, proper operation is indicated by WAVEFORMS 38, 39, 40, 41, and 42. WAVEFORM 42 amplitude depends on volume control setting of cassette.

MICROPROCESSOR CHIP (CPU) OPERATION — 502 BOARD

If "BREAK" key does not clear screen of random pattern, processor may not be working. Be sure key switch is functioning.

To verify processor is working, a pulse indication taken by scope (set on 1μSec. range) or logic probe at address lines (A0 through A15) at U4 will verify. No signal on an address line will suggest a defective U4 or a problem on that address line.

ROM MONITOR AND ROM BASIC CHIPS OPERATION CHECK — 502 BOARD

SYMPTOM: "BASIC" mode will not operate as "C" key is depressed and display does not change. "MACHINE" mode operates properly. This indicates a problem with ROM BASIC 1(U6), 2(U7) and/or 3(U8).

SYMPTOM: "BASIC" AND "MACHINE" modes not functioning. This indicates a problem with one or more of these chips and/or associated circuitry:

ROM MONITOR (U5), ROM BASIC 4 (U9), MICROPROCESSOR (CPU-U4), RAMS (U40 AND/OR U49)

C4PMF
TROUBLESHOOTING GUIDE
COLOR COORDINATED

See schematic for the colors matching those in this guide for circuitry to be checked.

When a portion of a chip function is being referred to for checking, this is indicated by the partial coloring of chip.

PRELIMINARY SETUP

"SHIFT LOCK" key must be depressed before any troubleshooting is attempted.
"BREAK" key must be depressed and then released.
Confirm power supplies output of 5V DC.
These steps are necessary before computer will operate.

CRYSTAL OSCILLATOR (X1) — 505 BOARD

Connect scope to U5C, Pin 8. Waveform should be similer to WAVEFORM 38. This confirms operation of X1 and associated circuitry.

Ø2 CLOCK (OSC.) — 505 BOARD

Connect scope to U1B, Pin 39. Waveform should be similar to WAVEFORM 41. This will check the operation of the clock section of U1B. Check the outputs of U4D Pin 3 and 13. Waveform should be similar to WAVEFORM 42.

VIDEO SIGNALS — 540 BOARD

VIDEO OSCILLATOR CHECK: Connect scope to U3A, Pin 6. Waveform should be similar to WAVEFORM 14. To check operation of clock divider, connect scope to U3B, Pin 12 and Pin 9. Waveform should be similar to WAVEFORM 13 and 15 respectively.

VIDEO COUNTERS (U5D, U5B, U5F, U5H) CHECK: Timing and phase relationship of U5D, U5B, U5F, U5H can be confirmed by use of a dual trace scope. For U5D use horizontal time base of .5μSec. See Figure 1 for scope connections to U5D. For U5B use horizontal time base of 10μSec. See Figure 1 for scope connections to U5B. For U5F use horizontal time base of .2mSec. It may be necessary to use a logic probe to see pulse at Pin 15. See Figure 1 for scope connections to U5F. For U5H use horizontal time base of 2mSec. See Figure 1 for scope connections to U5H.

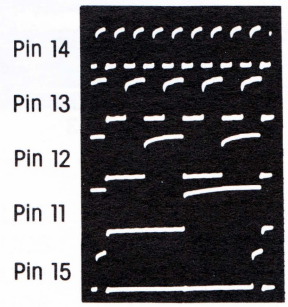


Figure 1

CL CLOCK CHECK: Connect scope to U3C, Pin 4. Output should be similar to WAVEFORM 14.

END BLANK CHECK: Connect scope to U3C, Pin 7. Output should be similar to WAVEFORM 17.

VIDEO ADDRESS DECODING CHECK: Check outputs of U5C, U5G, and U5E. See schematic for scope connections. Outputs should be similar to WAVEFORMS 7, 8, 9, 17, 22, 23, 24, 25, 28, 29, and 30. Check outputs of U5J and U5K. See schematic for scope connections. Outputs should be similar to WAVEFORMS 23, 24, 25, 28, 29, and 30. Timing and phase relationship of U5K and U5I can be confirmed by use of a dual trace scope. Set scope horizontal time base to 2mSec. See Figure 2 for scope connections and relationship of waveforms. This confirms operation of U5K, U5I, and associated circuitry.

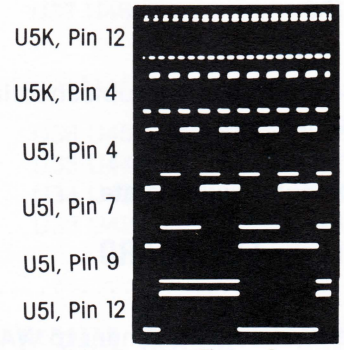


Figure 2

SYNC PULSE GENERATION — 540 BOARD

For horizontal sync, connect scope to Pin 12 of U4B. Output should be similar to WAVEFORM 26 and the negative pulse should be approximately 4.7μSec wide.

For vertical sync connect scope to Pin 12 of U4A. Output should be similar to WAVEFORM 27 and the negative pulse should be approximately 300μSec wide.

VIDEO MEMORY AND VIDEO DEVELOPMENT — 540 BOARD

The four memory chips U2C, U2D, U2E, and U2F are the B & W memory. U2C and U2F comprise memory for the top half of the monitor display, while U2D and U2E comprise memory for the bottom half of the monitor. The video information is fed thru U3F to ROM (U3E) to generate the dot pattern to be displayed. U3D then shifts this information serially to the Video Monitor (J21). See Figure 3 to compare timing of memory switch signal to video signal. Set horizontal time base on scope to 2mSec. This confirms operation of U2C, U2D, U2E, U2F, U3D, part of U3E, U3F, and associated circuitry.

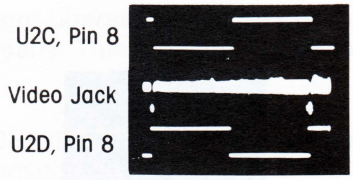


Figure 3

COLOR SIGNALS — 540 BOARD

To check X2 crystal oscillator (3.579545MHz), connect scope to U2A Pin 8. Output should be similar to WAVEFORM 11. This confirms operation of part of U2A, X2, and associated circuitry.

NOTE: U1B is used to generate the phase required to obtain the specific colors given in the operators manual. U1B must be replaced by original type to obtain proper color.

To check for color from memory, connect a logic probe to U1D, Pin 1. Enter machine language mode by depressing "BREAK", "M", ".", "D", "E", "0", "0". DE00 will appear in the left four positions of the six located in the top left hand of the monitor. Depress "/" and "01". The logic probe should indicate a low level. Enter "05", the logic probe should indicate a high level. Move logic probe to U1D, Pin 2. The logic probe should indicate a train of pulses. Enter "01", the logic probe should now indicate a low level. This confirms operation of part of U1F, U1G, U1E, U1D, and associated circuitry. Move logic probe to U1A, Pin 5. The logic probe should indicate a low level. Enter "05". The logic probe should indicate a train of pulses. This checks operation of part of U1A, U1D, and associated circuitry.

To check timing pulses that select background color, connect scope to U4A, Pin 4. Output should be similar to WAVEFORM 3 and the negative pulse should be approximately 8μSec wide.

CHIP SELECT LINES $\overline{\text{CE}}$ (0 thru 23) — 527 BOARD

To check chip select lines, bring the computer into machine language mode by depressing "BREAK", then "M". A six-character alpha-numeric display will appear on the monitor. Use the first four characters for the address code as shown charted below. Connect logic probe to chip select line.

Press "." then enter address selected from chart. If operating properly a pulse should be indicated on logic probe when the last character is entered.

RAMS

CHIPS OR ASSOCIATED CIRCUITRY	MACHINE ADDRESS NUMBERS	
UA1, UB1	0000-03FF	
UA2, UB2	0400-07FF	
UA3, UB3	0800-0BFF	
UA4, UB4	0C00-0FFF	
		4K
UA5, UB5	1000-13FF	
UA6, UB6	1400-17FF	
UA7, UB7	1800-1BFF	
UA8, UB8	1C00-1FFF	
		8K
UC1, UD1	2000-23FF	
UC2, UD2	2400-27FF	
UC3, UD3	2800-2BFF	
UC4, UD4	2C00-2FFF	
		12K
UC5, UD5	3000-33FF	
UC6, UD6	3400-37FF	
UC7, UD7	3800-3BFF	
UC8, UD8	3C00-3FFF	
		16K

UE1, UF1	4000-43FF
UE2, UF2	4400-47FF
UE3, UF3	4800-4BFF
UE4, UF4	4C00-4FFF

20K

UE5, UF5	5000-53FF
UE6, UF6	5400-57FF
UE7, UF7	5800-5BFF
UE8, UF8	5C00-5FFF

24K

MINIFLOPPY DATA-PATH CHECK — 505 BOARD

Connect scope to U5G, Pin 7 to check count down circuit operation. Output should be similar to WAVEFORM 57.

Connect scope to U3C Pin 4. Output should be similar to WAVEFORM 47 and the negative pulse should be approximately 400nSec. Connect scope to U3C Pin 5. Output should be similar to WAVEFORM 46 and the positive pulse should be approximately 400nSec. This checks the timing pulse needed to send the write data to the minifloppy.

Connect scope to J2 Pin 9. Output should be similar to WAVEFORM 51. When data is being sent to the minifloppy, it will appear as noise on the waveform. This confirms operation of parts of U1C, U4B, U5D, and U2B.

To check data input, connect scope to U4C Pin 12. Insert minifloppy disk. Output should appear similar to WAVEFORM 45.

To check clock input, connect scope to U4C Pin 13. Insert minifloppy disk. Output should appear similar to WAVEFORM 44.

MINIFLOPPY CONTROL SIGNAL CHECK — 505 BOARD

Connect scope to J2, Pin 17. Output should be similar to WAVEFORM 58.

Connect logic probe to J2, Pin 19. With Disk removed the logic probe will indicate a logic 1. While Disk is being inserted into Minifloppy, the logic probe will indicate a logic 0. After the Disk is inserted a logic 0 will remain if the Write Protect notch is covered; a logic 1 will be displayed if the notch is not covered.

Depress "BREAK", check for a pulse on a logic probe connected to J2, Pins 7, 8, and 21, just after depressing "D".

Depress "BREAK", check for pulses on a logic probe connected to J2, Pins 2 and 5. Check for a pulse on J2, Pins 3 and 18 after "BREAK" is depressed. Then check for two pulses after "D" is depressed.

Connect logic probe to J2, Pin 1. Depress "BREAK". Check for several pulses after "D" is depressed. Pin 1 should then become HI-Z. Connect logic probe to J2, Pin 6. Depress "BREAK" and confirm a logic 1. Depress "D" check for several pulses then a logic 0. This checks the operation of part of U1A and associated circuitry.

MICROPROCESSOR CHIP (CPU) OPERATION — 505 BOARD

If "BREAK" key does not clear screen of random pattern, processor may not be working. Be sure key switch is functioning.

To verify processor is working, a pulse indication taken by scope (set on 1μSec range) or logic probe at address lines (A0 thru A15) at U1B will verify. No signal on an address line will suggest a defective U1B or a problem on that address line.

ROM MONITOR OPERATION CHECK — 505 BOARD

SYMPTOM: "DISK" mode will not operate as "D" key is depressed. The "MACHINE" mode operates properly. This indicates a problem with one or more of these chips and/or associated circuitry;

ROM MONITOR (U2D), MICROPROCESSOR (CPU - U1B), RAMS (UA1 AND/OR UB1)

C4P/C4PMF— A15 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
D1-D4	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		MFGR. PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C1	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C2	.1 10V	CB-10410 490		MAG1201	QC1-223	HY-360

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R1	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R2	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R3	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R4	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R5	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R6	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R7	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R8	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R9	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J1	Socket	SC-40FI	40 Pin (Interconnect to 502 Board)
J2	Socket	SC-16FWW	16 Pin (OSI I/O BUS)
J3	Socket	SC-16FWW	16 Pin (Port "A")
J4	Socket	SC-16FWW	16 Pin (Port "B")
J5	Socket	SC-9FA	9 Pin (Joystick "A")
J6	Socket	SC-9FA	9 Pin (Joystick "B")
J7	Socket	SC-9FA	9 Pin (Key Pad "A")
J8	Socket	SC-25FCA	25 Pin (Printer)
J9	Socket	SC-25FCA	25 Pin (Modem)
J10	Socket	SC-9FA	9 Pin (Key Pad "B")
	P.C. Board	PC-A15A	C4-P Connector

C4P— 502 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
D1-02 D3-D5	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131
U1	F-7476PC	IC-7476	GE-7476			SK7476	ECG7476	TM7476	WEP7476/7476	
U2	CA3130E	IC-3130								
U3	MC6850P	IC-6850								
U4	6502	IC-6502								
U5	C38085 SYNMONV1.0	IC-7157								
U6	C38121	IC-BASIC 1								
U7	C38122	IC-BASIC 2								
U8	C38123	IC-BASIC 3								
U9	C38124	IC-BASIC 4								

C4P— 502 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results) (cont)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
U10	N8T26AN	IC-8T26								
U12	F-5404DM									
	7404	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U13	UA555TC	IC-555	GEIC-269	PTC1555		SK3564/955M	ECG955M	TM955M	WEP2119/955M	221-Z9042
U14	74148N	IC-74148								
U16	74LS139N	IC-74LS139								
U17	F-5404DM									
	7404	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U18	F-7430PC	IC-7430				SK7430	ECG7430	TM7430		
U19	N8T26AN	IC-8T26								
U20	7404	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U22	SN74123N	IC-74123	GE-74123		REN 74123	SK74123	ECG74123	TM74123		221-Z9086
U23	F-7474PC	IC-7474	GE-7474		REN 7474	SK7474	ECG7474	TM7474	WEP7474/7474	
U24	F-7417PC	IC-7417					ECG7417	TM7417		
U25	F-7417PC	IC-7417					ECG7417	TM7417		
U26	SN74LS138N	IC-74LS138				SK74LS138	ECG74LS138	TM74LS138		
U27	7410N	IC-7410	GE-7410			SK7410	ECG7410	TM7410		
U28	F-5404DM									
	7404	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U29	SN7420N	IC-7420	GE-7420			SK7420	ECG7420	TM7420		221-Z9077
U30	7414	IC-7414				SK7414	ECG7414	TM7414		
U31	7404	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U32	F-7417PC	IC-7417					ECG7417	TM7417		
U33-U40	2114L-3	IC-2114-L3								
		IC-L2114-550								
U41	F-7417PC	IC-7417					ECG7417	TM7417		
U42-U49	2114L-3	IC-2114-L3								
		IC-L2114-550								
Q1-Q6										

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		MFGR. PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C39	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C1	68 125V 5%	C-680	CD15ED680J03	SX468	QW1-23	MWA-680
C2	.01 100V 10%	C-103	WMF1S1	EWF1A110	QF1-91	1PB-S10
C3	.01 100V 10%	C-130	WMF1S1	EWF1A110	QF1-91	1PB-S10
C4	82 5%		CD15ED820J03	SX482	QW1-25	MWA-820
C5	150 1KV 5%	C-151		GP315		10TS-T15
C6	.01 100V 10%	C-103	WMF1S1	EWF1A110	QF1-91	1PB-S10
C7	.022 100V 10%	C-223	DPMS2S22	EWF1A122	QF1-127	1PB-S22
C8	82 5%		CD15ED820J03	SX482	QW1-25	MWA-820
C9	.1 10%	C-104	DPMS2P1	EWF1A010	QF1-215	1PB-P10
C10	.001 100V 10%	C-102	DPMS6D1	EWF1A210	QF1-1	1PB-D10
C20	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C21	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C22	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C23	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C24	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C25	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C26	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C28	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C29	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C30	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C31	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C32	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C33	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C34	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C35	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C36	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C37	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C38	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C39	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C40	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C41	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C42	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C43	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C44	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C45	.1 10V	CB-10410		MAG1201	QC1-223	HY-360

C4P— 502 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

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

ITEM No.	FUNCTION	RESISTANCE	REPLACEMENT DATA		
			MFGR. PART No.	MALLORY PART No.	TRW PART No.
R11	Frequency	10K	RP-103	RVA0911V103	X201R103B
R13	Duty Cycle	10K	RP-103	RVA0911V103	X201R103B
R17	TX Clock	5000	RP-502	RVA0911V502	X260R502B
R75	Duration (Tape Pulse)	10K	RP-103	RVA0911V103	X260R103B

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R1	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R2	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R3	100K 5% 1/4W Flameproof Carbon Film	R1-104	22-1144
R4	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R5	4700 5% 1/4W Carbon Film	R1-472	22-1112
R6	4700 5% 1/4W Carbon Film	R1-472	22-1112
R7	4700 5% 1/4W Carbon Film	R1-472	22-1112
R8	4700 5% 1/4W Carbon Film	R1-472	22-1112
R9	4700 5% 1/4W Carbon Film	R1-472	22-1112
R10	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R12	10K 5% 1/4 W Flameproof Carbon Film	R1-103	22-1120
R14	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R15	4700 5% 1/4W Carbon Film	R1-472	22-1112
R16	1000 5% 1/4W Flameproof Carbon Film	R1-101	22-1096
R18	4700 5% 1/4W Carbon Film	R1-472	22-1112
R19	4700 5% 1/4W Carbon Film	R1-472	22-1112
R20	4700 5% 1/4W Carbon Film	R1-472	22-1112
R21	4700 5% 1/4W Carbon Film	R1-472	22-1112
R22	4700 5% 1/4W Carbon Film	R1-472	22-1112
R23	4700 5% 1/4W Carbon Film	R1-472	22-1112
R24	4700 5% 1/4W Carbon Film	R1-472	22-1112
R25	4700 5% 1/4W Carbon Film	R1-472	22-1112
R26	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R27	100 5% 1/4W Flameproof Carbon Film	R1-101	22-1072
R28	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R29	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R30	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R31	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R32	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R33	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R34	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R35	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R36	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R37	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R38	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R39	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R40	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R41	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R42	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R43	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R44	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R45	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R46	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R47	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R48	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R49	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R50	220 10% 1/4W Flameproof Carbon Film	R1-221	22-1080
R51	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R52	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R53	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R54	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R55	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R56	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R57	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R58	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R59	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R60	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R61	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R62	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R63	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R64	4700 5% 1/4W Carbon Film	R1-472	22-1112
R65	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R66	4700 5% 1/4W Carbon Film	R1-472	22-1112

C4P— 502 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

RESISTORS (Power and Special) (cont)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R67	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R68	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R69	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R70	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R71	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R72	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R73	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R74	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R76	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J1	Socket	SC-12FM	12 Pin (4 used)
J2	Socket	SC-12FM	12 Pin
	Socket	SC-16FI	16 Pin IC Socket (3 used)
	Socket	SC-18FI	18 Pin IC Socket (16 used)
	Socket	SC-24FI	24 Pin IC Socket (6 used)
	Socket	SC-40FI	40 Pin IC Socket
	P.C. Board	PC-502	CPU Board

C4PMF— 505 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
D1	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131
D3-D4	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131
U1A	S6821P	IC-68B21								
U1B	6502A	IC-6502A								
U1C-U1D	S6850	IC-68B50								
U1E	F-74157PC					SK74157				
	74LS157PC	IC-74LS157				SK74LS157	ECG74LS157	TM74LS157		
U1F	F-7404PC	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U1G	MC1489/ SN75189N	IC-1489								
U1I	N8T26AN	IC-8T26								
U2A	N8T95N	IC-8T95								
U2B	F-7417PC	IC-7417					ECG7417	TM7417		
U2C	74148N	IC-74148								
U2D	C38085 SYNMONV1.0	IC-SYNMON								
U2E	N8T26AN	IC-8T26								
U3A-U3B	SN7417N	IC-7417					ECG7417	TM7417		
U3C	SN74123N	IC-74123	GE-74123		REN 74123	SK74123	ECG74123	TM74123		221-Z9086
U3D	MC8T95P	IC-8T95								
U3E	SN7410J	IC-7410	GE-7410			SK7410	ECG7410	TM7410		
U3F	S6821P	IC-68B21								
U3G	N8T26AN	IC-8T26								
U4A	SN7417N	IC-7417					ECG7417	TM7417		
U4B	DM7404N	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U4C	SN74123N	IC-74123	GE-74123		REN 74123	SK74123	ECG74123	TM74123		221-Z9086
U4D	MC8T95P	IC-8T95								
U4E	F-7404PC	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U4F	DM7404N	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U4H	N8T26AN	IC-8T26								
U5A	DM7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U5B	7476N	IC-7476N	GE-7476			SK7476	ECG7476	TM7476	WEP7476/7476	

C4PMF— 505 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results) (cont)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
U5C-U5D	DM7400N	IC-7400N	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U5E-U5F	F74LS390PC	IC-74LS390								
U5G	F74LS390PC	IC-74LS390								
	F-74390PC	IC-74390								
U5H-U5I	SN7420N	IC-7420	GE-7420			SK7420	ECG7420	TM7420		221-Z9077
U5J	SN74LS138N	IC-74LS138				SK74LS138	ECG74LS138	TM74LS138		
U5K	DM7404N	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U5L	SN7410J	IC-7410	GE-7410			SK7410	ECG7410	TM7410		
U6A	F-74163PC	IC-74163					ECG74163	TM74163		
U6B-U6D	7493N	IC-7493			REN 7493A	SK7493	ECG7493A	TM7493A		221-Z9078
U6E	F-5404DM									
	7404	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U6F	SN7402N	IC-7402	GE-7402			SK7402	ECG7402	TM7402	WEP7402/7402	
U6G	SN74LS138N	IC-74LS138				SK74LS138	ECG74LS138	TM74LS138		
U6H	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U6I	7430N	IC-7430				SK7430	ECG7430	TM7430		
Q1	2N5226	Q-2N5226	GE-82	PTC103	REN 159	SK3466/159	ECG159	TM159	WEP716	121-Z9003*
Q2	2N5226	Q-2N5226	GE-82	PTC103	REN 159	SK3466/159	ECG159	TM159	WEP716	121-Z9003*

* Lead configuration may vary from original.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		MFGR. PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C10	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150
C11	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C1	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C2	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C7	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C8	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C9	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C12	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C13	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C15	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C16	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C18	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C19	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C20	150 1KV 10%	C-151		GP315		10TS-T15
C21	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C22	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C23	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C24	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C25	150 1KV 10%	C-151		GP315		10TS-T15
C26	.001 100V 10%	C-102	DPMS6D1	EWF1A210	QF1-1	1PB-D10
C27	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C28	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C31	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C32	.001 100V 10%	C-151	DPMS6D1	EWF1A210	QF1-1	1PB-D10
C33	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C34	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C36	27 500V 10%	C-270		CN0427		10TCC-Q27
C37	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C38	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C39	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C40	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C41	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C42	.1 10V	CB-10410		MAG1201	QC1-223	HY-360

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

ITEM No.	FUNCTION	RESISTANCE	REPLACEMENT DATA		
			MFGR. PART No.	MALLORY PART No.	TRW PART No.
R52	TX Data	10K	RP-103	RVA0911V103	X260R103B
R56	TX Clock	10K	RP-103	RVA0911V103	X260R103B
R57	RX Clock	10K	RP-103	RVA0911V103	X260R103B
R58	RX Data	10K	RP-103	RVA0911V103	X260R103B

C4PMF— 505 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R1	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R2	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R3	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R4	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R5	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R6	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R7	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R8	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R9	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R10	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R11	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R12	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R13	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R14	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R15	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R16	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R17	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R18	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R19	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R20	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R21	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R22	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R23	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R24	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R25	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R26	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R27	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R28	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R29	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R30	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R31	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R32	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R33	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R34	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R35	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R36	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R37	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R38	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R39	1000 5% 1/2W Carbon	R2-102	22-2096
R40	1000 5% 1/2W Carbon	R2-102	22-2096
R41	1000 5% 1/2W Carbon	R2-102	22-2096
R42	1000 5% 1/2W Carbon	R2-102	22-2096
R43	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R44	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R45	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R46	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R47	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R48	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R49	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R50	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R51	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R53	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R54	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R55	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1086
R59	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R60	18K 5% 1/4W Flameproof Carbon Film	R1-183	22-1126
R61	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112

C4PMF— 505 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

RESISTORS (Power and Special) (cont)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R62	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R63	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R64	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R65	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R66	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R67	4700 5% 1/4W Carbon Film	R1-472	22-1112
R68	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R69	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R70	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R71	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R72	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R73	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R74	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R75	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R76	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R77	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R78	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R79	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R80	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R81	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R82	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R83	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R84	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R85	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R86	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R87	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R88	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R89	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R90	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R91	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R92	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R93	470 5% 1/4W Flameproof Carbon Film	R1-471	22-1088
R94	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R95	4700 5% 1/4W Carbon Film	R1-472	22-1112

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J1	Socket	SC-12FM	12 Pin
J2	Plug	SC-12MM	12 Pin
J3	Socket	SC-12FM	12 Pin
J4	Socket	SC-40FI	40 Pin (Connector to A15 Board)
X1	Crystal	X-405	4MHz
	Socket	SC-12FM	12 Pin (5 used)
	Plug	SC-12MM	12 Pin (2 used)
	P.C. Board	PC-505BP	CPU with Floppy Interface

C4PMF— 527 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
D1-D2	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131
UA1-UA8	2114L-3	IC-2114-L3								
UA9-UA10	N8T26AN	IC-8T26								
UB1-UB8	2114L-3	IC-2114-L3								
UC1-UC8	2114L-3	IC-2114-L3								
UC9	F-74S138PC	IC-74S138					ECG74S138	TM74S138		
UC10	SN7404N	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
UC11	DM7420N	IC-7420	GE-7420			SK7420	ECG7420	TM7420		221-Z9077
UD1-UD8	2114L-3	IC-2114-L3								
UD9	F-74S138PC	IC-74S138					ECG74S138	TM74S138		

C4PMF— 527 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results) (cont)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
UD10	F-74LS04PC	IC-74LS04				SK74LS04	ECG74LS04	TM74LS04		
UE1-UE8	2114L-3	IC-2114-L3								
UE9	F-74S138PC	IC-74S138					ECG74S138	TM74S138		
UE10	SN7410J	IC-7410	GE-7410			SK7410	ECG7410	TM7410		
UF1-UF8	2114L-3	IC-2114-L3								
UF9	F-74S138PC	IC-74S138					ECG74S138	TM74S138		

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		MFGR. PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C30	50 25V	C-506	WBR50-25	TT25X50A	QE1-353	TVA-1206

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C1	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C2	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C3	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C4	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C5	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C6	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C7	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C8	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C9	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C10	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C11	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C12	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C13	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C14	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C15	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C16	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C17	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C18	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C19	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C20	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C21	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C22	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C23	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C24	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C25	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C26	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C27	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C28	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C29	.1 10V	CB-10410		MAG1201	QC1-223	HY-360

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R1	4700 5% 1/4W Carbon Film	R1-472	22-1112
R2	4700 5% 1/4W Carbon Film	R1-472	22-1112

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R3	4700 5% 1/4W Carbon Film	R1-472	22-1112
R4	4700 5% 1/4W Carbon Film	R1-472	22-1112

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J1	Socket	SC-12FM	12 Pin (4 Required)
	Socket	SC-16FI	16 Pin IC Socket (6 used)
	Socket	SC-18FI	18 Pin IC Socket (48 used)
	P.C. Board	PC-527P	CM-9 Memory

C4P/C4PMF— 540 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
D1-D6	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131
U1A	DM74151AN	IC-74151				SK74151	ECG74151	TM74151		
U1B	DM74L04N	IC-74L04(1)								
U1C	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U1D	F-74175PC	IC-74175					ECG74175	TM74175		
U1E	DM74175N	IC-74175					ECG74175	TM74175		
	F-74175PC						ECG74175	TM74175		
U1F-U1G	2114L-3	IC-2114-L3								
U1H	N8T26N	IC-8T26								
U2A	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U2B	F-74LS86PC	IC-74LS86				SK74LS86	ECG74LS86	TM74LS86		
U2C-U2F	2114L-3	IC-2114-L3								
U2G-U2H	N8T26N	IC-8T26								
U3A	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U3B	SN7492AN	IC-7492	GE-7492			SK7492	ECG7492	TM7492		
U3C	74LS157N	IC-74LS157				SK74LS157	ECG74LS157	TM74LS157		
U3D	SN74165N	IC-74165					ECG74165	TM74165		
U3E	C38129	IC-CARGEN								
	CARGENV1.0									
U3F	SN74174N	IC-74174					ECG74174	TM74174		
U3G	F-74174PC	IC-74174					ECG74174	TM74174		
	SN74174N						ECG74174	TM74174		
U3H-U3I	N8T26N	IC-8T26								
U4A-U4B	SN74123N	IC-74123	GE-74123		REN 74123	SK74123	ECG74123	TM74123		221-Z9086
U4C	7408N	IC-7408	GE-7408			SK7408	ECG7408	TM7408	WEP7408/7408	
U4D	7403N	IC-7403					ECG7403	TM7403		
U4E	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U4F	7474N	IC-7474	GE-7474		REN 7474	SK7474	ECG7474	TM7474	WEP7474/7474	
	SN7474N		GE-7474		REN 7474	SK7474	ECG7474	TM7474	WEP7474/7474	
U4G	F-74175PC	IC-74175					ECG74175	TM74175		
U4H	F-7404PC	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
	SN7404N		GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U4J	SN74LS12N	IC-74LS12								
U4K	F-7404PC	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
	SN7404N		GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U5A	DM7420N	IC-7420	GE-7420			SK7420	ECG7420	TM7420		221-Z9077
	F-7420PC		GE-7420			SK7420	ECG7420	TM7420		221-Z9077
U5B-U5H	DM74LS163N	IC-74LS163				SK74LS163	ECG74LS163A	TM74LS163A		
U5I-U5K	SN74LS157N	IC-74LS157				SK74LS157	ECG74LS157	TM74LS157		
	F74LS157PC					SK74LS157	ECG74LS157	TM74LS157		
U6A	SN72555	IC-555	GEIC-269	PTC1555		SK3564/955M	ECG955M	TM955M	WEP2119/955M	221-Z9042
	UA555TC		GEIC-269	PTC1555		SK3564/955M	ECG955M	TM955M	WEP2119/955M	221-Z9042
U6B	74LS157PC	IC-74LS157				SK74LS157	ECG74LS157	TM74LS157		
U6C	7438N	IC-7438				SK7438	ECG7438	TM7438		
U6D	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U6E	74LS139N	IC-74LS139								
U6F	7430N	IC-7430				SK7430	ECG7430	TM7430		
	9N30/7430					SK7430	ECG7430	TM7430		
U6G-U6H	SN7400N	IC-7400	GE-7400		REN 7400	SK7400	ECG7400	TM7400	WEP7400/7400	221-Z9075
U6I	F-7402PC	IC-7402	GE-7402			SK7402	ECG7402	TM7402	WEP7402/7402	
	SN7402N		GE-7402			SK7402	ECG7402	TM7402	WEP7402/7402	
U6J	F-7404PC	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
	SN7404N		GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U6K	DM7420N	IC-7420	GE-7420			SK7420	ECG7420	TM7420		221-Z9077
	F-7420PC		GE-7420			SK7420	ECG7420	TM7420		221-Z9077
U6L	F-7404PC	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
	SN7404N		GE-7404			SK7404	ECG7404	TM7404		221-Z9076
Q1	2N5225	Q-2N5225	GE-20	PTC115	REN 123A	SK3444/123A	ECG123AP	TM123AP	WEP736/123A	121-Z9000A

(1) If replacement is required, do not substitute.

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		MFGR. PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C20	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150
C21	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C1	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C2	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C3	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C4	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C5	10 1KV 10%	C-100				

C4P/C4PMF— 540 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

CAPACITORS (cont)

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C6	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C7	.01 100V	C-103	WMF1S1	EWF1A110	QF1-91	1PB-S10
C8	10 1KV 10%	C-100				
C9	27 1KV 1%	C-270				
C10	50 Trimmer	CP-500				
C11	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C12	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C13	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C14	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C15	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C16	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C17	.1 50V 10%	C-104	WMF05P1	EWF05010		431P1049R5
C18	.001 100V 10%	C-102	DPMS6D1	EWF1A210	QF1-1	1PB-D10
C19	.001 100V 10%	C-102	DPMS6D1	EWF1A210	QF1-1	1PB-D10C-102
C22	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C23	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C24	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C25	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C26	.001 100V 10%	C-102	DPMS6D1	EWF1A210	QF1-1	1PB-D10
C27	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C28	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C29	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C30	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C31	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C32	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C33	.01 100V 10%	C-103	WMF1S1	EWF1A110	QF1-91	1PB-S10
C34	.0047 100V	C-472	WMF1D47	EWF1A247	QF1-57	1PB-D47
C35	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C36	220 500V 10%	C-221		GP322		10TS-T22
C37	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C38	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C39	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C40	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C41	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C42	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C43	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C99	150 1KV 10%			GP315		10TS-T15

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

ITEM No.	FUNCTION	RESISTANCE	REPLACEMENT DATA		
			MFGR. PART No.	MALLORY PART No.	TRW PART No.
R5	Bias	10K	RP-103	RVA0911V103	X260R103B
R9	Video	200	RP-201		
R10	Color	10K	RP-103	RVA0911V103	X260R103B
R22	Blanking	10K	RP-103	RVA0911V103	X260R103B
R23	Sync	500	RP-502	RVA0911V502	X260R502B

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R1	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R3	470 5% 1/4W Carbon Film	R1-471	22-1088
R4	470 5% 1/4W Carbon Film	R1-471	22-1088
R6	10 5% 1/4W Flameproof Carbon Film	R1-100	22-1048
R7	470 5% 1/4W Carbon Film	R1-471	22-1088
R8	27 5% 1/4W Carbon Film	R1-270	22-1058
R11	390 5% 1/4W Flameproof Carbon Film	R1-391	22-1081
R12	4700 5% 1/4W Carbon Film	R1-472	22-1112
R13	470 5% 1/4W Carbon Film	R1-471	22-1088
R14	470 5% 1/4W Carbon Film	R1-471	22-1088
R15	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R16	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R17	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R18	16K 5% 1/4W Flameproof Carbon Film	R1-163	
R21	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R25	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R26	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R27	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R28	18K 5% 1/4W Flameproof Carbon Film	R1-183	22-1126
R29	10K 5% 1/4W Flameproof Carbon Film	R1-103	22-1120
R30	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R31	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R32	220 5% 1/4W Flameproof Carbon Film	R1-221	22-1080
R33	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096

C4P/C4PMF— 540 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

RESISTORS (Power and Special) (cont)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R34	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R35	4700 5% 1/4W Carbon Film	R1-472	22-1112
R36	2200 5% 1/4W Flameproof Carbon Film	R1-222	22-1104
R37	100 5% 1/4W Flameproof Carbon Film	R1-101	22-1072
R38	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R39	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R40	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R41	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R42	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R43	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R44	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R45	100 5% 1/4W Flameproof Carbon Film	R1-101	22-1072

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J1	Socket	SC-12FM	12 Pin (4 used)
J2	Socket	SC-12FM	12 Pin
X1	Crystal	X-126	12MHz
X2	Crystal	X-355	3.58MHz
	Socket	SC-14FI	14 Pin IC Socket (2 used)
	Socket	SC-16FI	16 Pin IC Socket (9 used)
	Socket	SC-18FI	18 Pin IC Socket (6 used)
	Socket	SC-24FI	24 Pin IC Socket (1 used)
	P.C. Board	PC-540B1	Video/Color

C4P/C4PMF— 542 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

SEMICONDUCTORS (Select replacement transistor for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA							
			GENERAL ELECTRIC PART No.	MALLORY PART No.	RAYTHEON PART No.	RCA PART No.	SYLVANIA PART No.	THORDARSON PART No.	WORKMAN PART No.	ZENITH PART No.
D1-D16	1N914	Q-1N914	GE-514	PTC214	REN 177	SK3100/519	ECG519	TM519	WEP925/519	103-131
U1-U2	N8T26N	IC-8T26								
U3-U6	DM7475N	IC-7475	GE-7475			SK7475	ECG7475	TM7475		
U7	SN74LS138N	IC-74LS138				SK74LS138	ECG74LS138	TM74LS138		
U8	DM7404N	IC-7404	GE-7404			SK7404	ECG7404	TM7404		221-Z9076
U9-U10	74LS193N	IC-74LS193				SK74LS193	ECG74LS193	TM74LS193		
U11	74LS390PC	IC-74LS390								

ELECTROLYTIC CAPACITORS

ITEM No.	RATING	REPLACEMENT DATA				
		MFGR. PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C1	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150
C8	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150
C9	47 16V	C-506	NLW50-16	TT15X50A	QE1-351	TVA-1150

CAPACITORS

ITEM No.	RATING	MFGR. PART No.	REPLACEMENT DATA			
			CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
					Q-LINE	GENERAL LINE
C2	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C3	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C4	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C5	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C6	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C7	.1 10V	CB-10410		MAG1201	QC1-223	HY-360
C10	220 500V 10%	C-221				10TCC-T22
C11	220 500V 10%	C-221				10TCC-T22
C12	.1 10V	CB-10410		MAG1201	QC1-223	HY-360

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R1	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R2	8200 5% 1/4W Flameproof Carbon Film	R1-822	22-1118

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R3	510 5% 1/4W Flameproof Carbon Film	R1-511	
R4	68K 5% 1/4W Flameproof Carbon Film	R1-683	22-1140

C4P/C4PMF— 542 BOARD PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

RESISTORS (Power and Special) (cont)

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R5	33K 5% 1/4W Flameproof Carbon Film	R1-333	22-1132
R6	16K 5% 1/4W Flameproof Carbon Film	R1-163	
R7	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R8	3900 5% 1/4W Flameproof Carbon Film	R1-392	22-1110
R9	2000 5% 1/4W Flameproof Carbon Film	R1-202	
R10	1000 5% 1/4W Flameproof Carbon Film	R1-102	22-1096
R11	510 5% 1/4W Flameproof Carbon Film	R1-511	
R12	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112

ITEM No.	RATING	REPLACEMENT DATA	
		MFGR. PART No.	WORKMAN PART No.
R13	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R14	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R15	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R16	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R17	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R18	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112
R19	4700 5% 1/4W Flameproof Carbon Film	R1-472	22-1112

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J1	Socket	SC-12FM	12 Pin
J2	Socket	SC-16FI	16 Pin
J3	Socket	SC-16FI	16 Pin
S1 thru S52	Switch	HW-Keys Switch	Keyboard
	P.C. Board	PC-542B1	Keyboard Assembly (Rev B)
	Socket	SC-16FI	16 Pin IC Socket (10 used)
	Socket	SC-14FI	14 Pin IC Socket

C4P/C4PMF— 582 BOARD PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
	Plug	SC-12MM	12 Pin (16 used)
	P.C. Board	PC-582A	Backplane

C4P— CHASSIS PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

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. 8528 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors

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

ITEM No.	FUNCTION	RESISTANCE	REPLACEMENT DATA		
			MFGR. PART No.	MALLORY PART No.	TRW PART No.
R1	Fine Color Adj	1000	RP-102 19-7924 (5)	UA13L,SK1000	BU2,CF6,SS3,DC1

(5) Number on unit.

FUSE DEVICES

ITEM No.	DESCRIPTION	REPLACEMENT DATA						
		PART No.		BUSS PART No.		LITTELFUSE PART No.		WORKMAN PART No.
		DEVICE	HOLDER	DEVICE	HOLDER	DEVICE	HOLDER	DEVICE
F1	2A @ 250V Quick-acting	F-002	HW-FH1	AGC2	HKP	312002	342001AF	

C4P— CHASSIS PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J20	Jack	SC-1FJ	AC Control (Switchcraft 3501-FP)
J21	Jack	SC-1FJ	Video Monitor (Switchcraft 3501-FP)
J22	Jack	SC-1FJ	Cassette Output (Switchcraft 3501-FP)
J23	Jack	SC-1FJ	Cassette Mike (Switchcraft 3501-FP)
J24	Jack	SC-1FJ	Audio (Switchcraft 3501-FP)
J25	Jack	SC-1FJ	DAC (Switchcraft 3501-FP)
M1	Motor	HW-FAN	Fan, Assembly
SW1	Switch	SW-T01	Power Off/On
	AC Power Cord	W-3ST18AC	3 Conductor
	Cable	W-1612FC	12" Flexable Assembly, 16 Conductor
	Cable	W-1624FC	24" Flexable Assembly, 16 Conductor
	P.C. Board	PC-542BP	Keyboard Assembly
	P.C. Board	PC-502P	CPU
	P.C. Board	PC-A15P	C4-P Connector
	P.C. Board	PC-540B1P	Video-Color
	P.C. Board	PC-582P	Backplane
	Plug	SC-12MM	12 Pin

C4PMF— CHASSIS PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

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. 8528 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors

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

ITEM No.	FUNCTION	RESISTANCE	REPLACEMENT DATA		
			MFGR. PART No.	MALLORY PART No.	TRW PART No.
R1	Fine Color Adj	1000	RP-102 19-7924 (5)	UA13L,SK1000	BU2,CF6,SS3,DC1

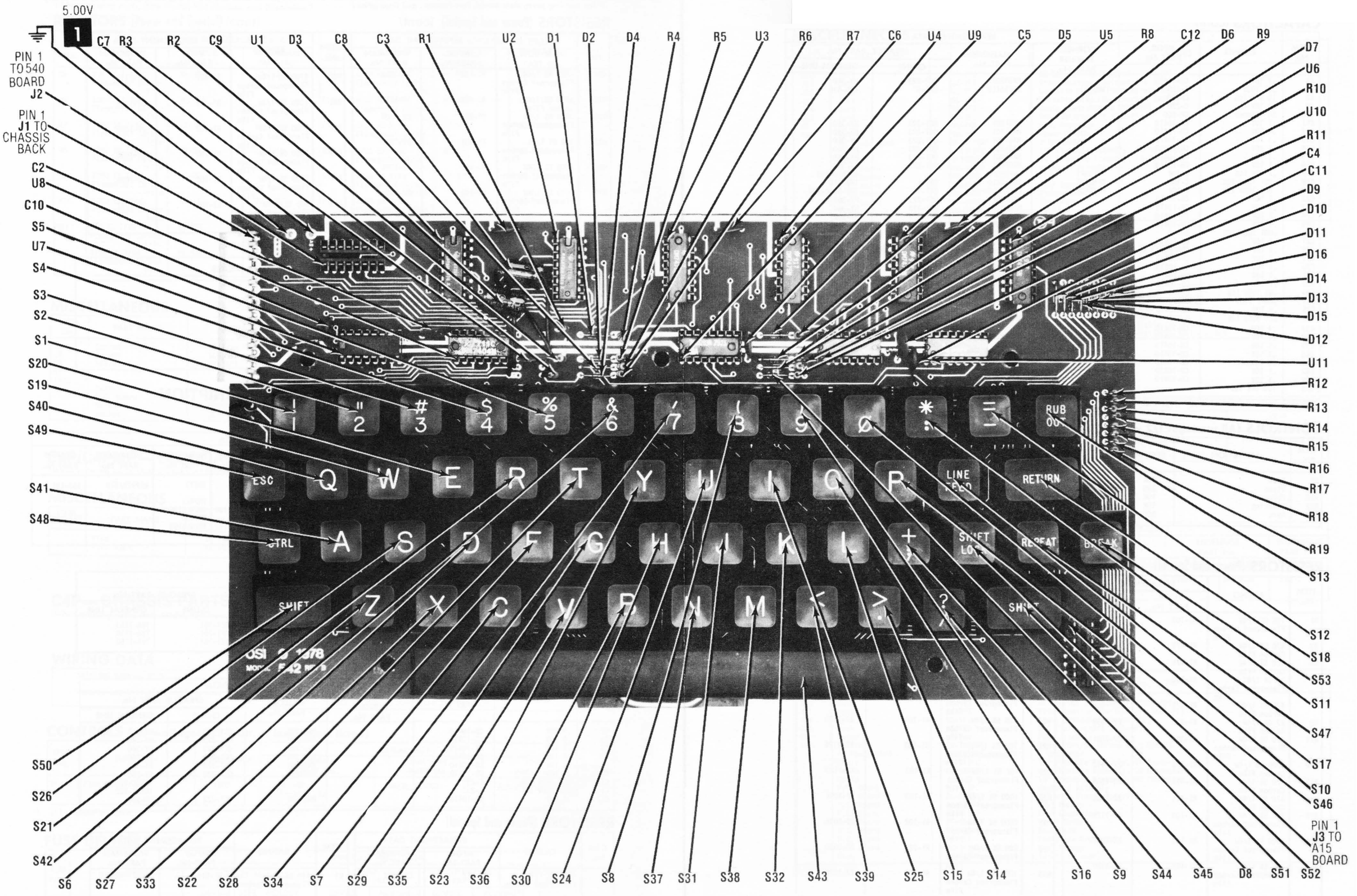
(5) Number on unit.

FUSE DEVICES

ITEM No.	DESCRIPTION	REPLACEMENT DATA						
		PART No.		BUSS PART No.		LITTELFUSE PART No.		WORKMAN PART No.
		DEVICE	HOLDER	DEVICE	HOLDER	DEVICE	HOLDER	DEVICE
F1	2A @ 250V Quick-acting	F-002	H342004A	AGC2	HKP	312002	342001AF	FG2-2

MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
J20	Jack	SC-1FJ	AC Control (Switchcraft 3501-FP)
J21	Jack	SC-1FJ	Video Monitor (Switchcraft 3501-FP)
J24	Jack	SC-1FJ	Audio (Switchcraft 3501-FP)
J25	Jack	SC-1FJ	DAC (Switchcraft 3501-FP)
M1	Motor	HW-FAN	Fan, Assembly
SW1	Switch	SW-T01	Power, Off/On (Arrow Hart 82607)
	AC Power Cord	U-3ST18AC	3 Conductor
	Cable	W-1612FC	12" Flexable Assembly, 16 Conductor
	Cable	W-1624FC	24" Flexable Assembly, 16 Conductor
	Cable		15" Flexable Assembly, 40 Conductor
	P.C. Board	PC-542P	Keyboard Assembly
	P.C. Board	PC-505PB	CPU with Floppy Interface
	P.C. Board	PC-527P	CM-9 Memory
	P.C. Board	PC-A15AP	C4-P Connector
	P.C. Board	PC-540B1P	Video Color
	P.C. Board	PC-582P	Backplane
	P.C. Board	PC-A11	Backplane Protector
	P.C. Board	PC-A13	Mini Floppy
	Plug	SC-12MM	12 Pin (3 used)

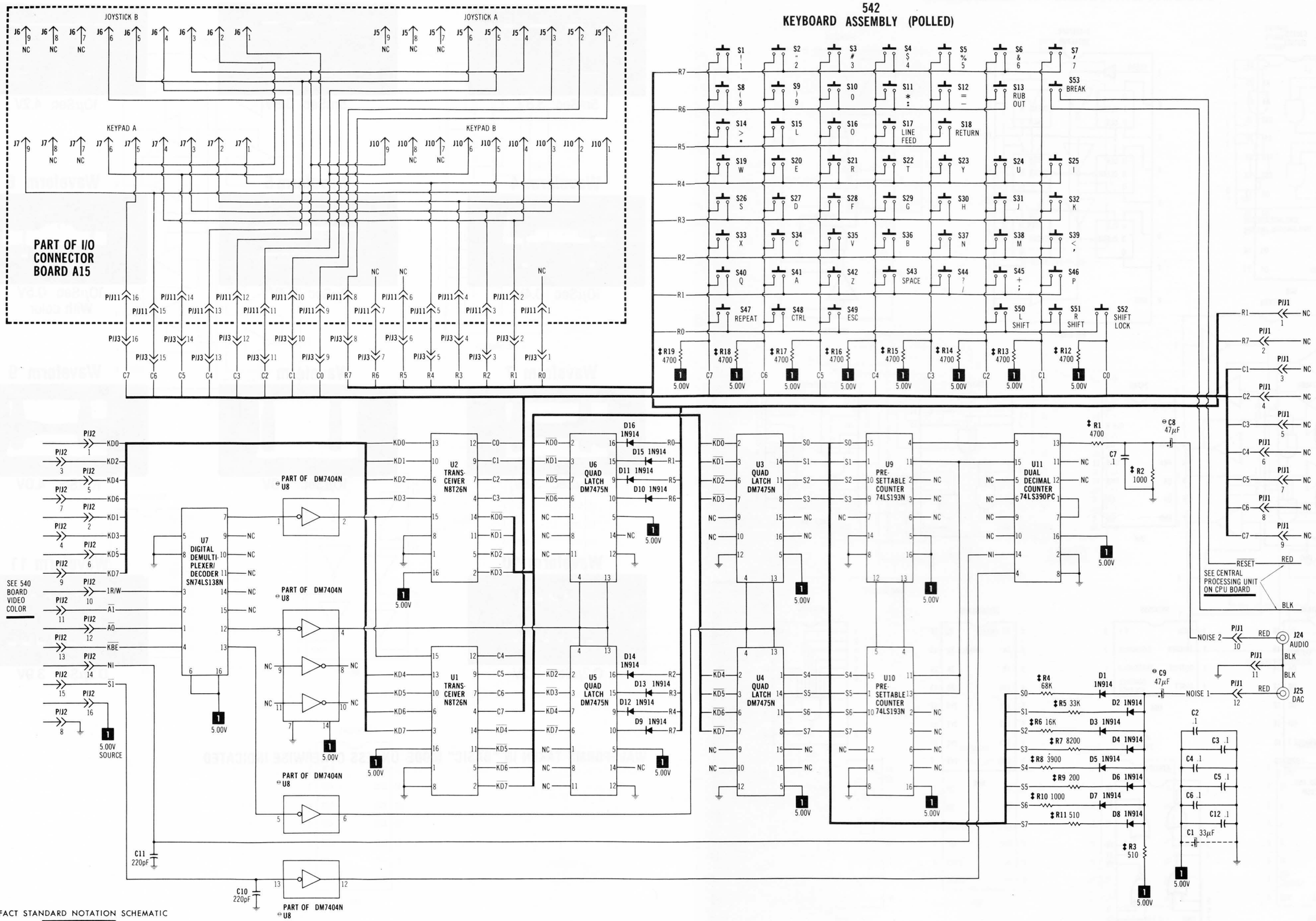


A Howard W. Sams CIRCUITRACE® Photo

C4P/C4PMF — 542 BOARD

C4P/C4PMF — 542 BOARD

542
KEYBOARD ASSEMBLY (POLLED)



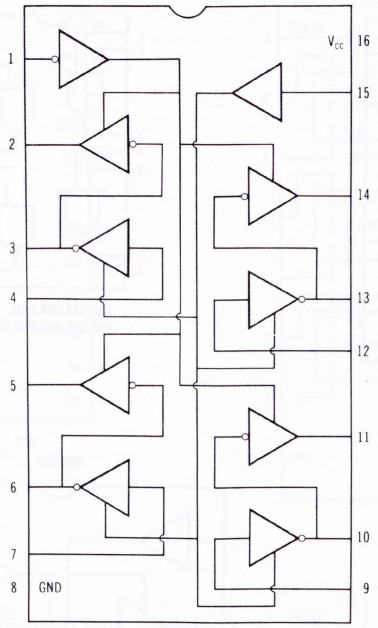
A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE®

FOR SCHEMATIC LEGEND AND NOTES SEE PAGES 91, 92 & INSIDE REAR COVER.

C4P/C4PMF — 542 BOARD

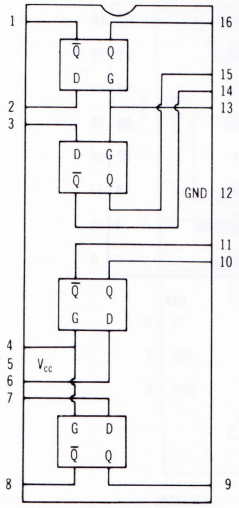
C4P/C4PMF — 542 BOARD PINOUTS

N8T26N



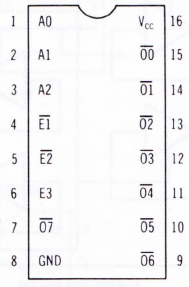
U1,U2

DM7475N



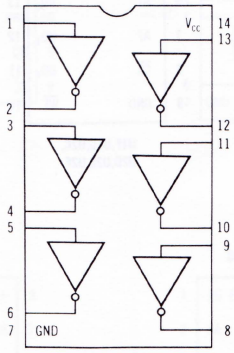
U3 THRU U6

SN74LS138N



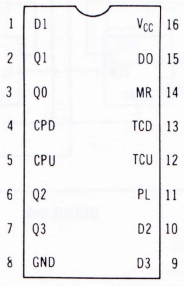
U7

DM7404N



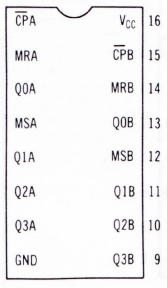
U8

74LS193N



U9,U10

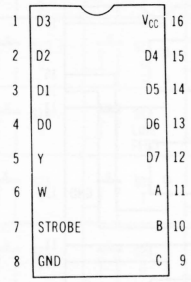
74LS390PC



U11

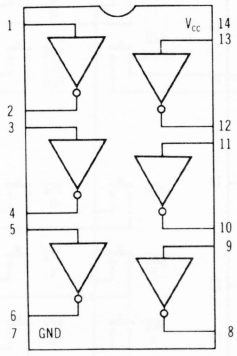
C4P/C4PMF — 540 BOARD PINOUTS

DN74151AN



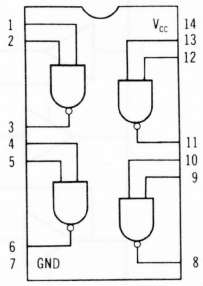
U1A

DN74L04N
F-7404PC



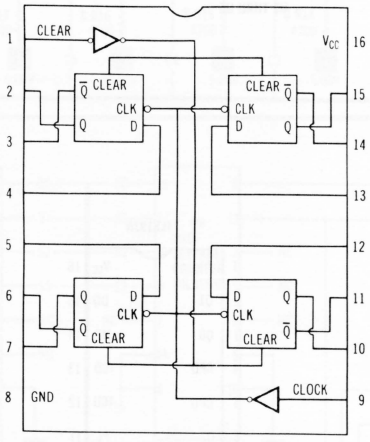
U1B,U4H,U4K,U6J,U6L

SN7400
F7403D
7438N



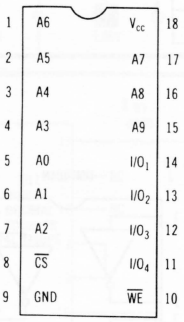
U1C,U2A,U3A,U4D,
U4E,U6C,U6D,U6G,U6H

F74175PC



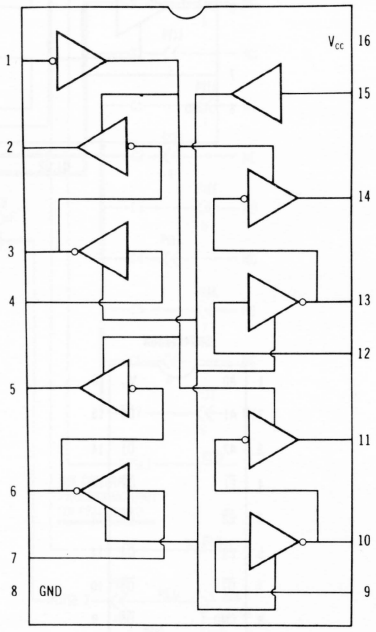
U1D,U1E,U4G

2114L-3



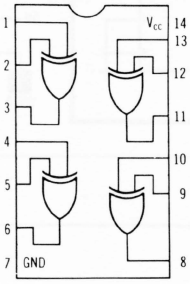
U1F,U1G,U2C,
U2D,U2E,U2F

N8T26N



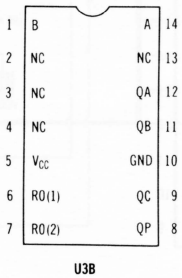
U1H,U2G,U2H,U3H,U3I

74LS86PC



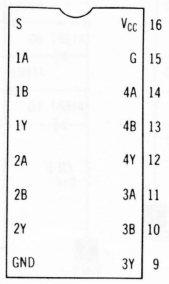
U2B

SN7492AN



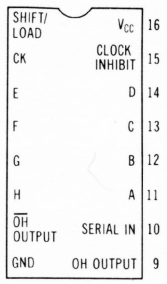
U3B

74LS157N
74LS157PC



U3C,U5I,U5J,U5K,U6B

SN74165N

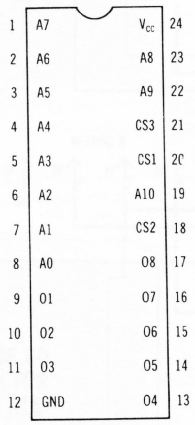


U3D

SEE PAGES 91, 92 & INSIDE REAR COVER.

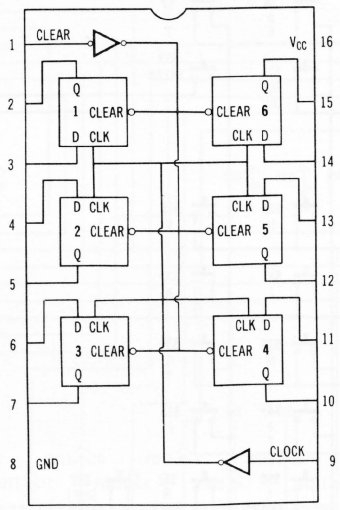
C4P/C4PMF — 540 BOARD PINOUTS

C38129
(2316E)



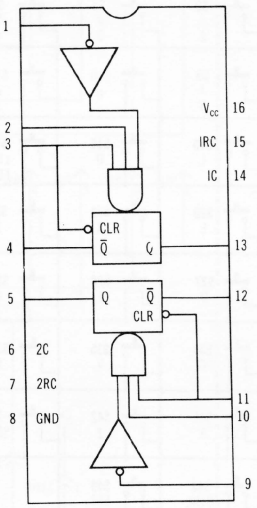
U3E

F-74174PC
SN74174N



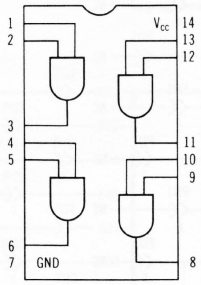
U3F,U3G

SN74123N



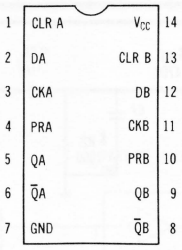
U4A,U4B

7408N



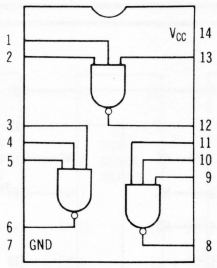
U4C

7474N



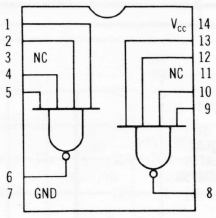
U4F

SN74LS12N



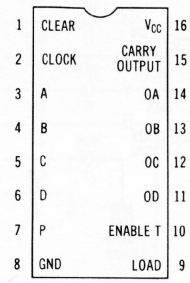
U4J

DM7420N



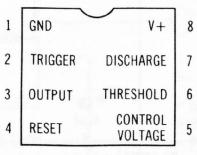
U5A,U6K

DM74LS163N



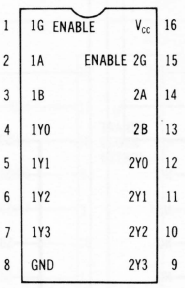
U5B,U5C,U5D, U5E,
U5F,U5G,U5H

SN742555



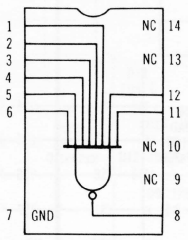
U6A

DM74LS139N



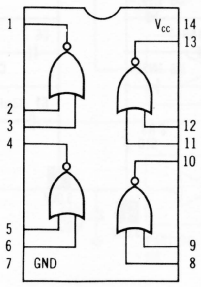
U6E

F7430PC



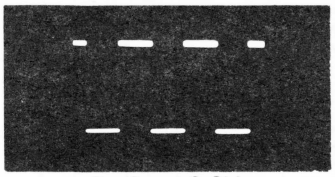
U6F

F7402PC



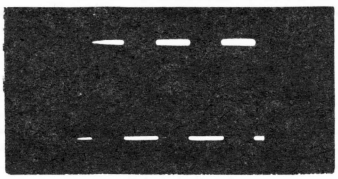
U6I

Waveform 1



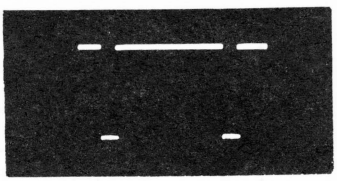
5mSec 3.8V

Waveform 2



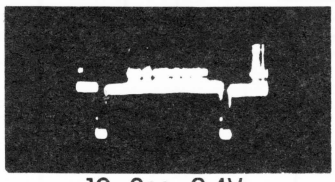
5mSec 3.8V

Waveform 3



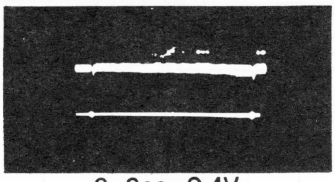
10μSec 4.2V

Waveform 4



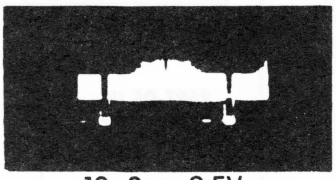
10μSec 0.4V

Waveform 5



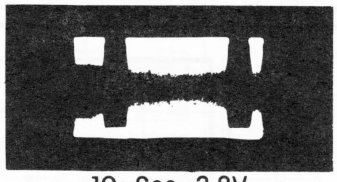
2μSec 0.4V

Waveform 6



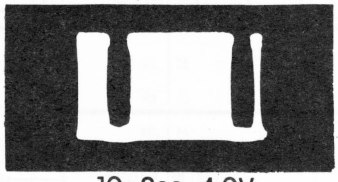
10μSec 0.5V
With color

Waveform 7



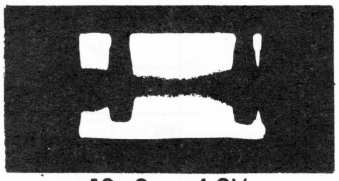
10μSec 3.8V

Waveform 8



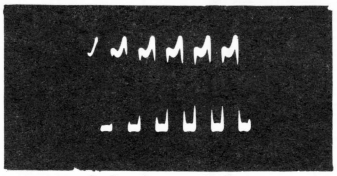
10μSec 4.0V

Waveform 9



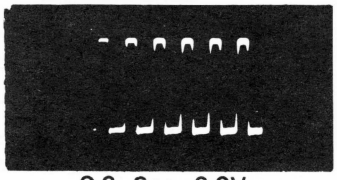
10μSec 4.0V

Waveform 10



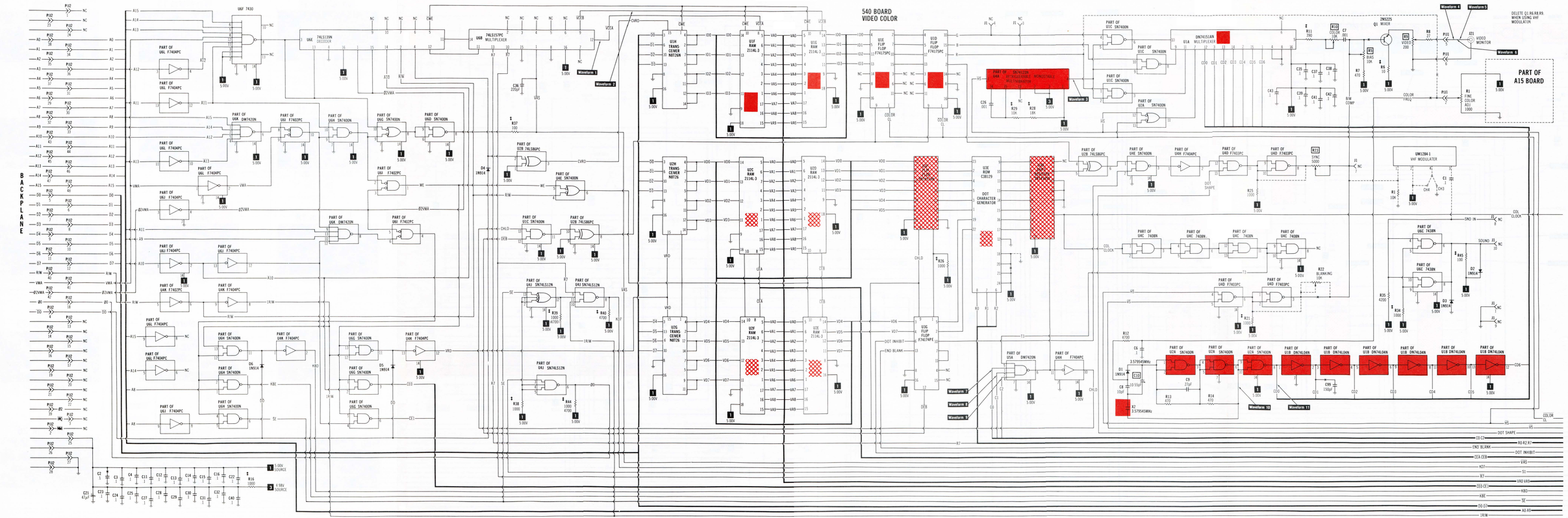
0.2μSec 3.2V

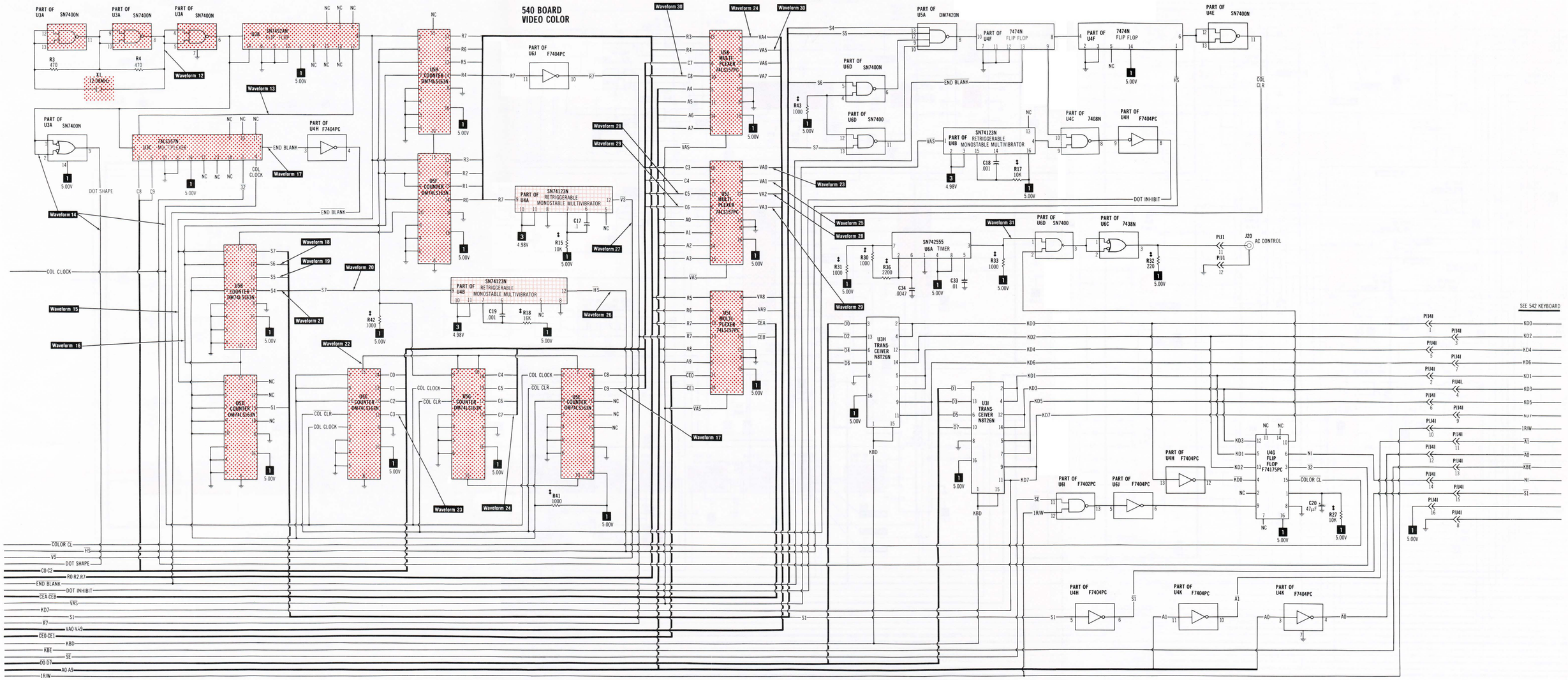
Waveform 11



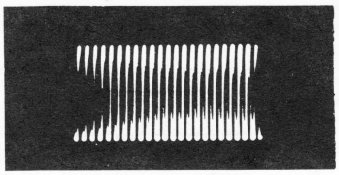
0.2μSec 3.9V

WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED


540 BOARD
VIDEO COLOR
BACKPLANE
PART OF A15 BOARD
DELETE Q1, R6, R8, R9, WHEN USING VHF MODULATOR
A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE
© Howard W. Sams & Co., Inc. 1980

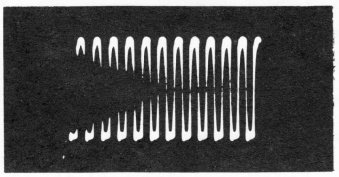

540 BOARD
VIDEO COLOR
SEE 542 KEYBOARD
COL CLOCK
COL CLR
END BLANK
DOT SHAPE
DOT INHIBIT
HS
VS
COL CLOCK
COLOR CL
HS
VS
DOT SHAPE
C0 C2
R0-R2,R7
END BLANK
DOT INHIBIT
CEA CEB
VAS
KD7
S1
R7
VA0-VA9
CE0 CE1
KBD
KBE
SE
D0 D7
A0 A9
1R/W
AC CONTROL

Waveform 12



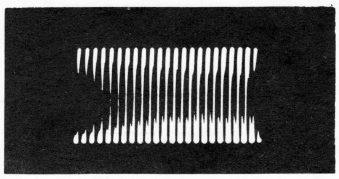
0.2μSec 3.2V

Waveform 13



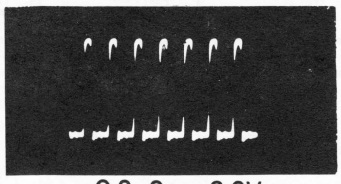
0.2μSec 4.0V

Waveform 14



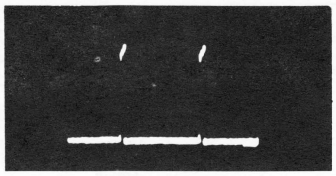
0.2μSec 3.8V

Waveform 15



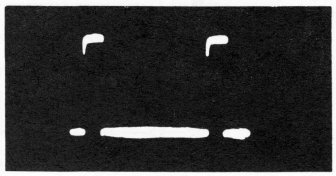
0.2μSec 3.8V

Waveform 16



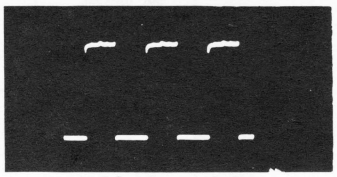
1μSec 4.0V

Waveform 17



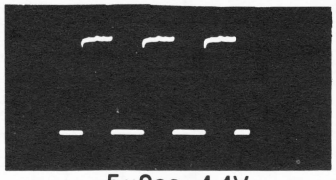
10μSec 4.4V

Waveform 18



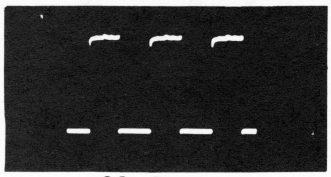
10μSec 4.4V

Waveform 19



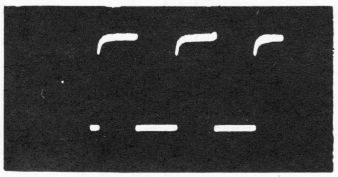
5μSec 4.4V

Waveform 20



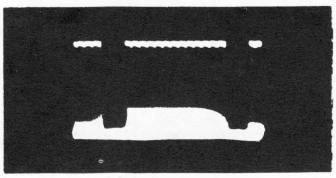
20μSec 4.4V

Waveform 21



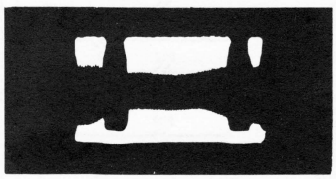
2μSec 4.4V

Waveform 22



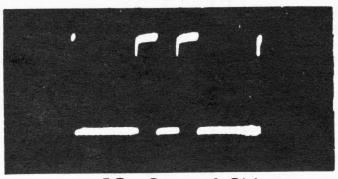
10μSec 3.8V

Waveform 23



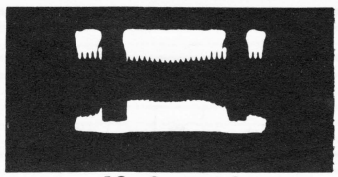
10μSec 4.3V

Waveform 24



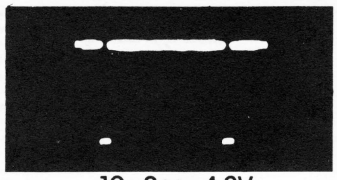
10μSec 4.6V

Waveform 25



10μSec 4.3V

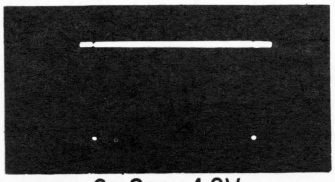
Waveform 26



10μSec 4.2V

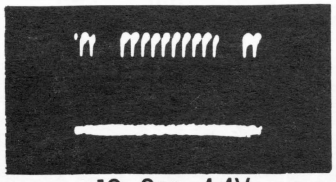
WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED

Waveform 27



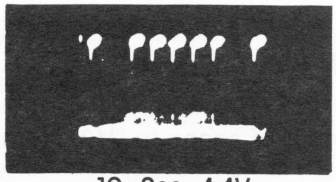
2mSec 4.3V

Waveform 28



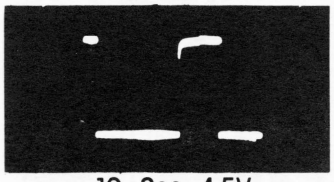
10μSec 4.4V

Waveform 29



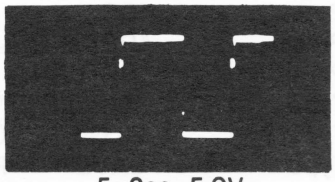
10μSec 4.4V

Waveform 30



10μSec 4.5V

Waveform 31



5μSec 5.0V

WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED

ELECTRICAL ADJUSTMENTS C4P/C4PMF — 540 BOARD

R9 VIDEO (MONITOR) AND R5 BIAS

Place computer into "BASIC" with color disabled. Enter the following program.

10 FOR X = 53248 TO 55295: POKE X,161: NEXT X: END

Type "RUN", Return.

Adjust R9 for best contrast, but do not allow unit to lose sync. Input of scope to Q1 emitter, adjust R5 for a peak level of 1.8 volts.

R23 SYNC

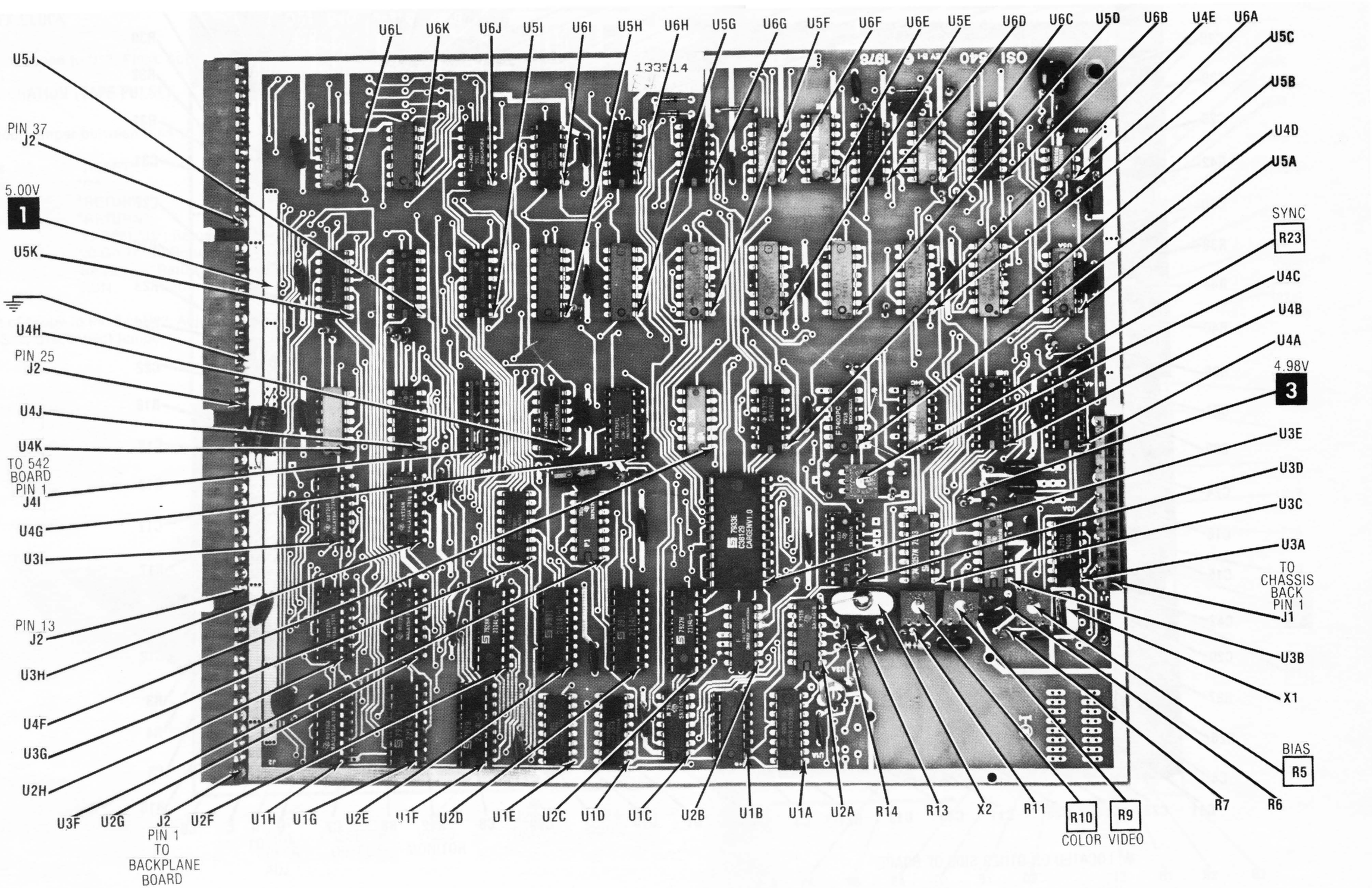
Input of scope to Q1 emitter. Adjust R23 for a sync pulse of .75 volts p-p.

R10 COLOR

With a color background displayed on monitor, connect scope to Q1 emitter. Adjust R10 for color burst signal of .6 volts p-p.

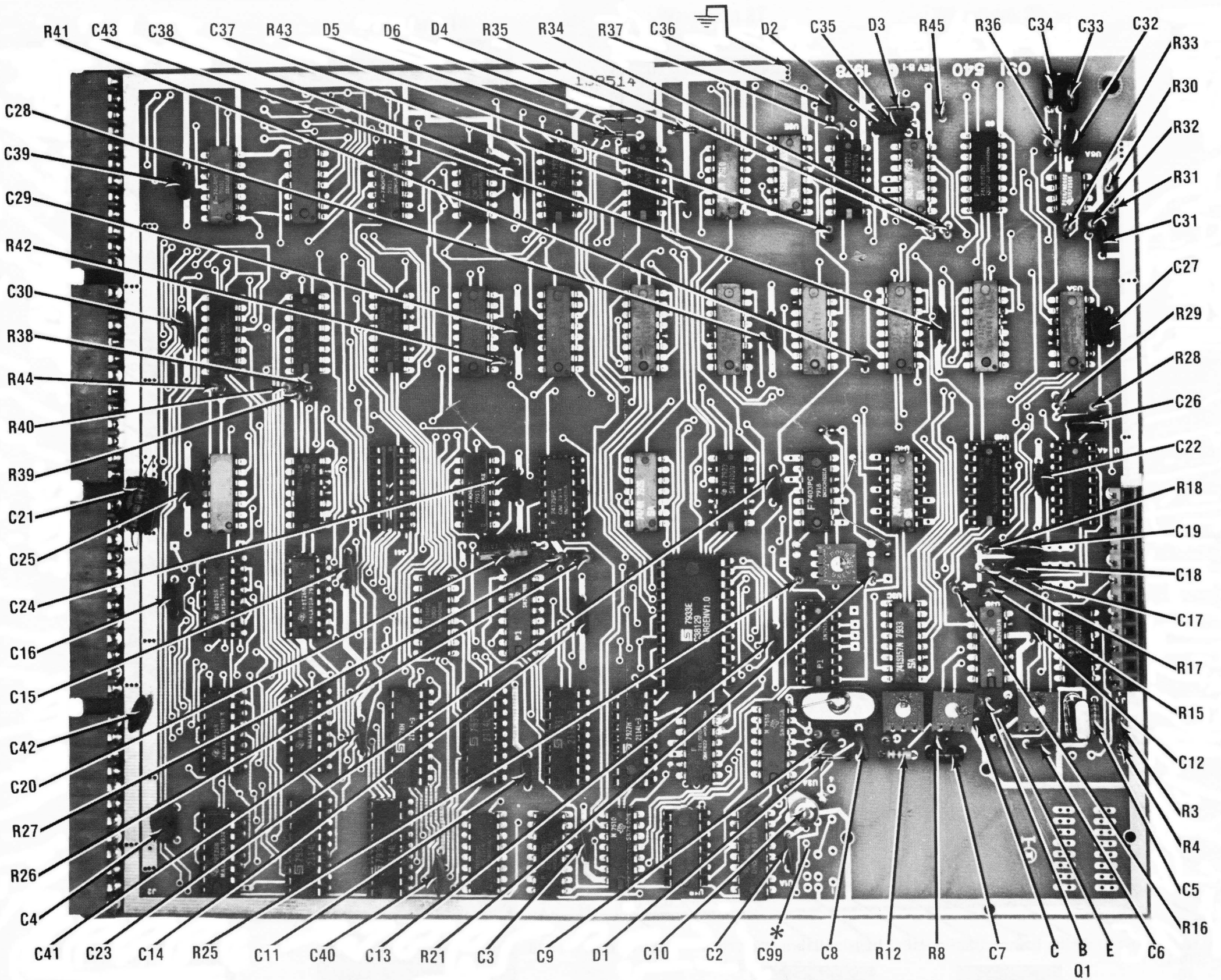
C10 3.579545MHz SIGNAL

Input of frequency counter to U2A, Pin 8. Adjust C10 for 3.579545MHz.



C4P/C4PMF — 540 BOARD A Howard W. Sams CIRCUITRACE® Photo

C4P/C4PMF — 540 BOARD



* LOCATED ON OTHER SIDE OF BOARD

C4P/C4PMF — 540 BOARD

C4P/C4PMF — 540 BOARD

R17 TX CLOCK

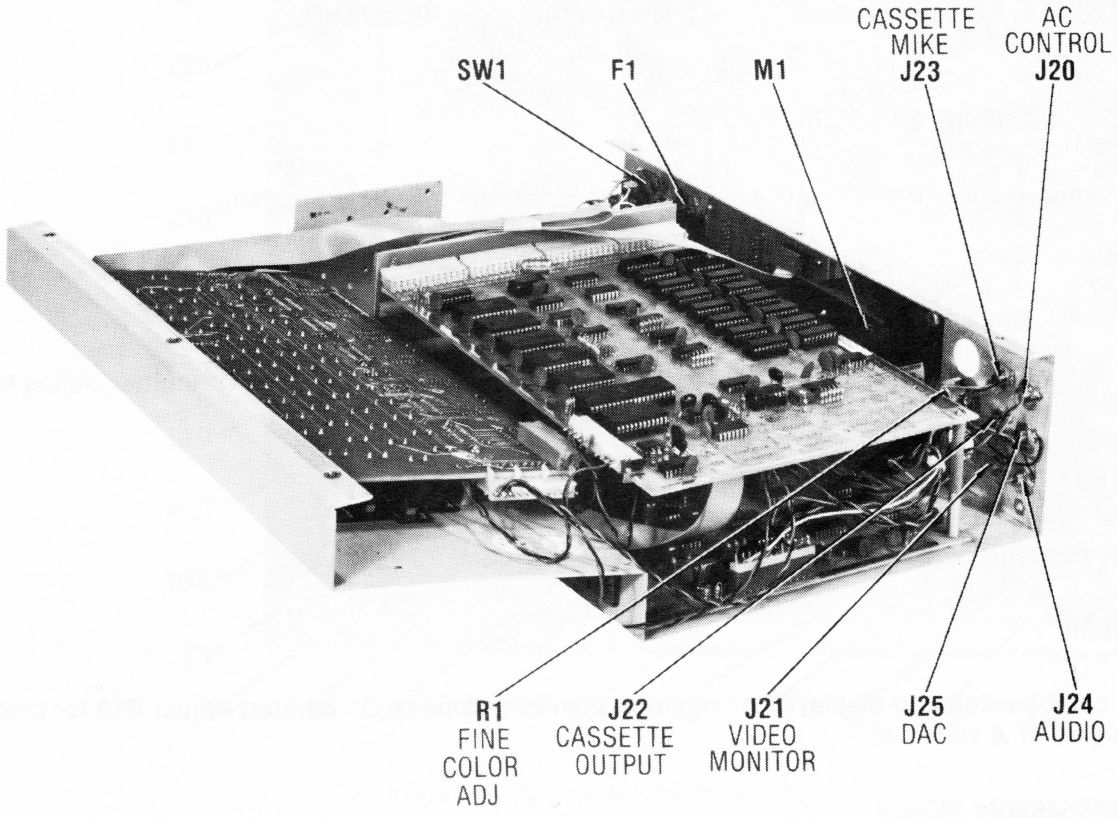
Input of scope to U13, Pin 3. Adjust R17 for a full cycle width of 210μSec.

R75 DURATION (TAPE PULSE)

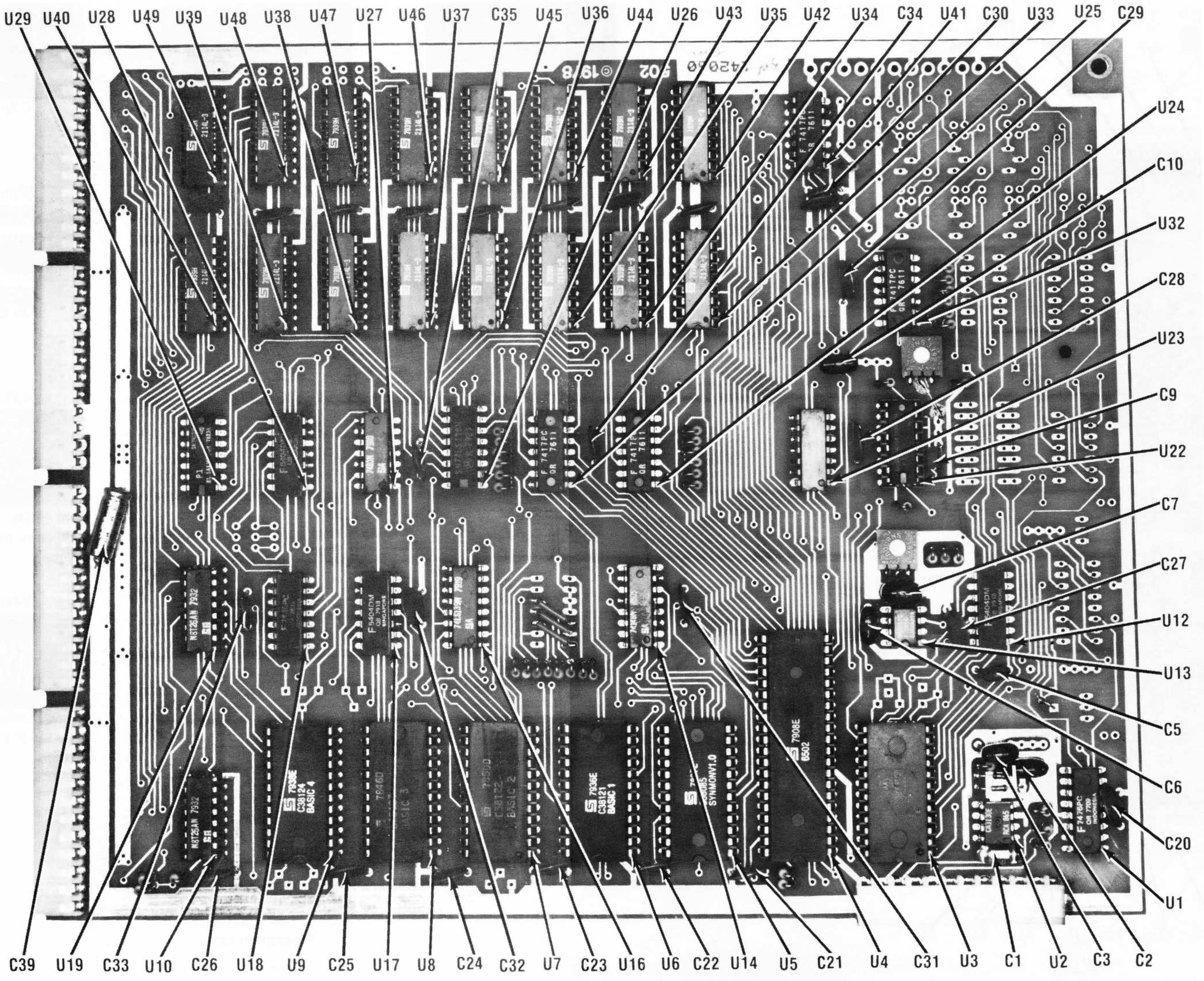
Connect jumper between Pins 10 and 11 of J2.

Press	"RESET"
Press	"C"
Press	"RETURN"
Press	"RETURN"
Type	10 Print "U"; Return
Type	20 Go TO 10 Return
Type	SAVE Return
Type	RUN Return

Input of scope to Pin 5 of U22. Adjust R75 for a positive pulse width of at least 500μSec. but not over 640μSec. Disconnect jumper.



C4P CHASSIS-SIDE VIEW

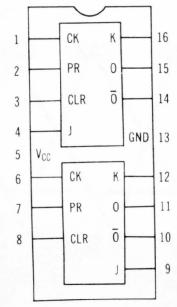


C4P — 502 BOARD

C4P — 502 BOARD

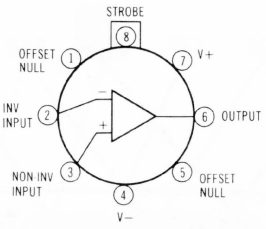
C4P — 502 BOARD PINOUTS

F7476PC



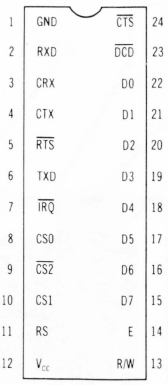
U1

CA3130E



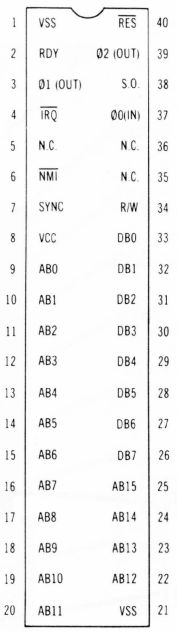
U2

MC6850P



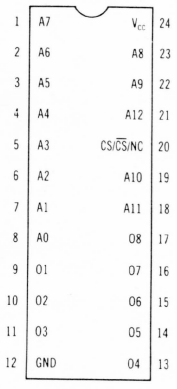
U3

6502



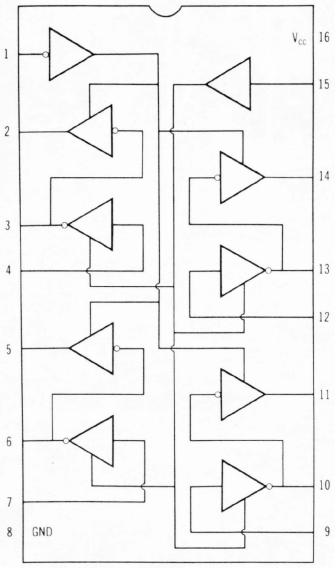
U4

2316B



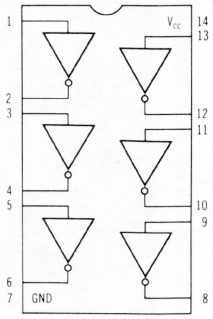
U5 THRU U9

N8T26N



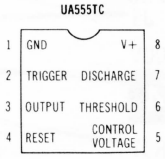
U10,U19

F5404DM



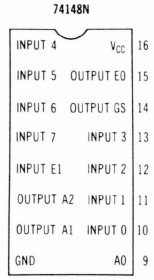
U12,U17,U28

UA555TC



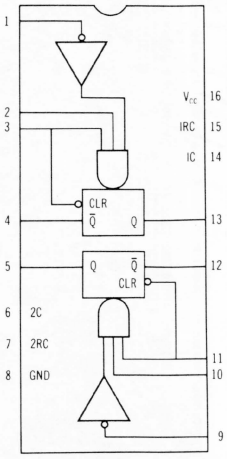
U13

74148N



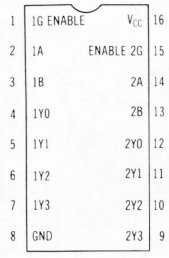
U14

SN74123N



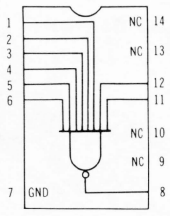
U22

74LS139N



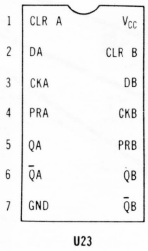
U16

F7430PC



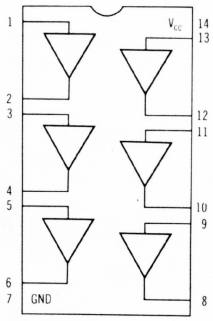
U18

F7474PC



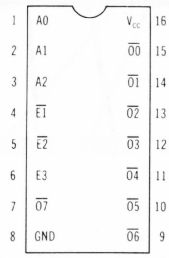
U23

F7417PC



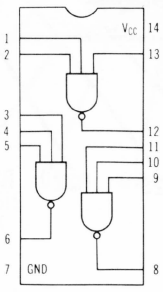
U24,U25,U32,U41

SN74LS138N



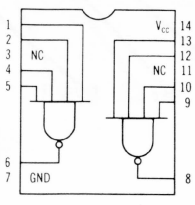
U26

7410N



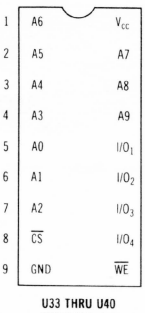
U27

SN7420N

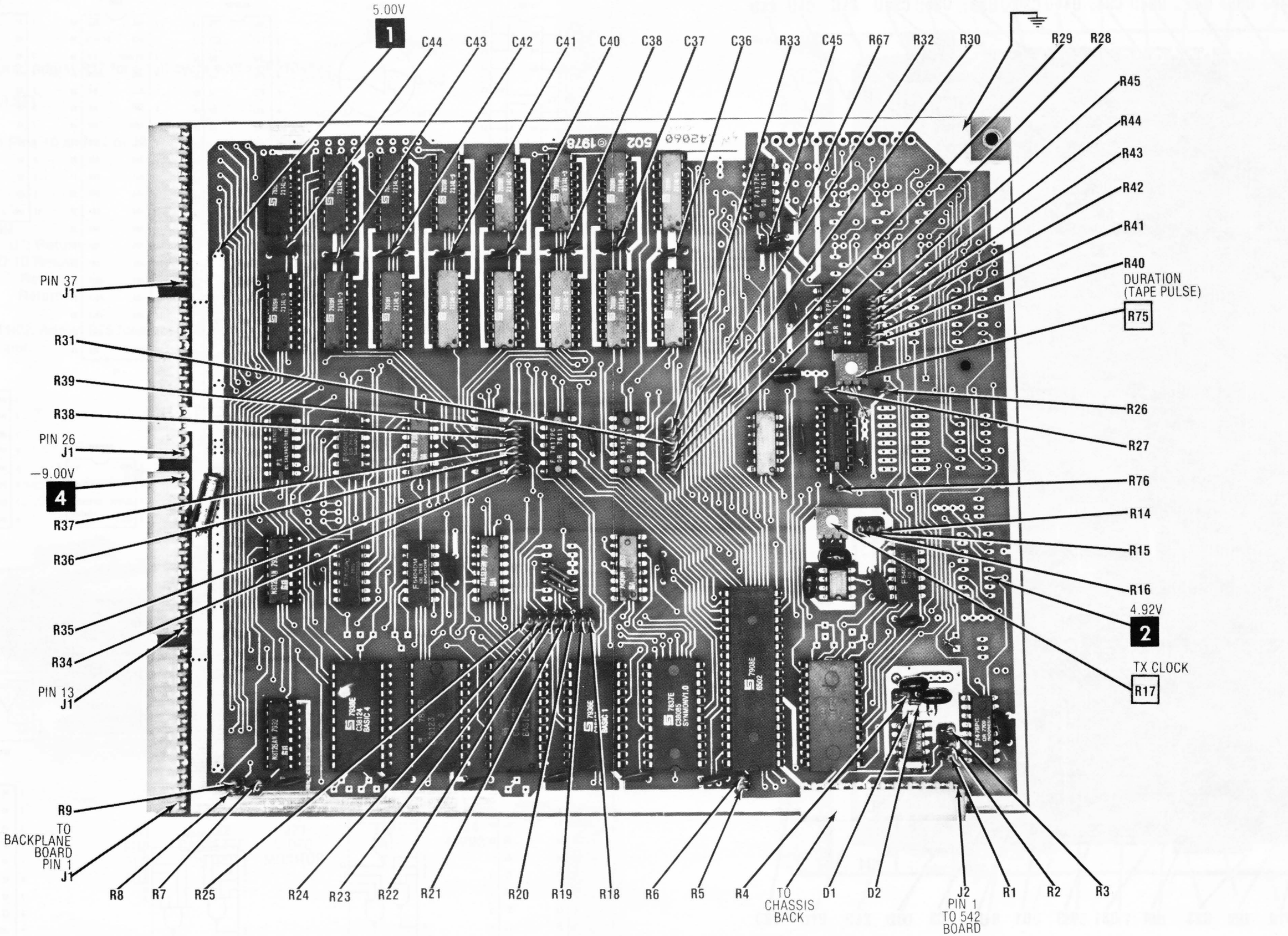


U29

2114L-3



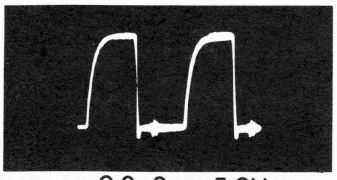
U33 THRU U40
U42 THRU U49



C4P — 502 BOARD A Howard W. Sams CIRCUITRACE® Photo

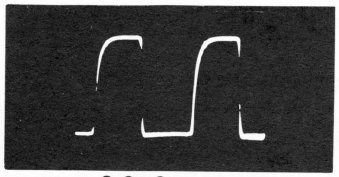
C4P — 502 BOARD

Waveform 33



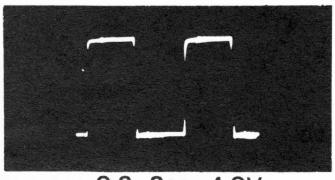
0.2μSec 5.0V

Waveform 34



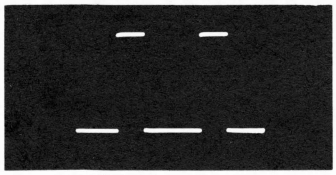
0.2μSec 5.0V

Waveform 35



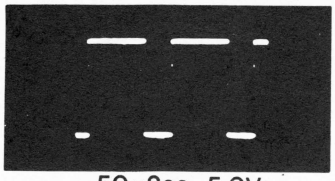
0.2μSec 4.0V

Waveform 36



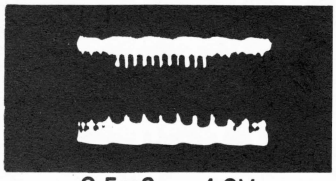
50μSec 3.8V

Waveform 37



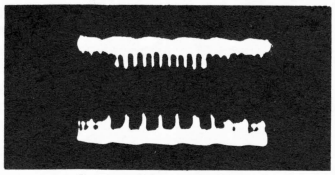
50μSec 5.0V

Waveform 38



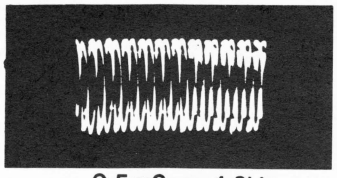
0.5mSec 4.0V

Waveform 39



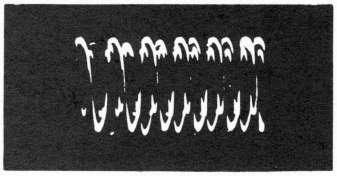
0.5mSec 4.3V
Program transferred from tape

Waveform 40



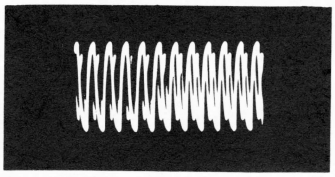
0.5mSec 4.3V
Program transferred from tape

Waveform 41



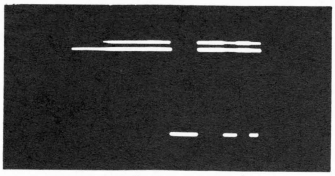
1mSec 1.1V
Program transferred from tape

Waveform 42



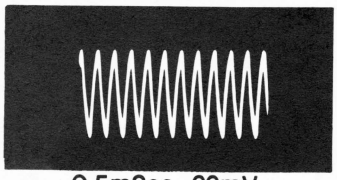
1mSec 5.0V
Amplitude depends on tape volume
Program transferred from tape

Waveform 43



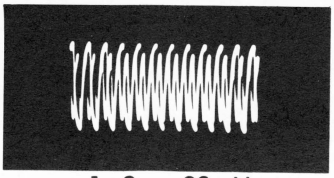
5mSec 4.3V
Program to tape

Waveform 44



0.5mSec 22mV
Tape mode prior to program storage

Waveform 45



1mSec 28mV
Program to tape

WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED

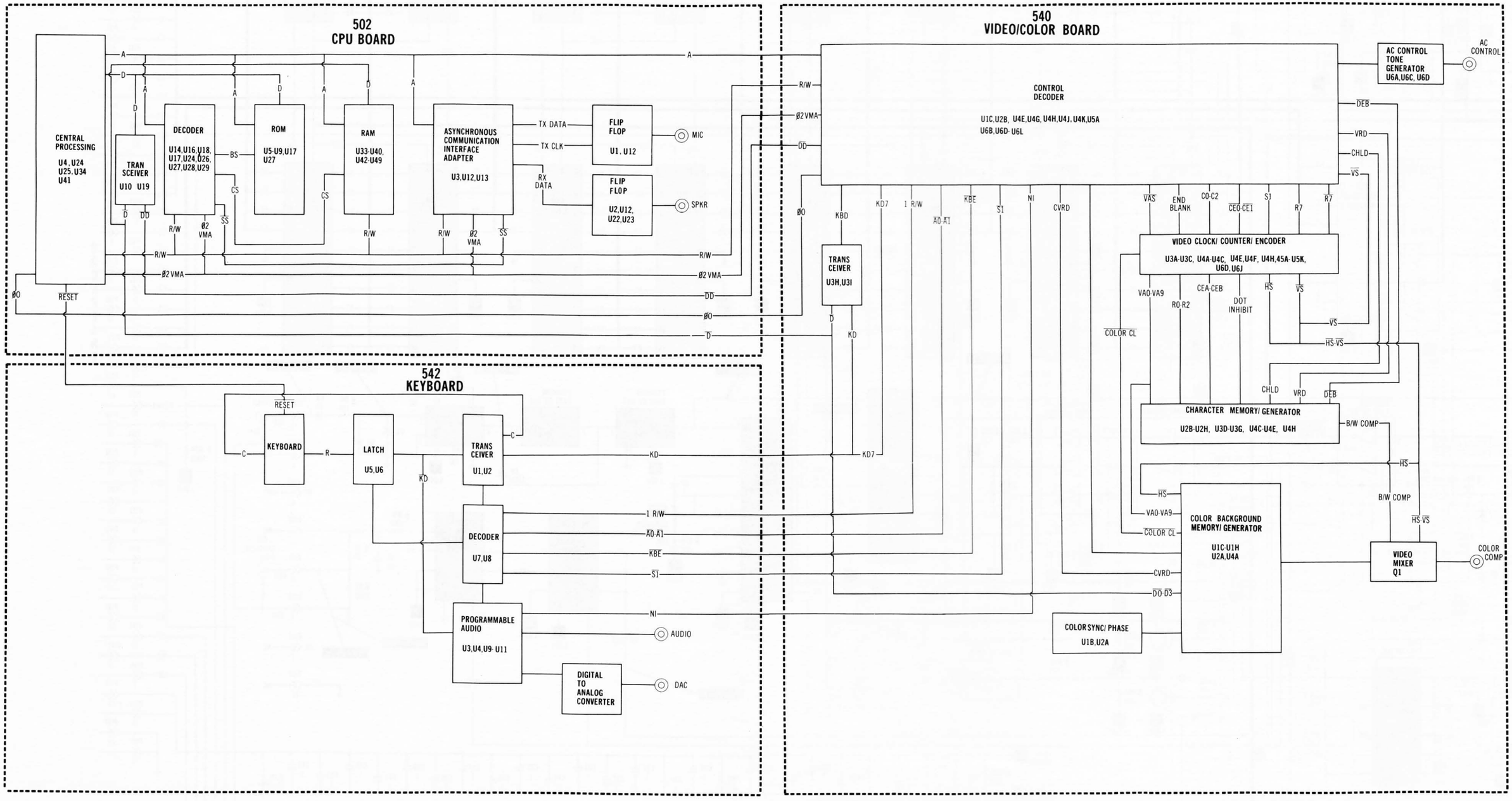
A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE®

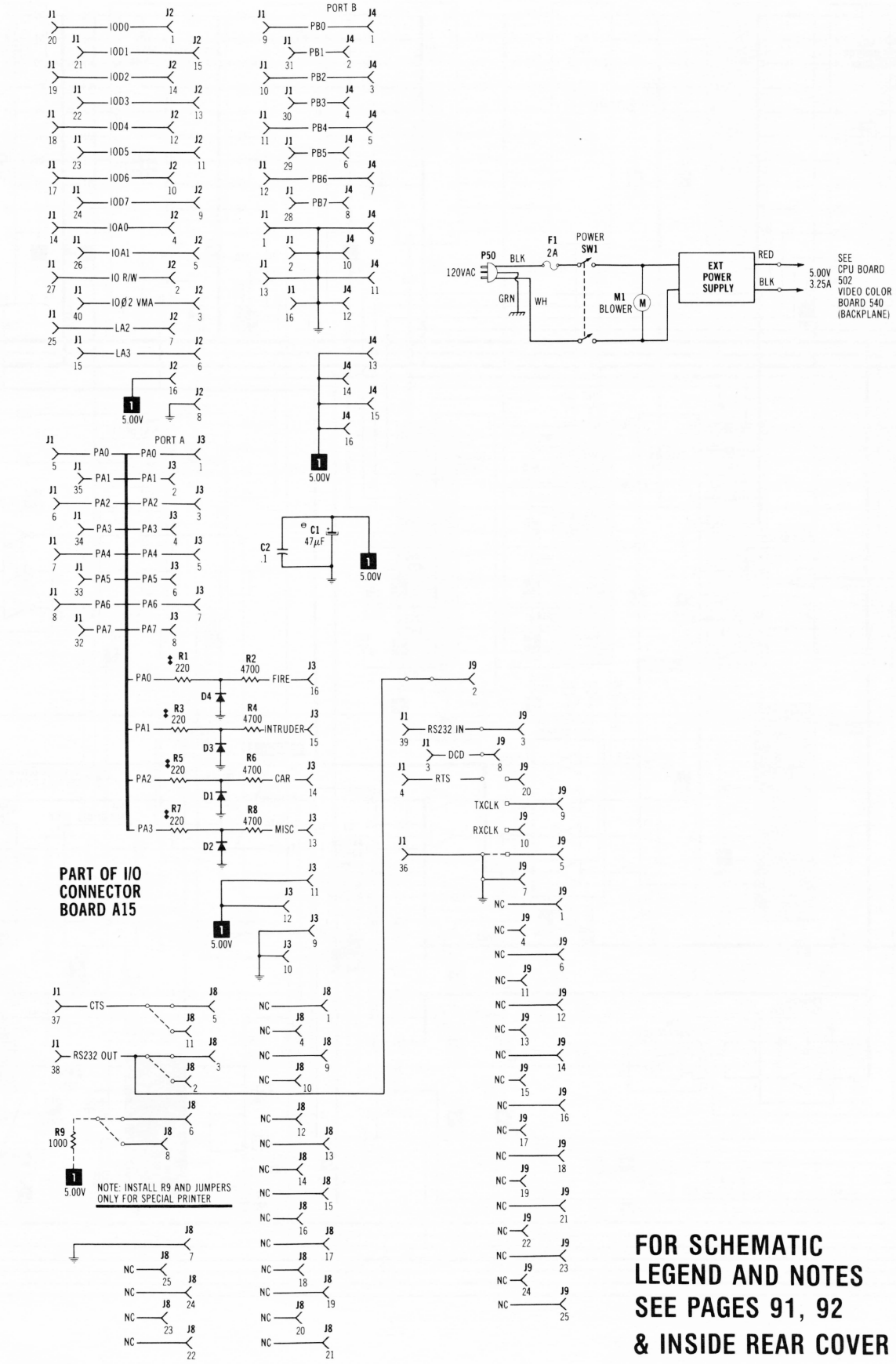
C4P — 502 BOARD

FOR COLOR KEYED TROUBLESHOOTING SEE PAGES 5, 6, 7 & 8.

FOR SCHEMATIC LEGEND AND NOTES SEE PAGES 91, 92 & INSIDE REAR COVER

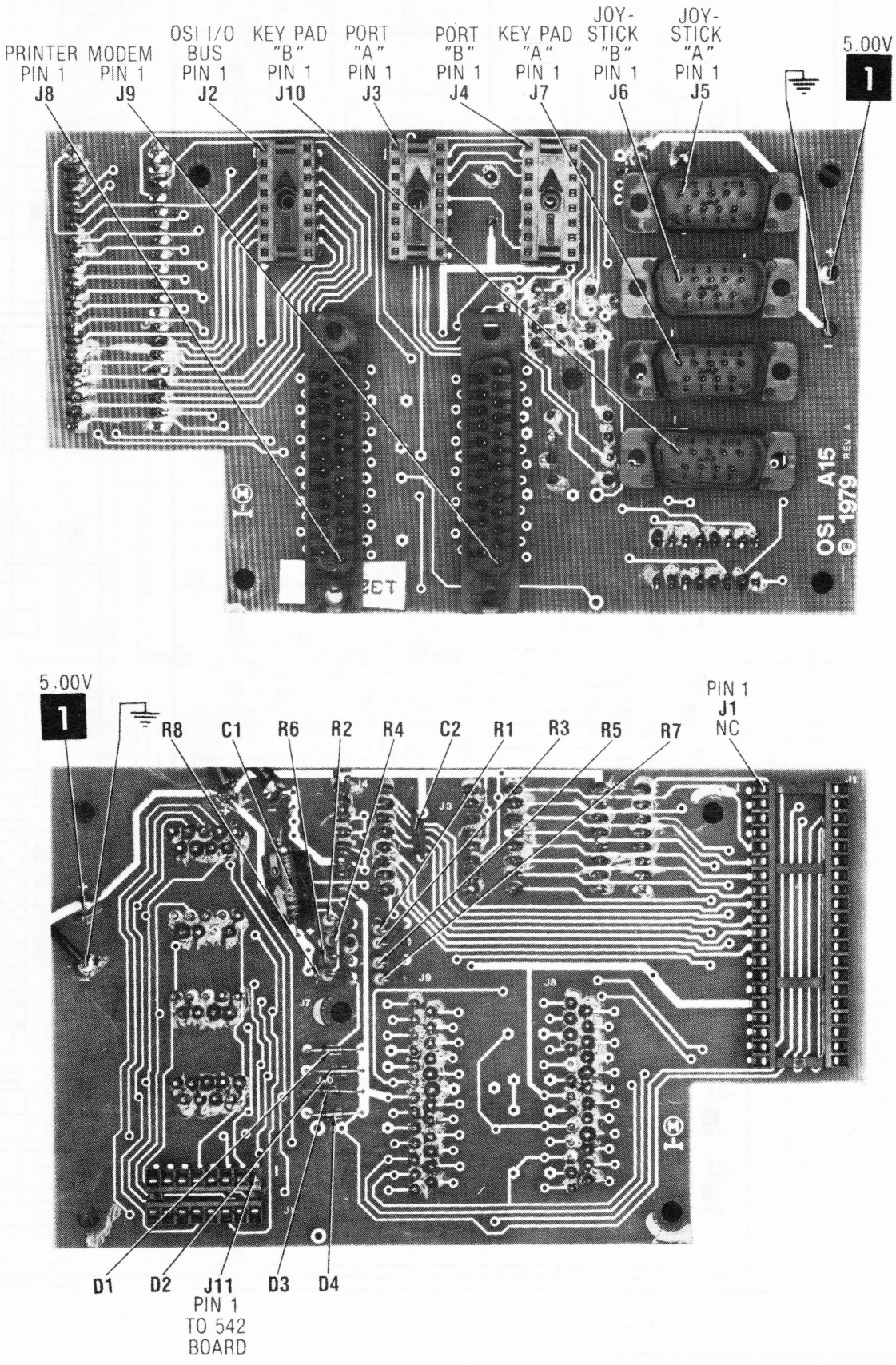
C4P — 502 BOARD


502
CPU BOARD
CENTRAL PROCESSING
U4, U24
U25, U34
U41
TRAN SCEIVER
U10 U19
DECODER
U14,U16,U18,
U17,U24,026,
U27,U28,U29
ROM
U5-U9,U17
U27
RAM
U33-U40,
U42-U49
ASYNCHRONOUS COMMUNICATION INTERFACE ADAPTER
U3,U12,U13
TX DATA
TX CLK
RX DATA
FLIP FLOP
U1, U12
FLIP FLOP
U2,U12,
U22,U23
MIC
SPKR
A
D
R/W
Ø2 VMA
SS
CS
BS
RESET
ØO
DD
540
VIDEO/COLOR BOARD
CONTROL DECODER
U1C,U2B, U4E,U4G, U4H,U4J, U4K,U5A
U6B,U6D- U6L
AC CONTROL TONE GENERATOR U6A,U6C, U6D
AC CONTROL
DEB
VRD
CHLD
VS
TRANS CEIVER
U3H,U3I
KBD
KD
KD7
I R/W
A0-A1
KBE
S1
NI
CVRD
VAS
END BLANK
CO-C2
CE0-CE1
S1
R7
VIDEO CLOCK/ COUNTER/ ENCODER
U3A-U3C, U4A-U4C, U4E,U4F, U4H,45A-U5K,
U6D, U6J
VA0-VA9
R0-R2
CEA-CEB
DOT INHIBIT
HS
VS
COLOR CL
HS-VS
CHARACTER MEMORY/ GENERATOR
U2B-U2H, U3D-U3G, U4C-U4E, U4H
B/W COMP
COLOR BACKGROUND MEMORY/ GENERATOR
U1C-U1H
U2A,U4A
COLOR SYNC/ PHASE
U1B,U2A
DO-D3
VIDEO MIXER
Q1
COLOR COMP
542
KEYBOARD
KEYBOARD
LATCH
U5,U6
TRANS CEIVER
U1,U2
DECODER
U7,U8
PROGRAMMABLE AUDIO
U3,U4,U9- U11
DIGITAL TO ANALOG CONVERTER
AUDIO
DAC
R
C

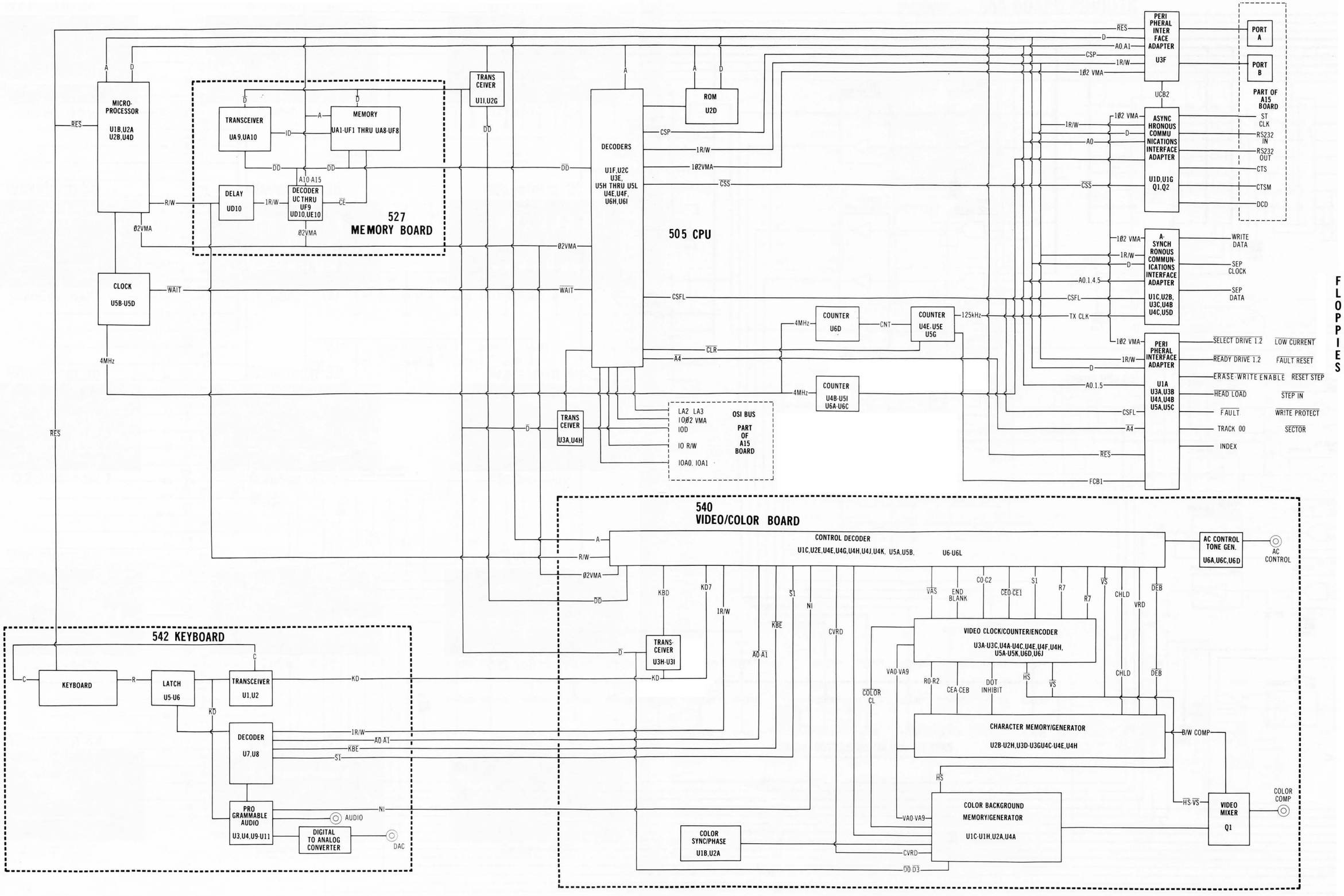


FOR SCHEMATIC LEGEND AND NOTES SEE PAGES 91, 92 & INSIDE REAR COVER

A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE™



C4P — A15 BOARD A Howard W. Sams CIRCUITRACE® Photo



C4PMF — BODY BLOCK DIAGRAM

C4PMF — BODY BLOCK DIAGRAM

C4PMF — 505 BOARD PINOUTS

S6821P

1	GND	CA1	40
2	PA0	CA2	39
3	PA1	$\overline{IRQA}$	38
4	PA2	$\overline{IRQB}$	37
5	PA3	RS0	36
6	PA4	RS1	35
7	PA5	$\overline{RESET}$	34
8	PA6	D0	33
9	PA7	D1	32
10	PB0	D2	31
11	PB1	D3	30
12	PB2	D4	29
13	PB3	D5	28
14	PB4	D6	27
15	PB5	D7	26
16	PB6	ENABLE	25
17	PB7	CS1	24
18	CB1	CS2	23
19	CB2	CS0	22
20	V_{CC}	R/W	21

U1A,U3F

6502A

1	VSS	$\overline{RES}$	40
2	RDY	Ø2 (OUT)	39
3	Ø1 (OUT)	S.O.	38
4	$\overline{IRQ}$	Ø0(IN)	37
5	N.C.	N.C.	36
6	$\overline{NMI}$	N.C.	35
7	SYNC	R/W	34
8	VCC	DB0	33
9	AB0	DB1	32
10	AB1	DB2	31
11	AB2	DB3	30
12	AB3	DB4	29
13	AB4	DB5	28
14	AB5	DB6	27
15	AB6	DB7	26
16	AB7	AB15	25
17	AB8	AB14	24
18	AB9	AB13	23
19	AB10	AB12	22
20	AB11	VSS	21

U1B

56850P

1	GND	$\overline{CTS}$	24
2	RXD	$\overline{DCD}$	23
3	CRX	D0	22
4	CTX	D1	21
5	$\overline{RTS}$	D2	20
6	TXD	D3	19
7	$\overline{IRQ}$	D4	18
8	CS0	D5	17
9	$\overline{CS2}$	D6	16
10	CS1	D7	15
11	RS	E	14
12	V_{CC}	R/W	13

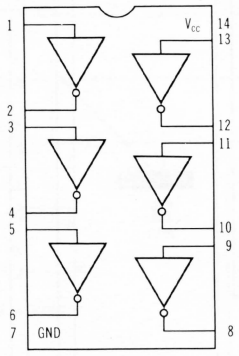
U1C,U1D

F74157

1	S	V_{CC}	16
2	1A	G	15
3	1B	4A	14
4	1Y	4B	13
5	2A	4Y	12
6	2B	3A	11
7	2Y	3B	10
8	GND	3Y	9

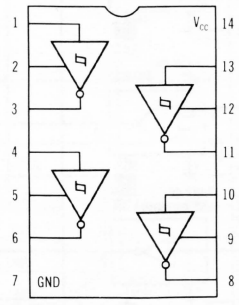
U1E

F5404DM
DM7404N
F-7404PC



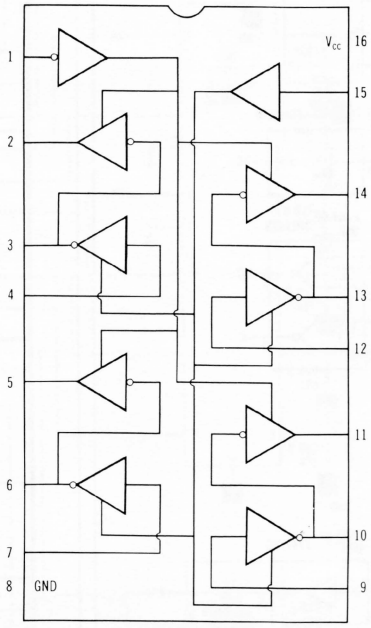
U1F,U4B,U4E,U4F,U5K,U6E

MC1489/SN75189N



U1G

N8T26AN



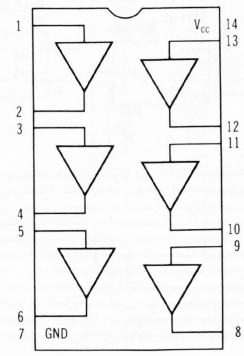
U1I,U2E,U3G,U4H

MC6885P
MC8T95P
N8T95N

1	$\overline{ENABLE\ 1}$	V_{CC}	16
2	INPUT A	$\overline{ENABLE\ 2}$	15
3	OUTPUT A	INPUT F	14
4	INPUT B	OUTPUT F	13
5	OUTPUT B	INPUT E	12
6	INPUT C	OUTPUT E	11
7	OUTPUT C	INPUT D	10
8	GND	OUTPUT D	9

U2A,U3D,U4D

SN7417N
F7417PC



U2B,U3A,U3B,U4A

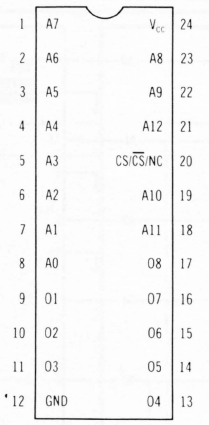
74148N

1	INPUT 4	V_{CC}	16
2	INPUT 5	OUTPUT EO	15
3	INPUT 6	OUTPUT GS	14
4	INPUT 7	INPUT 3	13
5	INPUT E1	INPUT 2	12
6	OUTPUT A2	INPUT 1	11
7	OUTPUT A1	INPUT 0	10
8	GND	A0	9

U2C

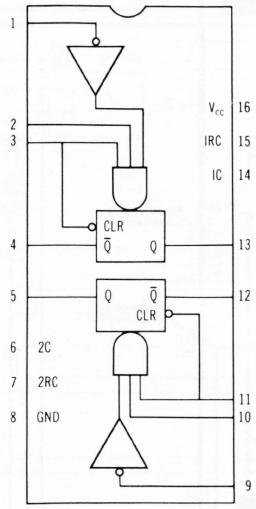
C4PMF — 505 BOARD PINOUTS

2316



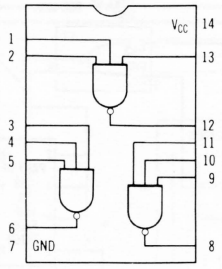
U2D

SN74123N



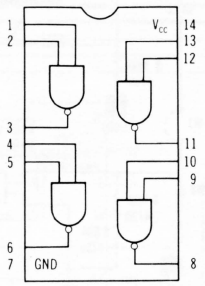
U3C,U4C

SN7410
SN7410J



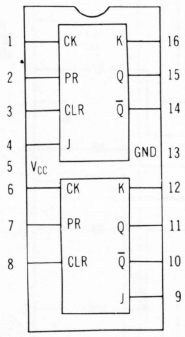
U3E,U5L

SN7400N
DM7400N



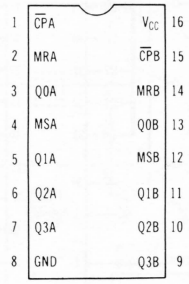
U5A,U5C,U5D,U6H

7476N



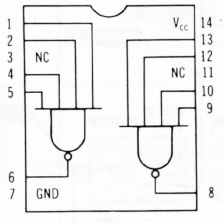
U5B

74LS390PC



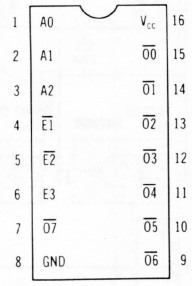
U5E,U5F,U5G

SN7420N



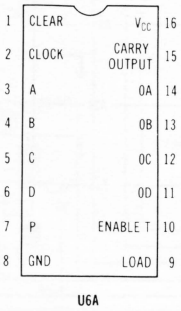
U5H,U5I

SN74LS138N



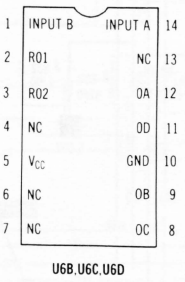
U5J,U6G

F74163PC



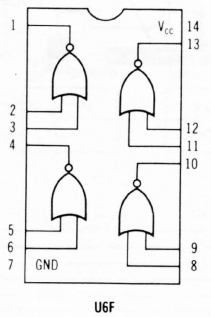
U6A

7493N



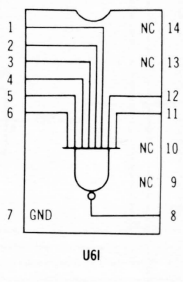
U6B,U6C,U6D

SN7402N



U6F

7430N



U6I

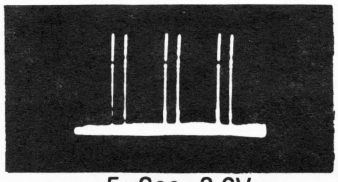
A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE®

FOR COLOR KEYED TROUBLESHOOTING SEE PAGES 9 THRU 13.

FOR SCHEMATIC LEGEND AND NOTES SEE PAGES 91, 92 & INSIDE REAR COVER.

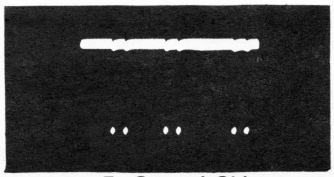
C4PMF — 505 BOARD

Waveform 32



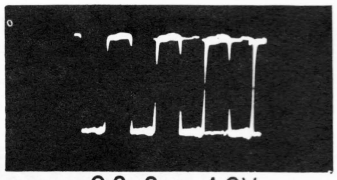
5μSec 3.6V

Waveform 33



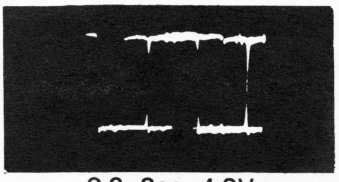
5μSec 4.0V

Waveform 34



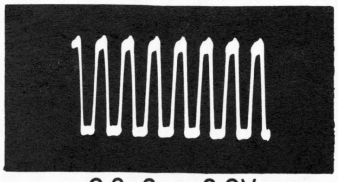
0.2μSec 4.0V

Waveform 35



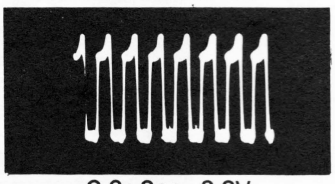
0.2μSec 4.0V

Waveform 36



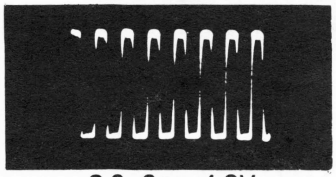
0.2μSec 3.0V

Waveform 37



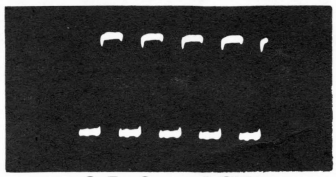
0.2μSec 3.2V

Waveform 38



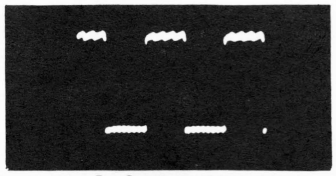
0.2μSec 4.0V

Waveform 39



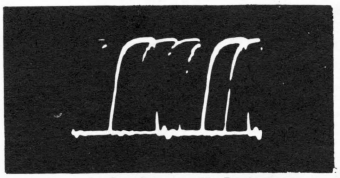
0.5μSec 4.0V

Waveform 40



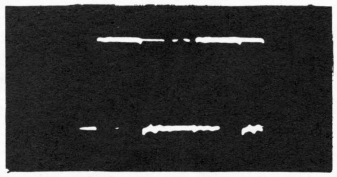
1μSec 4.0V

Waveform 41



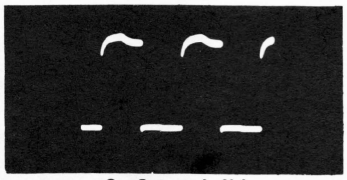
0.2μSec 5.0V

Waveform 42



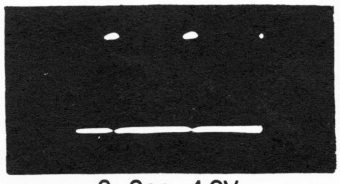
0.2μSec 4.0V

Waveform 43



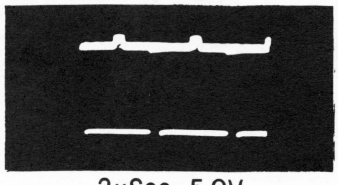
2μSec 4.4V

Waveform 44



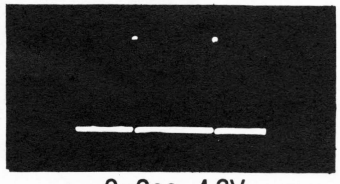
2μSec 4.2V

Waveform 45



2μSec 5.0V

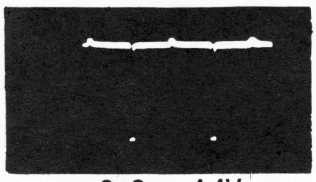
Waveform 46



2μSec 4.2V

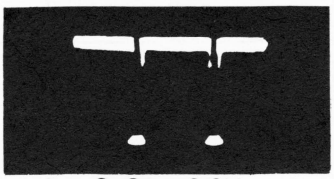
WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED

Waveform 47



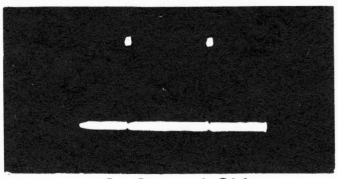
2μSec 4.4V

Waveform 48



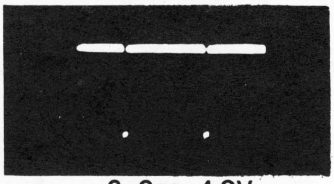
2μSec 3.0V

Waveform 49



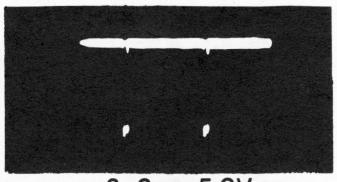
2μSec 4.0V

Waveform 50



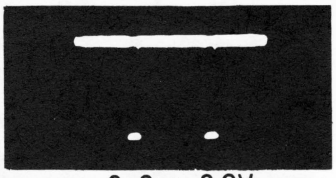
2μSec 4.0V

Waveform 51



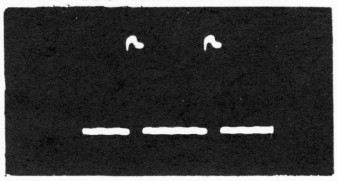
2μSec 5.0V

Waveform 52



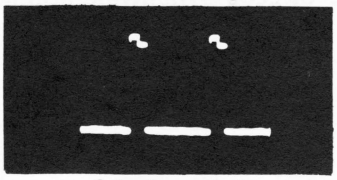
2μSec 3.0V

Waveform 53



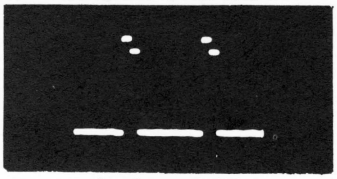
10μSec 4.4V

Waveform 54



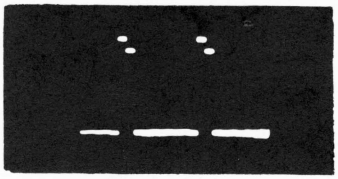
0.1mSec 4.4V

Waveform 55



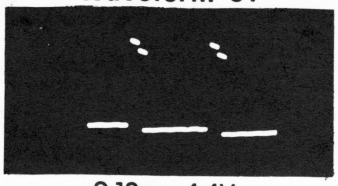
1mSec 4.4V

Waveform 56



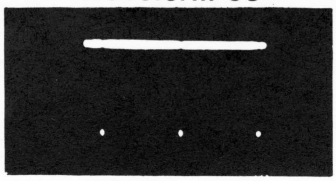
10mSec 4.4V

Waveform 57



0.1Sec 4.4V

Waveform 58



50mSec 3.2V

WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED

505 BOARD FLOPPY INTER FACE

VIC ASYNCHRONOUS COMMUNICATION INTERFACE ADAPTER 6850

PART OF U3C DUAL RETRIGGERABLE MULTIVIBRATOR SN74123N

PART OF U4C DUAL RETRIGGERABLE MULTIVIBRATOR SN74123N

DM7400N PART OF U5D

DM7404N PART OF U4B

F7417PC PART OF U2B

DM7400N PART OF U5C

DM7400N PART OF U5A

SN7417N PART OF U3B

F7417PC PART OF U4B

SN7417N U4A

U1A PERIPHERAL INTERFACE ADAPTER

SN7417N U3A

PART OF U4E

PART OF U5E CLOCK 74LS390PC

PART OF U5F CLOCK 74LS390PC

PART OF U5G CLOCK 74LS390PC

PART OF U5G CLOCK 47LS390PC

5.00V DC POWER SUPPLY

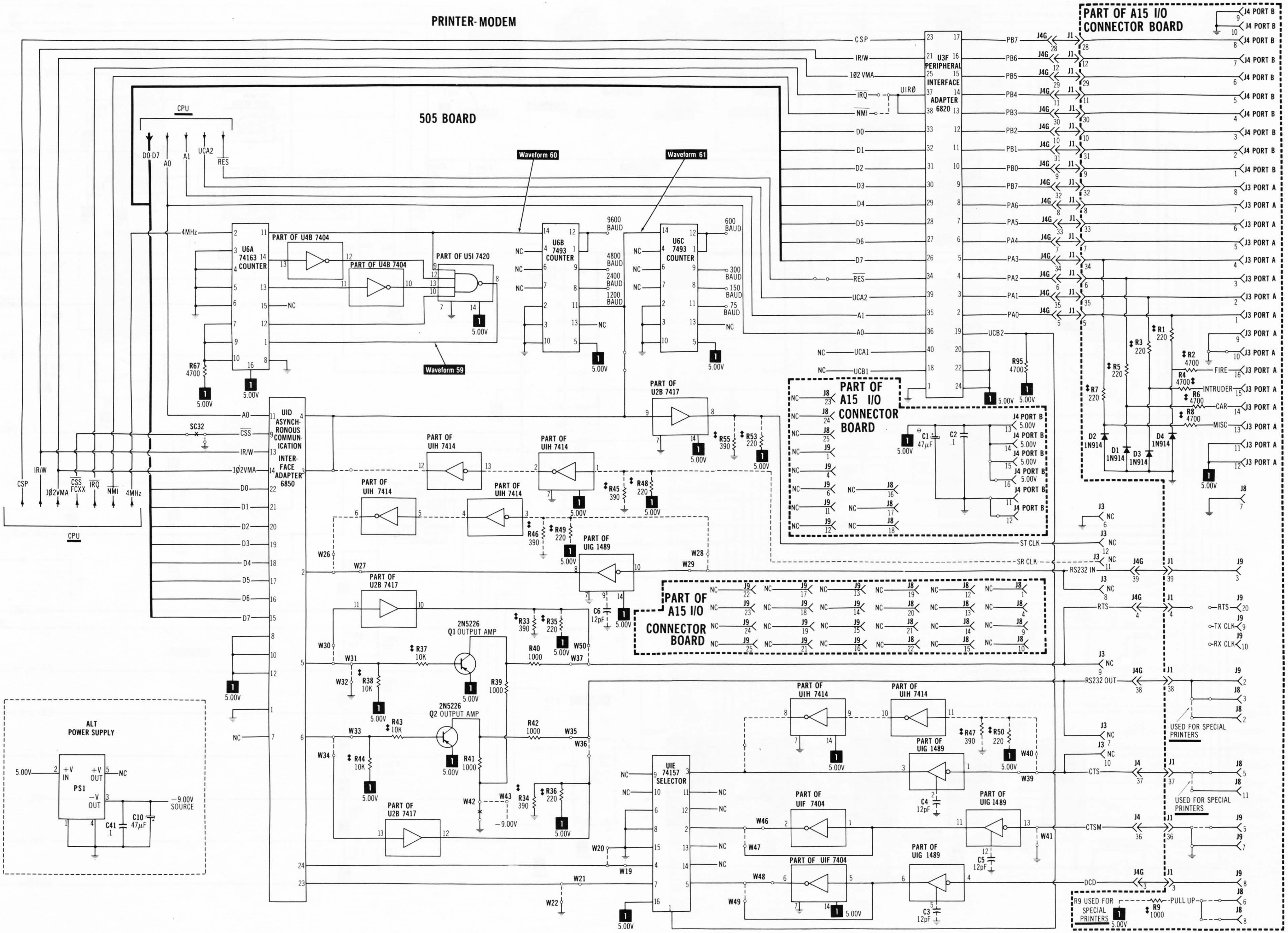
SEE CPU BOARD 505 VIDEO BOARD 540 MEM BOARD 527 BACKPLANE

SEE POWER SUPPLY

NOTE: FOR 8" DISK DIVIDE TIME BY 4

FLOPPIES

PRINTER- MODEM

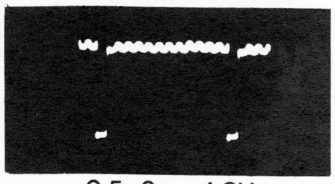


C4PMF — 505 BOARD

FOR SCHEMATIC LEGEND AND NOTES SEE PAGES 91, 92 & INSIDE REAR COVER

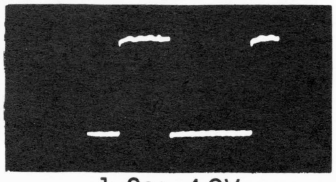
C4PMF — 505 BOARD

Waveform 59



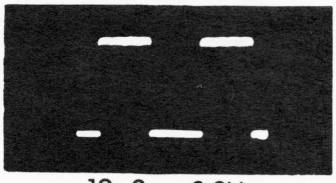
0.5μSec 4.0V

Waveform 60



1μSec 4.0V

Waveform 61



10μSec 3.8V

WAVEFORMS TAKEN IN "BASIC" MODE UNLESS OTHERWISE INDICATED

ELECTRICAL ADJUSTMENTS C4PMF — 505 BOARD

R56 TX CLOCK

Input of scope to U3C, Pin 5. Adjust R56 for a positive pulse width of 400nSec.

R52 TX DATA

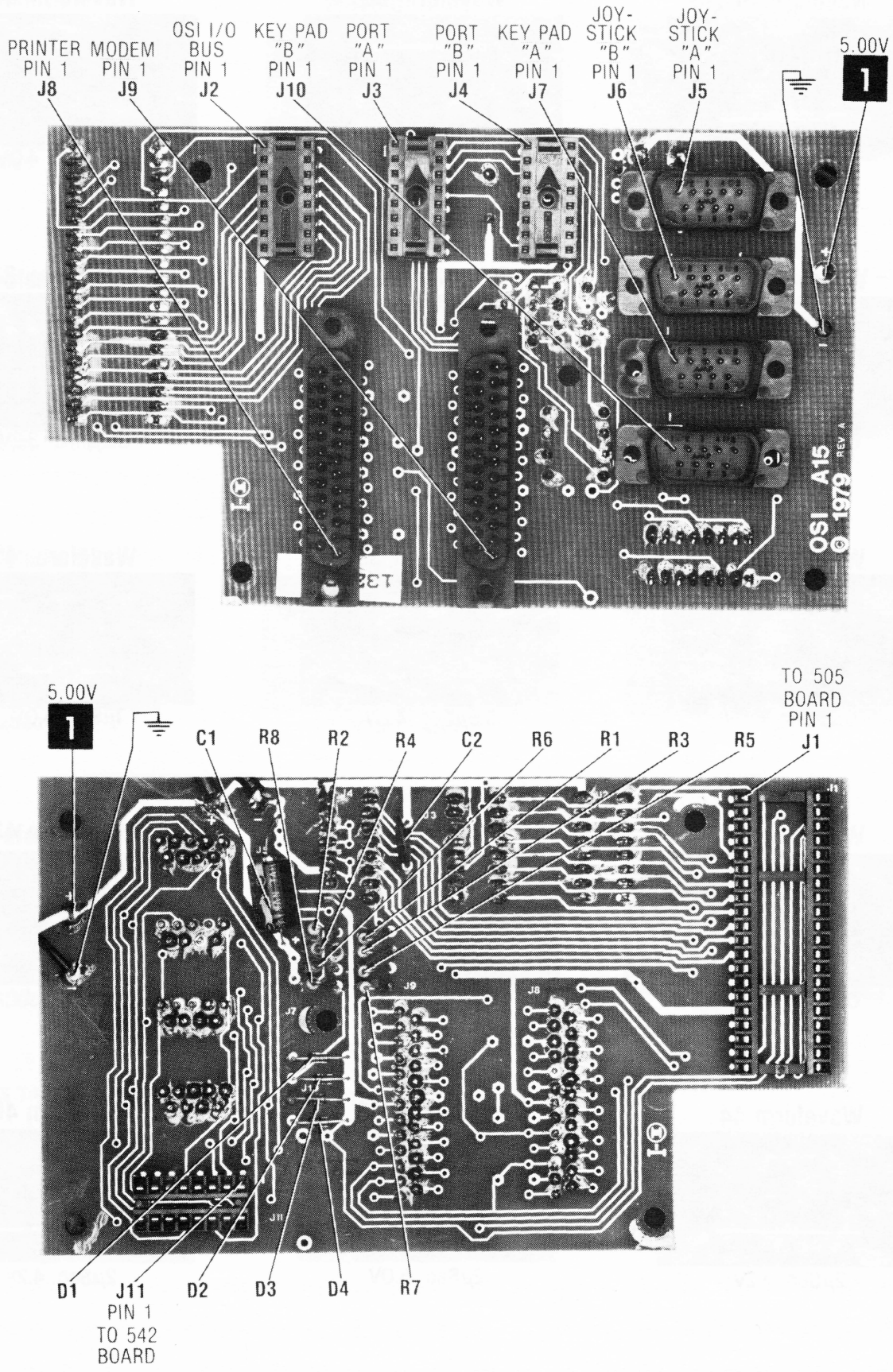
Input of scope to U3C, Pin 4. Adjust R52 for a negative pulse width of 400nSec.

R57 RX CLOCK

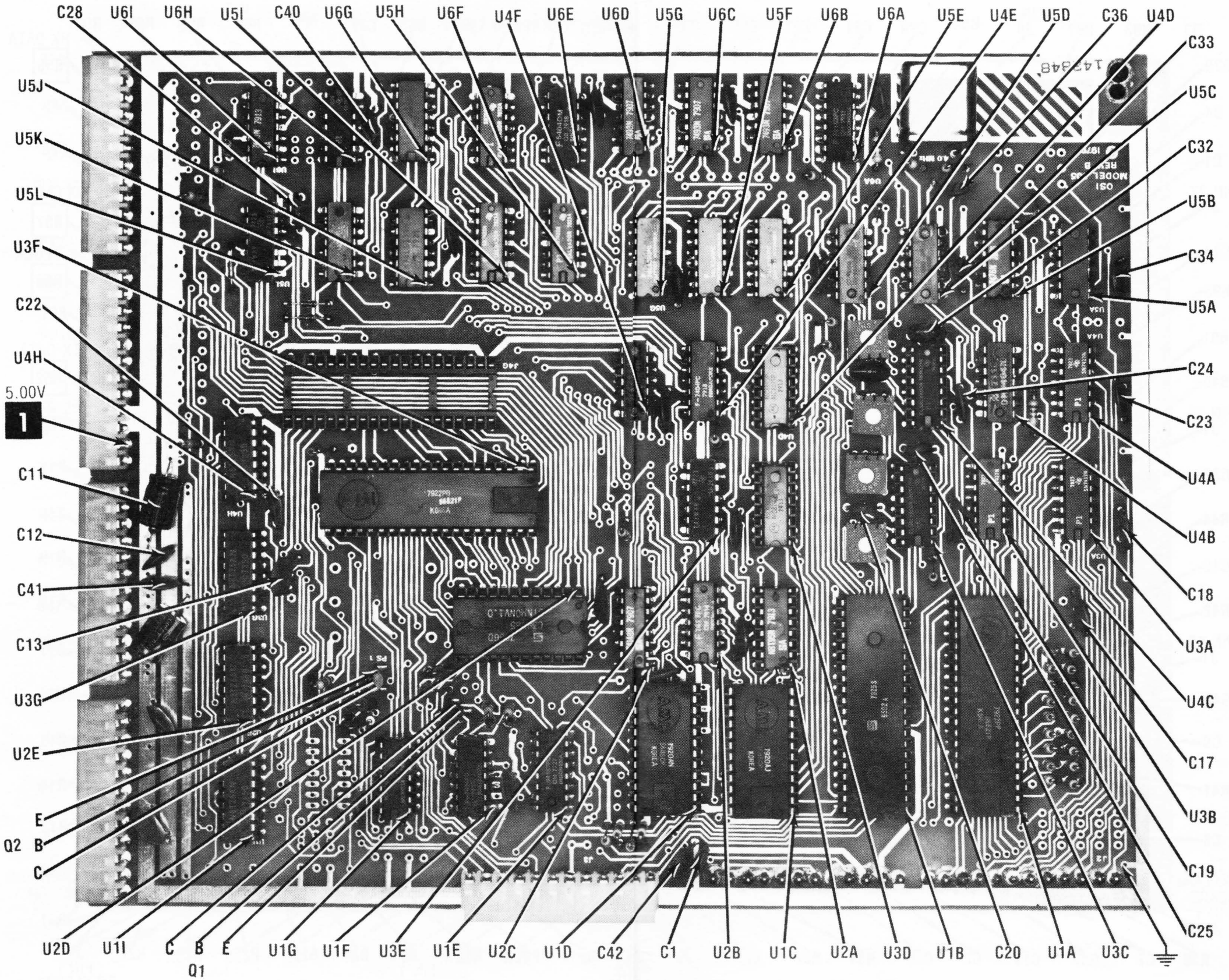
Remove floppy-disk cable (J2). Connect a jumper from Pin 9 of J2 to Pin 10 of J2. Input of scope to U4C, Pin 13. Adjust R57 for a positive pulse width of 1μSec. Remove jumper and reconnect J2.

R58 RX DATA

Remove floppy-disk cable (J2). Connect a jumper from Pin 9 of J2 to Pin 11 of J2. Input of scope to U4C, Pin 12. Adjust R58 for a negative pulse width of 6μSec. Remove jumper and reconnect J2.



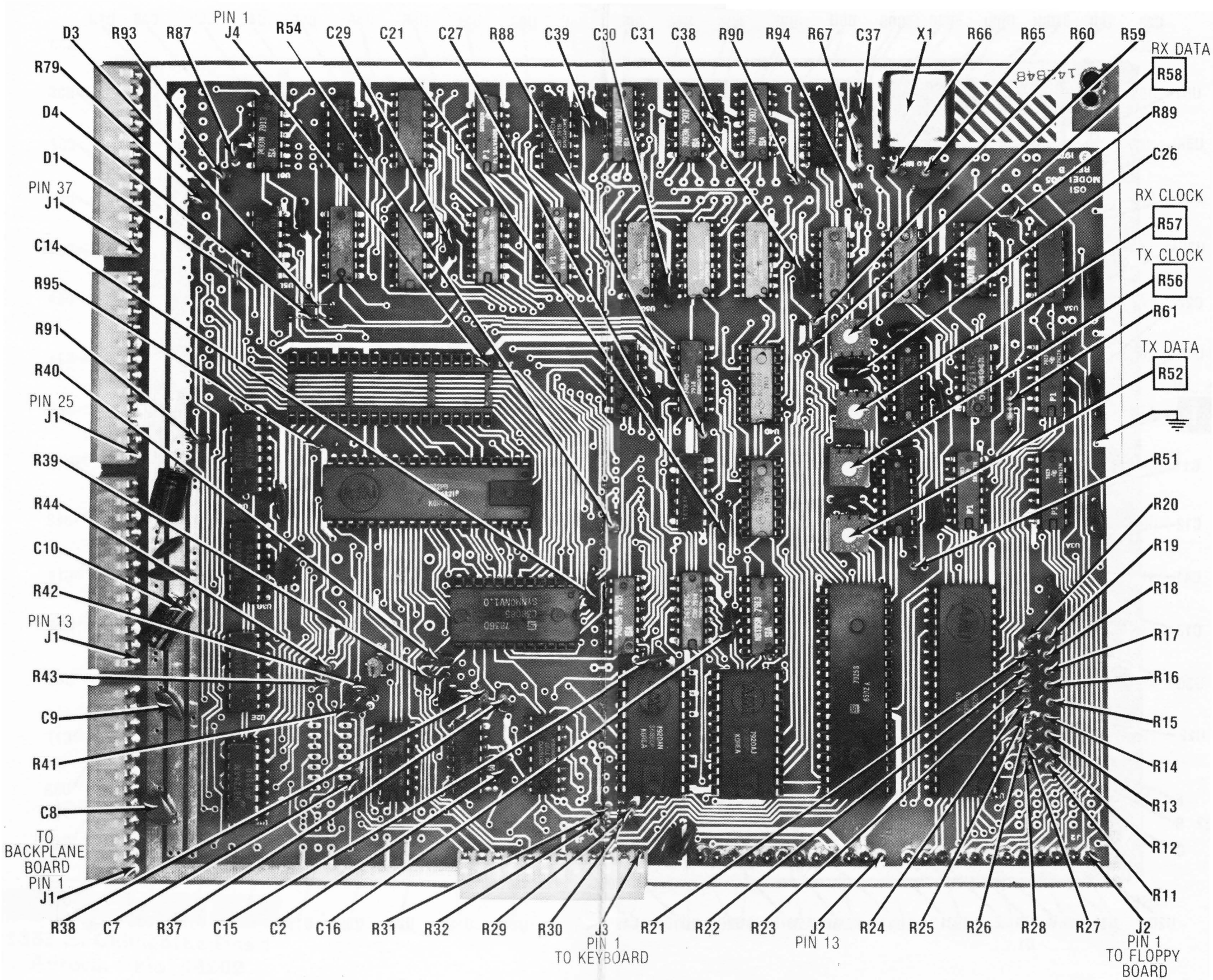
C4PMF — A15 BOARD A Howard W. Sams CIRCUITRACE® Photo



C4PMF — 505 BOARD

A Howard W. Sams CIRCUITRACE® Photo

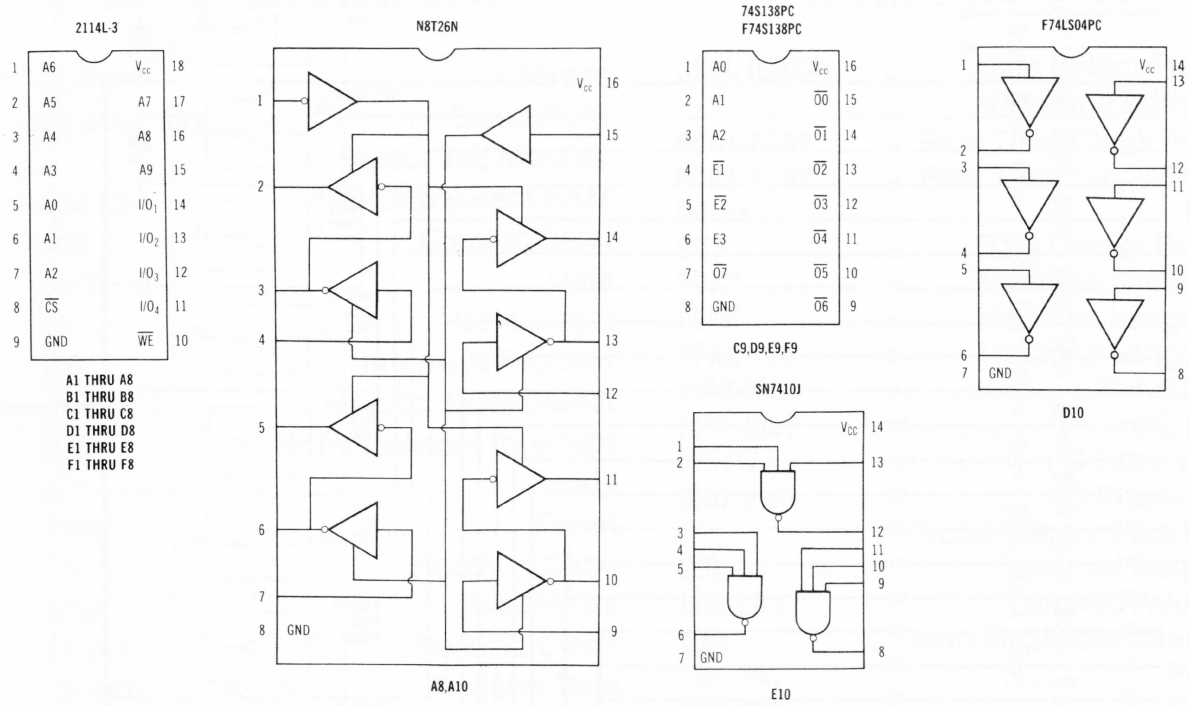
C4PMF — 505 BOARD

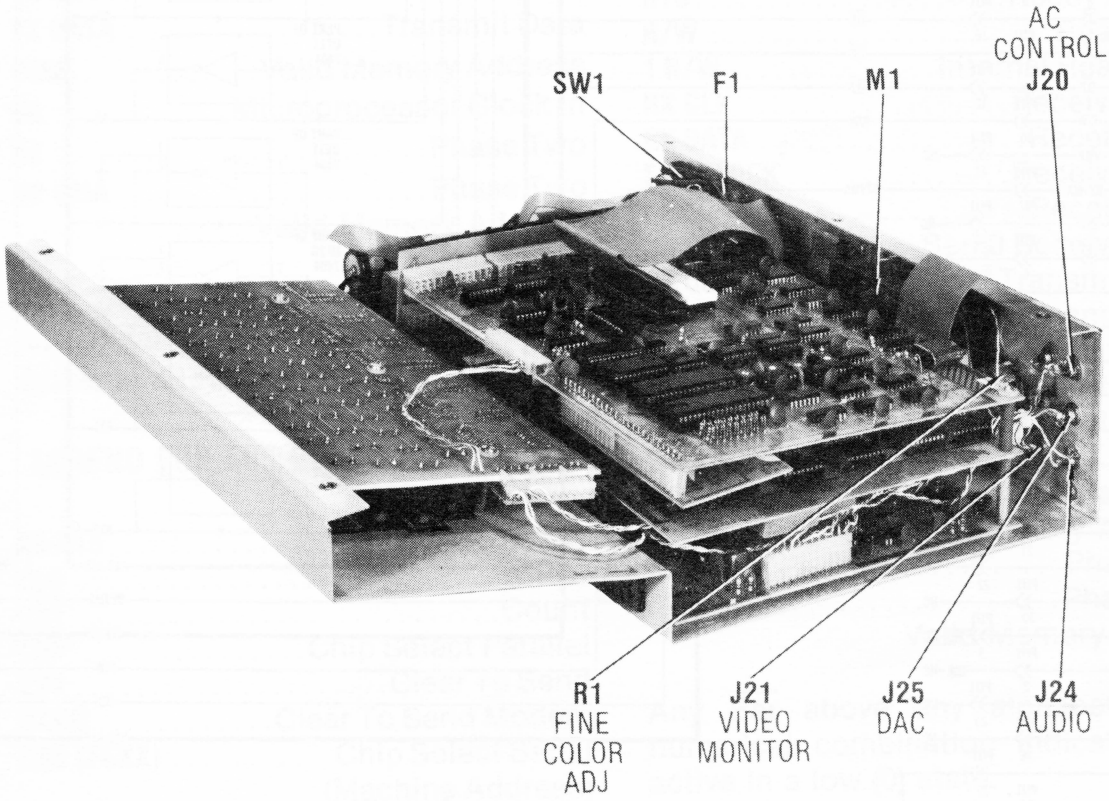


C4PMF — 505 BOARD

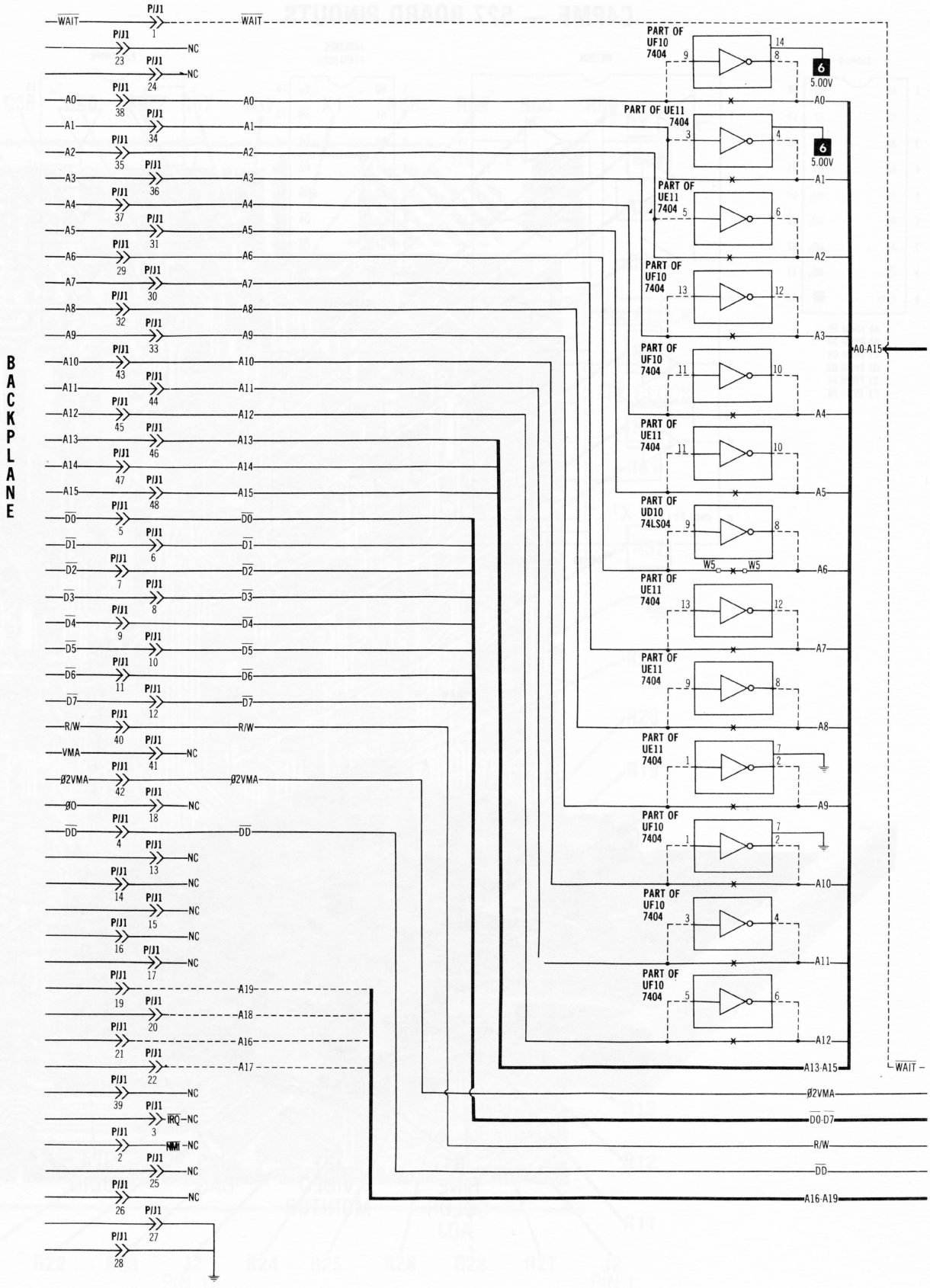
C4PMF — 505 BOARD

C4PMF — 527 BOARD PINOUTS



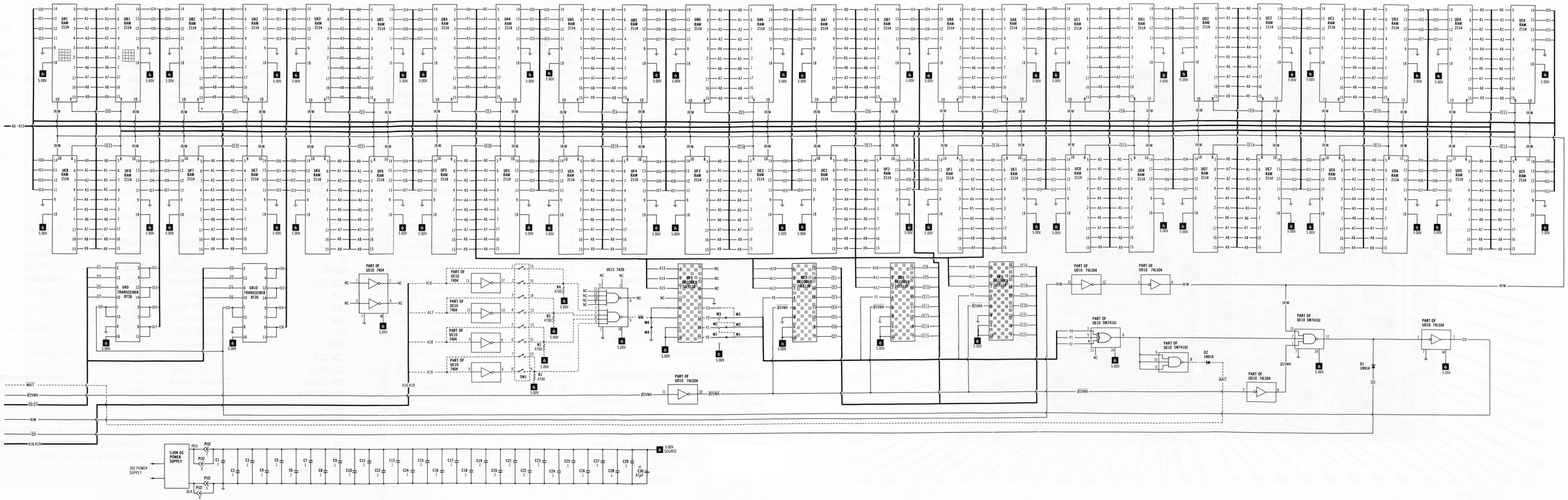


C4PMF — CHASSIS-SIDE VIEW



A PHOTOFACT STANDARD NOTATION SCHEMATIC
WITH CIRCUITRACE®

C4PMF — 527 BOARD



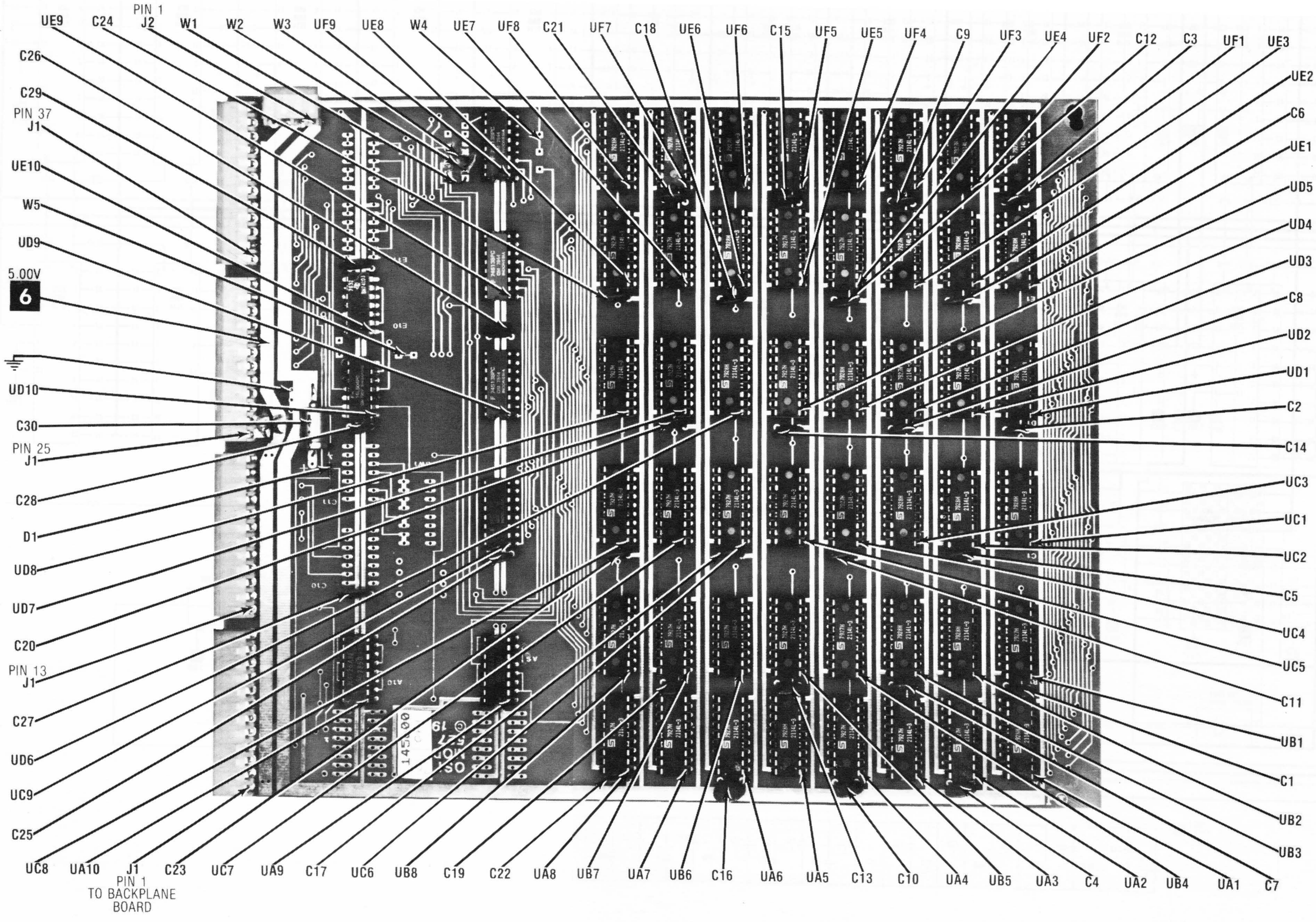
A PHOTOFACT STANDARD NOTATION SCHEMATIC WITH CIRCUITRACE®

C4PMF — 527 BOARD

FOR COLOR KEYED TROUBLESHOOTING SEE PAGES 9 THRU 13

FOR SCHEMATIC LEGEND AND NOTES SEE PAGES 91, 92 & INSIDE REAR COVER

C4PMF — 527 BOARD



C4PMF — 527 BOARD A Howard W. Sams CIRCUITRACE® Photo

C4PMF — 527 BOARD

LEGEND FOR 502 BOARD SCHEMATIC

A0-A15 ..... Address
BS,BS0-BS3 ..... Basic ROM Select and Monitor
CS0-CS7 ..... Chip Select RAM
CTS ..... Clear to Send
D0-D7 ..... Data
DD ..... Data Direct
IRQ ..... Interrupt Request
MS0-MS2 ..... Monitor ROM Select
NMI ..... Non-maskable Interrupt
RDY ..... Ready
RESET ..... Reset
RTS ..... Ready to Send
R/W ..... Read/Write
RX CLK ..... Receive Clock
RX DATA ..... Receive Data
SS ..... Sound Select
TX CLK ..... Transmit Clock
TX DATA ..... Transmit Data
VMA ..... Valid Memory Address
Ø0 ..... Microprocessor Clock In
Ø2 ..... Phase Two
Ø2 VMA ..... Phase Two Valid Memory Address

Any $\overline{\text{Bar}}$ above any alphabetical or numerical combination indicates line active in a low (0) state.

LEGEND FOR 505 BOARD SCHEMATIC

A0-A15 ..... Address
CLR ..... Clear
CNT ..... Count
CSP ..... Chip Select Parallel
CTS ..... Clear To Send
CTSM ..... Clear To Send Modem
CSS (FCXX) ..... Chip Select Serial (Machine Address)

505 BOARD (CONTINUED)

CSFL (COXX) ..... Chip Select Floppy (Machine Address)
FCA1-FCA2 ..... Real Time Clock Port A
FCB1-FCB2 ..... Real Time Clock Port B
D0-D7 ..... Data
DCD ..... Data Carrier Detect
FDXX ..... Machine Language
FEXX ..... Machine Language
FFXX ..... Machine Language
IOA0-IOA1 ..... I/O Address
IOD1-IOD7 ..... I/O Data
IOR/W ..... I/O Read Write
IOØ2 VMA ..... IO Phase Two Valid Memory Address
IRQ ..... Interrupt Request
LA2-LA3 ..... Latched Address
NMI ..... Non-Maskable Interrupt
PA0-PA7 ..... Port A
PB0-PB7 ..... Port B
RES ..... Reset
RTS ..... Ready to Send
R/W ..... Read/Write
1 R/W ..... Internal Read/Write
RX CLK ..... Receive Clock
RX DATA ..... Receive Data
SEP CLOCK ..... Receive Clock
SEP DATA ..... Receive Data
SR CLK ..... Serial Receive Clock
ST CLK ..... Serial Transmit Clock
TX CLK ..... Transmit Clock
TX DATA ..... Transmit Data
UCA2 ..... User Control Bits Port A
UCB2 ..... User Control Bits Port B
WAIT ..... Wait
1 Ø2 VMA ..... Internal Phase Two Valid Memory Address
Ø2 ..... Phase Two
Ø2 VMA ..... Phase Two Valid Memory Addres

Any $\overline{\text{Bar}}$ above any alphabetical or numerical combination indicates line active in a low (0) state.

LEGEND FOR 527 BOARD SCHEMATIC

A0-A19 ..... Address
CE0-CE23 ..... Chip Enable RAM
DD ..... Data Direct
D0-D7 ..... Data
IR/W ..... Internal Read/Write
MM ..... Memory Management
R/W ..... Read/Write
VMA ..... Video Monitor Address
WAIT ..... Wait
Y0-Y1-Y2 ..... Upper Memory Decode
Ø0 ..... Phase 0
Ø2 VMA ..... Phase Two
Valid Memory Address

Any $\overline{\text{Bar}}$ above any alphabetical or numerical combination indicates line active in a low (0) state.

LEGEND FOR 540 BOARD SCHEMATIC

A0-A15 ..... Address
B ..... Blue
C0-C9 ..... Count
CD0-CD6 ..... Color Data(Phase)
CEA ..... Chip Enable
CEB ..... Chip Enable
CE0 ..... Chip Enable
CE1 ..... Chip Enable
CHLD ..... Column Load
COL CLR ..... Column Clear
COLOR CL ..... Color Clear
COL CLOCK ..... Column Clock
COLOR FREQ ..... Color Frequency
CVRD ..... Color Video Read Direction
CWE ..... Color Write Enable
D0-D7 ..... Data
DD ..... Data Direct
DEB ..... Delayed End Blank
DOT INHIBIT ..... Dot Inhibit

540 BOARD (CONTINUED)

DOT SHAPE ..... Dot Shape
END BLANK ..... End Blank
G ..... Green
HS ..... Horiz Sync
ID0-ID3 ..... Internal Data
KBD ..... Keyboard Direction
KBE ..... Keyboard Enable
KD0-KD7 ..... Keyboard Data
NI ..... Noise Interval
R ..... Red
R0-R7 ..... Read
R/W ..... Read/Write
SE ..... Select Enable
S1 ..... Sync
S4-S7 ..... Sync
T3 ..... Time
VA0-VA9 ..... Video Address
VAS ..... Video Address Select
VD0-VD7 ..... Video Data
VCEA ..... Video Chip Enable
VCEB ..... Video Chip Enable
VMA ..... Video Monitor Address
VRD ..... Video RAM Direction
VS ..... Vert Sync
WE ..... Write Enable
1R/W ..... Internal Read/Write
32 ..... 32 Character
Ø0 ..... Microprocessor Clock In
Ø2 VMA ..... Phase Two
Valid Memory Address
Ø2 ..... Phase Two

Any $\overline{\text{Bar}}$ above any alphabetical or numerical combination indicates line active in a low (0) state.

LEGEND FOR 542 BOARD SCHEMATIC

A0,A1 ..... Address
C0-C7 ..... Column
KBE ..... Keyboard Enable
KD0-KD7 ..... Keyboard Data
NI ..... Noise Inhibit
NOISE 1 ..... Noise
NOISE 2 ..... Noise
RESET ..... Reset
R0-R7 ..... Row
S0-S7 ..... Sound
1R/W ..... Internal Read/Write

Any $\overline{\text{Bar}}$ above any alphabetical or numerical combination indicates line active in a low (0) state.

SCHEMATIC NOTES

—✕— Circuitry not used in some versions.
– – – Circuitry used in some versions.
※ Nominal value
⏚ Ground
Chassis
Flame retardant resistor
⊖ See parts list

Item numbers in rectangles appear in the alignment/adjustment instructions.
Supply voltage maintained as shown in input.
Voltages measured with digital meter.
Terminal identification may not be found on unit.
Resistors are ¼W or less, 5% unless noted.
Value in ( ) used in some versions.

OHIO SCIENTIFIC
1333 S. Chillicothe Road
Aurora, Ohio 44202

$15.95

TM-200