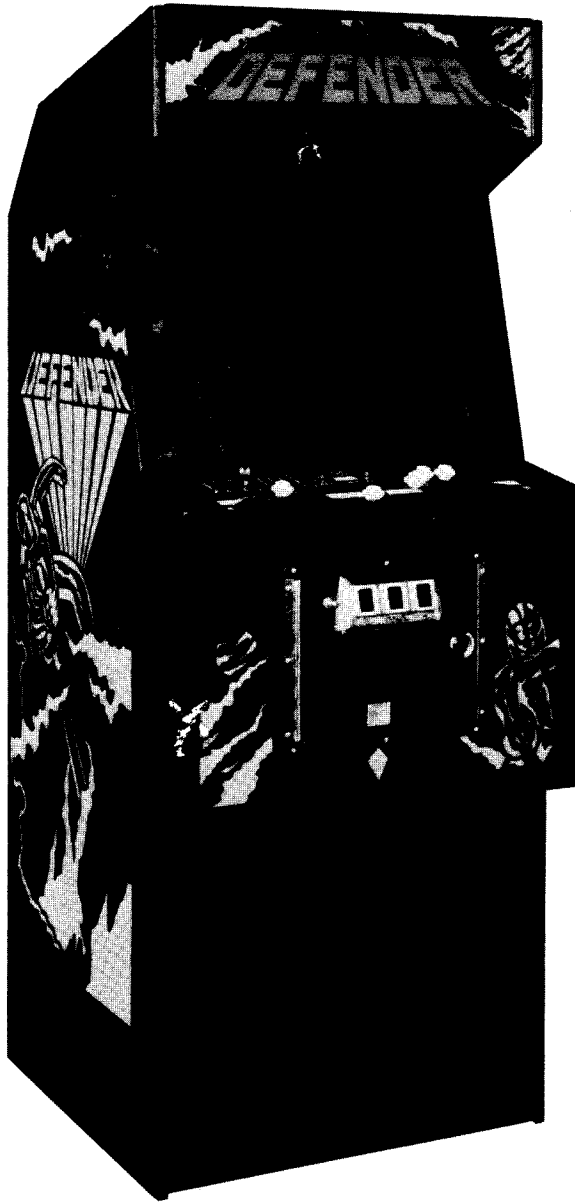


*Williams*<sup>®</sup>

16P-3001-101 R-T  
April, 1981

# DEFENDER



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**ELECTRONICS, INC.**

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SPECIAL NOTES

CPU/Video Board

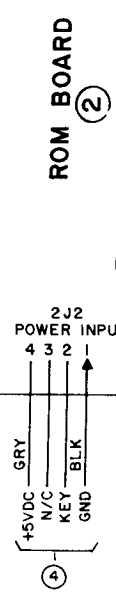
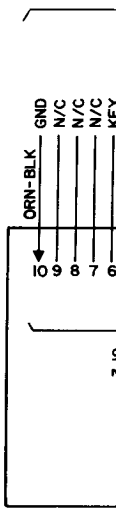
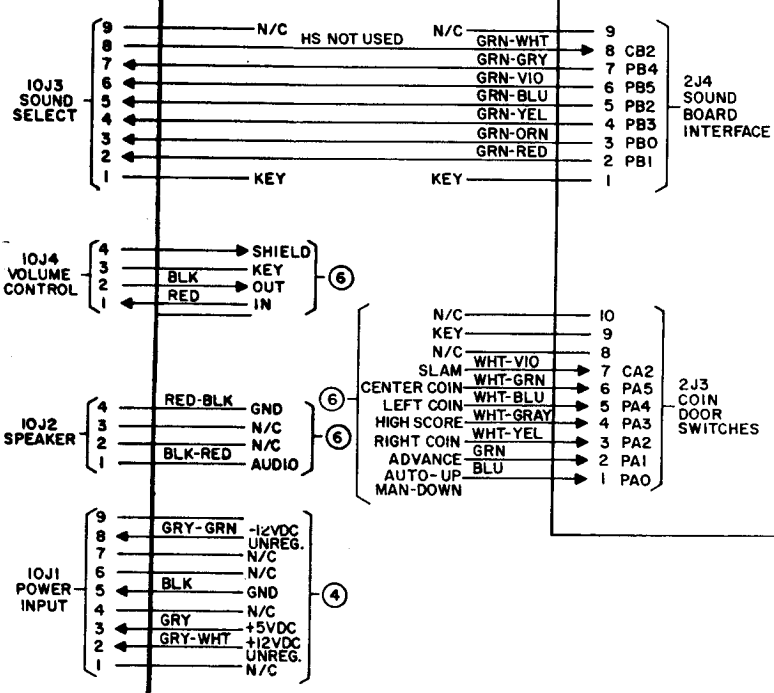
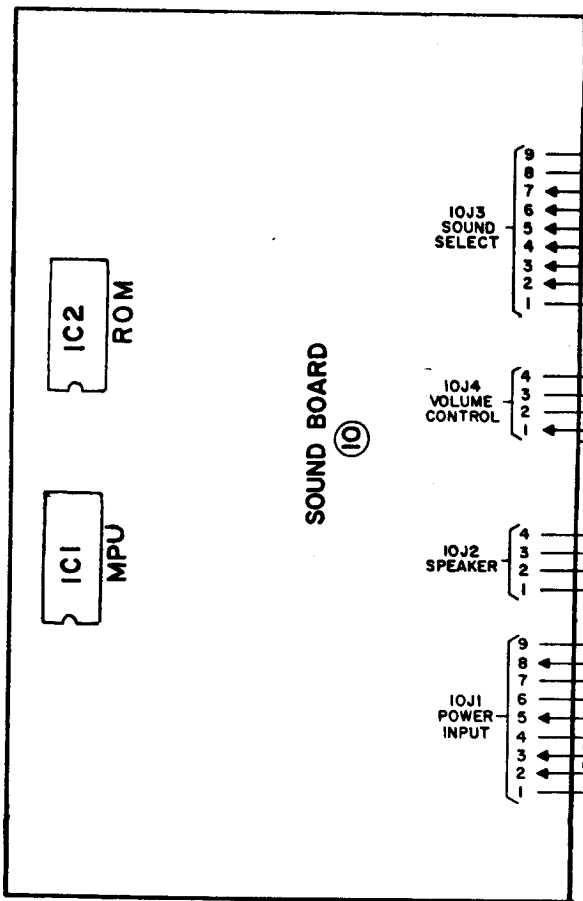
Requires Decoder ROM 2 at location 3K and Decoder ROM 3 at location 3E.

Interface Board

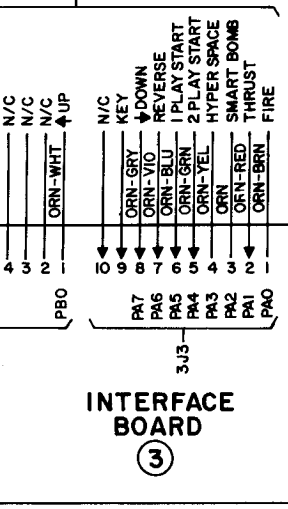
Jumper W1 must be installed. If red-labeled ROMS are not used, W2 must be removed.

CONTENTS

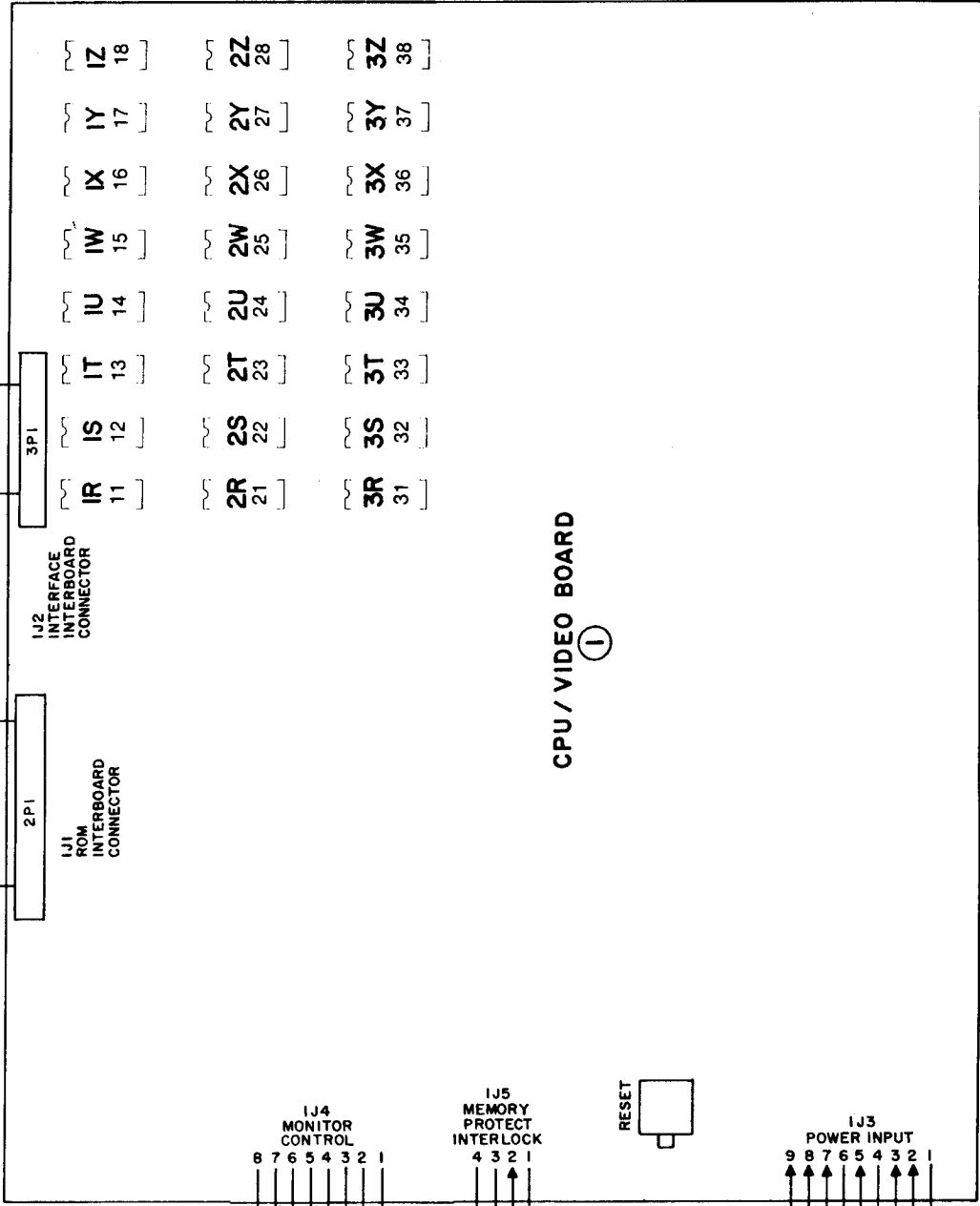
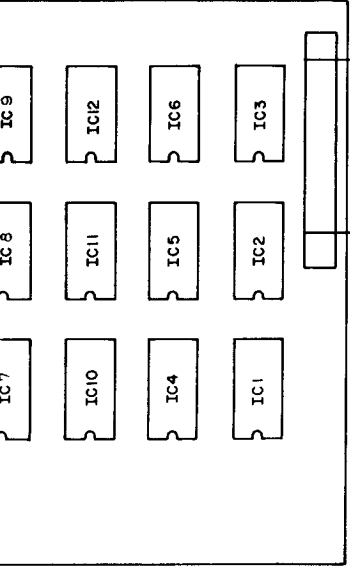
Interboard Wiring Diagram . . . . .	3
R8570 CPU/Video Board Assembly Drawing . . . . .	4
R8570 CPU/Video Board Logic Diagram (1 of 2) . . . . .	5
R8570 CPU/Video Board Logic Diagram (2 of 2) . . . . .	6
C8573 Interface Board Assembly and Logic Diagram . . . . .	7
D8572 ROM Board Assembly Drawing . . . . .	8
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D8121 Sound Board Assembly Drawing . . . . .	14
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7  
PLAYER PANEL

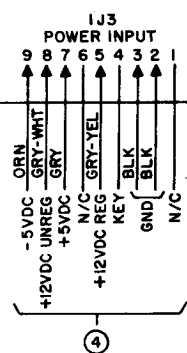
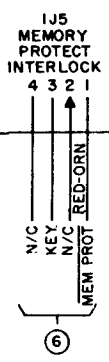
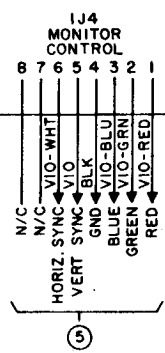


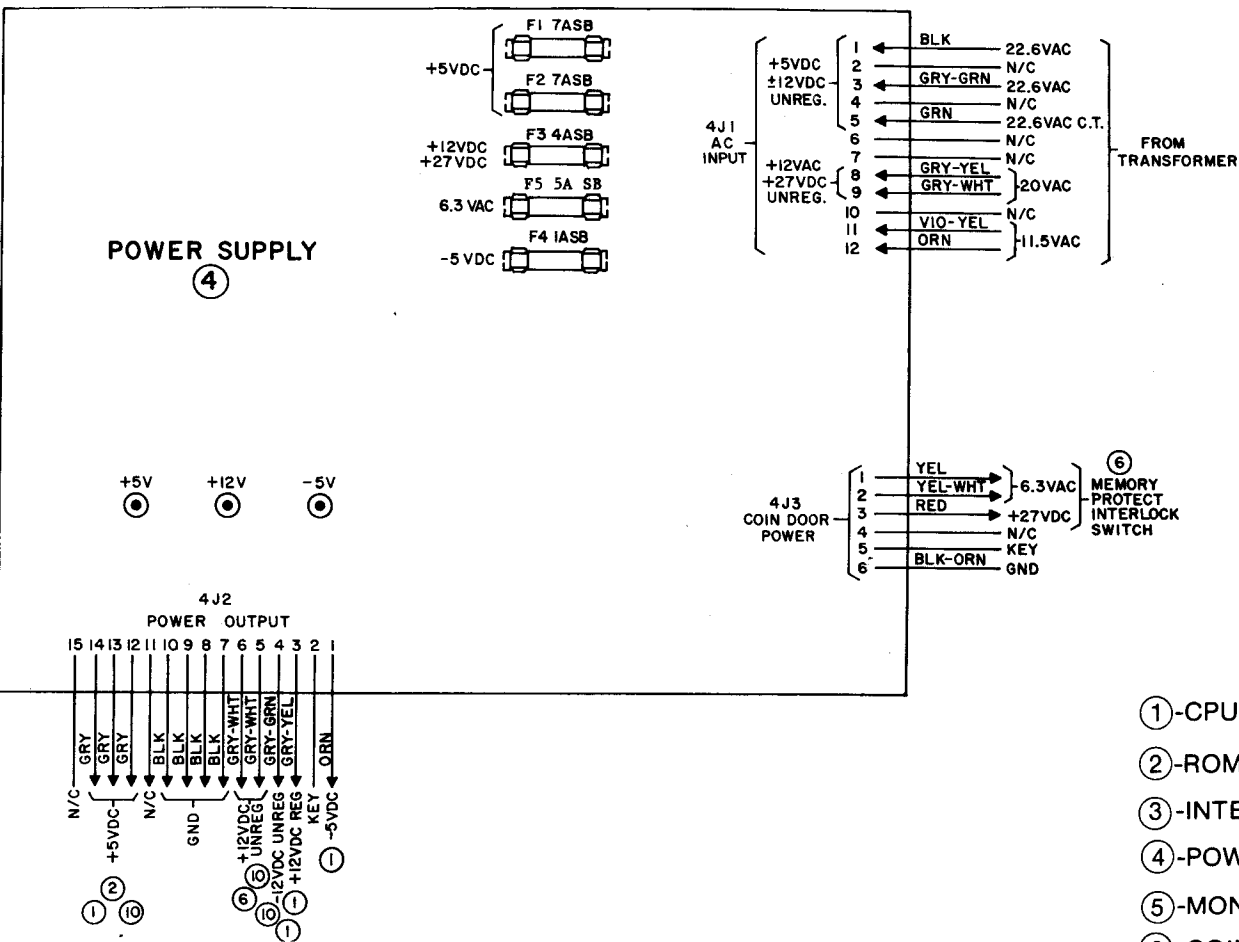
3  
INTERFACE BOARD



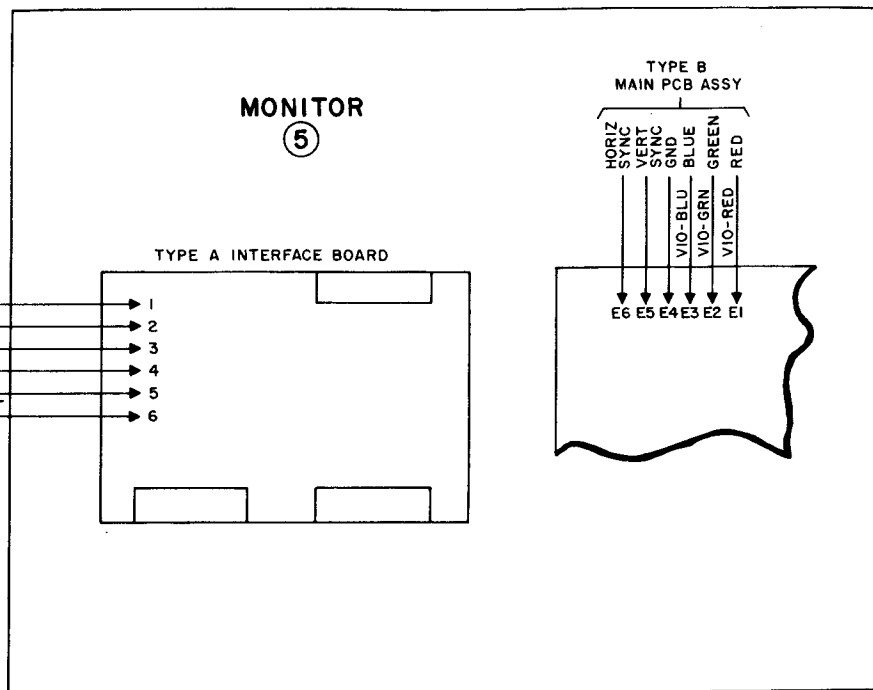
1  
CPU / VIDEO BOARD

SIDE PANEL

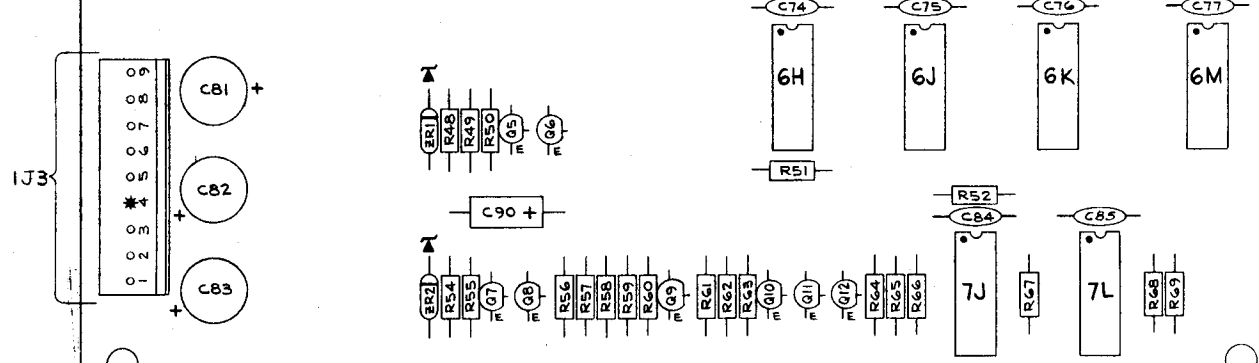
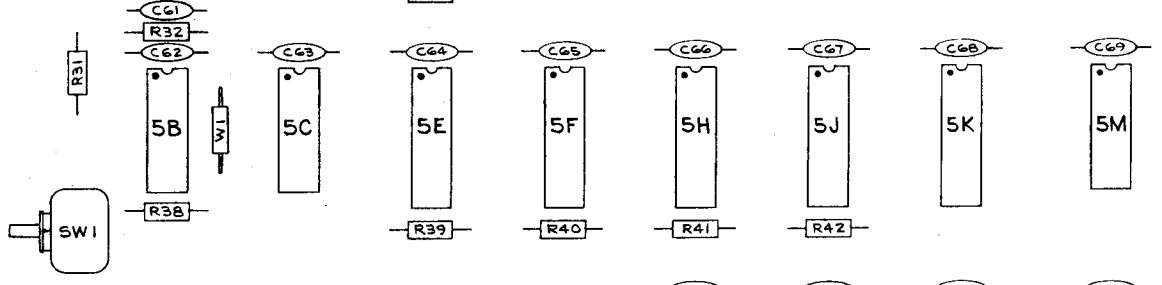
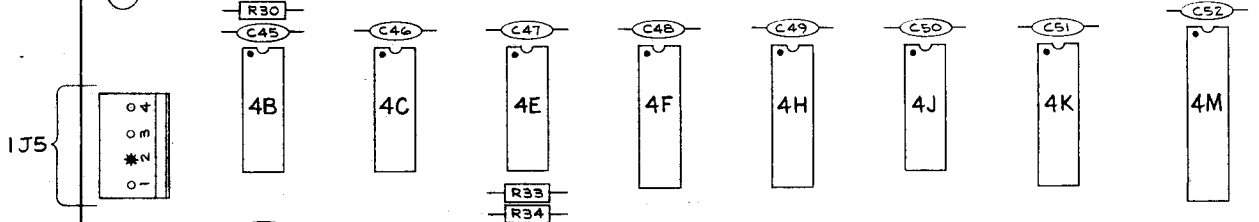
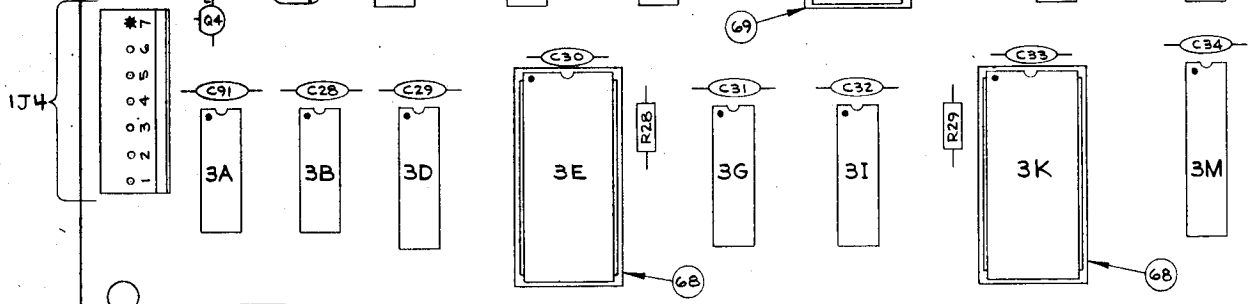
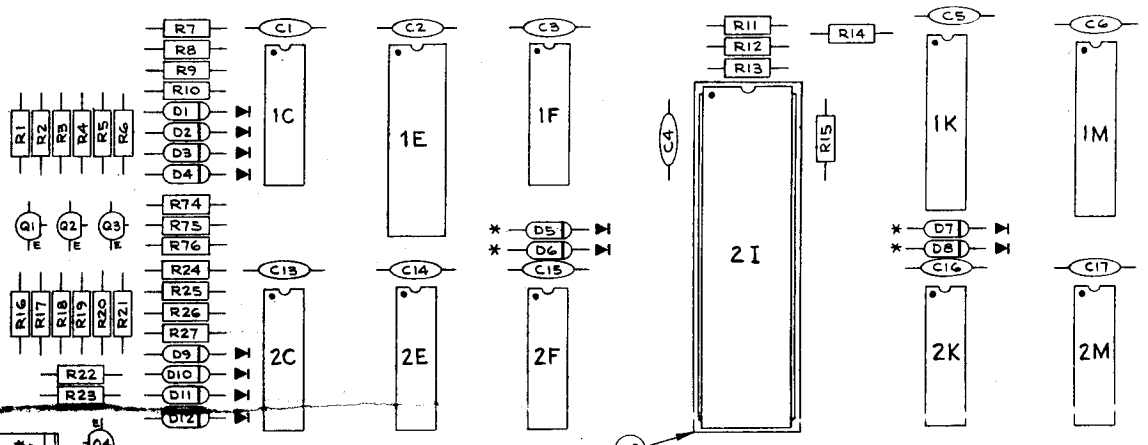
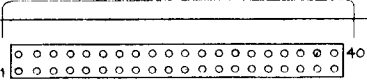


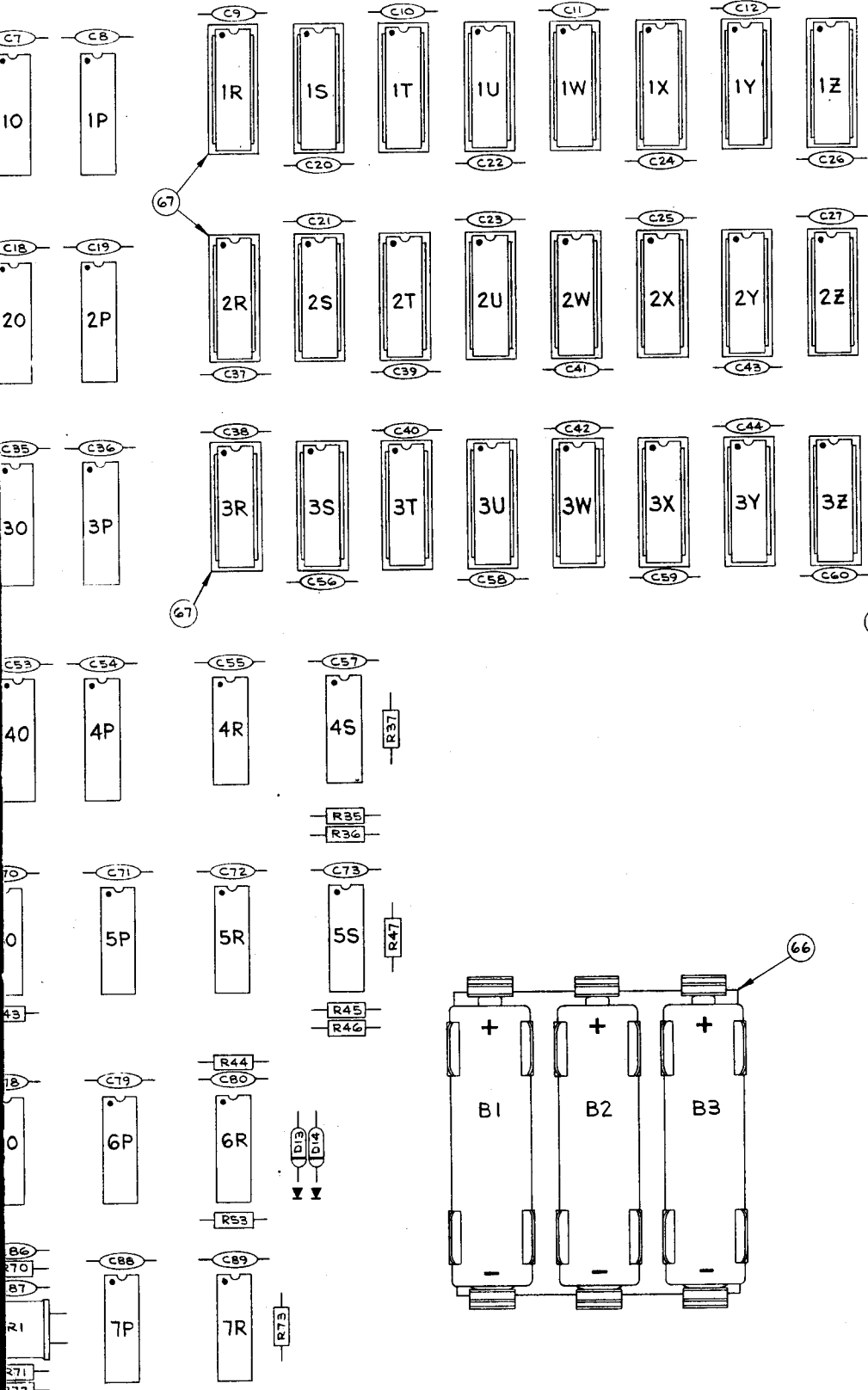
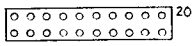


- ①-CPU/VIDEO BOARD
- ②-ROM BOARD
- ③-INTERFACE BOARD
- ④-POWER SUPPLY
- ⑤-MONITOR
- ⑥-COIN DOOR
- ⑦-PLAYER PANEL
- ⑧-HOOD
- ⑨-NOT USED
- ⑩-SOUND BOARD



Interboard Wiring Diagram





Q

1

2

3

4

5

6

7

O P Q R S T U V W X Y Z

NOTES:

- 411C: 1R, 1S, 1T, 1U, 1V, 1X, 1Y, 1Z, 2R, 2S, 2T, 2U, 2V, 2X, 2Y, 2Z, 3R, 3S, 3T, 3U, 3V, 3X, 3Y, 3Z
- 4.7K RESISTOR:  
R11, R12, R13, R14, R15, R25, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R40, R41, R42, R43, R45, R46, R47, R52, R53, R60, R69
- 1 MFD. CAPACITOR:  
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C84, C85, C88, C89, C91

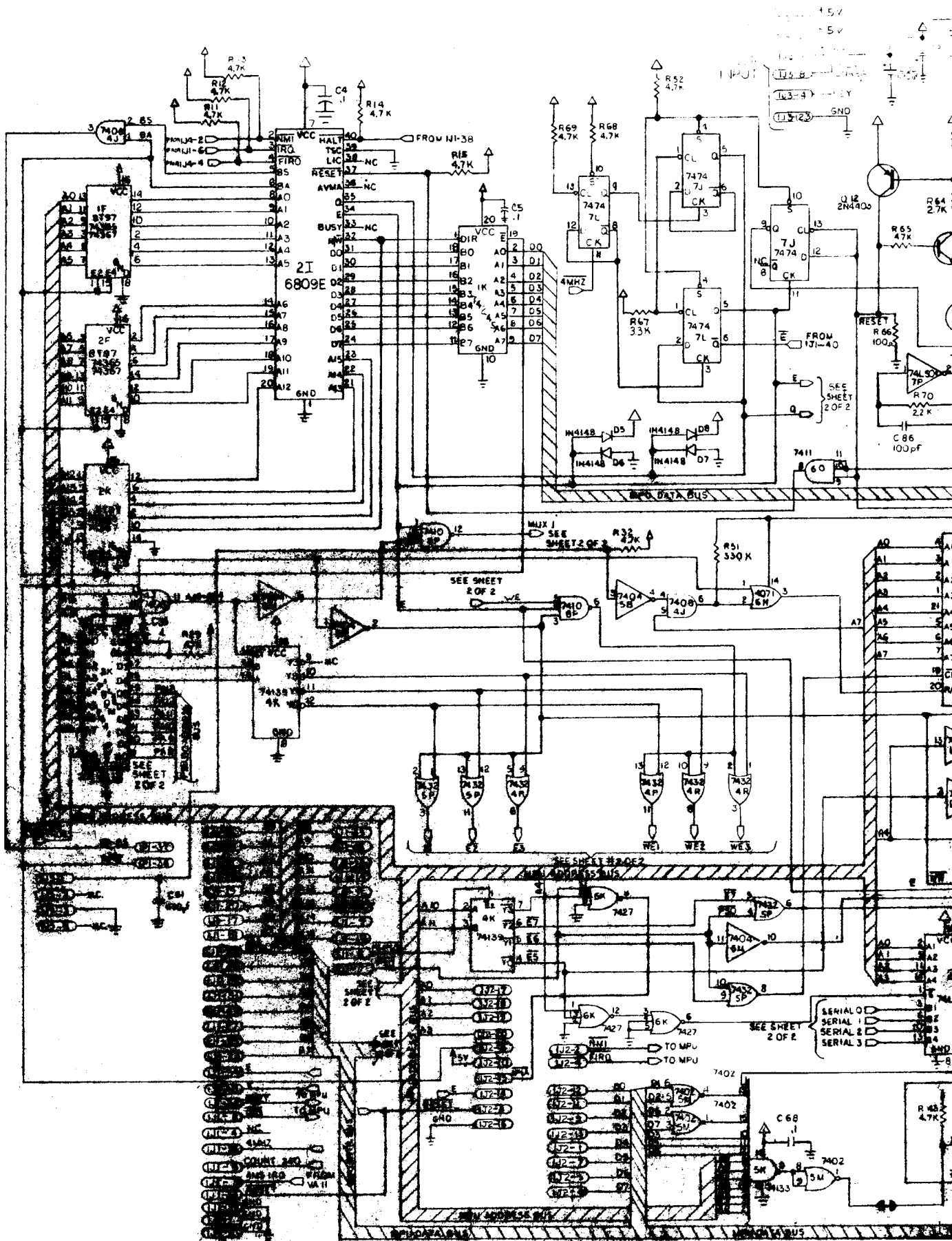
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
76	5010-09508-00	R17, R19, R21	RESISTOR, C.F., 270 OHM 2% 1/4 W.	3
77	5010-09634-00	W1	RESISTOR, C.F., 0 OHM	1

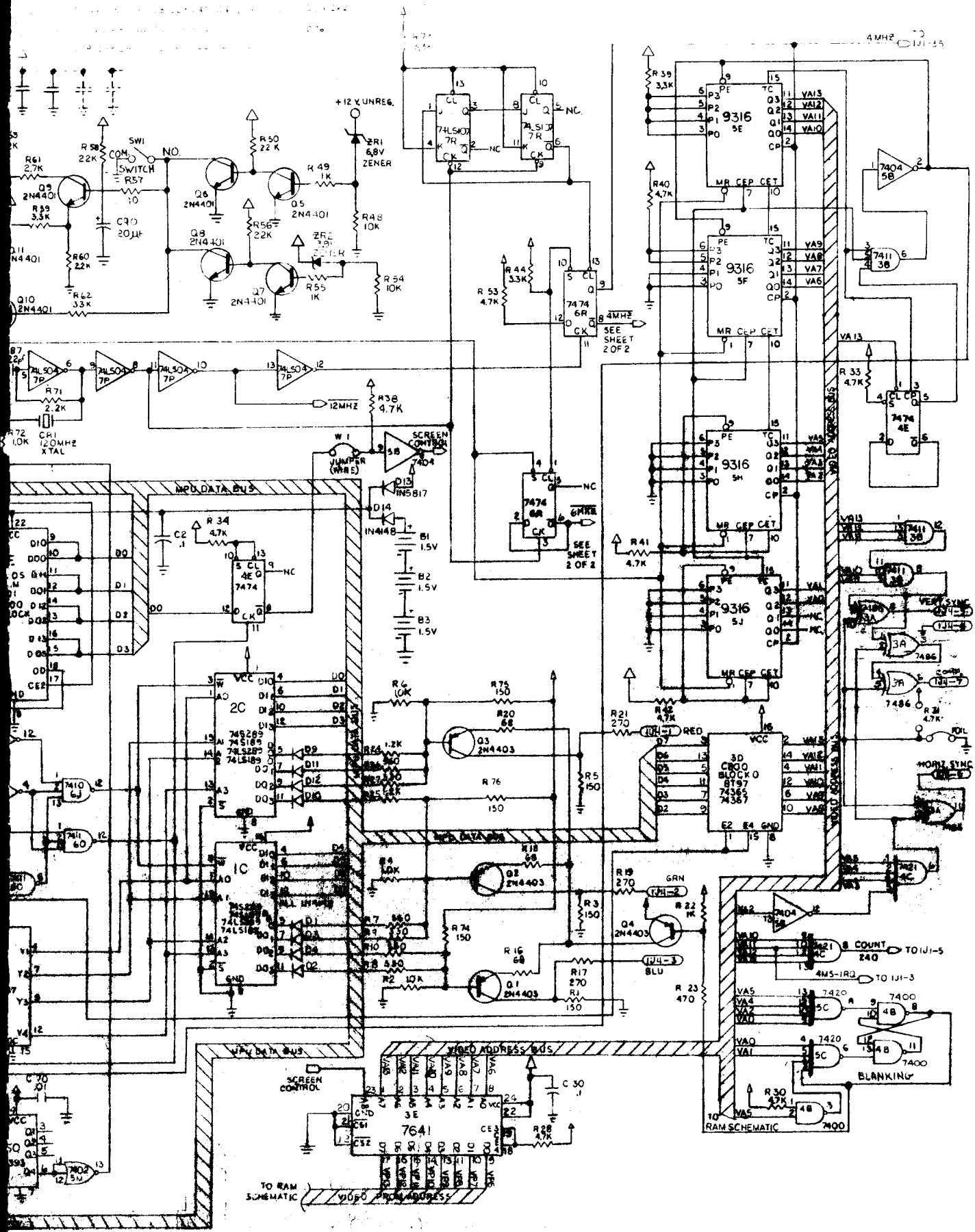
- IN4148 DIODE:  
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D14
- \* THESE COMPONENTS ARE NOT USED IN THIS GAME - DEFENDER.

BILL OF MATERIAL

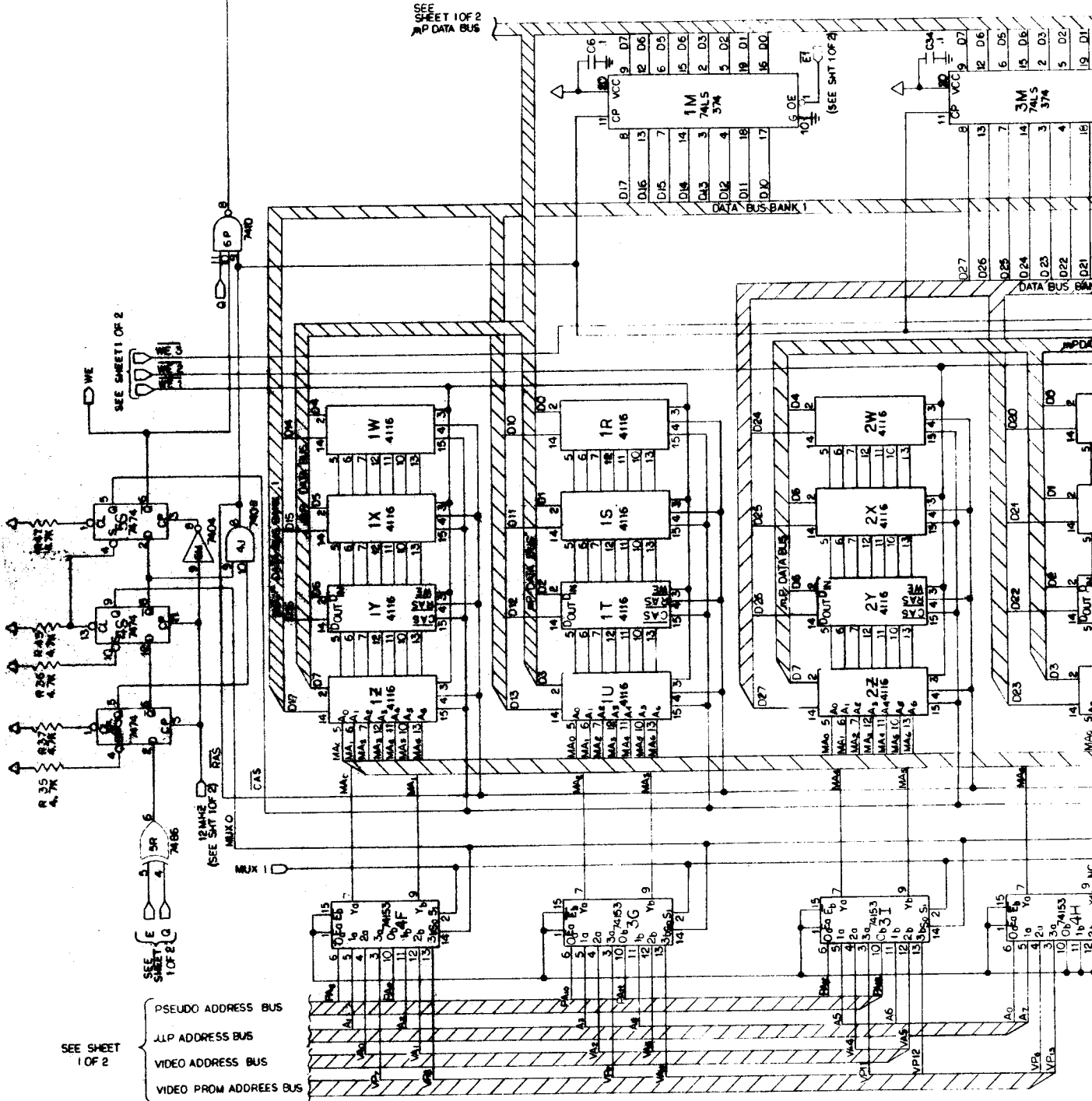
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
1	5170-09618-00	—	BARE P.C. BOARD	1
2	5280-09073-00	4B	7400 QUAD 2-INPUT NAND	1
3	5280-08948-00	5M	7402 QUAD 2-INPUT NOR	1
4	5281-09215-00	7P	741304 HEX. INVERTER	1
5	5280-09015-00	58, 6M	7404 HEX INVERTER	2
6	5280-09475-00	4J	7408 QUAD AND	1
7	5280-09011-00	6J, 6P	7410 TRIPLE 3-INPUT NAND	2
8	5280-09475-00	58, 60	7408 TRIPLE 3-INPUT AND	2
9	5280-09530-00	5C	7420 DUAL 4-INPUT NAND	1
10	5280-09476-00	4C	7421 DUAL 4-INPUT AND	1
11	5280-09477-00	4R, 5P	7432 QUAD 2-INPUT OR	2
12	5280-09478-00	4E, 4R, 1J, 7L	7474 DUAL D-TYPE FLIP-FLOP	4
13	5280-09479-00	3A, 5R	7486 QUAD 2-INPUT EX-OR	2
14	5281-09480-00	7R	74LS107 DUAL J-K FLIP-FLOP	1
15	5281-09532-00	5K	74LS133 13-INPUT NAND	1
16	5280-09481-00	4K	74LS159 DUAL 2-to-4 LINE DECODER	1
17	5280-09482-00	3G, 3I, 4F, 4H	74LS155 DUAL 4 to 1 DATA INVERT	4
18	5280-09482-00	10, 20, 30, 40, 1P, 2P, 3P, 4P	74LS165 8-BIT SHIFT REGISTER	8
19	5281-09483-00	1C, 2C	74LS189 OF 74LS189 OF 74LS289 16x4 RAM	2
20	5281-09308-00	1K	74LS245 OCTAL BUS TRANSCEIVER	1
21	5281-09485-00	2E, 2M	74LS257 QUAD DATA MULPLX.	2
22	5370-08989-00	1F, 2F	8T97 HEX. TS BUFFER	4
	5281-09385-00	2K, 3D	74LS367 HEX BUS DRIVER	2
23	5281-09486-00	1M, 3M, 4M	74LS374 OCTAL D-TYPE FLIP-FLOP	3
24	5281-09487-00	4S, 5S	74LS374 DUAL D-TYPE FLIP-FLOP	2
25	5281-09533-00	50	74LS393 DUAL 4-BIT BIN. COUNTER	1
26	5342-09015-00	3E, 3K	7641 1Kx8 PROM	2
27	5310-09237-00	6H	4071 CMOS QUAD 2-INPUT NOR	1
28	5340-09488-00	SEE NOTE #1	4116 (450 ns ACCESS) 16Kx1 DYNAMIC RAM	24
29	5340-09017-00	1E	5101 256 x 4 CMOS RAM	1
30	5280-09489-00	5E, 5F, 5H, 5J	9316 4-BIT BIN. COUNTER	4
31	5400-09490-00	2I	6805E MICROPROCESSOR	1
32	5280-09547-00	6K	7471 TRIPLE 3-INPUT FOUR-CORNER	1
33	5010-09548-00	R16, R18, R20	RESISTOR, C.F., 68 OHM 2% 1/4 W.	3
34	5010-09036-00	R66	RESISTOR, C.F., 100 OHM 5% 1/4 W.	1
35	5010-09181-00	R1, R3, R5, R4, R7, R7C	RESISTOR, C.F., 150 OHM 5% 1/4 W.	6
36	5010-09416-00	R23	RESISTOR, C.F., 470 OHM 5% 1/4 W.	1
37	5010-09092-00	R7, R10, R26	RESISTOR, C.F., 560 OHM 5% 1/4 W.	3
38	5010-09358-00	R2, R4, R6, R12, R19, R55, R72	RESISTOR, C.F., 1K OHM 5% 1/4 W.	7
39	5010-09316-00	R24, R25	RESISTOR, C.F., 1.2K OHM 5% 1/4 W.	2
40	5010-08998-00	R60, R70, R71	RESISTOR, C.F., 2.2K OHM 5% 1/4 W.	3
41	5010-08997-00	R61, R64	RESISTOR, C.F., 2.1K OHM 5% 1/4 W.	2
42	5010-08988-00	R39, R44, R59, R67, R78	RESISTOR, C.F., 3.3K OHM 5% 1/4 W.	5
43	5010-08991-00	SEE NOTE #2	RESISTOR, C.F., 4.7K OHM 5% 1/4 W.	27
44	5010-09034-00	R48, R54	RESISTOR, C.F., 10K OHM 5% 1/4 W.	2
45	5010-08174-00	R50, R56, R58, R62	RESISTOR, C.F., 22K OHM 5% 1/4 W.	4
46	5010-09118-00	R62	RESISTOR, C.F., 33K OHM 5% 1/4 W.	1
47	5010-09359-00	R65	RESISTOR, C.F., 47K OHM 5% 1/4 W.	1
48	5010-09442-00	R51	RESISTOR, C.F., 330K OHM 5% 1/4 W.	1
49	5010-09001-00	R8, R9, R27	RESISTOR, C.F., 330 OHM 5% 1/4 W.	3
50	5010-09039-00	R87	RESISTOR, C.F., 10 OHM 5% 1/4 W.	1
51	5043-09491-00	CB7	CAPACITOR, AXIAL 22 PFD. 1K V. 10%	1
52	5043-09492-00	CB6	CAPACITOR, AXIAL 100 PFD. 50 V. 10%	1
53	5040-09545-00	C90	CAPACITOR, AXIAL 22 MFD. 10 V. 20%	1
54	5043-09565-00	CG1	CAPACITOR, AXIAL 470 PFD. 50 V. XTR	1
55	5043-08996-00	SEE NOTE #3	CAPACITOR, AXIAL .1 MFD. 50 V. 20%	84
56	5040-09421-00	CB1, CB2, CB3	CAPACITOR, RADIAL 100 PFD. 25 V. 10-10%	3
57	5075-09059-00	BR2	1N5990A 3.9 V. ZENER DIODE	1
58	5075-09018-00	BR1	1N5996A 6.8 V. ZENER DIODE	1
59	5070-08919-00	SEE NOTE #4	IN4148 DOIDE, SILICON	13
60	5070-09246-00	D1B	1N5817 DOIDE, SILICON	1
61	5160-08938-00	Q3, Q6, Q7, Q8, Q9, Q10, Q11	2N4401, TO-92 TRANSISTOR, NPN	7
62	5190-09016-00	Q1, Q2, Q3, Q4, Q12	2N4403, TO-92 TRANSISTOR, PNP	5
63	5520-09495-00	CR1	12 MHz CRYSTAL	1
64	5641-09871-00	SW1	PUSH BUTTON SW. (MOMENTARY ON)	1
65	5880-09021-00	B1, B2, B3	BATTERY ALKALINE 1.5 V. (AA)	3
66	5881-09021-00	—	BATTERY HOLDER #171	1
67	5700-09006-00	—	16-PIN IC SOCKET	24
68	5700-09004-00	—	24-PIN IC SOCKET	2
69	5700-08988-00	—	40-PIN IC SOCKET	1
70	5791-09437-00	4PA	20 PIN RIBBON CABLE HEADER	1
71	5791-09449-00	4PI	40 PIN RIBBON CABLE HEADER	1
72	—	—	—	—
73	5791-09428-00	4PS	4PIN HEADER 09-65-1041	1
74	5791-09497-00	4PT	7PIN HEADER 09-65-1071	1
75	5791-09497-00	4PS	9PIN HEADER 09-65-1091	1







R8570 CPU/Video Board Logic Diagram  
(Sheet 1 of 2)



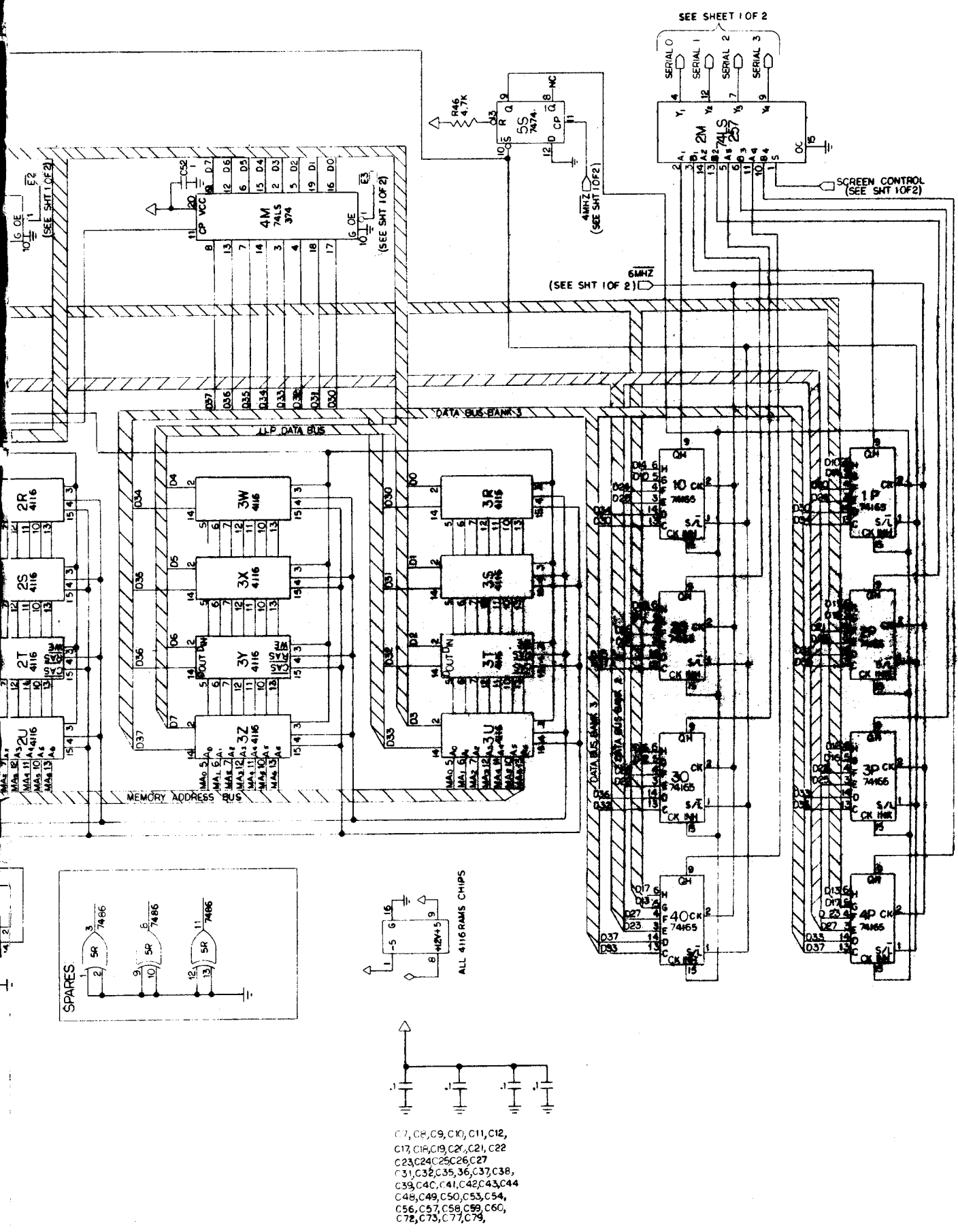
SEE SHEET 1 OF 2  
P DATA BUS

SEE SHEET 1 OF 2

SEE SHEET 1 OF 2

SEE SHEET 1 OF 2

- PSEUDO ADDRESS BUS
- ALP ADDRESS BUS
- VIDEO ADDRESS BUS
- VIDEO PROM ADDRESSES BUS



SEE SHEET 1 OF 2

G OE  
10  
1  
F2  
(SEE SHT 1 OF 2)

4.7K

4M  
74LS374

74LS55

6MHz  
(SEE SHT 1 OF 2)

2M  
74LS257

SCREEN CONTROL  
(SEE SHT 1 OF 2)

ALP DATA BUS

DATA BUS BANK 3

MEMORY ADDRESS

ALL 4116RAM CHIPS

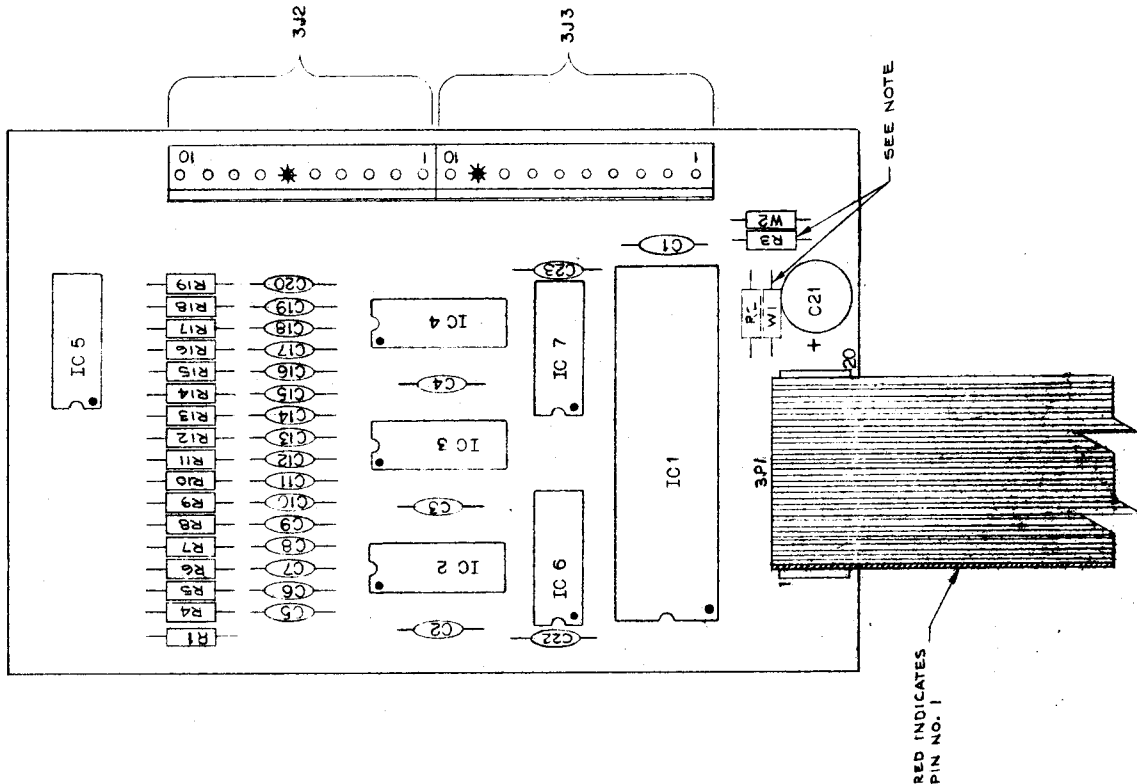
SPARES

- C7, C8, C9, C10, C11, C12,
- C17, C18, C19, C21, C22
- C23, C24, C25, C26, C27
- C31, C32, C35, C36, C37, C38,
- C39, C40, C41, C42, C43, C44
- C48, C49, C50, C53, C54,
- C56, C57, C58, C59, C60,
- C72, C73, C77, C79,

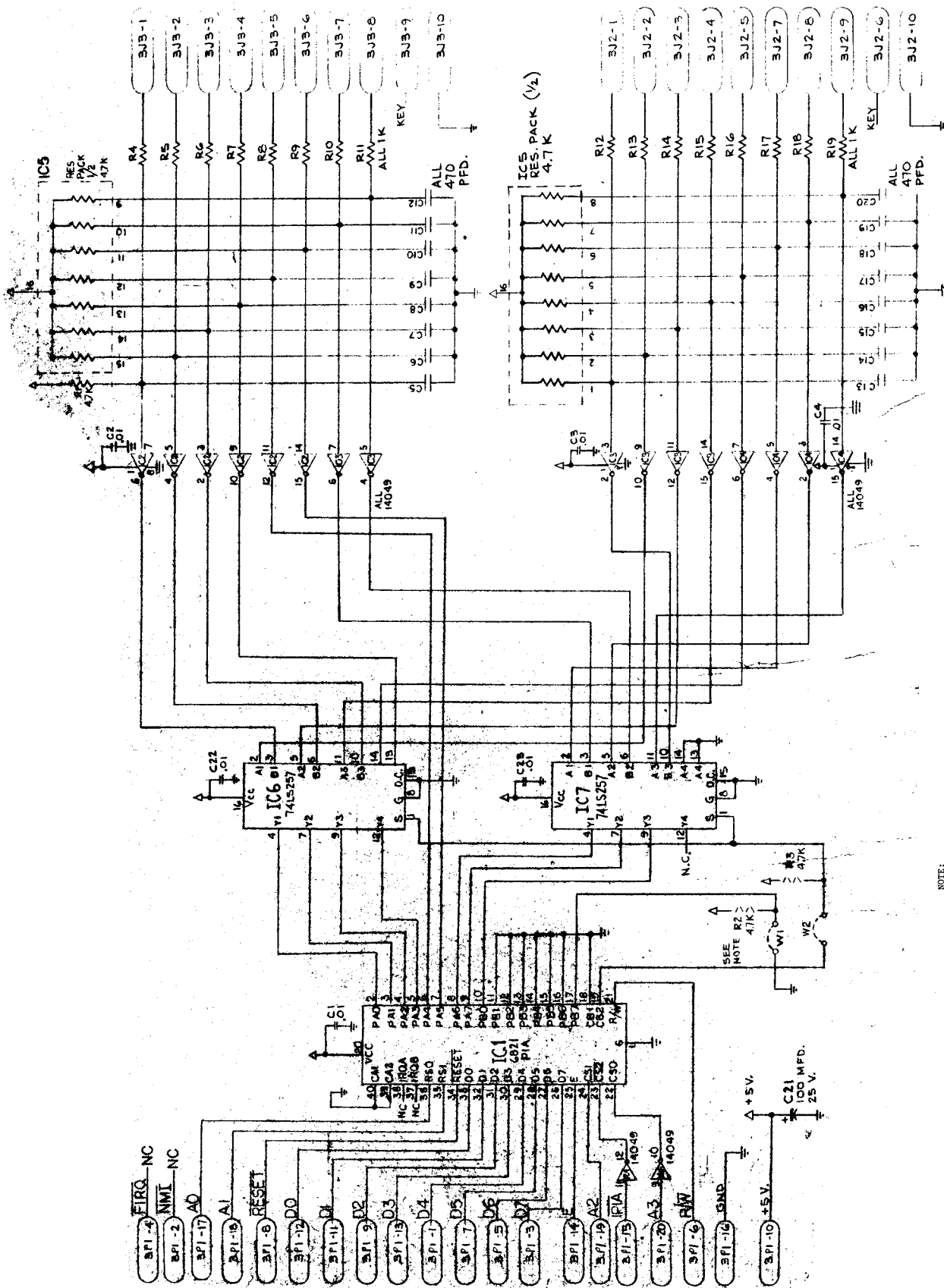
R8570 CPU/Video Board Logic Diagram  
(Sheet 2 of 2)

BILL OF MATERIALS

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	NO. REQ'D
1	50124-00		BARE P.C. BOARD	1
2	08975-00	IC2 IC3 IC4	4049 CMOS HEX INVERTER	3
3	5019-	IC5	47KΩ 15 RES 16PIN DIP PACK	1
4	5261-	IC6 IC7	74LS257 QUAD DATA MULTIPLEXER	2
5	08991-00	R1, R2, R3	RESISTOR, 1/4 WATT	3
6	5010-	RA THRU R19	RESISTOR, 1/4 WATT	16
7	09245-00	C5 THRU C20	100 MFD. 25 VOLT CERAMIC DISC, 5% TOL. ELECTROLYTIC CAP.	16
8	09421-00	C21	100 MFD. 25 VOLT CERAMIC DISC, 5% TOL. ELECTROLYTIC CAP.	1
9	08980-00	C1, C2, C3	CAPACITOR, CERAMIC 015C, .01 MFD. 50V. ±10-10%	6
10	09444-00	3J2, 3J3	10 PIN HEADER 09-65-1101	2
11	5795-	3P1	20 PIN RIBBON CABLE Assy	1
12	5490-	IC1	6821 PIM	1
13	08972-00	W1, W2	0 Ω RESISTOR	2

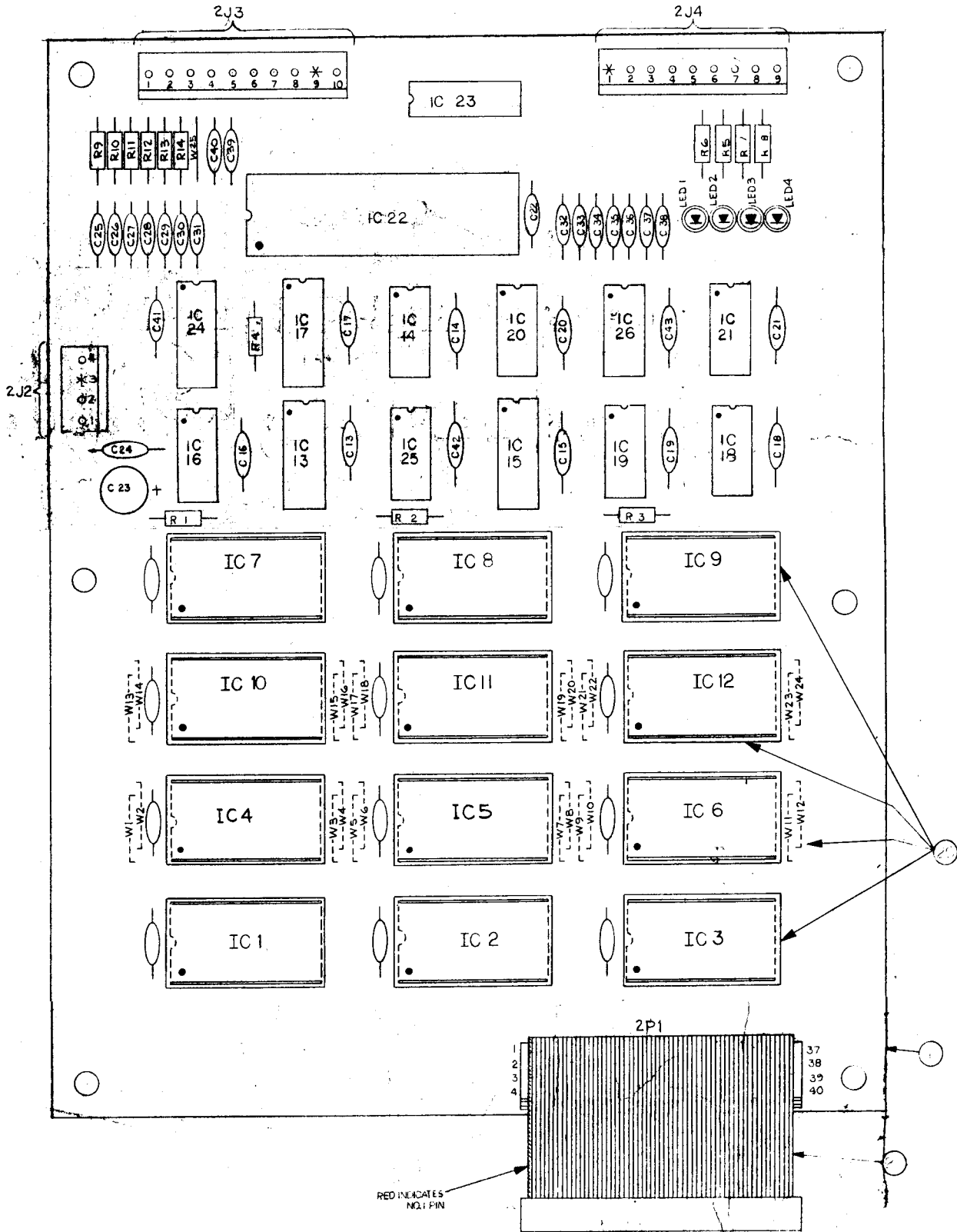


NOTE:  
 FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.  
 FOR UPRIGHT GAMES, W1 MUST BE CONNECTED. WITH RED-LABELLED RONS, W2 MAY BE CONNECTED OR REMOVED. WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.



NOTE:  
 FOR COCKTAIL TABLE GAMES, W2 MUST BE  
 CONNECTED AND W1 MUST BE REMOVED.  
 FOR UPRIGHT GAMES, W1 MUST BE CON-  
 NECTED, WITH RED-LABELLED PINS, W2 MAY  
 BE CONNECTED OR REMOVED, WITH LABELS OF  
 OTHER COLORS, W2 MUST BE REMOVED.

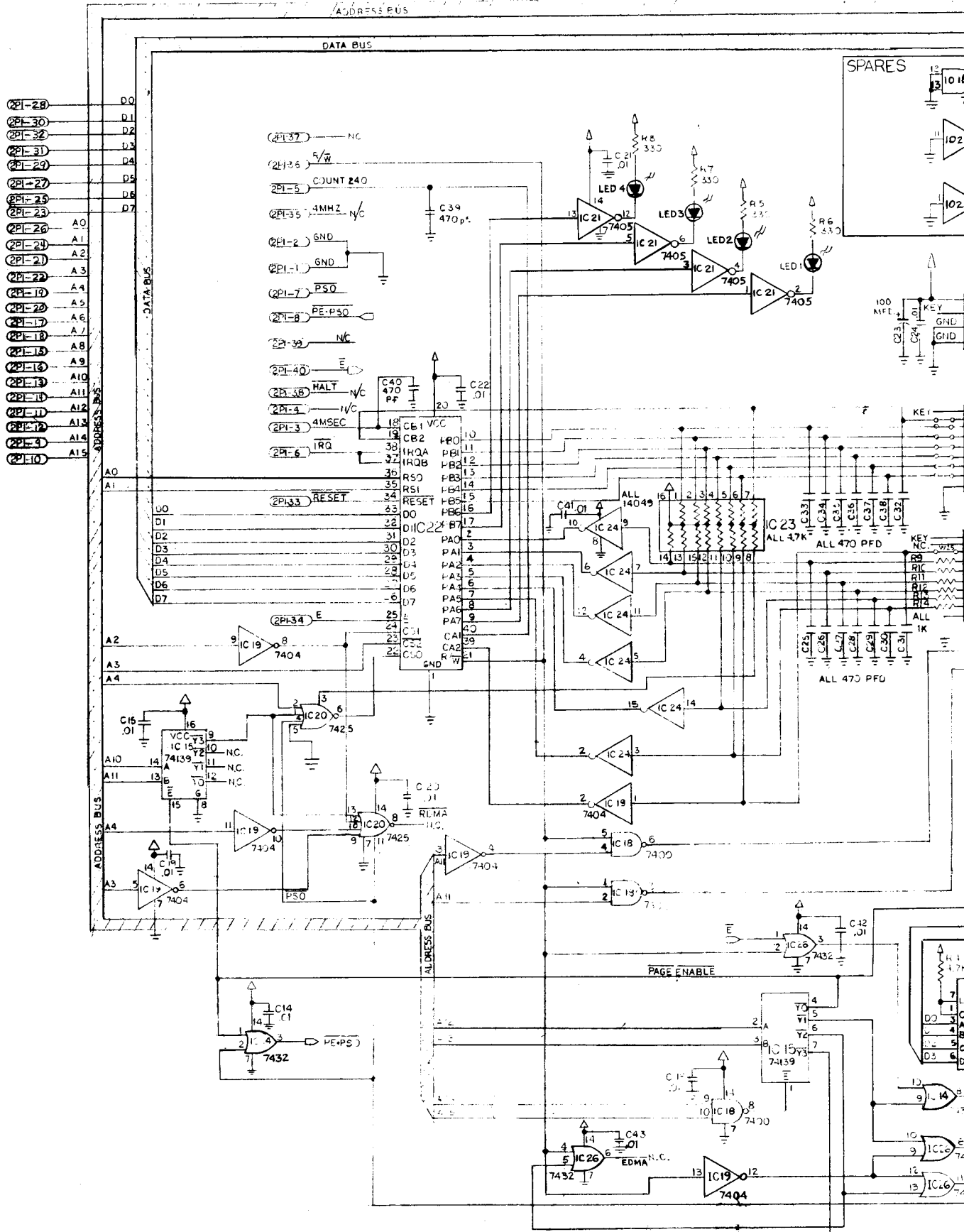
C8573 Interface Board Assembly  
 and Logic Diagram

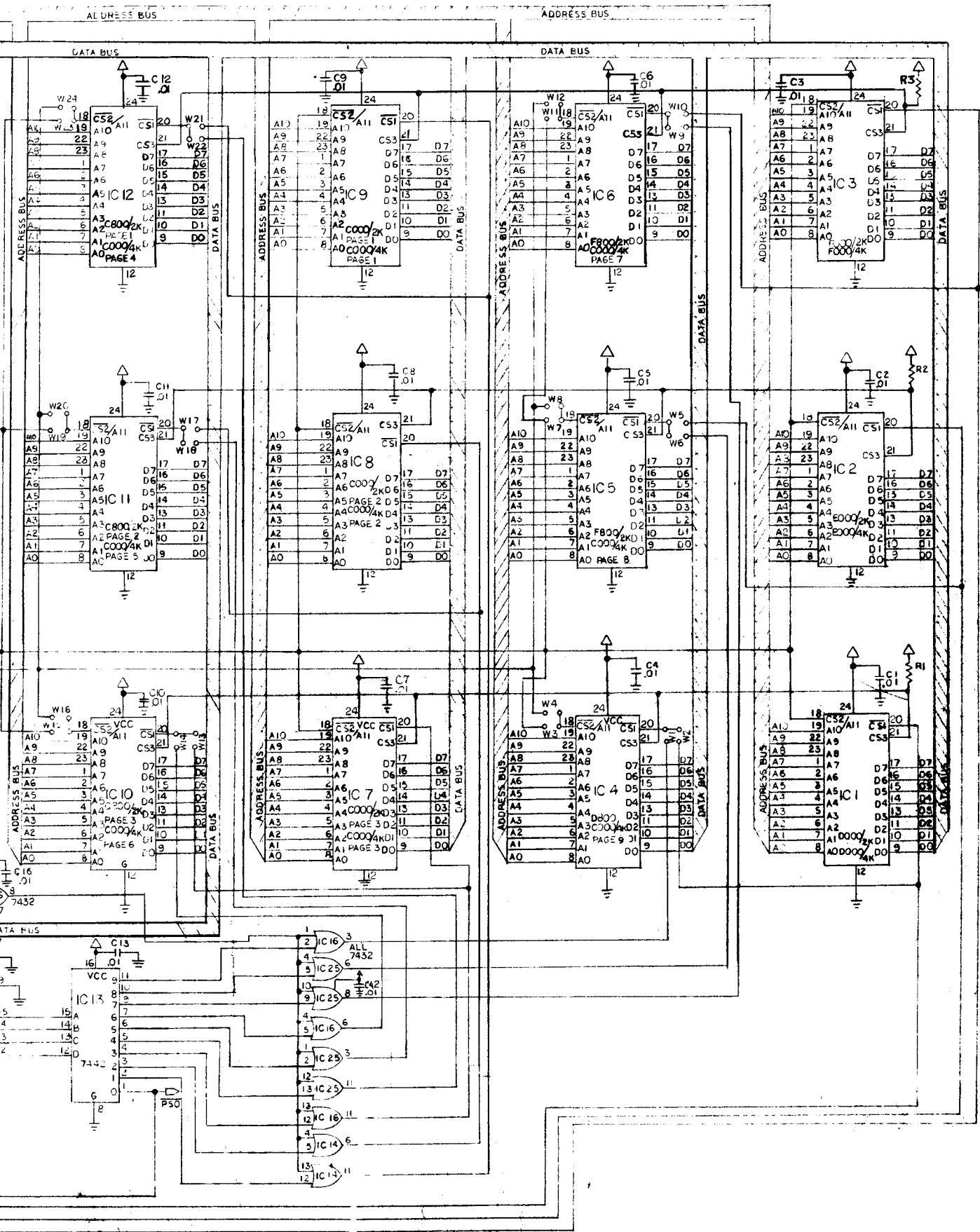


BILL OF MATERIALS			
QTY	PART NO.	DESIGNATION	DESCRIPTION
1	5211-0945-00		BARE PCB BOARD
8	5280-09013-00	IC 13	7442 BCD DECODER
3	5280-08471-00	IC 14, IC 16, IC 25, IC 26	7432 QUAD 4-INPUT NAND
1	5281-09246-00	IC 15	74139 DUAL 2 TO 4 LINE DECODER
5	5281-09501-00	IC 17	74LS393 3-BIT UNIVERSAL SHIFT REG.
5	5280-09013-00	IC 18	7400 QUAD 2-INPUT NAND
7	5280-09013-00	IC 19	7404 HEX INVERTERS
8	5280-09531-00	IC 20	7402 NOR GATE WITH STRAIGHT INPUTS
9	5280-09549-00	IC 21	7495 OPEN-COLLECTOR OUTPUTS
10	5430-08872-00	IC 22	MC6821 PIA
11	5019-09537-00	IC 23	5.7K 1/4W 1% PIN DIP PWR
12	5631-09018-00	LED 1 THRU LED 8	LED, RED
13	5010-09001-00	R 1 THRU R 3	RESISTOR, C.F., 300 OHM 1/4W
4	5010-08891-00	R 4	RESISTOR, C.F., 47 OHM 1/4W
16	5045-08990-00	C 1 THRU C 15	CAP CERAMIC, 100V 50V 500PF
17	5040-09482-00	C 23	CAP, ELECT., 100UF 25V RAD
18	5045-08996-00	C 24	CAP CERAMIC, 100V 50V 100PF
19	5045-09049-00	C 25 THRU C 27	CAP CERAMIC, 100V 50V 100PF
20	5700-09004-00		24 PIN IC SOCKET
21	5798-09611-00	Z 1	40 PIN RIBBON CABLE ASSEMBLY
22	5791-09028-00	Z 2	4 PIN Jumper
23	5791-09044-00	Z 3	10 PIN Jumper
24	5310-08578-00	IC 24	7404 INVERTING HEX. INVERTER
26	5010-09338-00	R 9 THRU R 14	RESISTOR, C.F., 1K OHM 1/4W
27	5010-09534-00	W 1 THRU W 25	RESISTOR, C.F., 0 OHM
28	SEE CHART	IC 1 THRU IC 12 SEE CHART	SEE CHART

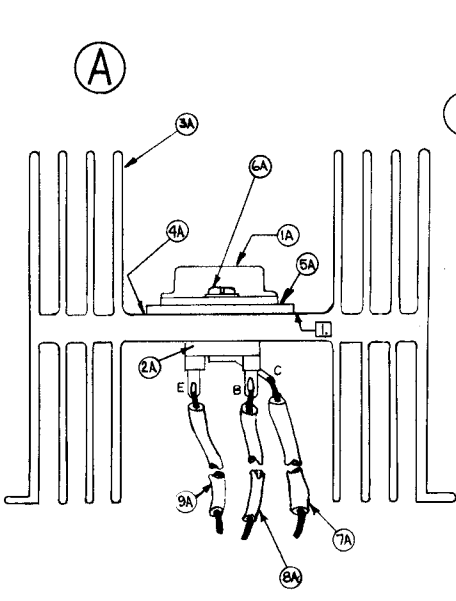
GAME NAME "DEFENDER" RED LABEL					
ASSEM. NO.	D-8572-3001				
IC 1	A-5343-09636				
IC 2	A-5343-09637				
IC 3	A-5343-09638				
IC 4	A-5343-09639				
IC 5	NOT USED				
IC 6	A-5343-09640				
IC 7	A-5343-09641				
IC 8	A-5343-09642				
IC 9	A-5343-09643				
IC 10	A-5343-09644				
IC 11	A-5343-09645				
IC 12	A-5343-09646				
JUMPERS	W2, W4, W6, W7, W9, W11, W13, W16, W17, W20, W21, W24				





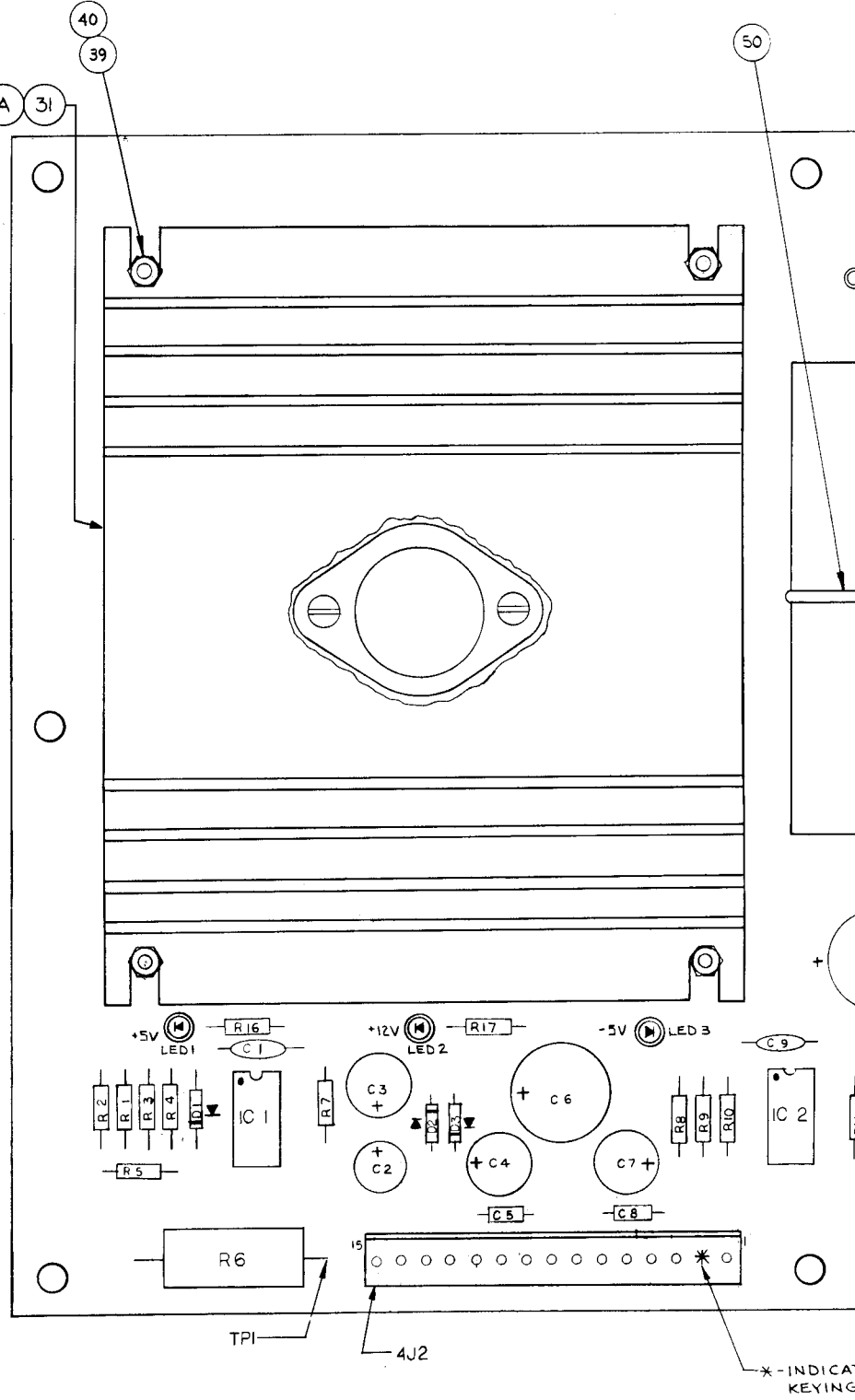


D8572 ROM Board Logic Diagram

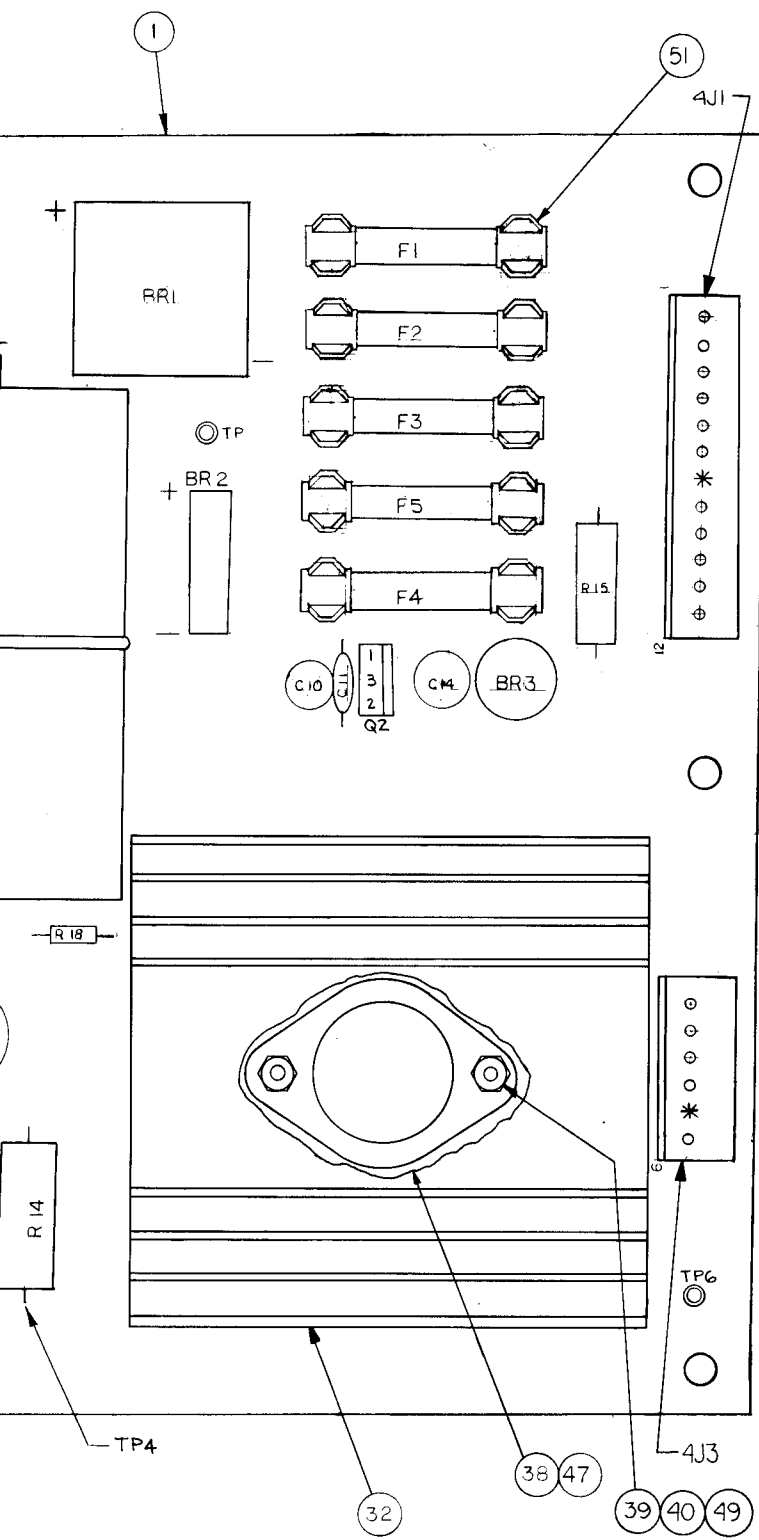


BILL OF MATERIAL			
ITEM NO	PART NO	DESCRIPTION	REQ'D NO.
1A	5162-09425-00	TRANSISTOR NPN 2N6057	1
2A	5700-09445-00	TRANSISTOR-SOCKET TO3	1
3A	5705-09431-00	HEAT SINK	1
4A	20-9229-00	THERMAL COMPOUND 1.5 OUNCE	1
5A	5701-09538-00	TO3 3 MIL MICA INSULATOR	1
6A	4006-01003-8	MS-6-22x1/2-P-PH	2
7A	5853-09591-00	LEAD WIRE #18AWG 3/8 STRIPPED (GRN)	1
8A	5853-09592-00	LEAD WIRE #18 AWG-4 3/8 STRIPPED (WHT)	1
9A	5853-09593-00	LEAD WIRE #18 AWG-4 3/8 STRIPPED (YEL)	1

NOTES.  
 1 HEAT SINK COMPOUND MUST BE APPLIED BETWEEN MICA INSULATOR AND HEAT SINK AND BETWEEN MICA INSULATOR AND TRANSISTOR.

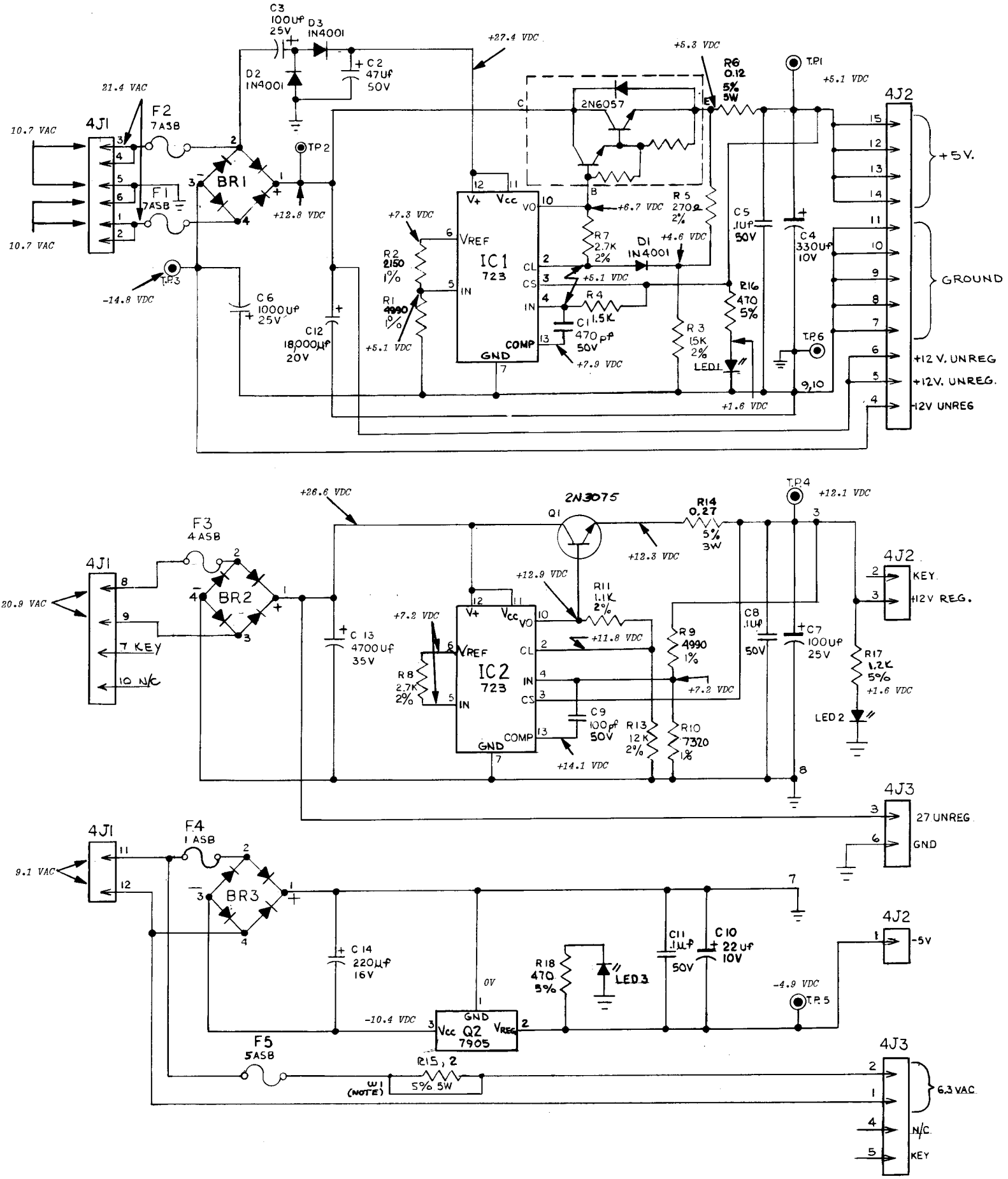


\*-INDICAT  
KEYING



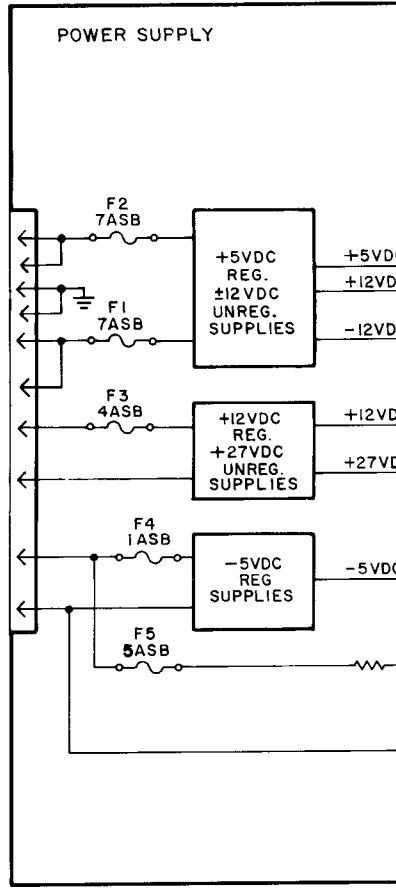
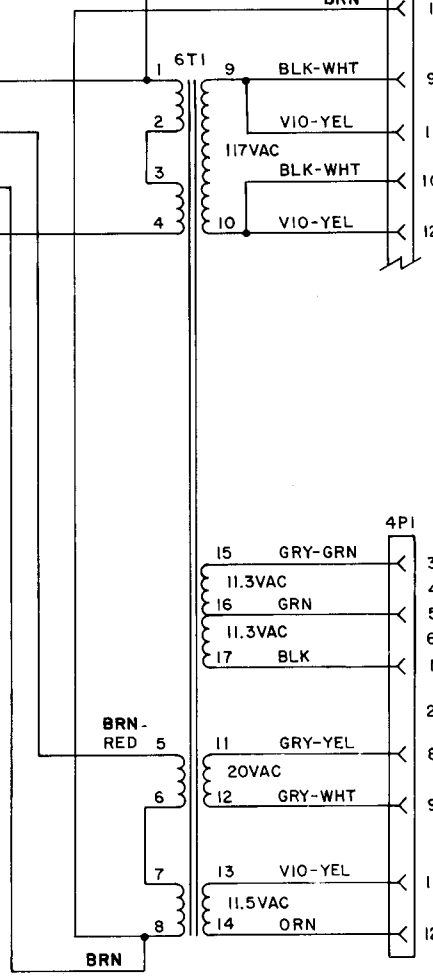
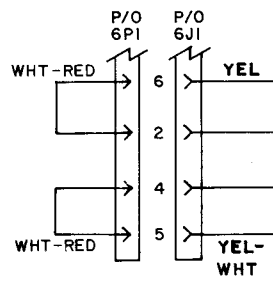
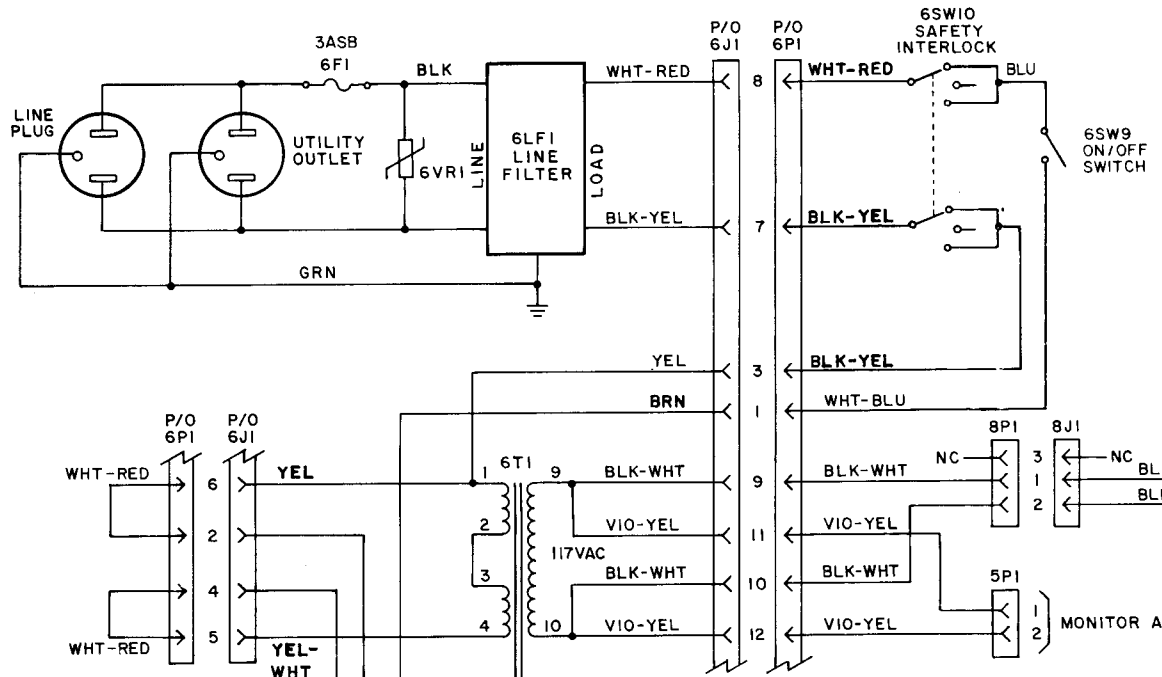
BILL OF MATERIAL

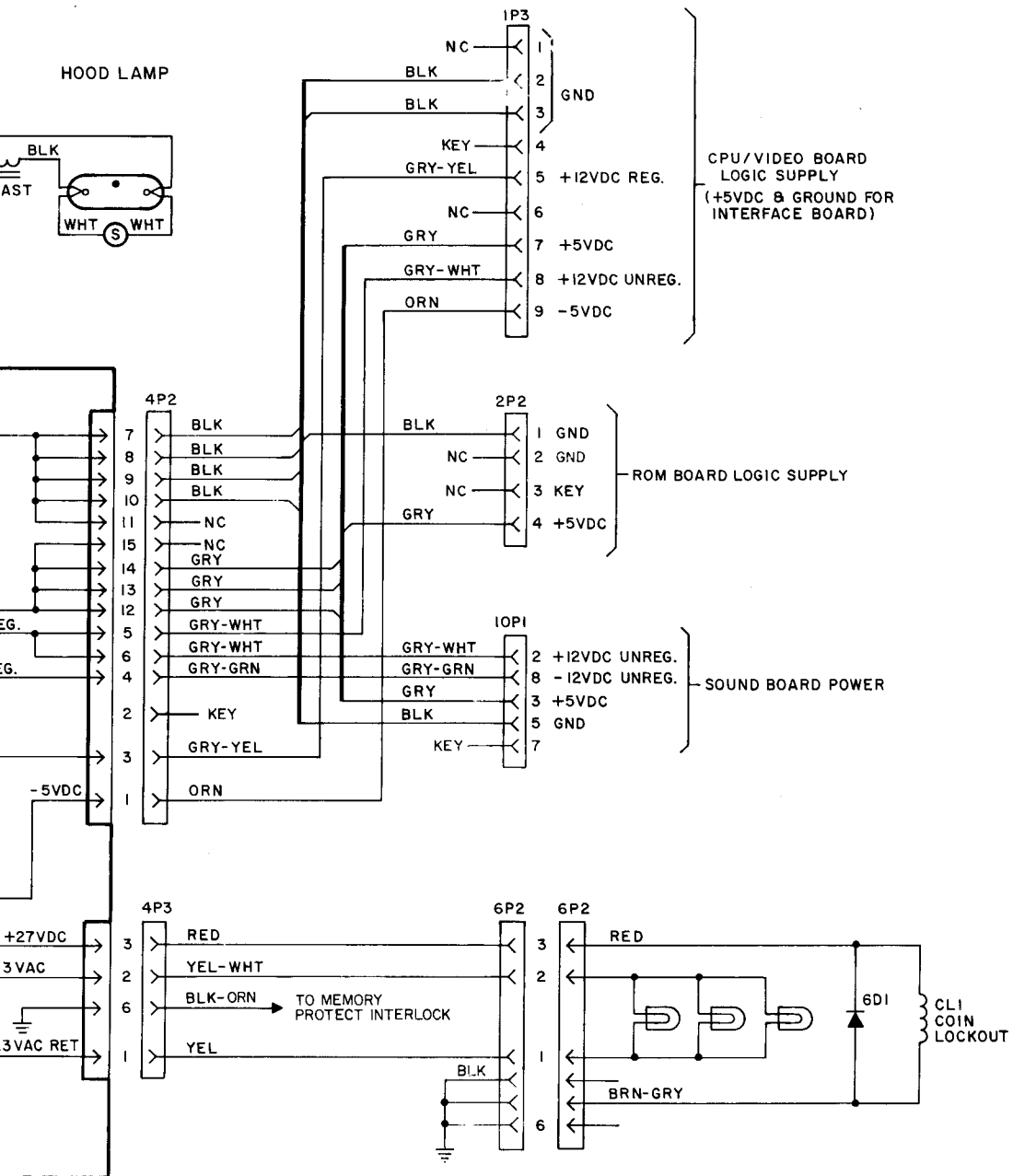
ITEM NO	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5113-09474-00		P.C. BOARD	
2	5010-09085-00	R4	RESISTOR, 1.5K 5%, 1/4W	1
3	5010-09541-00	R8, R7	RESISTOR, 2.7K 2%, 1/4W	2
4	5010-09508-00	R5	RESISTOR, 270 2%, 1/4W	1
5	5010-09428-00	R3	RESISTOR, 1.5K 2%, 1/4W	1
6	5010-09509-00	R11	RESISTOR, 1.1K 2%, 1/4W	1
7	5010-09510-00	R13	RESISTOR, 12K 2%, 1/4W	1
8	5013-09542-00	R10	RESISTOR, 732K 1%, 1/4W	1
9	5013-09427-00	R1 & R9	RESISTOR, 499K 1%, 1/4W	2
10	5013-09426-00	R2	RESISTOR, 2.15K 1%, 1/4W	1
11	5012-08429-00	R6	RESISTOR, 12Ω, 5%, 5W	1
12	5012-09512-00	R14	RESISTOR, 27 5%, 5W	1
13	5040-09421-00	C3 & C7	CAPACITOR, 100MFD, 25V, RADIAL	2
14	5040-09422-00	C2	CAPACITOR, 47MFD, 50V, RADIAL	1
15	5040-09420-00	C6	CAPACITOR, 1000MFD, 25V, RADIAL	1
16	5040-09419-00	C12	CAPACITOR, 18,000MFD, 20V, RADIAL	1
17	5040-09423-00	C4	CAPACITOR, 330MFD, 10V, RADIAL	1
18	5040-09504-00	C13	CAPACITOR, 4700MFD, 35V, RADIAL	1
19	5043-08994-00	C5, C8, C11	CAPACITOR, 1MFD, 50V, AXIAL 25U	3
20	5043-09065-00	C1	CAPACITOR, 470 PFD, 50V, AXIAL X7R	1
21	5043-09492-00	C9	CAPACITOR, 100 PFD, 50V, AXIAL 52L	1
22	5040-09506-00	C14	CAPACITOR, 220MFD, 16V, RADIAL	1
23	5040-09493-00	C10	CAPACITOR, 22MFD, 10V, RADIAL	1
24	5070-06258-00	D1, D2, D3	DIODE, 1N4001	3
25	5100-09418-00	BR1	BRIDGE RECTIFIER, 35AMP, 100V	1
26	5100-09513-00	BR2	DIODE BRIDGE, 4.0A, 50V	1
27	5100-09514-00	BR3	DIODE BRIDGE, 1.0A, 50V	1
28	5731-09452-00	F1, F2	FUSE, 7A, 5B	2
29	5731-06314-00	F3	FUSE, 4A, 5B, 250 V.	1
30	5731-06569-00	F4	FUSE, 1A, 5B	1
31	B-8416-00		HEAT SINK ASSEMBLY (SEE A)	1
32	5705-09543-00		HEAT SINK	1
33	5791-09074-00	4J2	HEADER, 15 PIN, 09-65-1151	1
34	5791-09043-00	4J1	HEADER, 12 PIN, 09-65-1121	1
35	5250-09515-00	Q2	VOLTAGE REGULATOR 7905	1
36	5460-09424-00	IC1, IC2	VOLTAGE REGULATOR 783	2
37	5824-09248-00	TP2, TP3, TP5, TP6	TERMINAL #1502-1 (TEST POST)	4
38	20-9229-00		THERMAL COMPOUND .02 OUNCE	AR
39	4005-01051-07		5-40x7/16 RH. MECH. SCREW	6
40	4405-01112-00		5-40 HEX NUT	6
41	5161-09552-00	Q1	2N3055 TRANSISTOR NPN	1
42	5731-09651-00	F5	FUSE, 5A, 5B	1
43	5791-09038-00	4J3	HEADER, 6 PIN, 09-65-1061	1
44	5012-09544-00	R15	RESISTOR, 2.0Ω, 5%, 5W	1
45	5010-09416-00	R16, R18	RESISTOR, 470Ω, 5%, 1/4W	2
46	5010-09314-00	R17	RESISTOR, 1.2K, 5%, 1/4W	1
47	5701-09538-00		INSULATOR, MICA, 3mil	1
48	5671-09019-00	LED1, LED2, LED3	LED, RED	3
49	03-7598		INSULATOR, NYLON	2
50	03-7520		TIE WRAP	1
51	6732-09178-00		FUSEHOLDER	10

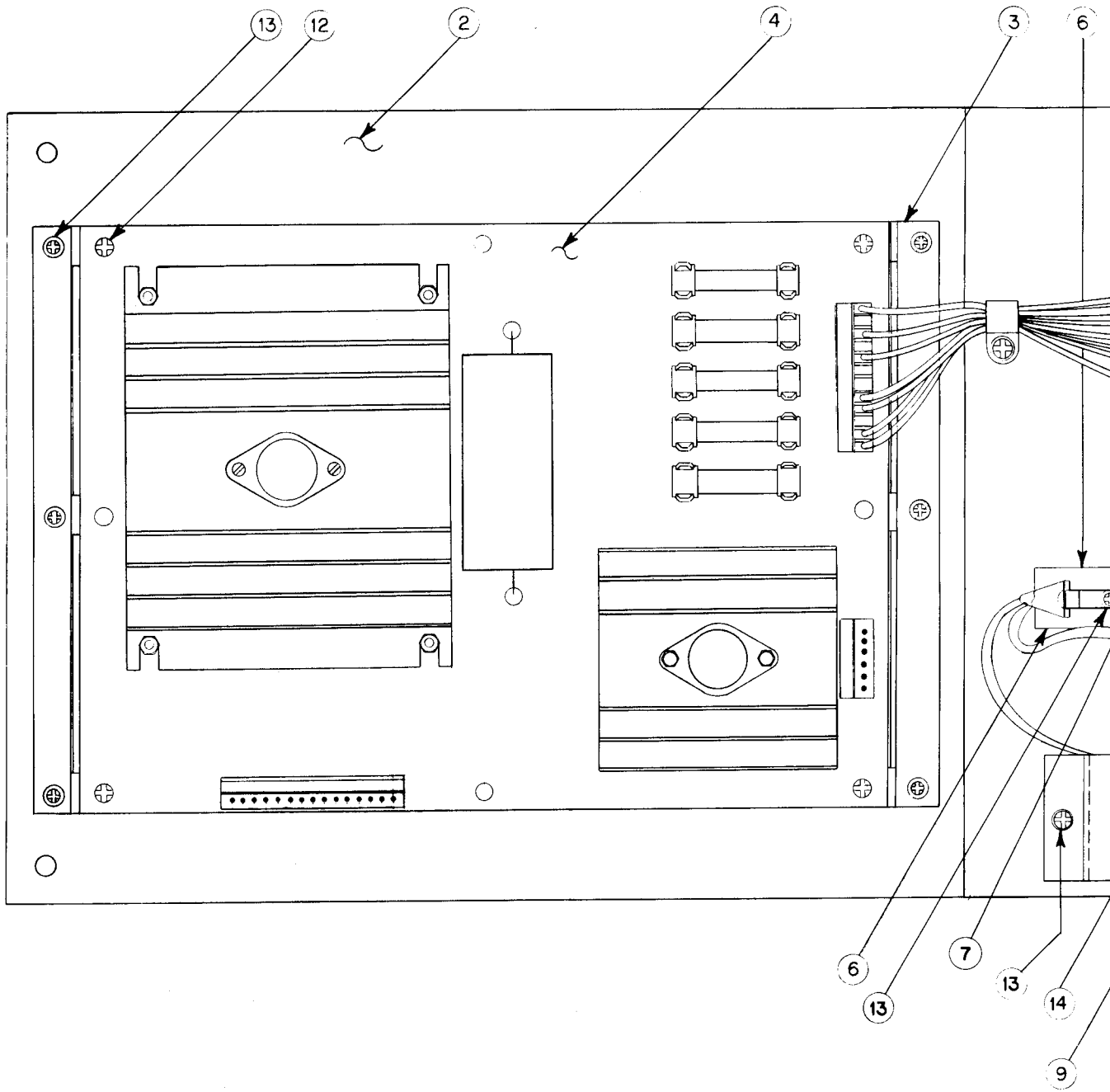


NOTE:  
W1 CONNECTED ONLY FOR COCKTAIL  
APPLICATIONS.

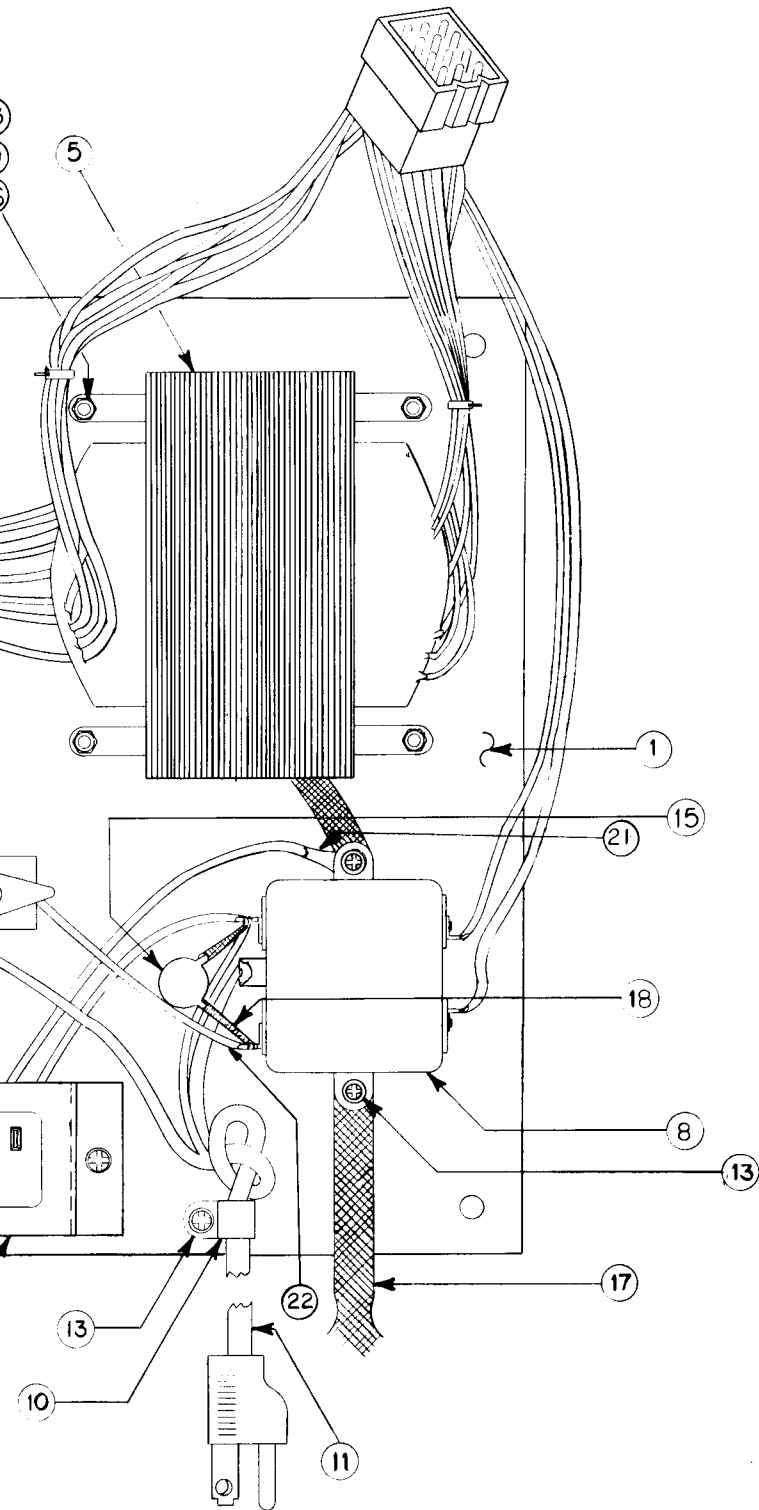
D8359 Power Supply Board  
Schematic Diagram











BILL OF MATERIALS			
ITEM	PART N <sup>o</sup>	DESCRIPTION	QTY.
1	11-580	POWER SUPPLY MTG. BD.	1
2	01-7001	POWER SUPPLY GND PLATE	1
3	01-7002	POWER SUPPLY SUPPORT BRKT.	2
4	D. 8359	POWER SUPPLY BOARD	1
5	C 8529	VIDEO TRANSFORMER ASSY	1
6	B-6448-1	FUSE MOUNT ASS'Y.	1
7	5731-08633-00	LINE FUSE 3AMP 115V	1
8	5102-08895-00	LINE FILTER 5A	1
9	01-6948-	OUTLET MTG BRACKET	1
10	03-6048-6	CABLE CLAMP-3/8	2
11	SEE NOTE #2	LINE CORD	1
12	4006-01018-04	MS #6-32 x 1/4 P-RH	4
13	4108-01022-08	SMS #8-32 x 1/2 P-RWH-A	13
14	5851-09184-00	3WIRE SNAP-IN OUTLET	1
15	SEE NOTE #1	VARIATOR	1
16	4408-01117-00	NUT 8-32 HEX	4
17	20-9223-3	6INCH BRAIDED GROUND WIRE	1
18	20-9256	1 INCH SLEEVING INSULATION	2
19	4703-00006-00	NO#8 EXTERNAL LOCK WASHER	4
20			
21	5825-06523-00	TERMINAL LUG	1
22	5852-09575-00	BLACK-18 AWG JUMPER WIRE-25'L	1
23	4008-01005-22	MS 8-32 x 1 3/8 P-PH	4

NOTES:

1. FOR 115V.A.C., 130V. VARIATOR # 5017-09044 IS USED.

FOR 230V.A.C., A 275V VARIATOR #5017-09063 IS USED.

2. LINE CORD PART NUMBERS:

5850-06206-00 12 FT. EUROPE

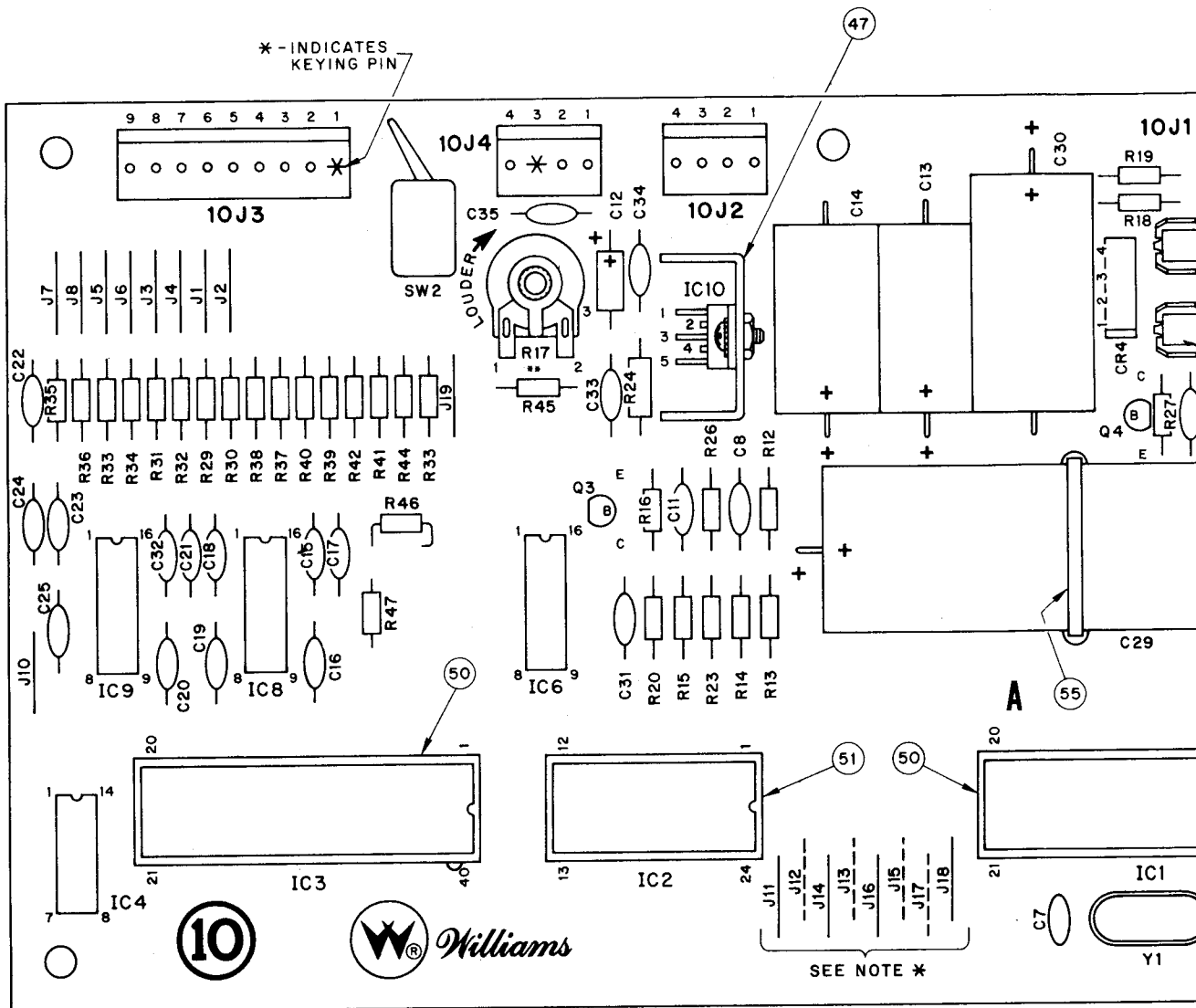
5850-08728-00 U.S. DOM.

5850-08737-00 AUS.

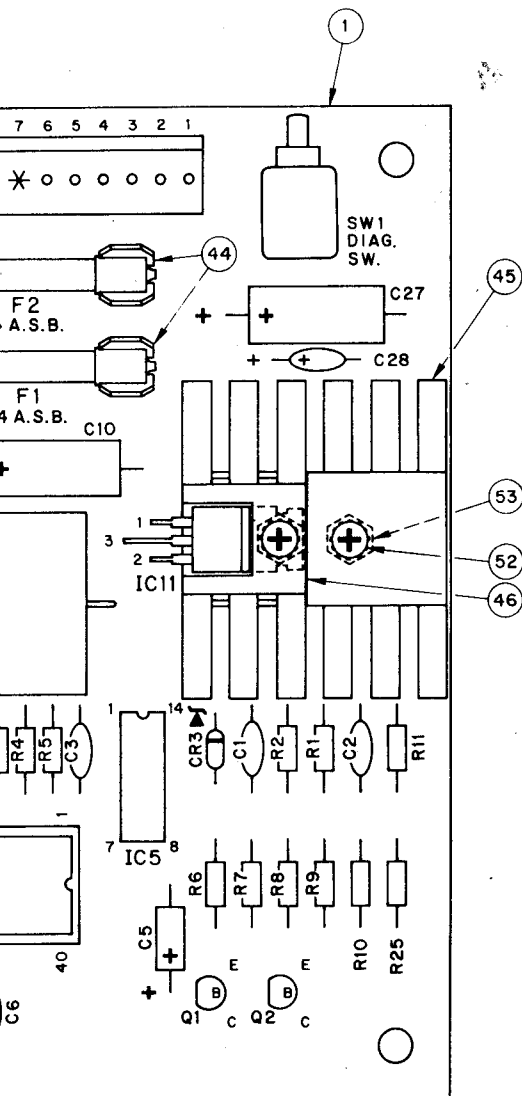
5850-08743-00 U.S.L.A.

5850-09128-00 12 FT. FRANCE

5850-09131-00 AWG 18-12 JAPAN



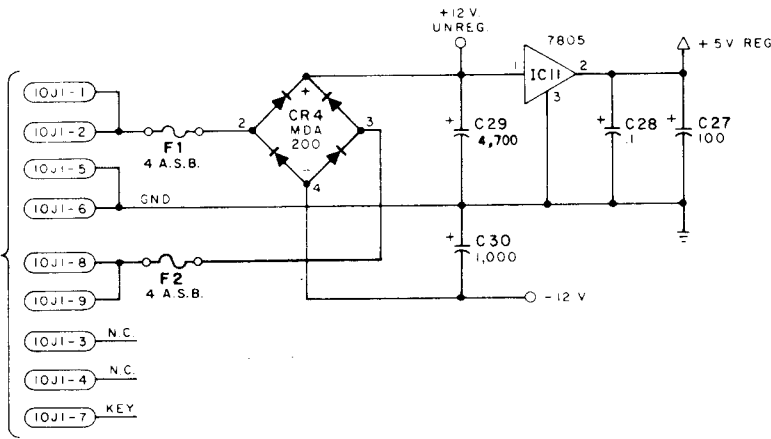
\* NOTE:  
 JUMPERS SHOWN WITH SOLID LINES CONNECTED FOR PROM OPERATION. THOSE SHOWN WITH DASHED LINES CONNECTED FOR ROM OPERATION.



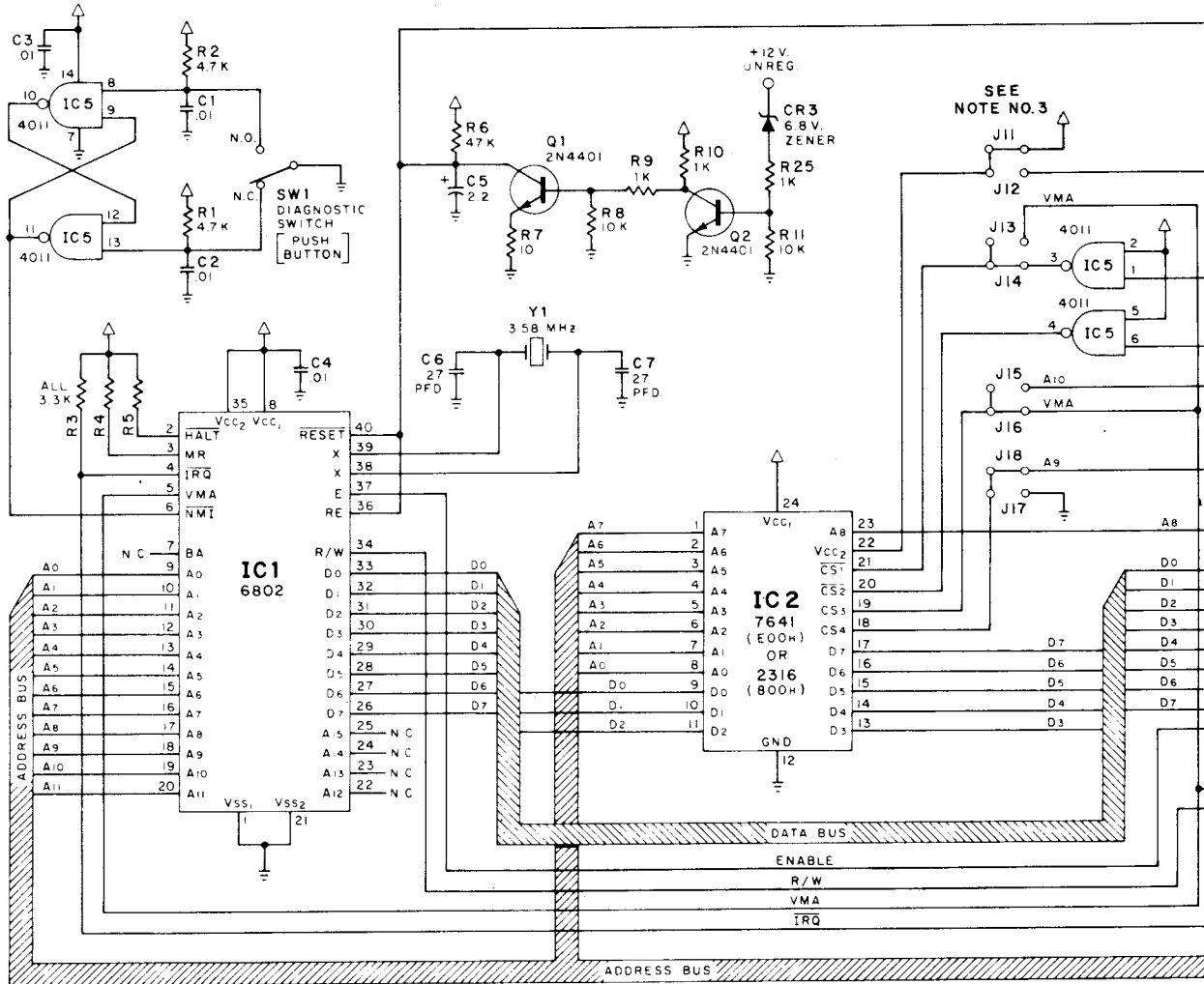
BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-137		BARE P.C. BOARD	1
2	5A-8972	IC3	MC6820 PIA	1
3	5A-9154	IC4	4068 8 INPUT NAND GATE	1
4	5A-9155	IC5	4011 QUAD 2 INPUT NAND GATE	1
5	5A-9152	IC6	MC1408 D/A CONVERTER	1
6	5A-9153	IC8, IC9	4050 BUFFER	2
7	5A-9156	IC10	TDA2002V AUDIO AMPLIFIER	1
8	5A-9157	IC11	7805 5 VOLT REG. W/T0220 CASE	1
9	5C-8938	Q1, Q2, Q3	2N4401 NPN TRANSISTOR	3
10	5A-8976	Q4	2N6427 NPN TRANSISTOR	1
11	5A-9018	CR3	1N5996 6.8V ZENER DIODE	1
12	5A-9158	CR4	MDA200/3N253 BRIDGE RECTIFIER	1
13	5B-8991	R1, R2, R14, R23, R37 THRU R45	RESISTOR, FC, 4.7 K OHM 10% 1/4 W	13
14	5B-8983	R3, R4, R5, R15, R16, R20	RESISTOR, FC, 3.3 K OHM 10% 1/4 W	6
15	5A-8984	R9, R10, R25, R27	RESISTOR, FC, 1K OHM 10% 1/4 W	5
16	5B-9039	R7	RESISTOR, FC, 10 OHM 10% 1/4 W	1
17	5B-8817	R8, R11, R46, R47	RESISTOR, FC, 10 K OHM 10% 1/4 W	4
18	5B-9035	R6, R12, R13	RESISTOR, FC, 47 K OHM 10% 1/4 W	3
19	5A-9160	R18	RESISTOR, FC, 220 OHM 10% 1/4 W	1
20	5A-9161	R19	RESISTOR, FC, 2.2 OHM 10% 1/4 W	1
21	5A-9179	R26	RESISTOR, FC, 3.3 M OHM 10% 1/4 W	1
22	5B-9036	R29 THRU R36	RESISTOR, FC, 100 OHM 10% 1/4 W	8
23	5A-9181	R24	RESISTOR, FC, 1 OHM 10% 1/2 W	1
24	5A-9376	C29	CAPACITOR, ELECTROLYTIC, 1.4, 700 MFD. 16 V.	1
25	5A-8986	C27	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V.	1
26	5A-8893	C30	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V.	1
27	5A-9164 5A-9164-1	C13	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V.	1
28	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V.	1
29	5A-9168 5A-9168-1	C10	CAPACITOR, ELECTROLYTIC, 25 MFD. 20 V. OR 33 MFD. 16 V.	1
30	5A-9031	C12	CAPACITOR, TANTALUM, 1 MFD. 25 V.	1
31	5A-9163	C5	CAPACITOR, TANTALUM, 2.2 MFD. 15 V.	1
32	5A-8980	C1 THRU C4, C15, C24, C25, C32, C35	CAPACITOR, CERAMIC, .01 MFD. 50 V.	9
33	5A-8996	C28, C31, C33, C34	CAPACITOR, CERAMIC, .1 MFD. 50 V.	4
34	5A-9169	C6, C7	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V.	2
35	5A-9065	C16 THRU C23	CAPACITOR, CERAMIC DISC, 470 PFD. 50 V.	8
36	5A-9166	C9	CAPACITOR, CERAMIC DISC, .0015 MFD. 1K V.	1
37	5A-9167	C8	CAPACITOR, CERAMIC DISC, .003 MFD. 1K V.	1
38	5A-9180	C11	CAPACITOR, CERAMIC DISC, 47 PFD. 1K V.	1
**39	5A-9185	R17	POTENTIOMETER, 5K OHM	1
40	5A-9020	Y1	CRYSTAL, 3.58 MHZ.	1
41	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
42	5A-9171	SW2	TOGGLE SWITCH SPDT	1
43	5A-6314	F1, F2	4 AMP. SLOW BLOW FUSE	2
44	5A-9178		FUSEHOLDER	4
45	5A-9172		HEAT SINK THERMALLOY #6072B	1
46	5A-9173		HEAT SINK THERMALLOY #6071B	1
47	5A-9199		HEAT SINK THERMALLOY #6030	1
48	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
49	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
50	5A-8985		40 PIN SOCKET	2
51	5A-9004		24 PIN SOCKET	1
52			6-32 X 3/8 BINDER HEAD SCREW	2
53			6-32 HEX. NUT	2
54		J1 THRU J8, J10, THRU J19	WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	18
55	3A-7520-1		TIE WRAP	1
56	5A-9150	IC1	MC6802 MICROPROCESSOR	1
57	5A-9264	IC2	VIDEO SOUND ROM 1	1

\*\*ON MOST BOARDS, R17 IS REMOVED AND A JUMPER CONNECTED BETWEEN TERMINALS 1 AND 2.

**POWER SUPPLY**



- NOTES:**  
 1. UNLESS OTHERWISE SPECIFIED, ALL RESISTORS ARE 1/4 WATT.  
 2. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE 50V.  
 3. J11, J14, J16, J17 ARE CONNECTED TO THE BOARD.  
 4. ON MOST BOARDS, A JUMPER IS CONNECTED TO 10J4-2.



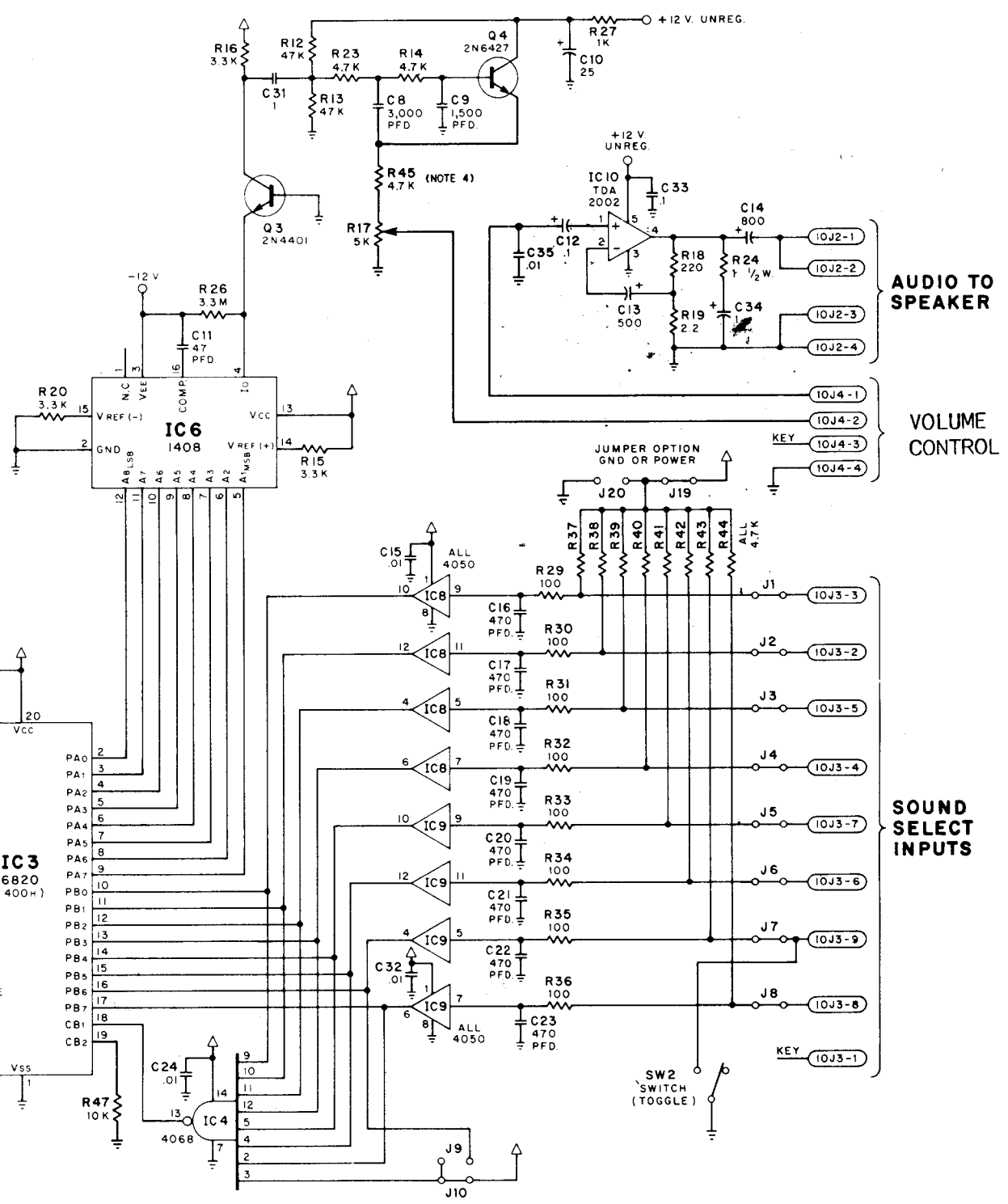
SEE NOTE NO. 3

ADDRESS BUS

DATA BUS

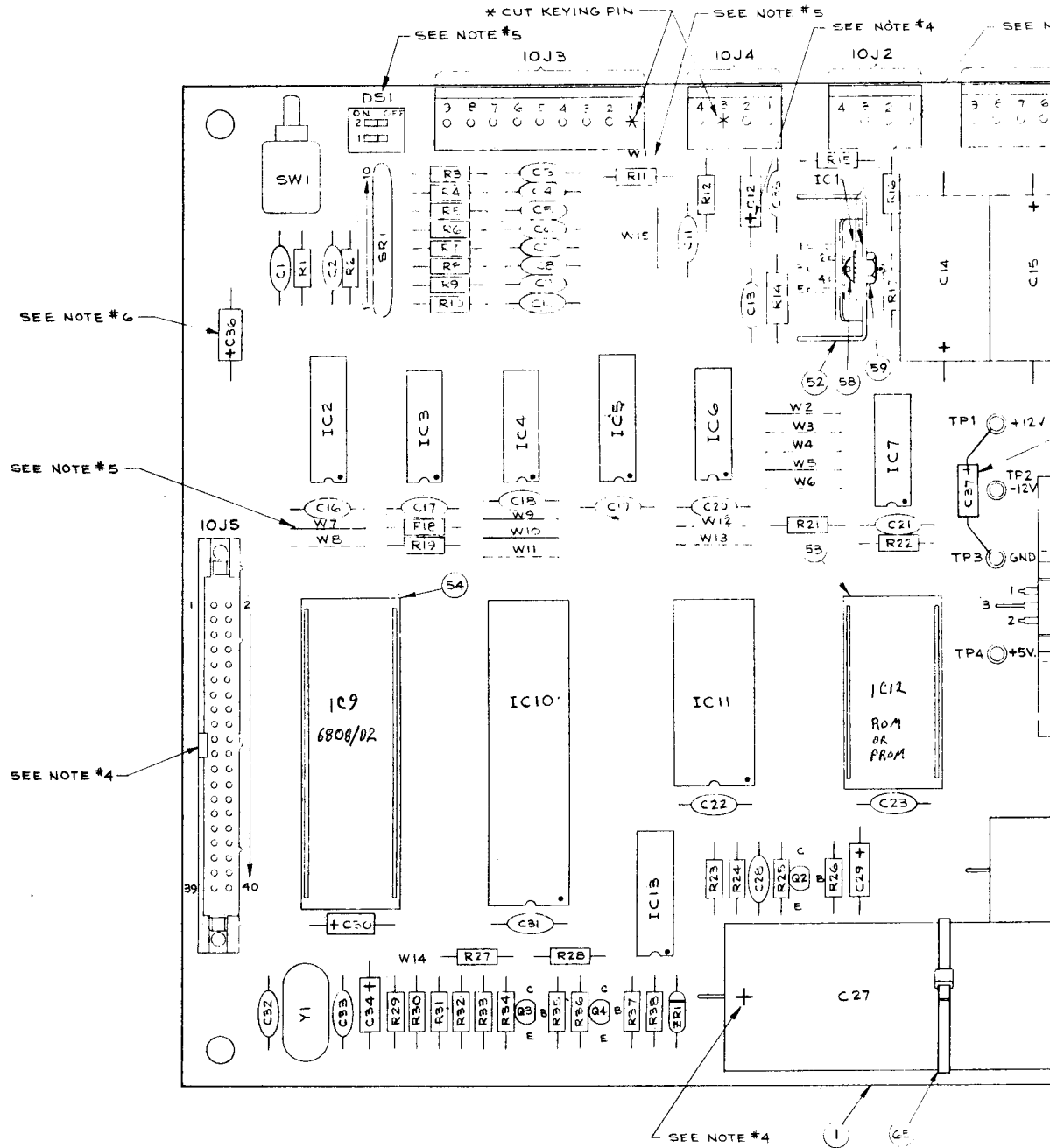
ADDRESS BUS

ICATED  
 1/4 WATT.  
 ICATED  
 MICROFARADS.  
 18 ARE  
 5, AND  
 S REMOVED  
 OUGH A



D8121 Sound Board Logic Diagram

ITEM NO.	PART NO.	PART DESIGNATION	DESCR.
58			6-32 X 3/8" BIN
59			6-32 HEX N
60		W1, W2, W5, W7, W9, W10, W15	WIRE JUMPER WIRE WITH
61	PA-9248	TP1 THR TPA	TERMINAL
62	5A-9363	R11	RESISTOR, 5% 1/4 WA
64	5A-9362	SRI	RESISTOR, 10 PIN S
65	3A-7520-1		TIE WRAP



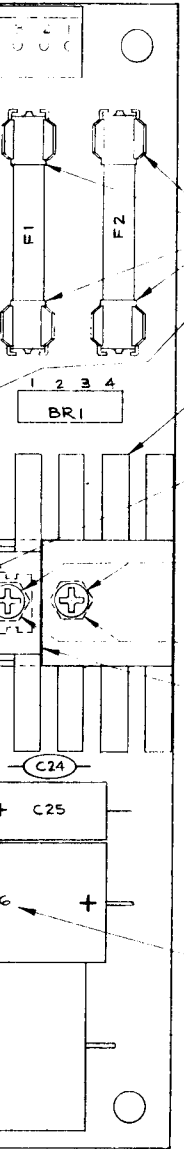
REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
3	48	5A-6314	F1, F2	4 AMP SLOW BLOW FUSE	2
3	49	5A-9178		FUSE HOLDER	4
7	50	5A-9172		HEAT SINK THERMALLOY #6072B	1
4	51	5A-9173		HEAT SINK THERMALLOY #6071B	1
1	52	5A-9199		HEAT SINK THERMALLOY #6030	1
1	53	5A-9004		24 PIN SOCKET	1
1	54	5A-8985		40 PIN SOCKET	1
1	55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
1	56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
1	57	5A-9349	10J5	40 PIN RIBBON HEADER	1

BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1C-2001-146-3		BARE P.C. BOARD	1
2	5A-9156	IC1	TDA2002 V AUDIO AMPLIFIER	1
3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	5A-8973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5A-9153	IC5	4050 BUFFER	1
7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	5A-8971	IC7	14069 HEX INVERTER	1
9	5A-9157	IC8	7805 5 VOLT REG. W/TO220 CASE	1
10	5A-8972	IC10	6821 P.I.A.	1
11	5A-9003	IC11	6810 RAM	1
12	5A-9152	IC13	1408 D/A CONVERTER	1
13	5C-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5A-9018	ZR1	1N5996 6.8V. ZENER DIODE	1
16				
17	5A-9158 OR 5A-9357	BR1	MDA 200/3N253 BRIDGE RECTIFIER	1
18	5A-9020	Y1	3.58 MHZ CRYSTAL	1
19	5B-8991	R1, R19, R21, P22, R27, R30, R31, R32	RESISTOR, FC, 4.7K OHM 5% 1/4 WATT	9
20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10% 1/4 WATT	9
21	5A-8984	R12, R15, R28, R36, R38	RESISTOR, FC, 1K OHM 10% 1/4 WATT	5
22	5A-9181	R14	RESISTOR, FC, 1 OHM 10% 1/2 WATT	1
23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 10% 1/4 WATT	1
24	5A-9361	R17	RESISTOR, FC, 220 OHM 10% 1/2 WATT	1
25				
26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3K OHM 10% 1/4 WATT	3
27	5A-9179	R25	RESISTOR, FC, 3.3M OHM 10% 1/4 WATT	1
28	5A-9359	R29	RESISTOR, FC, 47K OHM 5% 1/4 WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10K OHM 10% 1/4 WATT	3
30	5B-9039	R34	RESISTOR, FC, 10 OHM 10% 1/4 WATT	1
31	5A-8980	C1, C16 THRU C25, C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50 V. ±20%	9
33	5A-9345	C11	CAPACITOR, CERAMIC, .001 MFD. 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAPACITOR, ELECTROLYTIC 1 MFD. 6.3V. 10% 50%	3
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	3
36	5A-9165 OR 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	5A-9164 OR 5A-9164-1	C15	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V. ±20%	1
38	5A-8986	C25	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V. ±20%	1
39	5A-8893	C26,	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V. ±20%	1
40	5A-9046	C27	CAPACITOR, ELECTROLYTIC, 12,000 MFD. 16 V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25 V. LOW LEAK 22%	1
43	5A-9169	C32, C33	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V. ±10%	2
44	5A-9163	C34	CAPACITOR, TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAPACITOR, TANTALUM, 1 MFD. 25 V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	DS1	2 STD. DIP SWITCH	1

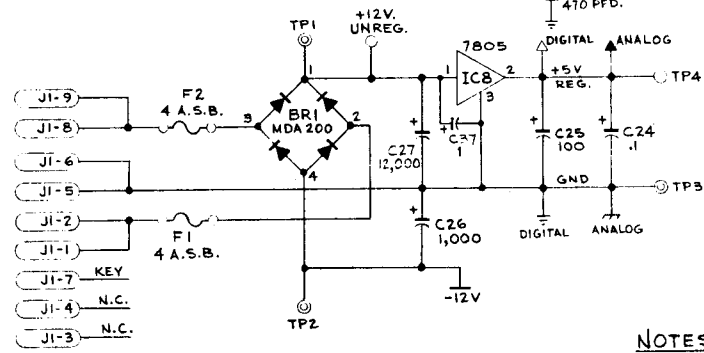
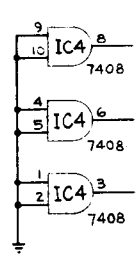
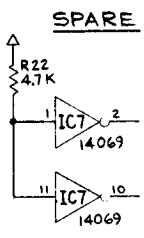
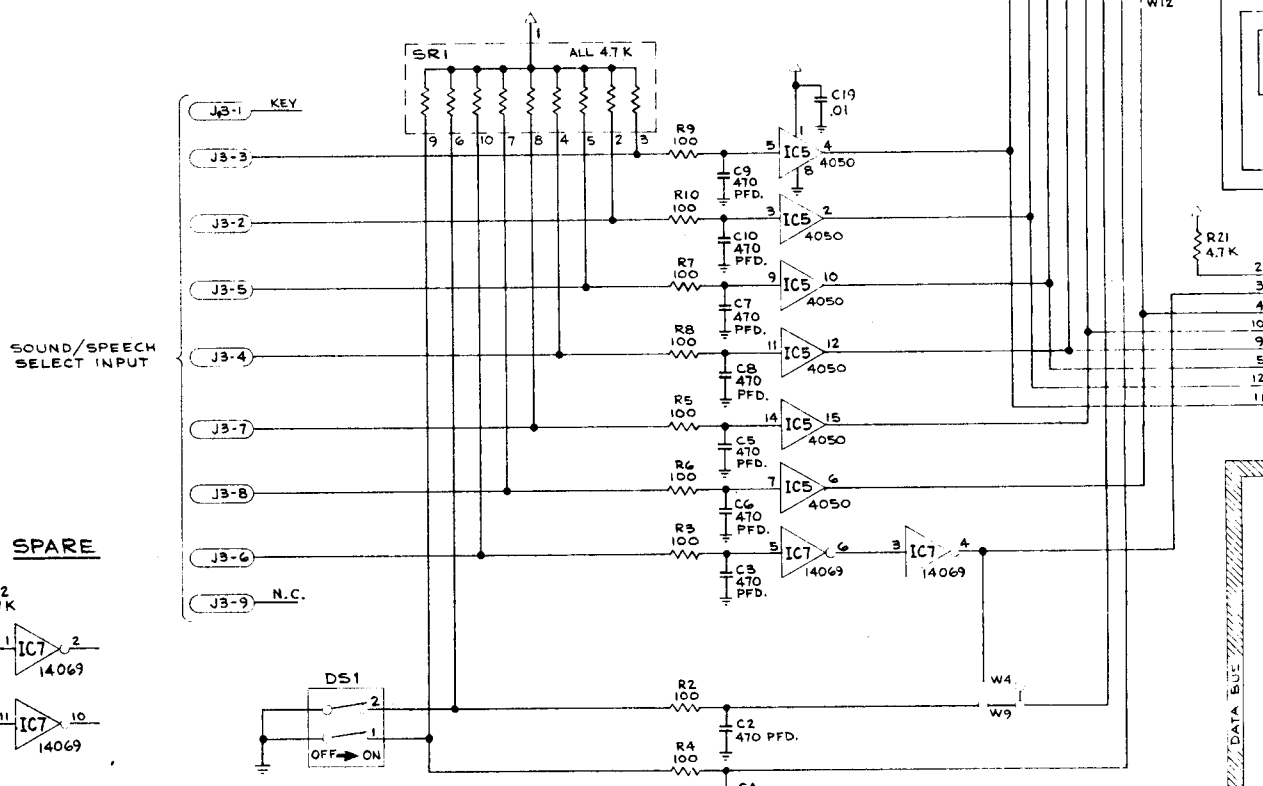
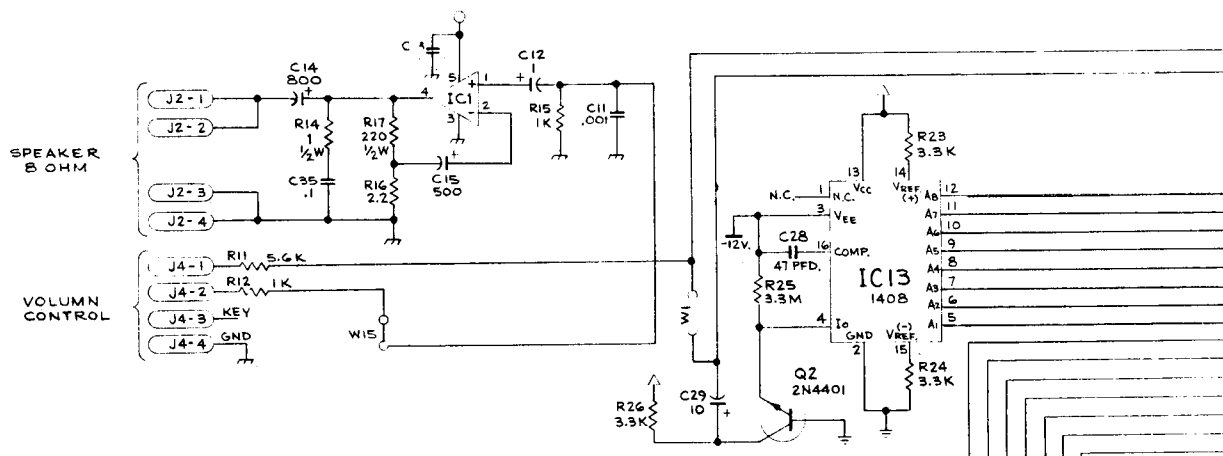
**NOTES:**

- USE THERMAL COMPOUND BETWEEN IC'S AND HEAT SINK.
- CAUTION: AVOID STATIC DISCHARGE DAMAGE TO MOS LOGIC.
- SYMBOLS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY. DO NOT SCREEN OR STAMP.
- OBSERVE INDEX MARK OF ALL INTEGRATED CIRCUITS, DIODES, DI, D2, AND ZR1.
- CAPACITORS C12, C14, C15, C25, C27, C28, C27.
- CONNECTORS 10J1, 10J2, 10J3, 10J4, 10J5.
- POSITION OF TRANSISTORS Q2, Q3, Q4.
- DS1 - 1 SELECTS SOUNDS/NOTES
- 2 SELECTS SPEECH/NO SPEECH (W9/W1)
- W1 - SPEECH MODULE STATUS
- IN - SPEECH MODULE NOT ATTACHED
- OUT - SPEECH MODULE ATTACHED
- W14 - MPU INTERNAL RAM ENABLE
- W7 & W8 - MEMORY MAP CONTROL
- W12 & W13 - PB7 STATUS CONTROL (W13 NEVER USED)
- W4 & W9 - PB5 STATUS CONTROL
6. SOLDERED ON TOP OF BOARD
- INSTALL THESE JUMPERS FOR FOLLOWING GAMES:
- W15, W6, W12, W4, W1, W3, W5, W11 FOR:
  - WORLD CUP
  - DISCO FEVER
  - CONTACT
  - POKER/NO
  - PHOENIX
  - ARISTOCRAT SHUFFLE
  - POMPLI SHUFFLE
  - KING TUT SHUFFLE
  - TAGURUS SHUFFLE
- W15, W9, W12, W4, W1, W2, W3, W10, FOR:
  - FLASH
  - STELLAR WARS
  - TRI ZONE
  - TIME WARP
- W7, W15, W9, W1, (SEE NOTE #5) W2, W5, W10 FOR:
  - GORGAR
  - SOUND ROM 2 - JT-4950
- NOTE SELECTION STRAPPING:
 

(2K x 8)	(8K x 8)	(32 x 8)
W2	W3	W3
47 IN	W3 47 IN	W3 47 IN
47	47	W11



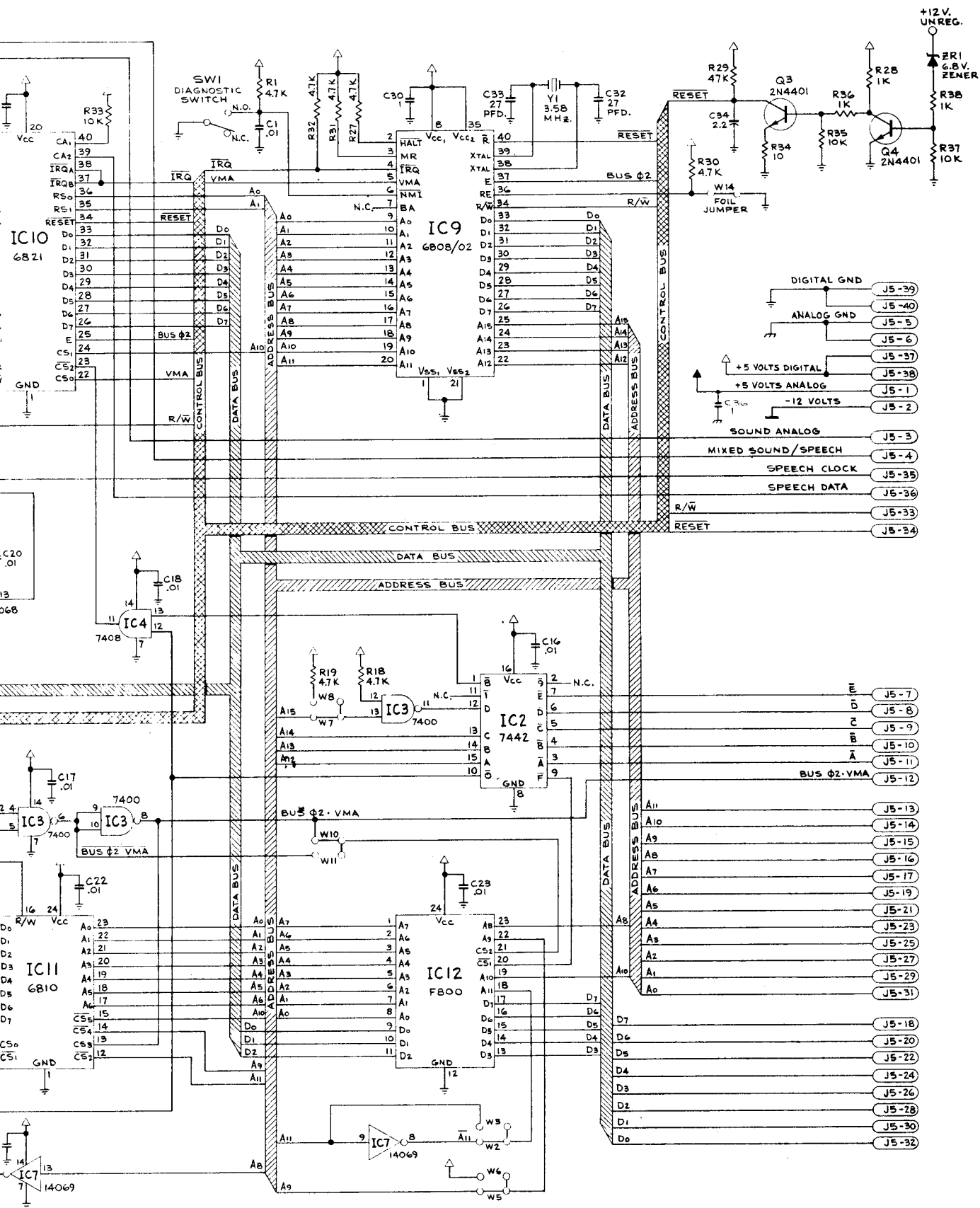
TOLERANCES		QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED:	FRACTIONAL	±.004"	WILLIAMS ELECTRONICS, INC.
	DECIMAL	±.005"	MEMBER OF THE HERBOLD COS.
	HOLE DIA.	±.002 - .000"	3401 N. CALIFORNIA - CHICAGO, ILL. 60618
	ANGULAR	±1/8°	287-2520
	CONCENTRICITY	±.005"	NAME
	SCREW THREADS	CLASS 2	SOUND BOARD SUB-ASSEM
	MATERIAL	HEAT TREATMENT	FINISH
DATE	APP'D.	SCALE	D-8223
9/23/79	W/10/79	2:1	



- NOTES:**
1. ALL RESISTORS, 1/4 WATT UNLESS OTHERWISE NOTED.
  2. ALL CAPACITORS, MFD. UNLESS OTHERWISE NOTED.







D8224 Sound Board Logic Diagram

