

Williams[®]

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

DEFENDER



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Williams[®] 
ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618
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SPECIAL NOTES

CPU/Video Board

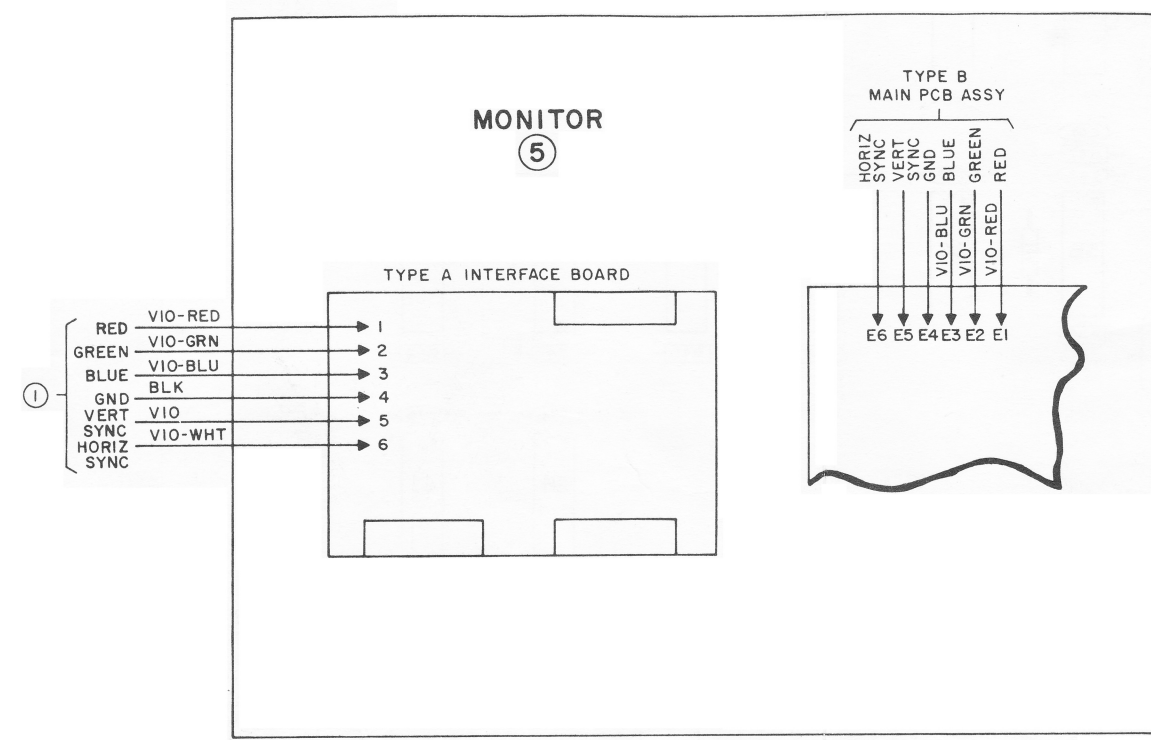
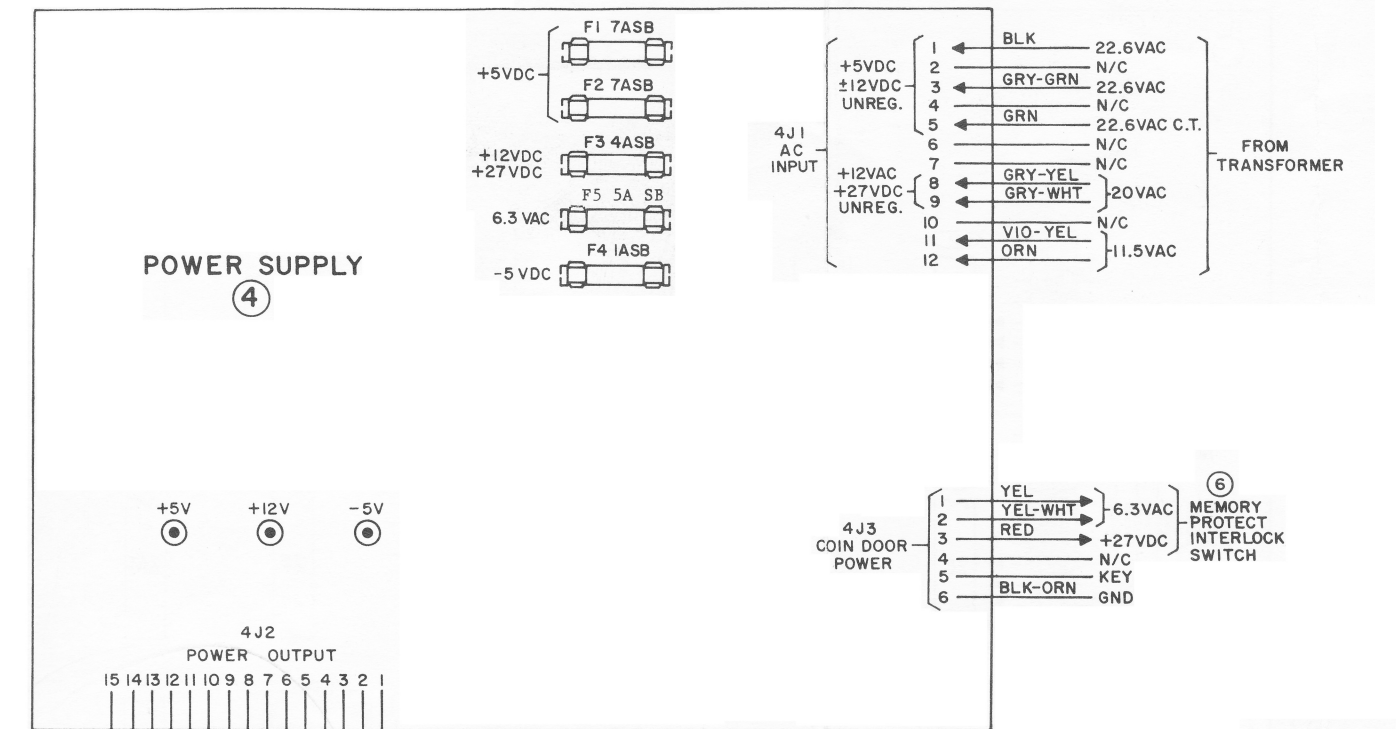
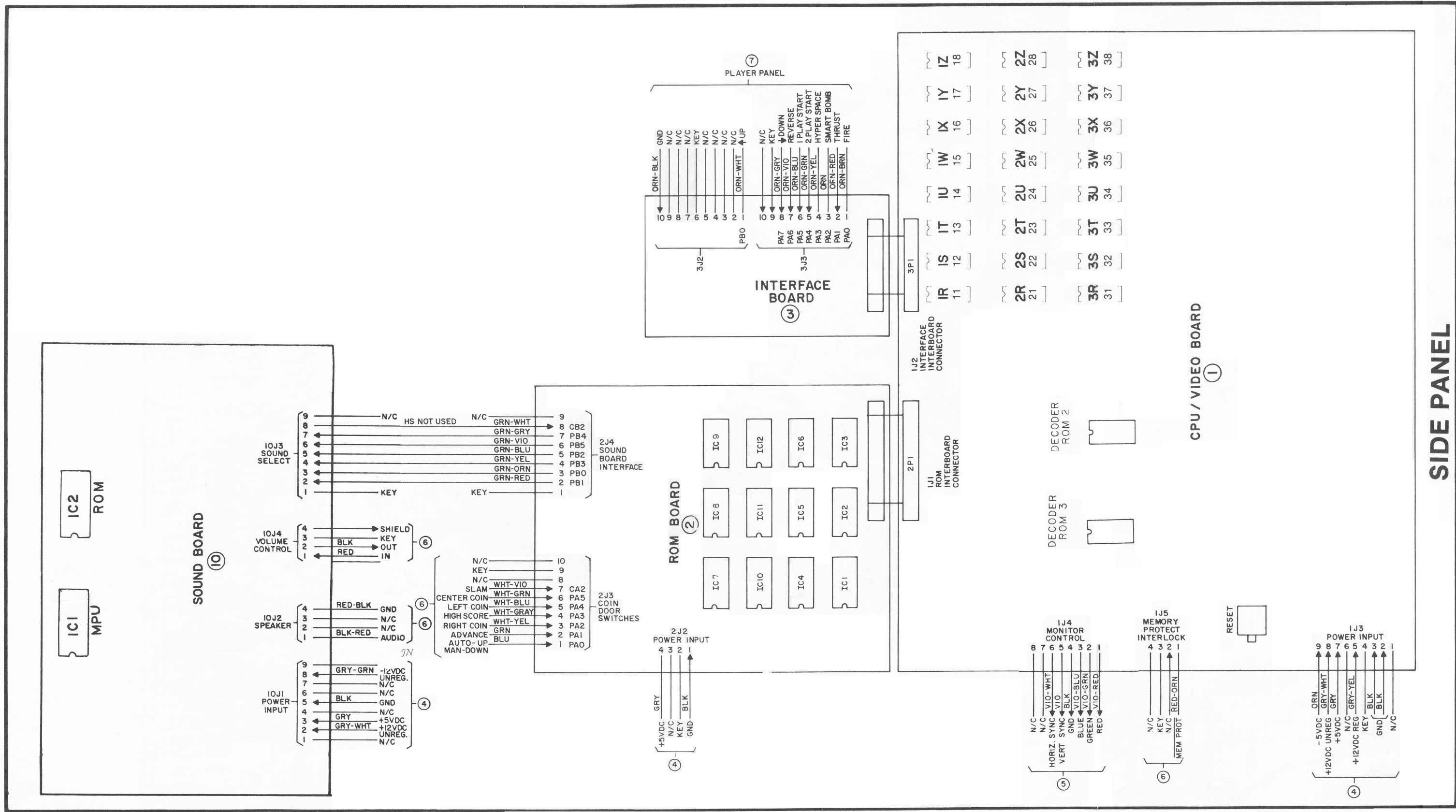
Requires Decoder ROM 2 at location 3K and Decoder ROM 3 at location 3E.

Interface Board

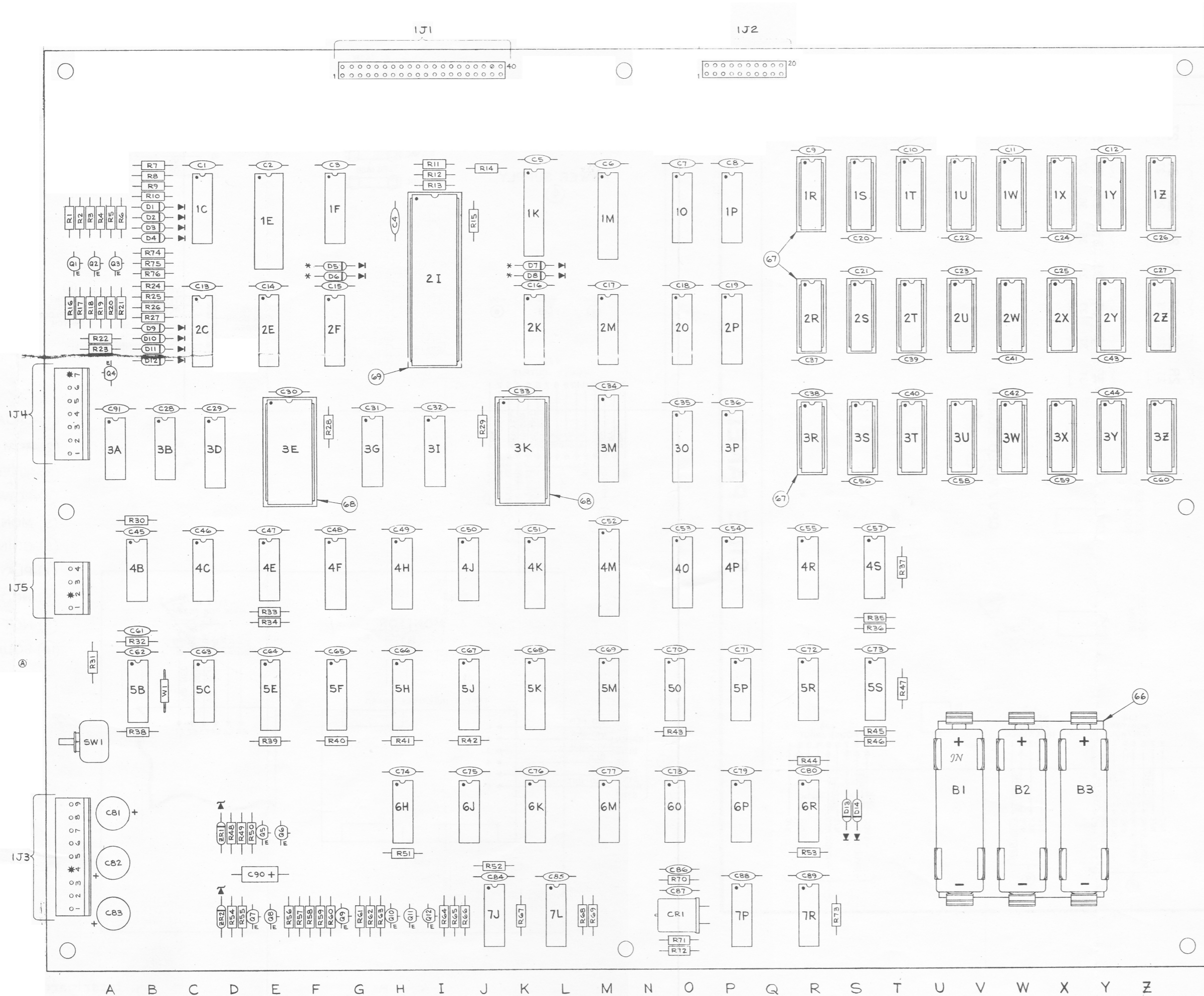
Jumper W1 must be installed. If red-labeled ROMS are not used, W2 must be removed.

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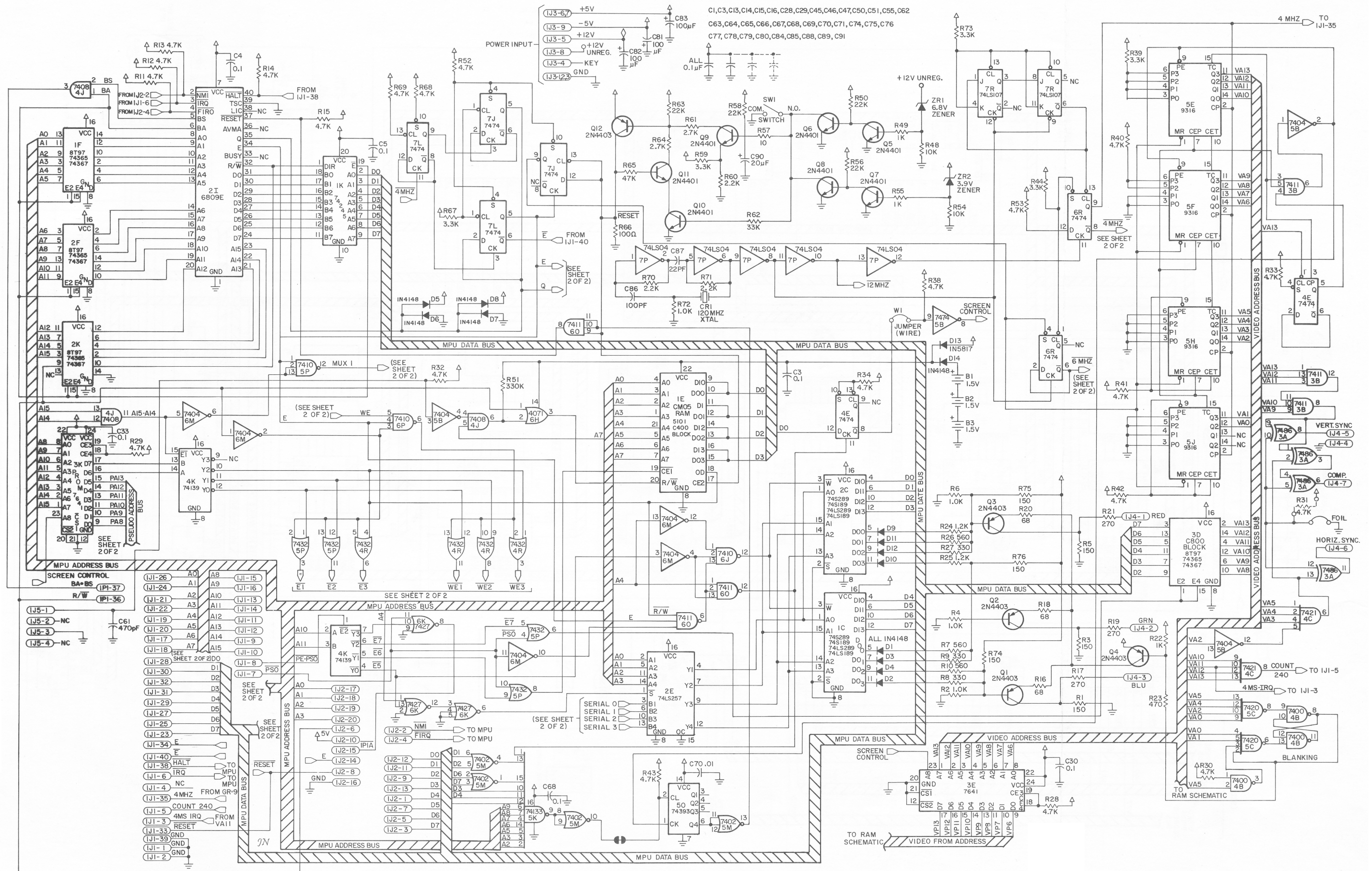
- ①-CPU/VIDEO BOARD
- ②-ROM BOARD
- ③-INTERFACE BOARD
- ④-POWER SUPPLY
- ⑤-MONITOR
- ⑥-COIN DOOR
- ⑦-PLAYER PANEL
- ⑧-HOOD
- ⑨-NOT USED
- ⑩-SOUND BOARD



NOTES:

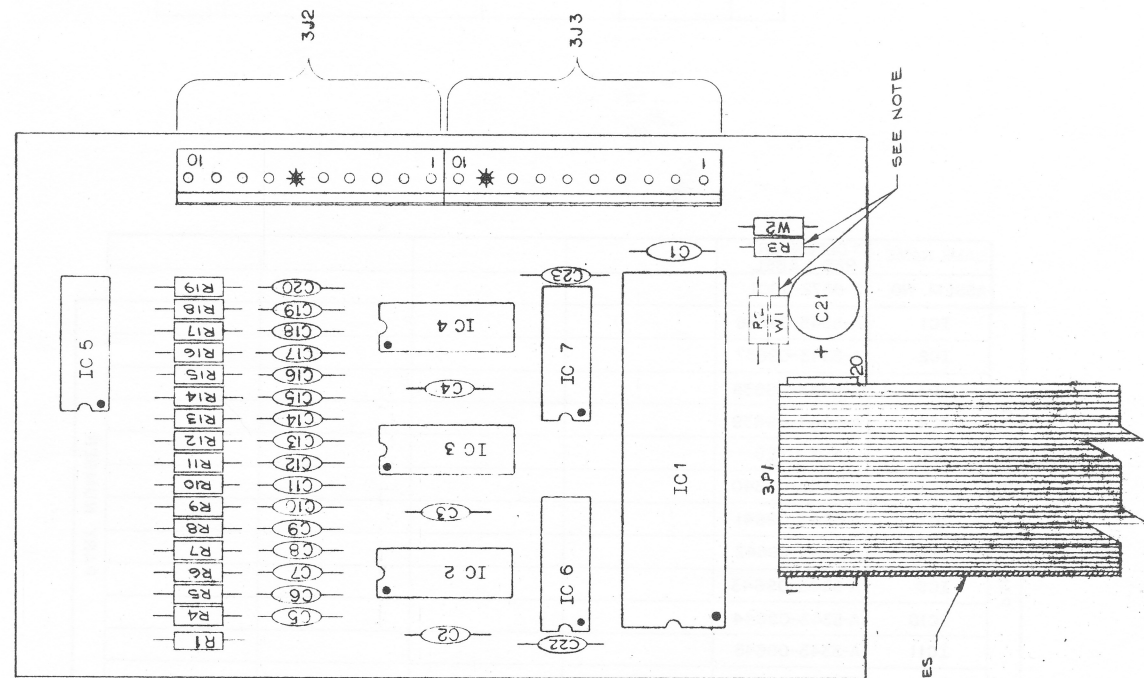
1. 411G: 1R, 1S, 1T, 1U, 1V, 1X, 1Y, 1Z, 2R, 2S, 2T, 2U, 2V, 2X, 2Y, 2Z, 3R, 3S, 3T, 3U, 3V, 3X, 3Y, 3Z
2. 27K RESISTORS:
R1, R2, R3, R4, R5, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R40, R41, R42, R43, R45, R46, R47, R52, R59, R66, R67
3. 1 MED. CAPACITORS:
C1, C2, C3, C4, C5, C6, C7, 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, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C84, C85, C86, C89, C91

BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
1	5770-09616-00	---	BARE P.C. BOARD	1
2	5280-09478-00	4B	7400 QUAD 2-INPUT NAND	1
3	5280-09478-00	5M	7402 QUAD 2-INPUT NOR	1
4	5281-09115-00	7P	74LS04 HEX. INVERTER	1
5	5280-09478-00	5B, 6M	7404 HEX. INVERTER	2
6	5280-09478-00	4J	7408 QUAD AND	1
7	5280-09011-00	6J, 6P	7410 TRIPLE 3-INPUT NAND	2
8	5280-09478-00	3B, 6D	7411 TRIPLE 3-INPUT AND	2
9	5280-09478-00	5C	7420 DUAL 4-INPUT NAND	1
10	5280-09478-00	4C	7421 DUAL 4-INPUT AND	1
11	5280-09477-00	4R, 5P	7452 QUAD 2-INPUT OR	2
12	5280-09478-00	4E, 6R, 7J, 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 74LS107 JK FLIP-FLOP	1
15	5281-09482-00	5K	74LS193 74LS193 8-BIT UP/DN COUNTER	1
16	5281-09484-00	4K	74LS199 DUAL 2 to 4 LINE DECODER	1
17	5280-09481-00	30, 31, 4F, 4H	74185 30, 31, 4F, 4H 8-BIT COMPARATOR	4
18	5280-09482-00	10, 20, 30, 40	74188 10, 20, 30, 40 8-BIT SHIFT REGISTER	5
19	5281-09483-00	1C, 2C	74LS199 or 74LS199 of 74LS199 16K4 RAM	2
20	5281-09485-00	1K	74LS245 74LS245 OCTAL BUS TRANSCEIVER	1
21	5281-09485-00	2E, 2M	74LS257 74LS257 QUAD DATA MUXPK.	2
22	5280-09489-00	1F, 2F	8T HEX. 15 BUFFER	4
23	5281-09485-00	2K, 3D	74LS261 74LS261 HEX. BUS DRIVER	4
24	5281-09485-00	1M, 3M, 4M	74LS274 74LS274 DUAL D-TYPE FLIP-FLOP	3
25	5281-09487-00	4S, 5S	74LS274 74LS274 DUAL D-TYPE FLIP-FLOP	2
26	5281-09487-00	5Q	74LS293 74LS293 DUAL 4-BIT BIN. COUNTER	1
27	5280-09487-00	6H	74LS293 74LS293 DUAL 4-BIT BIN. COUNTER	1
28	5280-09488-00	SEE NOTE #1	7416 (ASO RS ACCESS) 16 K x 1 DYNAMIC RAM	24
29	5280-09489-00	1E	9101 256 K x 4 CMOS RAM	1
30	5280-09489-00	5E, 5F, 5H, 5J	9516 4-BIT BIN. COUNTER	4
31	5400-09490-00	2I	6809E MICROPROCESSOR	1
32	5280-09491-00	6K	TRIPLE 3-INPUT ORNOR LATCH	1
33	5010-09495-00	R16, R18, R20	68 OHM 2% 1/4 W.	3
34	5010-09495-00	R66	RESISTOR, C.F. 100 OHM 5% 1/4 W.	1
35	5010-09495-00	R1, R3, R5, R7, R9, R11, R13, R15, R17, R19, R21	RESISTOR, C.F. 150 OHM 5% 1/4 W.	6
36	5010-09495-00	R23	RESISTOR, C.F. 470 OHM 5% 1/4 W.	1
37	5010-09495-00	R7, R10, R26	RESISTOR, C.F. 560 OHM 5% 1/4 W.	3
38	5010-09495-00	R2, R4, R6, R12, R14, R16, R22	RESISTOR, C.F. 1K OHM 5% 1/4 W.	7
39	5010-09495-00	R24, R25	RESISTOR, C.F. 12K OHM 5% 1/4 W.	2
40	5010-09495-00	R60, R70, R71	RESISTOR, C.F. 2.2K OHM 5% 1/4 W.	3
41	5010-09495-00	R61, R64	RESISTOR, C.F. 2.7K OHM 5% 1/4 W.	2
42	5010-09495-00	R33, R44, R49, R51, R53	RESISTOR, C.F. 3.3K OHM 5% 1/4 W.	5
43	5010-09495-00	SEE NOTE #2	RESISTOR, C.F. 4.7K OHM 5% 1/4 W.	27
44	5010-09495-00	R48, R54	RESISTOR, C.F. 10K OHM 5% 1/4 W.	2
45	5010-09495-00	R50, R56, R58, R65	RESISTOR, C.F. 22K OHM 5% 1/4 W.	4
46	5010-09495-00	R62	RESISTOR, C.F. 33K OHM 5% 1/4 W.	1
47	5010-09495-00	R65	RESISTOR, C.F. 47K OHM 5% 1/4 W.	1
48	5010-09495-00	R51	RESISTOR, C.F. 330K OHM 5% 1/4 W.	1
49	5010-09495-00	R6, R9, R17	RESISTOR, C.F. 330 OHM 5% 1/4 W.	3
50	5010-09495-00	R87	RESISTOR, C.F. 10 OHM 5% 1/4 W.	1
51	5043-09491-00	C87	CAPACITOR, AXIAL 22 PFD. 1K V. 20%	1
52	5043-09492-00	C86	CAPACITOR, AXIAL 100 PFD. 50 V. 50%	1
53	5043-09495-00	C90	CAPACITOR, AXIAL 22 MFD. 10 V. 20%	1
54	5043-09495-00	C61	CAPACITOR, AXIAL 470 PFD. 50 V. 50%	1
55	5043-09496-00	SEE NOTE #3	CAPACITOR, AXIAL 1 MFD. 50 V. 20%	84
56	5040-09421-00	C81, C82, C88	CAPACITOR, RADIAL 100 MFD. 25 V. 10+10%	3
57	5076-09499-00	BR2	IN990CA 8.5V. ZENER DIODE	1
58	5076-09499-00	BR1	IN990CA 8.5V. ZENER DIODE	1
59	5070-09499-00	SEE NOTE #4	1N4148 DO-18 SILICON	13
60	5070-09499-00	D13	1N5817 10-92 INSBT DIODE, SILICON	1
61	5100-09499-00	2N4401, 2N4401, 2N4401	2N4401 TO-18 TRANSISTOR, NPN	7
62	5100-09499-00	2N4401, 2N4401, 2N4401	2N4401 TO-18 TRANSISTOR, PNP	5
63	5225-09499-00	CR1	12 MHz CRYSTAL	1
64	5641-09499-00	SW1	PUSH BUTTON SW. (MOMENTARY ON)	1
65	5880-09499-00	B1, B2, B3	BATTERY ALKALINE 1.5V. (AA)	3
66	5881-09499-00	---	BATTERY HOLDER #111	1
67	5700-09499-00	---	16-PIN IC SOCKET	24
68	5700-09499-00	---	24-PIN IC SOCKET	2
69	5700-09499-00	---	40-PIN IC SOCKET	1
70	5791-09499-00	IP4	20 PIN RIBBON CABLE HEADER	1
71	5791-09499-00	IP1	40 PIN RIBBON CABLE HEADER	1
72	---	---	---	---
73	5791-09499-00	IP5	4 PIN HEADER 09-45-1041	1
74	5791-09499-00	IP2	7 PIN HEADER 09-45-1071	1
75	5791-09499-00	IP3	9 PIN HEADER 09-45-1091	1



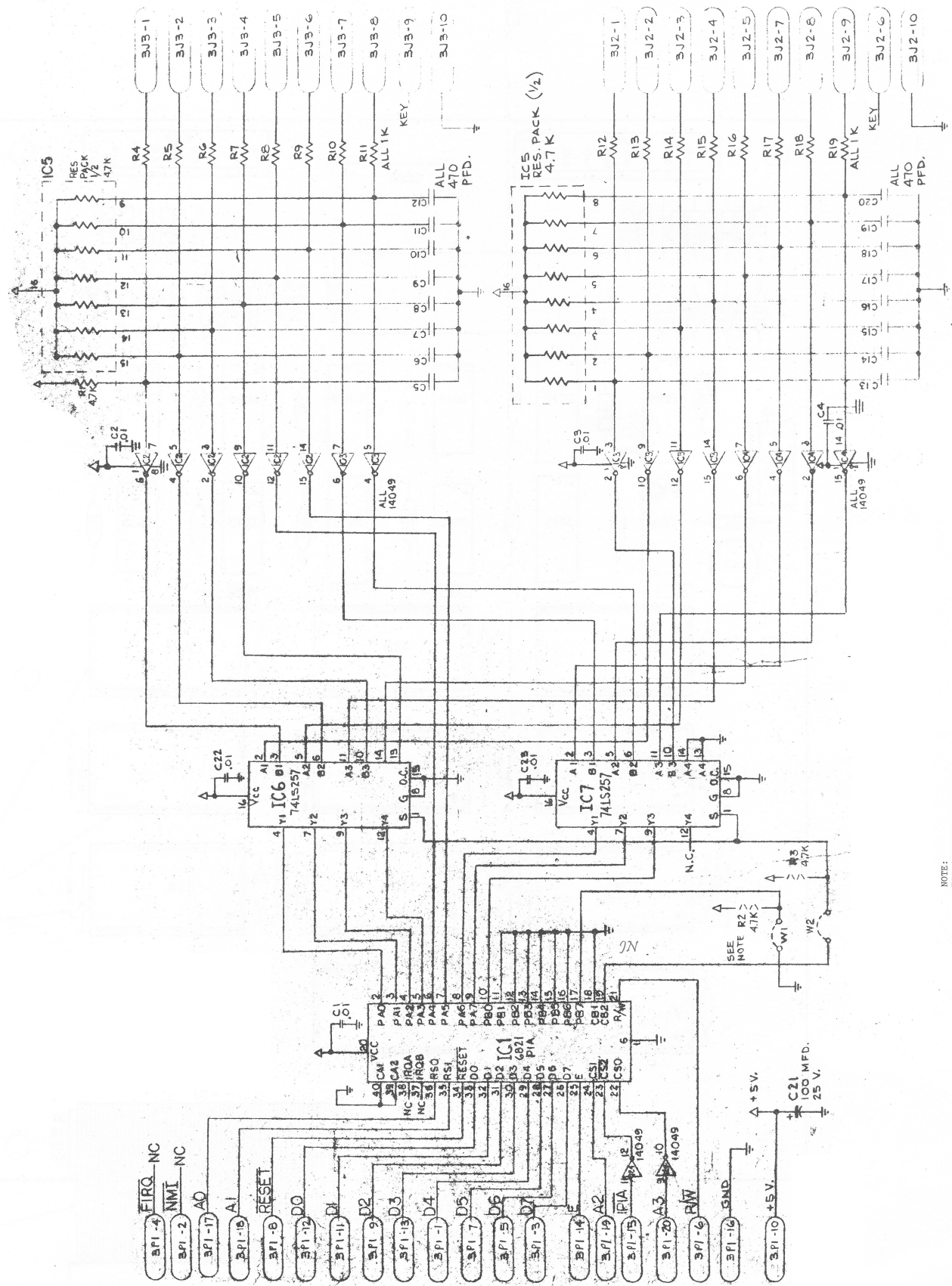
R8570 CPU/Video Board Logic Diagram
(Sheet 1 of 2)

BILL OF MATERIALS				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	NO REQD
1	5172-09514-00	BNRD	P.C. BOARD	1
2	5310-08715-00	IC2 IC3 IC4	4049 CMOS HEX INVERTER	3
3	09239-00	IC5	47K 1/2 15RES 16PINDIP PACK	1
4	5281-00485-00	IC6 IC7	74LS257 QUAD DATA MULTIPLEXER	2
5	08991-00	R1, R2, R3	RESISTOR, 5%, 1/4 WATT	3
6	5010-09858-00	R4 THRU R9	RESISTOR, F.C., 1/4 WATT	16
7	09405-00	C5 THRU C20	CAPACITOR, CERAMIC	16
8	5040-09421-00	C21	100 MFD. 25 VOLT, +50% TOL. ELECTROLYTIC RAD.	1
9	5043-09580-00	C4, C22, C23	CAPACITOR, CERAMIC DISC, 0.1 MFD. 50 V. +50%	6
10	09444-00	3J2, 3J3	20 PIN HEADER 09-65-1101	2
11	5795-04190-00	3P1	20 PIN RIBBON CABLE Assy	1
12	09702-00	IC1	6821 PIA	1
13	09557-00	W1, W2	0 Ω RESISTOR	2

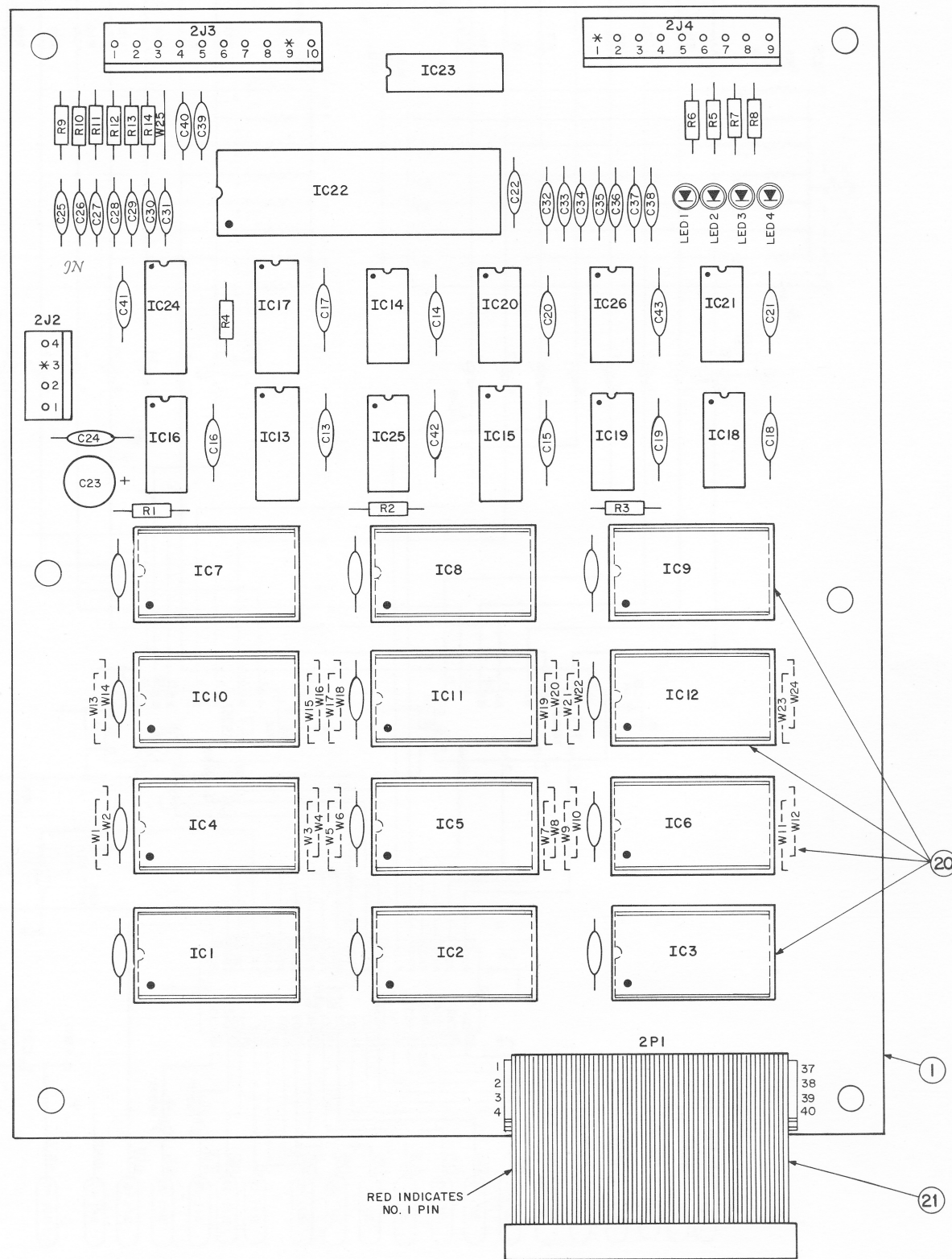


NOTE:
FOR COCKTAIL TABLE GAMES, W2 MUST BE CONNECTED AND W1 MUST BE REMOVED.
FOR UPRIGHT GAMES, W1 MUST BE CONNECTED, WITH RED-LABELLED RONS, W2 MAY BE CONNECTED OR REMOVED, WITH LABELS OF OTHER COLORS, W2 MUST BE REMOVED.

RED INDICATES PIN NO. 1

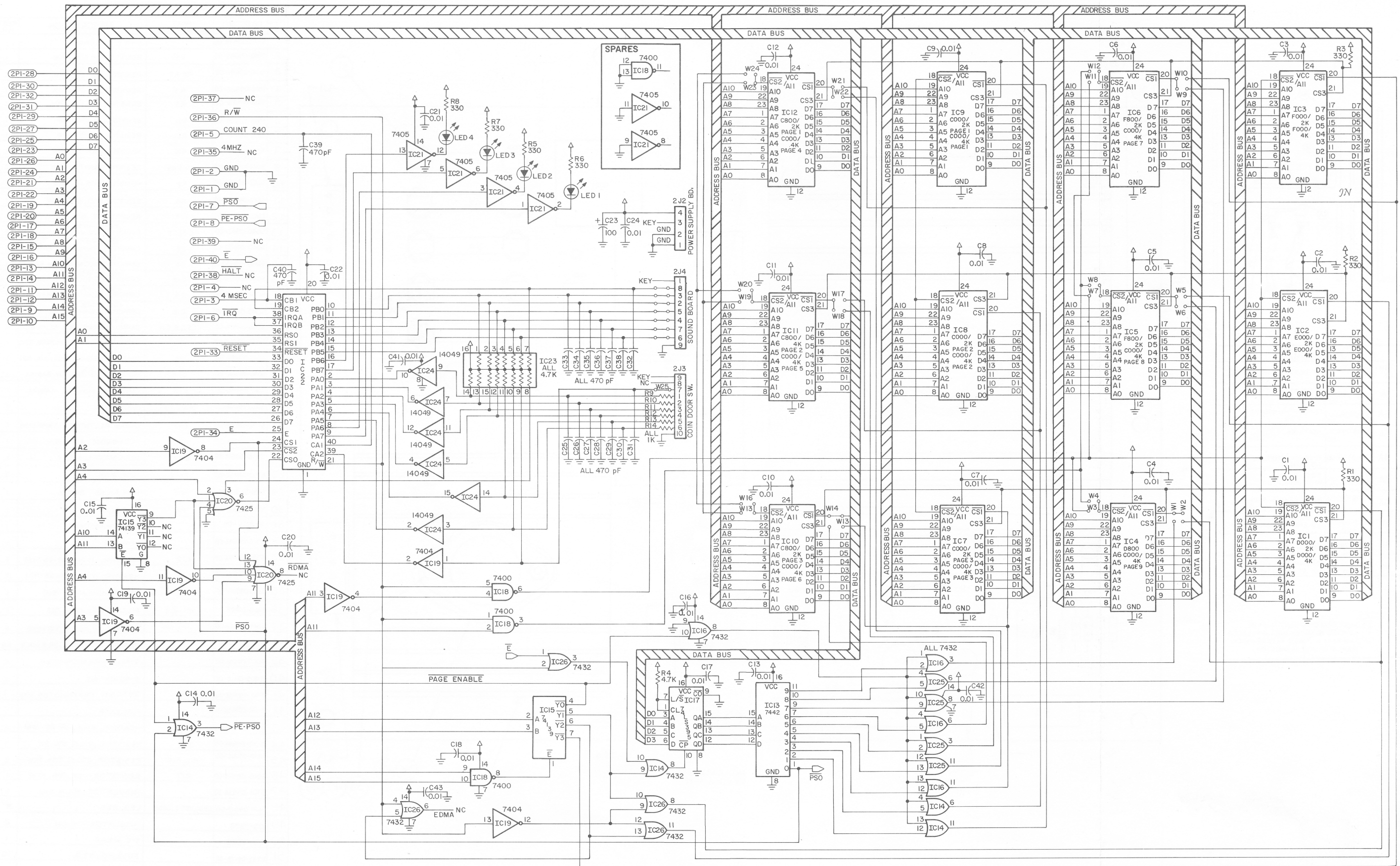


NOTE:
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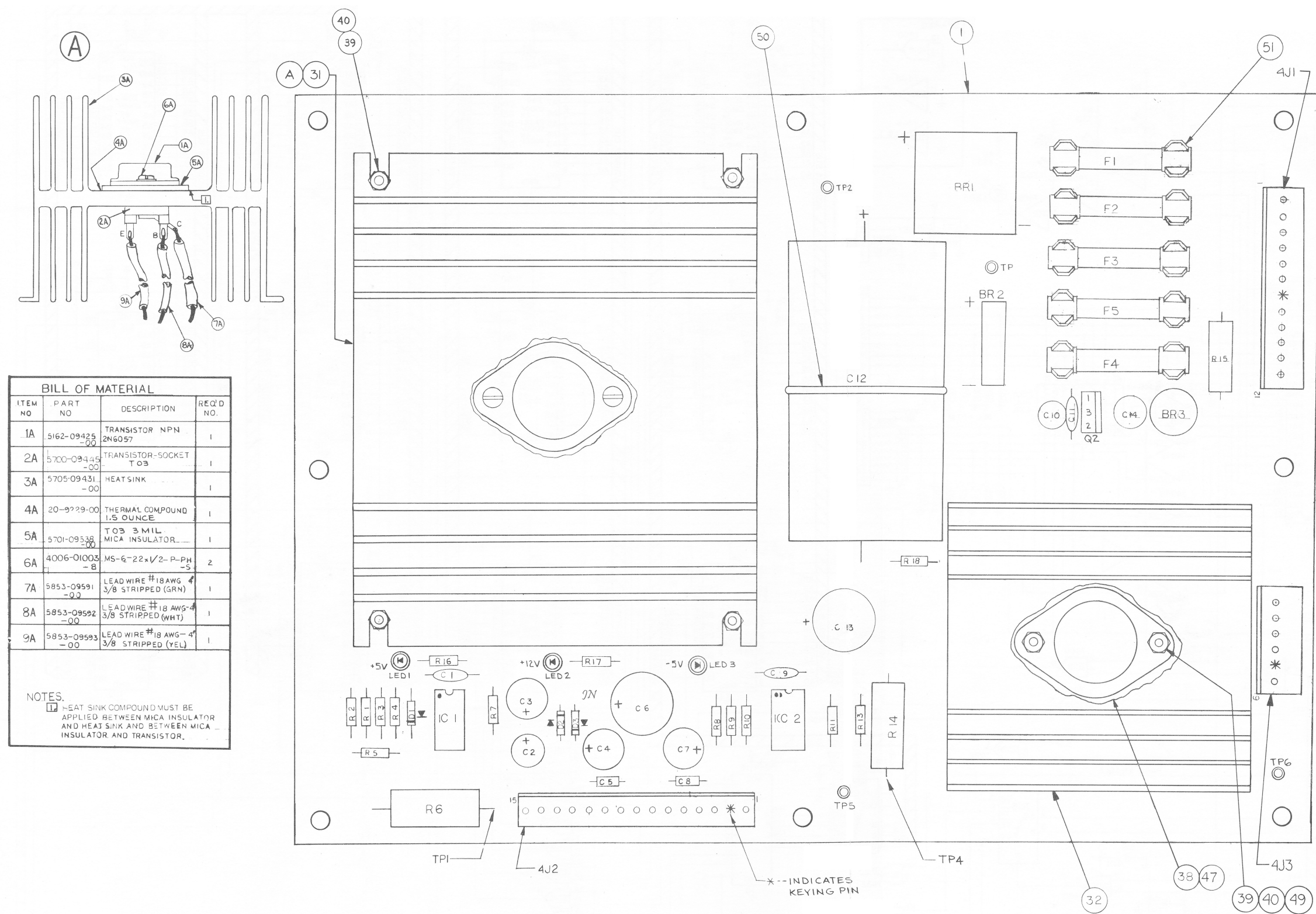
BILL OF MATERIALS				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO
1	5771-09615-00		BARE P.C. BOARD	1
2	5280-09012-00	IC13	7442 BCD DECODER	1
3	5280-09477-00	IC4,IC16,IC25,IC26	7432 QUAD 2-INPUT OR GATE	4
4	5281-09246-00	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
5	5281-09501-00	IC17	74LS395 4-BIT UNIVERSAL SHIFT REG.	1
6	5280-09073-00	IC18	7400 QUAD 2 INPUT NAND	1
7	5280-09013-00	IC19	7404 HEX. INVERTERS	1
8	5280-09551-00	IC20	7425 DUAL 4 INPUT NOR GATES WITH STROBE	1
9	5280-08949-00	IC21	7405 HEX INVERTERS WITH OPEN-COLLECTOR OUTPUTS.	1
10	5430-08972-00	IC22	MC6821 P1A	1
11	5019-09239-00	IC23	4.7K 15 RES. 16 PIN DIP PACK	1
12	5671-09019-00	LED1 THRU LED4	LED RED	4
13	5010-09001-00	R1 THRU R3	RESISTOR, FC, 330 OHM 5% 1/4 W	7
14	5010-08991-00	R4	RESISTOR, FC, 4.7K OHM 5% 1/4 W	1
15				
16	5043-08980-00	C1 THRU C16, C18 THRU C22, C41-C43	CAP. CERAMIC 0.01 MFD. 50V	24
17	5040-09421-00	C23	CAP. ELECT., 100MFD. 25V	1
18	5043-08996-00	C24	CAP. CERAMIC 0.1 MFD	1
19	5043-09065-00	C17, C25 THRU C28	CAP. CERAMIC, 470 PFD. 50V AXIAL	17
20	5700-09004-00		24 PIN IC SOCKET	12
21	5795-09611-00	2P1	40 PIN RIBBON CABLE ASS'Y. 5"	1
22	5791-09028-00	2J2	4 PIN MALE CONNECTOR 09-65-1041	1
23	5791-09444-00	2J3	10 PIN MALE CONNECTOR 09-65-1101	1
24	5791-09027-00	2J4	9 PIN MALE CONNECTOR 09-65-1091	1
25	5310-08975-00	IC24	4049 INVERTING HEX. BUFFER	1
26	5010-09358-00	R9 THRU R14	RESISTOR, FC, 1K OHM 5% 1/4 W	6
27	5010-09534-00	W1 THRU W25	RESISTOR, FC, 0 OHM	AS REQ'D
28	SEE CHART	IC1 THRU IC12 SEE CHART	SEE CHART	AS REQ'D

GAME NAME	"DEFENDER" RED LABEL			
ASSEM. NO.	D-8572-3001			
IC1	A-5343-09636			
IC2	A-5343-09637			
IC3	A-5343-09638			
IC4	A-5343-09639			
IC5	NOT USED			
IC6	A-5343-09640			
IC7	A-5343-09641			
IC8	A-5343-09642			
IC9	A-5343-09643			
IC10	A-5343-09644			
IC11	A-5343-09645			
IC12	A-5343-09646			
JUMPERS	W2, W4, W6, W7, W9, W11, W13, W16, W17, W20, W21, W24			



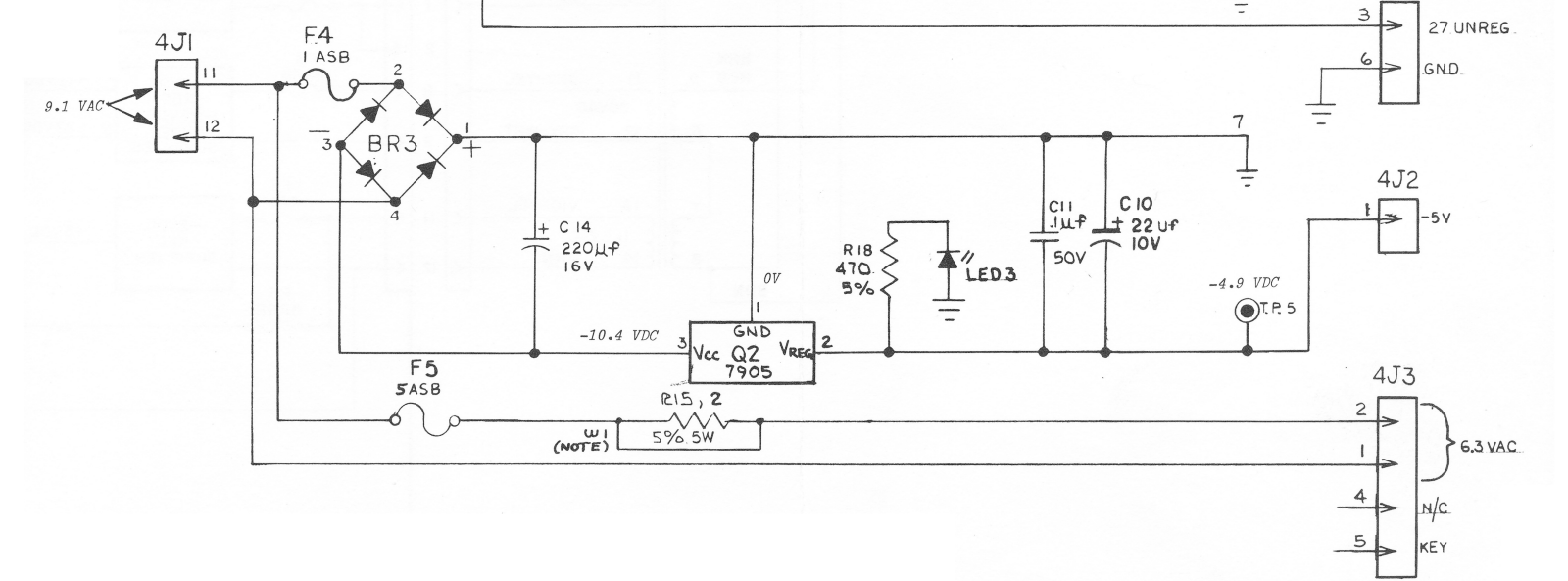
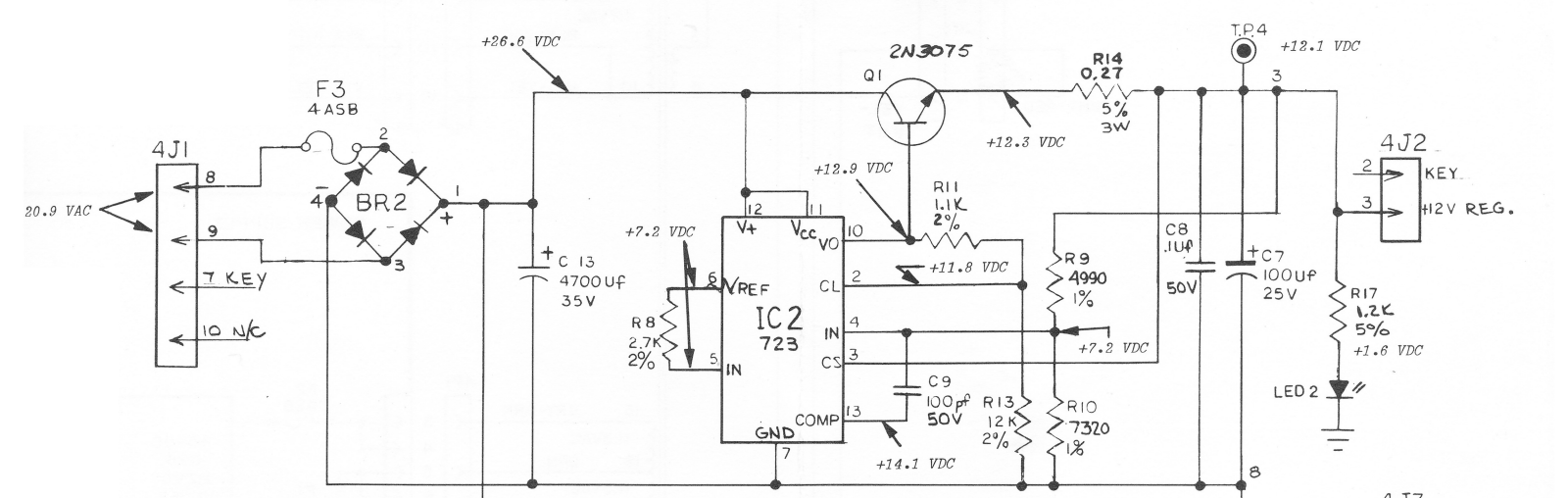
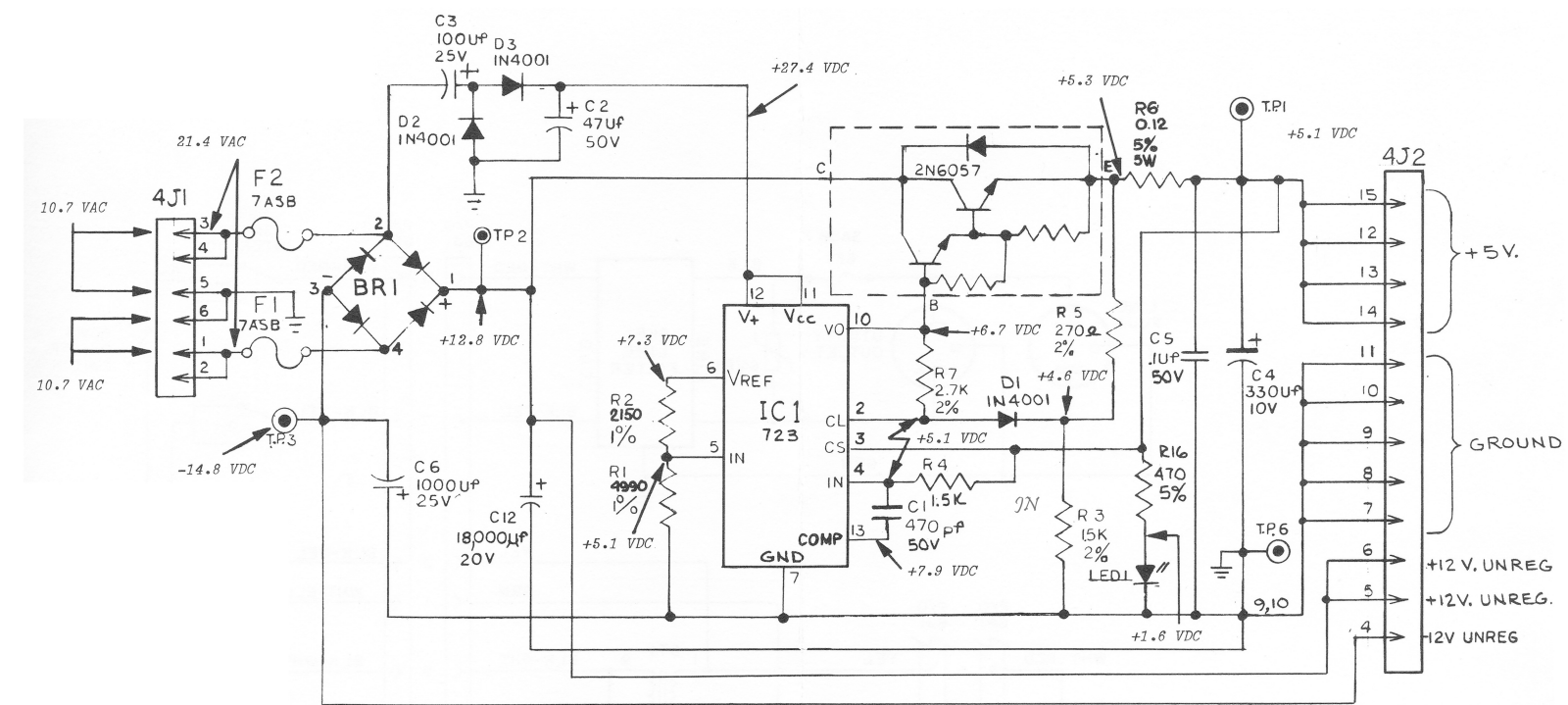
D8572 ROM Board Logic Diagram

BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5113-09414-00		P.B. BARE P.C. BOARD	1
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, 1000MFD, 20V, RADIAL	1
17	5040-09423-00	C4	CAPACITOR, 330MFD, 10V, RADIAL	1
18	5040-09504-00	C13	CAPACITOR, 4700MFD, 35V, RADIAL	1
19	5043-08996-00	C5, C8, C11	CAPACITOR, 1MFD, 50V, AXIAL ±5%	3
20	5043-09065-00	C1	CAPACITOR, 470PFD, 50V, AXIAL X7R ±5%	1
21	5043-09492-00	C9	CAPACITOR, 100PFD, 50V, AXIAL S2L ±5%	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, IN4001	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	5731-09432-00	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	8-8416-00		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	44005-011051-07		5-40x7/16 RH. MECH. SCREW	6
40	44005-01112-00		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	5732-09178-00		FUSEHOLDER	10

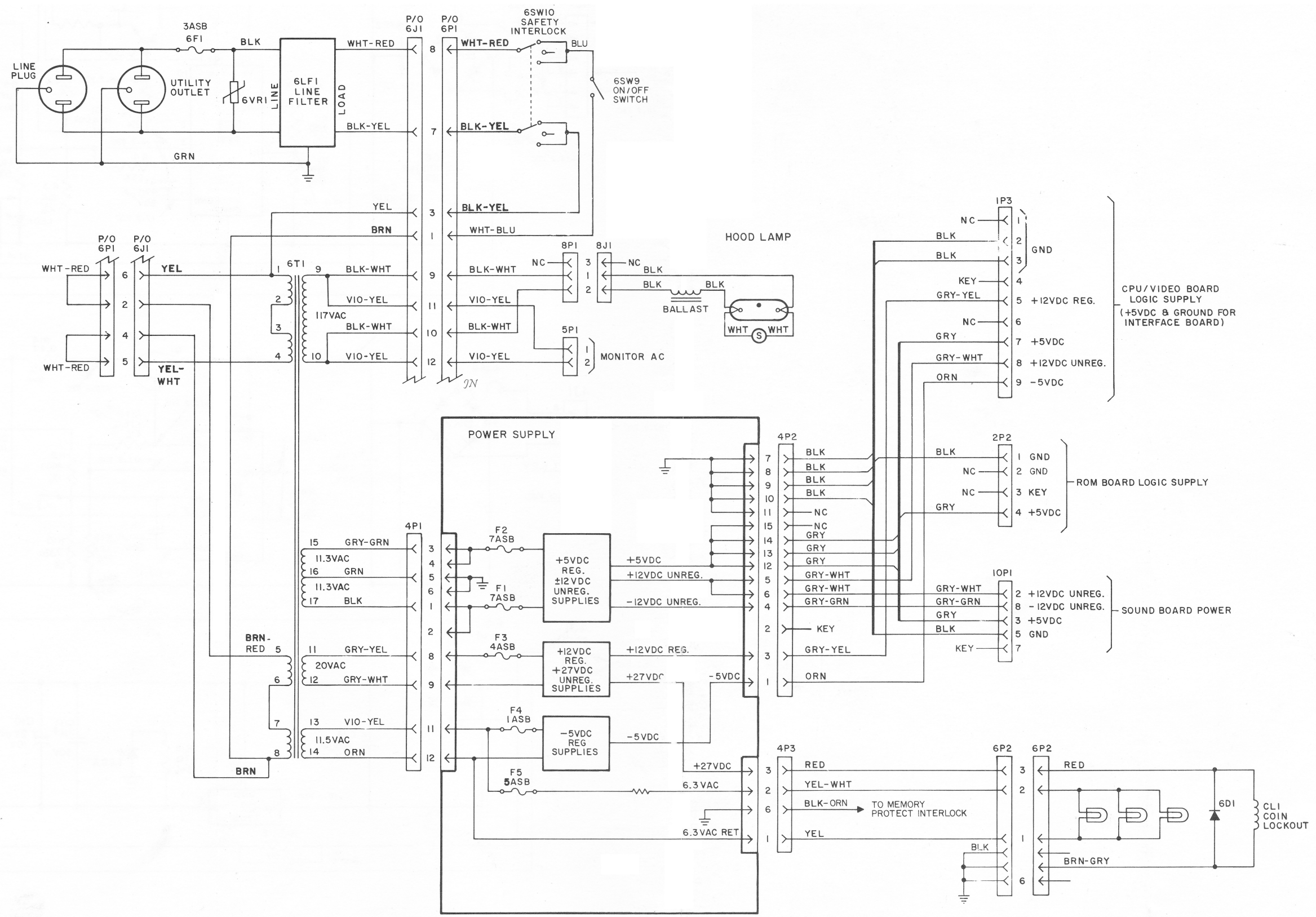


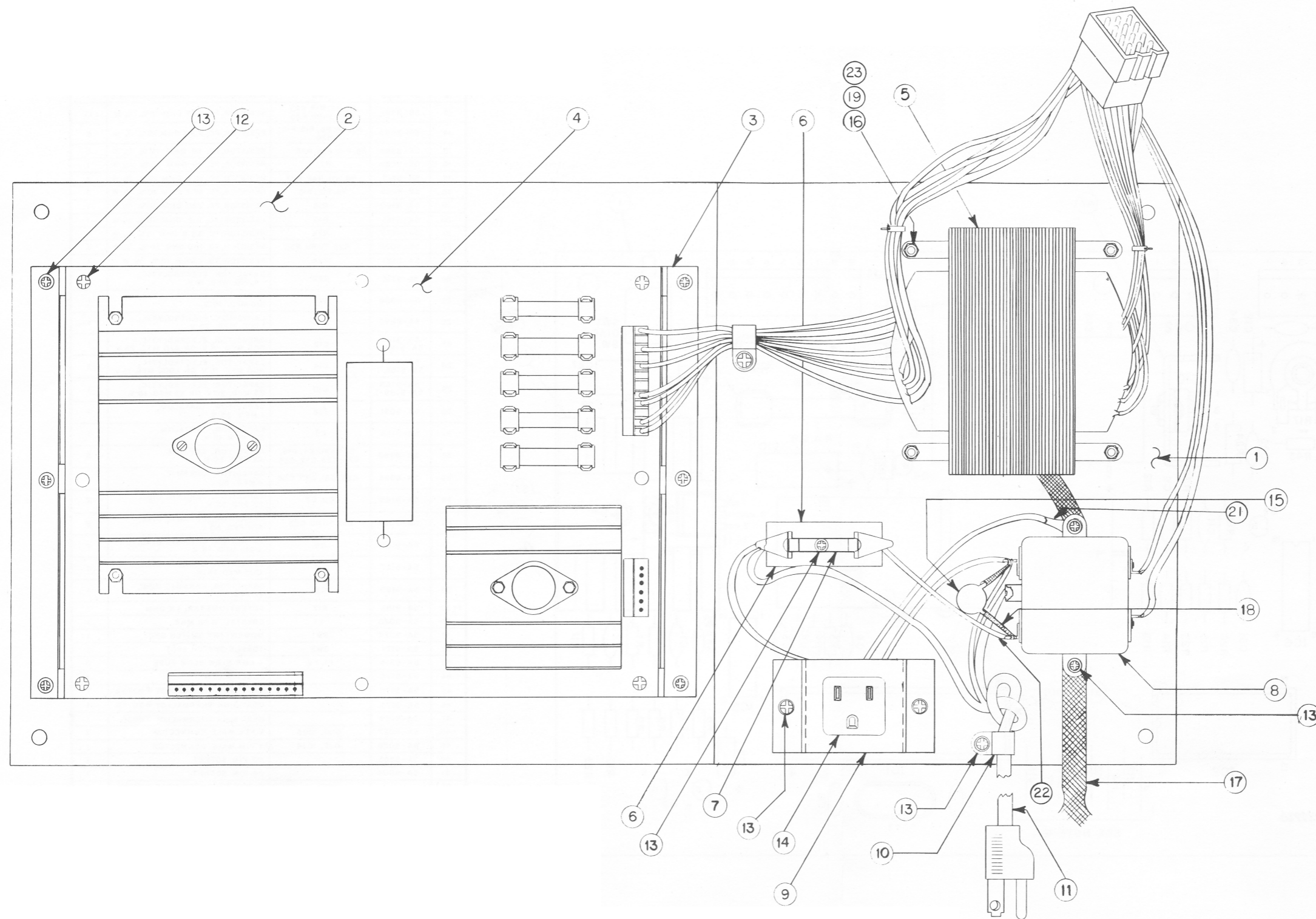
BILL OF MATERIAL			
ITEM NO.	PART NO.	DESCRIPTION	REQ'D NO.
1A	5162-09425-00	TRANSISTOR NPN 2N6057	1
2A	5700-09445-00	TRANSISTOR-SOCKET T03	1
3A	5705-09431-00	HEAT SINK	1
4A	20-9229-00	THERMAL COMPOUND 1.5 OUNCE	1
5A	5701-09538-00	T03 3 MIL MICA INSULATOR	1
6A	4006-01005-B	MS-6-22x1/2-P-PH-5	2
7A	5853-09591-00	LEAD WIRE #18AWG 3/8 STRIPPED (GRN)	1
8A	5853-09592-00	LEAD WIRE #18 AWG 3/8 STRIPPED (WHT)	1
9A	5853-09593-00	LEAD WIRE #18 AWG 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.



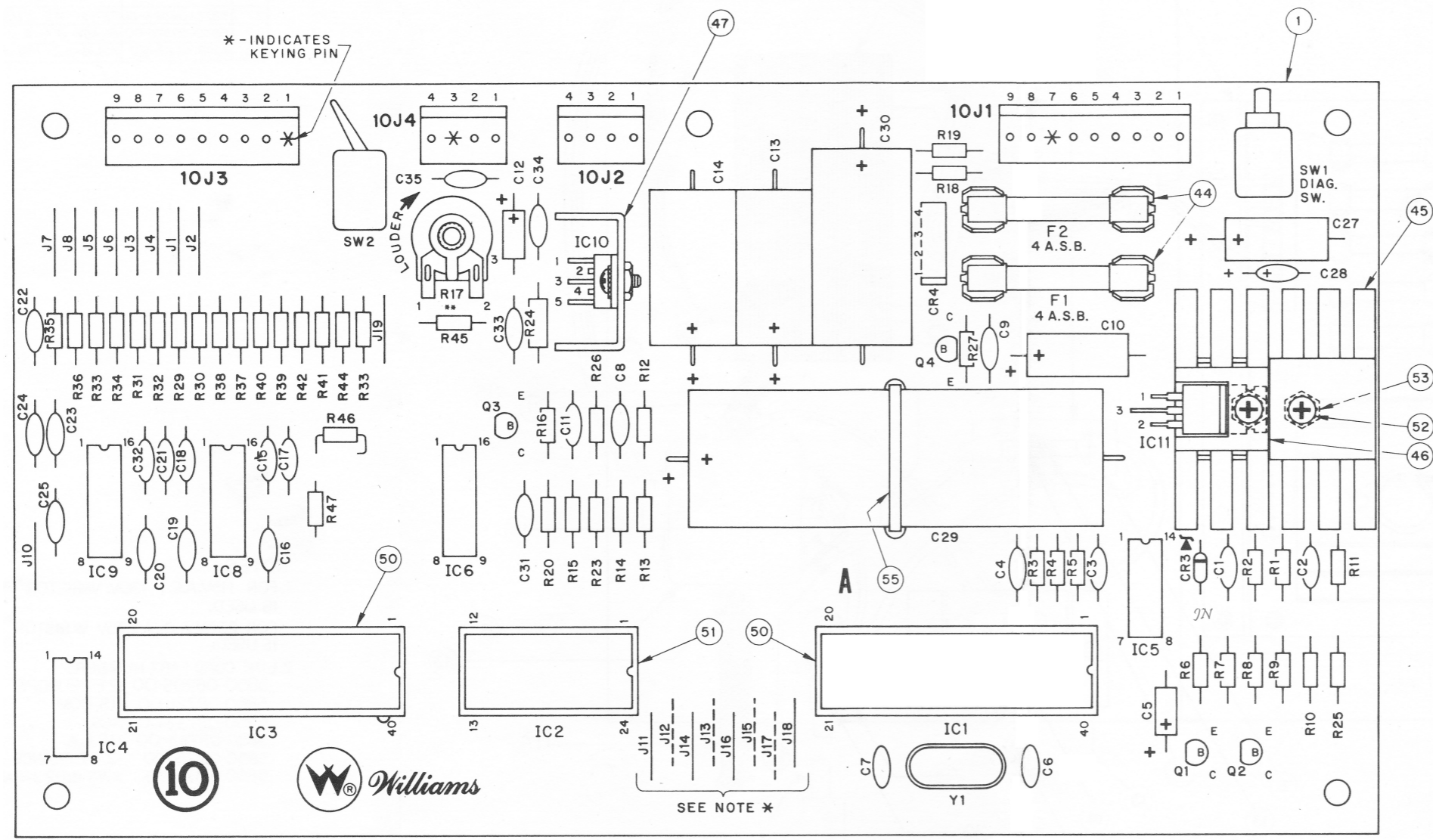
NOTE:
W1 CONNECTED ONLY FOR COCKTAIL
APPLICATIONS.





BILL OF MATERIALS			
ITEM	PART N ^o	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 115/V	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	VARISTOR	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	4703-00008-00	NO#8 EXTERNAL LOCK WASHER	4
20	5825-06523-00	TERMINAL LUG	1
21	5852-09575-00	BLACK-18'AWG JUMPER WIRE-2.5'L	1
22	4008-01005-22	MS. 8-32 x 1 5/8 P-PH	4

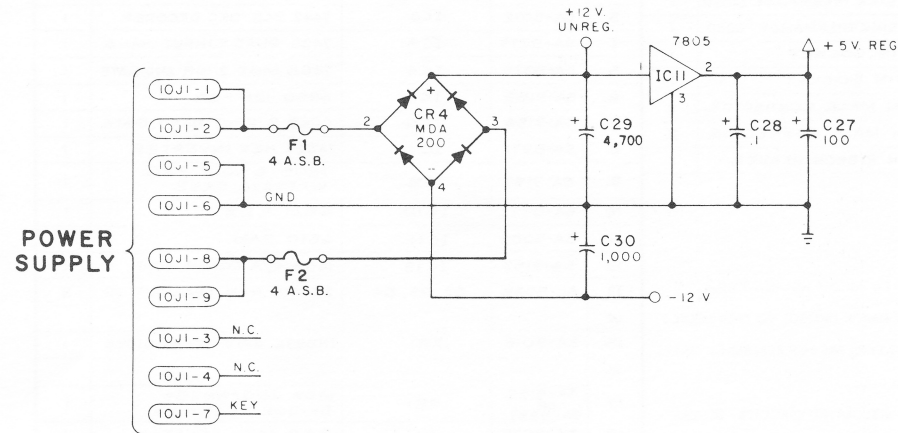
NOTES:
 1. FOR 115V.A.C., 130V. VARISTOR # 5017-09044. IS USED.
 FOR 230V.A.C., A 275V VARISTOR # 5017-09063 IS USED.
 2. LINE CORD PART NUMBERS:
 5850-06206-00 12 FT. EUROPE
 5850-08728-00 U.S. DOM.
 5850-08737-00 AUS. JN
 5850-08743-00 U.S.L.A.
 5850-09128-00 12 FT. FRANCE
 5850-09131-00 AWG 18-12 JAPAN



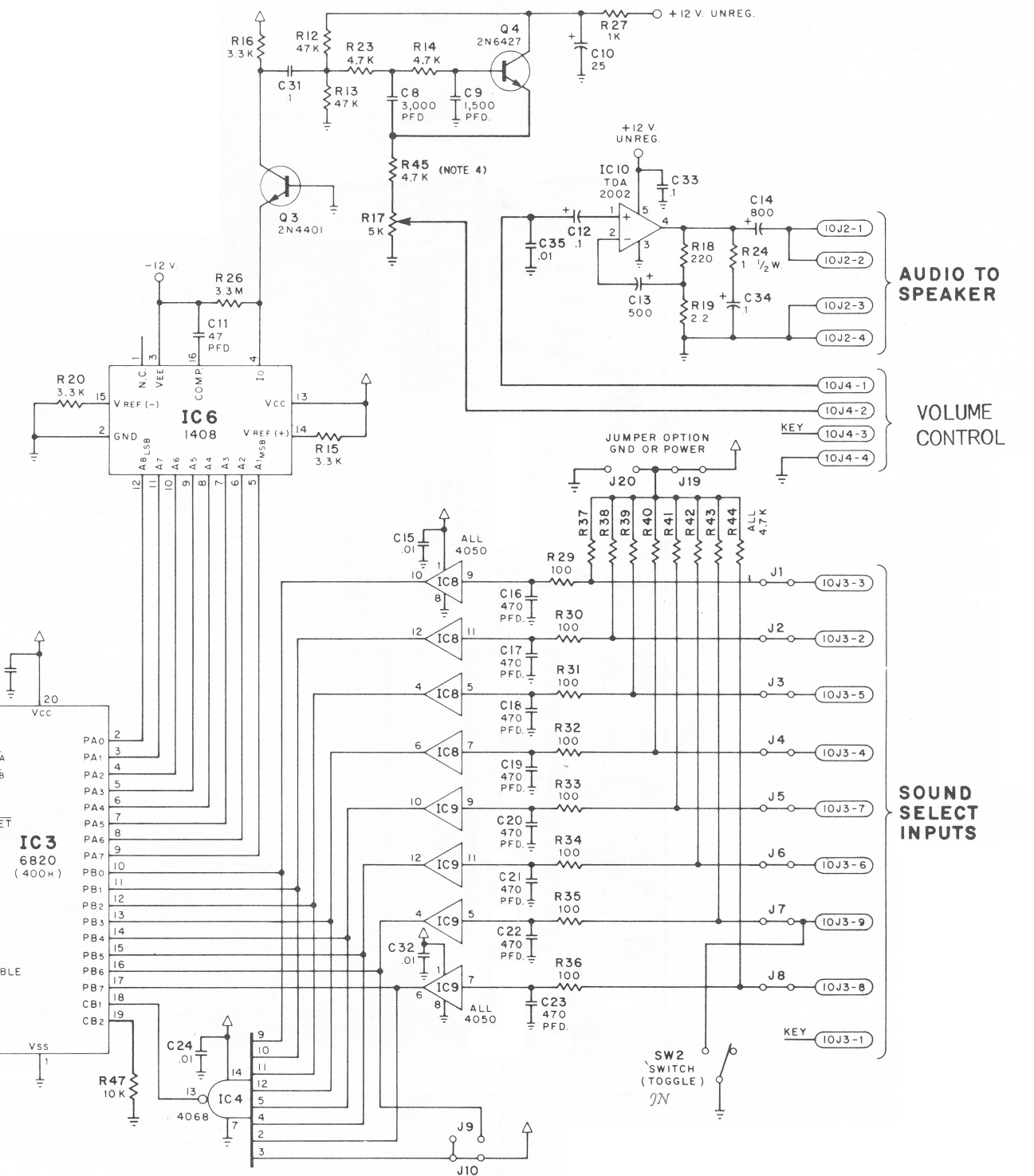
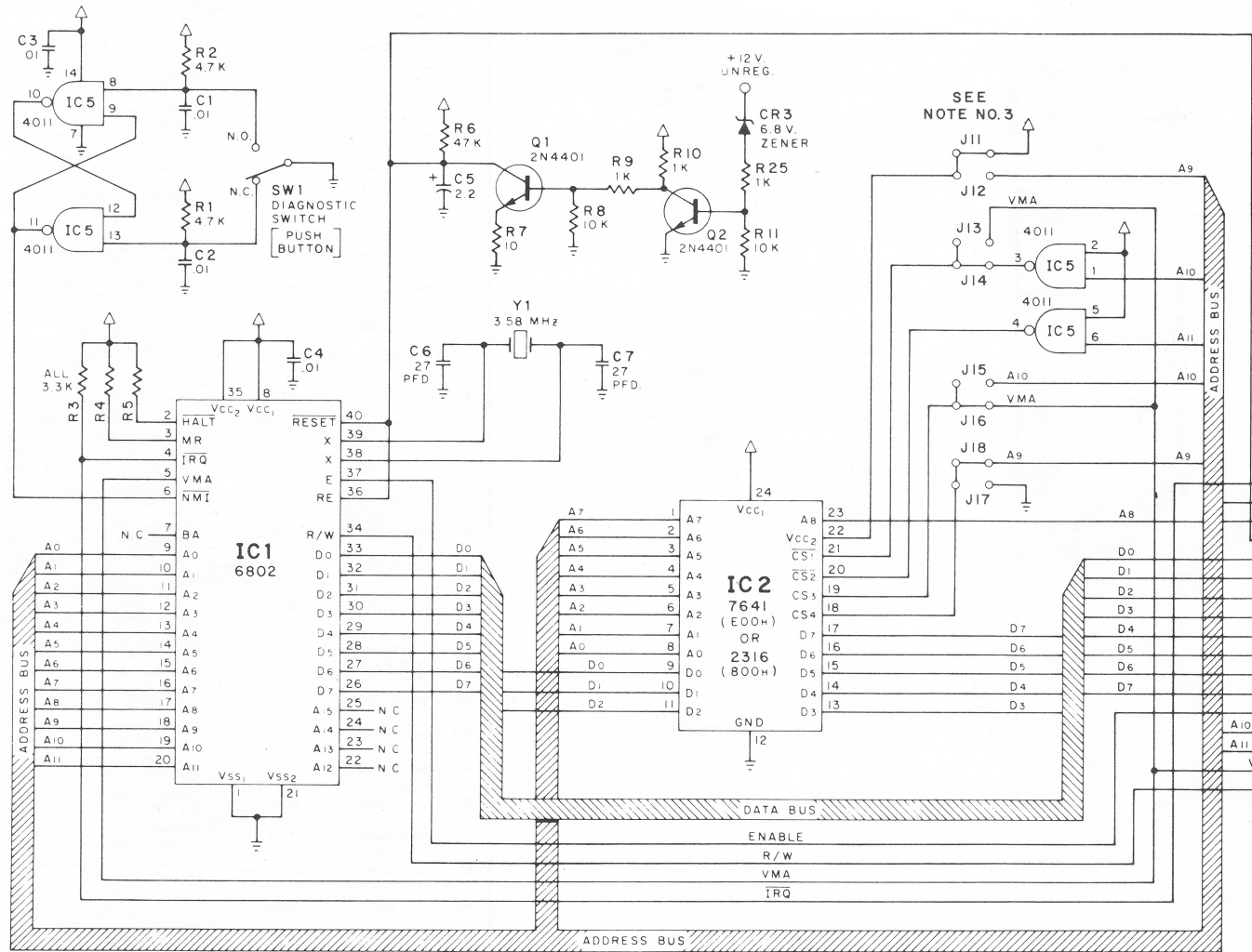
BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-137		BARE P.C. BOARD	1
2	5A-8972	IC3	MC6820 PIA	1
3	5A-9154	IC4	4068 8 INPUT NAND GATE	1
4	5A-9155	IC5	4011 QUAD 2 INPUT NAND GATE	1
5	5A-9152	IC6	MC1408 D/A CONVERTER	1
6	5A-9153	IC8, IC9	4050 BUFFER	2
7	5A-9156	IC10	TDA2002V AUDIO AMPLIFIER	1
8	5A-9157	IC11	7805 5 VOLT REG. W/TO220 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 6.8 V 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, 1 K 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, 14,700 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, 5 K 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 #6072 B	1
46	5A-9173		HEAT SINK THERMALLOY #6071 B	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.

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



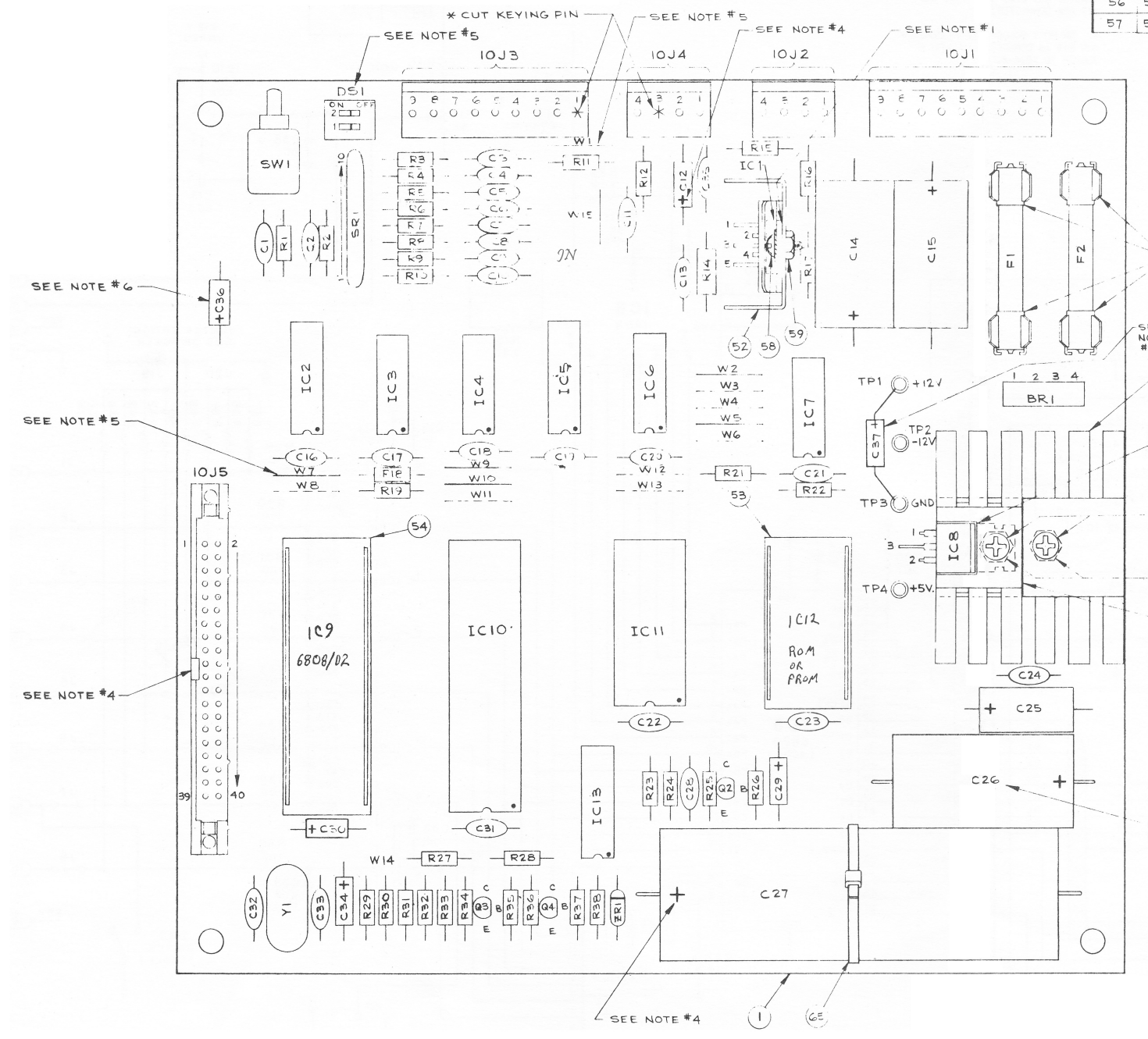
- NOTES:
1. UNLESS OTHERWISE INDICATED ALL RESISTORS IN OHMS, 1/4 WATT.
 2. UNLESS OTHERWISE INDICATED ALL CAPACITORS ARE IN MICROFARADS.
 3. J11, J14, J16, AND J18 ARE REMOVED AND J12, J13, J15, AND J17 ARE CONNECTED.
 4. ON MOST BOARDS R17 IS REMOVED AND R45 IS CONNECTED THROUGH A JUMPER TO 10J4-2.



D8121 Sound Board Logic Diagram

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
58			6-32 x 3/8" BINDER HEAD SCREW	3	48	5A-6314	F1, F2	4 AMP SLOW BLOW FUSE	2
59			6-32 HEX NUT	3	49	5A-9178		FUSEHOLDER	4
60			WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	7	50	5A-9172		HEAT SINK THERMALLOY #6072B	1
61	5A-9248	TP1 THR TPA	TERMINAL # 1502-1	4	51	5A-9173		HEAT SINK THERMALLOY #6071B	1
62	5A-9363	R11	RESISTOR, FC, 5.6 KOHM 5% 1/4 WATT	1	52	5A-9199		HEAT SINK THERMALLOY #6030	1
64	5A-9362	SRI	RESISTOR, 4.7 KOHM 10 PIN SIP	1	53	5A-9004		24 PIN SOCKET	1
65	3A-7520-1		TIE WRAP	1	54	5A-8985		40 PIN SOCKET	1
					55	5A-9027	10J1, 10J3	9, PIN MALE CONNECTOR	2
					56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
					57	5A-9349	10J5	40 PIN RIBBON HEADER	1

BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	IC-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 BINPUT 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, R18, R19, R21, R22, 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, 47 K OHM 5% 1/4 WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K 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. 6.3 V. -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, 500 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 ±20%	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 IC8 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 D1, D2, AND ZR1.
- CAPACITORS C12, C14, C15, C25, C24, C27, CONNECTORS 10J1, 10J2, 10J3, 10J4, 10J5, POSITION OF TRANSISTORS Q2, Q3, Q4.
- DS1 - 1 SELECTS SOUNDS/NOTES
2 SELECTS SPEECH/NO SPEECH (W9/W4)
- 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, W8, W12, W4, W1, W3, W6, W11 FOR:
WORLD CUP
DISCO FEVER
CONTACT
POKERO
PHOENIX
ARISTOCRAT SHUFFLE
POMPLI SHUFFLE
KING TUT SHUFFLE
TAURUS SHUFFLE
W15, W8, W12, W4, W1, W3, W6, W11 FOR:
FLASH
STELLAR WARS
TRI ZONE
TIME WARP
W7, W15, W9, W1, (SEE NOTE #5) W2, W5, W10 FOR:
GORGAR
SOUND ROM 2 - JT-9950
IC12 SELECTION STRAPPING:
(2K x 8) (1K x 4) (512 x 8)
W2 W3 W3 W3
W5 IN W5 IN W5 IN
W6 W6 W6

TOLERANCES		QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED			
FRACTIONAL	±1/64"		
DECIMAL	±.0005"		
HOLE DIA.	+0.008 -0.000"		
ANGULAR	±1/2°		
CONCENTRICITY	±1.0% .001"		
SCREW THREADS	CLASS 2		
MATERIAL		HEAT TREATMENT	FINISH
DATE	APP'D.	SCALE	
9-23-79		2:1	

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA - CHICAGO, ILL. 60618
287-2340
NAME: SOUND BOARD SUB-ASSEM
D-8223

