

Williams®

16P-3001-101
February, 1981

DEFENDER



For service call TOLL-FREE:
800-621-4765
In Illinois call
800-972-7898

Williams® 
ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
(312) 267-2240

SPECIAL NOTES

CPU/Video Board

Note modification required on all sample games described in Service Bulletin V-1. Should failure of 4D 7486 IC occur, make foil cuts on board as described in Service Bulletin V-3.

ROM Board

When blue-labeled ROMs are used, ROM 4 is not used, jumpers W2 and W3 are connected, and jumper W1 and W4 are removed. When green-labeled ROMs are used, ROM 4 is used, jumpers W1 and W4 are connected, and jumpers W2 and W3 are removed. Between blue and green-labeled ROM sets, ROMs 2, 6, 7, 8, 9, 10, 11, and 12 are compatible.

Note foil cuts and addition of resistors required as described in Service Bulletin V-2.

Interface Board

Note foil cuts and addition of resistors required as described in Service Bulletin V-2.

CONTENTS

Service Bulletin V-1	3
Service Bulletin V-2	5
Service Bulletin V-3	7/8
Interboard Wiring Diagram	9
D8356 CPU/Video Board Assembly Drawing	10
D8356 CPU/Video Board Logic Diagram (1 of 2)	11
D8356 CPU/Video Board Logic Diagram (2 of 2)	12
C8358 Interface Board Assembly and Logic Diagram	13
D8520 ROM Board Assembly Drawing	14
D8520 ROM Board Logic Diagram	15
D8359 Power Supply Board Assembly Drawing	16
D8359 Power Supply Board Schematic Diagram	17
Power Wiring Diagram	18
D8373 Power Panel Assembly Drawing	19
D8224 Sound Board Assembly Drawing	20
D8224 Sound Board Logic Diagram	21
Cabinet Wiring Diagram	22

SERVICE BULLETIN

DEFENDER CPU/VIDEO BOARD MODEL D8356

Watchdog Circuit Modification

INTRODUCTION

The Watchdog timer on D8356 CPU/Video Board in sample games has exhibited a tendency to timeout too quickly. This results in the game intermittently resetting. Should this occur with credits in the game, the credits will be removed.

MODIFICATION

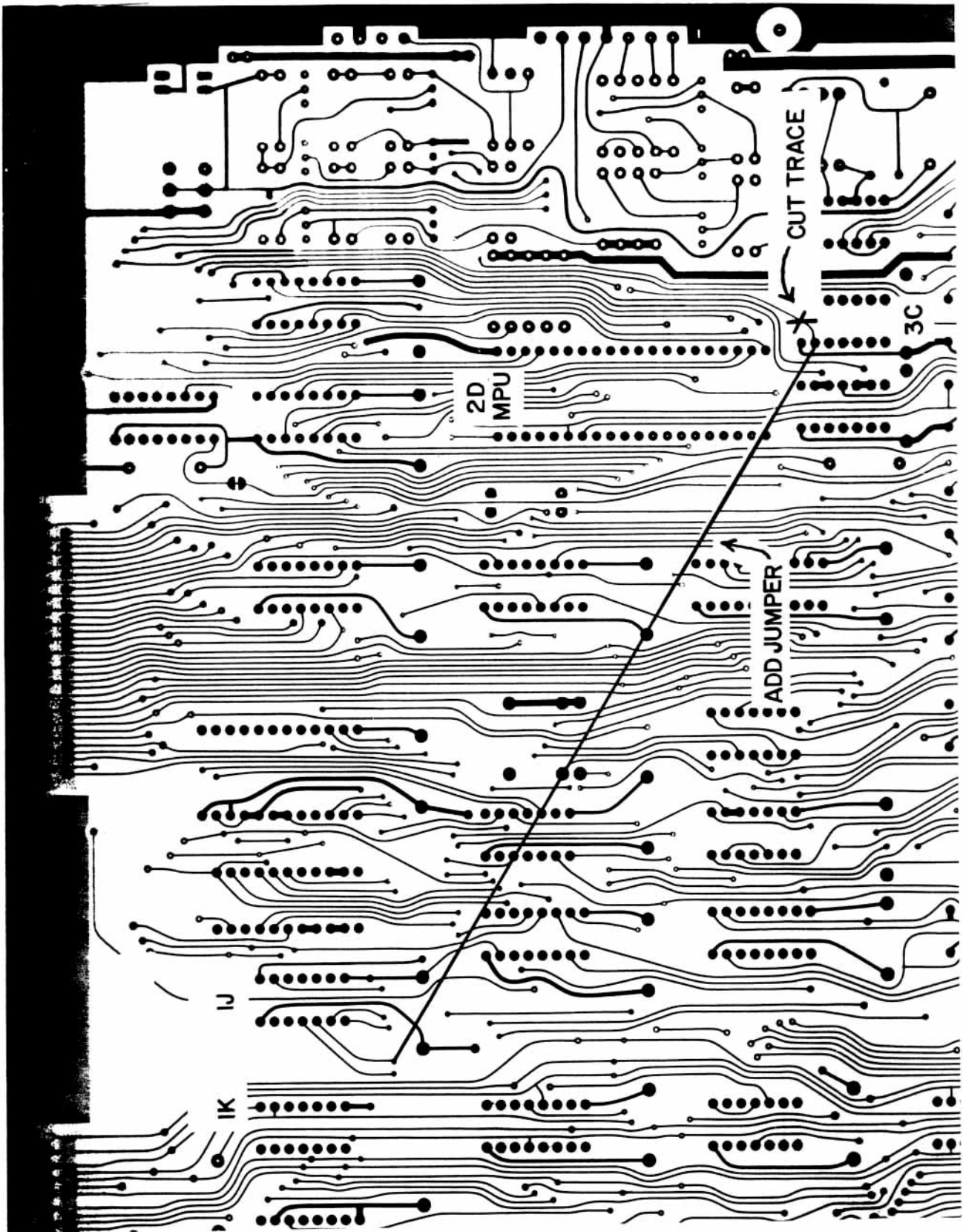
All CPU/Video Boards in sample games shipped prior to 12-8-80 must be modified as follows. The modification consists of cutting a trace and adding a jumper. Refer to the drawing on the other side of the sheet and proceed as follows:

1. Locate the trace from 3C pin 13 on the solder side of the board. 3C is a type 74393 or 74LS393.
2. Cut the trace located in step 1.
3. Obtain a 6 inch length of 30-gauge or other available gauge of insulated wire.
4. Strip back the insulation at each end of the wire approximately 1/8-inch and tin the wire.
5. Solder one end of the wire to 3C pin 13 on the solder side of the board.
6. Locate the trace connected to 1J pin 10. 15 is a type 7404.
7. Solder the other end of the wire to the feedthru connected to 1J pin 10.



Williams[®]
ELECTRONICS, INC.

3401 N. California Ave., Chicago, IL 60618



SERVICE BULLETIN

DEFENDER ROM AND INTERFACE BOARDS MODELS D8357 AND C8358 Addition of Resistors

INTRODUCTION

Switch inputs to the ROM Board and Interface Board are applied to CMOS hex inverters which are susceptible to possible damage from static discharge. Addition of series resistors is required to provide protection.

MODIFICATION

This modification must be made to these boards in all sample games. Refer to the drawings on the reverse side and proceed as follows:

1. Obtain 23, 1K $\pm 10\%$, 1/4 W resistor (Williams Part No. 5A-8984)
2. Cut the traces as indicated in seven places on the ROM board.
3. Solder in a resistor bridging each cut trace in the pads on the board.
4. Repeat steps 2 and 3 for the Interface board, cutting 16 traces.

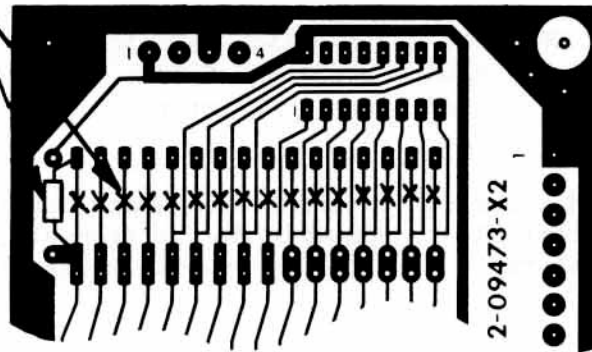


Williams®
ELECTRONICS, INC.

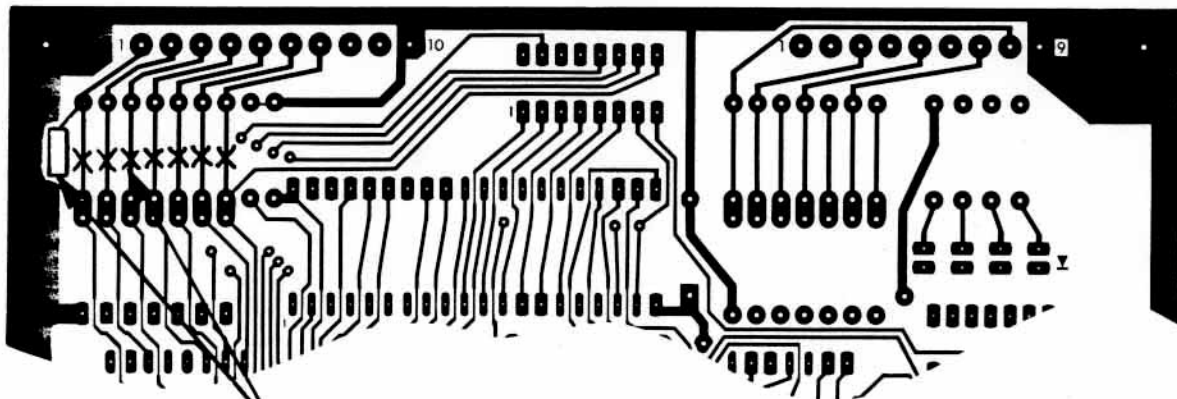
3401 N. California Ave., Chicago, IL 60618

C 8358
INTERFACE BOARD

CUT 16 TRACES,
ADD 16 RESISTORS



D 8357
ROM BOARD



CUT 7 TRACES,
ADD 7 RESISTORS

SERVICE BULLETIN

DEFENDER CPU/VIDEO BOARD
MODEL D8356
Foil Cuts at 4D 7486 IC

INTRODUCTION

Termination of pins for unused gates in the 4D 7486 IC may cause overheating in ICs with certain pin configurations. This could cause the IC to fail.

MODIFICATION

Failure will normally occur within a few days of operation so it is recommended not to make the modification unless replacement of the 4D 7486 IC is required. When replacing the chip, proceed as follows:

1. On the foil side of the board, remove solder from pins 6 and 7 and pins 8 and 9 of the 4D IC.
2. Cut the foil between pins 6 and 7 and between pins 8 and 9.
3. Carefully resolder pins 6, 7, 8, and 9, making sure that solder does not bridge across the pins.

01/11/2019

ALBION BATTERY

100% Lead Acid
12V 100Ah
100% Recycled

ALBION BATTERY is a leading manufacturer of 12V 100Ah Lead Acid Batteries. We are proud to offer a wide range of products to meet your needs. Our batteries are made from 100% recycled materials and are designed to provide long life and reliable performance.

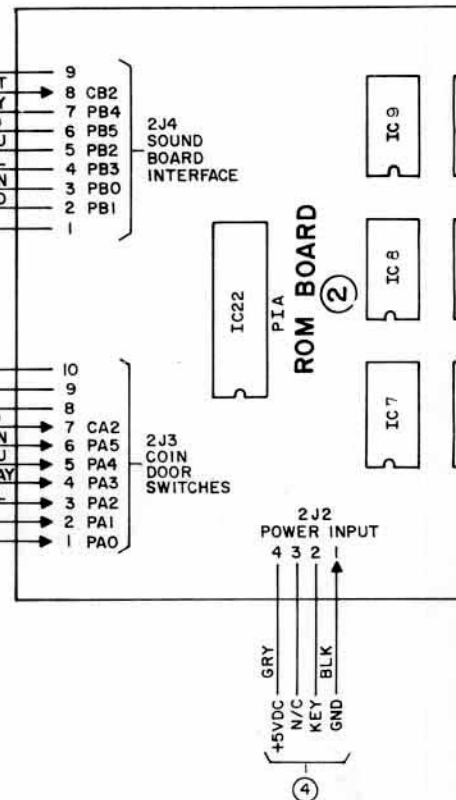
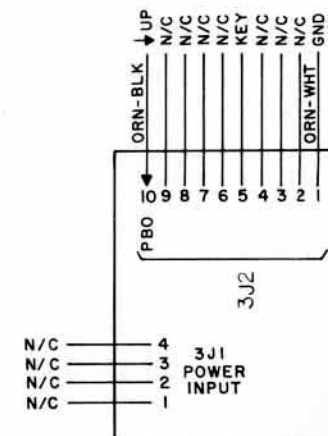
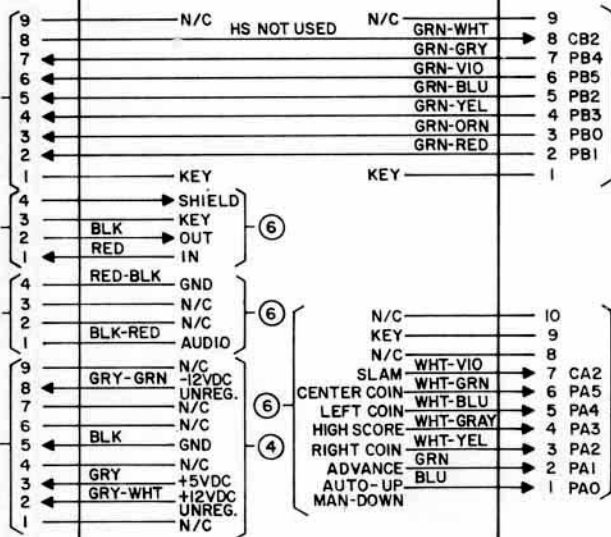
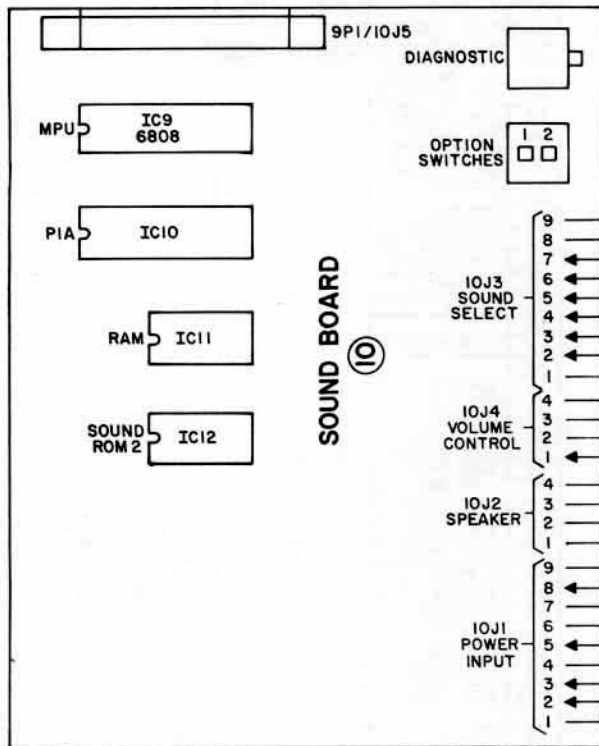
Our batteries are available in a variety of sizes and configurations to suit your application. We also offer a range of accessories and services to help you get the most out of your battery. Contact us today to learn more about our products and services.

ALBION BATTERY is committed to providing high quality products and services to our customers. We are proud to be a leading manufacturer in the industry and we look forward to serving you.

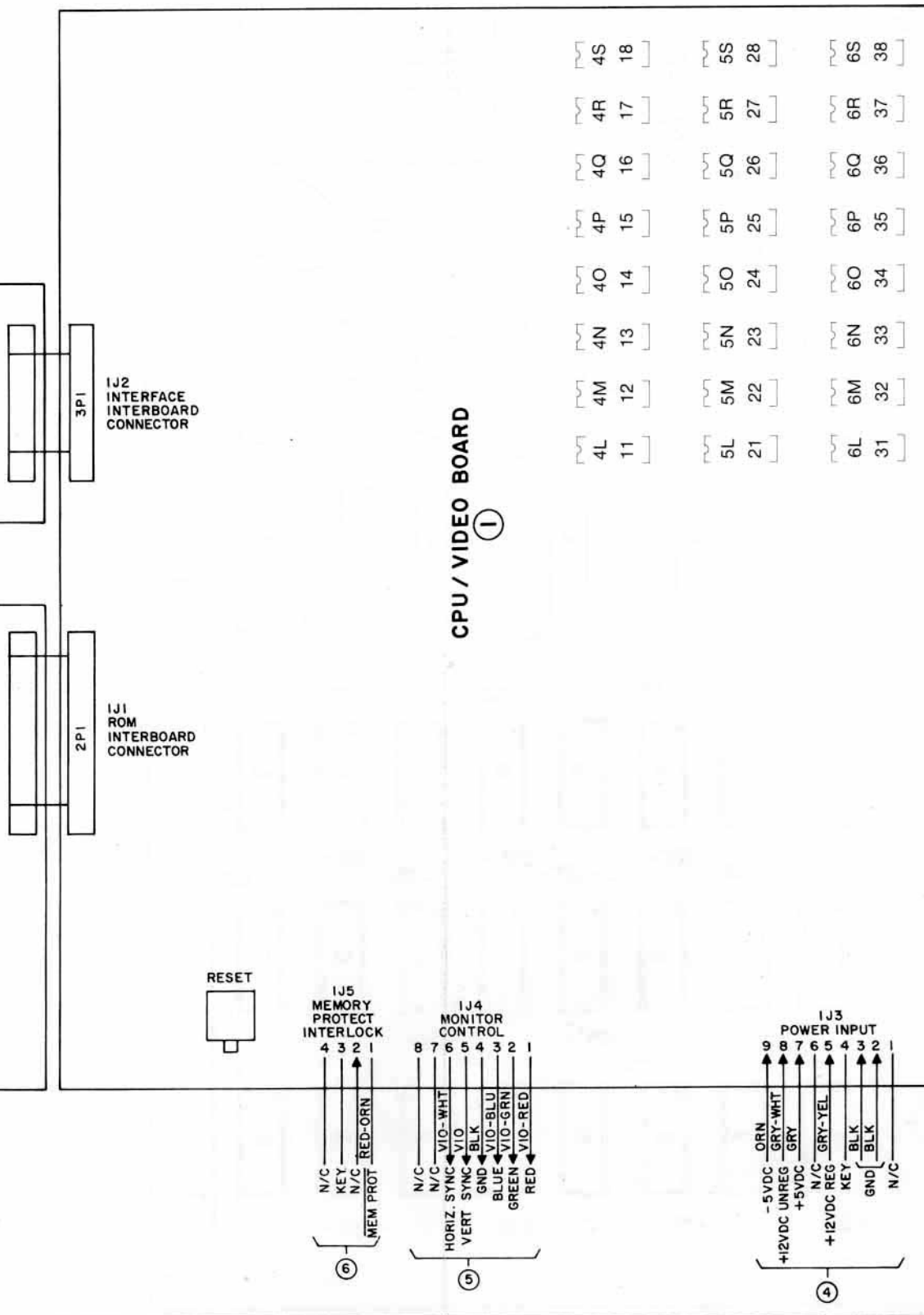
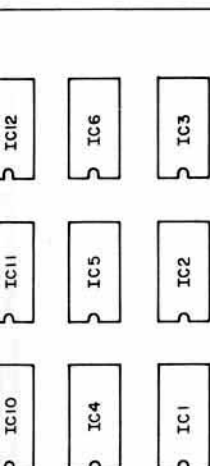
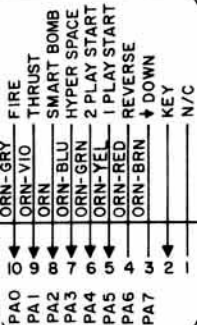
For more information, please visit our website at www.albionbattery.com or contact us at 1-800-ALBION. We are here to help you with any questions or concerns you may have.

ALBION BATTERY, INC.
100% Recycled Lead Acid Batteries



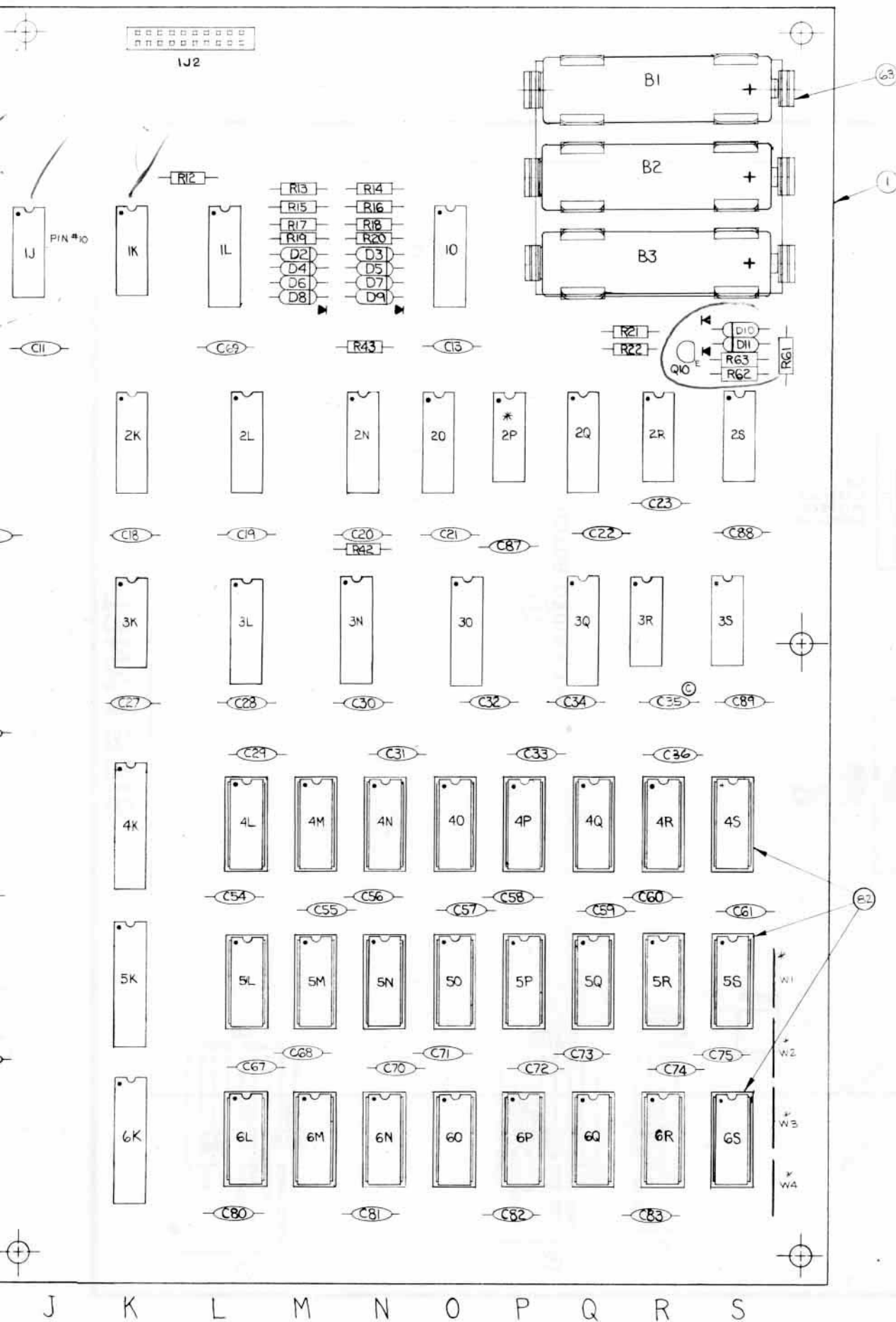


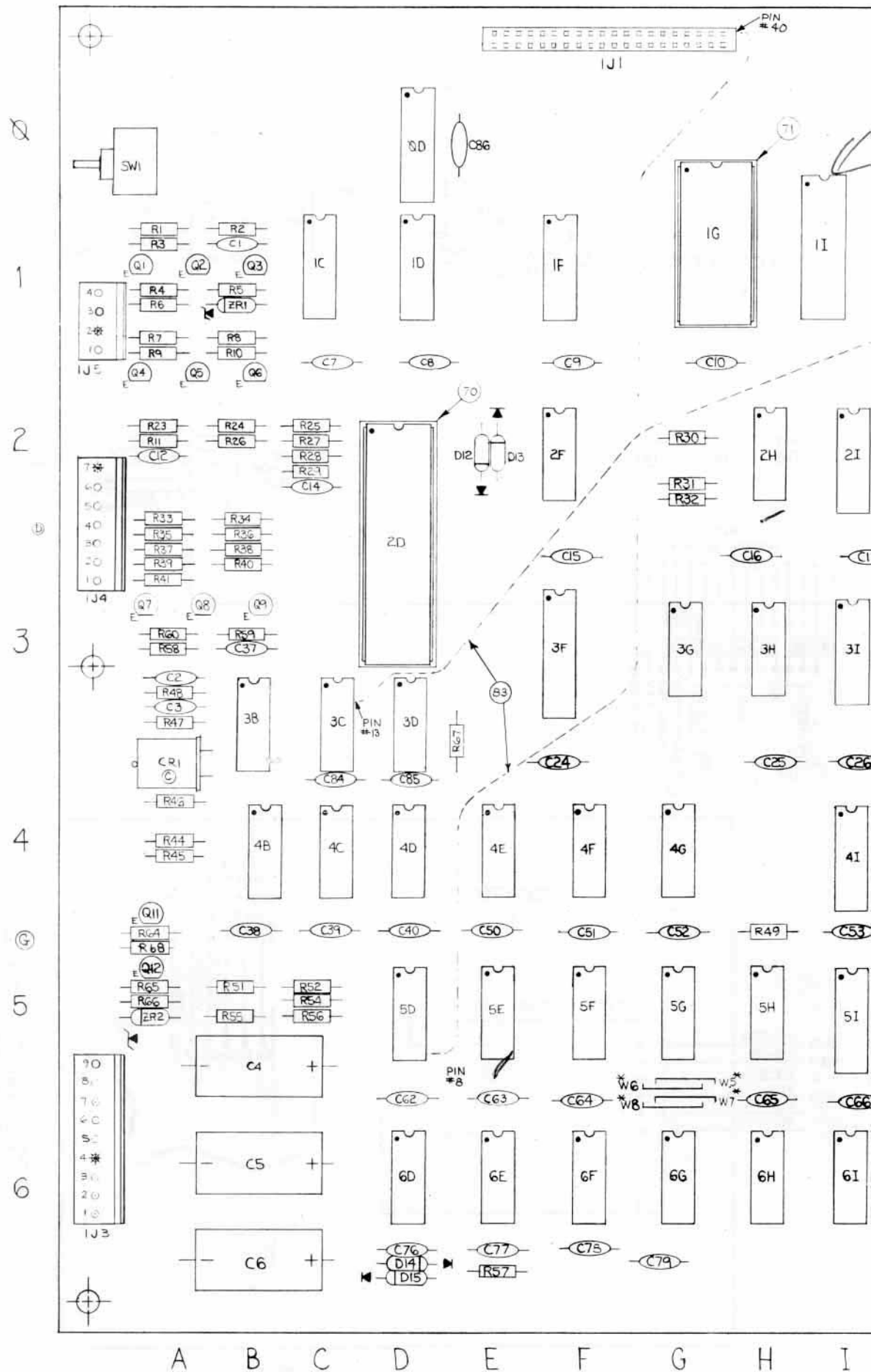
PANEL



SIDE PANEL

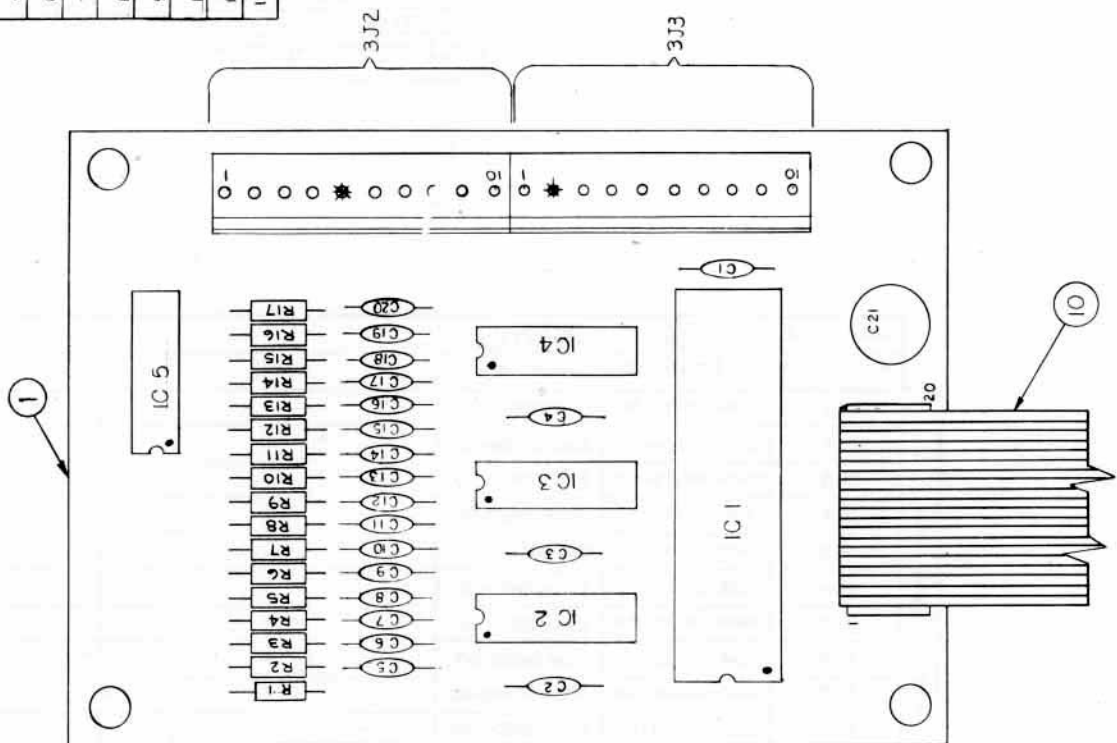
NOTE 10: ALL RESISTORS ARE 1/4 WATT AT 5%

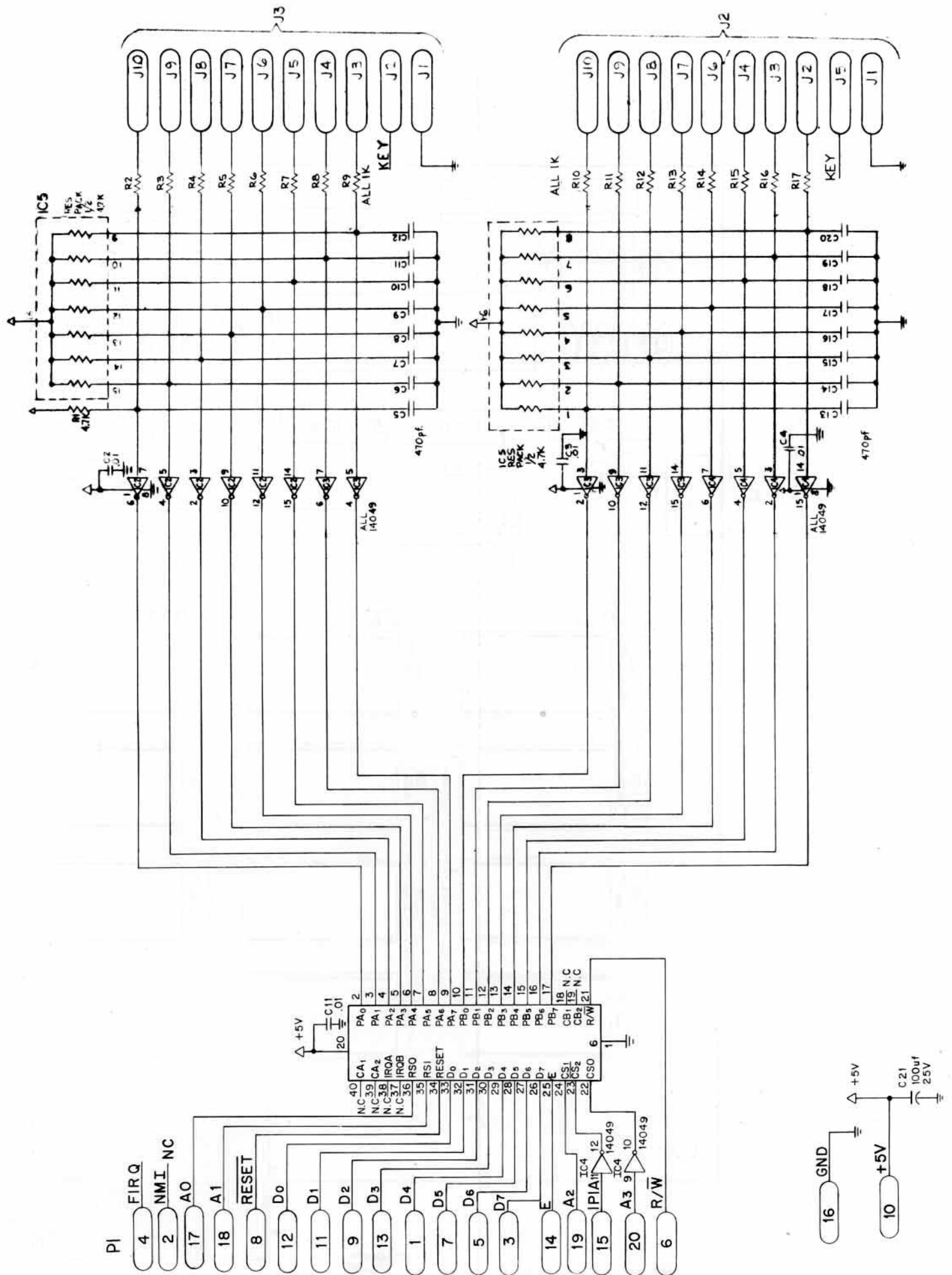




BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	QTY
1	5772-09473-00	IC 2, IC 3, IC 4	BARE P.C. BOARD	1
2	5310-08375-00	IC 2, IC 3, IC 4	4049, INV. HEX BUFFER	3
3	5019-03239-00	IC 5	.47 K 15 RES, 16 DIP	1
4	5010-08331-00	R1	47K 1/4 RESISTOR, 1/4 W 5%	1
5	5043-08380-00	C1, C2, C3, C4	.01 MFD. CAPACITOR 50V. AXIAL, CERAMIC +80-20%	4
6	5043-09045-00	C5 THRU C20	470 PFD. CAPACITOR 50V. AXIAL, CERAMIC	16
7	5040-0942100	C21	100 MFD. CAPACITOR 25V. RADIAL, ELECTROLYTIC	1
8				
9	5791-09444-00	J2 J3	10 PIN HEADER, MOLEX 09-65-1101	2
10	5795-09540-00	3PI	20 PIN RIBBON CABLE ASSY.	1
11	5430-08972-00	IC1	MC6821 PIA	1
12	5010-09358-00	R2 THRU R17	1K OHM RESISTOR 1/4 W 5%	16

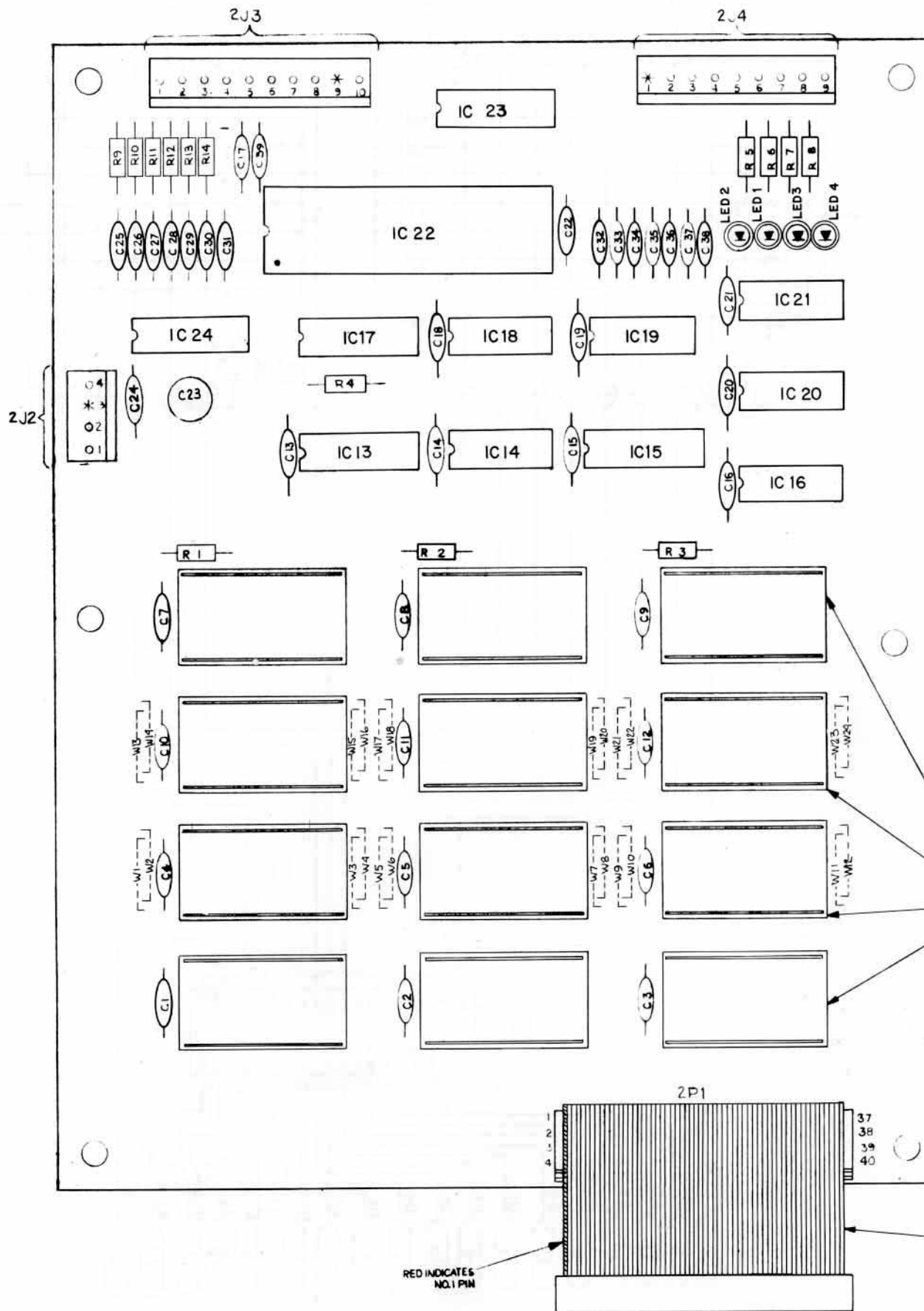




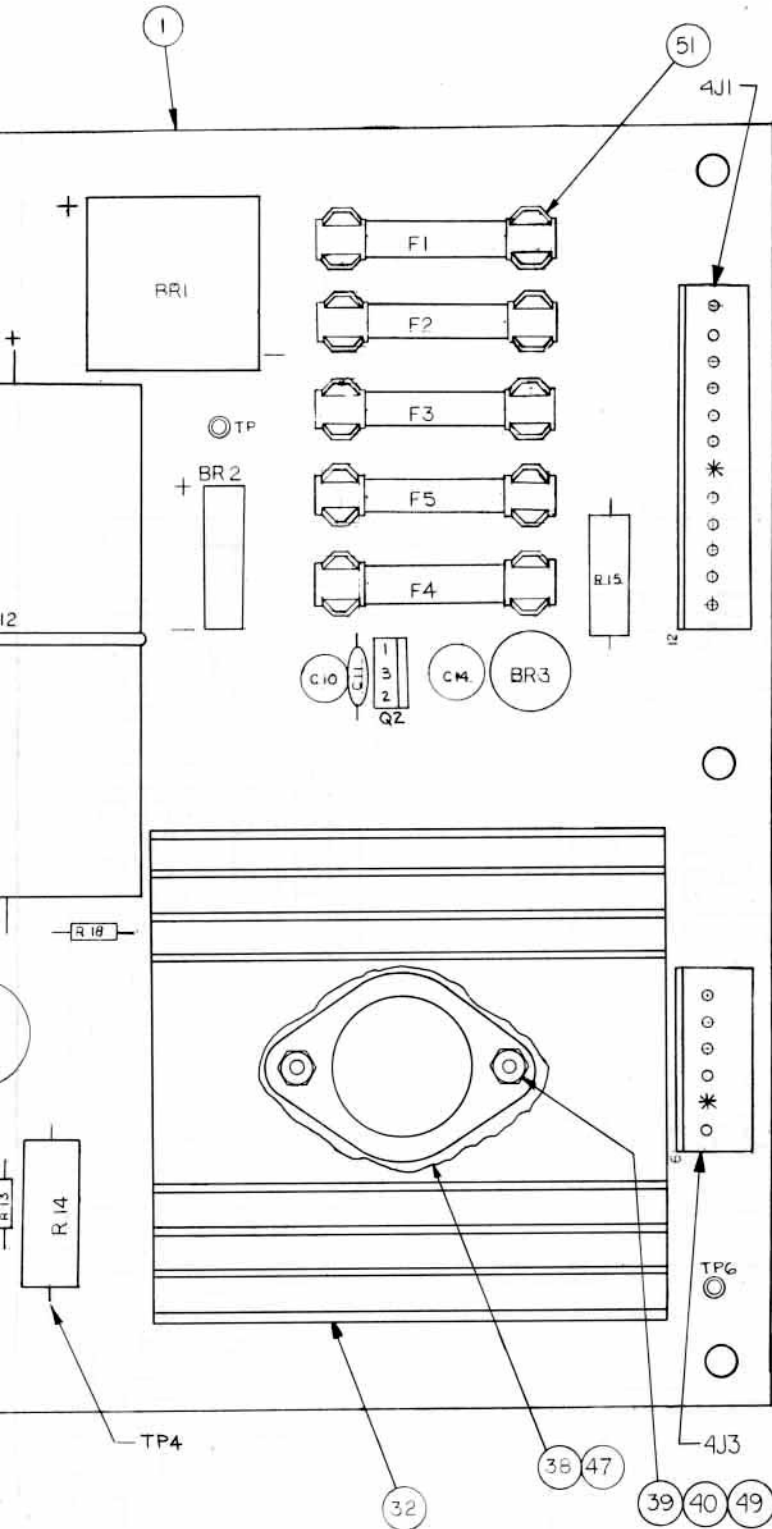
C8353 Interface Board Assembly and Logic Diagram

BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	NO. REQ'D
1	5171-09472-00		BARE PC BOARD	1
2	5280-09012-00	IC 13	7442 BCD DECODER	1
3	5280-09471-00	IC 14, IC 16	7432 QUADRUPLE 2 INPUT	2
4	5281-09246-00	IC 15	74LS139 DUAL 2 TO 4 LINE DECODER	1
5	5281-09501-00	IC 17	74LS395 4-BIT UNIVERSAL SHIFT	1
6	5280-09073-00	IC 18	7400 QUAD 2 INPUT NAND GATE	1
7	5280-09013-00	IC 19	7404 HEX, INVERTER	1
8	5280-09551-00	IC 20	7425 NOR GATE WITH STROBE	1
9	5280-08949-00	IC 21	7405 OPEN COLLECTOR OUTPUT	1
10	5430-08972-00	IC 22	MC 6821 PIA	1
11	5019-09239-00	IC 23	16 PIN, 15 RES DIP PACK 4.7K OHM	1
12	5671-09019-00	LED 1 THRU LED 4	LED, RED	4
13	5010-09442-00	R1 THRU R3, R5-R8	RESISTOR, C.F. 330 OHM 5% 1/4 W	7
14	5010-08991-00	R 4	RESISTOR, C.F., 4.7K OHM 5% 1/4 W	1
15				
16	5043-08980-00	C1 THRU C16, C18 THRU C22	CAP CERAMIC, 0.1MFD, 50V, AXIAL	21
17	5040-09421-00	C 23	CAP. ELECT., 100 MFD, 25V, RAD. ^{+50%} _{-10%}	1
18	5043-08996-00	C 24	CAP CERAMIC, 1MFD, 50V, AXIAL $\pm 20\%$	1
19	5043-09065-00	C17, C25 THRU C39	CAP CERAMIC, 470 PFD, 50V, AXIAL	16
20	5700-09004-00		24 PIN IC SOCKET	12
21	5795-09352-00	2 P1	40 PIN RIBBON CABLE ASSEM	1
22	5791-09028-00	2 J2	4 PIN MALE CONNECTOR 09-65-1041	1
23	5791-09444-00	2 J3	10 PIN MALE CONNECTOR 09-65-1101	1
24	5791-09027-00	2 J4	9 PIN MALE CONNECTOR 09-65-1091	1
25	5310-08975-00	IC 24	4049 INVERTING HEX. BUFFER	1
26	5010-09358-00	R9 THRU R14	RESISTOR, C.F., 1K OHM 5% 1/4 W	6
27	SEE CHART	IC1 THRU IC12	SEE CHART	AS REQ'D
28	5010-09534-00	W1 THRU W24	RESISTOR, 0 OHM	AS REQ'D

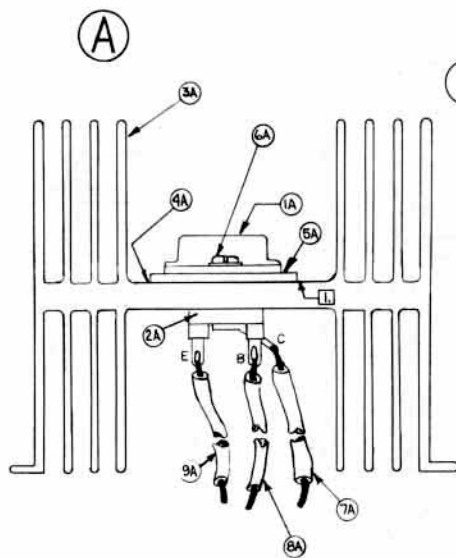
GAME NAME	DEFENDER BLUE LABEL	DEFENDER GREEN LABEL			
ASSEM NO.	D-8520-00	D-8520-00			
PART DESIGNATION	IC 1	5343-09595-00	5343-09621-00		
	IC 2	5343-09596-00	5343-09596-00		
	IC 3	5343-09597-00	5343-09622-00		
	IC 4	NOT USED	5343-09623-00		
	IC 5	NOT USED	NOT USED		
	IC 6	5343-09600-00	5343-09600-00		
	IC 7	5343-09601-00	5343-09601-00		
	IC 8	5343-09602-00	5343-09602-00		
	IC 9	5343-09603-00	5343-09603-00		
	IC 10	5343-09604-00	5343-09604-00		
	IC 11	5343-09605-00	5343-09605-00		
	IC 12	5343-09606-00	5343-09606-00		
JUMPERS	W2, W3, W6, W7, W10, W11, W13, W16, W17, W20, W21, W24	W1, W4, W6, W7, W10, W11, W13, W16, W17, W20, W21, W24			



BILL OF MATERIAL



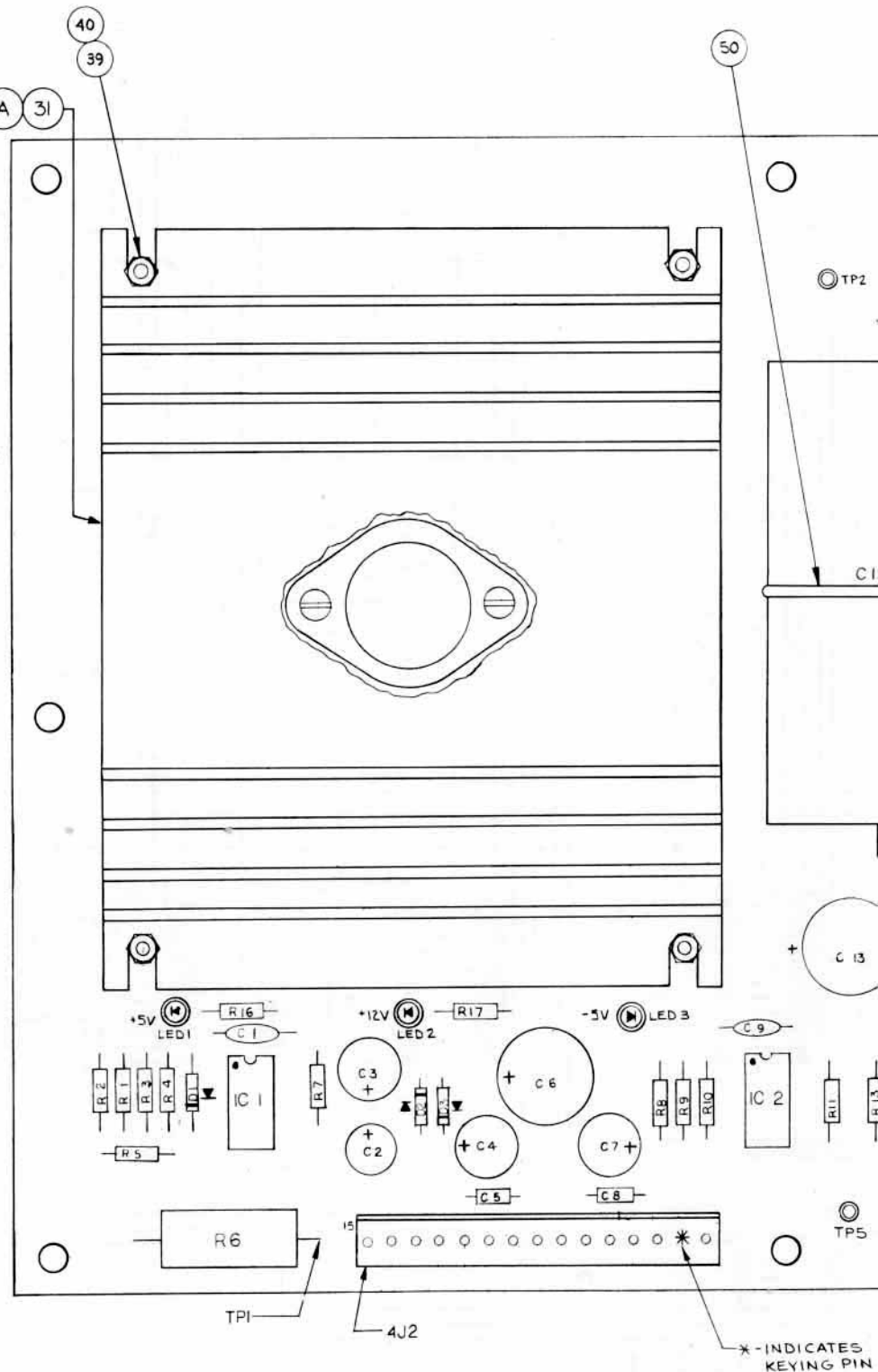
ITEM NO	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5713-09474-00		BARE P.C. BOARD	1
2	5010-09085-00	R4	RESISTOR, 1.5K 5%, 1/4W	1
3	5010-09541-00	R8, R7	RESISTOR, 2.7K 2%, 1/4W	2
4	5010-09508-00	R5	RESISTOR, 270 2%, 1/4W	1
5	5010-09428-00	R3	RESISTOR, 1.5K 2%, 1/4W	1
6	5010-09509-00	R11	RESISTOR, 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	5012-09429-00	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	5043-08996-00	C5, C8, C11	CAPACITOR, 1MFD, 50V. AXIAL .250	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, 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	5731-09492-00	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 723	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	4405-01117-00		5-40 HEX NUT	6
41	5161-09552-00	Q1	2N3055 TRANSISTOR, NPN	1
42	5731-08665-00	F5	FUSE, 2A, 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

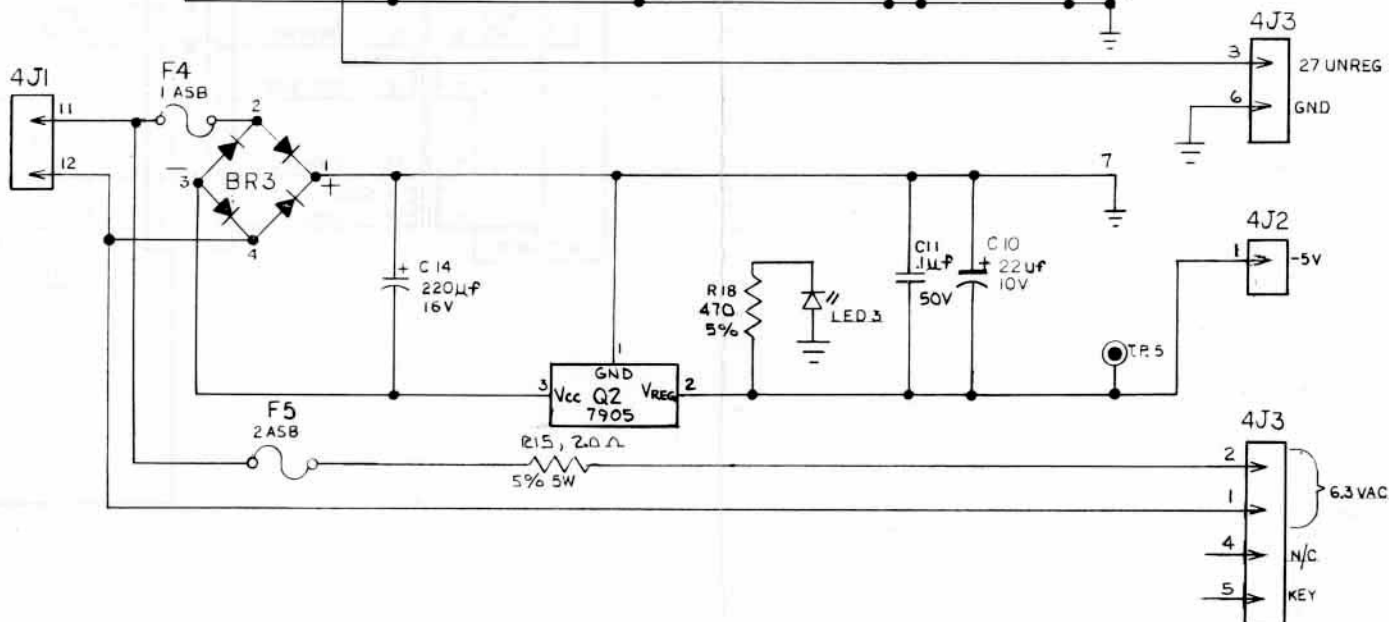
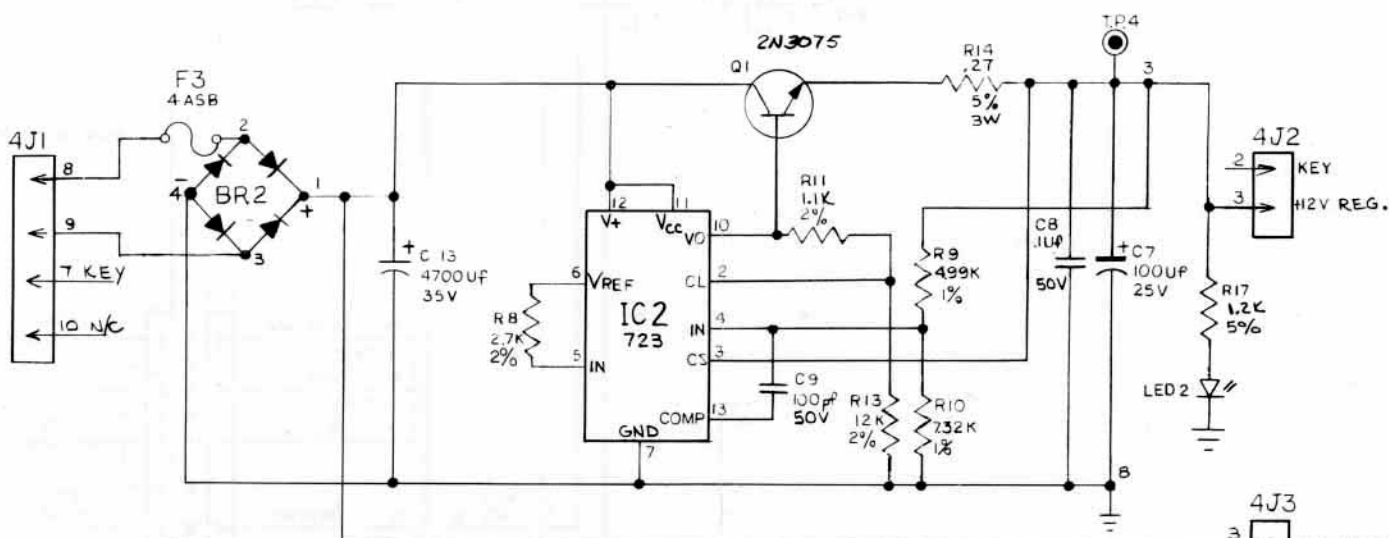
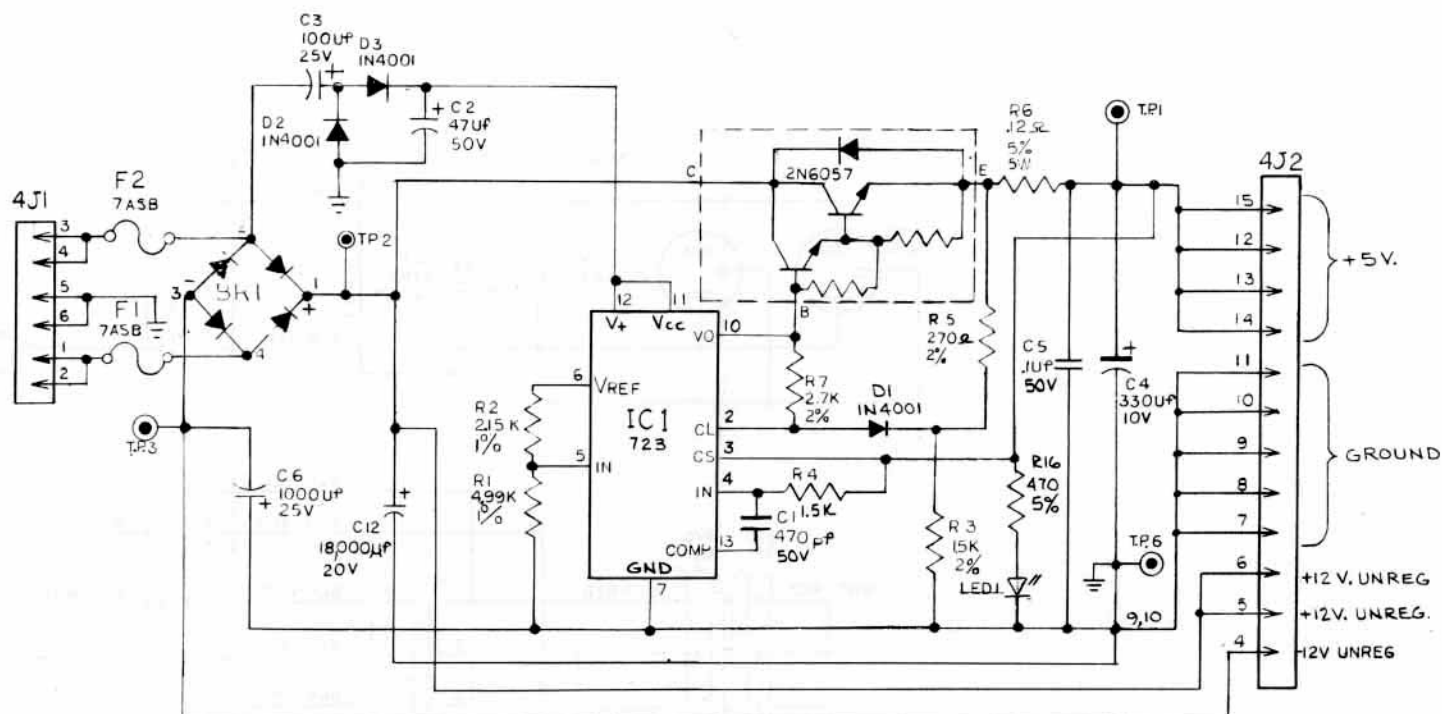


BILL OF MATERIAL			
ITEM NO	PART NO	DESCRIPTION	REQ'D NO.
1A	5162-09425-00	TRANSISTOR NPN 2N6057	1
2A	5700-09445-00	TRANSISTOR-SOCKET TO3	1
3A	5705-09431-00	HEAT SINK	1
4A	20-9729-00	THERMAL COMPOUND 1.5 OUNCE	1
5A	5701-09538-00	TO3 3 MIL. MICA INSULATOR	1
6A	4006-01003-B	MS-6-22x1/2-P-PH	2
7A	5853-09591-00	LEAD WIRE #18 AWG 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

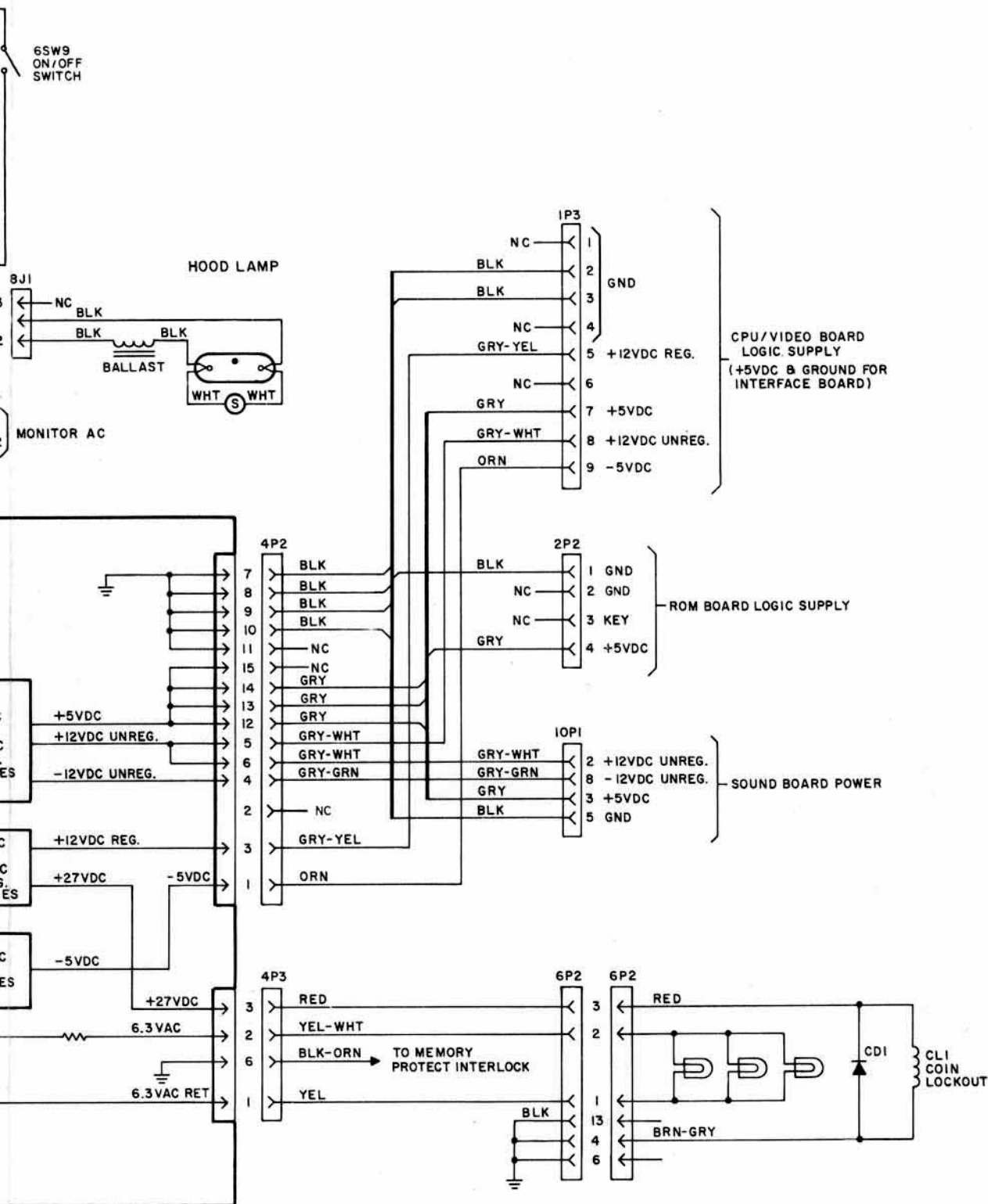
NOTES.

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

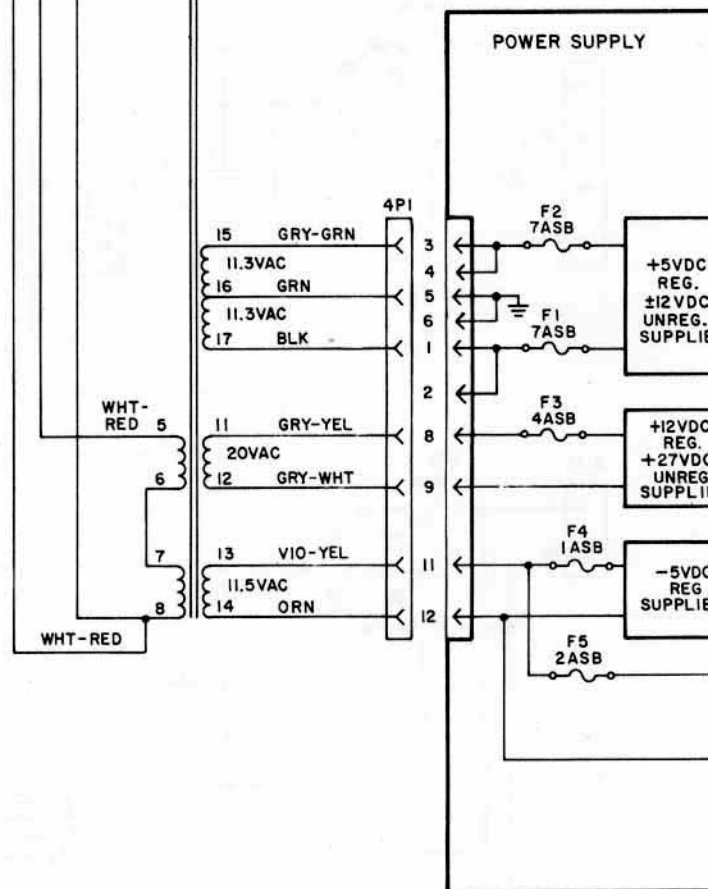
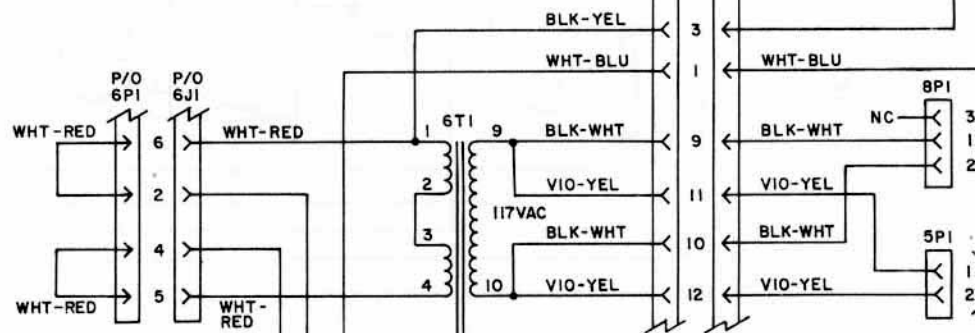
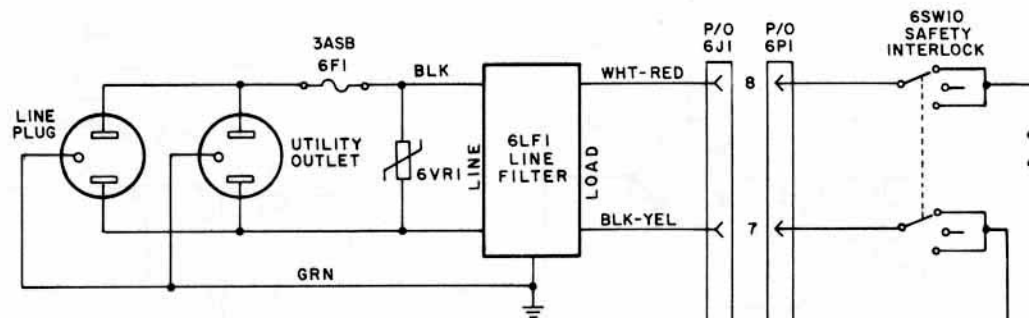


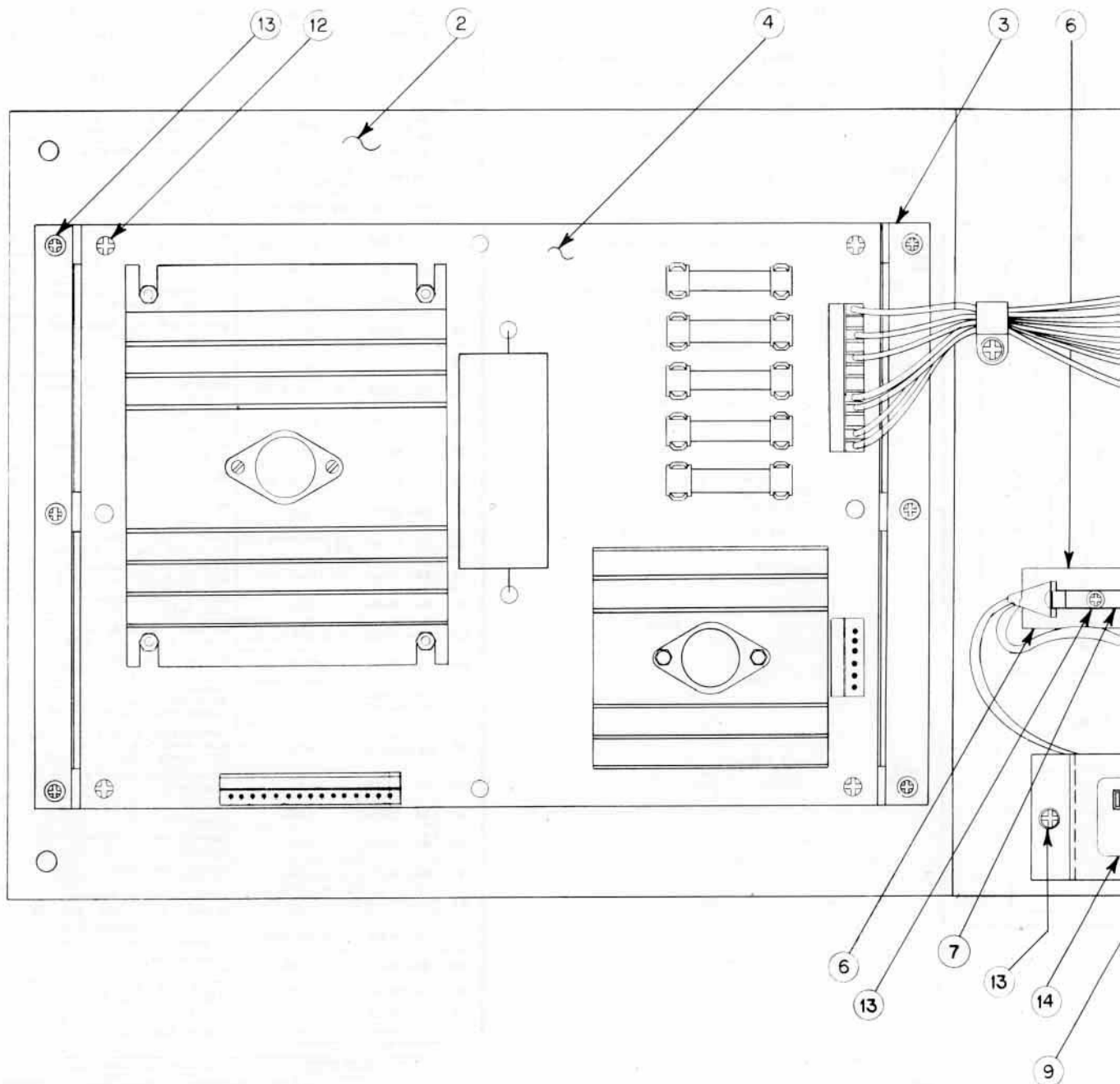


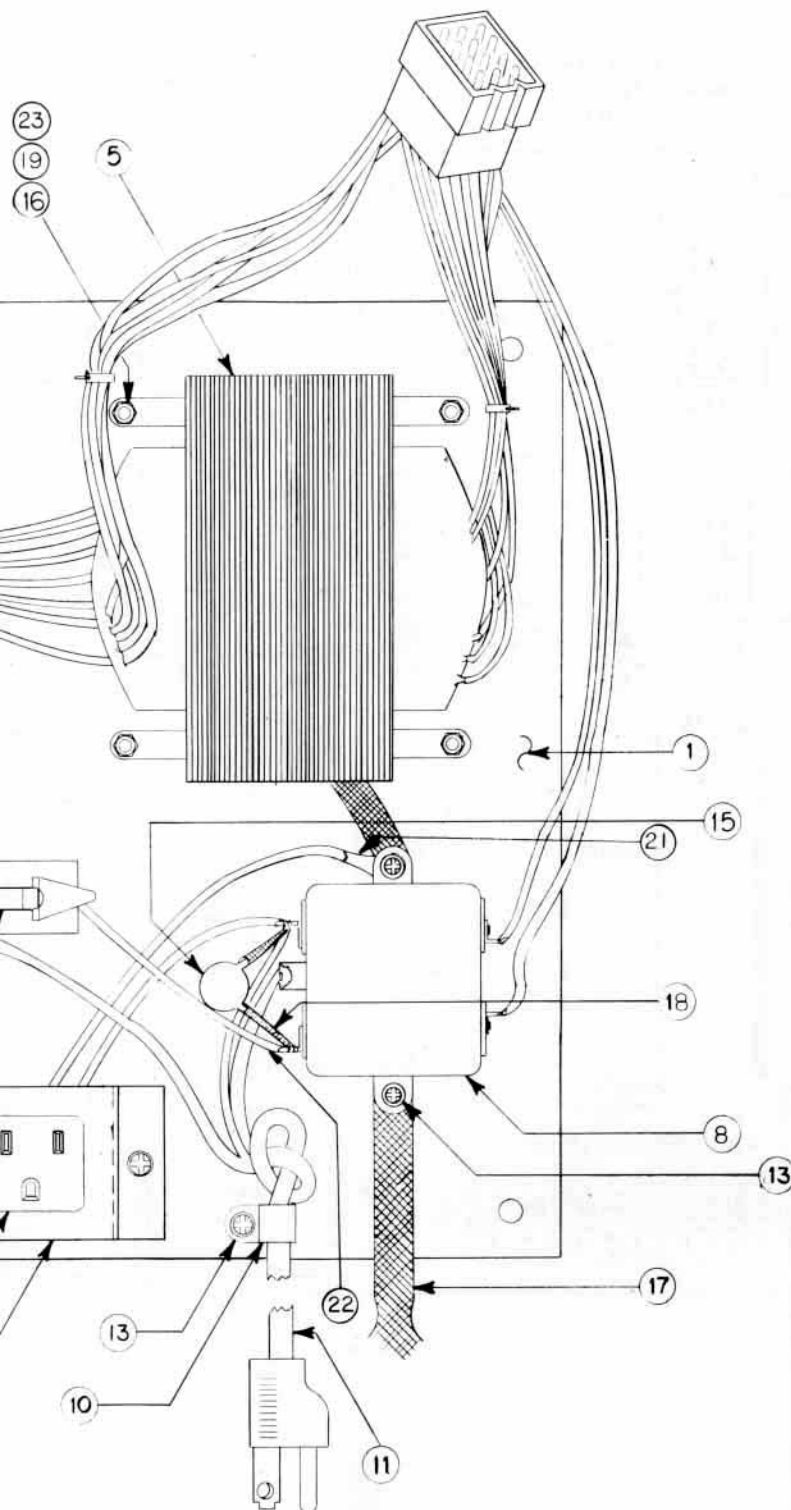
D8359 Power Supply Board
Schematic Diagram



Power Wiring Diagram







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	C8529	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	3 WIRE SNAP-IN OUTLET	1
15	SEE NOTE #1	VARISTOR	1
16	4408-01117-00	NUT 8-32 HEX	4
17	20-9223-3	6 INCH BRAIDED GROUND WIRE	1
18	20-9256	1 INCH SLEEVING INSULATION	2
19	4703-00006-00	NO #8 EXTERNAL LOCK WASHER	4
20	5825-06523-00	TERMINAL LUG	1
21	5852-09575-00	BLACK 18 AWG JUMPER WIRE-25'L	1
22	4008-01005-22	MS 8-32 x 1 3/8 P-PH	4

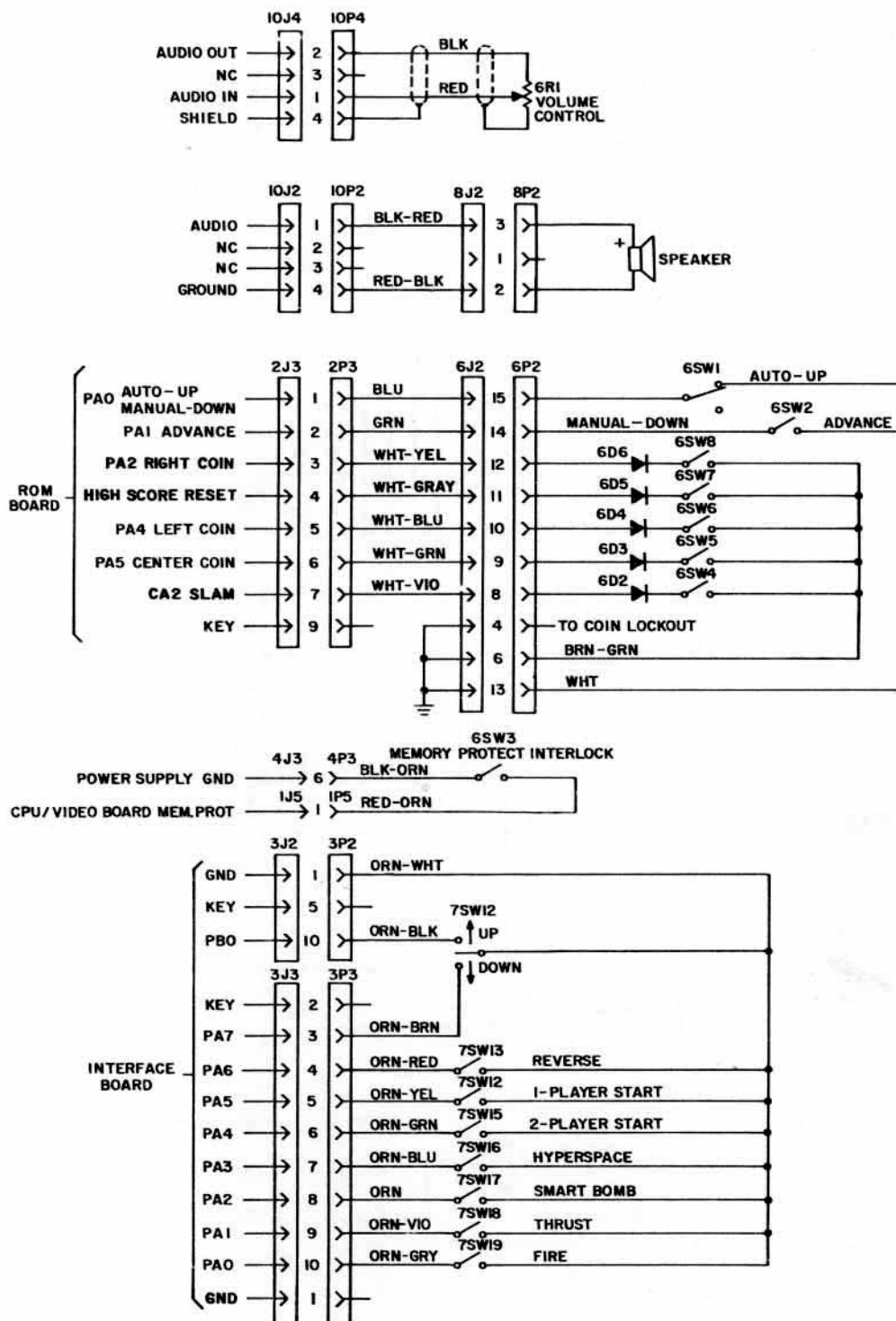
NOTES:

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

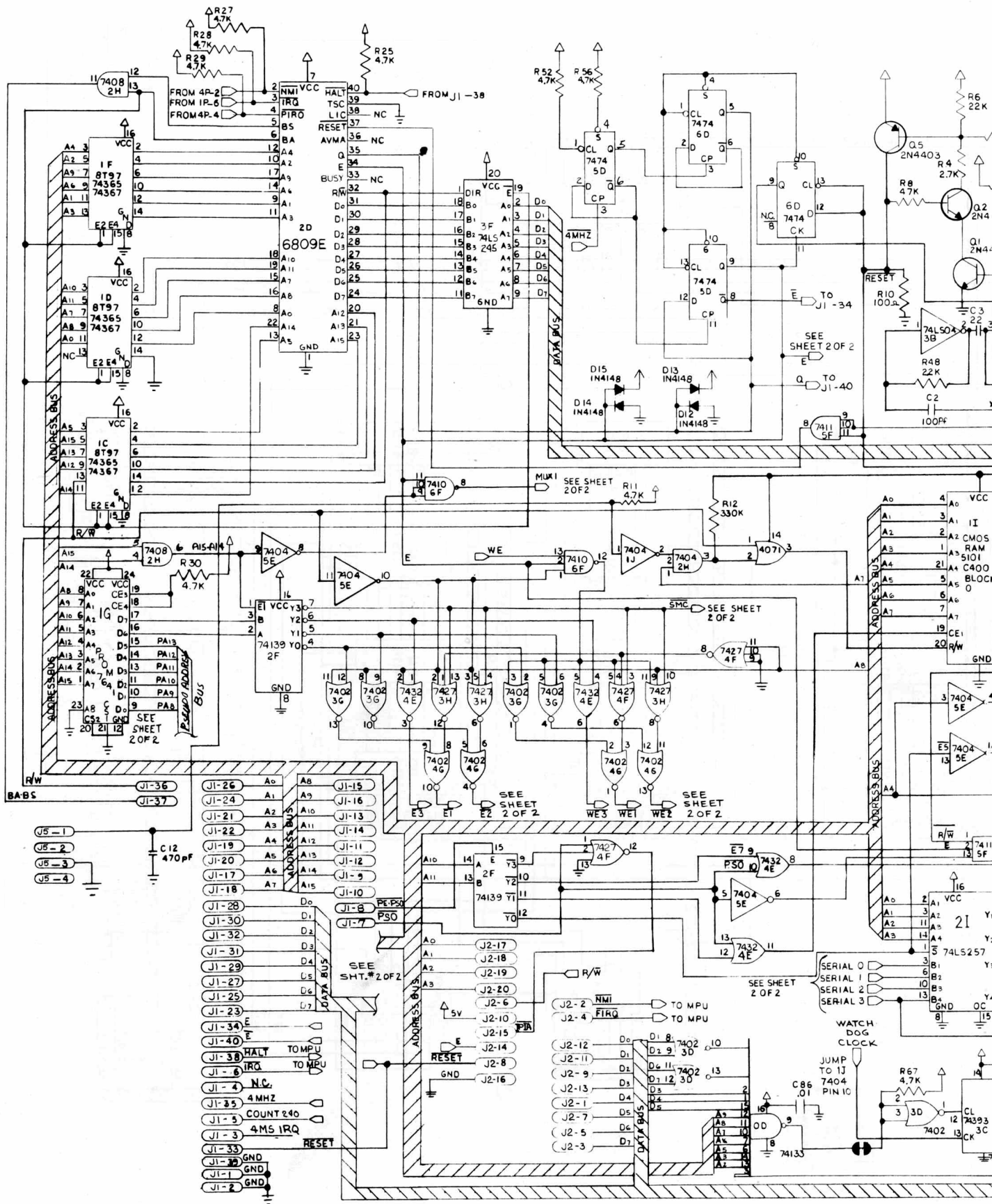
FOR 230V.A.C., A 275V VARISTOR #5017-09063 IS USED.

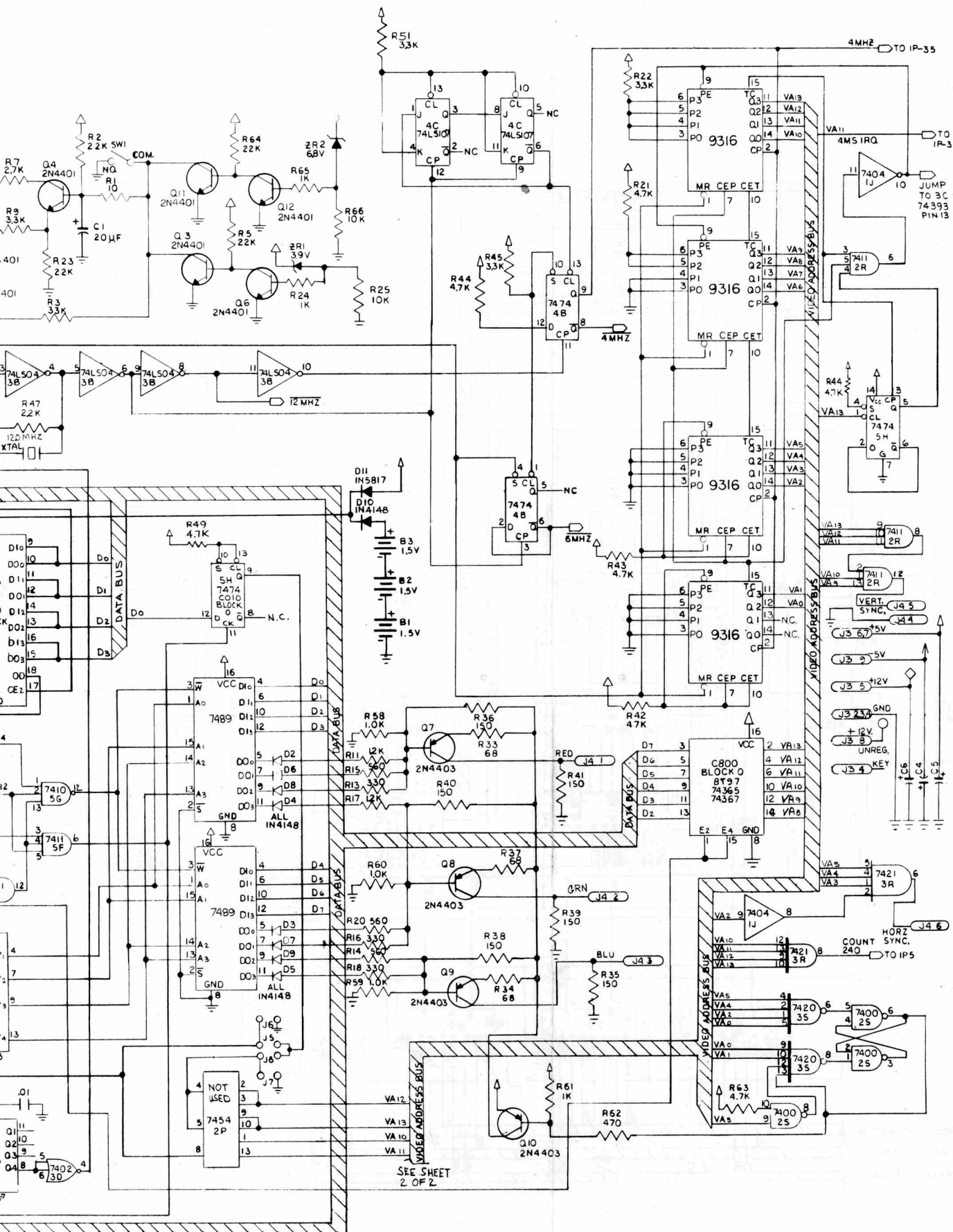
2. LINE CORD PART NUMBERS:

5850-06206-00 12 FT. EUROPE
 5850-08728-00 U.S. DOM.
 5850-08737-00 AUS.
 5850-08743-00 U.S.L.A.
 5850-09128-00 12 FT. FRANCE
 5850-09131-00 AWG 18-12 JAPAN

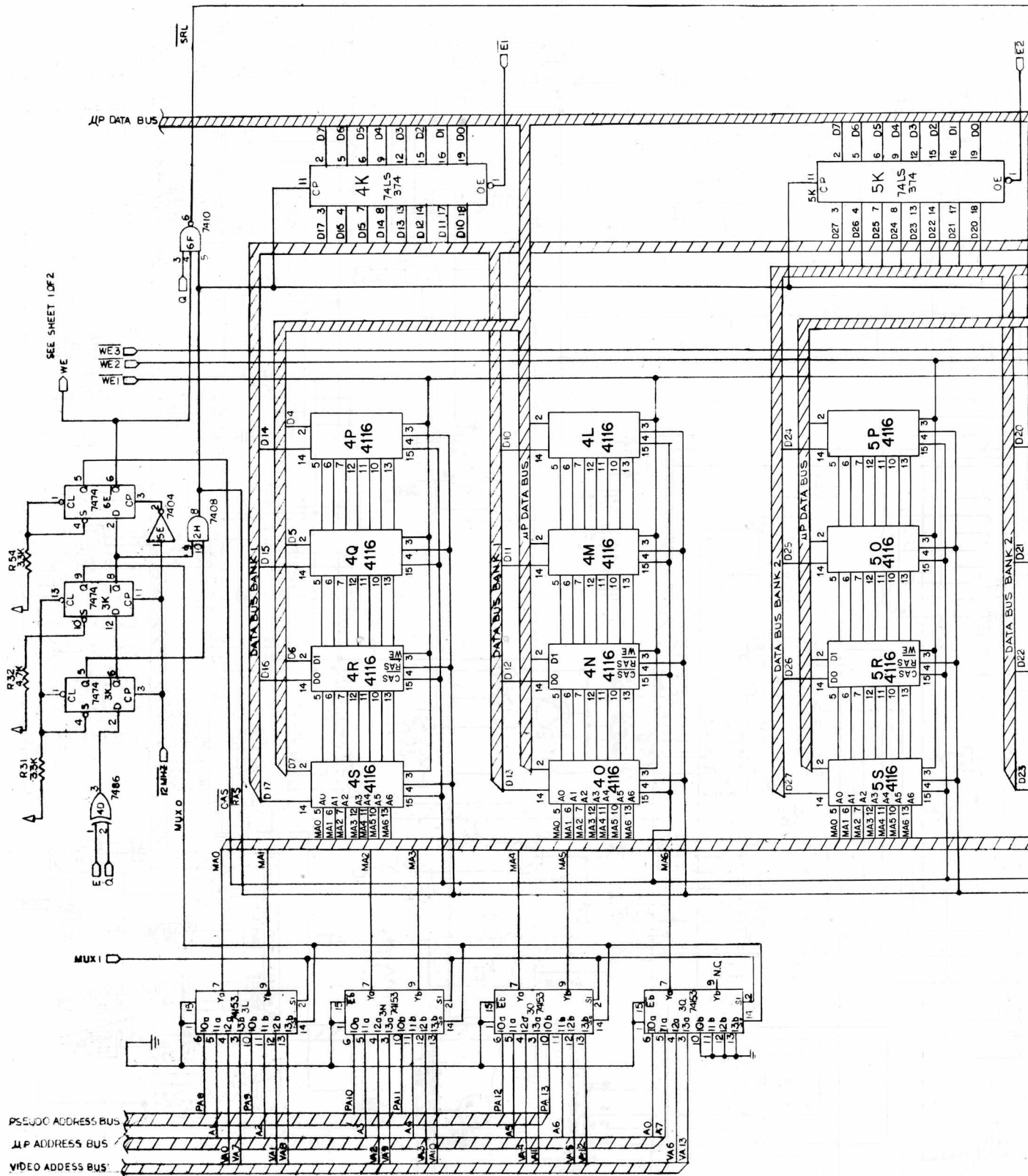


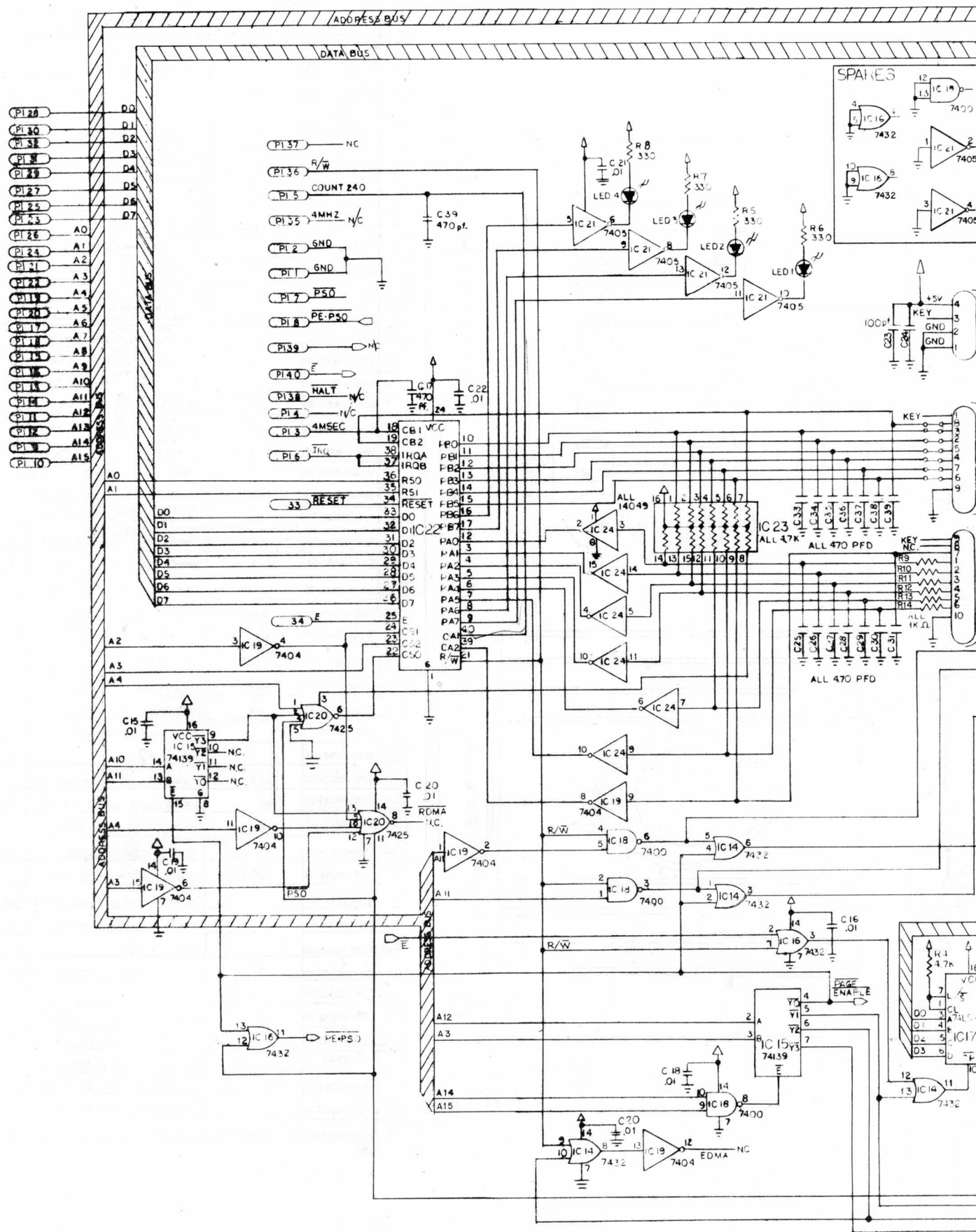
Cabinet Wiring Diagram





D8356 CPU/Video Board Logic Diagram
(Sheet 1 of 2)





ITEM NO.	REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.	BILL OF MATERIAL				
ITEM NO.	REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	3	48	5A-6314	F1, F2	4 AMP SLOW BLOW FUSE	2	1	IC-2001-146-3		BARE P.C. BOARD	1
2	3	49	5A-9178		FUSEHOLDER	4	2	5A-9156	IC1	TDA2002 V AUDIO AMPLIFIER	1
3	7	50	5A-9172		HEAT SINK THERMALLOY #6072B	1	3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	1	51	5A-9173		HEAT SINK THERMALLOY #6071B	1	4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	1	52	5A-9199		HEAT SINK THERMALLOY #6030	1	5	5A-8973	IC4	7408 QUAD 2 INP. AND GATE	1
6	1	53	5A-9004		24 PIN SOCKET	1	6	5A-9153	IC5	4050 BUFFER	1
7	1	54	5A-8985		40 PIN SOCKET	1	7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	1	55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2	8	5A-8971	IC7	14069 HEX INVERTER	1
9	1	56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2	9	5A-9157	IC8	7805 5 VOLT REG. W/TO220 CASE	1
10	1	57	5A-9349	10J5	40 PIN RIBBON HEADER	1	10	5A-8972	IC10	6821 P.I.A.	1
11	1						11	5A-9003	IC11	6810 RAM	1
12	1						12	5A-9152	IC13	1408 D/A CONVERTER	1
13	3						13	5C-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14	1						14				
15	1						15	5A-9018	ZR1	1N5996 6.8V. ZENER DIODE	1
16	1						16				
17	1						17	5A-9158	BR1	MDA 200/3N253 BRIDGE RECTIFIER	1
18	1						18	5A-9020	Y1	3.58 MHZ CRYSTAL	1
19	9						19	5B-8991	R1, R18, R19, R21, R22, R27, R30, R31, R32	RESISTOR, FC, 4.7K OHM 5% 1/4 WATT	9
20	9						20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10% 1/4 WATT	9
21	5						21	5A-8984	R12, R15, R28, R36, R38	RESISTOR, FC, 1K OHM 10% 1/4 WATT	5
22	1						22	5A-9181	R14	RESISTOR, FC, 1 OHM 10% 1/2 WATT	1
23	1						23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 10% 1/4 WATT	1
24	1						24	5A-9361	R17	RESISTOR, FC, 220 OHM 10% 1/2 WATT	1
25							25				
26	3						26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3K OHM 10% 1/4 WATT	3
27	1						27	5A-9179	R25	RESISTOR, FC, 3.3M OHM 10% 1/4 WATT	1
28	1						28	5A-9359	R29	RESISTOR, FC, 47 K OHM 5% 1/4 WATT	1
29	3						29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K OHM 10% 1/4 WATT	3
30	1						30	5B-9039	R34	RESISTOR, FC, 10 OHM 10% 1/4 WATT	1
31	11						31	5A-8980	C1, C16 THRU C23, C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	9						32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50 V. ±20%	9
33	1						33	5A-9345	C11	CAPACITOR, CERAMIC, .001 MFD. 20% 100 V.	1
34	3						34	5A-9345	C12, C30, C36	CAPACITOR, ELECTROLYTIC 1 MFD. 6.3 V. -10% +50%	3
35	3						35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	3
36	1						36	5A-9165	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	1						37	5A-9164	C15	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V. ±20%	1
38	1						38	5A-8986	C25	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V. ±20%	1
39	1						39	5A-8893	C26	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V. ±20%	1
40	1						40	5A-9046	C27	CAPACITOR, ELECTROLYTIC, 12,000 MFD. 16 V. ±20%	1
41	1						41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1K V. ±20%	1
42	1						42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25 V. LOW LEAK ±20%	1
43	2						43	5A-9169	C32, C33	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V. ±10%	2
44	1						44	5A-9163	C34	CAPACITOR, TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	1						45	5A-9031	C37	CAPACITOR, TANTALUM, 1 MFD. 25 V. ±20%	1
46	1						46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	1						47	5A-9330	DS1	2 STD. DIP SWITCH	1

NOTES:

- USE THERMAL COMPOUND BETWEEN TOP 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, 10J4, 10J3, 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
POKER/NO
PHOENIX
ARISTOCRAT SHUFFLE
POMPLI SHUFFLE
KING TUT SHUFFLE
TAURUS SHUFFLE

SOUND
ROM 1

W15, W8, W12, W4, W1, W3, W6, W11, FOR:

FLASH
STELLAR WARS
TRI ZONE
TIME WARP

SOUND ROM 1
5A-9198

W7, W15, W9, W1, (SEE NOTE #5) W2, W5, W10 FOR:

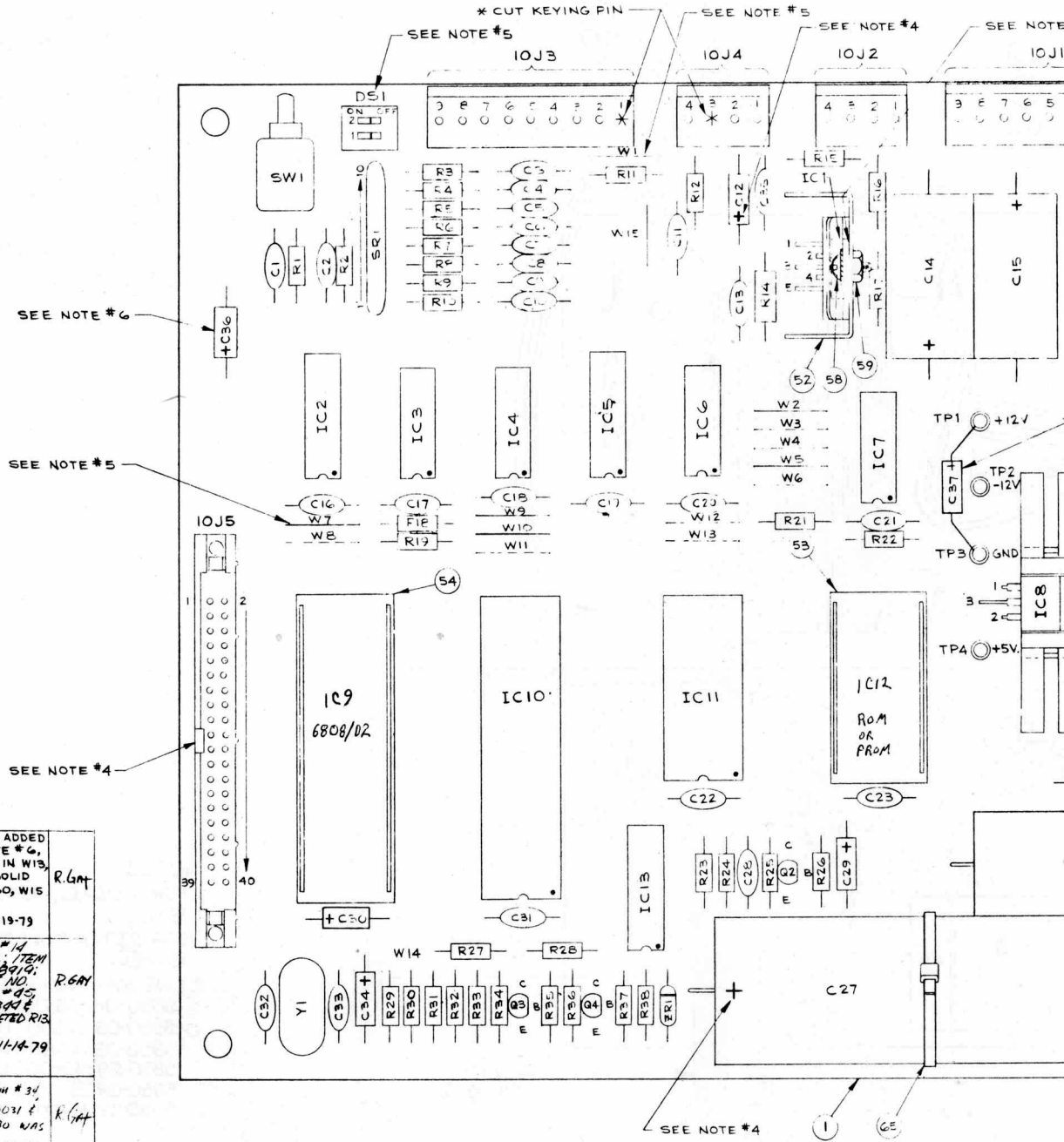
GORGAR, SOUND ROM 2 - JT-4960

IC 12 SELECTION STRAPPING:

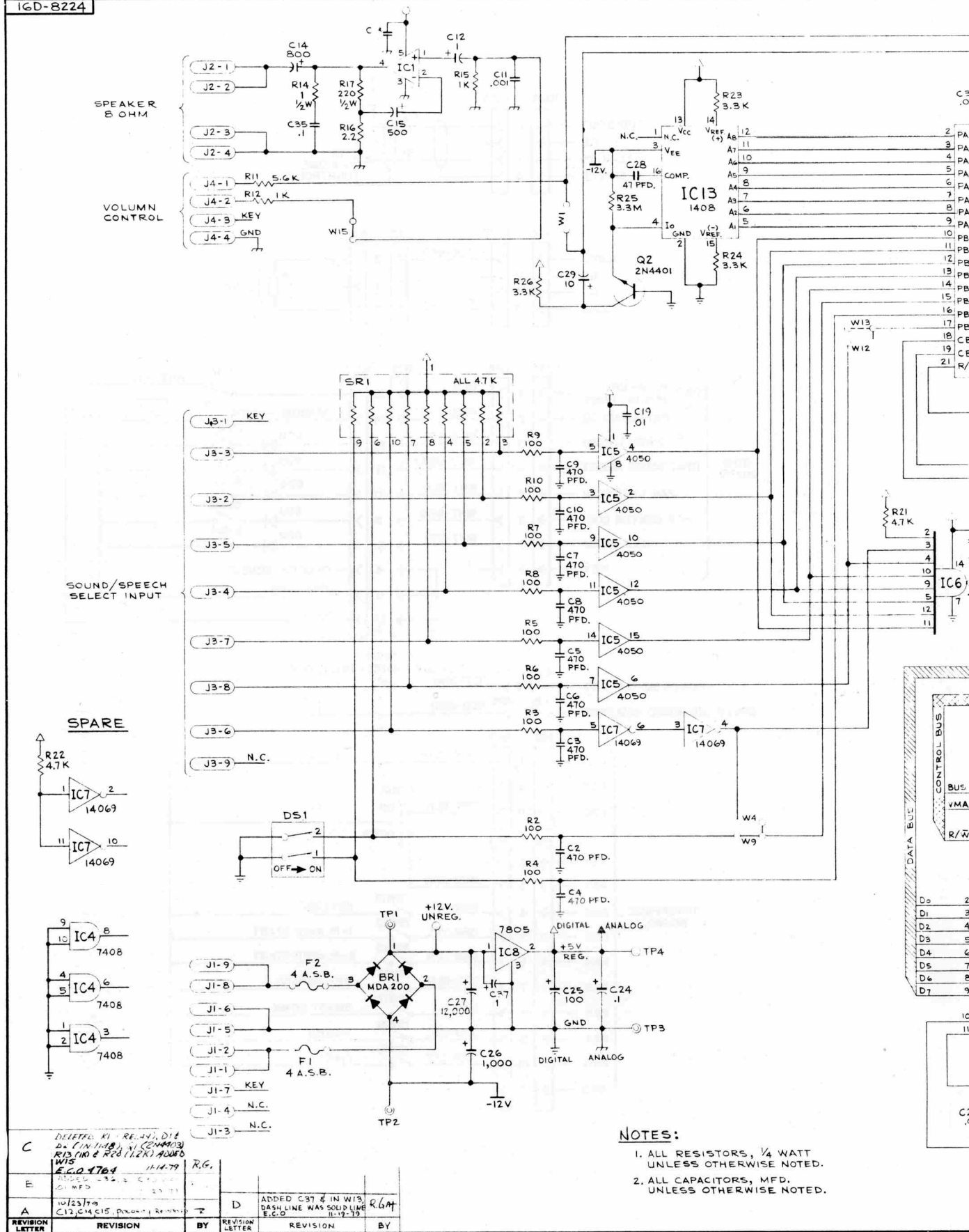
(2K x 8) (1K x 8) (512 x 8)
W2 W3 W3
W5 IN W5 IN W5 IN
W6 W6 W6

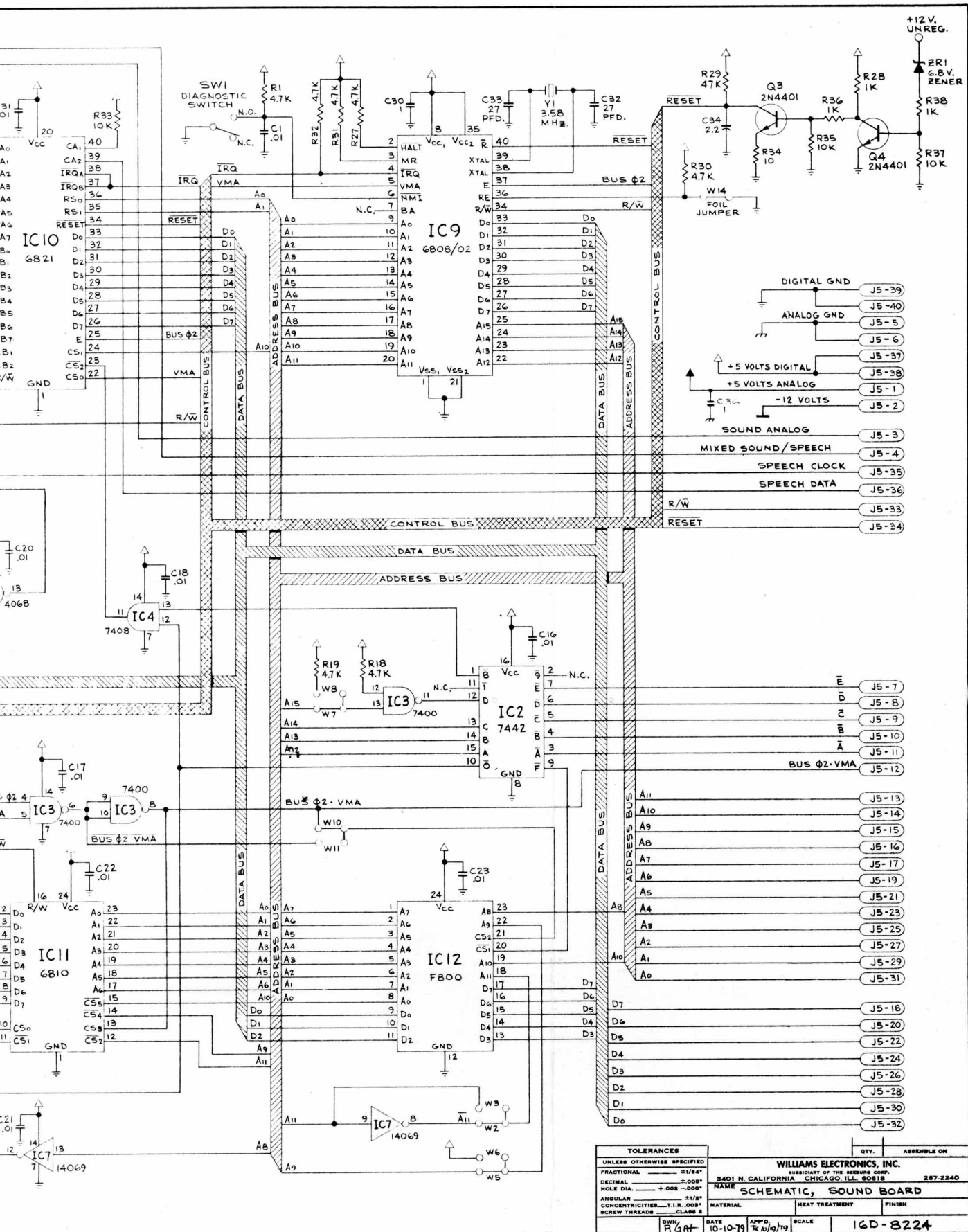
TOLERANCES		QTY.	ASSEMBLY ON
UNLESS OTHERWISE SPECIFIED			
FRACTIONAL	±1/16"	WILLIAMS ELECTRONICS, INC.	
DECIMAL	±.005"	HUBBARD OF THE REEDS CORP.	
HOLE DIA.	±.002 - .000"	3401 N. CALIFORNIA CHICAGO, ILL. 60618	
ANGULAR	±1/8"	NAME	
CONCENTRICITY	±1/8"	MATERIAL	
SCREW THREAD	CLASS 2	HEAT TREATMENT	
DATE	9-23-79	SCALE	D-8223

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION
58			6-32 X 1/8" BINDER
59			6-32 HEX NUT
60		W1, W2, W5, W7, W9, W10, W15	WIRE JUMPER 22
61	5A-9248	TP1 THR TPA	TERMINAL # 150
62	5A-9363	R11	RESISTOR, FC, 5% 1/4 WATT
64	5A-9362	SRI	RESISTOR, 4.7K 10 PIN SIP
65	3A-7520-1		TIE WRAP



E	REVISED NOTES, ADDED ITEM #45 & NOTE #6, RELOCATED W15, IN W13, DASH LINE WAS SOLID LINE & ITEM #60, W15 WAS W13 E.C.O. 11-19-79	R.G.M.
D	DELETED ITEM #14 PT. NO. 5C-9016, ITEM #14 PT. NO. 5A-9199, ITEM #25, PT. NO. 5A-9314 ITEM #45, PT. NO. 5A-9344 & IN ITEM #21, DELETED R13 QTY. WAS 6 E.C.O. 4764 11-14-79	R.G.M.
C	ADDED C36, ITEM #34 PT. NO. WAS 5A-9031 & QTY. WAS 1, & C30 WAS 01 MFD. 10-29-79 E.C.O. 4760	R.G.M.
B	DELETED ITEM #22 ADDED R12 TO ITEM #14 QTY. WAS 7 10-20-79	R.G.M.
A	ITEM #11, A.D.C. 5A-9310 ITEM #22, A.D.C. 5A-9310 ITEM #25, A.D.C. 5A-9310	R.G.M.
REVISION LETTER	REVISION	BY





D8224 Sound Board Logic Diagram