

*Williams*<sup>®</sup>

16P-493-101  
Game No. 493  
January, 1980

# LASER BALL



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

*Williams*<sup>®</sup>   
**ELECTRONICS, INC.**

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

## FOREWORD

This is a basic instruction manual that provides information unique to LASER BALL. For detailed troubleshooting and interconnection information refer to the Williams Solid State Flipper Maintenance Manual.

### SPECIAL CONSIDERATIONS WHEN REPLACING CIRCUIT BOARDS

#### CPU BOARD

1. For memory protection feature, revision level 6 CPU Boards (batteries located on lower right corner of board) must be used. Revision level 4 CPU BOARDS equipped with three PROM sockets may be used but the memory protection feature is lost:
2. Must be equipped with green-labeled LASER BALL PROMs and green-labeled flipper ROMs.

#### Sound Board

1. **Must** be equipped with two fuse clips.
2. Must be jumpered for ROM operation and be equipped with Sound ROM 2 or be jumpered for PROM operation and be equipped with LASER BALL Sound PROM.

#### Power Supply Board

1. Fuse F4 (10A SB) for flipper solenoids must be installed.

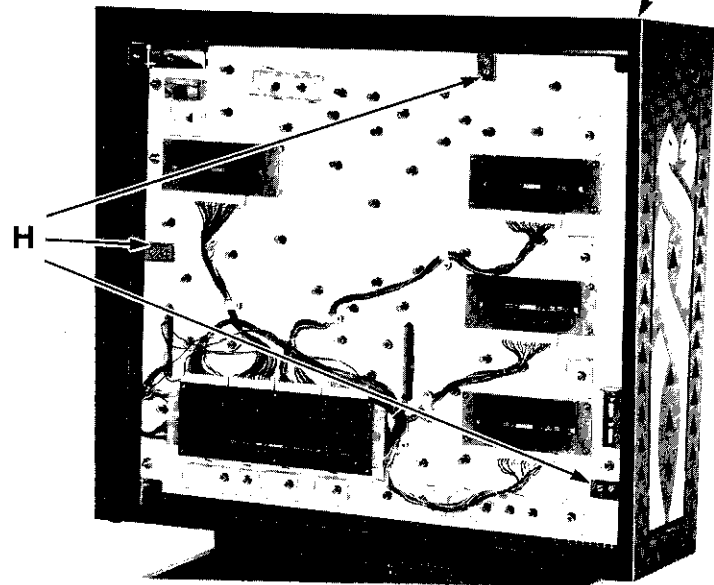
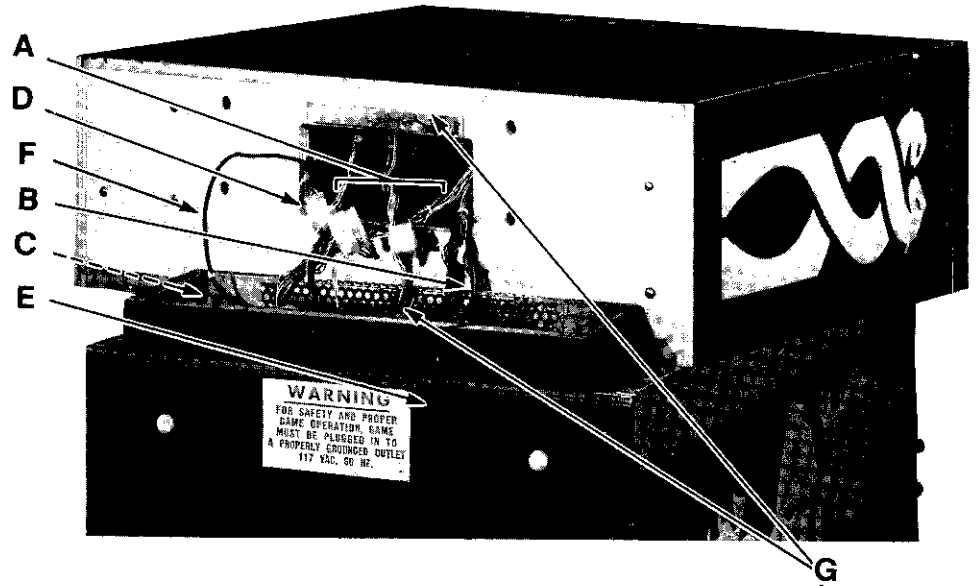
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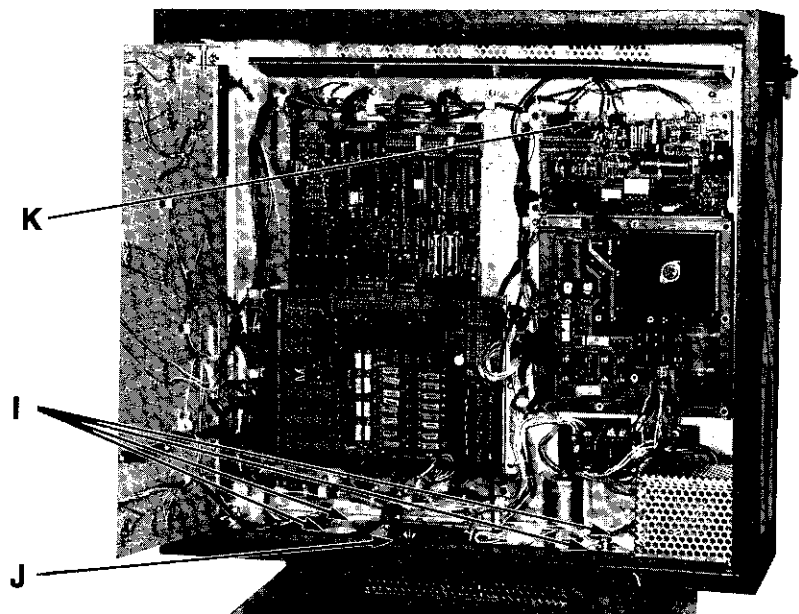
### Assembly and Interconnection

With legs attached to cabinet, position backbox as shown and proceed as follows:

- A Pull five cables from backbox.
- B Reach into right side of pedestal hole, pull up ground strap, and push it into backbox.
- C Remove the tie securing cabinet and playfield cables to cabinet and pull up these cables.
- D Interconnect five cables. They are size and color coded except for power connector where wire colors do not match.
- E Insert line cord into notch in cabinet. **DO NOT PLUG IN AT THIS TIME.**
- F Push remote volume control cable into backbox.
- G Lift up backbox and position on cabinet pedestal, engaging brackets for support.
- H Remove shipping blocks.



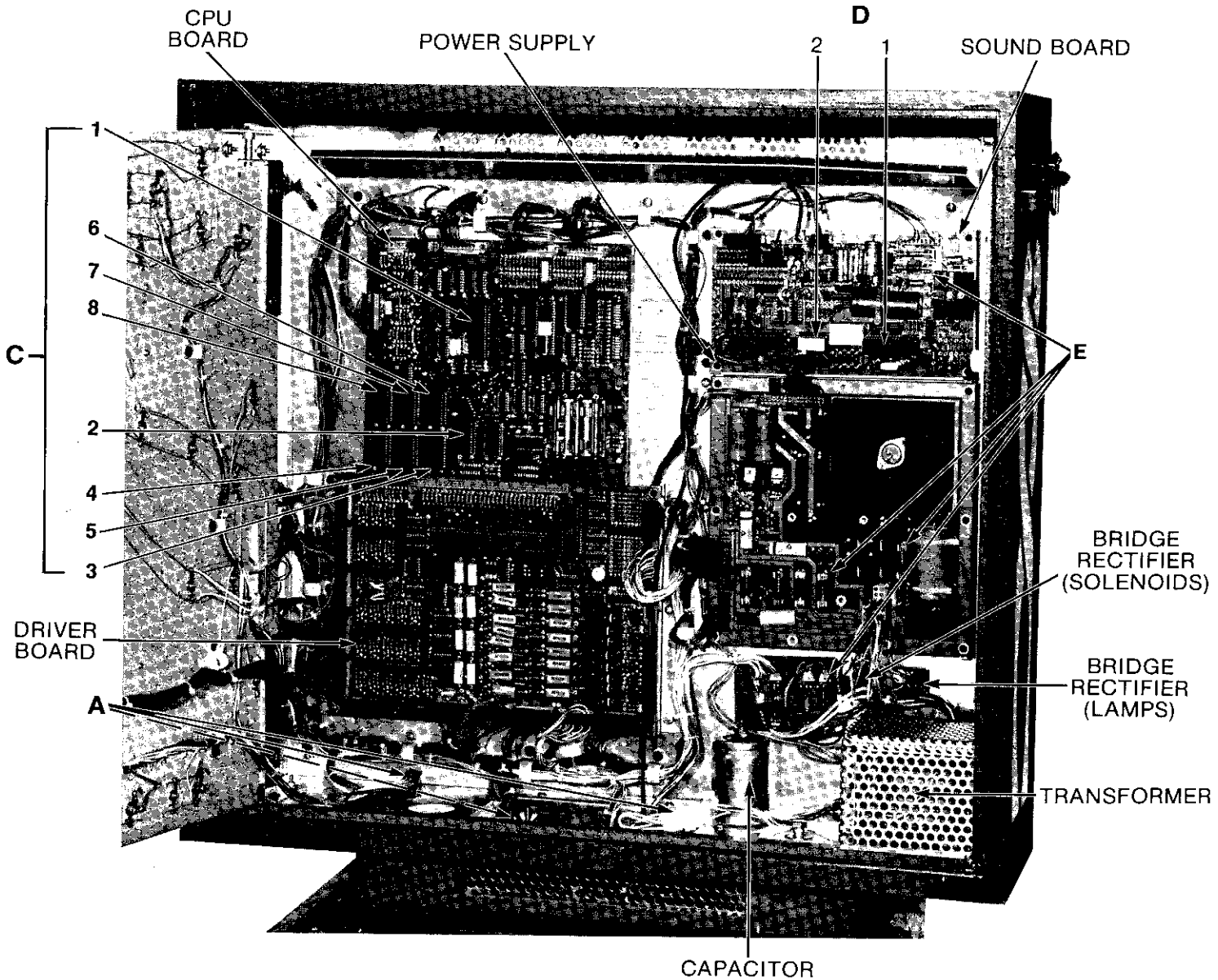
- I Secure backbox to cabinet using four bolts and washers.
- J Connect ground braid under wing nut and washer.
- K Loosely position remote volume control cable in harness and plug connector into 10J4 on Sound Board.



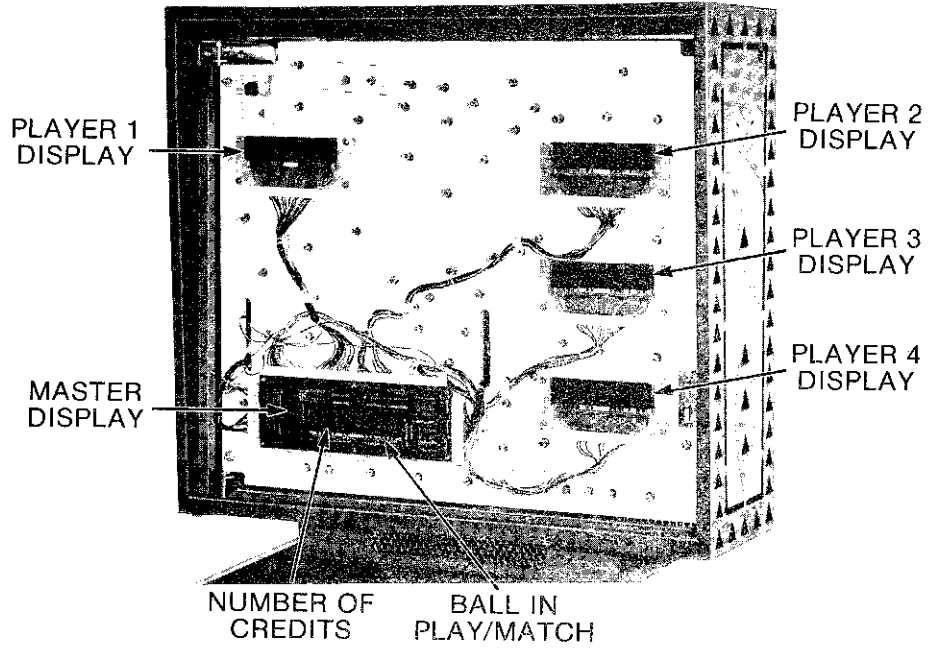
**Inspection**

- A** Check all connectors in backbox for loose wire terminations. Reseat any loose wires by pushing in on the termination.
- B** (Not called out) Push on all connectors attached to the CPU, Driver, Sound, and Power Supply Boards and check terminations on capacitor and bridge rectifiers.

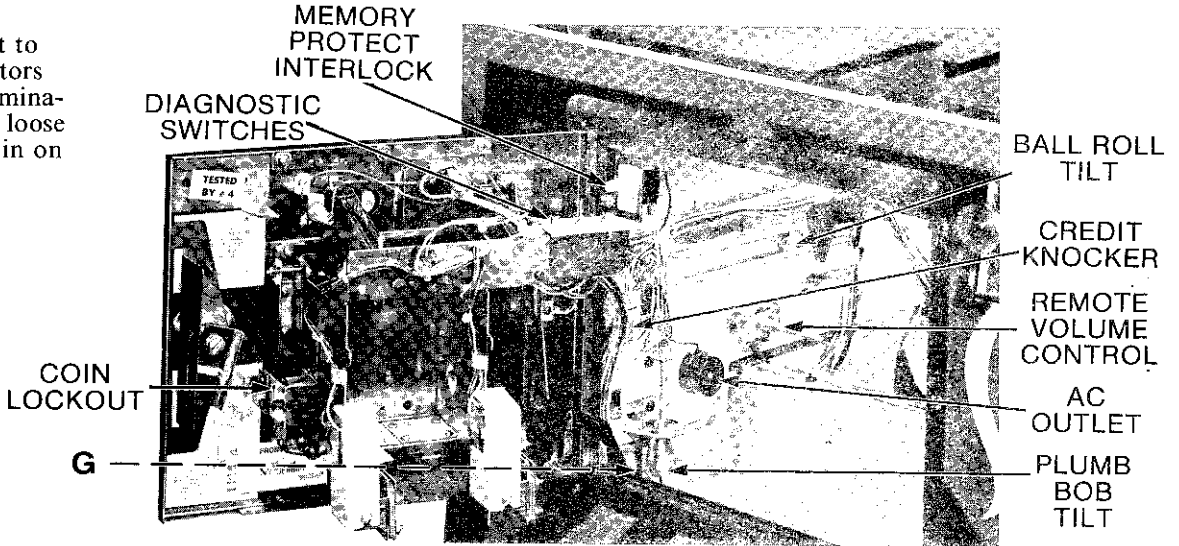
- C** Gently press on the socketed IC packages on CPU Board: 1 MPU, 2 RAM, 6, 7, and 8 PROMs, and 4 and 5 ROMs.
- D** Gently press on the socketed IC packages on Sound Board: 1 MPU, 2 Sound ROM or PROM.
- E** Check that two fuses on Sound Board, five fuses on Power Supply, and three fuses on fuse card are secure.



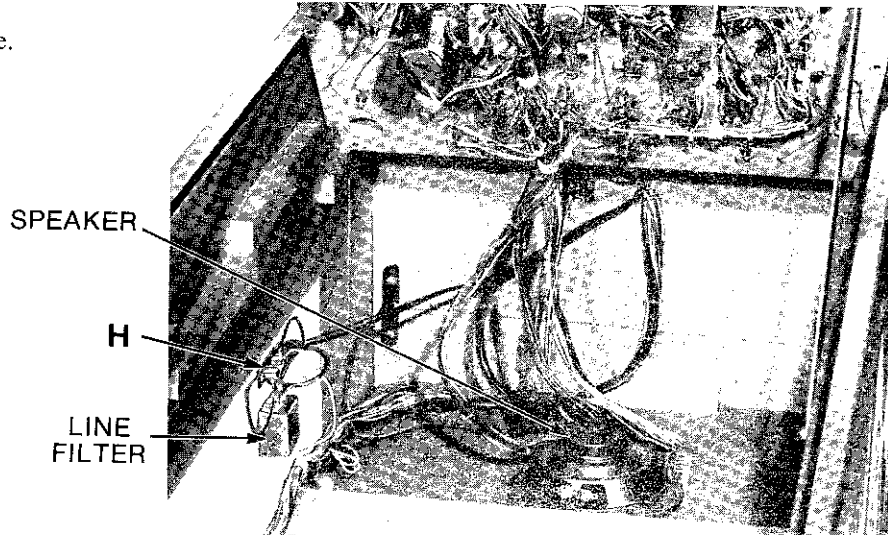
F (Not called out) Push on all connectors attached to Master and Player Display Boards.



G Check the cabinet to coin door connectors for loose wire terminations. Reseat any loose wires by pushing in on the termination.



H Check that the line fuse is secure.



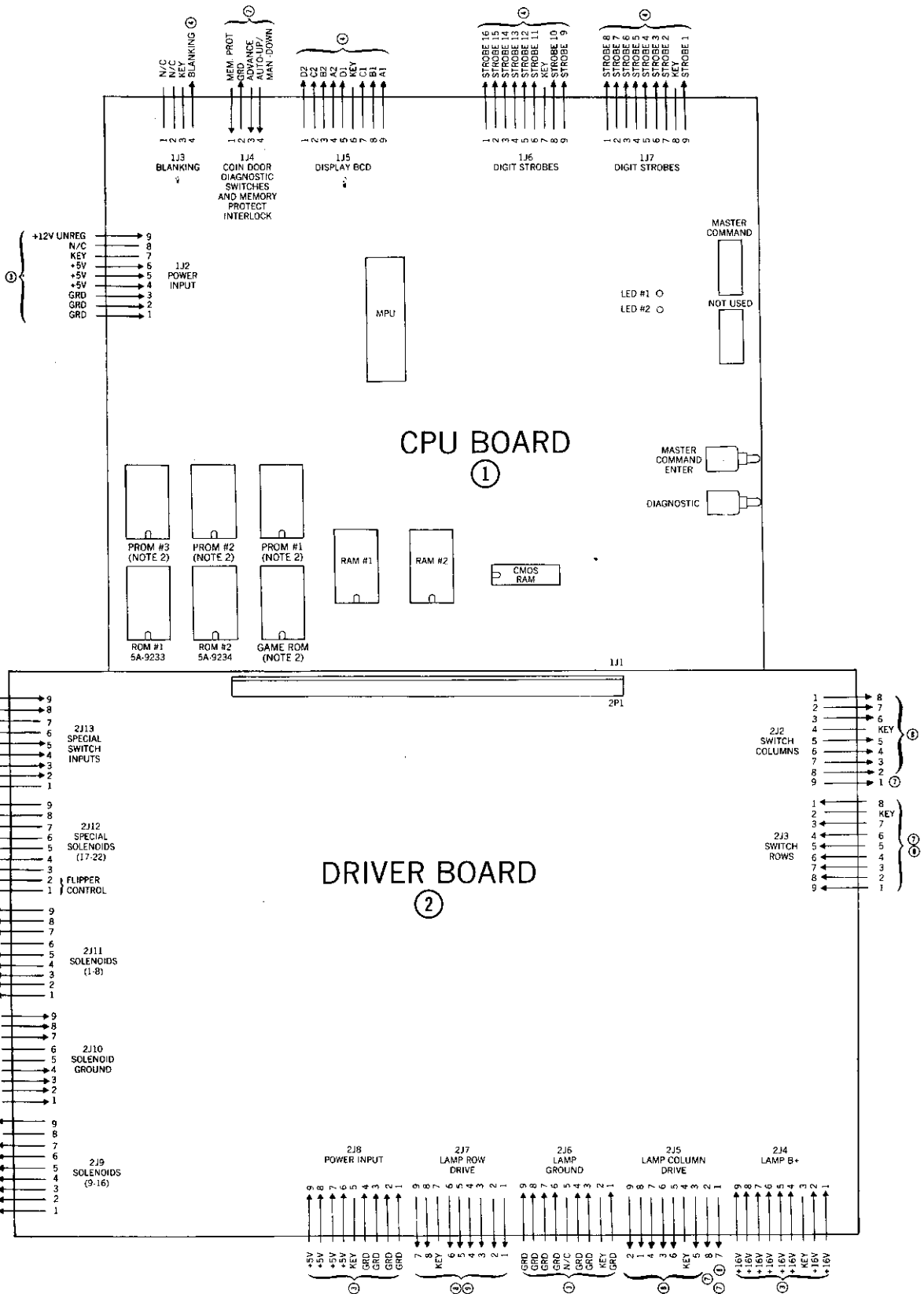
**Power Turn-On**

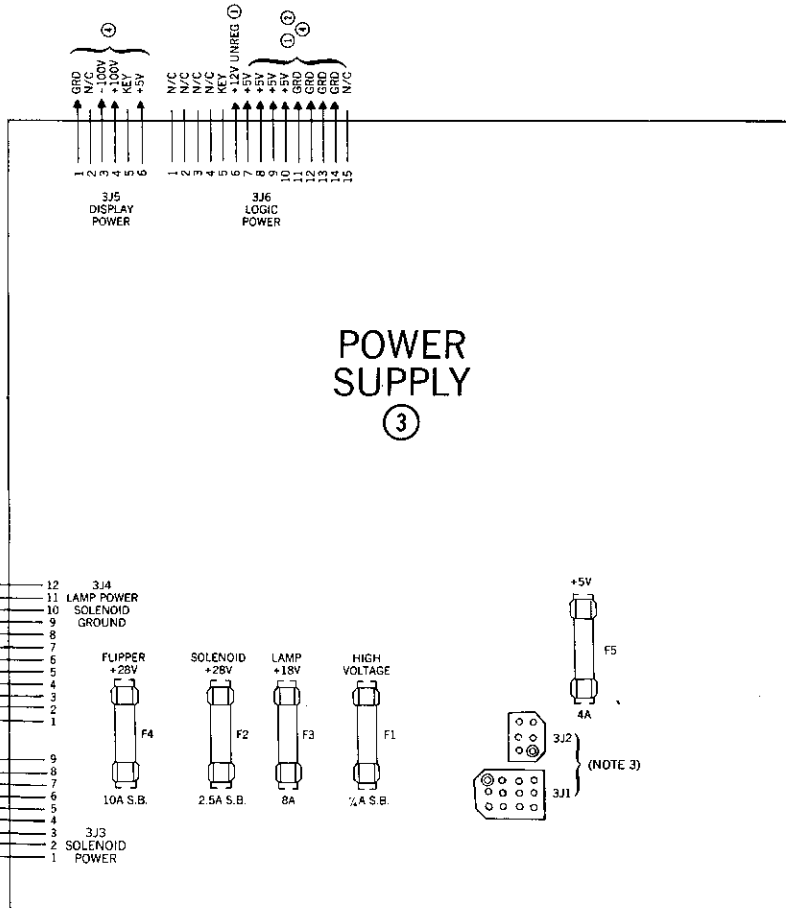
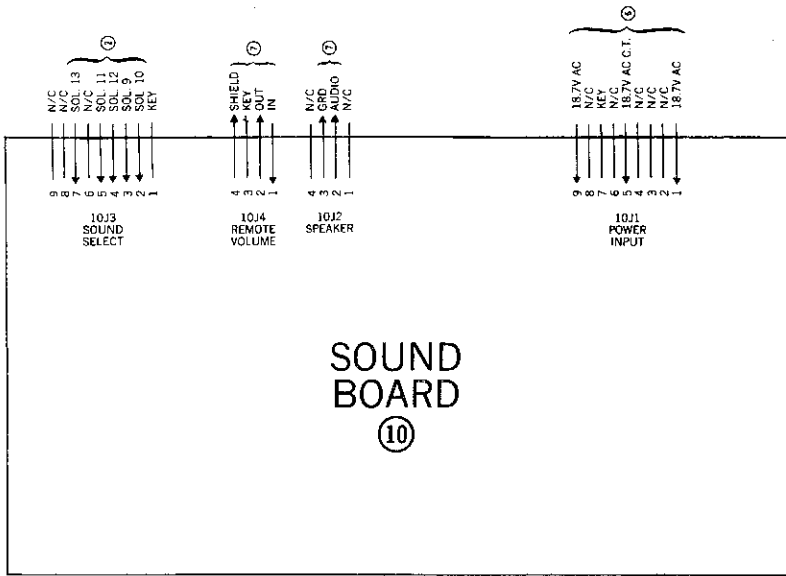
This machine **MUST BE PLUGGED INTO A PROPERLY GROUNDED OUTLET** to PREVENT SHOCK HAZARD and to ensure PROPER GAME OPERATION. DO NOT use a "cheater" plug to defeat the ground pin on the line cord, and DO NOT cut off the ground pin. The line voltage MUST agree with that specified on the back of the cabinet or serious damage to the machine could occur. For low-line applications (105 or 210V ac), refer to the power wiring diagram (page 23).

1. **With the coin door closed**, plug the game in and turn it ON. The game should come on in the game over mode as indicated by the player scores reading zero, player 1 up light flashing, game over lights lit, and the high score to date alternating with the player 1 score.
2. If the game comes on in the diagnostic mode (number of credits display showing 04, ball in play display showing

00, and player 1 display showing game identification) turn the game OFF and ON again.

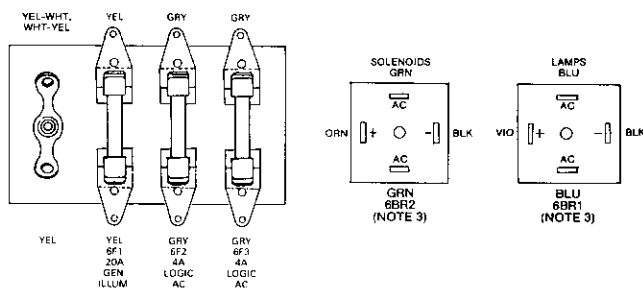
- a. If the game now comes on in the game over mode the bookkeeping and game evaluation totals have been reset to zero.
  - b. If the game still comes on in the diagnostic mode, open the coin door and turn the game OFF and ON **twice**. This is an indication of the batteries being removed with the power OFF or coming loose during shipment. This has also resulted in features reverting to factory settings. Any changes from factory settings must be reentered using procedures provided in the instruction booklet.
3. If the game still comes on in the diagnostic mode, refer to troubleshooting procedures in the maintenance manual.
  4. Perform diagnostic tests and make any desired changes to features as described in the instruction booklet.





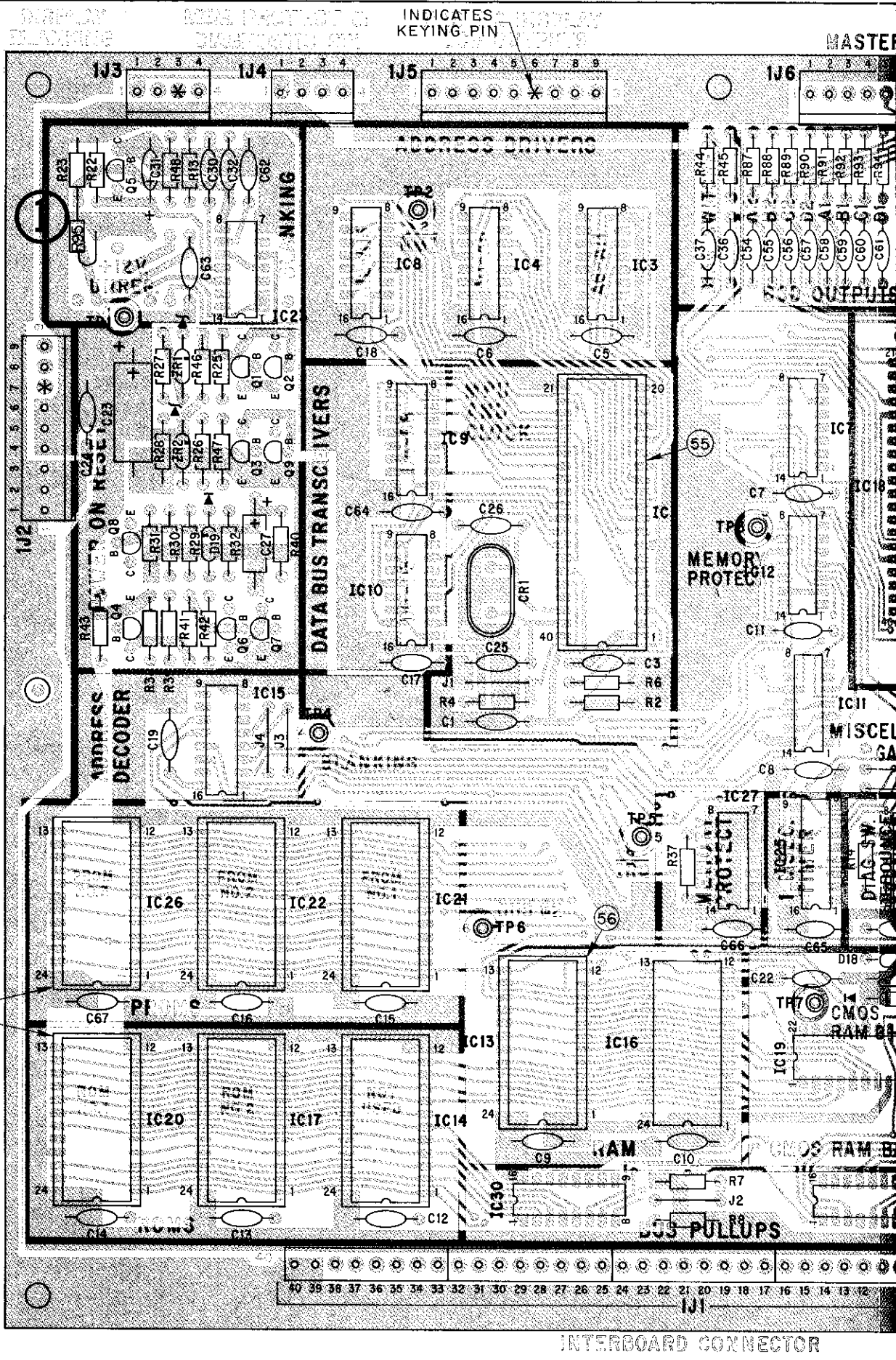
**NOTES:**

- CONNECTIONS ARE INDICATED CIRCLED NUMBERS AS FOLLOWS:
  - ① CPU BOARD
  - ② DRIVER BOARD
  - ③ POWER SUPPLY BOARD
  - ④ MASTER DISPLAY BOARD
  - ⑤ SLAVE DISPLAY BOARD
  - ⑥ BACKBOX
  - ⑦ CABINET
  - ⑧ PLAYFIELD
  - ⑨ INSERT BOARD
  - ⑩ SOUND BOARD
- PROMS #1, #2 and #3 ARE USED A GAME ROM IS NOT USED.
- REFER TO POWER WIRING DIAGRAM (PAGE 15) FOR CONNECTIONS TO 3P2, 6BR1, 6BR2, 6F1, 6F2, AND 6F3.





REVISION LETTER	REVISION
D	REVISED AND REDRAWN REVISED DWG. TO CONFORM TO ARTWORK NO. 18-2001-133 LATEST ISSUE NO. 6. R. GAY, 1-8-79
E	ITEM NO. 3, MFG'S PT. NO. WAS 1N5991. E.C.O. 4670 R.GAY, 1-31-79



TP1 9.0V 100000

TP2 5.0V 100000

TP3 5.0V 100000

TP4 5.0V 100000

TP5 5.0V 100000

TP6 5.0V 100000

TP7 5.0V 100000

TP8 5.0V 100000

TP9 5.0V 100000

TP10 5.0V 100000

TP11 5.0V 100000

TP12 5.0V 100000

TP13 5.0V 100000

TP14 5.0V 100000

TP15 5.0V 100000

TP16 5.0V 100000

TP17 5.0V 100000

TP18 5.0V 100000

TP19 5.0V 100000

TP20 5.0V 100000

TP21 5.0V 100000

TP22 5.0V 100000

TP23 5.0V 100000

TP24 5.0V 100000

TP25 5.0V 100000

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TP65 5.0V 100000

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TP69 5.0V 100000

TP70 5.0V 100000

TP71 5.0V 100000

TP72 5.0V 100000

TP73 5.0V 100000

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TP77 5.0V 100000

TP78 5.0V 100000

TP79 5.0V 100000

TP80 5.0V 100000

TP81 5.0V 100000

TP82 5.0V 100000

TP83 5.0V 100000

TP84 5.0V 100000

TP85 5.0V 100000

TP86 5.0V 100000

TP87 5.0V 100000

TP88 5.0V 100000

TP89 5.0V 100000

TP90 5.0V 100000

TP91 5.0V 100000

TP92 5.0V 100000

TP93 5.0V 100000

TP94 5.0V 100000

TP95 5.0V 100000

TP96 5.0V 100000

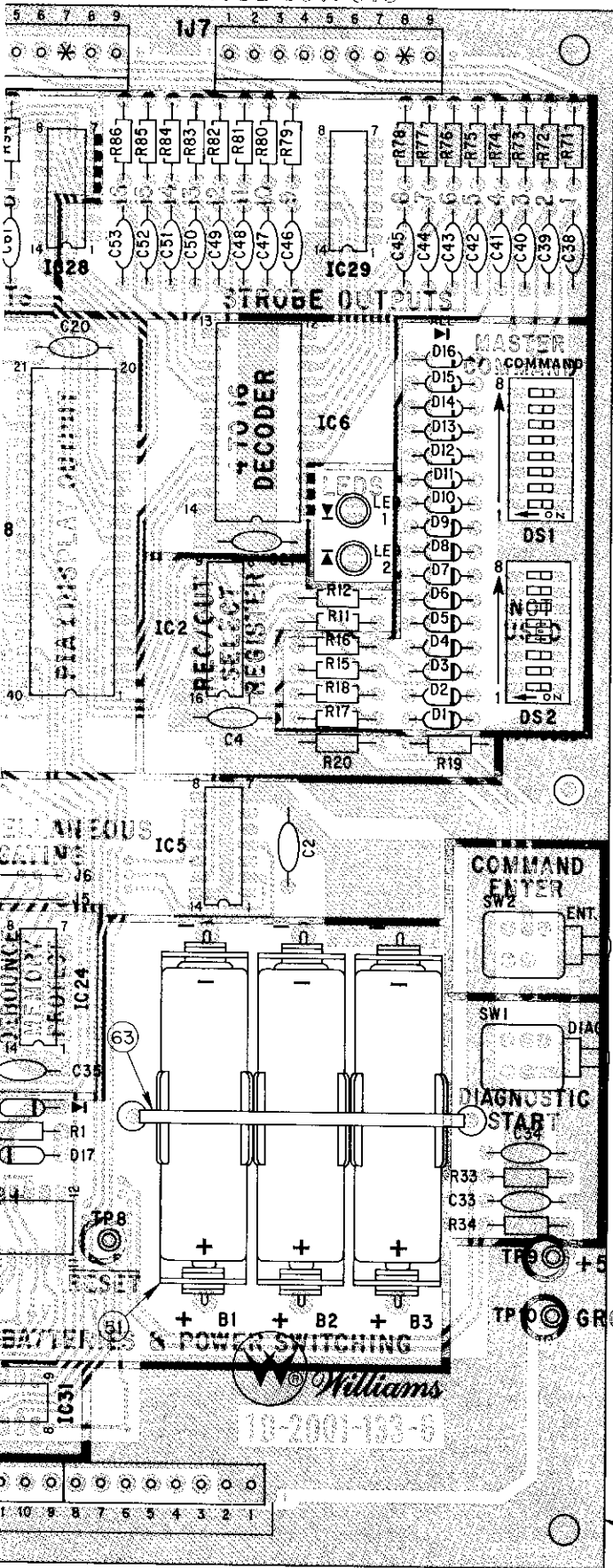
TP97 5.0V 100000

TP98 5.0V 100000

TP99 5.0V 100000

TP100 5.0V 100000

ER DISPLAY STROBE OUTPUTS



BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	18 2001-133-6		BARE P.C. BOARD	1
2	5A-8990	IC2, IC9, IC10	8T28 QUAD BUFFER/RECEIVER	3
3	5A-8989	IC3, IC4, IC8	8T97 HEX. TS BUFFER	3
4	5A-9010	IC6	74154 4 TO 16 DECODER	1
5	5A-9013	IC7	7404 HEX. INVERTER	1
6	5A-9235	IC11	74LS10 TRIPLE 3 INPUT NAND	1
7	5A-8973	IC12	7408 QUAD AND	1
8	5A-9011	IC13, IC14	MC6810 RAM	2
9	5A-9246	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
10	5A-9247	IC17	ROM 2K X 8 LOWER	1
11	5A-8972	IC18	MC6820 PIA	1
12	5A-9017	IC19	CMOS RAM 5101	1
13	5A-9248	IC20	ROM 2K X 8 UPPER	1
14	5C-9002	IC23	MC3456/556 DUAL TIMER	1
15	5A-9073	IC24	7400 QUAD 2 INPUT NAND	1
16	5A-9236	IC25	4020 CMOS 14 BIT COUNTER	1
17	5A-9237	IC27	4071 CMOS QUAD 2 INPUT NOR	1
18	5A-9247	IC5	74LS02 QUAD 2 INPUT NOR GATE	1
19	5A-9238	IC29, IC29	13 DIP RESISTOR/PACK, 4.7 K OHM	2
20	5A-9239	IC30, IC31	15 DIP RESISTOR/PACK, 4.7 K OHM	2
21	5B-9025	DS1, DS2	8 STN. DIP SWITCH	2
22	5A-9018	ZR1	1N5996 ZENER DIODE	1
23	5A-9240	ZR2	1N5990 ZENER DIODE	1
24	5A-8919	D1 THRU D19	1N4148 DIODE, SILICON	19
25	5C-8938	Q1, Q2, Q3, Q6 THRU Q9	2N4401 TRANSISTOR	9
26	5C-9116	Q4, Q5	2N4403 TRANSISTOR	2
27	5A-9020	CR1	CRYSTAL, 3.58 MHZ	1
28	5B-8984	R20, R25, R26, R48, R71 THRU R94	RESISTOR, FC, 1K OHM 10% 1/4 W.	28
29	5B-8983	R2, R6, R7, R8, R23, R30	RESISTOR, FC, 3.3K OHM 10% 1/4 W.	6
30	5B-8991	R4, R13 THRU R19, R33, R34 R41	RESISTOR, FC, 4.7K OHM 10% 1/4 W.	11
31	5A-9033	R1	RESISTOR, FC, 680 OHM 5% 1/4 W.	1
32	5B-9036	R11, R12, R42	RESISTOR, FC, 100 OHM 10% 1/4 W.	3
33	5B-9113	R22, R40	RESISTOR, FC, 33K OHM 5% 1/4 W.	2
34	5B-9034	R27, R28	RESISTOR, FC, 10K OHM 10% 1/4 W.	2
35	5A-9241	R29, R38, R46, R47	RESISTOR, FC, 22K OHM 10% 1/4 W.	4
36	5A-8994	R31	RESISTOR, FC, 2.2K OHM 10% 1/4 W.	1
37	5A-9029	R32	RESISTOR, FC, 10 OHM 10% 1/4 W.	1
38	5A-9242	R37	RESISTOR, FC, 300K OHM 10% 1/4 W.	1
39	5A-8997	R39, R43	RESISTOR, FC, 2.7K OHM 10% 1/4 W.	2
40	5B-9044	R44, R45	RESISTOR, FC, 470 OHM 10% 1/4 W.	2
41	5A-8990	C1 THRU C21, C30, C33 THRU C37, C63 THRU C67	CAPACITOR, CERAMIC, 01 MFD. 50 V.	30
42	5A-8986	C23	CAPACITOR, ELECT, 100 MFD. 10 V.	1
43	5A-8996	C22, C24	CAPACITOR, CERAMIC, 1 MFD. 50 V.	2
44	5A-9169	C25, C26	CAPACITOR, CERAMIC, 27 PFD. 1K V.	2
45	5A-9243	C27	CAPACITOR, TANT., 10 MFD. 10 V.	1
46	5A-9031	C31	CAPACITOR, TANT., 1 MFD. 25 V.	1
47	5A-9030	C32	CAPACITOR, CERAMIC, .047 MFD 50V.	1
48	5A-9065	C38 THRU C62	CAPACITOR, CERAMIC, 470 PFD. 50V.	25
49	5A-9019	LED1, LED2	LED, RED	2
50	5A-9024	SW1, SW2	SWITCH, SPOT MOMENTARY	2
51	5A-9021		BATTERY HOLDER #171	1
52	5A-9026	U1	HEADER 09-64-1083	5
53	5A-9028	U3, U4	HEADER 09-65-1041	2
54	5A-9027	U2, U5, U6, U7	HEADER 09-65-1091	4
55	5A-8985		40 PIN IC SOCKET	1
56	5A-9004		24 PIN IC SOCKET	7
57		J1 THRU J6	WIRE JUMPER 22 GAUGE WIRE WITH INSULATION	6
58		TP1 THRU TP10	TERMINAL #1502-1	10
59	5A-9250	IC1	MC6808 MICROPROCESSOR	1
60		IC14	NOT USED	0
61	5A-9015	IC21, IC22, IC26	PROM 512 X 8 7641/6341	3
62	5A-9022	B1, B2, B3	BATTERY, ALKALINE, 1.5 V.	3
63	3A-7520-1		TIE WRAP	1
64	5A-9266	D18	1N5817 DIODE	1
65	5A-9086	R95	RESISTOR, 68K OHM 10% 1/4 W.	1

\* - J2 THRU J4, R1 & R4 NOT USED.

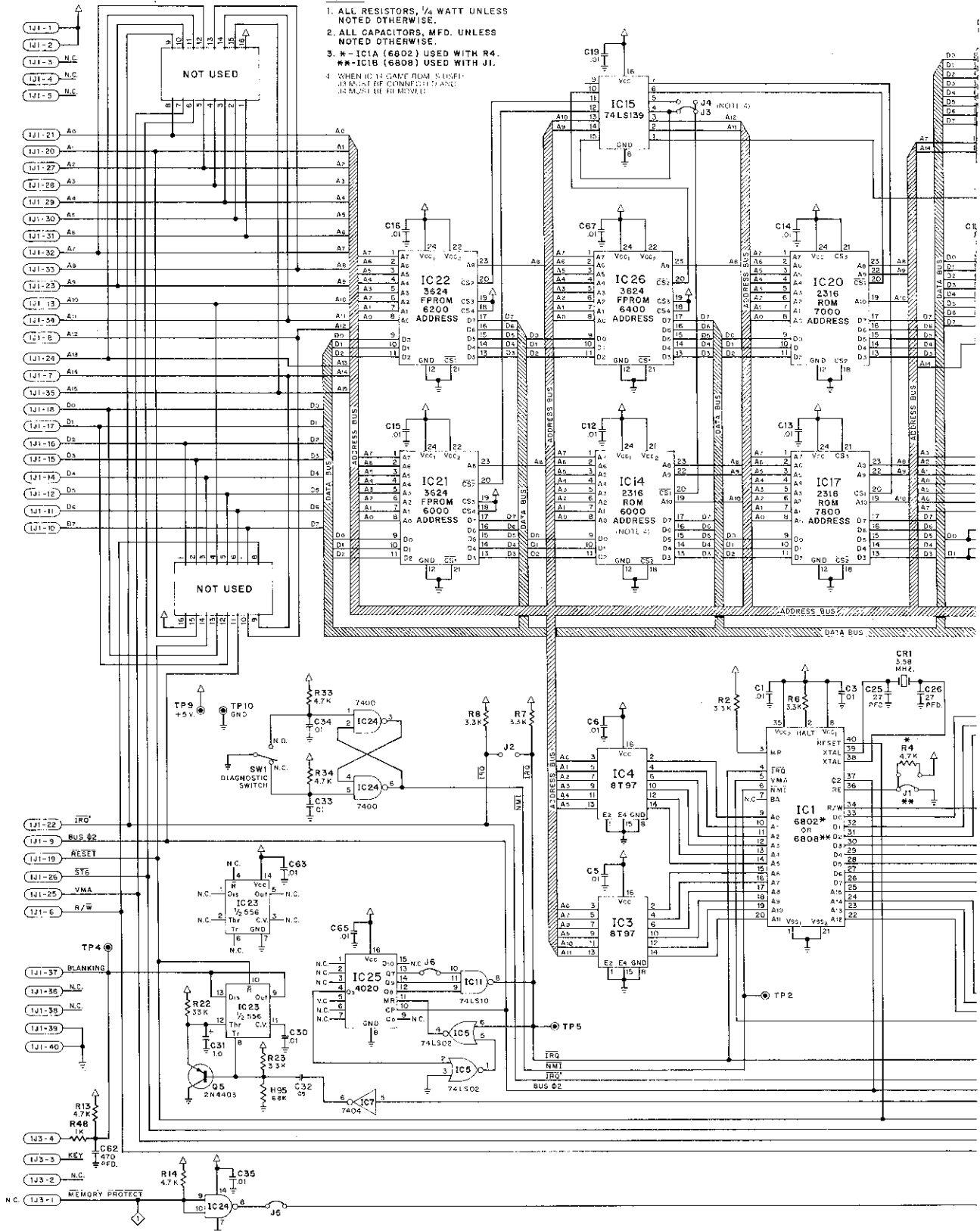
WILLIAMS ELECTRONICS, INC.  
 SUBSIDIARY OF XCOR CORPORATION  
 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

PART NAME  
**CPU BOARD ASSEMBLY**

DWN. R. Gay	DATE 1-11-79	APP'D.	SCALE 2=1	PART NO. D-8161
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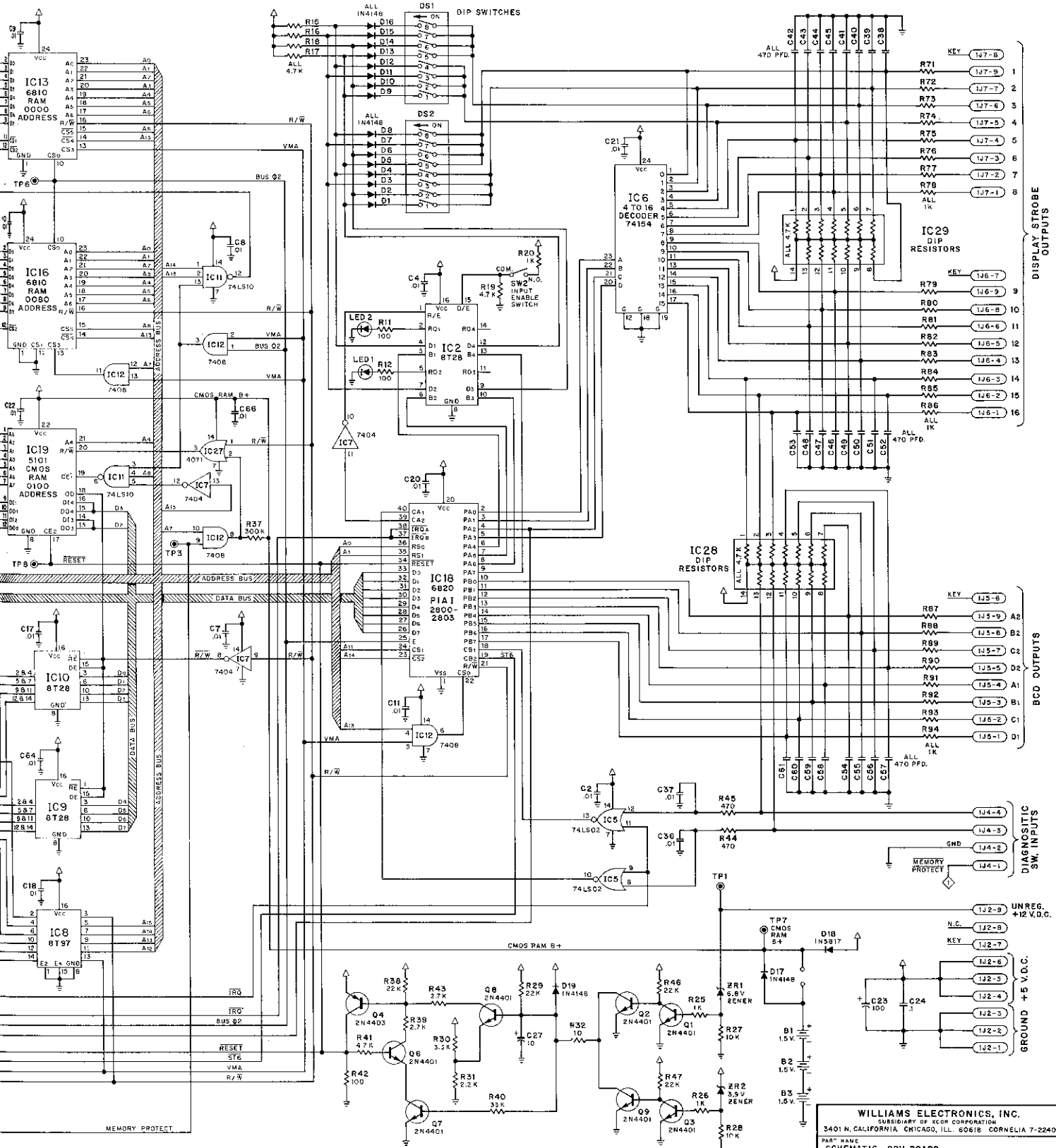
NOTES:

1. ALL RESISTORS, 1/4 WATT UNLESS NOTED OTHERWISE.
2. ALL CAPACITORS, MFD. UNLESS NOTED OTHERWISE.
3. \* - IC1A (6802) USED WITH R4. \*\* - IC1B (6808) USED WITH J1.
4. WHEN IC14 GAME ROM IS USED, J3 MUST BE CONNECTED AND J4 MUST BE REMOVED.



- 1J1-1
- 1J1-2
- 1J1-3
- 1J1-4
- 1J1-5
- 1J1-21
- 1J1-20
- 1J1-27
- 1J1-28
- 1J1-29
- 1J1-30
- 1J1-31
- 1J1-32
- 1J1-33
- 1J1-23
- 1J1-13
- 1J1-24
- 1J1-8
- 1J1-24
- 1J1-7
- 1J1-35
- 1J1-18
- 1J1-17
- 1J1-16
- 1J1-15
- 1J1-14
- 1J1-12
- 1J1-11
- 1J1-10
- 1J1-22
- 1J1-9
- 1J1-19
- 1J1-26
- 1J1-25
- 1J1-6
- 1J1-37
- 1J1-36
- 1J1-38
- 1J1-39
- 1J1-40
- 1J3-4
- 1J3-3
- 1J3-2
- 1J3-1

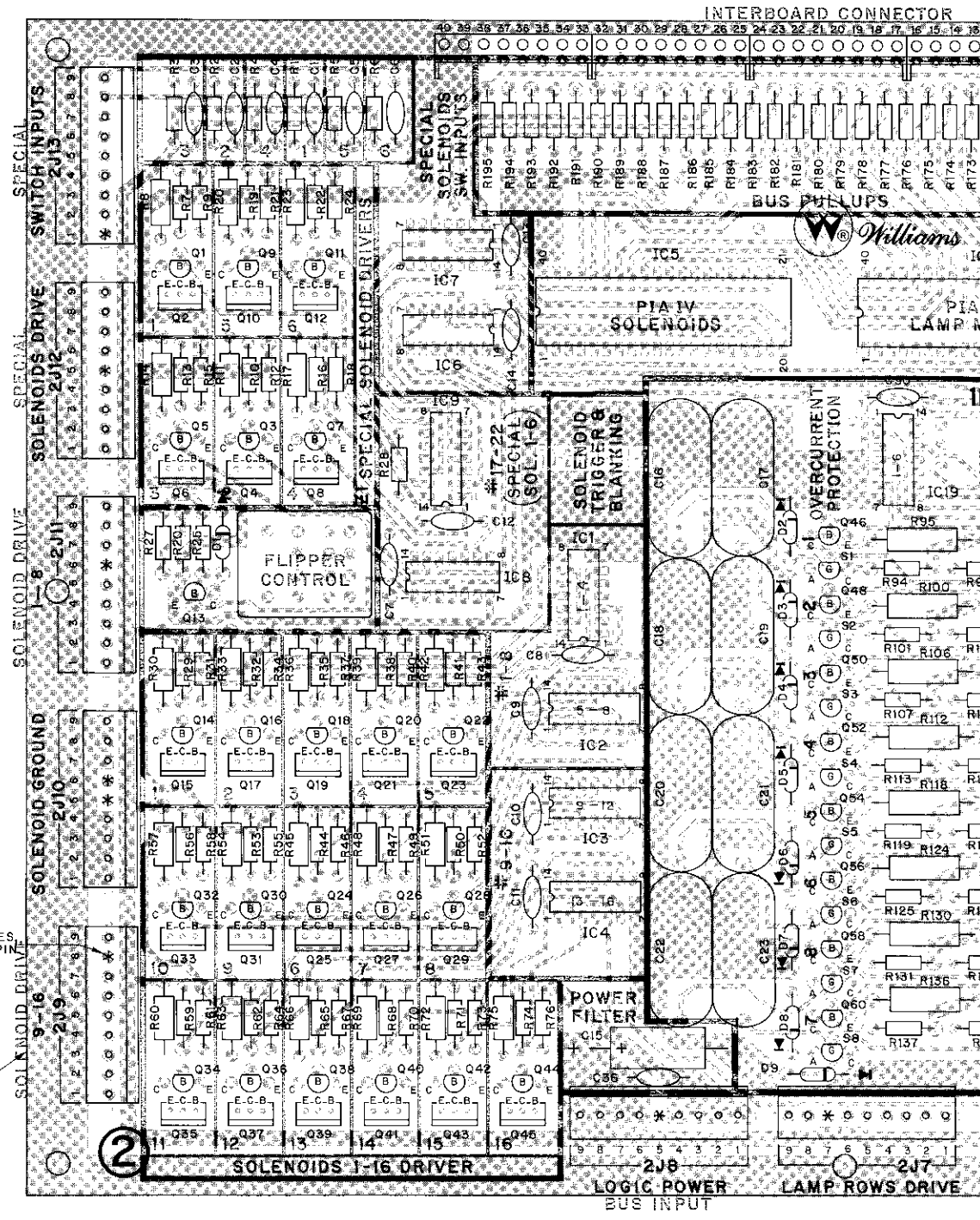
- IRQ
- BUS B2
- RESET
- STG
- VMA
- R/W
- TP4
- BLANKING
- N.C.
- N.C.
- N.C.
- N.C.
- R13
- R48
- KEY
- N.C.
- MEMORY PROTECT



WILLIAMS ELECTRONICS, INC.  
 3401 N. CALIFORNIA, CHICAGO, ILL. 60618 CORNELIA 7-2240  
 PART NAME: SCHEMATIC, CPU BOARD  
 DWG. DATE APPD. SCALE PART NO.  
 R. Gay 2-13-79 2:1 16D-8163

CPU Board Logic Diagram

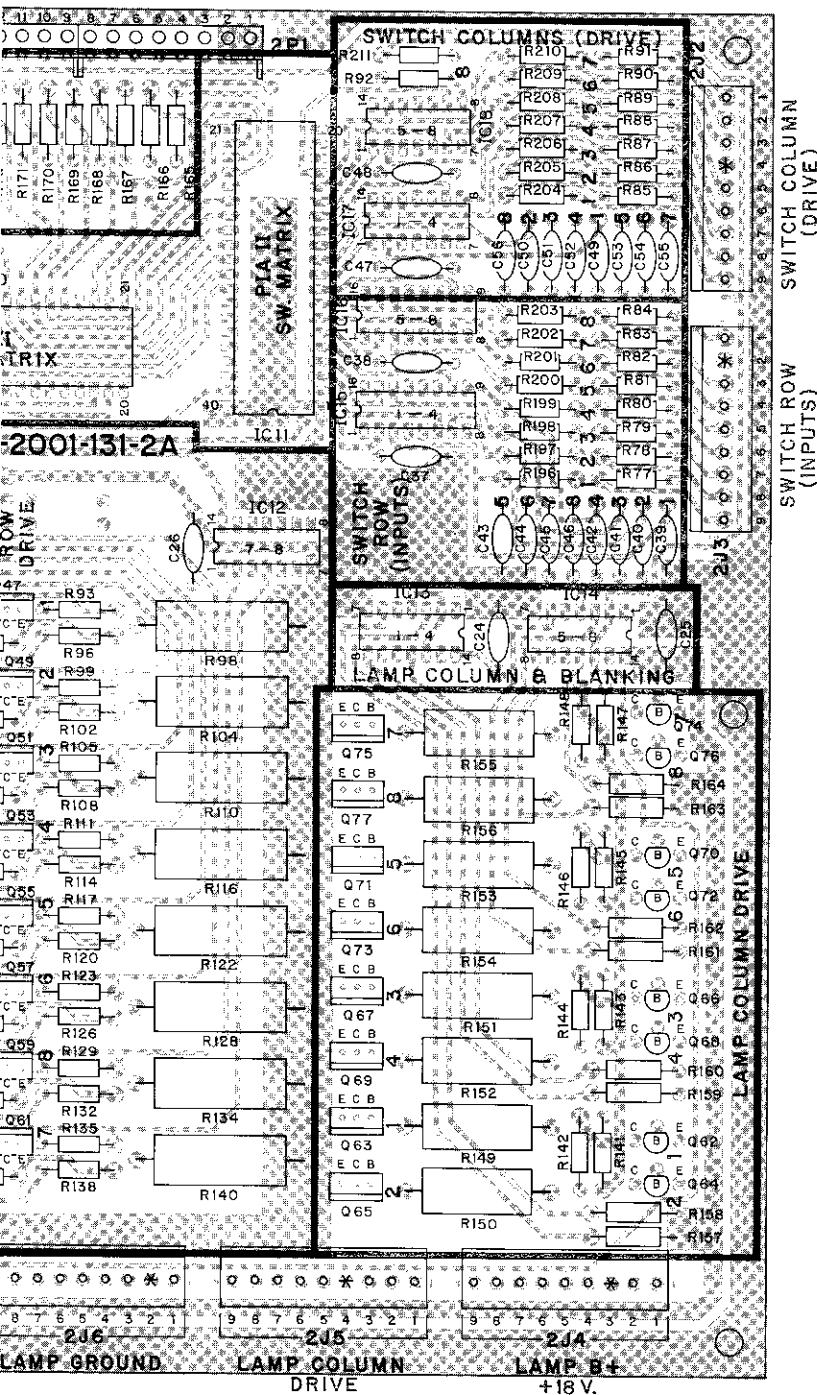
REVISION LETTER	REVISION
C	REVISED AND REDRAWN R. GAY 11-28-77
D	ITEM NO. 28, PT. NO. WAS 9A-8999 & ADDED MOUNTING NOTE FOR R149 THRU R156. R. GAY 4-11-78
E	DELETED ITEM NO. 36, PT. NO. 5A-8985 E.C.O. R. GAY 9-12-78
F	ADDED ITEM NO. 36 B ITEM NO. 22, DELETED (8) RESISTORS & QTY. WAS 32 E.C.O. 4524 R. GAY 10-4-78



\* INDICATES KEYING POINT

1

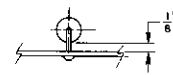
2



**BILL OF MATERIAL**

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-131		BARE P.C. BOARD	1
2	5A-8948	IC8, IC9	N7402 QUADRUPLE 2 INPUT POSITIVE NDR GATE	2
3	5A-8974	IC12, IC17, IC18, IC19	N7406 HEX INVERTER BUFFER DRIVERS W/ OPEN COLLECTOR HIGH VOLTAGE OUTPUTS	4
4	5A-8973	IC1 THRU IC4, IC6, IC7, IC13, IC14	N7408 QUADRUPLE 2 INPUT POSITIVE NDR GATE	8
5	5A-8975	IC15, IC16	MC14049 INVERTING HEX BUFFER	2
6	5A-8972	IC5, IC10, IC11	MC6820 PERIPHERAL INTERFACE ADAPTER	3
7	5A-8939	Q1, Q3, Q5, Q7, Q9, Q11, Q13, Q14, Q16, Q18, Q20, Q22, Q24, Q26, Q28, Q30, Q32, Q34, Q36, Q38, Q40, Q42, Q44	2N4401 KPN TRANSISTOR	23
8	5A-8976	Q46, Q48, Q50, Q52, Q54, Q56, Q58, Q60, Q62, Q64, Q66, Q68, Q70, Q72, Q74, Q76	2N6427 DARLINGTON NPN TRANSISTOR	16
9	5A-8977	Q2, Q4, Q6, Q8, Q10, Q12, Q15, Q17, Q19, Q21, Q25, Q27, Q29, Q31, Q33, Q35, Q37, Q39, Q41, Q43, Q45	TIP120 DARLINGTON NPN POWER TRANSISTOR	22
10	5A-8978	Q63, Q65, Q67, Q69, Q71, Q73, Q75, Q77	TIP42 PNP POWER TRANSISTOR	8
11	5A-8979	Q47, Q49, Q51, Q53, Q55, Q57, Q59, Q61	2N6122 NPN POWER TRANSISTOR	8
12	5A-6258	D1	1N4001 DIODE	1
13	5A-8919	D2 THRU D9	1N4148 DIODE	8
14	5A-9014	S1 THRU S8	2N5060 SCR	8
15	5A-8980	C1 THRU C14, C24, C28, C30, C32, C37, C38, C41, C48	CAPACITOR, CERAMIC, .01 MFD. +80 - 20% 50 V.	22
16	5A-8995	C16 THRU C23	CAPACITOR, POLYESTER FILM, .1 MFD. 10 V.	7
17	5A-9065	C37 THRU C46, C49 THRU C56	CAPACITOR, CERAMIC, 470 PFD. 20% 50 V.	16
18	5A-8986	C15	CAPACITOR, ELECT., 100 MFD. 10 V.	1
19	5A-8996	C36	CAPACITOR, CERAMIC, 1 MFD. +80 - 20% 50 V.	1
20	5A-8991	R1 THRU R6, R27, R37 THRU R92, R157 THRU R199	RESISTOR, FC, 4.7 K OHM 10% 1/4 W	62
21	5A-8983	R27	RESISTOR, FC, 3.3 K OHM 10% 1/4 W	1
22	5A-8984	R96, R97, R102, R103, R108, R109, R114, R115, R121, R122, R125, R127, R132, R133, R138, R139, R196 THRU R203	RESISTOR, FC, 1K OHM 10% 1/4 W	24
23	5A-8992	R7, R10, R13, R16, R19, R22, R29, R32, R35, R36, R41, R44, R47, R50, R53, R56, R59, R62, R65, R68, R71, R74	RESISTOR, FC, 560 OHM 10% 1/4 W	22
24	5A-8993	R8, R11, R14, R17, R20, R23, R30, R33, R36, R39, R42, R45, R48, R51, R54, R57, R60, R63, R66, R69, R72, R75	RESISTOR, FC, 68 OHM 10% 1/2 W	22
25	5A-8997	R5, R12, R15, R18, R21, R24, R25, R31, R34, R37, R40, R43, R46, R49, R52, R55, R58, R61, R64, R67, R70, R73, R76	RESISTOR, FC, 2.7 K OHM 10% 1/4 W	23
26	5A-8917	R26	RESISTOR, FC, 10 K OHM 10% 1/4 W	1
27	5A-8998	R141 THRU R146	RESISTOR, FC, 2.2 K OHM 10% 1/4 W	8
28	5A-8999-1	R149 THRU R156	RESISTOR, FC, 27 OHM 10% 2 W	8
29	5A-9084	R95, R100, R106, R112, R113, R124, R130, R135	RESISTOR, FC, 100 OHM 10% 3 W	8
30	5A-9085	R93, R99, R105, R111, R117, R123, R129, R135	RESISTOR, FC, 1.5 K OHM 10% 1/4 W	8
31	5A-9086	R94, R101, R107, R113, R119, R125, R131, R137	RESISTOR, FC, 6.8 K OHM 10% 1/4 W	8
32	5A-9037	R98, R104, R110, R116, R122, R128, R134, R140	RESISTOR, WIREWOUND, .4 OHM 10% 3 WATT	8
33	5A-8994	Z1	RELAY - 4 90LE - 5 AMP. CONTACTS .40 OHM COIL 6 V.D.C.	1
34	5A-9066	2P1	8 PIN RECEPTACLE	5
35	5A-9027	2J2 THRU 2J13	9 PIN HEADER	12
36	5A-9001	R204 THRU R211	RESISTOR, FC, 330 OHM 10% 1/4 W	8

\* R149 THRU R156 MUST BE MOUNTED 1/8" ABOVE SURFACE OF BOARD.



**WILLIAMS ELECTRONICS, INC.**  
 SUBSIDIARY OF XCOR CORPORATION  
 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

PART NAME: DRIVER BOARD ASSEMBLY  
 OWN: R. GY  
 DATE: 8-16-77  
 APPD.:  
 SCALE: 2=1  
 PART NO.: D-7997

DOCUMENT #1

SWITCH MATRIX INPUTS 1-8

SWITCH MATRIX DRIVES 1-8

ADDRESS BUS 0-15

DATA BUS 0-7

ADDRESS BUS 16-31

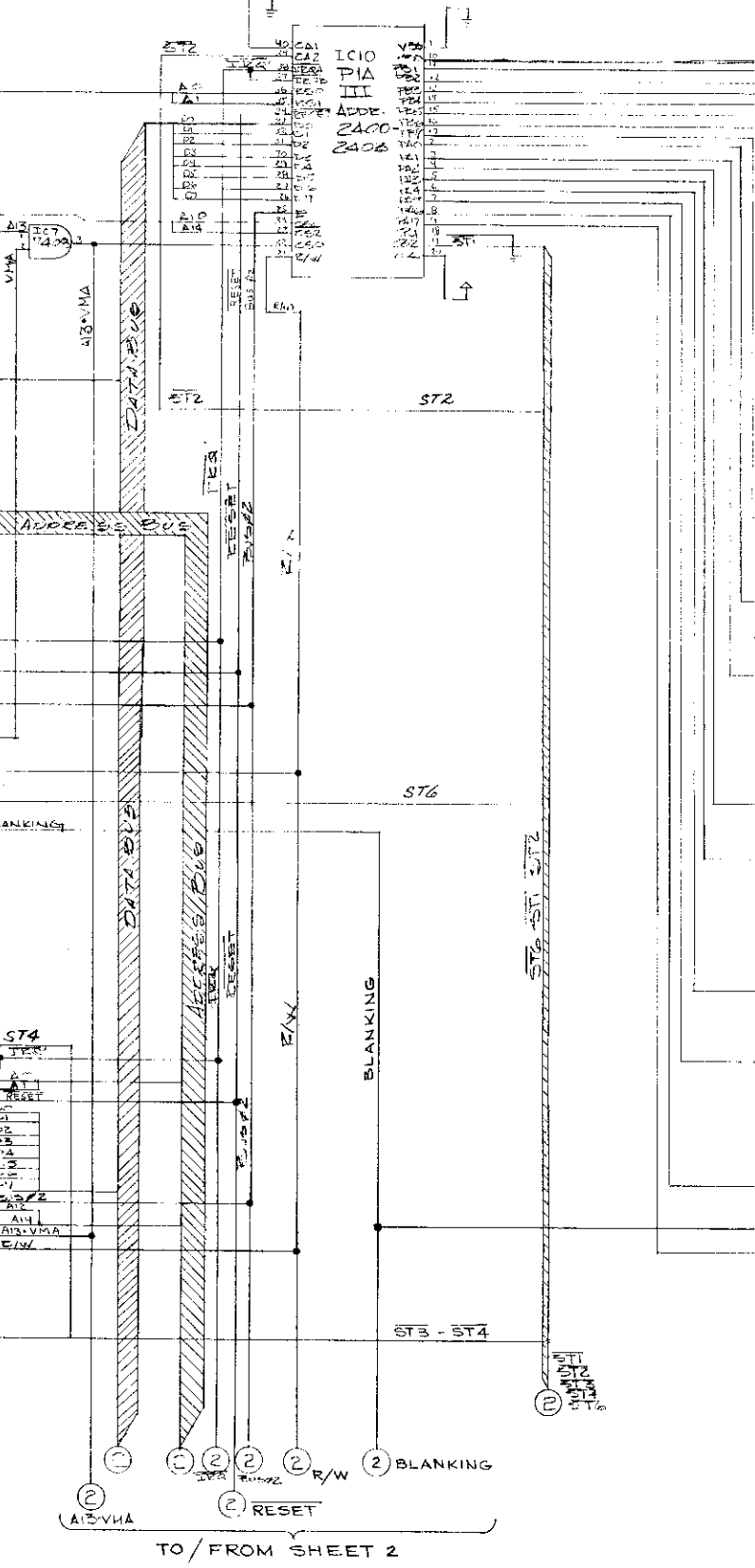
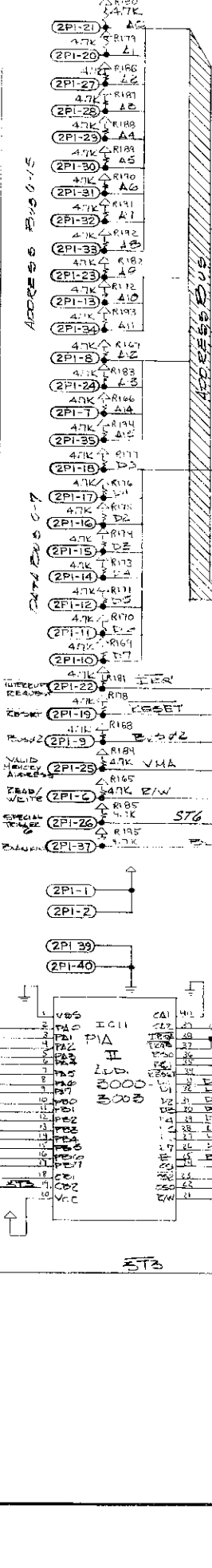
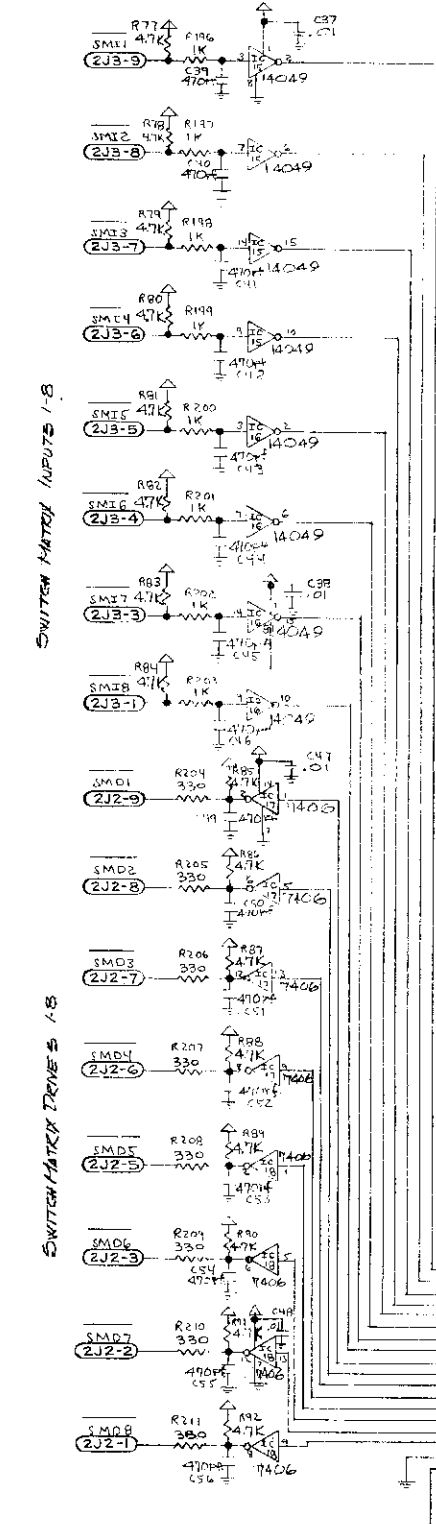
ADDRESS BUS 32-47

ADDRESS BUS 48-63

ADDRESS BUS 64-79

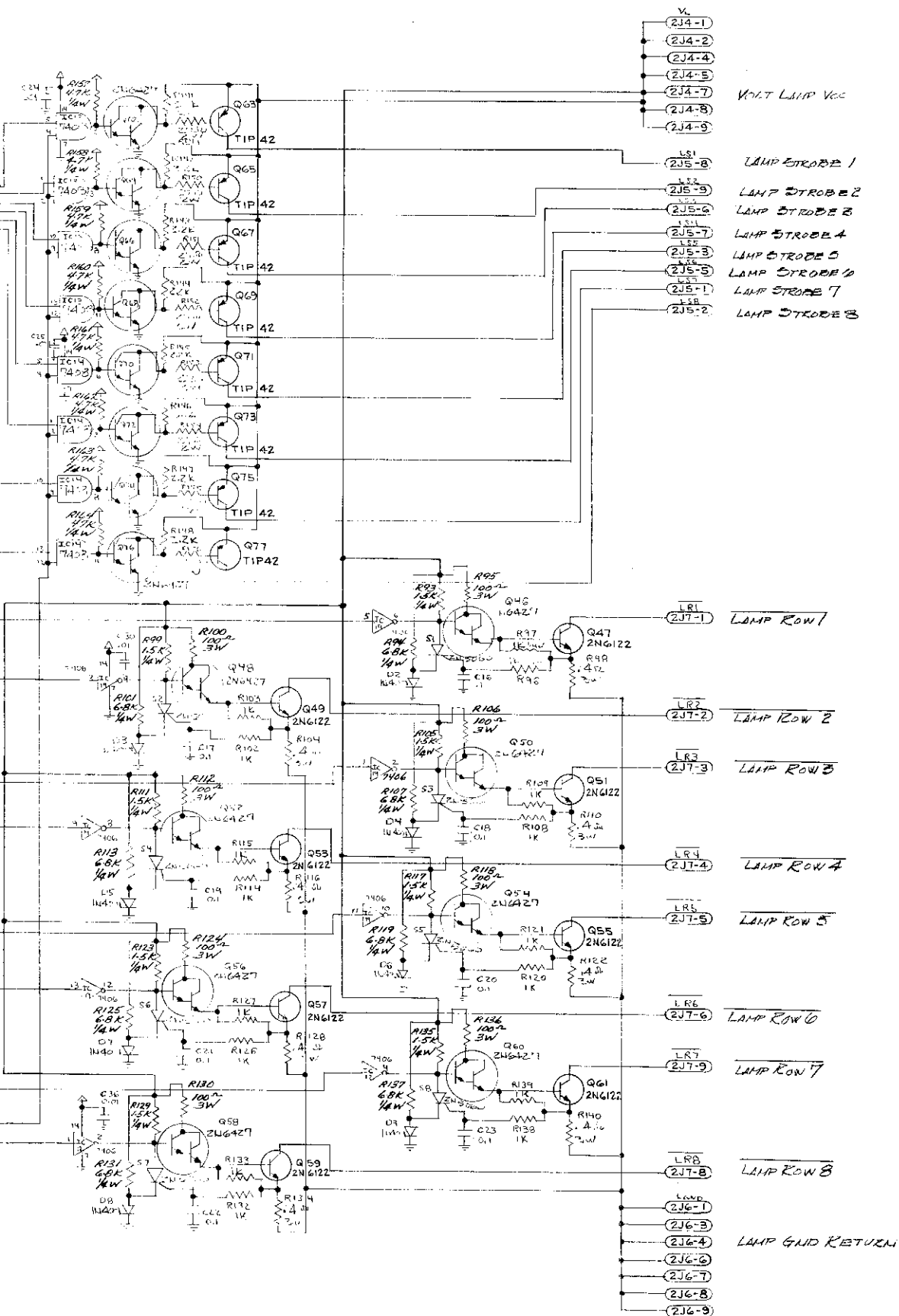
ADDRESS BUS 80-95

ADDRESS BUS 96-111



D	R 204 THRU R 211, 330 Ω WAS 1K Ω	ECO. #4624
C	2P1'S WAS P4, 2J2'S WAS A5, 2J3'S WAS B5, 2J4'S WAS C5, 2J5'S WAS D5, 2J6'S WAS E5, 2J7'S WAS F5, & ADDED CIRCLES TO ALL 2N6122 & TIP42 TRANSISTOR # TO FROM SHEETS	R.G.F.
B	DELETED +5V LEAD & ADDED VOLT LAMP Vcc LEAD TO R93-R95, R99-R101, R106-R107, R111-R113, R17-R19, R23-R25, R28-R30, & R35-R37	R.G.F.
A	REDUCE POWER SUPPLY CURRENT	D.L.P.
REVISION LETTER	REVISION	BY

TO / FROM SHEET 2

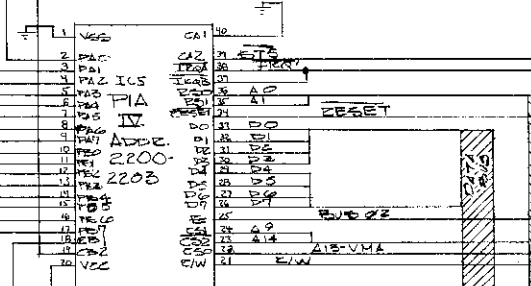
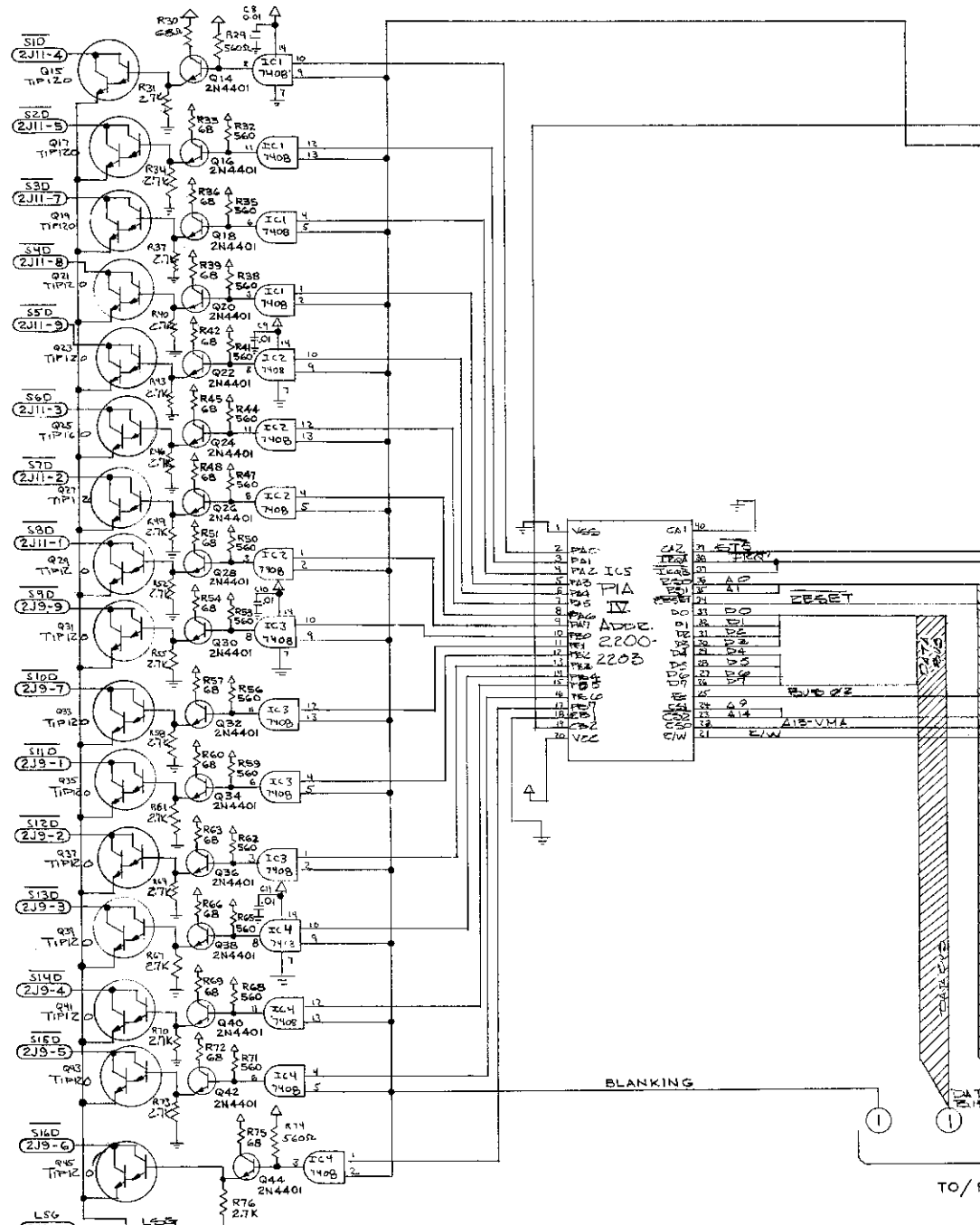


TOLERANCES UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONIC MFG. CORP. SUBSIDIARY OF THE TESSCO CORP. 3401 N. CALIFORNIA CHICAGO 18, ILL. CORNELIA 7-3840	
FRACTIONS ± 1/64	DECIMALS ± .008	NAME	SCHMATIC, DRIVER BOARD
HOLES - .000	ANGULAR ± 1/8"	MATERIAL	HEAT TREATMENT FINISH
DATE	APP.	SCALE	16D-7997

Driver Board Logic Diagram  
(Sheet 1 of 2) 5

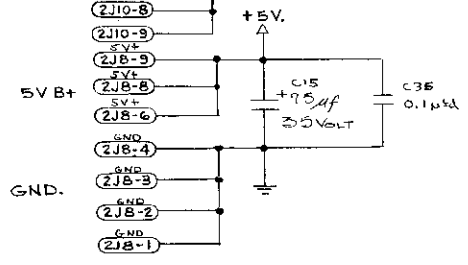


- SOLENOID 1 DRIVE
- SOLENOID 2 DRIVE
- SOLENOID 3 DRIVE
- SOLENOID 4 DRIVE
- SOLENOID 5 DRIVE
- SOLENOID 6 DRIVE
- SOLENOID 7 DRIVE
- SOLENOID 8 DRIVE
- SOLENOID 9 DRIVE
- SOLENOID 10 DRIVE
- SOLENOID 11 DRIVE
- SOLENOID 12 DRIVE
- SOLENOID 13 DRIVE
- SOLENOID 14 DRIVE
- SOLENOID 15 DRIVE
- SOLENOID 16 DRIVE

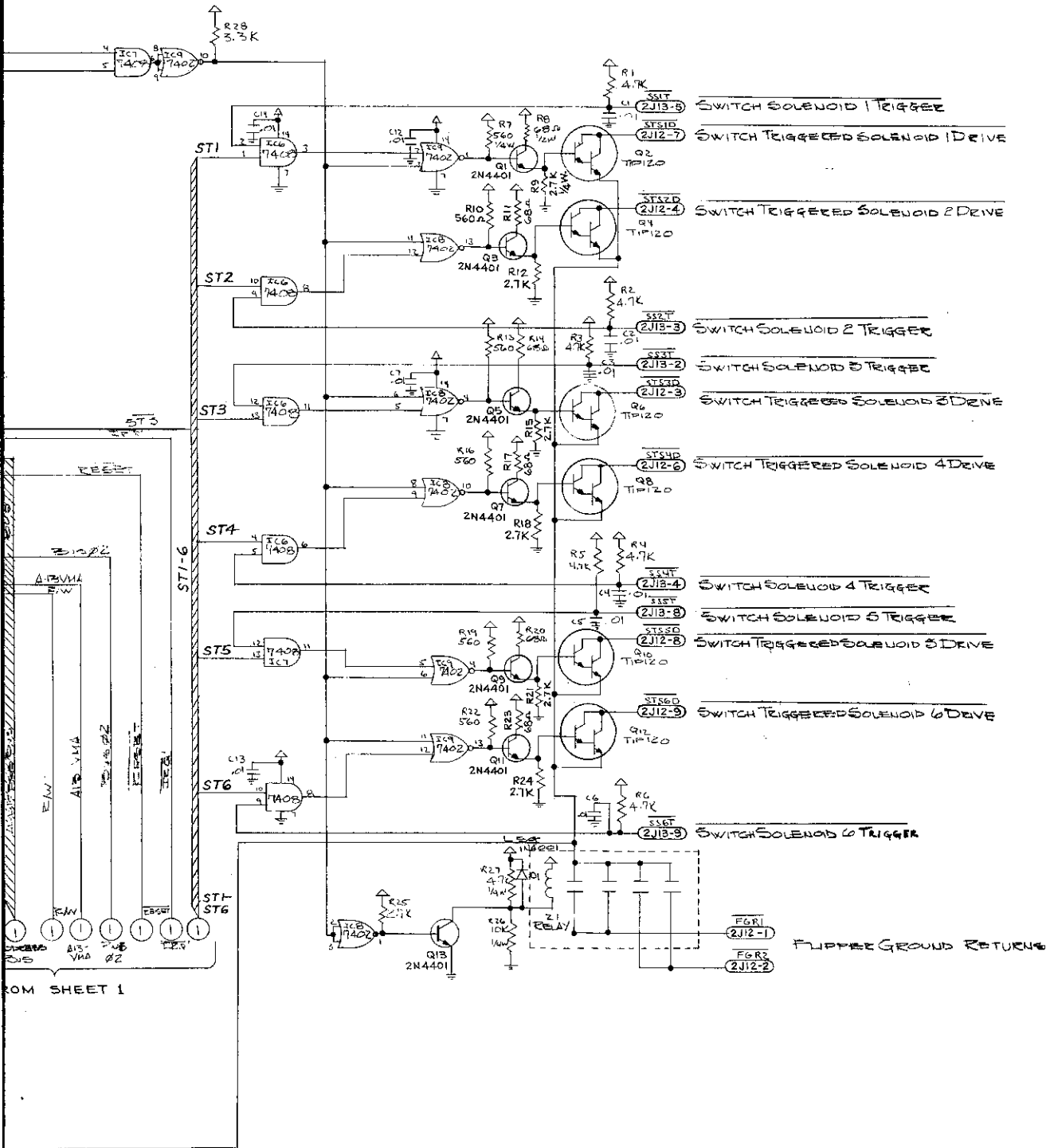


LAMP & SOLENOID GROUND

LAMP & SOLENOID GND.



B	2J8's WAS G's, 2J9's WAS H's, 2J10's WAS J's, 2J11 WAS K's, 2J12 WAS L's 2J13's WAS M's & ADDED "TO/FROM SHEET 1" & CIRCLES TO ALL 2N4401 TRANSISTORS	A. Gert 8-28-77
A	REVISION "A"	
REVISION LETTER	REVISION	BY



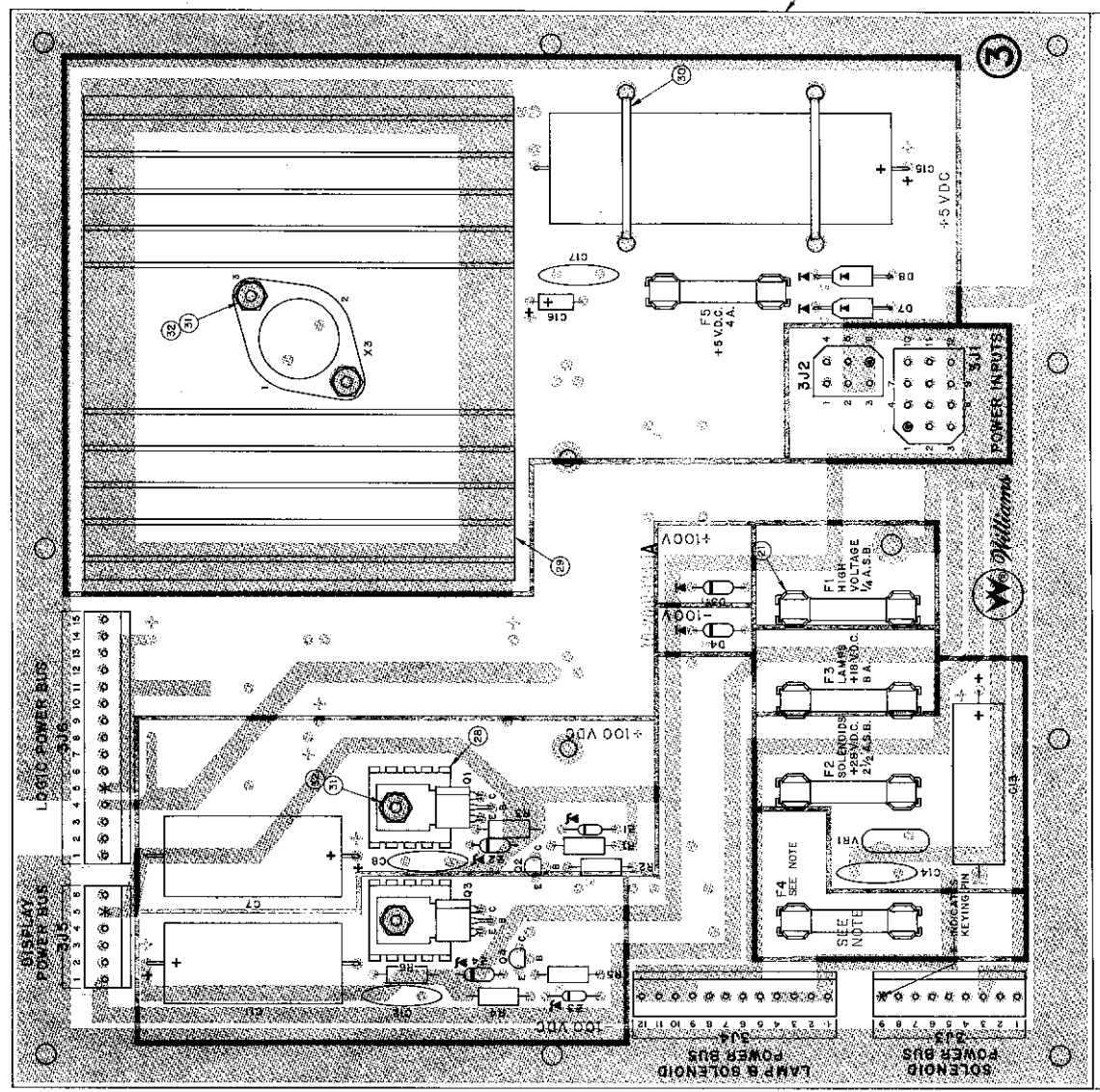
FROM SHEET 1

TOLERANCES UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONIC MFG. CORP. SUBSIDIARY OF THE FERROALLOY CORP.	
FRACTIONS ± 1/64	DECIMALS ± .005	3401 N. CALIFORNIA	CHICAGO 18, ILL.
Holes + .000	ANGULAR ± 1/8"	CORNELIA 7-2840	
MATERIAL		NAME SCHEMATIC, DRIVER BOARD	
DATE 1-3-77		SCALE 16D-7997	

REV. NO.	REVISION
1	REVISED AND REDRAWN P. J. W. 11-22-62

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
1	10-2000-10K		BARE P.C. BOARD	1
2	5A-9049	X3	5 AMP 5 VOLT POSITIVE VOLTAGE	1
3	5A-9057	Q1	2SD4-201 JPNR TRANSISTOR	1
4	5C-9055	Q2	MPF502 PNP TRANSISTOR	1
5	5A-9058	Q3	50-502 PNP TRANSISTOR	1
6	5C-9058	Q4	MPF502 PNP TRANSISTOR	1
7	5E-9054	Q5, Q4	1N9001 DIODE	2
8	5A-9059	Q1, Q3	1N9003 JPNR DIODE	2
9	5A-9059	Q1, Q3	1N9003 JPNR DIODE	2
10	5B-9059	R1, R4	1/4W 5K OHM 5% RESISTOR	2
11	5B-9064	VR1	VARIABLE	1
12	5B-9068	R1, R4	RESISTOR, 1/4W 5K OHM 5% W	2
13	5B-9061	R2, R3	RESISTOR, 1/4W 5K OHM 5% W	2
14	5B-9058	R3, R5	RESISTOR, 1/4W 5K OHM 5% W	2
15	5A-9055	C7, C11	100 OHM 50V CAPACITOR	2
16	5A-9055	C7, C11	100 OHM 50V CAPACITOR	2
17	5A-9056	C15	CAPACITOR, ELECT., 100 OHM 50V	1
18	5A-9071	C8, C12, C14, C17	CAPACITOR, CERAMIC, 1 MFD 500 V	4
19				
20	5A-9031	C16	CAPACITOR, ELECT., 1 MFD 35V	1
21	5A-9032		FUSEHOLDER	10
22	5A-9053	J1	12 PIN CONNECTOR	1
23	5A-9057	J2	8 PIN HEADER CONNECTOR	1
24	5A-9057	J3	9 PIN HEADER CONNECTOR	1
25	5A-9055	J4	12 PIN HEADER CONNECTOR	1
26	5A-9055	J4	12 PIN HEADER CONNECTOR	1
27	5A-9058	J4	12 PIN HEADER CONNECTOR	1
28	5A-9042	J4	12 PIN CIRCUIT CONNECTOR	1
29	5B-9041		HEAT SINK	2
30	5A-7820-1		4" X 4" X 1/2" HEAT SINK	1
31			TIE WRAP	2
32			5-40 X 7/16 R.H. MECH. SCREW	4
33	5A-9050	F1	5-40 X 7/16 R.H. MECH. SCREW	4
34	5A-9050	F1	5-40 X 7/16 R.H. MECH. SCREW	4
35	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
36	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
37	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
38	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
39	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
40	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
41	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
42	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
43	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
44	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
45	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
46	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
47	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
48	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
49	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
50	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
51	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
52	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
53	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
54	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
55	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
56	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
57	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
58	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
59	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
60	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
61	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
62	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
63	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
64	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
65	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
66	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
67	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
68	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
69	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
70	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
71	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
72	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
73	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
74	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
75	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
76	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
77	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
78	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
79	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
80	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
81	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
82	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
83	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
84	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
85	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
86	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
87	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
88	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
89	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
90	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
91	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
92	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
93	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
94	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
95	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
96	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
97	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
98	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
99	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4
100	5A-9050	F2	5-40 X 7/16 R.H. MECH. SCREW	4

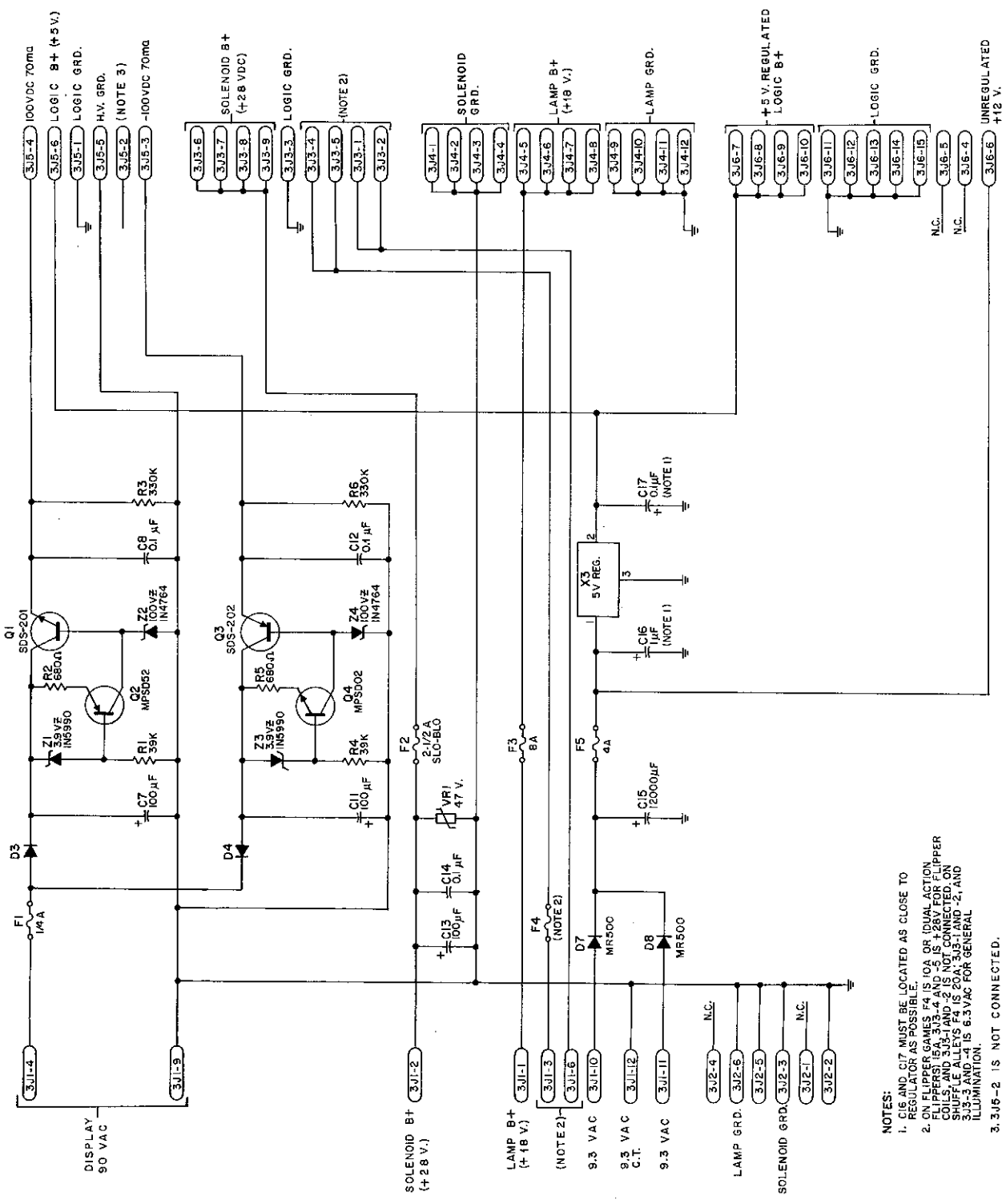
NOTE:  
F4 IS FLIPPER FUSE ON FLIPPER  
GAMES AND GENERAL ILLUMINATION  
ON SHUFFLE ALLEYS.



WILLIAMS ELECTRONICS, INC.  
3401 N. CALIFORNIA AVE., CHICAGO, ILL. 60642  
CORNELL 4-7-2640  
PART NAME  
POWER SUPPLY BOARD ASSEMBLY  
REV. 2.1  
DATE 8-15-77  
DRAWN BY  
D-7999  
DOCUMENT #1

REDUCE TO EXACTLY 10.000"

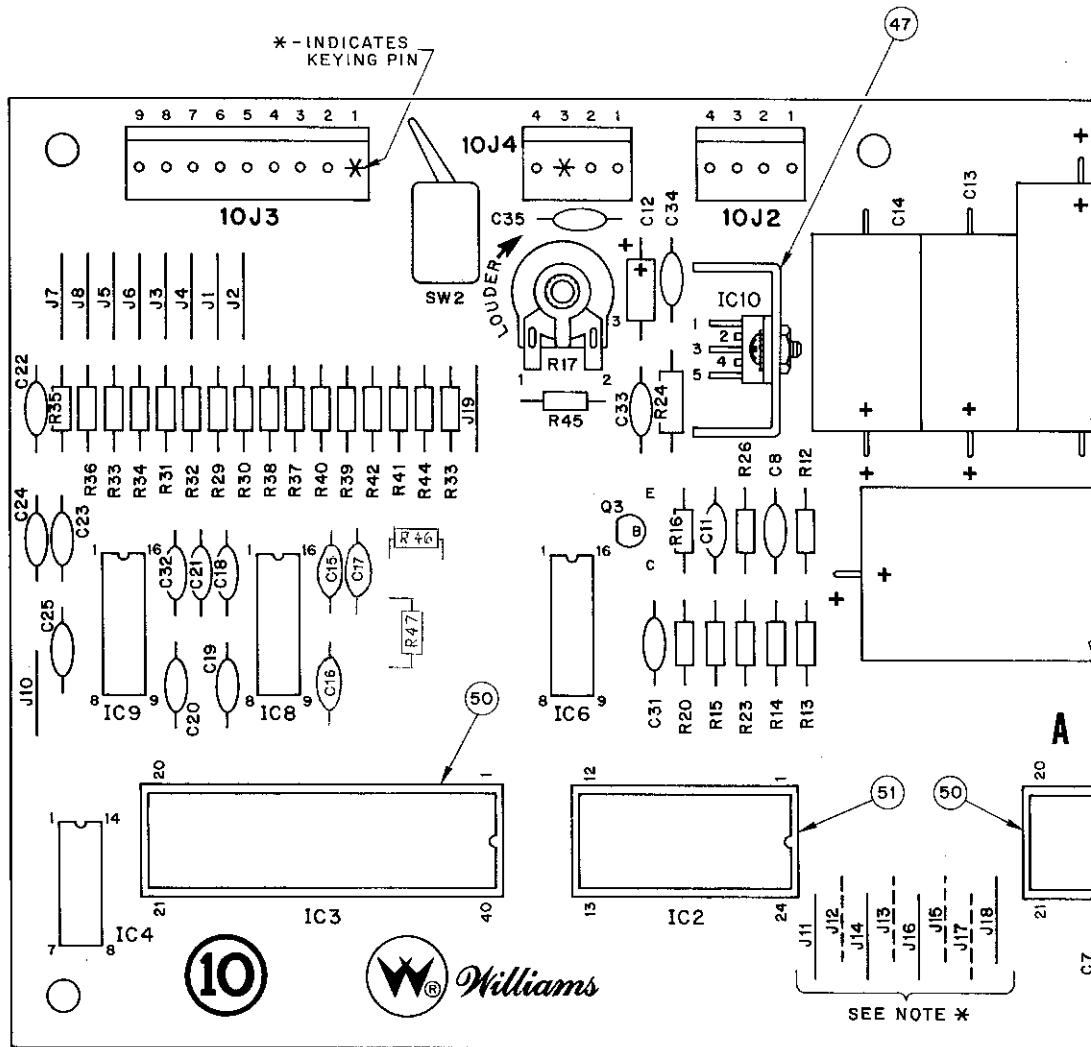
16C-7999



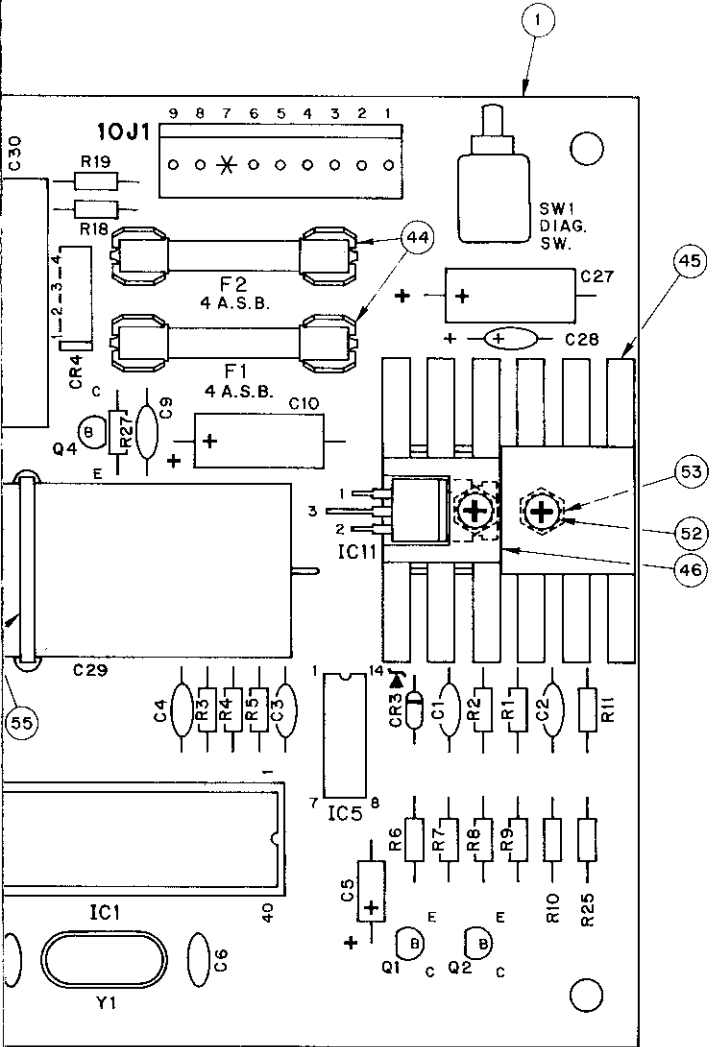
- NOTES:
1. RESISTORS C17 MUST BE LOCATED AS CLOSE TO THE DIODE AS POSSIBLE.
  2. ON FLIPPER GAMES F4 OR DUAL ACTION FLIPPER IS A 3J2-4 AND -5 IS +28V FOR FLIPPER COILS, AND 3J3-1 AND -2 IS NOT CONNECTED. ON SHUFFLE ALLEYS F4 IS 20A, 3J3-1 AND -2, AND 3J3-3 AND -4 IS 6.3VAC FOR GENERAL ILLUMINATION.
  3. 3J6-2 IS NOT CONNECTED.
  4. UNLESS OTHERWISE INDICATED ALL RESISTORS ARE 1/2 W. AND ALL DIODES ARE TYPE IN4004.

TOLERANCES UNLESS OTHERWISE SPECIFIED		QTY.	ASSEMBLY ON
FRACTIONAL	± 1/4"		
DECIMAL	± .005"		
HOLE DIA.	± .002 - .005"		
ANGULAR DISTANCE	± 1/16"		
SCREW THREADS	± CLASS 2		
DATE	9-10-79	APP'D.	SCALE
DWN.	A.V.		16C-7999

WILLIAMS ELECTRONICS, INC.		SUBSIDIARY OF THE SEARS, ROEBUCK & CO. OF DELAWARE	
3801 N. CALIFORNIA CHICAGO, ILL. 60618		CORNELIA 7-2240	
NAME SCHEMATIC, POWER SUPPLY BOARD		MATERIAL	
FINISH		HEAT TREATMENT	
REVISION		BY	
A	REDRAWN, WAS D. SIZE.	5-9-79	
F4 AND NOTES 2, 3, 4 ADDED			



\* NOTE:  
 JUMPERS SHOWN WITH SOLID LINES 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 B 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-9046	C29	CAPACITOR, ELECTROLYTIC, 12,000 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 MHE.	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-9015	IC2	7641 512 X 8 PROM	1
	5A-9198		MCM68312 2 K X 8 ROM	1

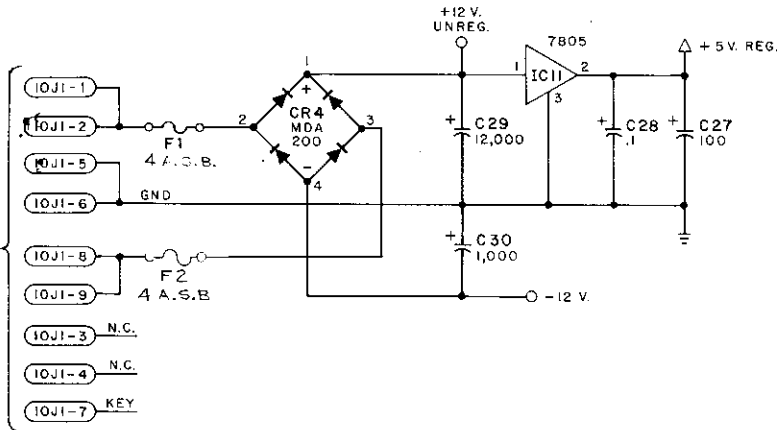
CONNECTED FOR  
DASHED LINES

**WILLIAMS ELECTRONICS, INC.**  
 SUBSIDIARY OF XCOR CORPORATION  
 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

PART NAME  
**SOUND BOARD ASSEMBLY**

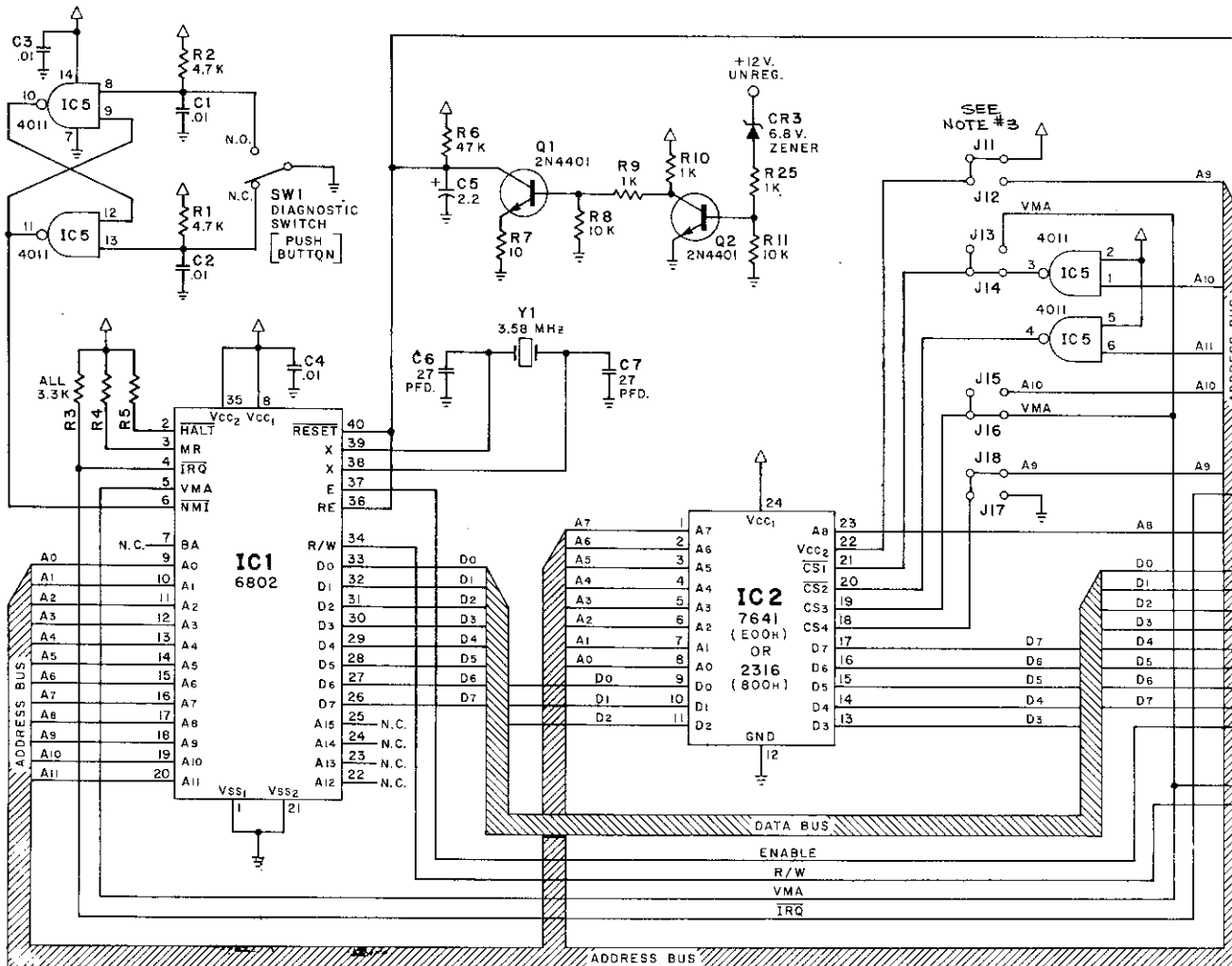
DWN.	DATE	APP'D.	SCALE	PART NO.
R. Gay	12-20-78		2=1	

**POWER SUPPLY**



**NOTES:**

- UNLESS OTHERWISE SPECIFIC
- 1. ALL RESISTOR VALUES IN
- 2. ALL CAPACITOR VALUES IN
- 3. J11, J14, J16 AND J18 CO WHEN IC2 IS A PROM
- J12, J13, J15 AND J17 CC WHEN IC2 IS A ROM (



SEE NOTE #3

ADDRESS BUS

DATA BUS

ENABLE

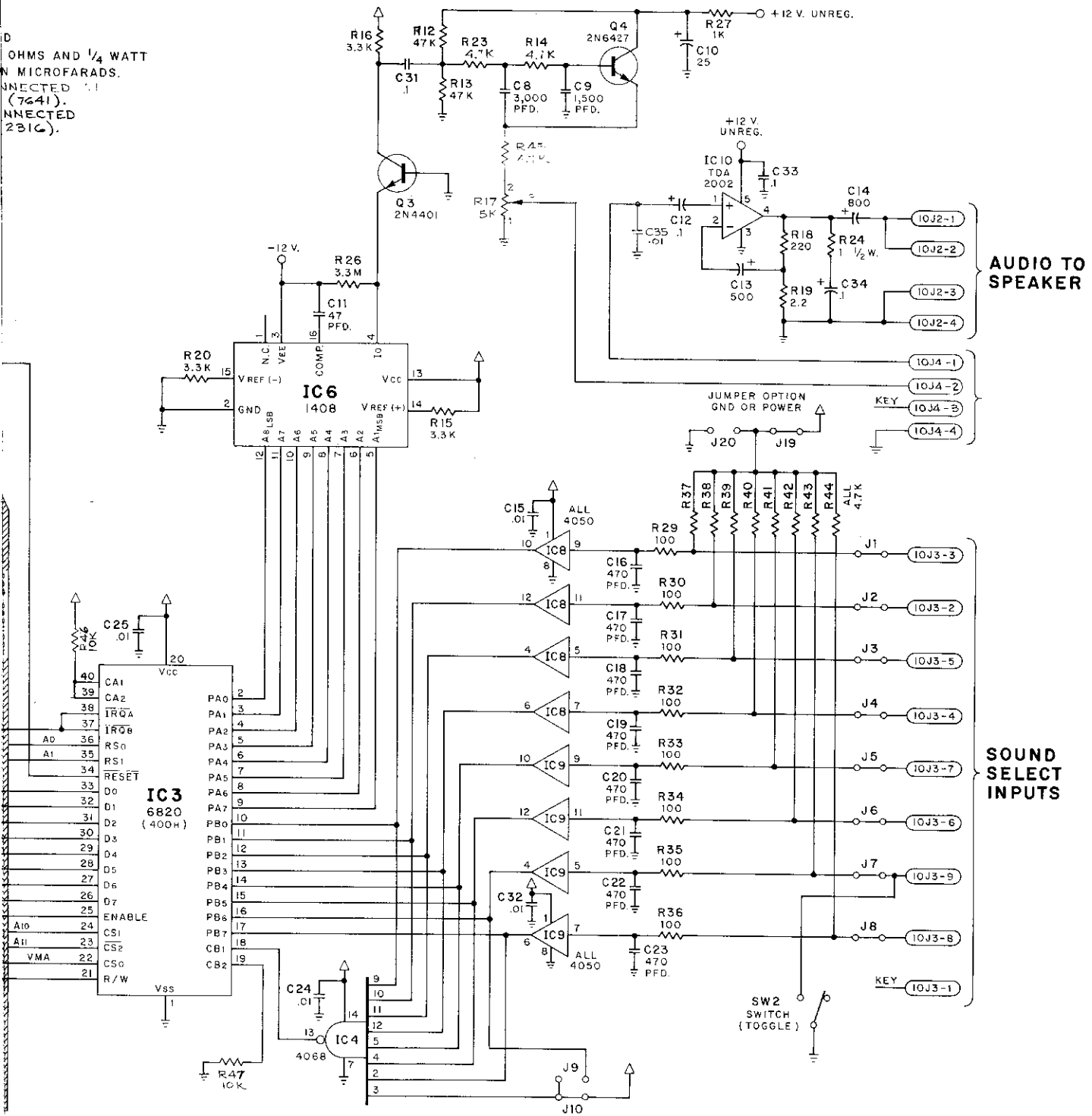
R/W

VMA

IRQ

ADDRESS BUS

OHMS AND 1/4 WATT  
N MICROFARADS.  
CONNECTED TO  
(7641).  
CONNECTED  
231G.



**AUDIO TO SPEAKER**

**SOUND SELECT INPUTS**

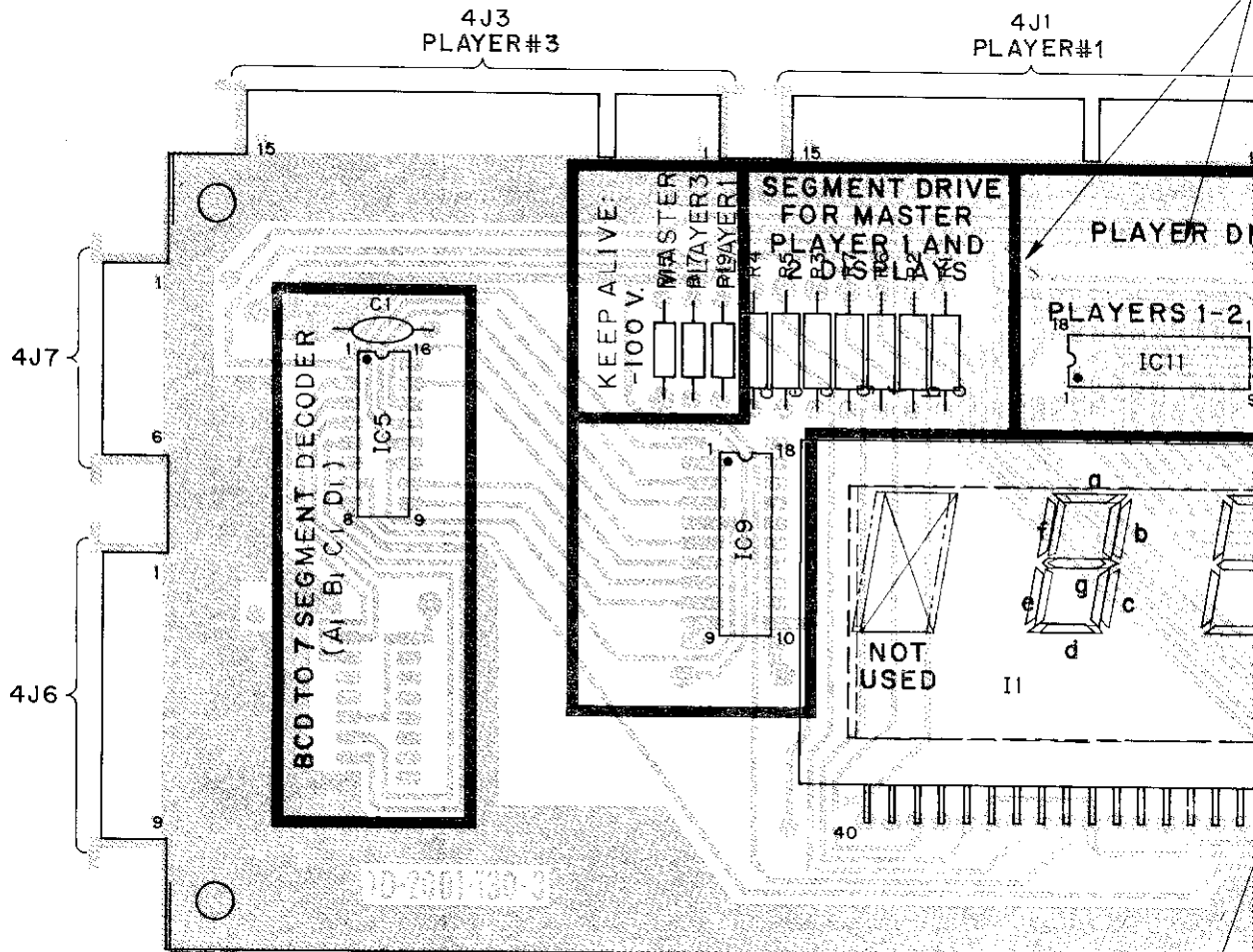
Sound Board Logic Diagram



**NOTES:**

\* - IF IC11, IC12, IC13 & IC14 ARE  
DRIVERS THEN R1 - R14  
F.C., 15K OHM  $\pm 10\%$  1/2 W

\*\* - CUT & JUMP ON +100V.

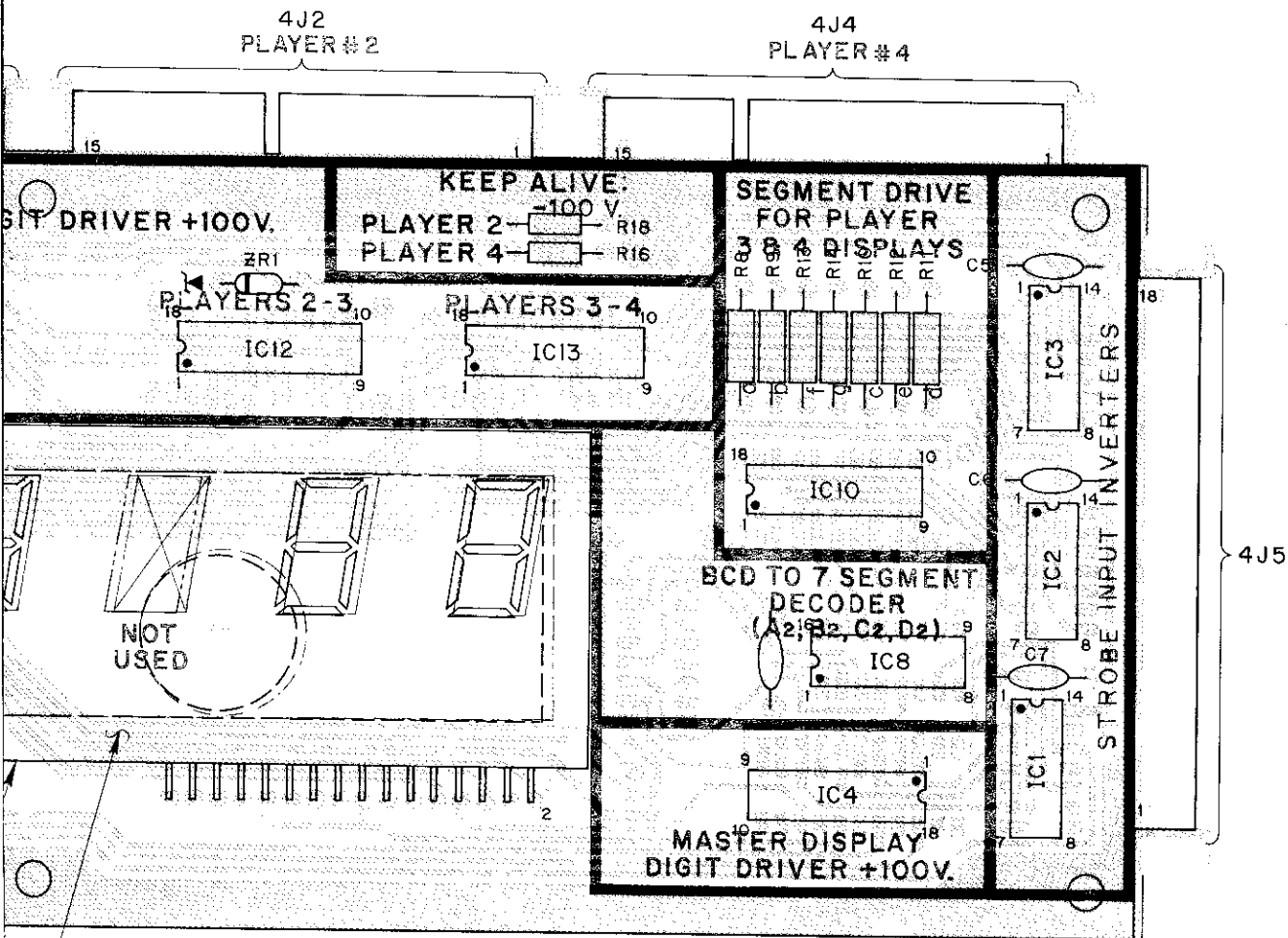


**BILL OF MATERIAL**

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1D-2001-130-3		BARE P.C. BOARD	1
2	5A-8971	IC1, IC2, IC3	MC14069 HEX. INVERTER	3
3	5A-8970	IC5, IC8	MC14543 BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER	2
4	5A-8969	IC9, IC10	UDN-7180 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
*	5A-8968	IC4, IC11, IC12, IC13	UDN-6184 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
*	5B-8981	R1 THRU R14	RESISTOR, FC, 10K OHM 10% 1/2 W	14
7	5B-8982	R15 THRU R19	RESISTOR, FC, 3 MEG OHM 10% 1/4 W	5
8	5A-9135	ZR1	1N4740A ZENER DIODE, 10V. 5% 1W	1
9	5A-8980	C1, C4 THRU C7	CAPACITOR, CERAMIC, .01 MFD. 50V.	5
**			JUMPER, #22 GA. SOLID WIRE	1
11	5B-8966	I1	6 DIGIT DISPLAY	1
12	23A 6542		DISPLAY MTG. ADHESIVE FORM	1

RE DIONICS-512  
RE 5A-9149 RES.,  
ZR1 NOT USED.  
NOT IMPLEMENTED.

\*\*

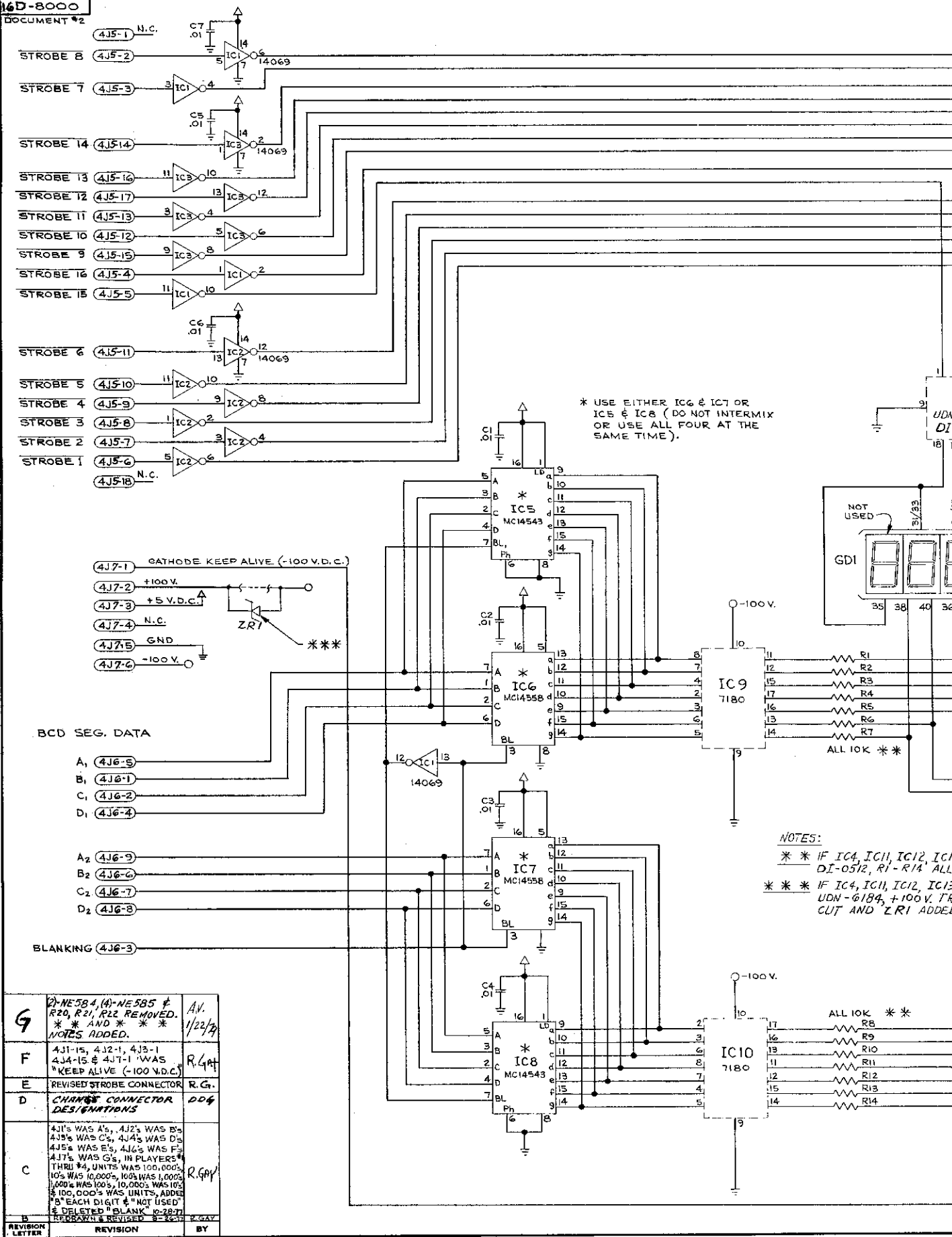


**WILLIAMS ELECTRONICS, INC.**  
SUBSIDIARY OF XCOR CORPORATION  
3401 N. CALIFORNIA CHICAGO, ILL 60618 CORNELIA 7-2240

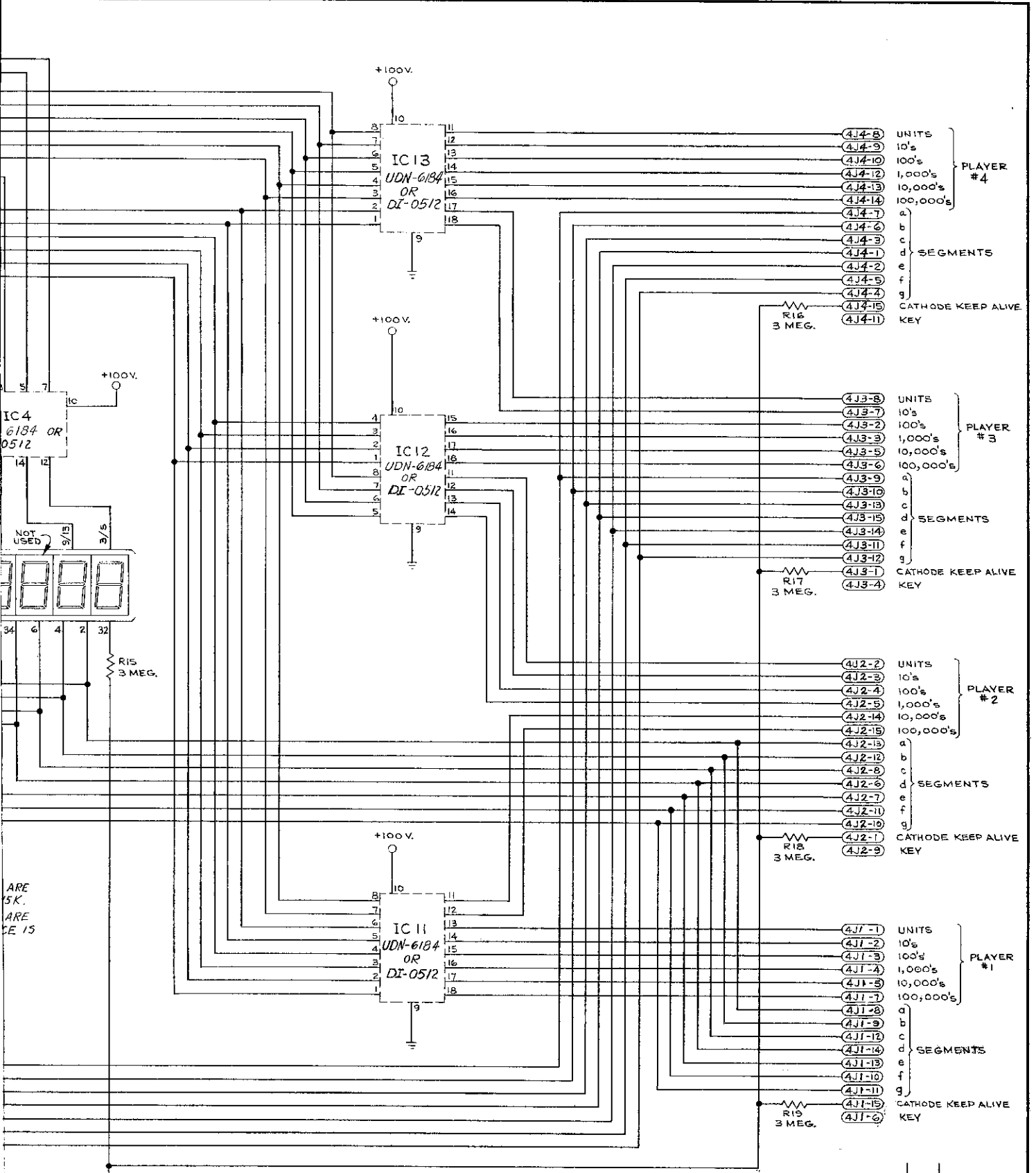
PART NAME  
**MASTER DISPLAY ASSEMBLY**

DWN. R. Gay	DATE 1-30-79	APP'D.	SCALE 2=1	PART NO. <b>D-8000</b>
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D8000 Master Display Board Assembly Drawing  
(IC Drivers)



G	DI-NE584, (4)-NE585 & R20, R21, R22 REMOVED. ** AND ** NOTES ADDED.	AV. 1/22/74	
F	4J1-15, 4J2-1, 4J3-1 4J4-15 & 4J7-1 WAS "KEEP ALIVE (-100 V.D.C.)"	R.G.H.	
E	REVISED STROBE CONNECTOR	R.G.	
D	CHARACTER CONNECTOR DESIGNATIONS	DDG	
C	4J1'S WAS A'S, 4J2'S WAS B'S 4J3'S WAS C'S, 4J4'S WAS D'S 4J5'S WAS E'S, 4J6'S WAS F'S 4J7'S WAS G'S, 4J8'S WAS H'S THRU #4, UNITS WAS 100,000'S 10'S WAS 10,000'S, 100'S WAS 1,000'S 1,000'S WAS 100'S, 10,000'S WAS 10'S & 100,000'S WAS UNITS, ADDED "B" EACH DIGIT & "NOT USED" & DELETED "BLANK" 10-28-74	R.G.P.	
B	REVISION LETTER	REVISION	BY

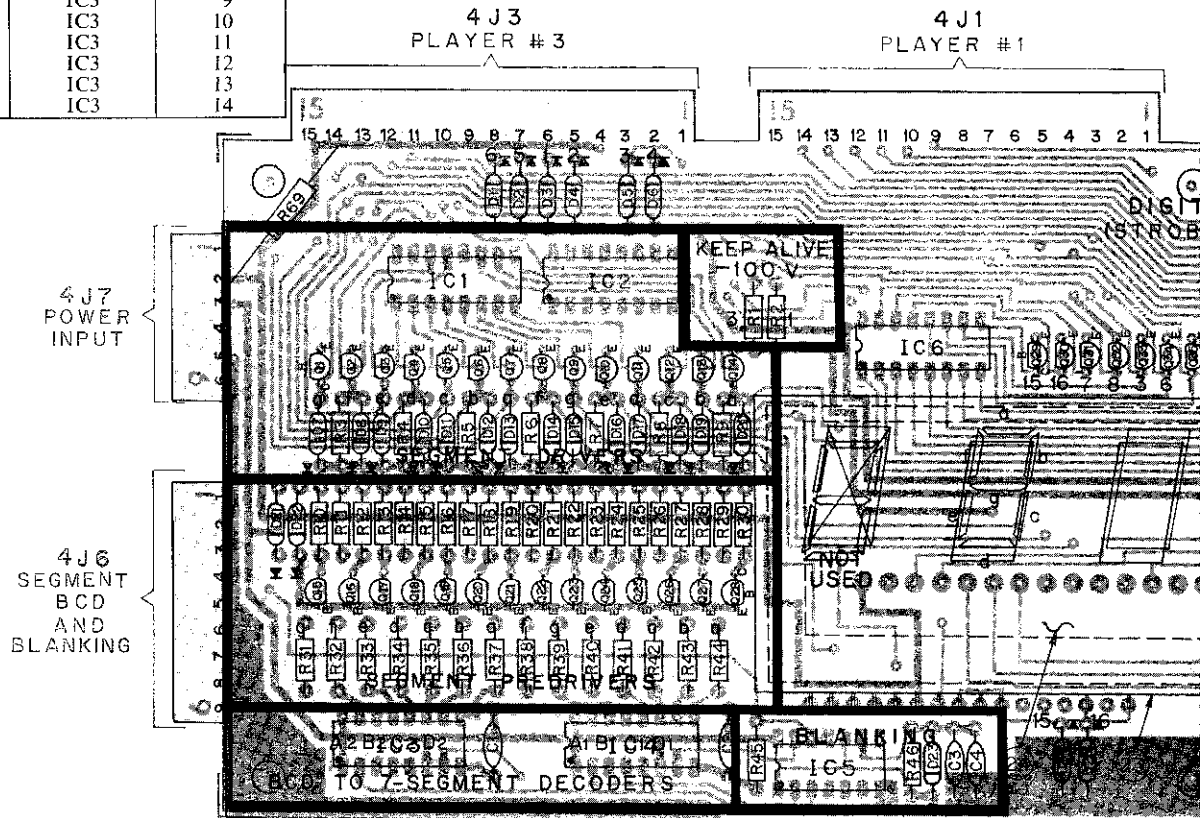


TOLERANCES UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONIC MFG. CORP. SUBSIDIARY OF THE SBBBUN CORP.		
FRACTIONS	± 1/64	3401 N. CALIFORNIA	CHICAGO 18, ILL.	CORNELIA 7-2240
DECIMALS	± .005	NAME SCHEMATIC, MASTER DISPLAY BD.		
HOLES	+ .002	MATERIAL	HEAT TREATMENT	FINISH
ANGULAR	± 1/2°	DATE	APPD.	SCALE
		DRW. R.GM	8-26-77	16D-8000

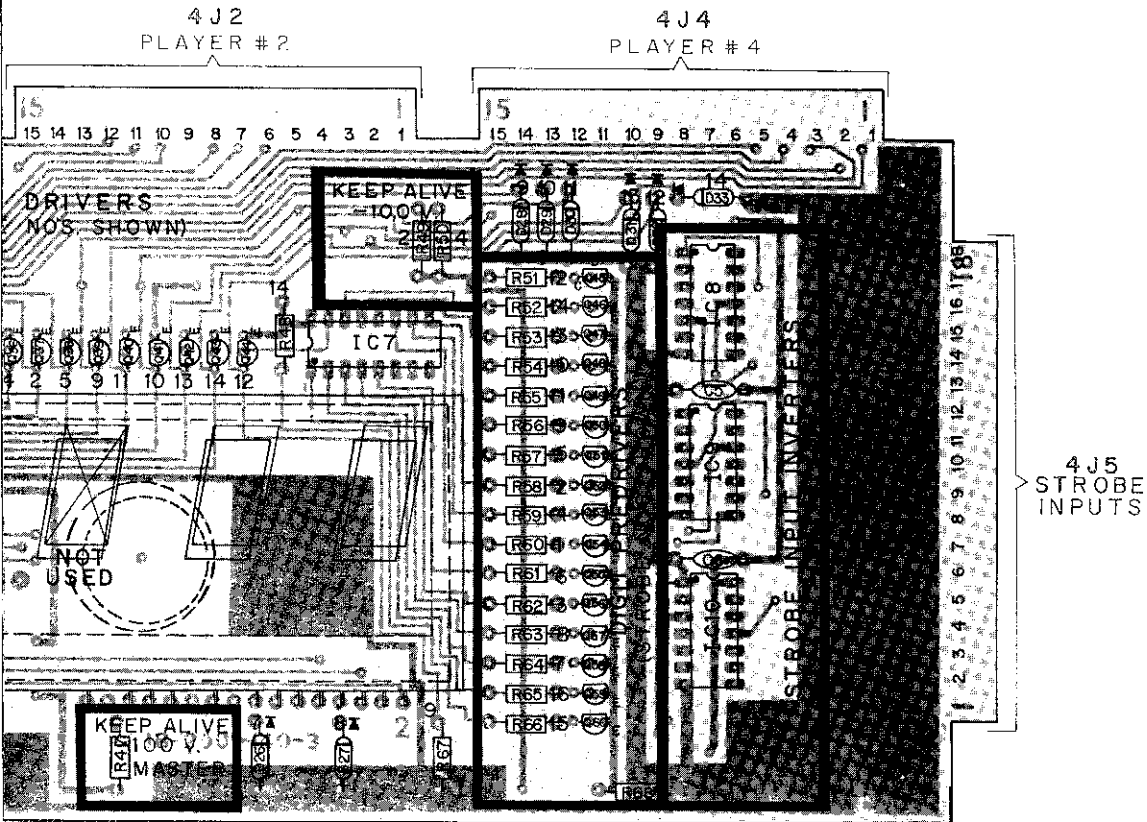
DOCUMENT #2

DIGIT CROSS-REFERENCE

DIGIT	7-SEGMENT DECODER	STROBE
Master 1 (Left)	IC4	15
Master 2	IC4	16
Master 3	IC4	7
Master 4 (Right)	IC4	8
#1 100,000	IC4	1
#1 10,000	IC4	2
#1 1,000	IC4	3
#1 100	IC4	4
#1 10	IC4	5
#1 Units	IC4	6
#2 100,000	IC4	9
#2 10,000	IC4	10
#2 1,000	IC4	11
#2 100	IC4	12
#2 10	IC4	13
#2 Units	IC4	14
#3 100,000	IC3	1
#3 10,000	IC3	2
#3 1,000	IC3	3
#3 100	IC3	4
#3 10	IC3	5
#3 Units	IC3	6
#4 100,000	IC3	9
#4 10,000	IC3	10
#4 1,000	IC3	11
#4 100	IC3	12
#4 10	IC3	13
#4 Units	IC3	14



ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.	BILL OF MATERIAL				
					ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
17	5A-8774	R45, R67	RESISTOR, FC, 22 K OHM 10% 1/4 W	2	1	1B-2000-140-3		BARE P.C. BOARD	1
18	5A-9035	R10, R12, R13, R15, R16, R18, R19, R21, R22, R24, R25, R27, R26, R30	RESISTOR, FC, 47K OHM 10% 1/4 W	14	2	5A-9221	IC1	15 DIP RESISTOR/PACK 2.2 K OHM	1
19	5A-9162	R3 THRU R9, R11, R14, R17, R20, R23, R26, R29, R46	RESISTOR, FC, 100K OHM 10% 1/4 W	15	3	5A-9222	IC2	15 DIP RESISTOR/PACK 1 K OHM	1
20	5A-9218	R1, R2, R47, R49, R50	RESISTOR, FC, 2.2 M. OHM 10% 1/4 W	5	4	5A-8970	IC3, IC4	MC14543 7 SEGMENT DRIVER	2
21	5A-8980	C1, C2, C5, C6	CAPACITOR, CERAMIC, .01 MFD. 50V	4	5	5A-9213	IC5	4012 CMOS DUAL 4 INPUT NAND GATE	1
22	5A-9065	C3, C4	CAPACITOR, CERAMIC, 470PFD. 50V	2	6	5A-9220	IC6	15 DIP RESISTOR/PACK 2.2 K OHM	1
23	5R-8966	I1	6-DIGIT DISPLAY	1	7	5A-9223	IC7	15 DIP RESISTOR/PACK 10K OHM	1
24	23A-6542	F1	DISPLAY MOUNTING ADHESIVE FOAM	1	8	5A-9267	IC8, IC9, IC10	4069 LOW PWR. HEX. INVERTER	3
25	5A-9285	R69	RESISTOR, FC, 180 OHM 5% 1/2 W	1	9	5A-9216	Q1 THRU Q14 Q45 THRU Q60	HIGH VOLTAGE NPN TRANSISTOR MPS-A42	30
					10	5A-9217	Q15 THRU Q44	HIGH VOLTAGE NPN TRANSISTOR MPS-A42	30
					11	5A-8785	D1 THRU D20 D24 THRU D33	IN4003 DIODE, SILICON	30
					12	5A-8919	D21, D22, D23	IN4148 DIODE, SILICON	3
					13	5A-9224	R68	RESISTOR, FC, 270 OHM 10% 1/4 W	1
					14	5A-9219	R51 THRU R66	RESISTOR, FC, 8.2 K OHM 10% 1/4 W	16
					15	5A-8817	R48	RESISTOR, FC, 10 K OHM 10% 1/4 W	1
					16	5A-9032	R31 THRU R44	RESISTOR, FC, 12 K OHM 10% 1/4 W	14



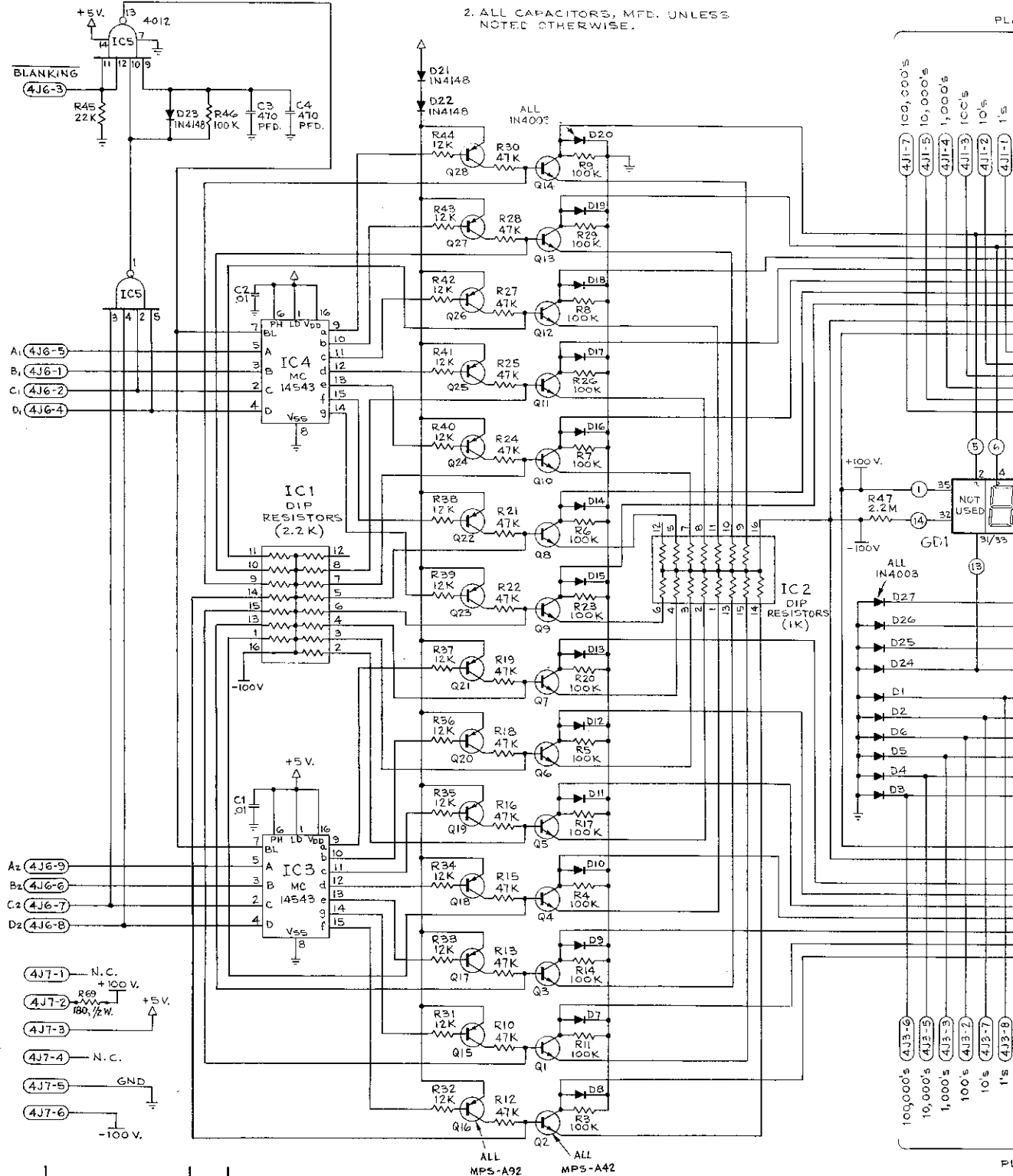
WILLIAMS ELECTRONICS, INC.				
SUBSIDIARY OF XCOR CORPORATION				
3401 N. CALIFORNIA		CHICAGO, ILL. 60618		CORNELIA 7-2240
PART NAME				
DISCRETE MASTER DISPLAY BD. ASSEM.				
DWN.	DATE	APP'D.	SCALE	PART NO.
A.V.	5-8-79		2=1	D-8168

D8169 Master Display Board Assembly  
(Discrete Drivers)

16D-8169

NOTES:

1. ALL RESISTORS, 1/4 WATT UNLESS NOTED OTHERWISE.
2. ALL CAPACITORS, MFD. UNLESS NOTED OTHERWISE.

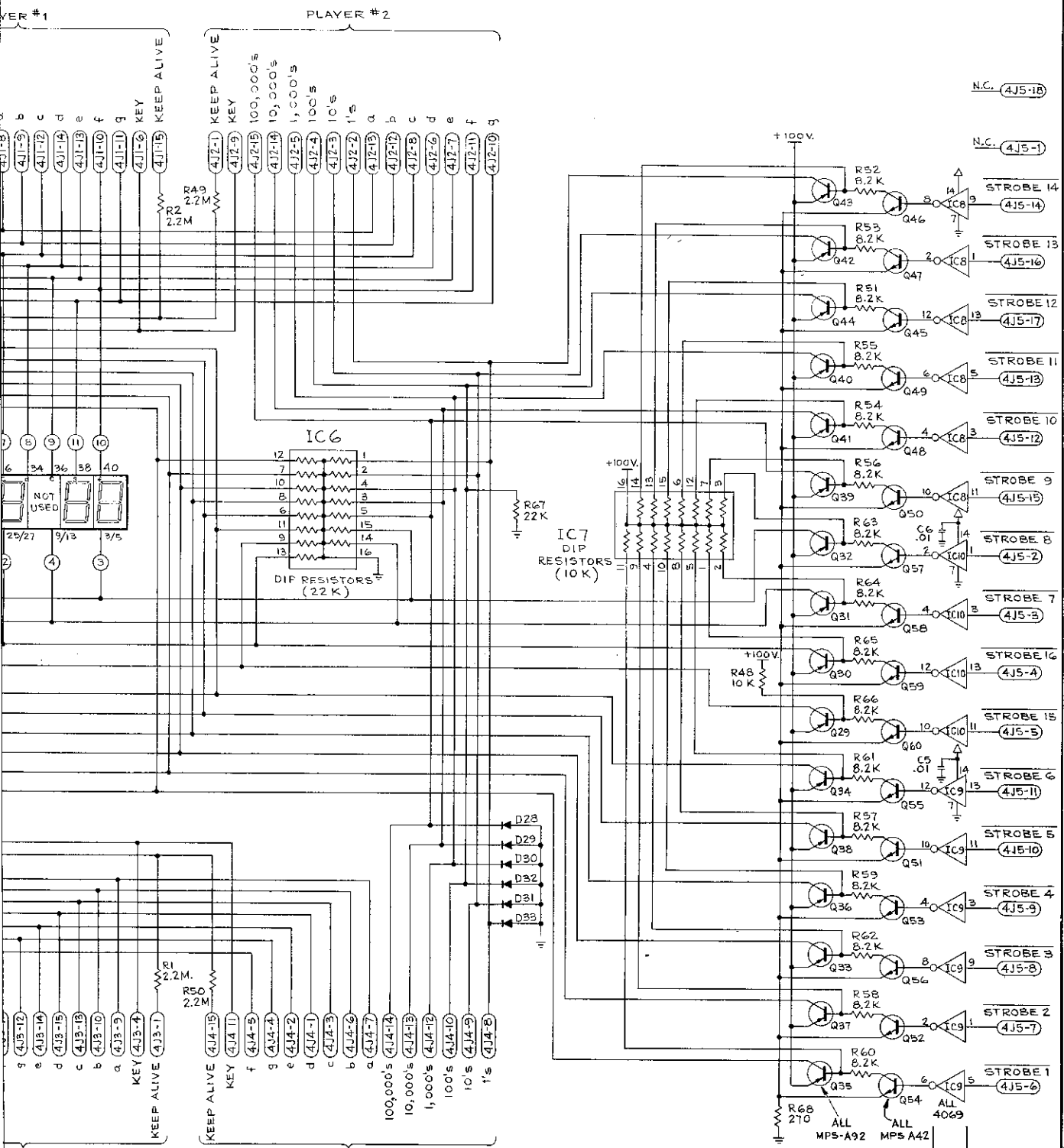


- (4J7-1) - N.C.
- (4J7-2)  $R_{69}$   $\frac{R_{69}}{180}$  1/2W. +5V.
- (4J7-3) - N.C.
- (4J7-4) - N.C.
- (4J7-5) - GND
- (4J7-6) - -100V.

A	AT 4J7-2 CONNECTION R69 ADDED E.C.O.478	4-23-79
REVISION LETTER	REVISION	BY

DIETZGEN NO. 198K AGEPROOF

(REV.)  
D.A.F.



TOLERANCES		QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED			
FRACTIONAL	±1/64"		
DECIMAL	±.003"		
HOLE DIA.	+0.002 -0.001"		
ANGULAR	±1/2°		
CONCENTRICITY	±1/16" DIA.		
SCREW THREADS	CLASS 2		
MATERIAL		HEAT TREATMENT	FINISH
MPS-A92			
MPS-A42			
DATE	APP'D.	SCALE	16D-8169
3-21-79			

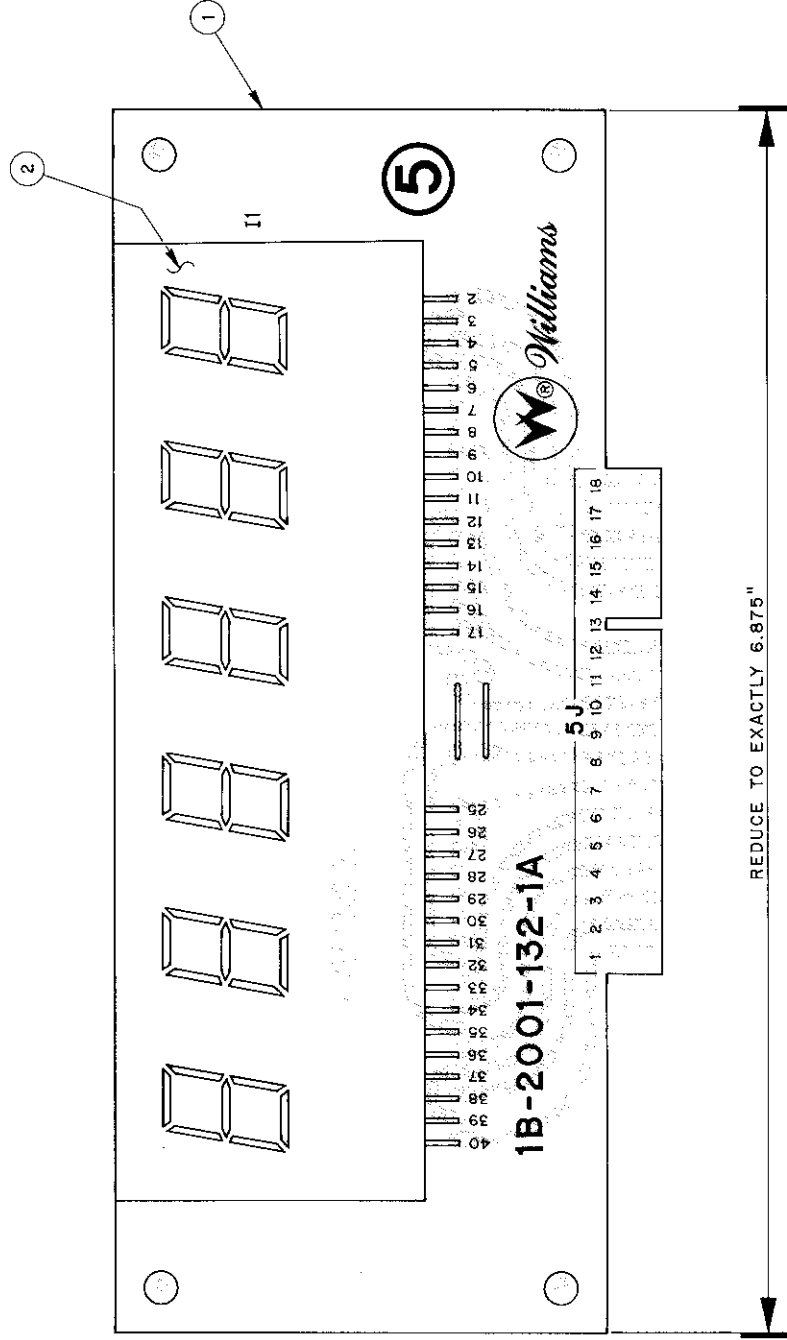
D8169 Master Display Board Logic Diagram (Discrete Drivers)



REVISION LETTER      REVISION  
 REVISOR AND REDRAWN  
 R. GAY 7-19-78

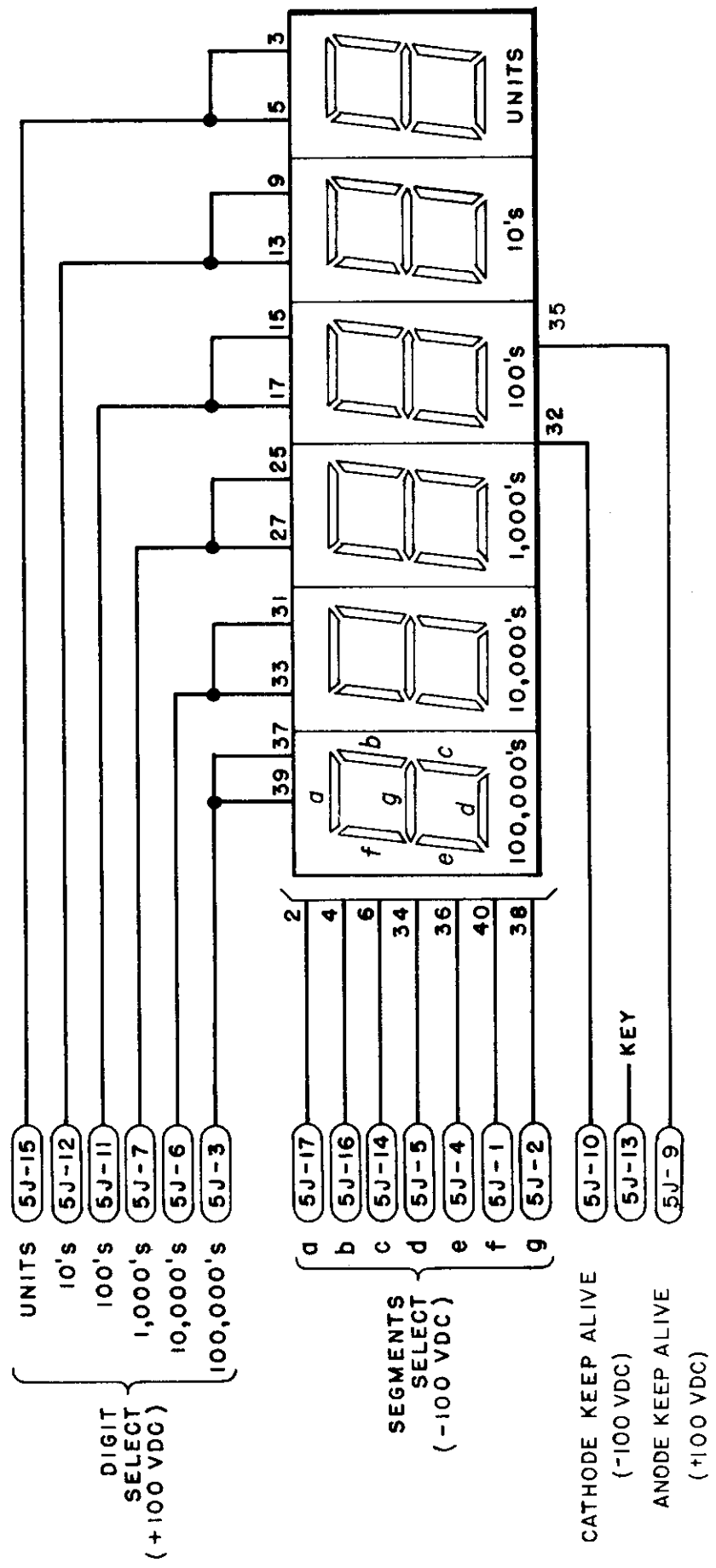
**BILL OF MATERIAL**

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-132		BARE P.C. BOARD	1
2	5A-6966	11	6 DIGIT DISPLAY	1
3	23A-6534		DISPLAY MTG. ADHESIVE FOAM	1



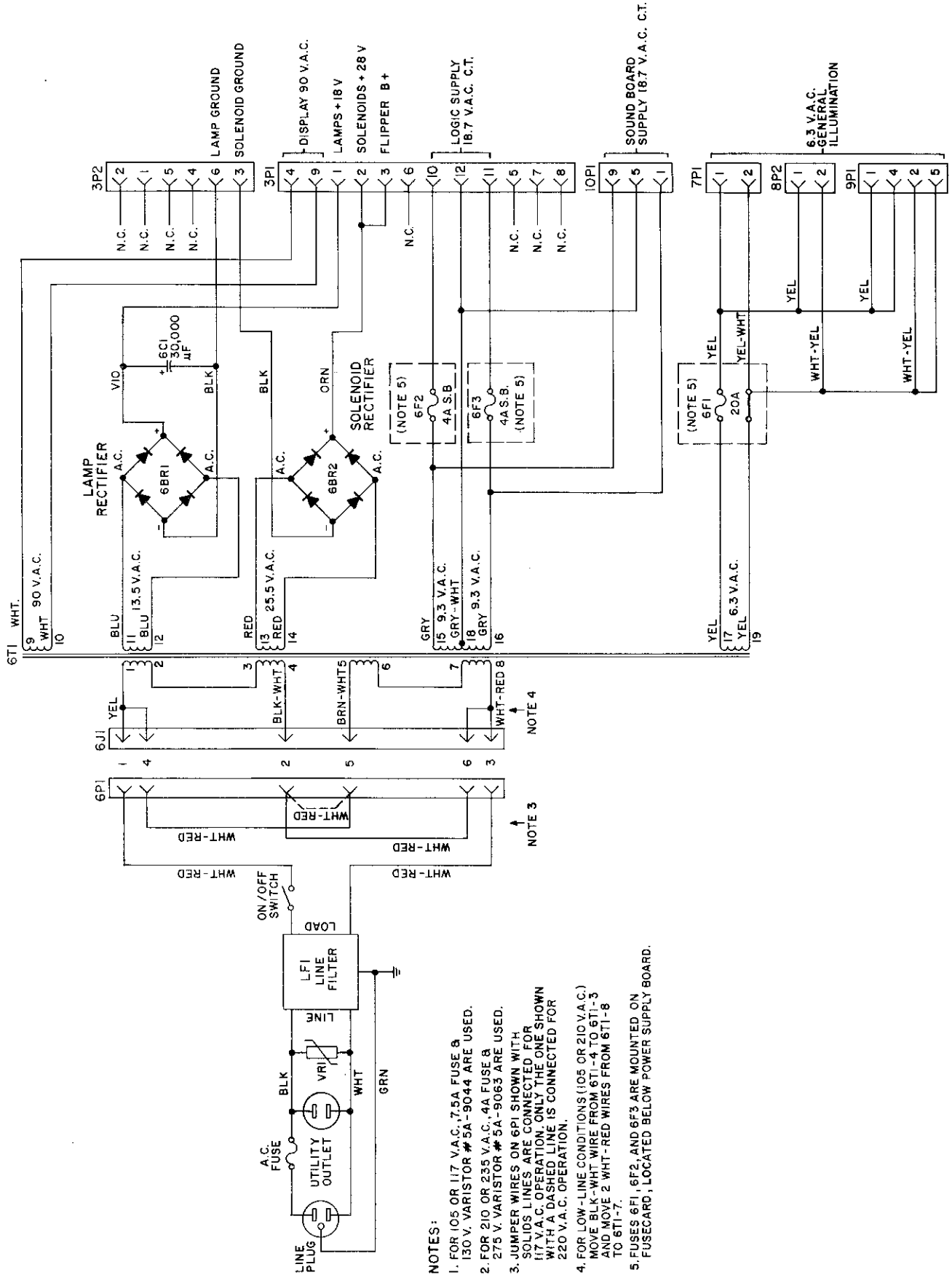
**WILLIAMS ELECTRONICS, INC.**  
 SUBSIDIARY OF XCOR CORPORATION  
 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240  
 PART NAME      SLAVE DISPLAY BOARD ASSEMBLY  
 DWN      R. Goy      DATE      APP'D.      SCALE      2=1      PART NO.      **C-8019**

# SLAVE DISPLAY BOARD



Slave Display Board Assembly and Schematic Diagrams

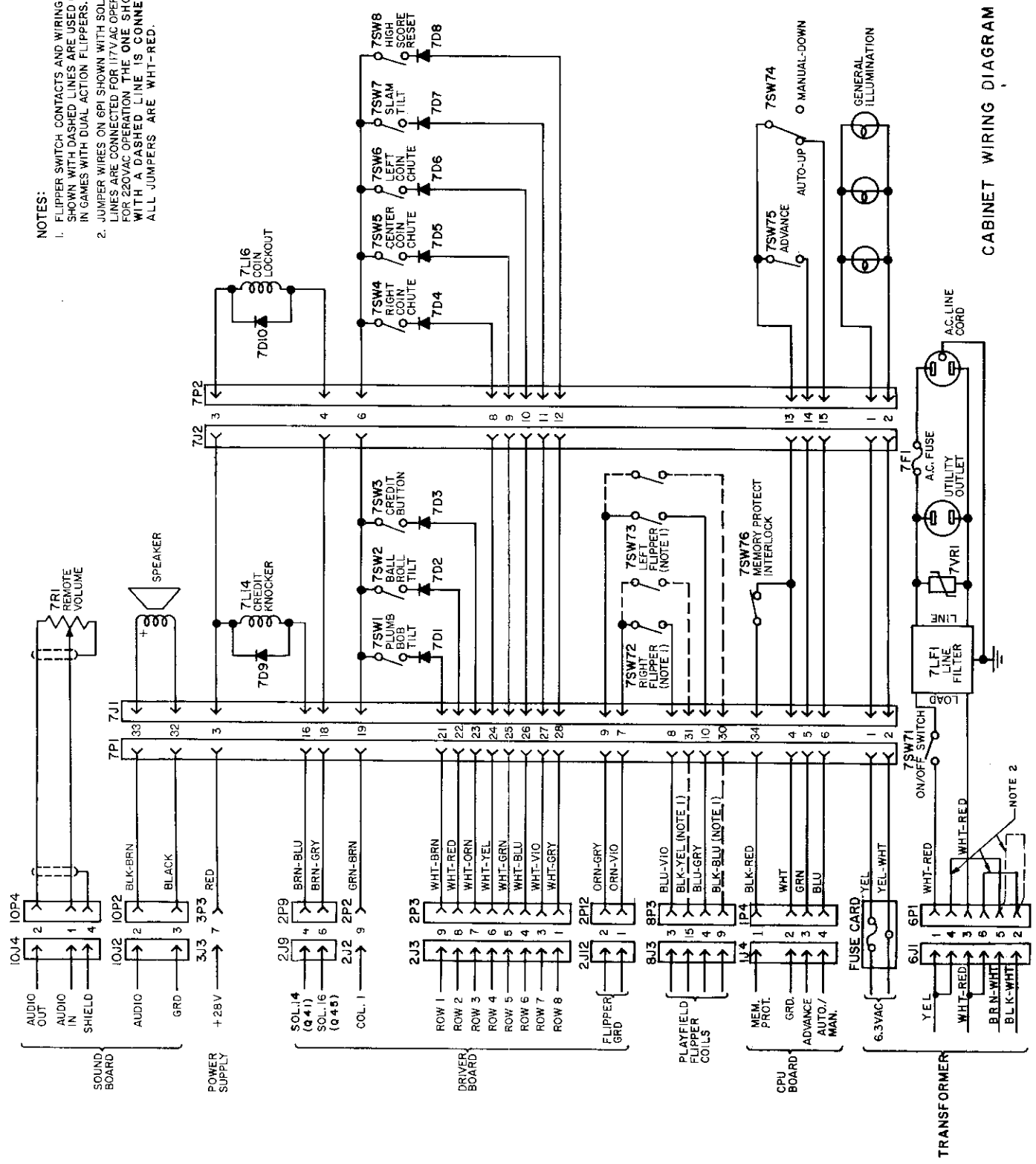
**POWER WIRING**



**NOTES:**

1. FOR 105 OR 117 V.A.C. 7.5A FUSE & 130 V. VARIATOR # 5A-9044 ARE USED.
2. FOR 210 OR 235 V.A.C., 4A FUSE & 275 V. VARIATOR # 5A-9063 ARE USED.
3. JUMPER WIRES ON 6P1 SHOWN WITH SOLIDS LINES ARE CONNECTED FOR 117 V.A.C. OPERATION. ONLY THE ONE SHOWN WITH A DASHED LINE IS CONNECTED FOR 220 V.A.C. OPERATION.
4. FOR LOW-LINE CONDITIONS (105 OR 210 V.A.C.) MOVE BLK-WHT WIRE FROM 6TI-4 TO 6TI-3 AND MOVE 2 WHT-RED WIRES FROM 6TI-8 TO 6TI-7.
5. FUSES 6F1, 6F2, AND 6F3 ARE MOUNTED ON FUSECARD 1, LOCATED BELOW POWER SUPPLY BOARD.

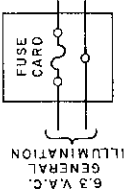
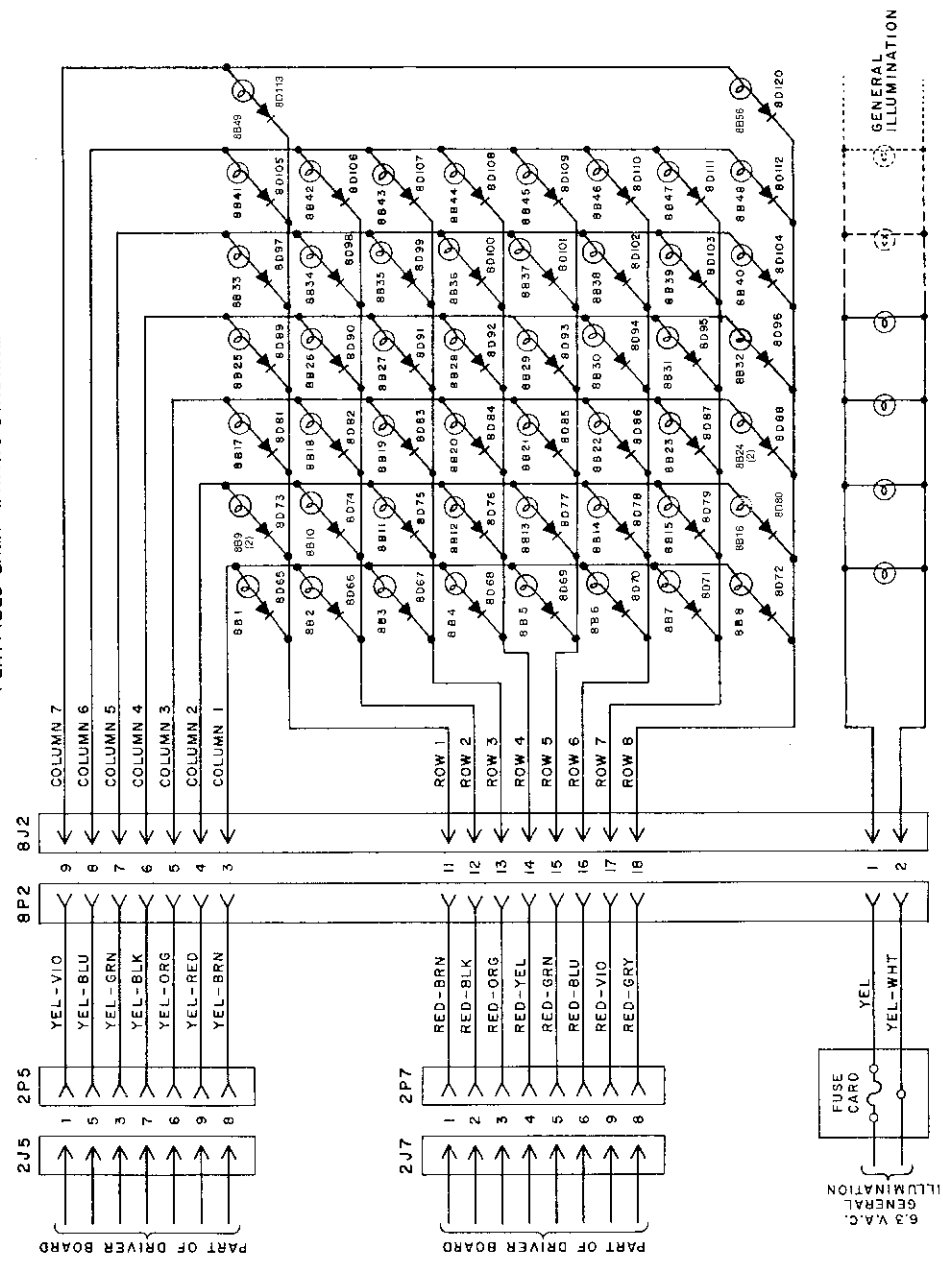
- NOTES:**
1. FLIPPER SWITCH CONTACTS AND WIRING SHOWN WITH DASHED LINES ARE USED ONLY IN GAMES WITH DUAL ACTION FLIPPERS.
  2. JUMPER WIRES ON GPI SHOWN WITH SOLID LINES ARE CONNECTED FOR 117VAC OPERATION, FOR 220VAC OPERATION THE ONE SHOWN WITH A DASHED LINE IS CONNECTED. ALL JUMPERS ARE WHT-RED.



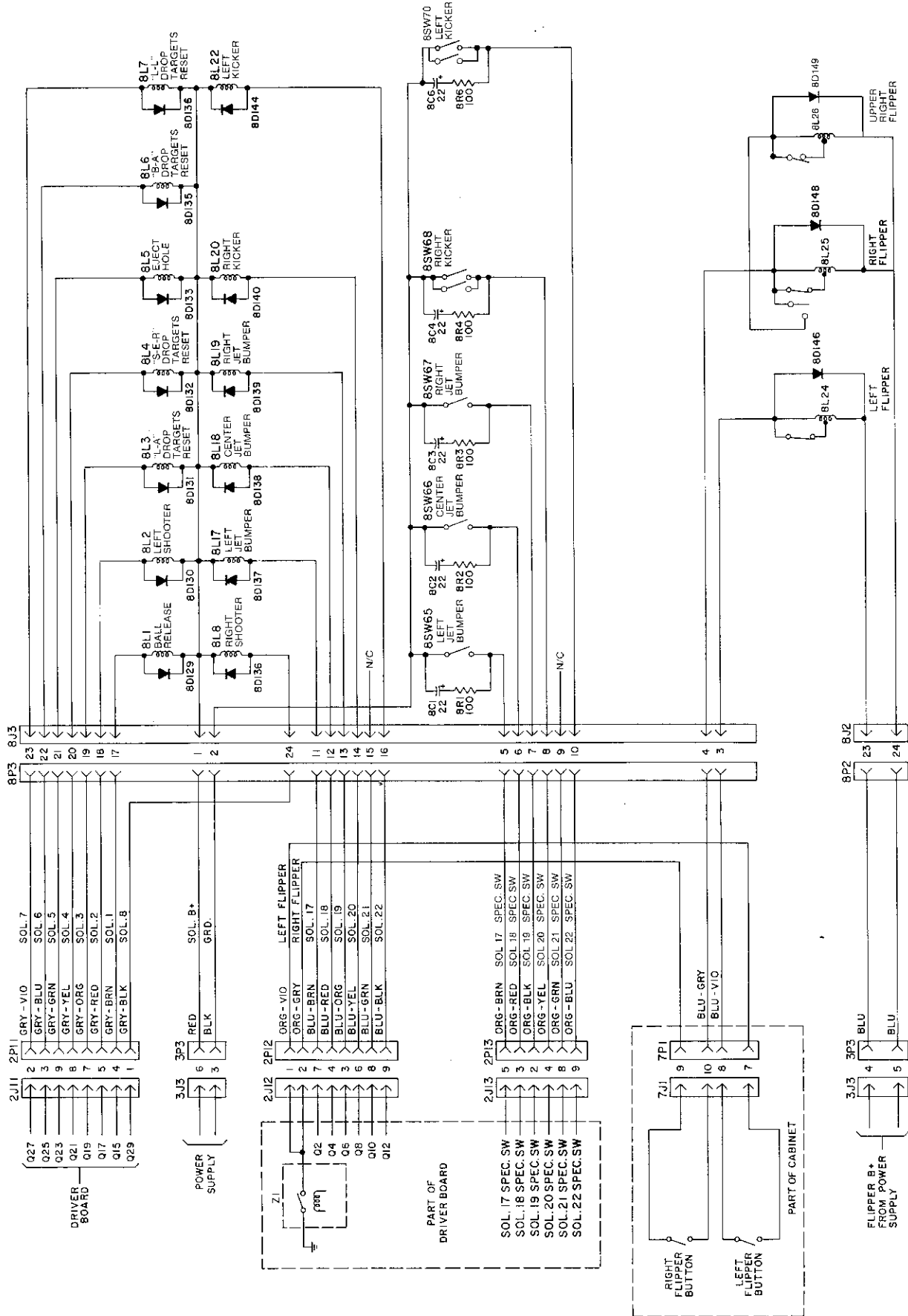
CABINET WIRING DIAGRAM

# LASER BALL PLAYFIELD LAMP WIRING DIAGRAM

BULB NO.	FUNCTION
01	Shoot Again
02	Bull's-Eye Extra Ball when Lit
03	Æ 1 (Top)
04	Æ 2
05	Æ 3
06	Æ 4
07	Æ 5
08	Æ 6 (Bottom Right)
09	Left and Right Specials (2)
10	10,000 Bonus
11	2X
12	3X
13	5X
14	1000 Bonus
15	2000 Bonus
16	3000 Bonus
17	4000 Bonus
18	5000 Bonus
19	6000 Bonus
20	7000 Bonus
21	8000 Bonus
22	9000 Bonus
23	Bull's-Eye Special
24	Spinner 1000 (2)
25	20,000 Bonus
26	L-A-S-E-R 10,000
27	L-A-S-E-R 15,000
28	L-A-S-E-R 20,000
29	Top 1
30	Top 2
31	Top 3
32	Top 4
33	Top 5
34	Top 6
35	Top 7
36	Top 8
37	Top 9
38	Top 10
39	Star 1
40	Star 2
41	Star 3
42	Star 4
43	Star 5
44	Star 6
45	Star 7
46	Star 8
47	Star 9
48	Star 10
49	Eject Hole Extra Ball when Lit
56	Credits (Playfield)



# LASER BALL PLAYFIELD SOLENOIDS WIRING DIAGRAM



**SWITCH NO. FUNCTION**

- 09 Out-hole
- 10 Left Shooter
- 11 Left Special
- 12 Left Inside Rollover
- 13 Left Kicker
- 14 Middle Left Side Standup
- 15 Not Used
- 16 Left Side Target
- 17 Left Spinner
- 18 Bullseye Target
- 19 "L" Drop Target
- 20 "A" Drop Target
- 21 "S" Drop Target
- 22 "F" Drop Target
- 23 "R" Drop Target
- 24 L-A-S-E-R Drop Target Series
- 25 Lower Top Left Standup
- 26 Upper Top Left Standup
- 27 "1" and "2" Rollover
- 28 "3" and "4" Rollover
- 29 "5" and "6" Rollover
- 30 "7" and "8" Rollover
- 31 "9" and "10" Rollover
- 32 Eject Hole
- 33 Upper Right Standup
- 34 "B" Drop Target
- 35 "A" Drop Target
- 36 "L" Drop Target
- 37 "L" Drop Target (Bottom)
- 38 B-A-L-L Drop Target Standup
- 39 Right Spinner
- 40 Right Shooter
- 41 Right Special
- 42 Right Inside Rollover
- 43 Right Kicker
- 44 Left Jet Bumper
- 45 Right Jet Bumper
- 46 Center Jet Bumper
- 47 "S-E-R" Drop Target Standup
- 48 Playfield Tilt
- 49 Star 1 Rollover
- 50 Star 2 Rollover
- 51 Star 3 Rollover
- 52 Star 4 Rollover
- 53 Star 5 Rollover
- 54 Star 6 Rollover
- 55 Star 7 Rollover
- 56 Star 8 Rollover
- 57 Star 9 Rollover
- 58 Star 10 Rollover
- 59

**LASER BALL  
PLAYFIELD SWITCH WIRING DIAGRAM**

