

Williams®

16P-495-101
Game No. 495
April, 1980

BLACKOUT



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Williams® 
ELECTRONICS, INC.

An Xcor International Inc., Company
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FOREWORD

This instruction and drawing set provides essential installation information and any maintenance information unique to BLACKOUT. All assembly drawings and logic and schematic diagrams are also included. For game operation, bookkeeping, game adjustment and diagnostic procedures, refer to the instruction booklet located in the envelope inside the coin door. The booklet also provides solenoid, lamp, and switch charts. For troubleshooting and interconnection information refer to 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 IC14 and IC16 sockets may be used but the memory protection feature is lost:
- 2. Must be equipped with green-labeled BLACKOUT PROMs or game ROM and green-labeled flipper ROMs.
- 3. When Game ROM is used, jumper J3 must be connected and J4 removed.

Sound Board

- 1. Model D 8224 required for speech.
- 2. Must be jumpered for white-labeled sound ROM operation and be equipped with Sound ROM 2. (Jumpers W2, W5, W7, W9, W10, and W15 connected; W3, W4, W6, W8, W11, W12, and W13 removed)

Power Supply Board

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

Optional Speech Module

- 1. Requires 5T4951 (IC7), 5T4952 (IC5), and 5T4953 (IC6) speech ROMs.

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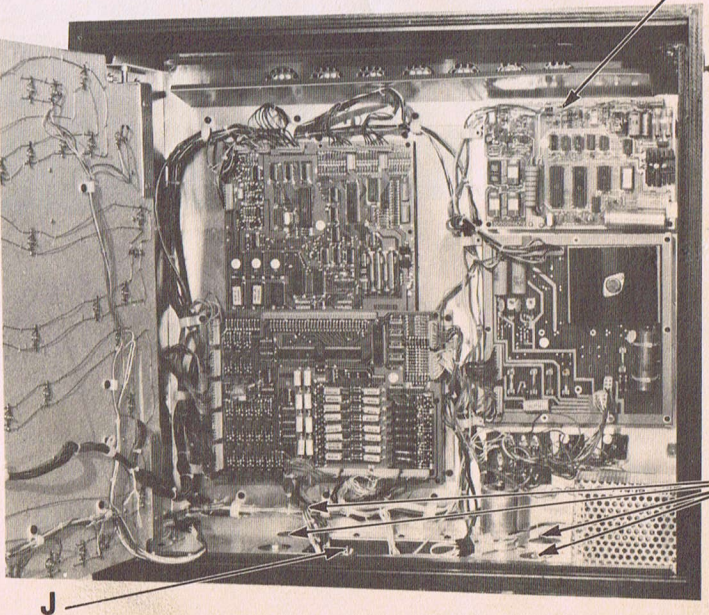
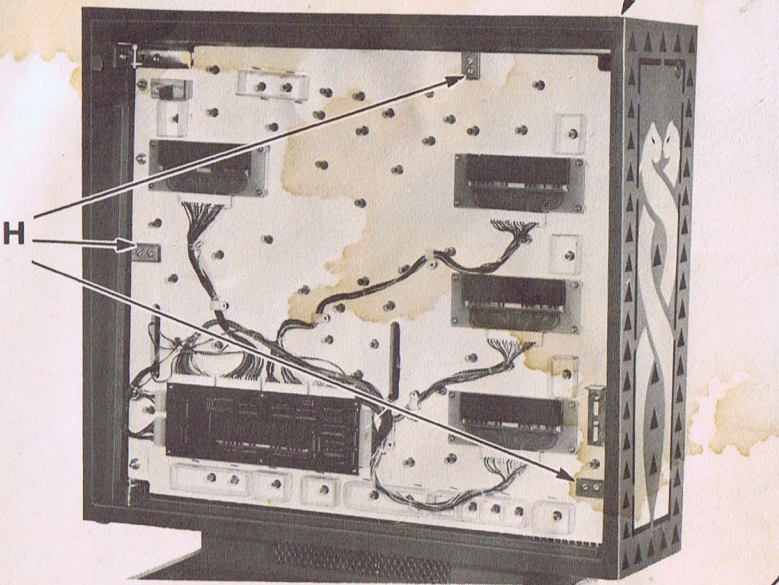
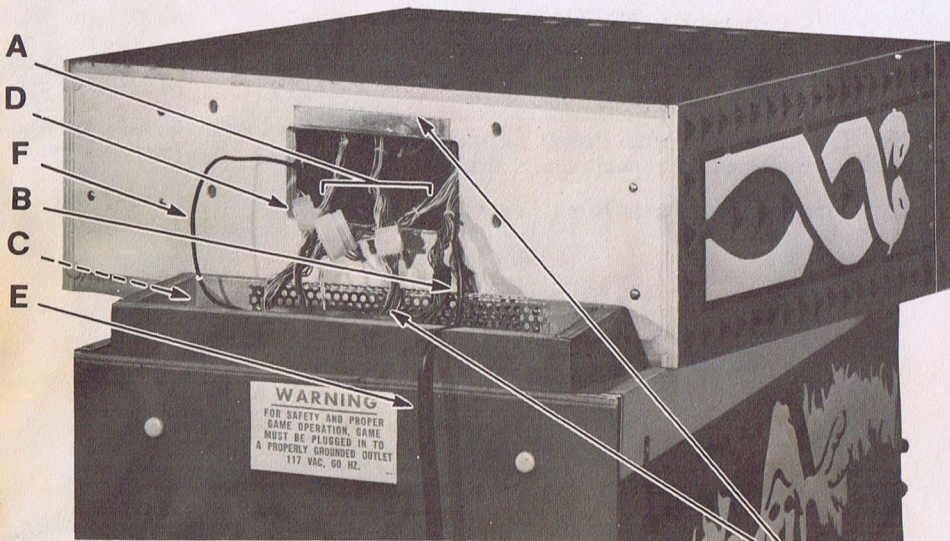
Assembly and Interconnection

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.



J

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.

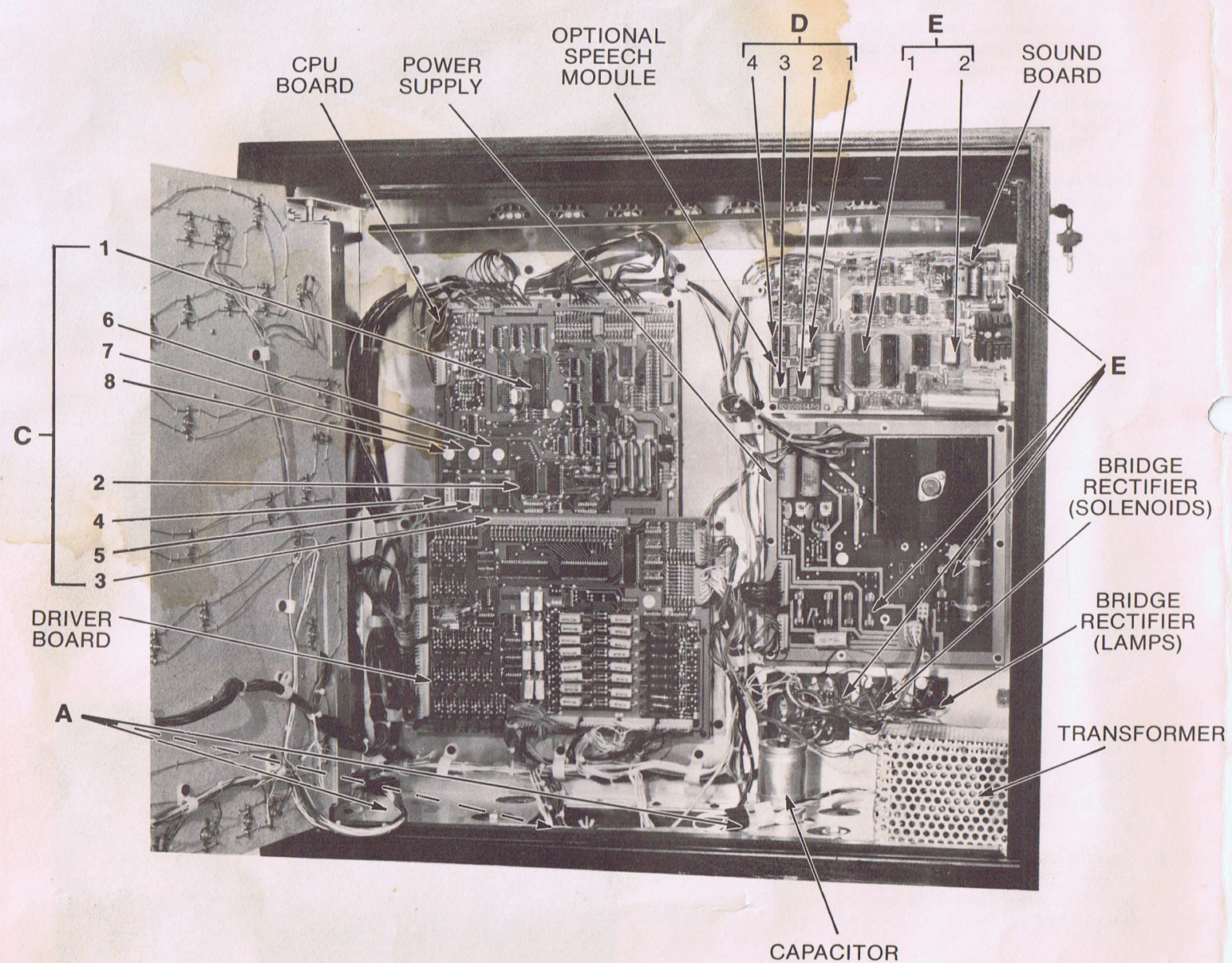
C Gently press on the socketed IC packages on CPU Board:

1 MPU, 2 RAM, 4 and 5 ROMS, and 6, 7 and 8 PROMS or 3 Game ROM.

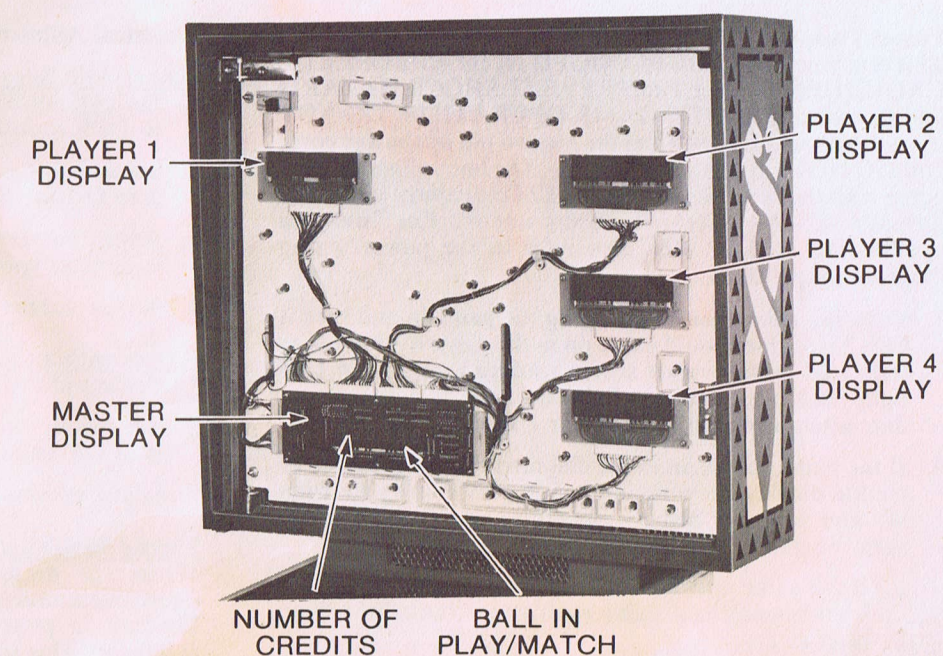
D Gently press on the socketed IC packages on the Speech Module (if provided): 1, 2, and 3 ROMs.

E Gently press on the socketed IC packages on Sound Board: 1 MPU, 2 Sound ROM.

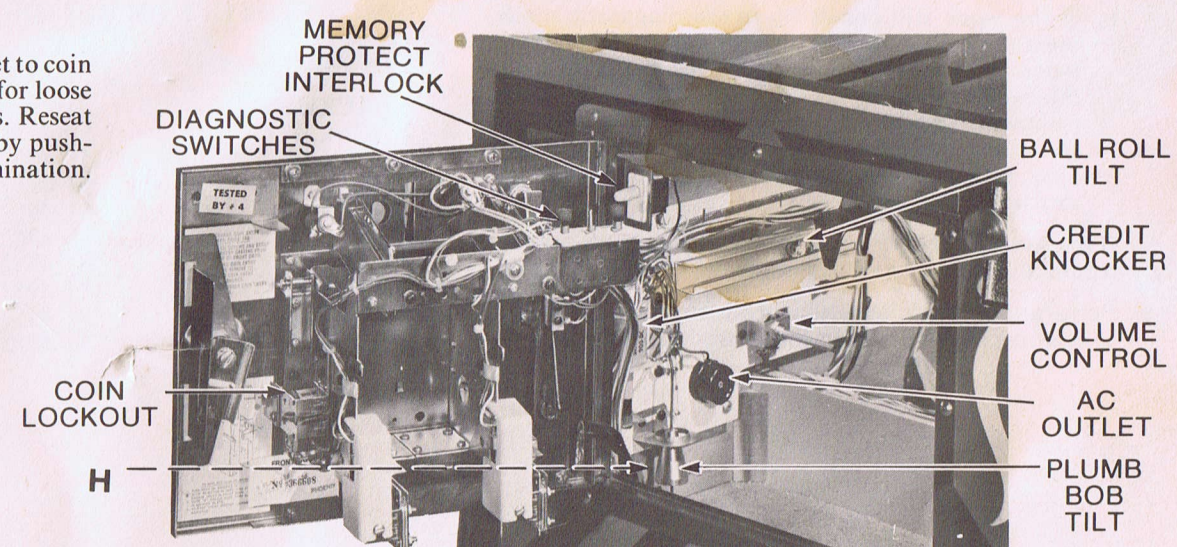
F Check that two fuses on Sound Board, five fuses on Power Supply, and three fuses on fuse card are secure.



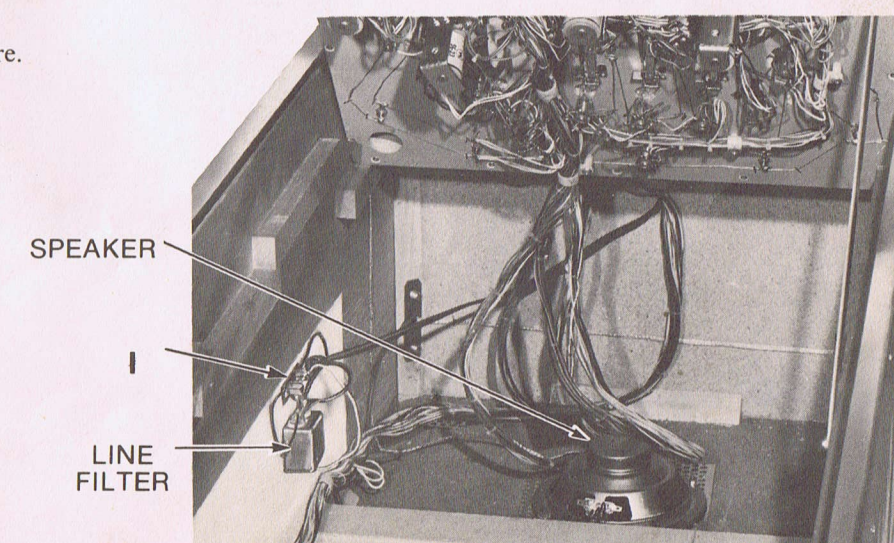
G (Not called out) Push on all connectors attached to Master and Player Display Boards.



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



I 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.

Electrical Adjustments

Games with Speech Module

1. Set miniature switch 2 to ON to enable speech; set it to OFF to inhibit speech.
2. Set switch 1 to OFF to select synthesized sounds, set it to ON to select musical notes.
3. Adjust balance control on Speech Module for relative volume of speech and sounds.
4. Adjust volume control in cabinet for desired volume.

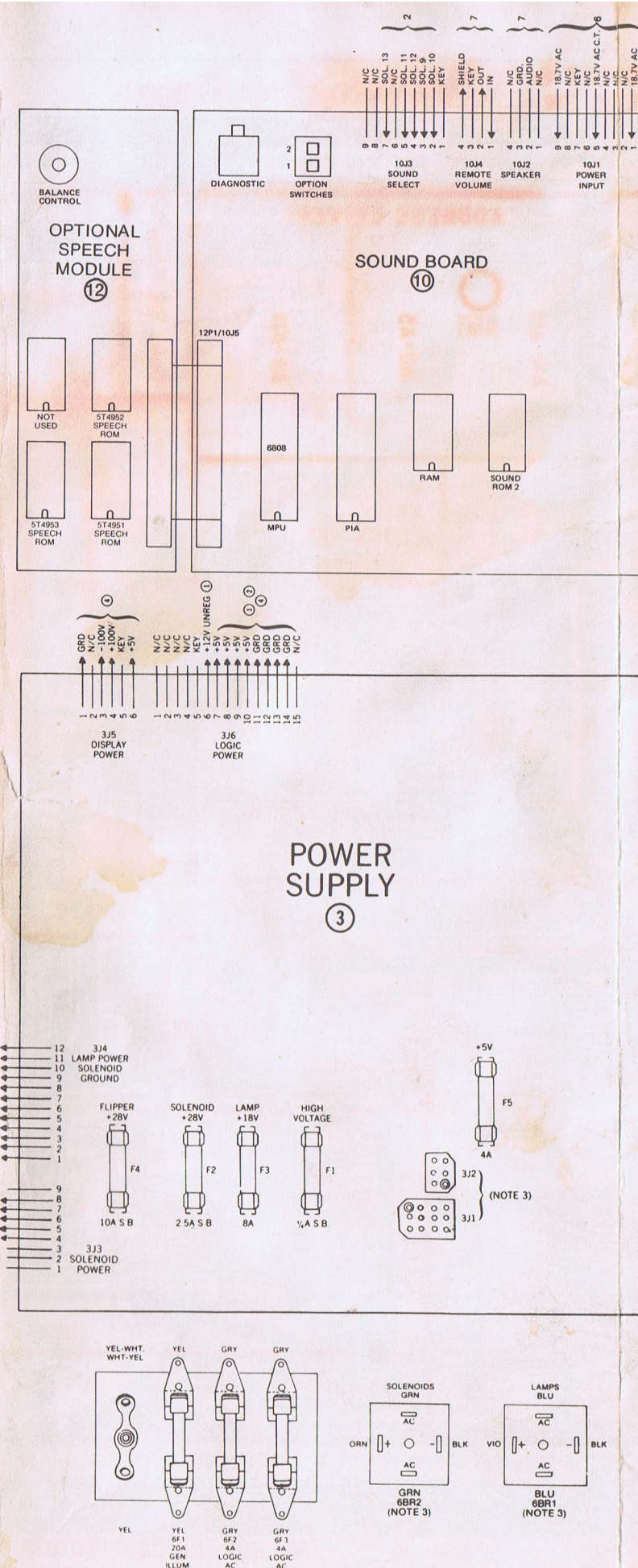
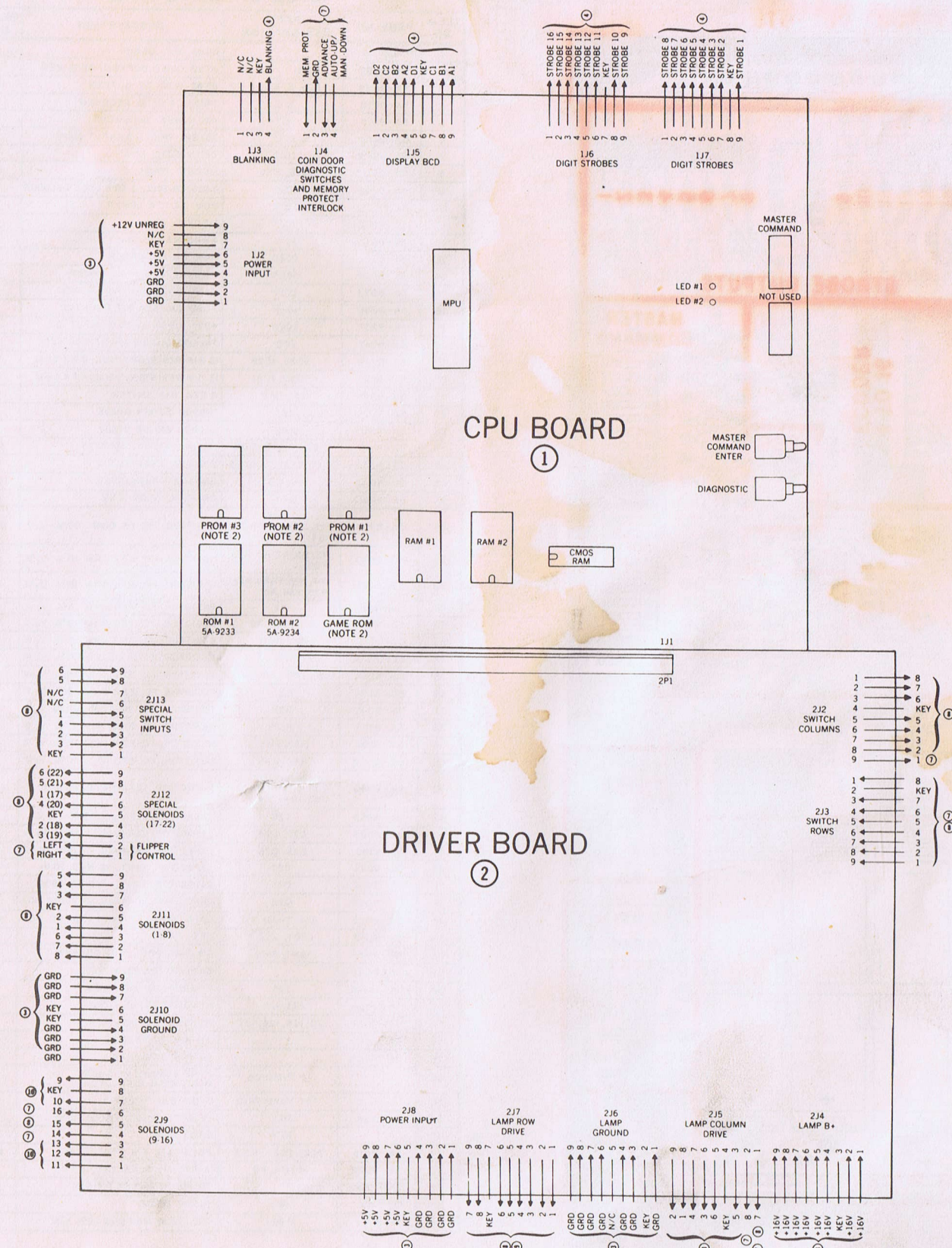
Games without Speech Module

1. Setting of miniature switch 2 does not matter.
2. Set switch 1 to OFF to select synthesized sounds; set it to ON to select musical notes.
3. Adjust volume control in cabinet for desired volume.

Special Maintenance Information

When the diagnostic pushbutton is depressed, eight electronic sounds are produced. Next, if the optional Speech Module is provided, the BLACKOUT vocabulary is produced. This sequence is continuously repeated until the game is turned OFF and back ON.

VOCABULARY	LOCATED IN ROM
BLACKOUT	5T 4951
LAUNCH	5T 4951
MISSION	5T 4951
CONDITION	5T 4951 and 5T 4952
GREEN	5T 4952
RED	5T 4952
YELLOW	5T 4952
RESUME	5T 4952 and 5T 4953
ORBIT	5T 4953
COMPLETED	5T 4953



NOTES:

1. CONNECTIONS ARE INDICATED BY 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
 - ⑪ NOT ASSIGNED
 - ⑫ SPEECH MODULE
2. WHEN GAME ROM IS USED, PROM #1, PROM #2, AND PROM #3 ARE NOT USED.
3. REFER TO POWER WIRING DIAGRAM (PAGE 23) FOR CONNECTIONS TO 3P1, 3P2, 6BR1, 6BR2, 6F1, 6F2, AND 6F3.

REVISION LETTER	REVISION
D	REVISED AND REDRAWN REVISED DWG. TO CONFORM TO ARTWORK NO. 1B-2001-133 LATEST ISSUE NO. 6. R. GAY, 1-8-79
E	ITEM NO. 3, MFG'S PT. NO. WAS IN5991. E.C.O. 4670 R. GAY, 1-31-79

TP1 +12V. UNREG.

TP2 NMI

+5V.
0V.
DIAGNOSTIC
SWITCH
DEPRESSED

TP3 MEMORY
PROTECT
0V.

TP4 BLANKING

+5V.
0V.
NORMAL
OPERATION BLANKING

TP5 IRQ

+5V.
0V.
30μS
1MS

TP6 BUS Φ2

+5V.
0V.
1.1μS

TP7 CMOS
RAM B+

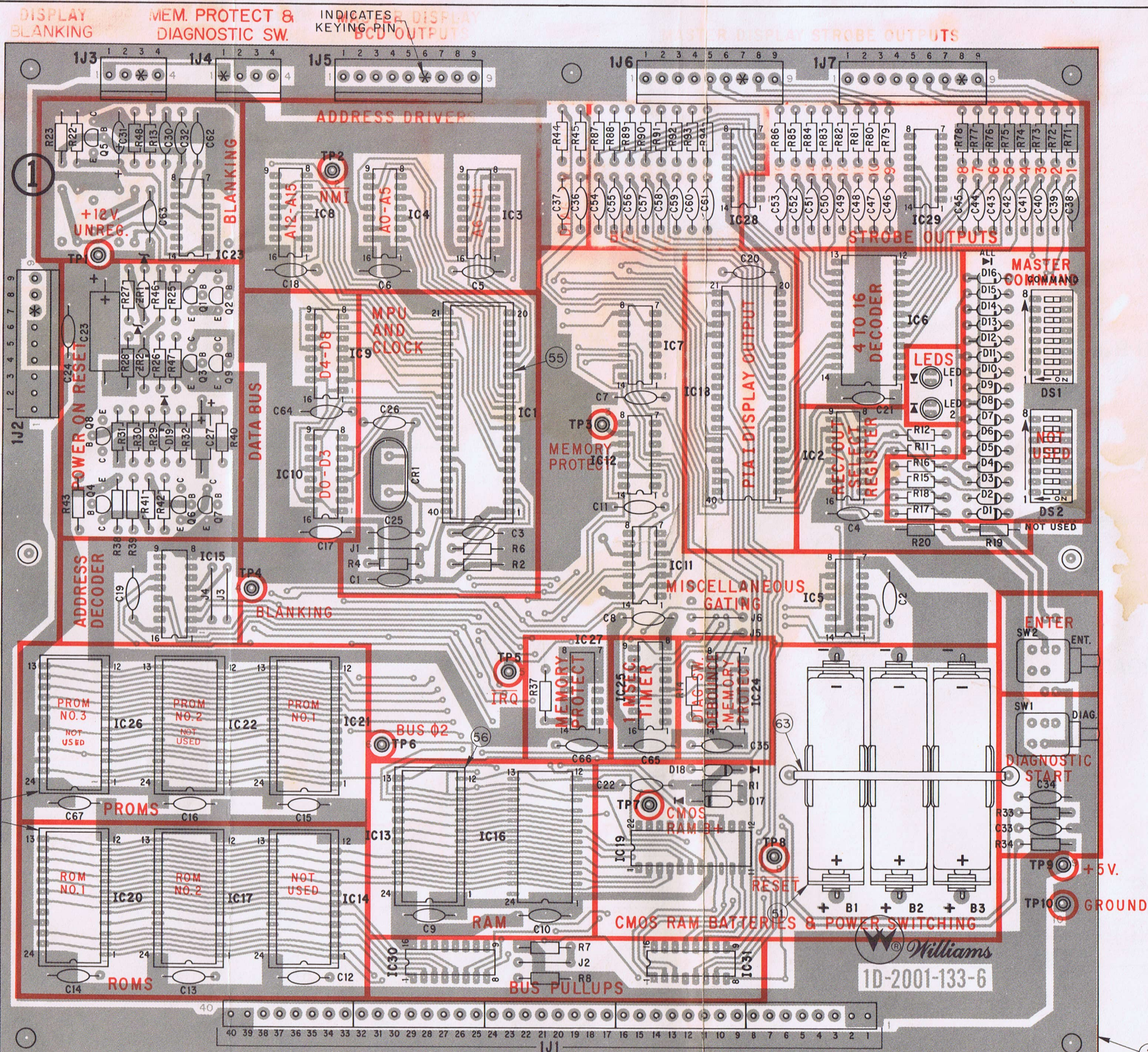
POWER ON 4.3V.
POWER OFF 3.9V.

TP8 RESET

1 SEC.
POWER
TURN ON
+5V.
0V.

TP9 +5V.

TP10 GND

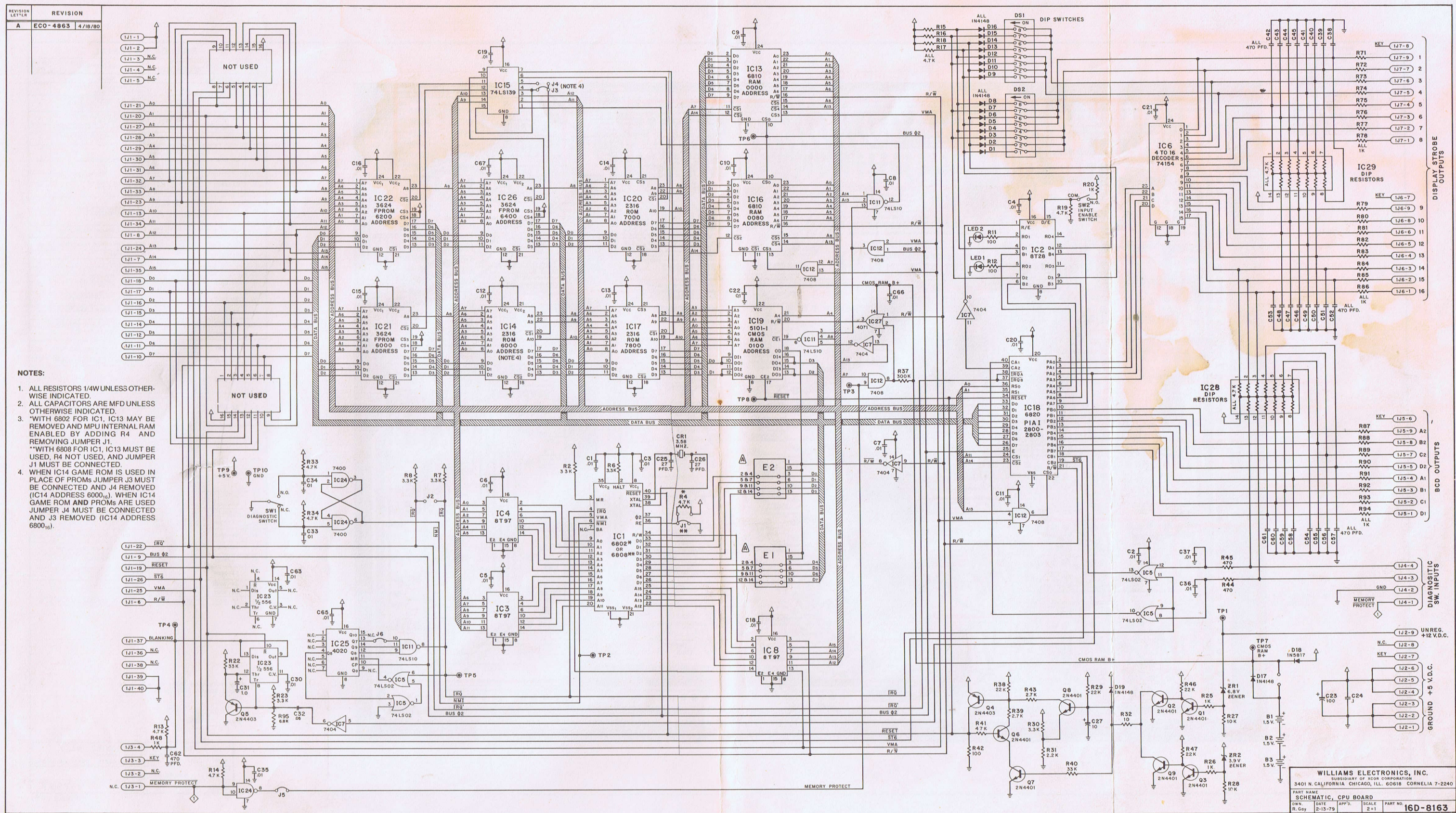


BILL OF MATERIAL

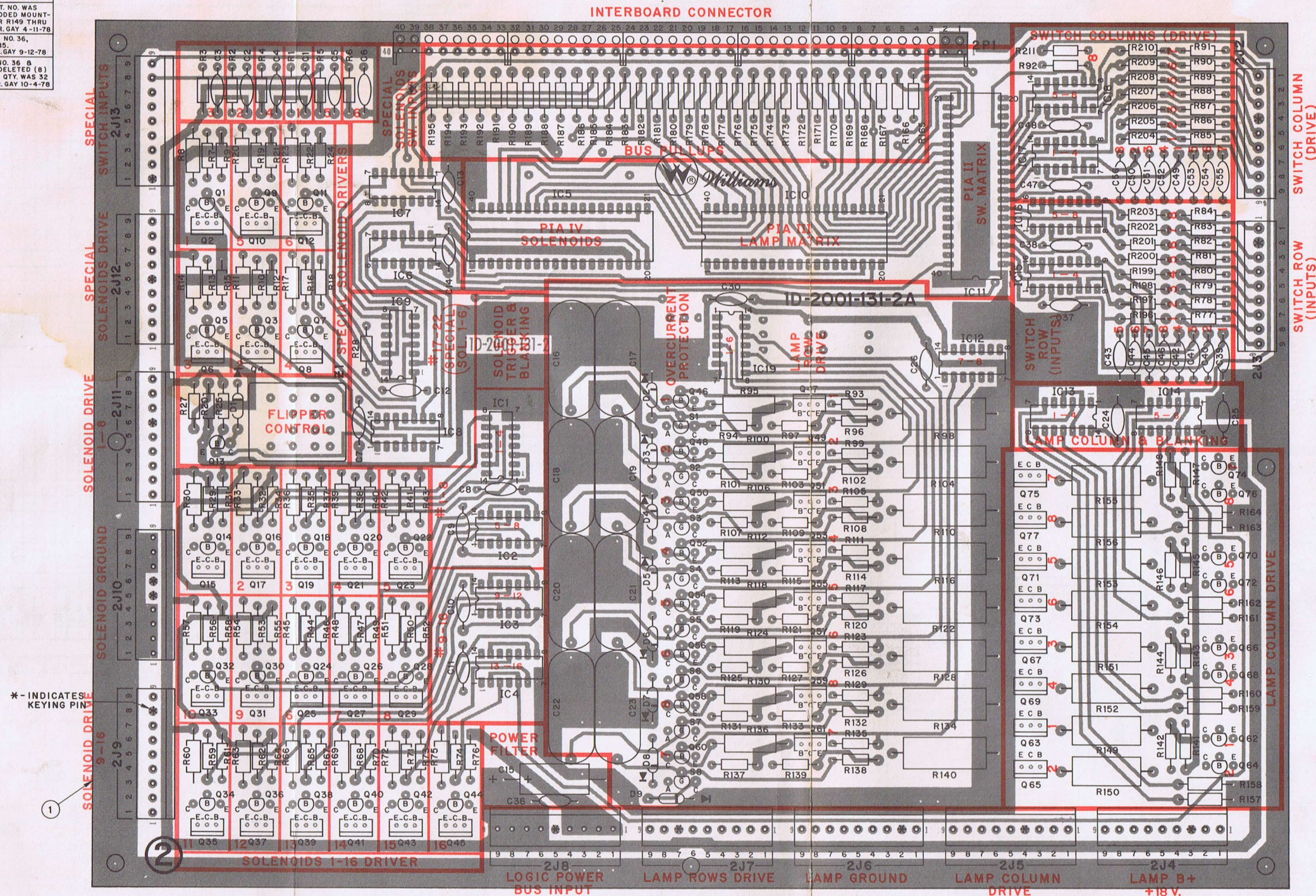
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-133-6		BARE P.C. BOARD	1
2	5A-8990	IC 2	BT28 QUAD BUFFER/RECEIVER	1
3	5A-8989	IC3, IC4, IC8	BT97 HEX. TS BUFFER	3
4	5A-9010	IC6	74154 4 TO 16 DECODER	1
5	5A-9013	IC7	7404 HEX. INVERTER	1
6	5A-9235	IC11	74LS10 TRIPLE 3 INPUT NAND	1
7	5A-8973	IC12	7408 QUAD AND	1
8	5A-9003	IC13, IC16	MC6810 RAM	2
9	5A-9246	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
10	5A-9004	IC17	ROM 2 K X 8 LOWER	1
11	5A-8972	IC18	MC6821 PIA	1
12	5A-9017	IC19	CMOS RAM 5101-1	1
13	5A-9002	IC20	ROM 2 K X 8 UPPER	1
14	5A-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 OR	1
18	5A-9247	IC5	74LS02 QUAD 2 INPUT NOR GATE	1
19	5A-9238	IC28, 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	IN5996 ZENER DIODE	1
23	5A-9240	ZR2	IN5990 ZENER DIODE	1
24	5A-8919	D1 THRU D17, D19	IN4148 DIODE, SILICON	19
25	5C-8938	Q1, Q2, Q3, Q6 THRU Q9	2N4401 TRANSISTOR	9
26	5C-9016	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, 1 K OHM 10% 1/4 W.	28
29	5B-8983	R2, R6, R7, R8, R23, R30	RESISTOR, FC, 3.3 K OHM 10% 1/4 W.	6
30	5B-8991	R4, R13 THRU R19, R33, R34, R41	RESISTOR, FC, 4.7 K 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, 33 K OHM 5% 1/4 W.	2
34	5B-9034	R27, R28	RESISTOR, FC, 10 K OHM 10% 1/4 W.	2
35	5A-9241	R29, R38, R46, R47	RESISTOR, FC, 22 K OHM 10% 1/4 W.	4
36	5A-8998	R31	RESISTOR, FC, 2.2 K OHM 10% 1/4 W.	1
37	5A-9039	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, 2.7 K OHM 10% 1/4 W.	2
40	5B-9083	R44, R45	RESISTOR, FC, 470 OHM 10% 1/4 W.	2
41	5A-8980	C1, THRU C21, C30, C33 THRU C37, C63 THRU C67	CAPACITOR, CERAMIC, .01 MFD. 50 V.	28
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, SPDT MOMENTARY	2
51	5A-9021		BATTERY HOLDER #171	1
52	5A-9026	IJ1	HEADER 09-64-1083	5
53	5A-9028	IJ3, IJ4	HEADER 09-65-1041	2
54	5A-9027	IJ2, IJ5, IJ6, IJ7	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	GAME ROM	0
61	5A-9015	IC21, IC22, IC26	PROM 512 X 8 7641/6341	2/3
62	5A-9022	B1, B2, B3	BATTERY, ALKALINE, 1.5 V.	3
63	5701-09398	E1, E2	16 PIN IC SOCKET HDR.	1
64	5A-9266	D18	IN5817 DIODE	1
65	5A-9086	R95	RESISTOR, 68K OHM 10% 1/4 W	1

* WHEN USED IC14 REPLACES IC21, IC22 AND IC26

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

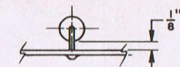


REVISION LETTER	REVISION
C	REVISED AND REDRAWN R. GAY 11-28-77
D	ITEM NO. 28, PT. NO. WAS 5A-8999 & ADDED MOUNT- ING NOTE FOR R149 THRU R156. R. GAY 4-11-78
E	DELETED ITEM NO. 36, PT. NO. 5A-8985. E.C.O. R. GAY 9-12-78
F	ADDED ITEM NO. 36 & ITEM NO. 22, DELETED (8) RESISTORS & QTY. WAS 32 E.C.O. 4624 R. GAY 10-4-78

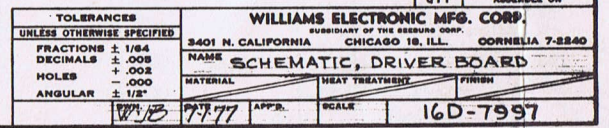


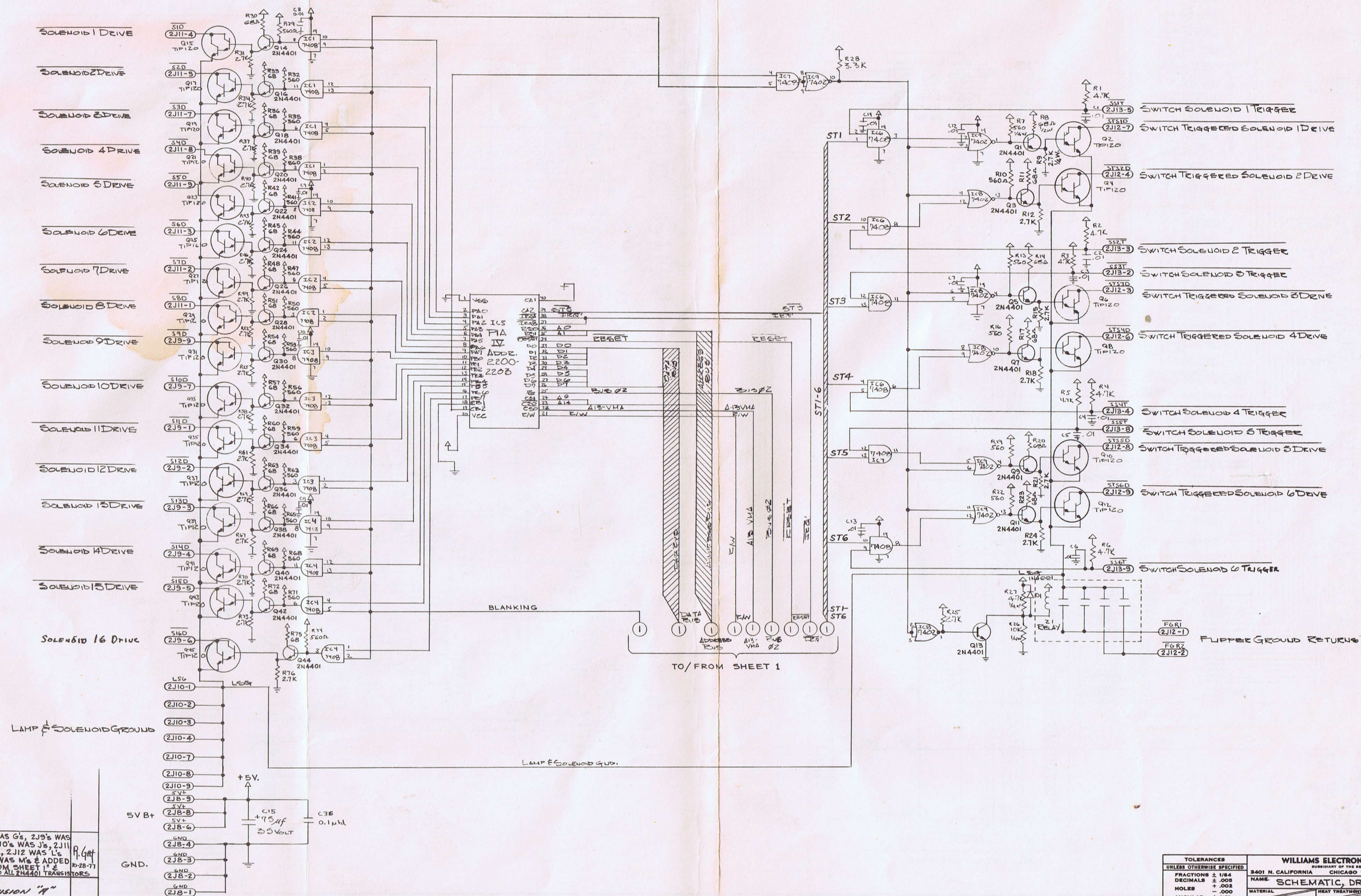
BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-131		BARE P.C. BOARD	1
2	5A-8948	1C8, 1C9	N7402 QUADRUPEL 2 INPUT POSITIVE NOR GATE	2
3	5A-8974	1C12, 1C17, 1C18, 1C19	N7406 HEX. INVERTER BUFFER DRIVERS W/ OPEN COLLECTOR HIGH VOLTAGE OUTPUTS	4
4	5A-8973	1C1 THRU 1C4, 1C6, 1C7, 1C13, 1C14	N7408 QUADRUPEL 2 INPUT POSITIVE AND GATE	8
5	5A-8975	1C15, 1C16	MC14009 INVERTING HEX. BUFFER	2
6	5A-8972	1C5, 1C10, 1C11	MC6820 PERIPHERAL INTERFACE ADAPTER	3
7	5A-8938	Q1, Q3, Q5, Q7, Q9, Q11, Q13, Q14, Q16, Q18, Q20, Q22, Q24, Q26, Q28, Q30, Q32, Q34, Q36, Q38, Q40, Q42, Q44	2N4401 NPN 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	TI1202 DARLINGTON NPN POWER TRANSISTOR	22
10	5A-8978	Q63, Q65, Q67, Q69, Q71, Q73, Q75, Q77,	TI142 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, THRU C26, C30, C37, C38, C47, C48	CAPACITOR, CERAMIC, .01 MFD. +80 -20% 50 V.	22
16	5A-8995	C16 THRU C23	CAPACITOR, POLYESTER FILM, 1 MFD. 10 %	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, R77 THRU R92, R157 THRU R195	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, R126, R127, R132, R133, R136, R139, R196 THRU R203	RESISTOR, FC, 1 K OHM 10% 1/4 W	24
23	5A-8992	R7, R10, R15, R16, R19, R22, R29, R32, R35, R38, 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	R9, 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-8817	R26	RESISTOR, FC, 10 K OHM 10% 1/4 W	1
27	5A-8998	R141 THRU R148	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, R118, R124, R130, R136	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	1
33	5A-8994	Z1	RELAY - 4 POLE - 5 AMP. CONTACTS 40 OHM COIL & V.D.C.	1
34	5A-9066	2P1	8 PIN RECEPTACLE	5
35	5A-9027	242 THRU 2J13	9 PIN HEADER	12
36	5A-9001	R2 THRU R211	RESISTOR, FC, 330 OHM 10% 1/4 W	8

★ R149 THRU R156 MUST BE MOUNTED $\frac{1}{8}$ "
ABOVE SURFACE OF BOARD.



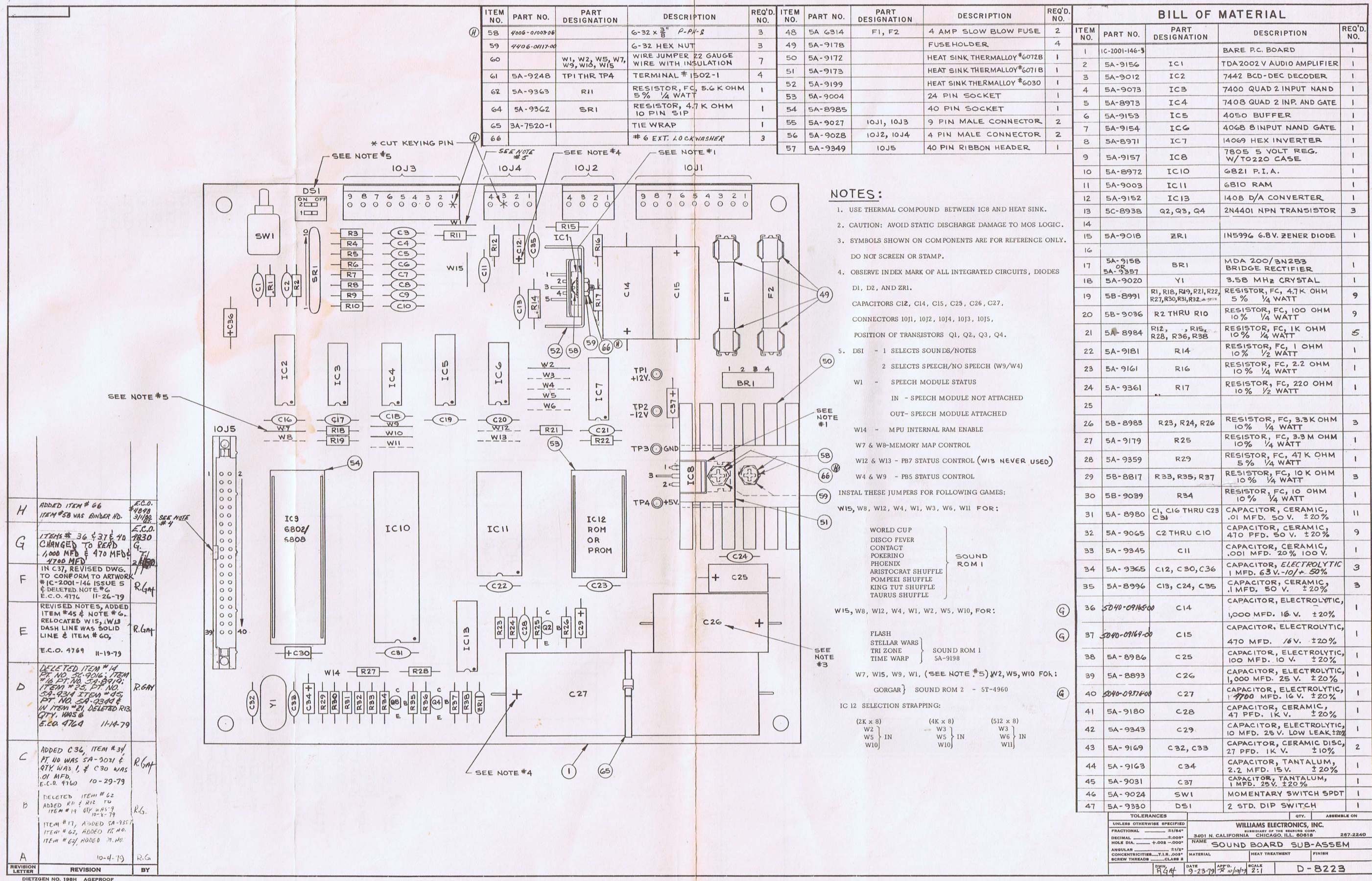
WILLIAMS ELECTRONICS, INC. SUBSIDIARY OF XCOR CORPORATION 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240				
PART NAME				
DRIVER BOARD ASSEMBLY				
DWN.	DATE	APP'D.	SCALE	PART NO.
R. Gay	8-16-77		2 = 1	D-7997
DOCUMENT #1				





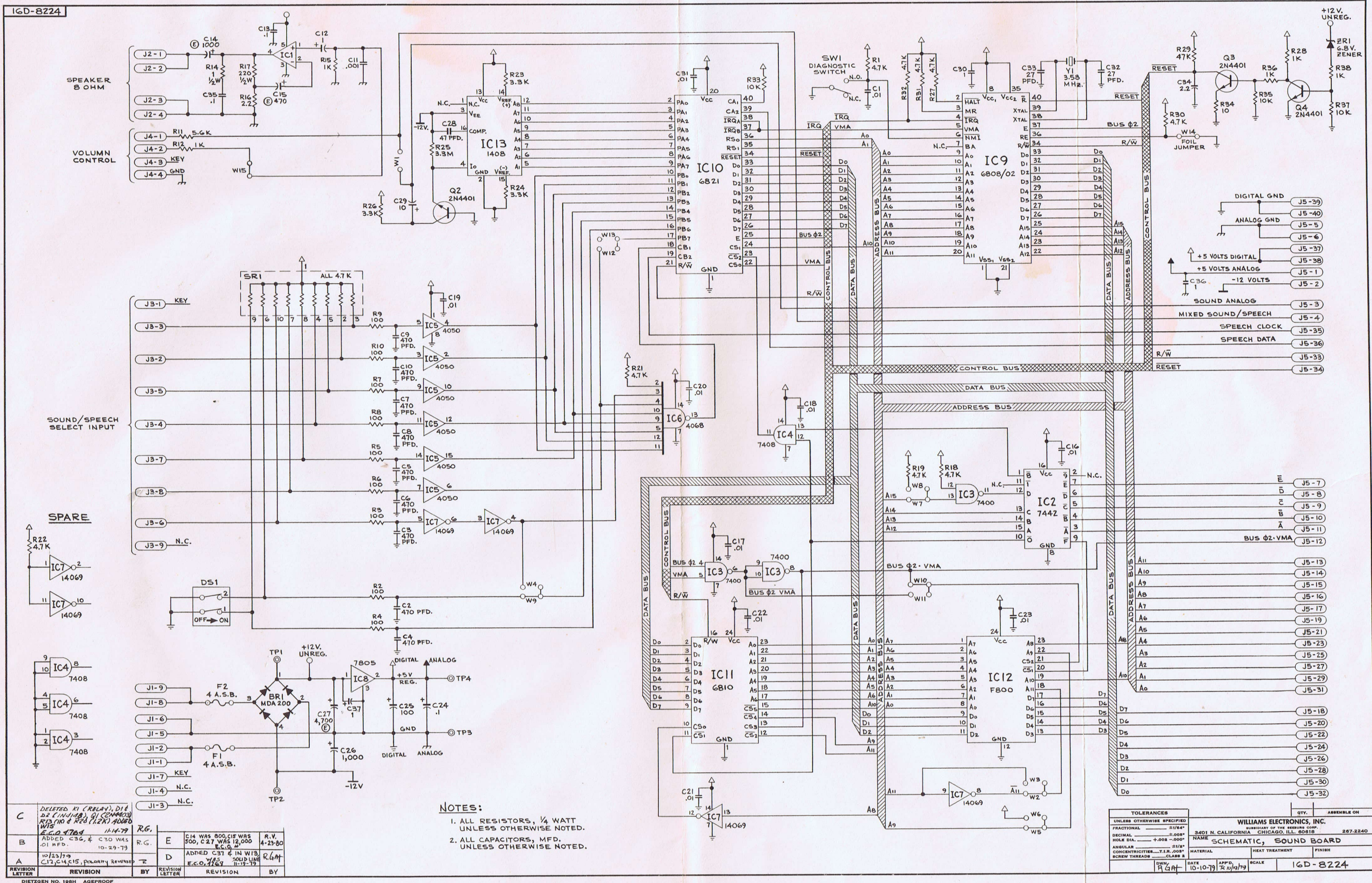
B	2J8's WAS G's, 2J9's WAS H's, 2J10's WAS J's, 2J11 WAS K's, 2J12 WAS L's 2J13's WAS M's & ADDED "1" TO FROM SHEET 1 & CIRCLES TO ALL 2N4401 TRANSISTORS	P. 40 10-28-77
A	REVISION "A"	
REVISION LATER	REVISION	BY

TOLERANCES		QTY		ASSEMBLY ON	
UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONIC MFG. CORP. SUBSIDIARY OF THE BEHRM CO.			
FRACTIONS ± 1/64 DECIMALS ± .005 HOLES +.002 - .000 ANGULAR ± 1/8°		3401 N. CALIFORNIA CHICAGO 18, ILL.		CORNELIA 7-284	
NAME SCHEMATIC, DRIVER BOARD					
MATERIAL		HEAT TREATMENT		FINISH	
PRICE 75-77		SCALE 16D-7997			



H	ADDED ITEM # 66 ITEM # 58 WAS BINDER NO.	E.C.O. #4990 3/1/79	SEE NOTE #4
G	ITEMS # 36 & 37 TO CHANGED TO READ 1,000 MFD & 470 MFD 4700 MFD	E.C.O. 11/30 11/30	
F	IN C37, REVISED DWG. TO CONFORM TO ARTWORK *IC-2001-146 ISSUE 5 & DELETED NOTE #6 E.C.O. 4776 11-26-79	R.Gaf	
E	REVISED NOTES, ADDED ITEM #45 & NOTE #6. RELOCATED W15, W13 DASH LINE WAS SOLID LINE & ITEM #60. E.C.O. 4769 11-19-79	R.Gaf	
D	DELETED ITEM #14 PT. NO. 5A-9016, ITEM #18 PT. NO. 5A-8990, 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.Gaf	
C	ADDED C36, ITEM #34, PT. NO. WAS 5A-9031 & QTY. WAS 1, & C30 WAS .01 MFD. E.C.O. 4760 10-29-79	R.Gaf	
B	DELETED ITEM #62 ADDED R1 & R12 TO ITEM #19 QTY. WAS 9 10-8-79	R.G.	
A	ITEM #17, ADDED 5A-9357 ITEM #62, ADDED PT. NO. ITEM #62, ADDED PT. NO.	R.G.	
REVISION	REVISION	BY	
DIETZGEN NO. 198H	AGEPROOF		

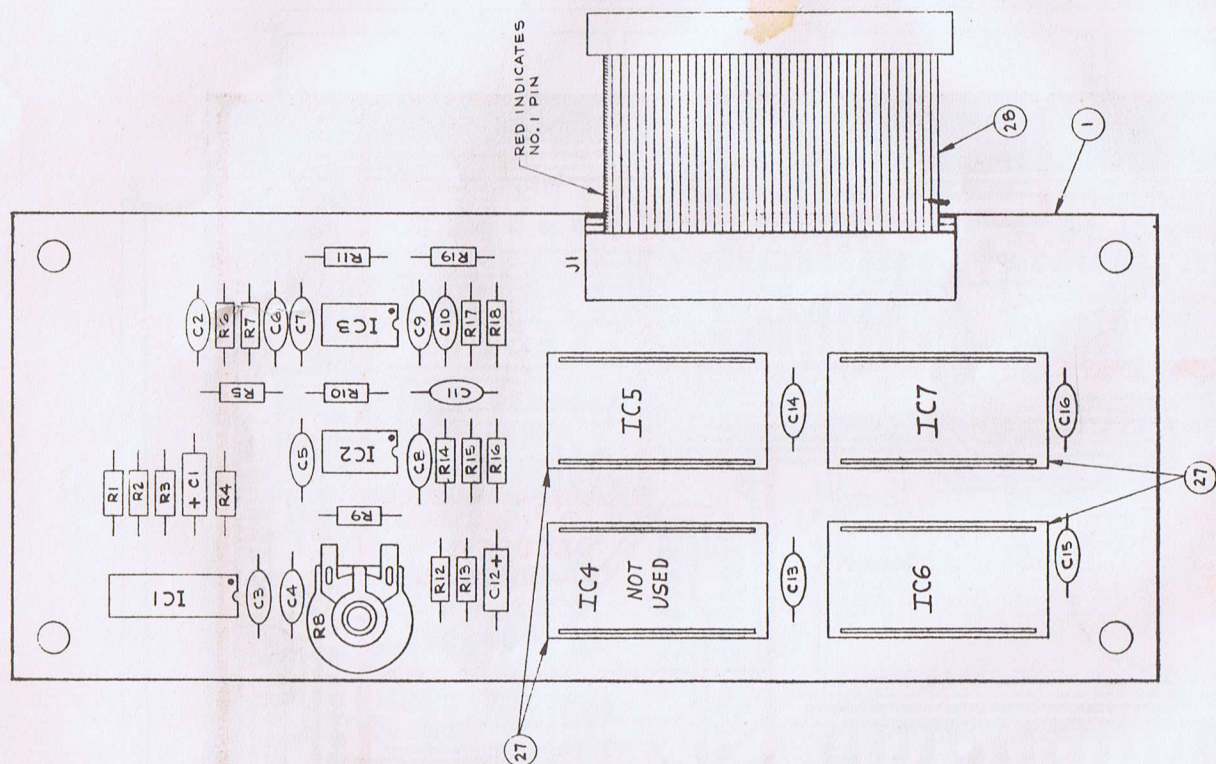
TOLERANCES		QTY. ASSEMBLY ON	
UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONICS, INC.	
FRACTIONAL	±1/64"	3401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240	
DECIMAL	±.005"	NAME	
HOLE DIA.	±.005"	SOUND BOARD SUB-ASSEM	
ANGULAR	±1/2°	MATERIAL	
CONCENTRICITY	±.005"	HEAT TREATMENT	
SCREW THREADS	CLASS 2	FINISH	
DWG. R.Gaf	DATE 9-23-79	APPRO. R 10/10/79	SCALE 2:1
			D-8223



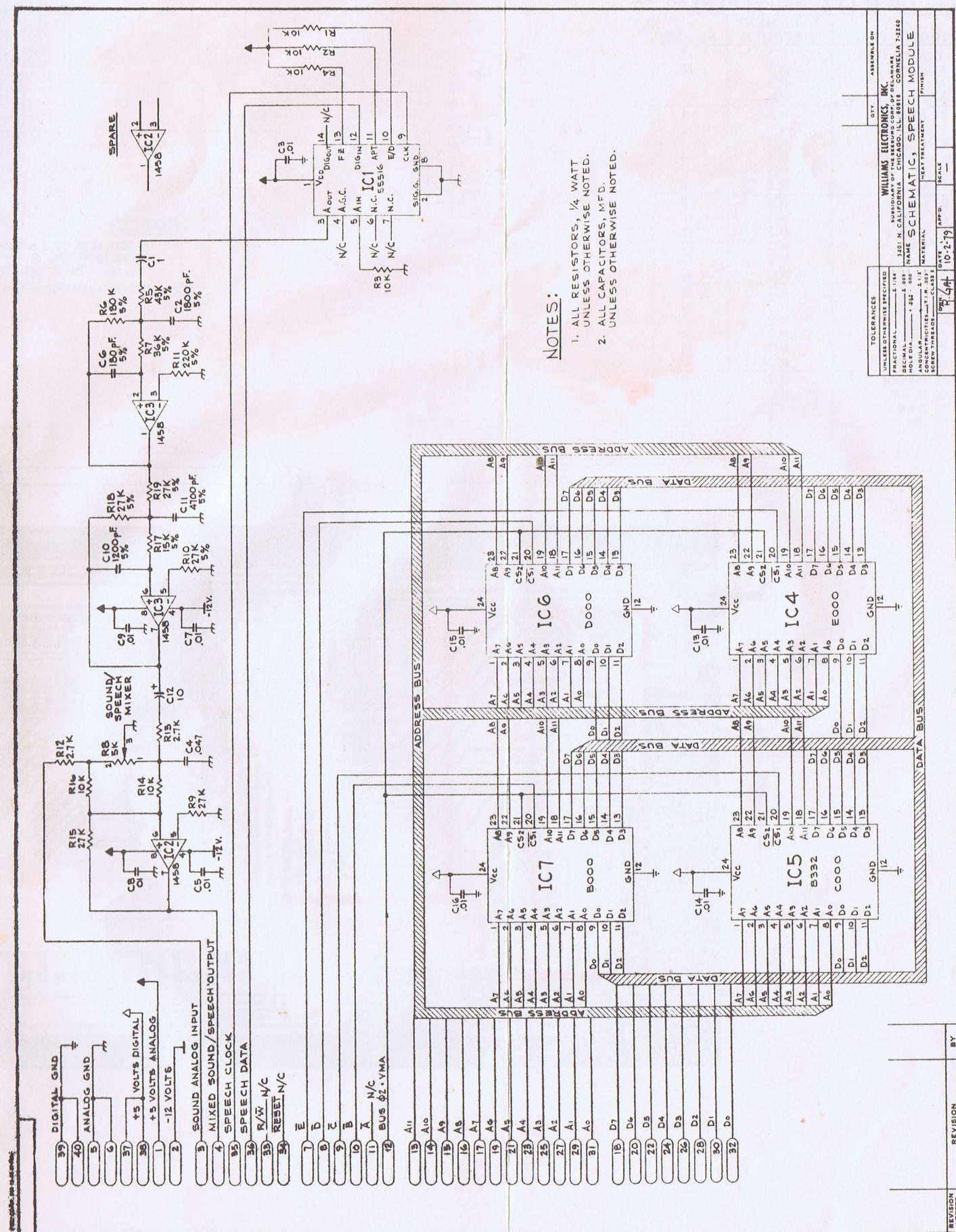
BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	RECD. NO.
1	1C-2001-1473		BASE P.C. BOARD	1
2	5A-9335	IC1	555 μ C CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR	1
3	5A-9321	IC2, IC3	1458 DUAL OP-AMP.	2
4				
5				
6				
7				
8				
9				
10	5A-8846	R11	RESISTOR, FC, 20 K OHM 5% 1/4 WATT	1
11	5B-8817	R1, R2, R3, R4, R14, R16	RESISTOR, FC, 10 K OHM 10% 1/4 WATT	6
12	5A-8624	R5	RESISTOR, FC, 43 K OHM 5% 1/4 WATT	1
13	5A-9333	R6	RESISTOR, FC, 16 K OHM 5% 1/4 WATT	1
14	5A-1342	R7	RESISTOR, FC, 30 K OHM 5% 1/4 WATT	1
15	5A-9185	R8	POTENTIOMETER, 5 K OHM	1
16	5A-9324	R9, R10, R12, R17	RESISTOR, FC, 27 K OHM 10% 1/4 WATT	6
17	5B-8997	R12, R13	RESISTOR, FC, 2.7 K OHM 10% 1/4 WATT	2
18	5A-8172	R17	RESISTOR, FC, 15 K OHM 5% 1/4 WATT	1
19	5A-9030	C4	CAPACITOR, .047 MFD. 20% 50 VOLT	1
20	5A-9350	C6	CAPACITOR, CERAMIC, 180 PFD. 5% 100 VOLT	1
21	5A-8980	C3, C5, C7, C8, C9, C13 THROUGH C16	CAPACITOR, CERAMIC, .01 MFD. +80%,-20% 50 VOLT	9
22	5A-9081	C1	CAPACITOR, TANTALUM, 1 MFD. 20% 25 VOLT	1
23	5A-9347	C2	CAPACITOR, CERAMIC, 1800 PFD. 5% 50 VOLT	1
24	5A-9343	C12	CAPACITOR, ELECTROLYTIC, 10 MFD. 20% 20 VOLT LOW LEAK	1
25	5A-9348	C11	CAPACITOR, CERAMIC, 4100 PFD. 5% 50 VOLT	1
26	5A-9346	C10	CAPACITOR, CERAMIC, 1200 PFD. 5% 50 VOLT	1
27	5A-9004	J1	24 PIN SOCKET	4
28	5A-9352	J1	RIBBON CABLE ASSEM.	1

TOLERANCES		QTY.		ASSEMBLY ON	
UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONICS, INC.		SUBSIDIARY	
FRACTIONAL		3401 N. CALIFORNIA		CHICAGO, ILL. 60618	
DECIMAL		CORNELIA		7-32260	
HOLE DIA.		NAME		SPEECH MODULE	
HOLE DIA.		MATERIAL		HEAT TREATMENT	
HOLE DIA.		FINISH		FINISH	
HOLE DIA.		DATE		DATE	
HOLE DIA.		APP'D.		DATE	
HOLE DIA.		C-8228		C-8228	



ITEM # 2 PT. NO WAS	BY
SA-935, ITEM # 11 AXED	
PT. NO., ITEM # 10 AXED	
PT NO., ITEM # 24 CELFS	
WAS 30V. 10-4-79	
REVISION	REVISION



DIGIT CROSS-REFERENCE

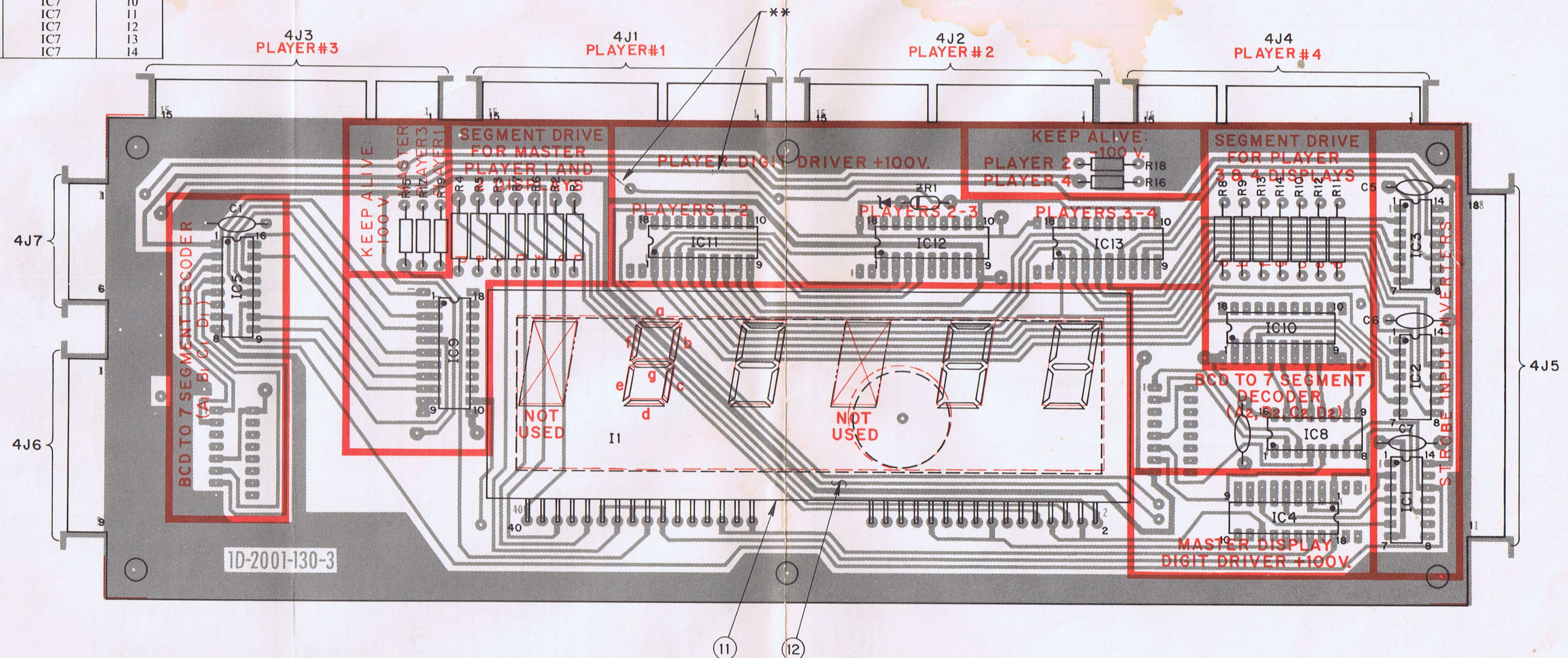
DIGIT	7-SEGMENT DECODER	STROBE
Master 1 (Left)	IC5	15
Master 2	IC5	16
Master 3	IC5	7
Master 4 (Right)	IC5	8
#1 100,000	IC5	1
#1 10,000	IC5	2
#1 1,000	IC5	3
#1 100	IC5	4
#1 10	IC5	5
#1 Units	IC5	6
#2 100,000	IC5	9
#2 10,000	IC5	10
#2 1,000	IC5	11
#2 100	IC5	12
#2 10	IC5	13
#2 Units	IC5	14
#3 100,000	IC7	1
#3 10,000	IC7	2
#3 1,000	IC7	3
#3 100	IC7	4
#3 10	IC7	5
#3 Units	IC7	6
#4 100,000	IC7	9
#4 10,000	IC7	10
#4 1,000	IC7	11
#4 100	IC7	12
#4 10	IC7	13
#4 Units	IC7	14

NOTES:

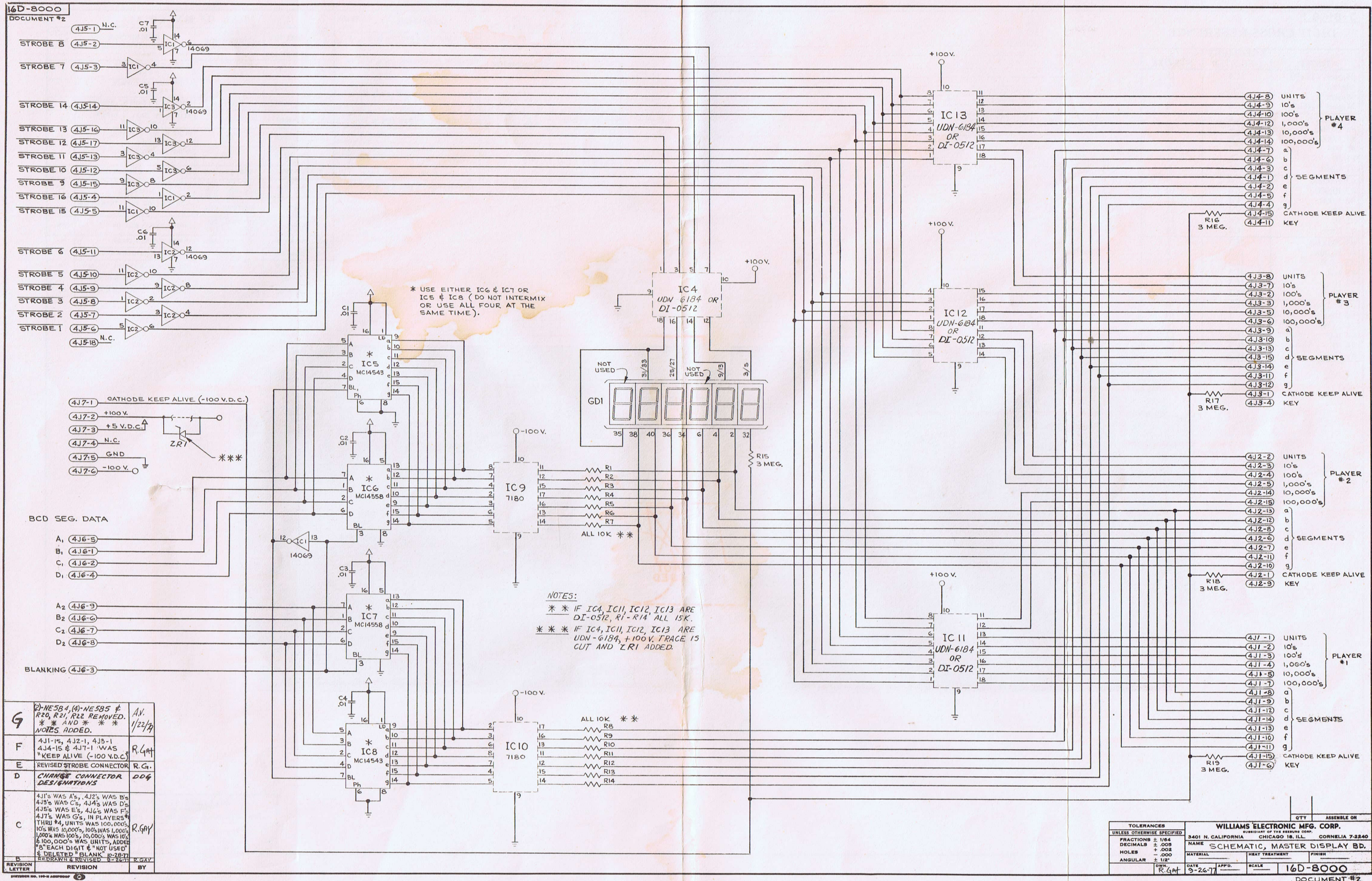
- * - IF IC11, IC12, IC13 & IC14 ARE DIONICS-512 DRIVERS THEN R1-R14 ARE 5A-9149 RES., F.C., 15K OHM $\pm 10\%$ $\frac{1}{2}$ W. ZR1 NOT USED.
 ** - CUT & JUMP ON +100V. NOT IMPLEMENTED.

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
* 5	5A-8968	IC4, IC11, IC12, IC13	UDN-6184 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
* 6	5B-8981	R1 THRU R14	RESISTOR, FC, 10K OHM 10% $\frac{1}{2}$ W	14
7	5B-8982	R15 THRU R19	RESISTOR, FC, 3 MEG OHM 10% $\frac{1}{4}$ 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
** 10			JUMPER, #22 GA. SOLID WIRE	1
11	5B-8966	I1	6 DIGIT DISPLAY	1
12	23A 6542		DISPLAY MTG. ADHESIVE FORM	1



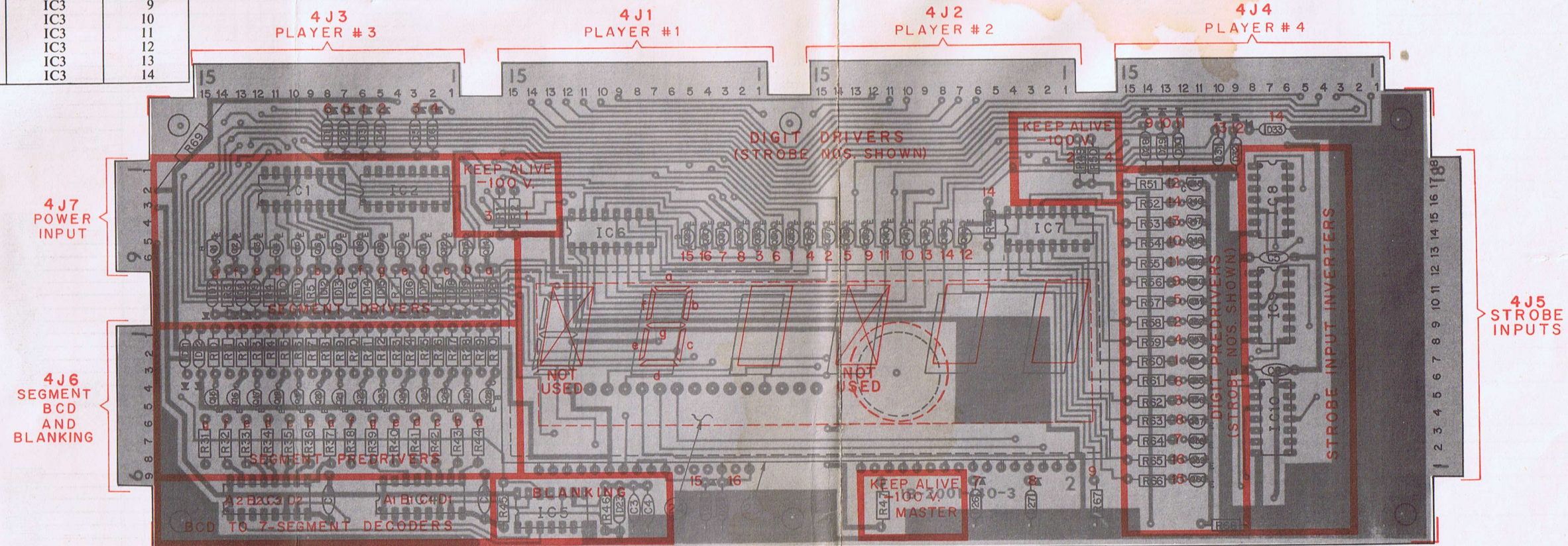
WILLIAMS ELECTRONICS, INC. SUBSIDIARY OF XCOR CORPORATION 3401 N. CALIFORNIA CHICAGO, ILL 60618 CORNELIA 7-2240				
PART NAME MASTER DISPLAY ASSEMBLY				
OWN. R. Gay	DATE 1-30-79	APP'D.	SCALE 2=1	PART NO. D-8000



D-8168
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

					BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
17	5A-8774	R45,R67	RESISTOR,FC,22 K OHM10% 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 OHM10% 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	15DIP 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. 50 V.	2	6	5A-9220	IC6	15 DIP RESISTOR/PACK 2.2 K OHM	1
23	5B-8966	I1	6-DIGIT DISPLAY	1	7	5A-9223	IC7	15 DIP RESISTOR/PACK 10 K 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 PNP TRANSISTOR MPS-A92	30
					11	5A-8785	D1 THRU D20 D24 THRU D33	1N4003 DIODE, SILICON	30
					12	5A-8919	D21, D22, D23	1N4148 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 OHM10% 1/4 W	1
					16	5A-9032	R31 THRU R44	RESISTOR,FC,12 K OHM 10% 1/4 W	14

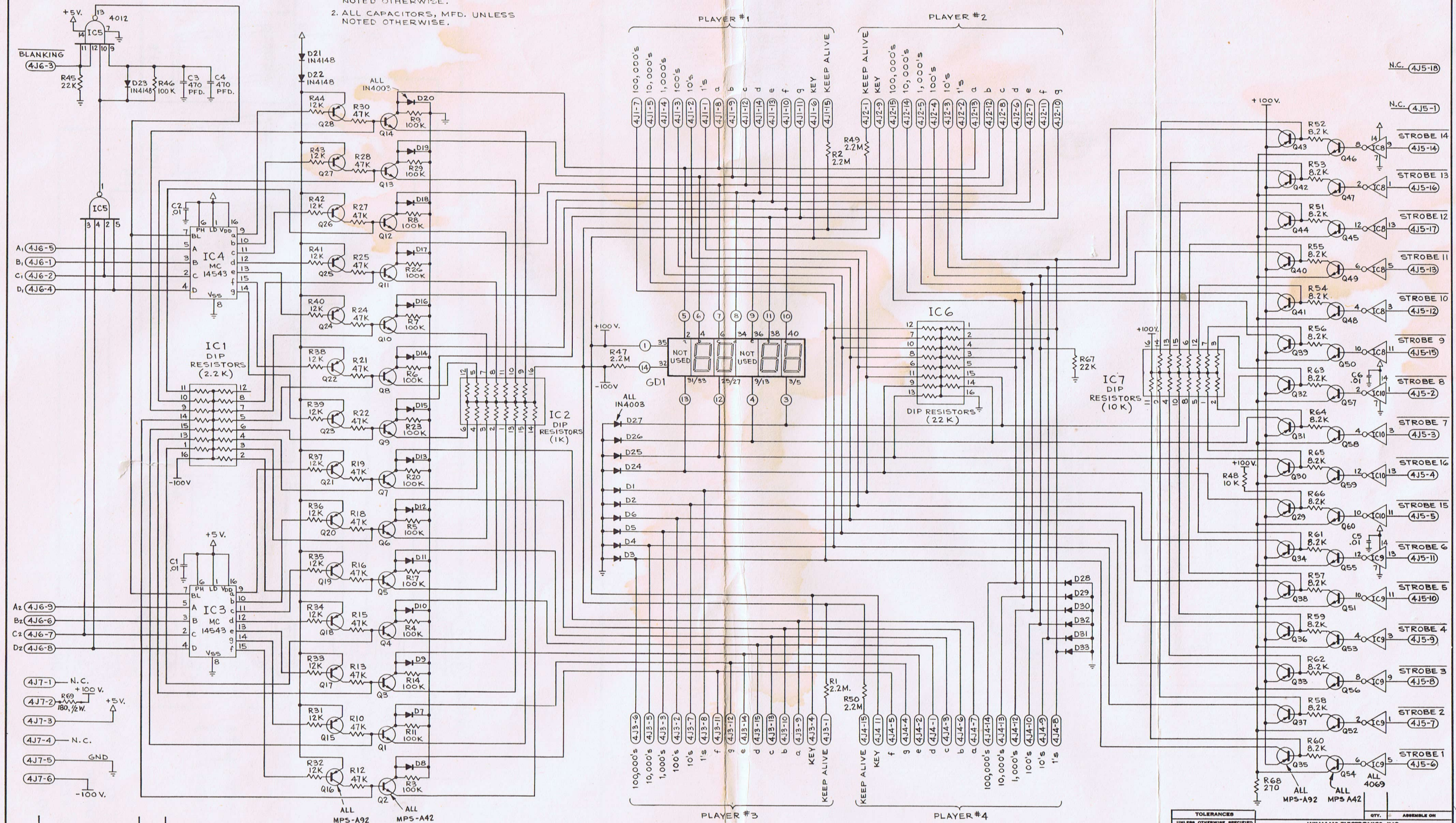


WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF XCOR CORPORATION
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240
PART NAME DISCRETE MASTER DISPLAY BD. ASSEM.
DWN. DATE APPD. SCALE PART NO.
A.V. 5-8-79 2=1 D-8168

16D-8169

NOTES:

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

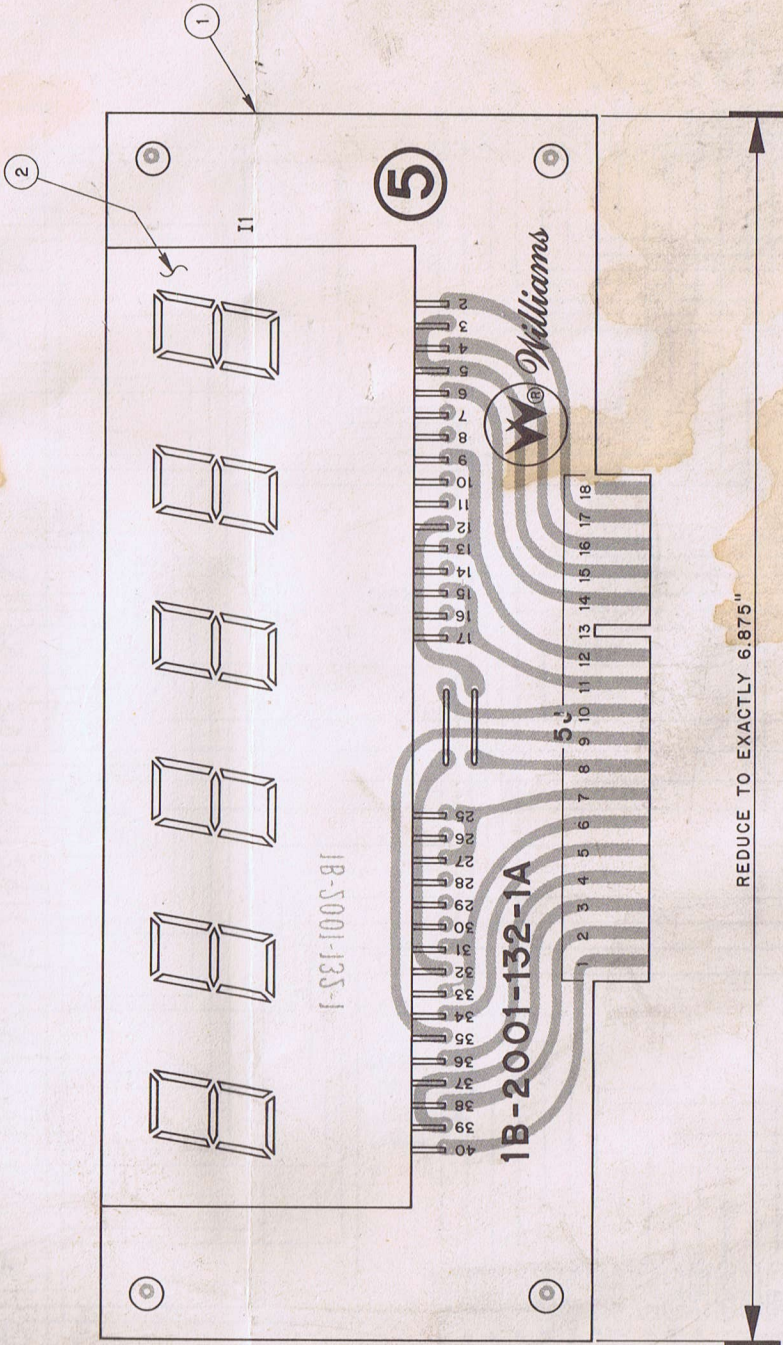


REVISION LETTER	REVISION	BY
A	AT 4772 CONNECTION R69 ADDED E.C.O. 4/79	BY

TOLERANCES UNLESS OTHERWISE SPECIFIED		QTY.	ASSEMBLE ON
FRACTIONAL	31/64"		
DECIMAL	±.008"		
HOLE DIA.	+.008 - .000"		
ANGULAR	±1/2°		
CONCENTRICITY	±.008"		
SCREW THREAD	CLASS 8		

BILL OF MATERIAL

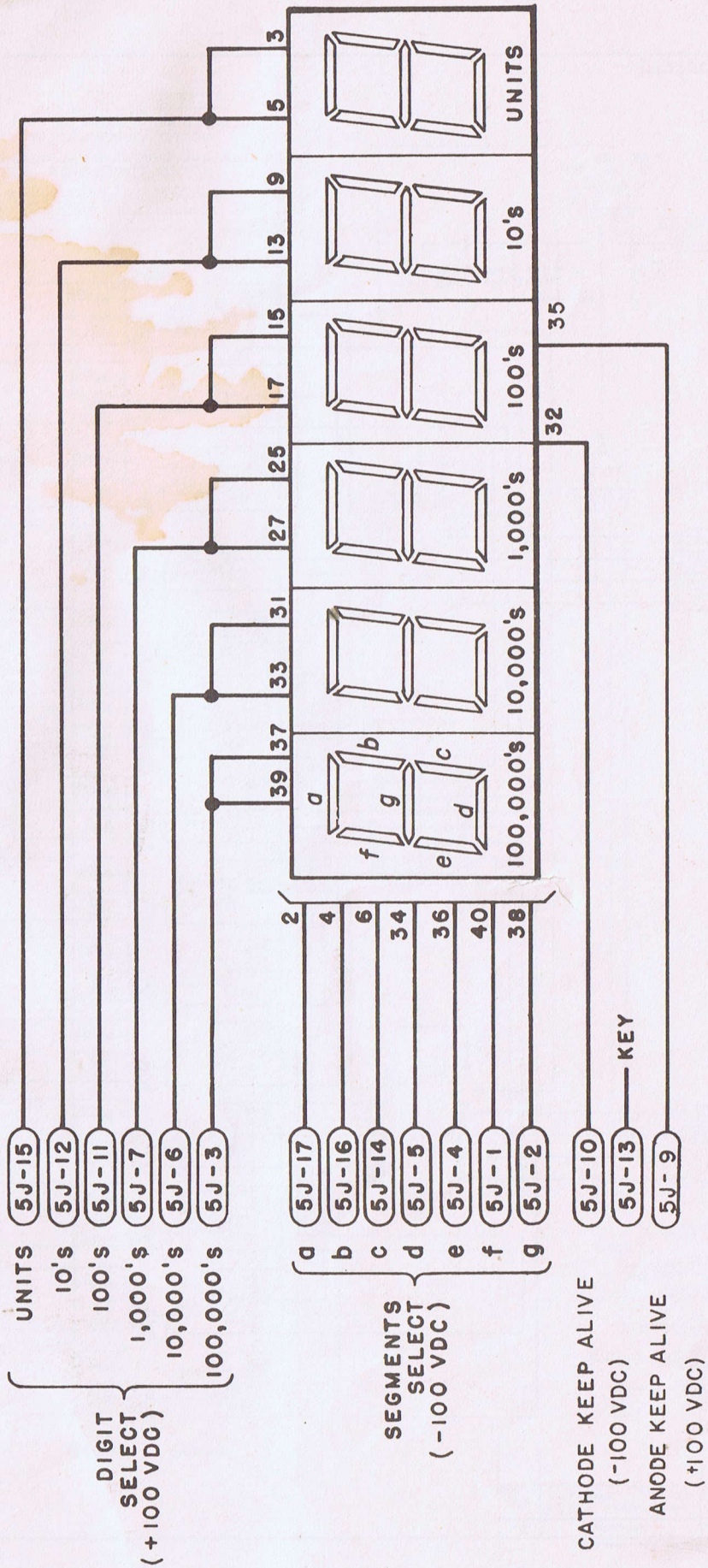
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-132		BARE P.C. BOARD	1
2	5A-8966	I1	6 DIGIT DISPLAY	1
3	23A-6534		DISPLAY MTG. ADHESIVE FOAM	1



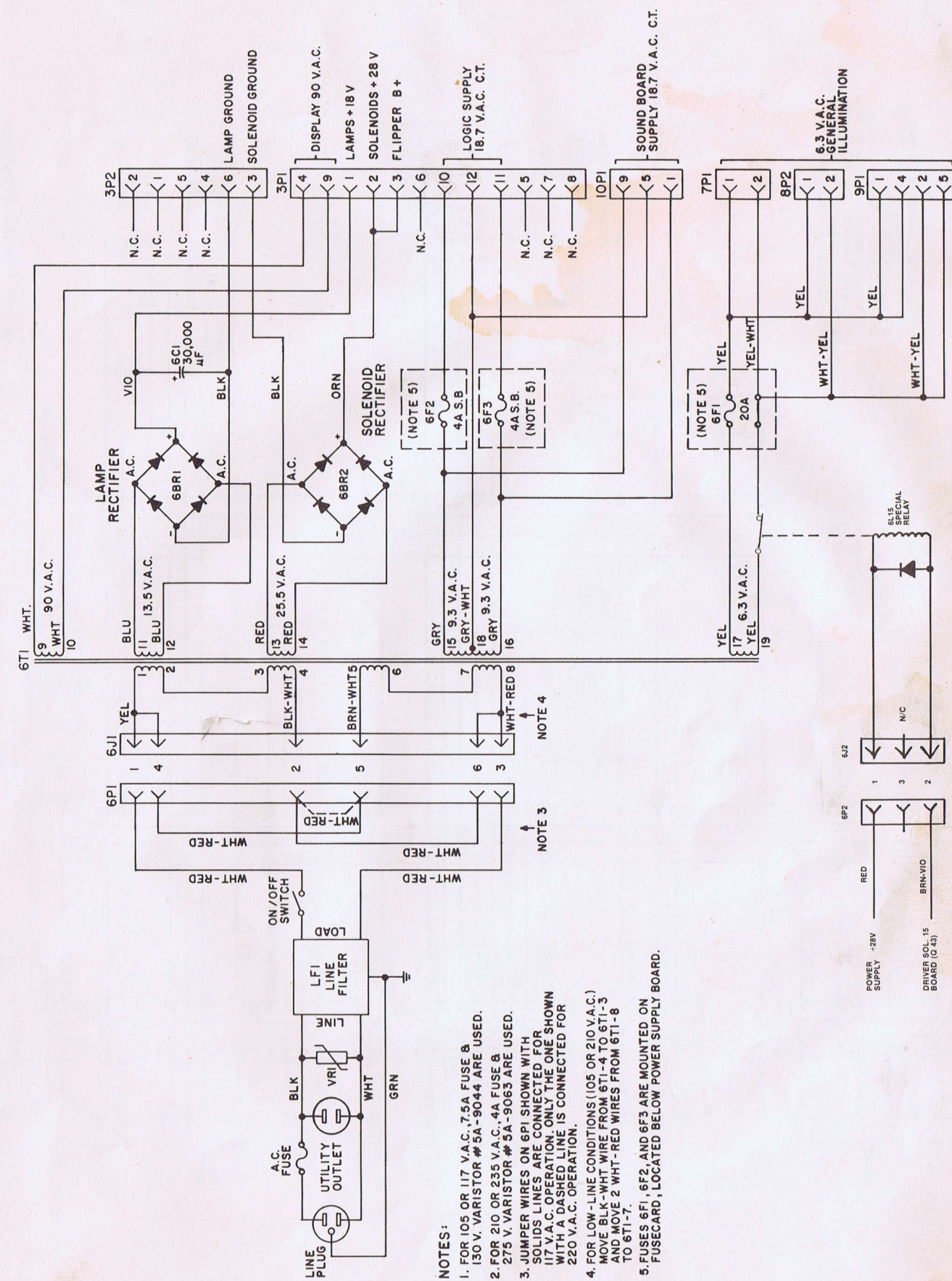
WILLIAMS ELECTRONICS, INC.			
SUBSIDIARY OF XCOR CORPORATION			
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240			
PART NAME	DATE	APPD.	SCALE
SLAVE DISPLAY BOARD ASSEMBLY			2=1
DWN. R. Gay			PART NO. C-8019

DOCUMENT #1

SLAVE DISPLAY BOARD

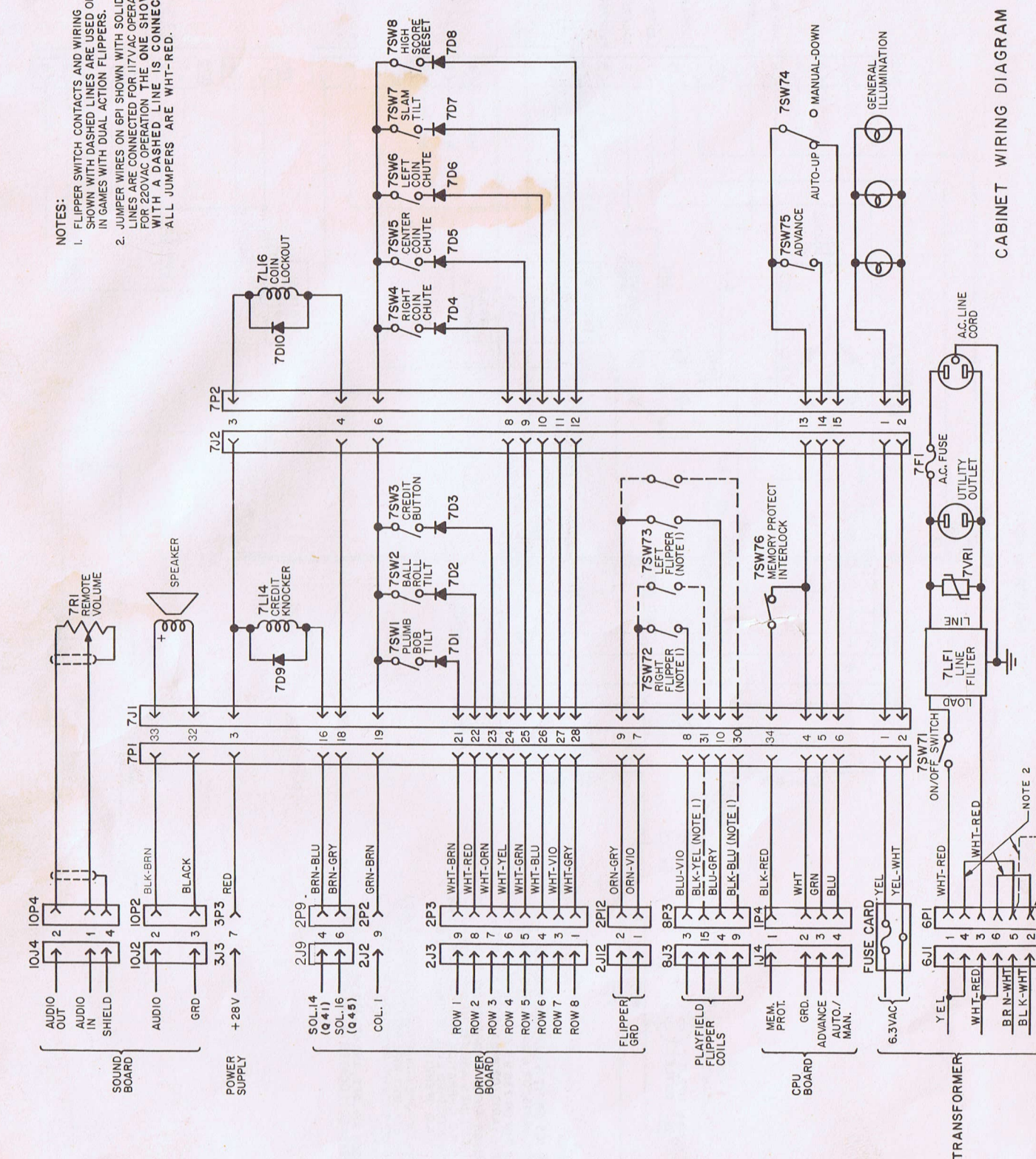


POWER WIRING



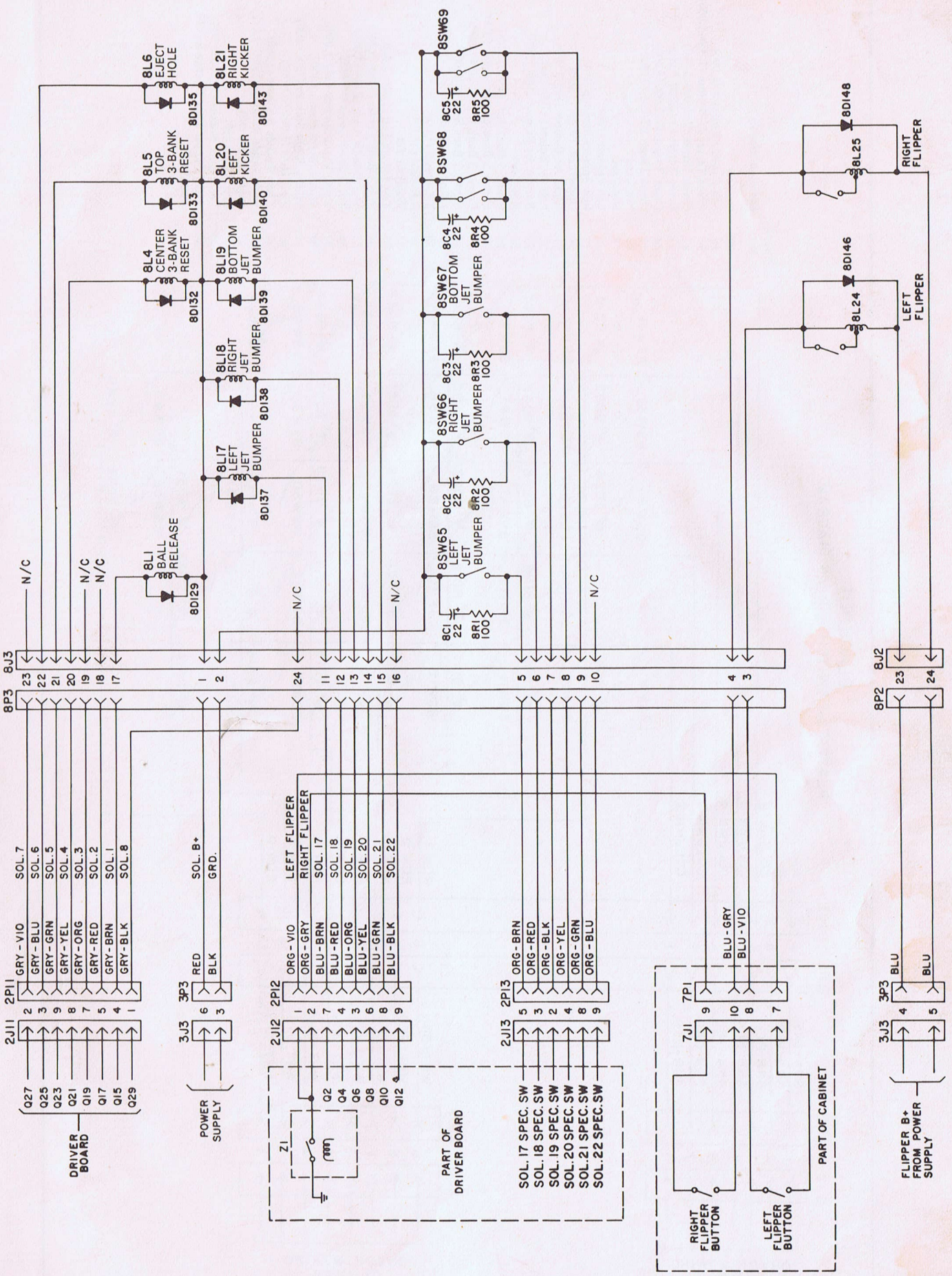
- NOTES:**
1. FOR 105 OR 117 V.A.C. 7.5A FUSE & 150V. VARISTOR # 5A-5044 ARE USED.
 2. FOR 210 OR 235 V.A.C. 4A FUSE & 275V. VARISTOR # 5A-9063 ARE USED.
 3. JUMPER WIRES ON 6PI SHOWN WITH SOLIDS LINES ARE CONNECTED FOR 117 V.A.C. OPERATION. ONLY THE ONE SHOWN WITH A DASHED LINE IS CONNECTED FOR 220 V.A.C. OPERATION.
 4. FOR LOW-LINE CONDITIONS (105 OR 210 V.A.C.) MOVE BLK-WHT WIRE FROM 6T1-4 TO 6T1-3 AND MOVE 2 WHT-RED WIRES FROM 6T1-8 TO 6T1-7.
 5. FUSES 6F1, 6F2, AND 6F3 ARE MOUNTED ON FUSECARD, 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

PLAYFIELD SOLENOIDS WIRING DIAGRAM



Playfield Solenoid Wiring Diagram

