

Williams®

16P-500-101
Game No. 500
December, 1980

Black Knight



For service call TOLL-FREE:
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Williams® 
ELECTRONICS, INC.

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FOREWORD

This instruction and drawing set provides essential installation information unique to BLACK KNIGHT. For game operation, bookkeeping, game adjustment, diagnostic and self-test and basic troubleshooting procedures, refer to the instruction booklet located in the envelope inside the coin door. For detailed troubleshooting and interconnection information, refer to Williams Solid State Flipper Maintenance Manual and Supplements.

SPECIAL CONSIDERATIONS WHEN REPLACING CIRCUIT BOARDS

CPU Board

- 1. Revision level 7 CPU Boards (batteries located on lower left corner at board) or later boards must be used.
- 2. Must be equipped with blue-labeled Flipper ROMs and blue-labeled Game ROMs.
- 3. Jumpers W3, W10, W11, W14, W17, W19, W10, and W22 must be connected. Jumpers W4, W9, W12, W15, W16, W18, W21, and W23 must be removed. With the exception of W25, (Factory Setting Jumper) all other jumpers are not changed.

Driver Board

Either earlier model D7997 or later model D8341 boards may be used. When earlier boards are used, switch matrix series resistors R204 thru R211 must be zero-ohm or be replaced with wire jumpers.

Sound Board

- 1. D 8224 required for speech
- 2. Must be jumpered for white-labeled sound ROM operation and be equipped with Sound ROM 5. (Jumpers W2, W5, W7, W9, W10, W12, and W15 connected; W3, W4, W6, W8, W11, and W13 removed).

Power Supply Board

- 1. When transformer is mounted in cabinet, D 8345 board (equipped with relay) is required. When transformer is mounted in backbox, earlier D 7999 board is required.
- 2. F4 (20A SB) for flipper solenoids and magnets must be installed.

Display Boards

Model C 8363 Master Display and 7-digit Slave Displays required.

Optional Speech Module

Requires 5T5001 (IC7), 5T5002 (IC5), 5T5003 (IC6), and 5T5004 (IC4) Speech ROMs.

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Assembly and Interconnection

With legs attached to cabinet and backbox positioned face-down on top of cabinet with the opening facing the rear of the cabinet proceed as follows:

- A. Pull four cables from backbox.
- B. Reach into right side of pedestal hole, pull up ground strap, and push it into backbox.
- C. Remove ties securing cabinet and playfield cables to cabinet and pull up these cables.
- D. Interconnect four cables. They are size and color coded.
- E. Insert line cord into notch in cabinet. DO NOT PLUG IN AT THIS TIME.
- F. Push remote volume control cable, White-Red solenoid ground cable, and transformer cable (terminated with four plugs) into backbox.
- G. Lift up backbox and position on cabinet pedestal, engaging brackets for support.
- H. Remove shipping blocks from insert door.
- I. Secure backbox to cabinet using two bolts and washers.
- J. Connect ground braid and White-Red wire under wing nut and washer at bottom of backbox.
- K. Loosely position remote volume cable and Sound Board power cable in harness and plug connectors into 10J4 and 10J1, respectively.
- L. Connect bridge rectifier connector 6P1/6J1, and plug remaining two transformer connections into 3J1 and 3J9 on the Power Supply Board.

Inspection

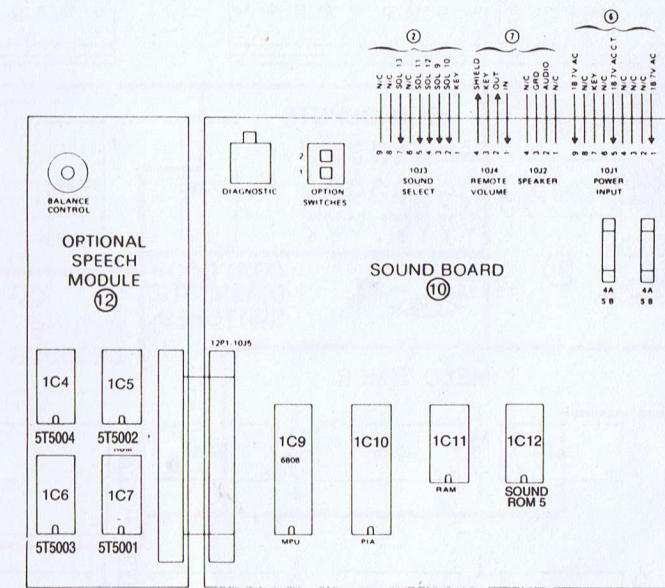
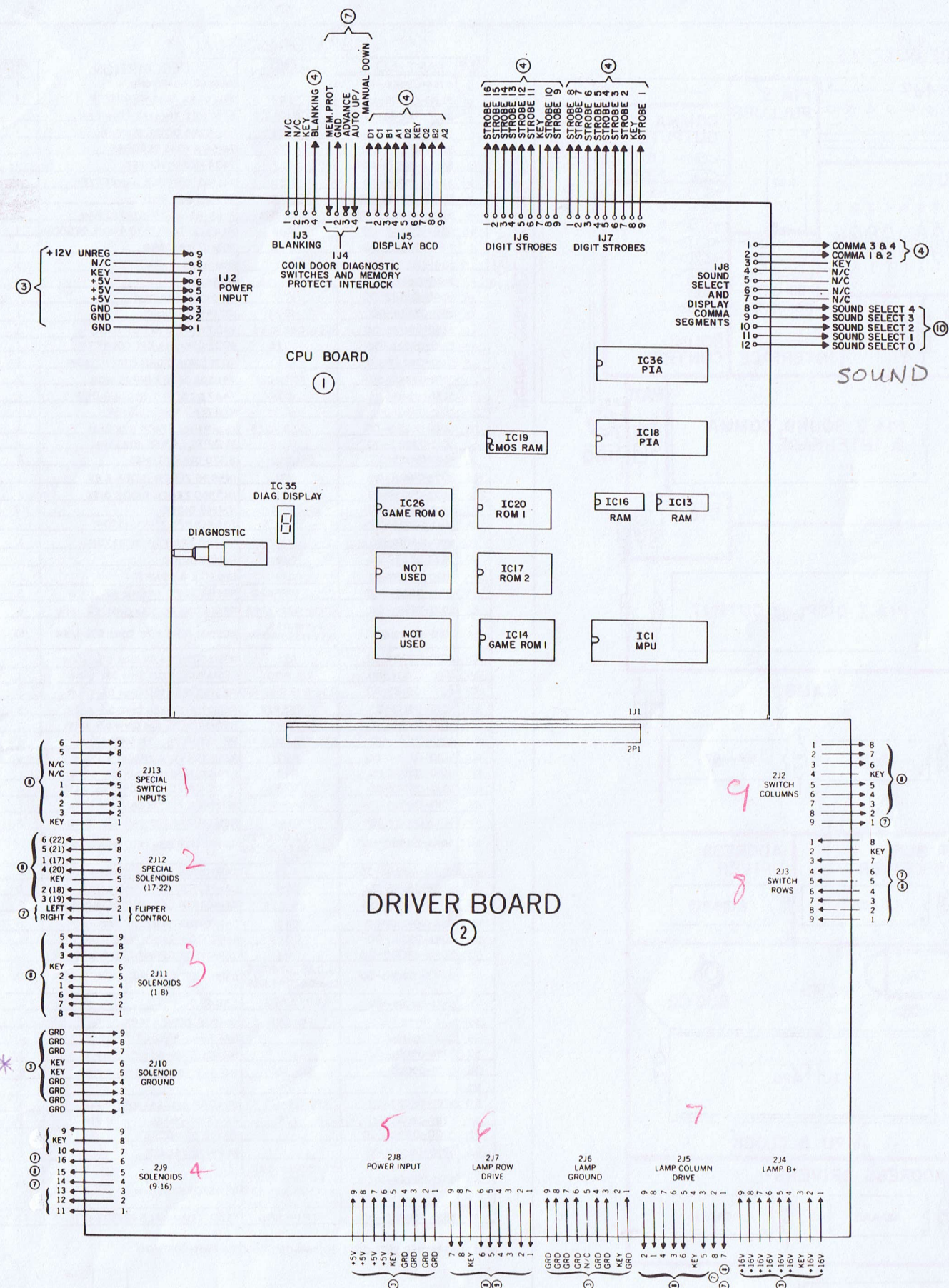
- A. Check all connectors in backbox for loose wire terminations. Reseat any loose wires by pushing in on the terminal.
- B. Push on all connectors attached to Master Display, CPU, Driver, and Sound Boards, and check terminations on capacitor and bridge rectifier at the lower right of the backbox.
- C. Gently press on all the socketed IC packages on the CPU and Sound Boards.
- D. Check that two fuses on the Sound Board, seven fuses on Power Supply Board, and two fuses on Insert Board are secure.
- E. Push on the connector attached to Slave Display Boards.
- F. Check that the line fuse in the bottom of the cabinet is secure.
- G. Check the transformer input connector in bottom of cabinet for loose wire termination. Reseat any loose wires by pushing in on the termination.

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

Power Turn-On and Game Setup

This machine MUST BE PLUGGED INTO A PROPERLY GROUNDED OUTLET to PREVENT SHOCK HAZARD 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.

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 1 score reading zero, game over lights lit, and the high score to date alternating with the player scores.
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. Place three balls on playfield next to outhole.
5. Perform diagnostic tests and make any desired changes to features as described in the instruction booklet.

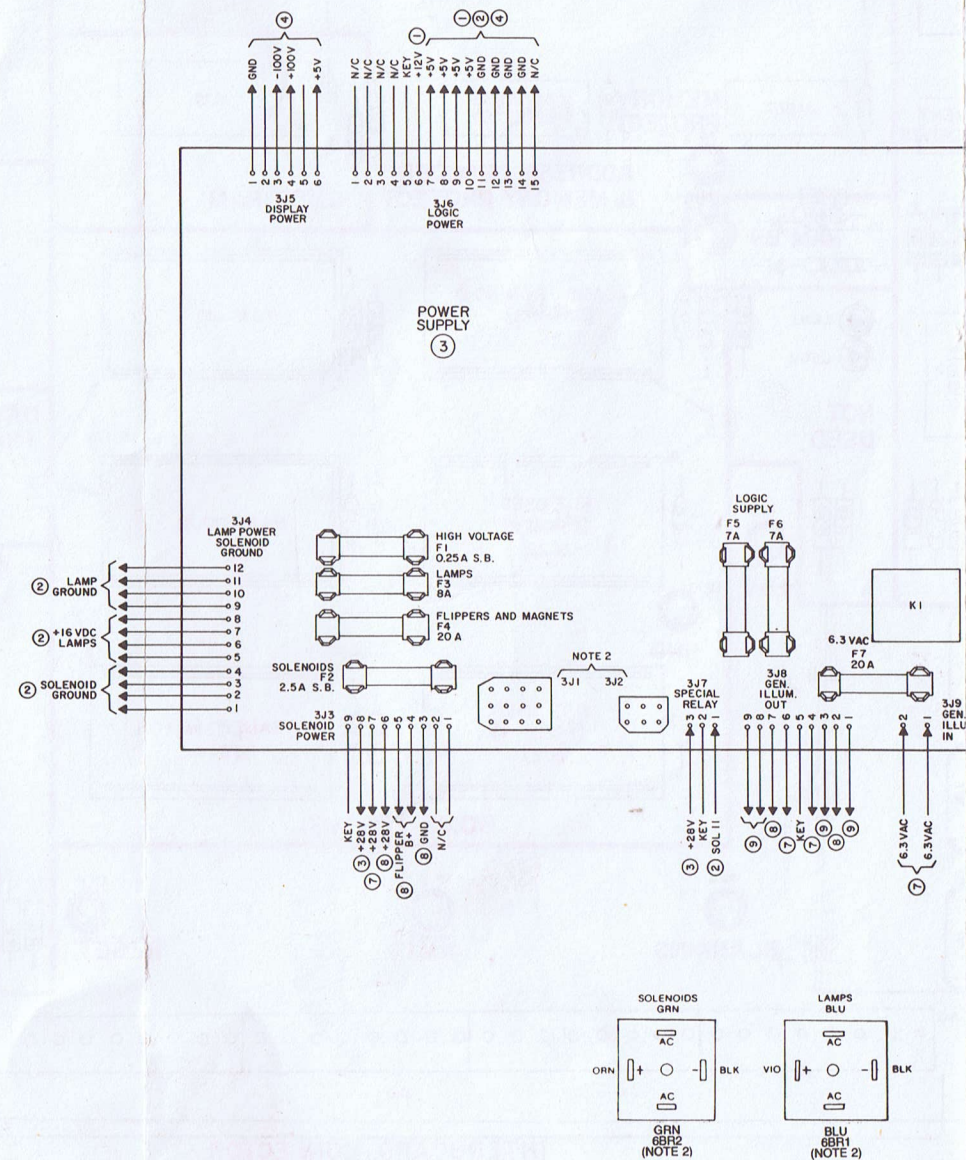


NOTES:

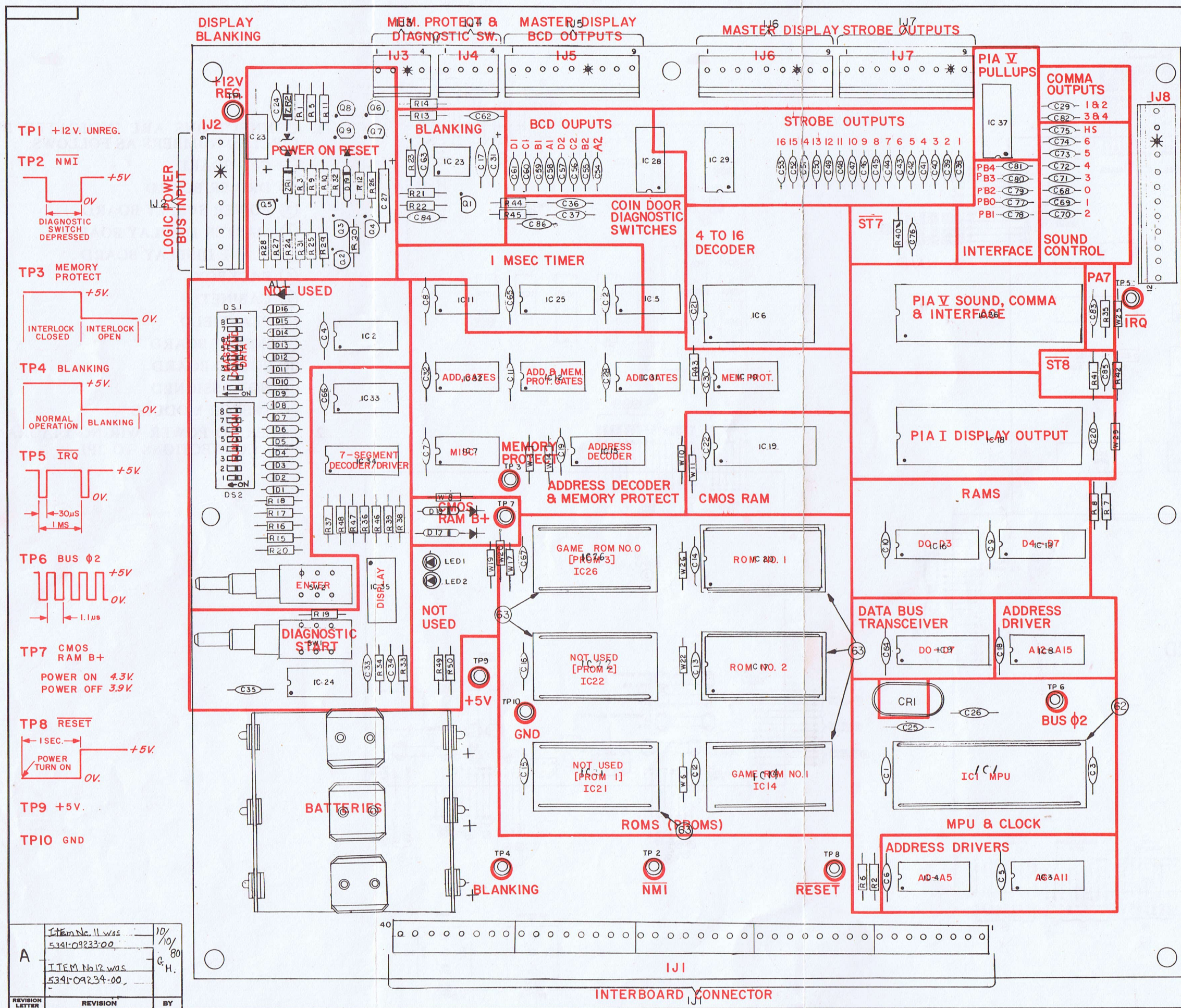
1. CONNECTIONS ARE INDICATED BY CIRCLED NUMBERS AS FOLLOWS:

- 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. REFER TO POWER WIRING DIAGRAM FOR CONNECTIONS TO 3P1.



*5792-09290
COVER 5794-09297



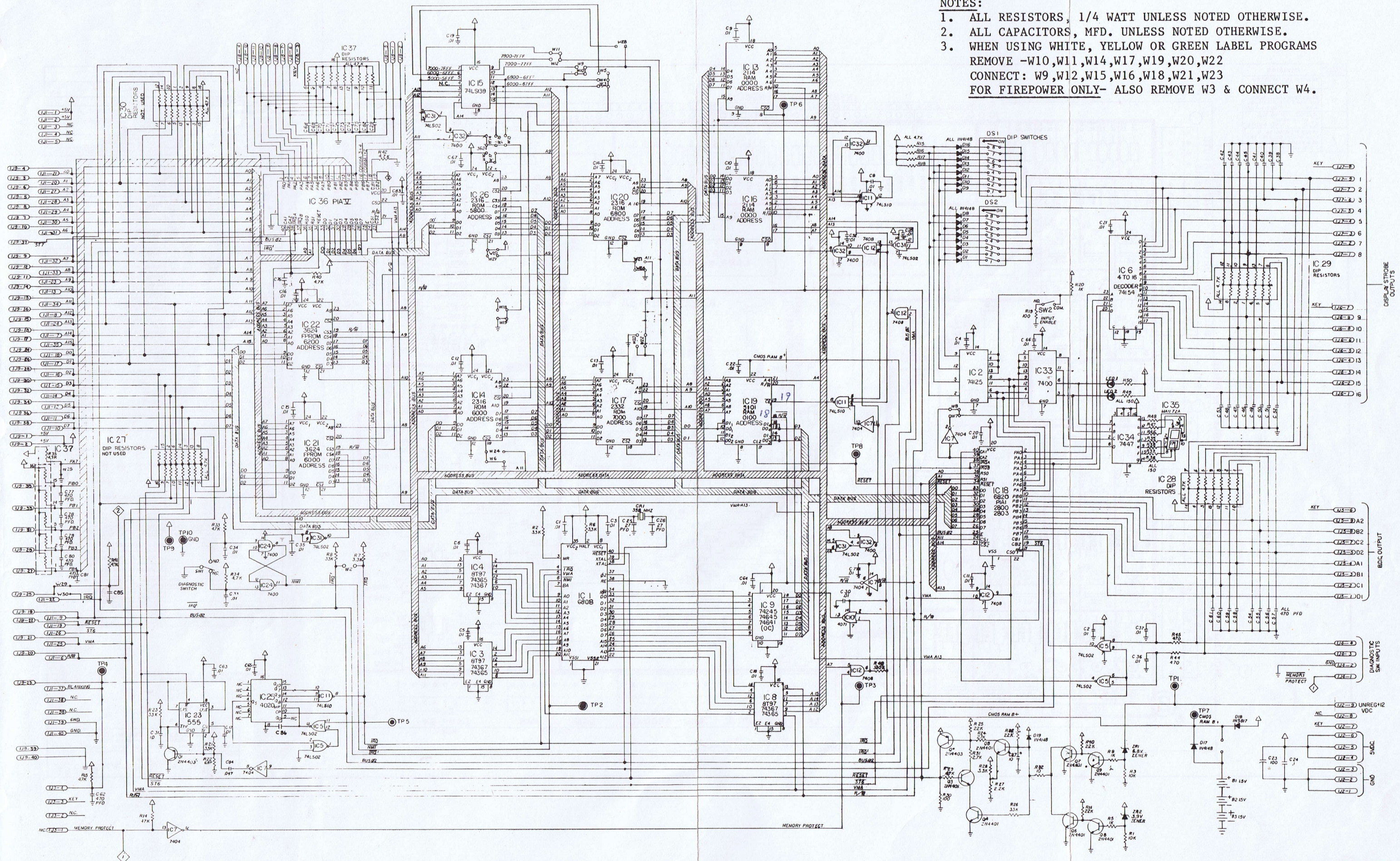
BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD NO.
1	5764-09465-X0	IC2	BARE PC. BOARD CPU	1
2	5280-09408-X0	IC3,IC4,IC8	74125 HEX TRISTATE BUFFER	3
3	5370-08989-00	IC9	8T97 HEX TRISTATE BUFFER	1
4	5281-09308-X0	IC6	74LS245 OCTAL BUFFER	1
5	5280-09010-00	IC7	7404 HEX INVERTER	1
6	5280-09013-00	IC11	74LS10 TRIPPLE 3 INVERTER	1
7	5281-09235-00	IC12	7408 QUAD AND	1
8	5280-08973-00	IC13,IC16	2114-45 1K X4 STATIC RAM	2
9	5340-09409-X0	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
10	5281-09246-00	IC20	ROM 2K X8 LOWER	1
11	5341-09553-00	IC17	ROM 4KX8 UPPER	1
12	5341-09554-00	IC18,IC36	MC6821 PIA	2
13	5430-08972-00	IC19	MC 5101 CMOS RAM	1
14	5340-09017-00	IC23	MC 1455 PI TIMER	1
15	5431-09449-00	IC24,IC32,IC33	7400 QUAD 2 INPUT NAND	3
16	5280-09073-00	IC25	4020 CMOS 14 BIT COUNTER	1
17	5310-09233-00	IC10	4071 CMOS QUAD 2 INPUT NOR	1
18	5310-09237-00	IC5,IC31	74LS02 QUAD 2 INPUT NOR	2
19	5281-09247-00	IC34	7447 BCD TO 7 SEG LED DISP	1
20	5280-09407-X0	IC35	MAN 72A 7 SEG LED DISP	1
21	5671-09411-00	IC28,IC29	13 DIP RES./PACK 47K OHM	2
22	5019-09238-00	IC37	15 DIP RES./PACK 10K OHM	1
23	5019-09223-00	DS1,DS2	8 STD DIP SWITCHES	2
24	5645-09025-00	ZR1	IN5996 ZENER DIODE 6.8V	1
25	5075-09018-00	ZR2	IN5990 ZENER DIODE 3.9V	1
26	5075-09059-00	D1-D17,D19	IN4148 DIODE	18
27	5070-08919-00	Q3-Q9	2N4401 PNP TRANSISTOR	7
28	5160-08938-00	Q1,Q2	2N4403 PNP TRANSISTOR	2
29	5070-09016-00	D18	IN5817 DIODE	1
30	5070-09266-00	CRI	CRYSTAL 3.58 MHZ	1
31	5520-09020-00	R5,R9,R20	RESISTOR FC 1K OHM 5% 1/4W	3
32	5010-09358-00	R2,R6-R8,R21,R28	RESISTOR FC 3.3K OHM 5% 1/4W	6
33	5010-08993-00	R13-R18,R29,R33-R35,R40,R42	RESISTOR FC 4.7K OHM 5% 1/4W	13
34	5010-08999-00	R22	RESISTOR FC 6.8K OHM 5% 1/4W	1
35	5010-09086-00	R19,R30	RESISTOR FC 100 OHM 5% 1/4W	2
36	5010-09187-00	R36-R39,R46-R50	RESISTOR FC 150 OHM 5% 1/4W	9
37	5010-09113-00	R23,R26	RESISTOR FC 33K OHM 5% 1/4W	2
38	5010-09036-00	R1,R3	RESISTOR FC 10K OHM 5% 1/4W	2
39	5010-09024-00	R25,R32,R10,R11	RESISTOR FC 22K OHM 5% 1/4W	4
40	5010-08998-00	R27	RESISTOR FC 2.2K OHM 5% 1/4W	1
41	5010-09039-00	R12	RESISTOR FC 10 OHM 5% 1/4W	1
42	5010-09442-00	R43	RESISTOR FC 330K OHM 5% 1/4W	1
43	5010-08997-00	R24,R31	RESISTOR FC 27K OHM 5% 1/4W	2
44	5010-09083-00	R44,R45	RESISTOR FC 470 OHM 5% 1/4W	2
45	5043-08980-00	C1-C22,C28,C30,C32-C37,C63-C67,C83	CAPACITOR CERAMIC 01MFD 50V	36
46	5040-08986-00	C23	CAPACITOR ELECT. 100MFD 10V	1
47	5043-08996-00	C24	CAPACITOR CERAMIC 1MFD 50V	1
48	5043-09169-00	C25,C26	CAPACITOR CERAMIC 27PFD 1KV	2
49	5041-09243-00	C27	CAPACITOR TANT. 10 MFD 10V	1
50	5041-09031-00	C31	CAPACITOR TANT. 1MFD 25V	1
51	5043-09030-00	C84	CAPACITOR CERAMIC .047MFD 50V	1
52	5043-09065-00	C29,C38-C62,C68-C82,C85,C86	CAPACITOR CERAMIC 470PFD 50V	43
53	5671-09019-00	LED1,LED2	LED RED	2
54	SEE NOTE	SW1,SW2	SWITCH MOMENTARY	2
55	5881-09021-00		BATTERY HOLDER #171	1
56	5791-09026-00	UJ1	HEADER 09-64-1083 8 PIN	5
57	5791-09028-00	U3,U4	HEADER 09-65-1041 4 PIN	2
58				
59	5791-09027-00	UJ2,UJ5-UJ7	HEADER 09-65-1091 9 PIN	4
60	5791-09043-00	UJ8	HEADER 09-65-1121 12 PIN	1
61	5700-08985-00		40 PIN IC SOCKET	1
62	5700-09004-00		24 PIN IC SOCKET	6
63				
64	5010-09334-00	W3,W6,W8,W10,W11,W14,W17,W19,W20,W25,W26,W29,W22	RESISTOR FC 0 OHM 1/4W	13
65	5824-09248-00	TP1-TP10	TEST TERMINALS #1502-1	10

NOTE: USE EITHER 5641-09312-00, 5641-09024-00 OR 5641-09371-00

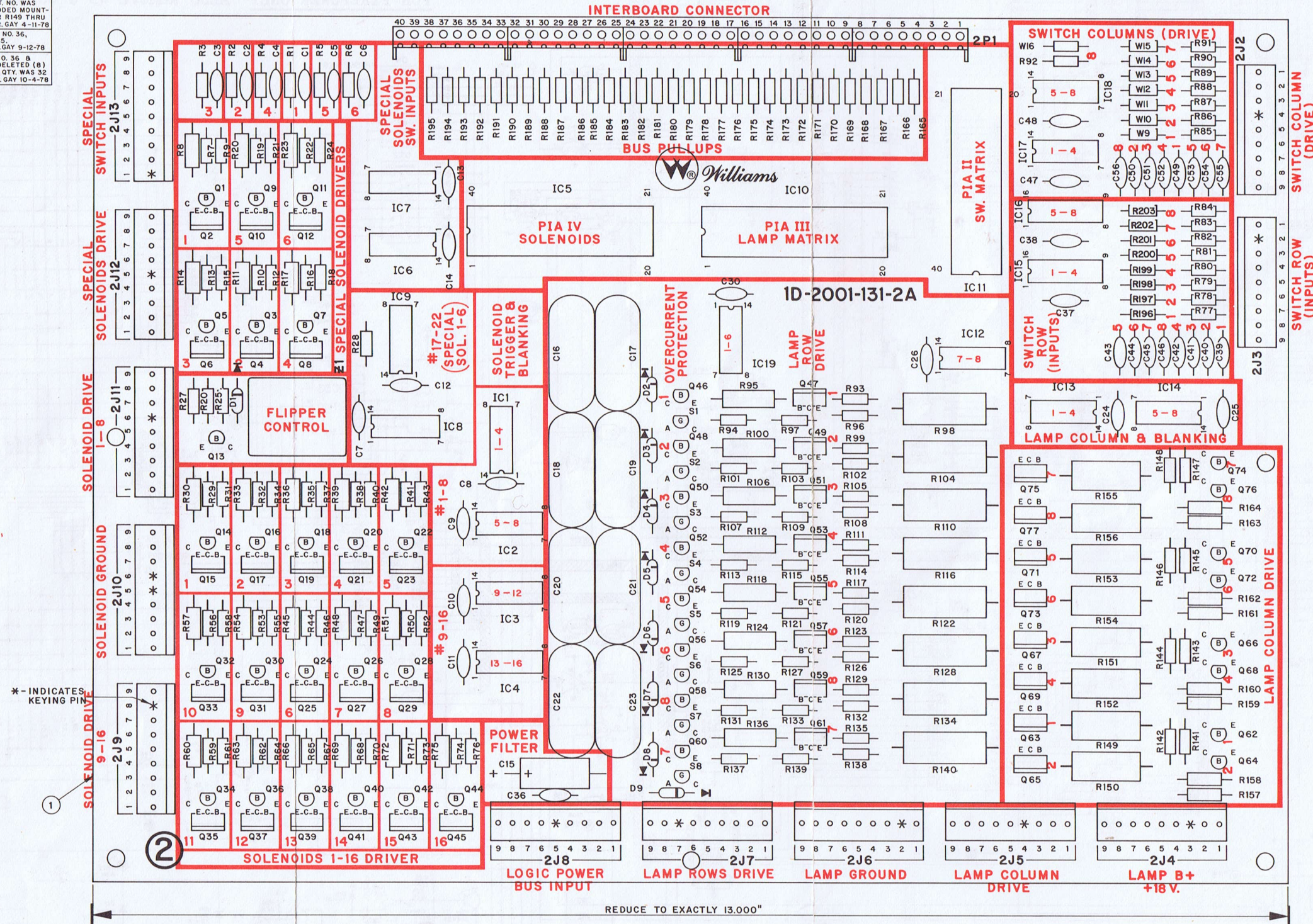
TOLERANCES		QTY.	ASSEMBLY ON
UNLESS OTHERWISE SPECIFIED			
FRACTIONAL	3/16"		
DECIMAL	0.0005"		
HOLE DIA.	+0.002 -0.001"		
ANGULAR	3/16"		
CONCENTRICITY	0.005"		
SCREW THREADS	CLASS 2		
MATERIAL		HEAT TREATMENT	FINISH
DWN. 5.0000		DATE 9-20-80	APPD. SCALE
			D-8342

NOTES:

1. ALL RESISTORS, 1/4 WATT UNLESS NOTED OTHERWISE.
2. ALL CAPACITORS, MFD. UNLESS NOTED OTHERWISE.
3. WHEN USING WHITE, YELLOW OR GREEN LABEL PROGRAMS REMOVE -W10,W11,W14,W17,W19,W20,W22 CONNECT: W9,W12,W15,W16,W18,W21,W23 FOR FIREPOWER ONLY- ALSO REMOVE W3 & CONNECT W4.

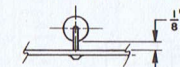


REVISION LETTER	REVISION
C	REVISED AND REDRAWN R.GAY 11-28-77
D	ITEM NO. 28, PT. NO. WAS 5A-8999 & ADDED MOUNT- ING NOTE FOR R149 THRU R156. R.GAY 4-11-78
E	DELETED ITEM NO. 36, PT. NO. 5A-8985. E.C.O. R.GAY 9-12-78
F	ADDED ITEM NO. 36 & ITEM NO. 22, DELETED (8) RESISTORS & QTY. WAS 32 E.C.O. 4624 R.GAY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

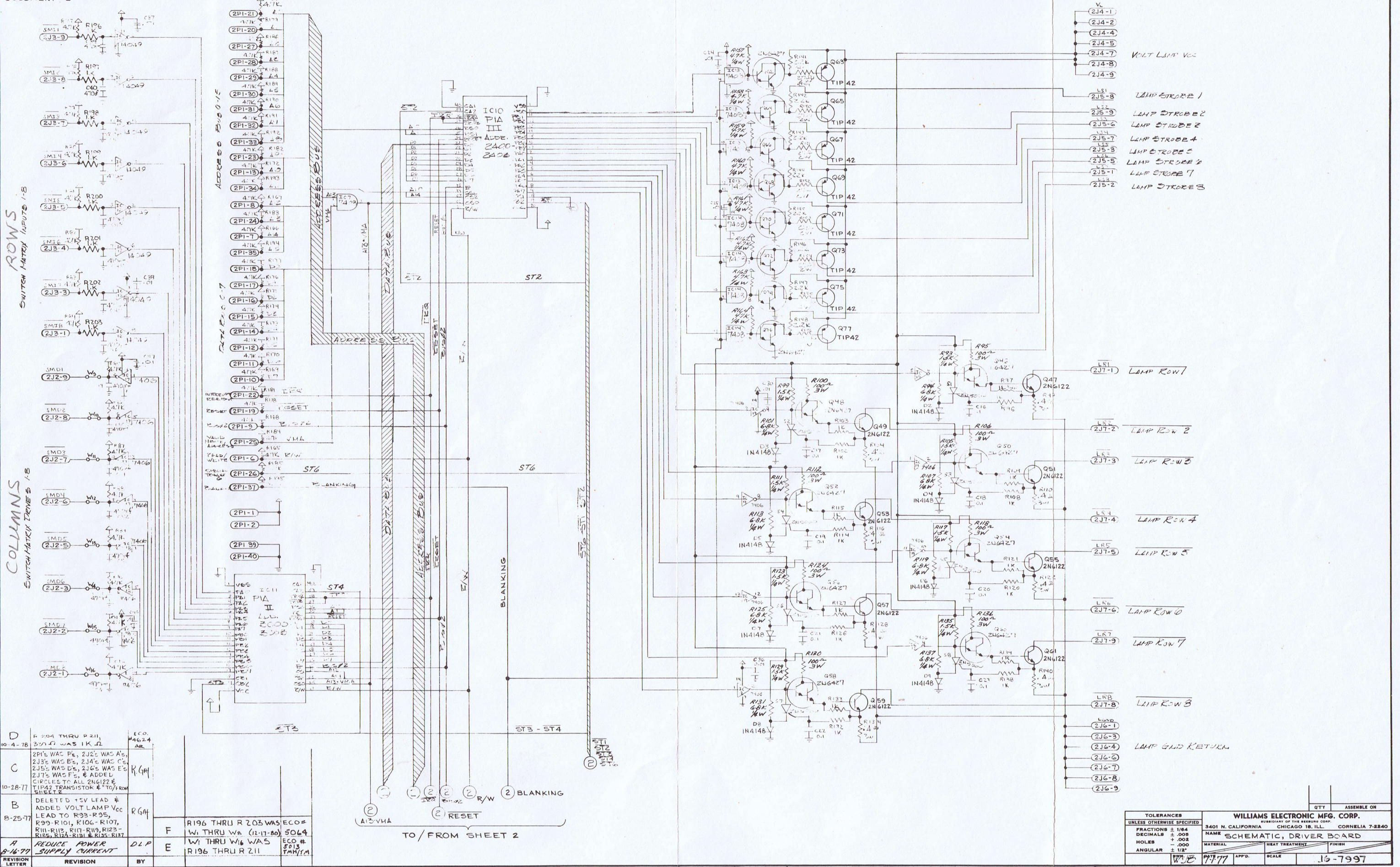


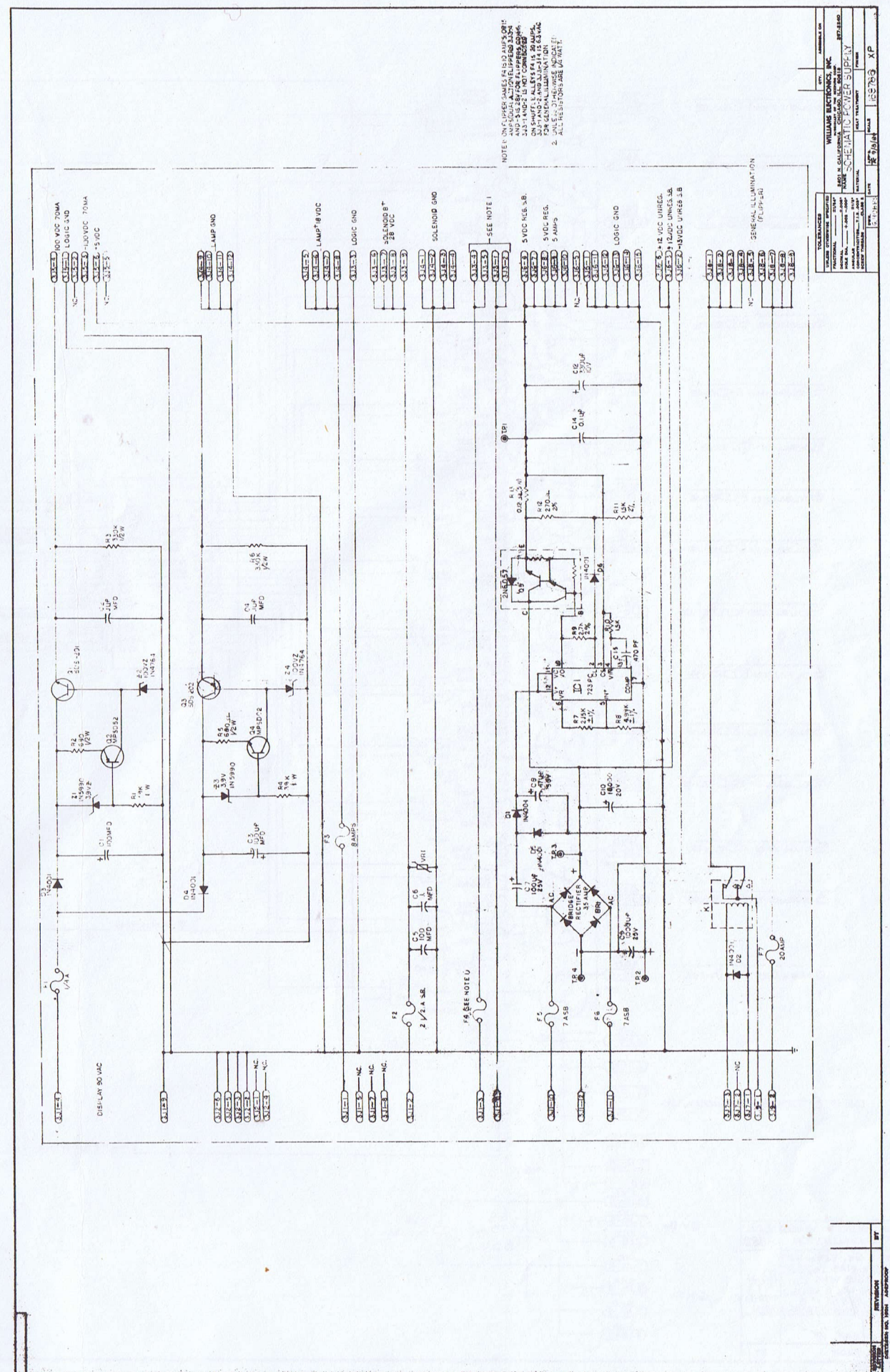
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-131		BARE P.C. BOARD	1
2	5A-8948	IC8, IC9	N7402 QUADRUPLE 2 INPUT POSITIVE NOR GATE	2
3	5A-8974	IC12, IC17, IC18, IC19	N7405 HEX. INVERTER BUFFER DRIVERS W/ OPEN COLLECTOR HIGH VOLTAGE OUTPUTS	4
4	5A-8973	IC1 THRU IC4, IC6, IC7, IC13, IC14	N7408 QUADRUPLE 2 INPUT POSITIVE AND 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-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, Q23, Q25, Q27, Q29, Q31, Q33, Q35, Q37, Q39, Q41, Q43, Q45	TIP122 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, 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 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, R77 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, R126, R127, R132, R133, R136, 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, 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	8
33	5A-8994	Z1	RELAY - 4 POLE - 5 AMP. CONTACTS 40 OHM COIL 6 V.D.C.	1
34	5A-9066	2P1	8 PIN RECEPTACLE	6
35	5A-9027	2J2 THRU 2J13	9 PIN HEADER	12
36	5A-5534	W9 THRU W16	RESISTOR, FC, 0 OHM, 1/4 W	8

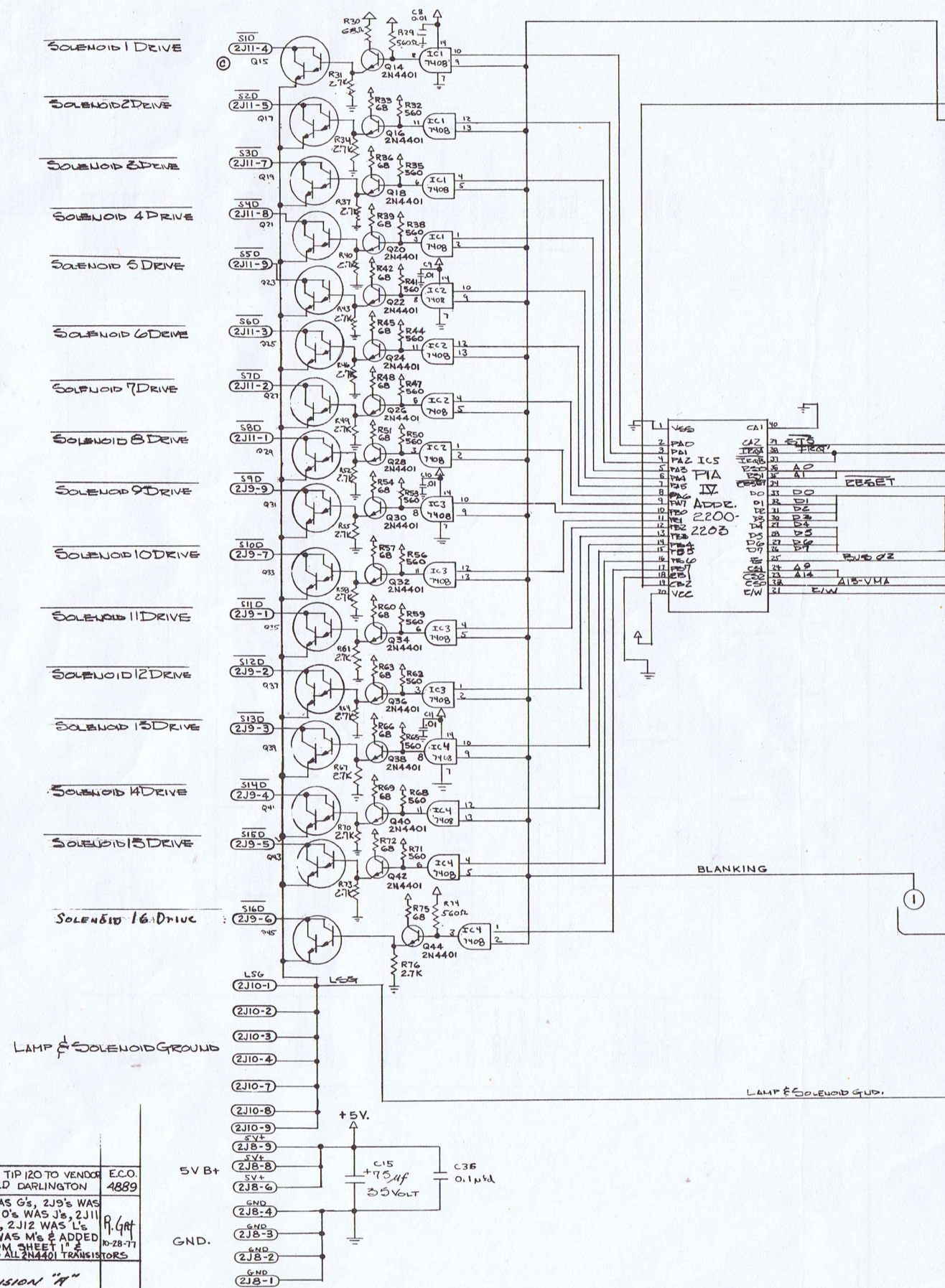
★ R149 THRU R156 MUST BE MOUNTED 1" ABOVE SURFACE OF BOARD.



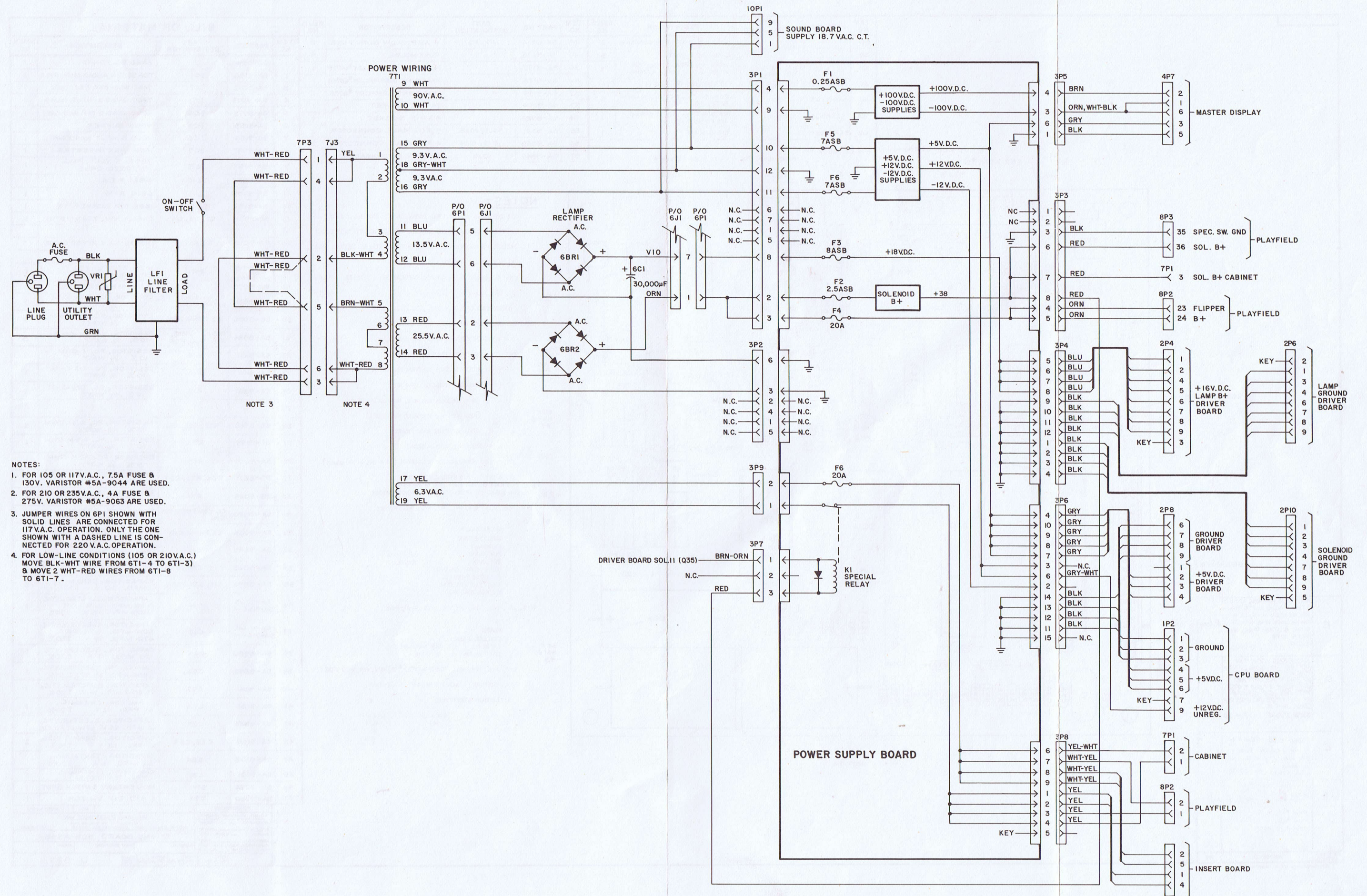
WILLIAMS ELECTRONICS, INC. SUBSIDIARY OF XCOR CORPORATION 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240			
PART NAME DRIVER BOARD ASSEMBLY			
DWN. R. Gay	DATE 8-16-77	APP'D. [Signature]	PART NO. D-7997

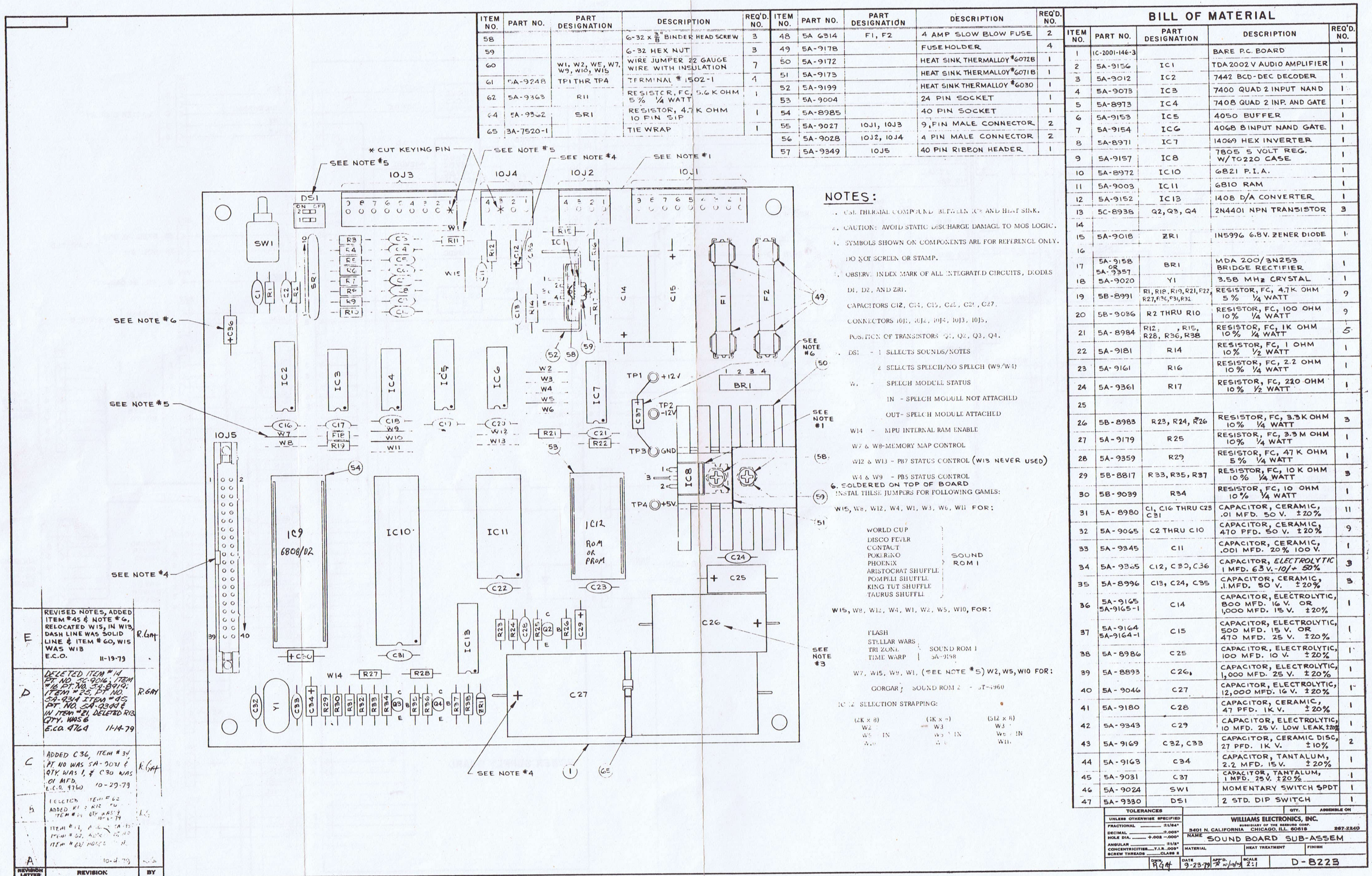






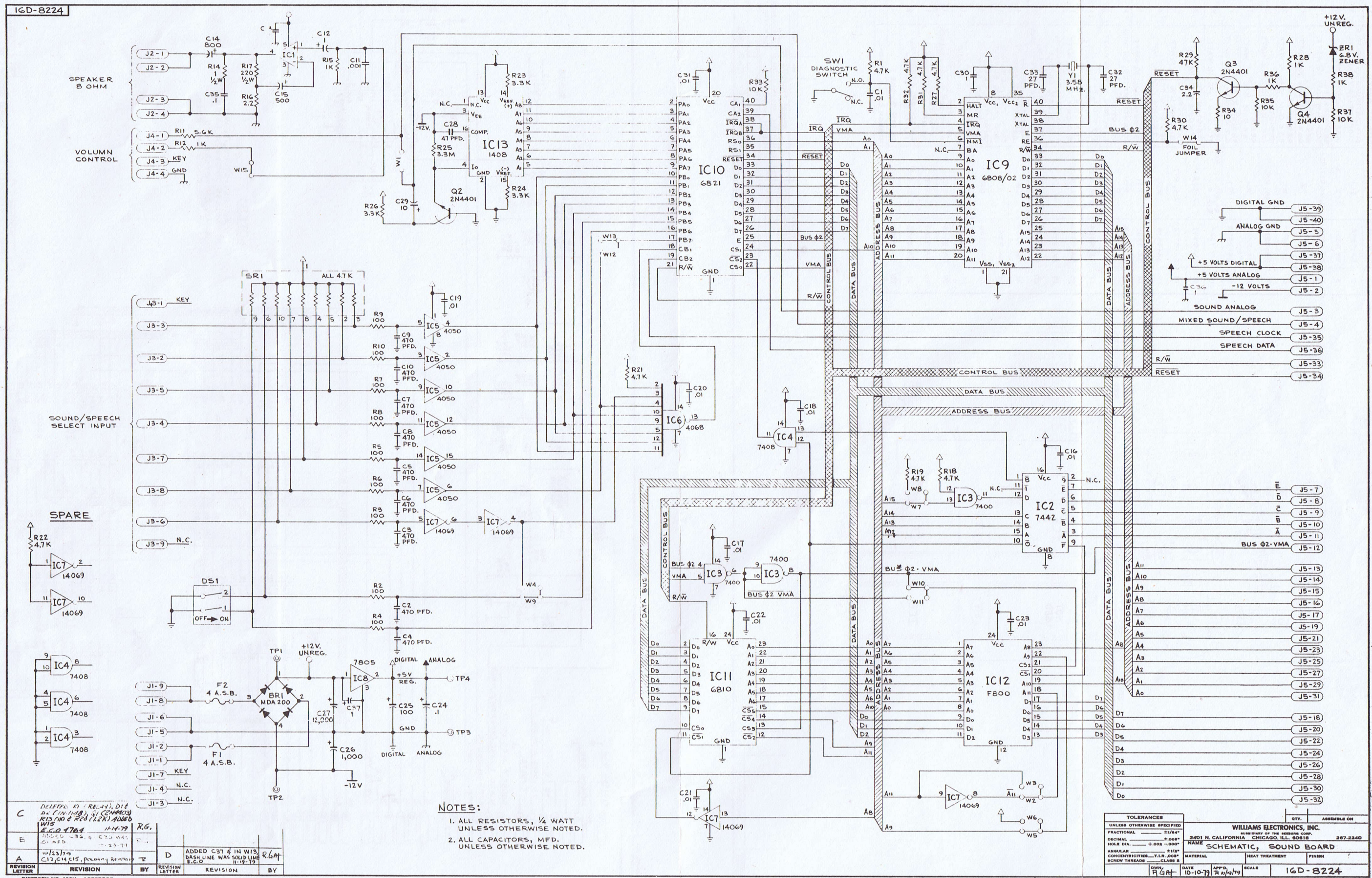
C	CHANGE TIP 120 TO VENDOR SELECTED DARLINGTON	E.C. 488
B	2JB'S WAS G'S, 2J9'S WAS H'S, 2J10'S WAS J'S, 2J11 WAS K'S, 2J12 WAS L'S 2J13'S WAS M'S & ADDED "TO/FROM SHEET 1" & CIRCLES TO ALL 2NA401 TRANSIS	9-64 10-28-71 TORS
A 5-28-77	REVISION "A"	
REVISION DATE	REVISION	BY



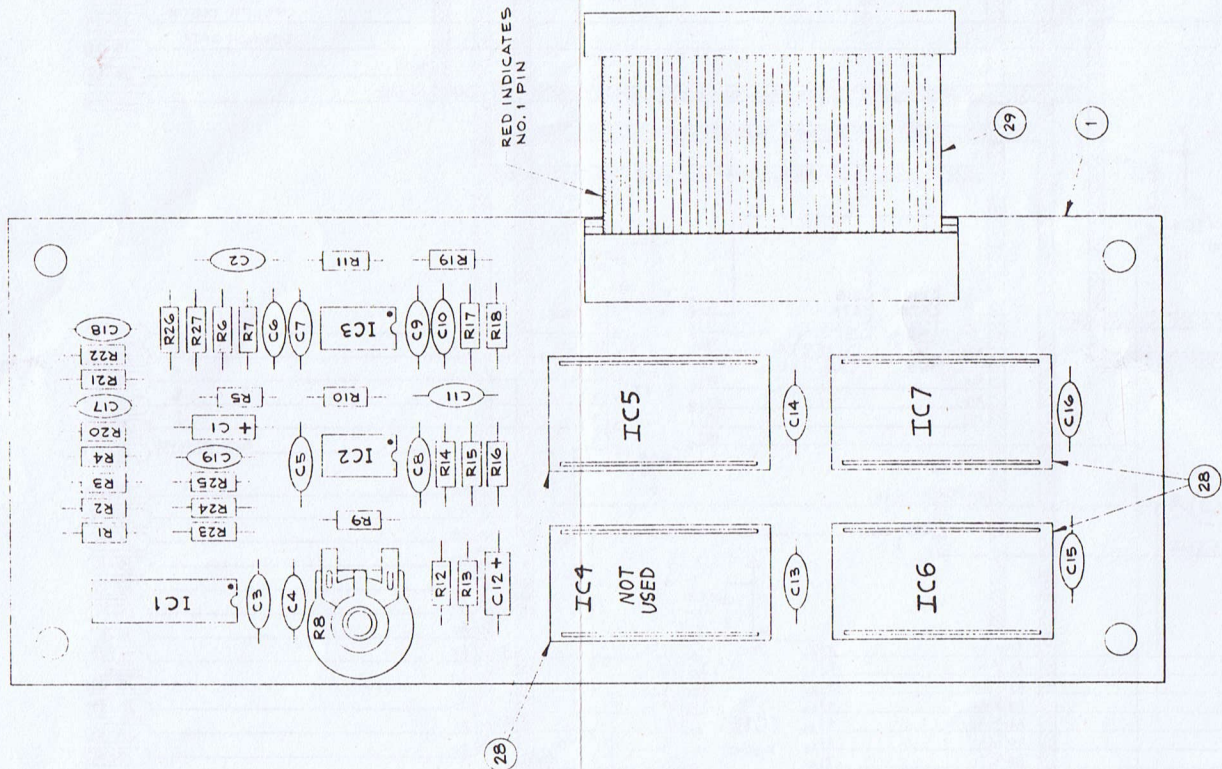


	REVISED NOTES, ADDED ITEM #45 & NOTE #6, RELOCATED W15, IN W13, DASH LINE WAS SOLID LINE & ITEM #60, W15 WAS W13 E.C.O.	11-19-79	R.G.H.
E			
	DELETED ITEM #14 PT. NO. 5C-9016; ITEM #16 PT. NO. 5A-8999; ITEM #25, PT. NO. 5A-9344; ITEM #45 PT. NO. 5A-9344 & IN ITEM #21, DELETED R13 CTV. WAS 6 E.C.O. 4764	11-14-79	R.G.H.
D			
	ADDED C36, ITEM #34, PT. NO. WAS 5A-9031 & R17 WAS 1, & C30 WAS 01 MFD. E.C.O. 4760	10-29-79	R.G.H.
C			
	RELOCATED ITEM #62 ADDED K1 & R12 TO ITEM #14, DTP WAS 79	10-6-79	R.G.H.
H			
	ITEM #11, A 10-1-79, ITEM #62, ADDED C30 ITEM #63, ADDED C30	10-4-79	R.G.H.
A			

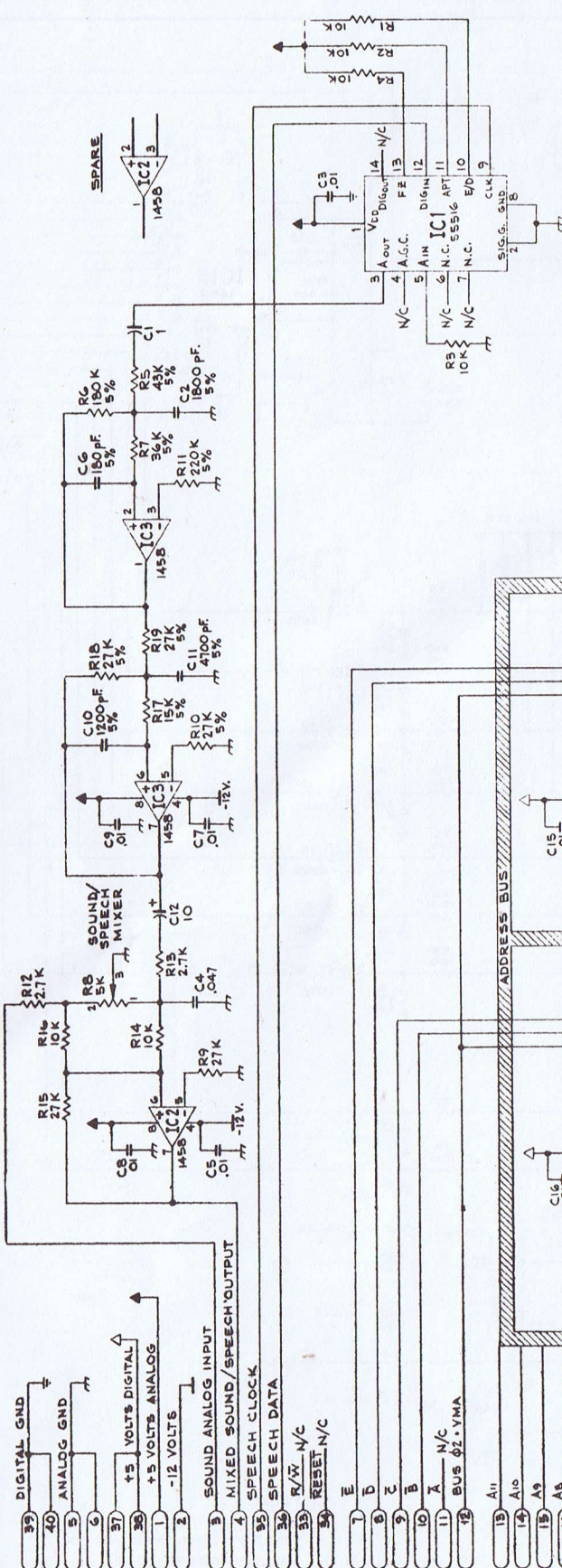
DIETZGEN NO. 188H AGEPROOF



ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
1	IC-2001-148-2		BARE P.C. BOARD	1
2	5A-9354	IC1	3417 CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR	1
3	5A-9351	IC2, IC3	1458 DUAL OP-AMP.	2
4	5A-8992	R1, R4, R22, R23	RESISTOR, FC, 560 OHM 10% 1/4 WATT	4
5	5A-8776	R2	RESISTOR, FC, 68K OHM 5% 1/4 WATT	1
6	5A-8983	R3	RESISTOR, FC, 3.3K OHM 10% 1/4 WATT	1
7	5B-8817	R5, R16	RESISTOR, FC, 10K OHM 10% 1/4 WATT	2
8	5A-8773	R6	RESISTOR, FC, 18K OHM 5% 1/4 WATT	1
9	5A-9353	R7	RESISTOR, FC, 6.2K OHM 5% 1/4 WATT	1
10	5A-9324	R9, R10, R11, R15, R18, R19	RESISTOR, FC, 27K OHM 10% 1/4 WATT	6
11	5B-8997	R12, R13	RESISTOR, FC, 2.7K OHM 10% 1/4 WATT	2
12	5A-8772	R14, R17	RESISTOR, FC, 15K OHM 5% 1/4 WATT	2
13	5A-9314	R20	RESISTOR, FC, 1.2K OHM 10% 1/4 WATT	1
14	5A-9331	R21	RESISTOR, FC, 13K OHM 10% 1/4 WATT	1
15	5A-9185	R8	POTENTIOMETER, 5K OHM	1
16	5A-9218	R24	RESISTOR, FC, 2.2M OHM 10% 1/4 WATT	1
17	5A-8984	R25, R27	RESISTOR, FC, 1K OHM 10% 1/4 WATT	1
18	5A-9356	R26	RESISTOR, FC, 820 OHM 5% 1/4 WATT	1
19	5A-9031	C1	CAPACITOR, TANTALUM, 1MFD-20% 25 VOLT	1
20	5A-8980	C2, C3, C5, C7, C8, C9, C13 THRU C16	CAPACITOR, CERAMIC, .01MFD-80% 50 VOLT	10
21	5A-9050	C4	CAPACITOR, CERAMIC, .047MFD-20% 50 VOLT	1
22	5A-9347	C6	CAPACITOR, CERAMIC, 1800 PFD-5% 50 VOLT	1
23	5A-9346	C10	CAPACITOR, CERAMIC, 1200 PFD-5% 50 VOLT	1
24	5A-9348	C11	CAPACITOR, CERAMIC, 4700 PFD-5% 50 VOLT	1
25	5A-9343	C12	CAPACITOR, ELECTROLYTIC, 10MFD-20% 25 VOLT LOW LEAK	1
26	5A-9263	C17	CAPACITOR, .33MFD-20% 200 VOLT	1
27	5A-8996	C18, C19	CAPACITOR, CERAMIC, .1MFD-20% 25 VOLT	2
28	5A-9004		24 PIN SOCKET	4
29	5A-9354	J1	RIBBON CABLE ASSEM	1



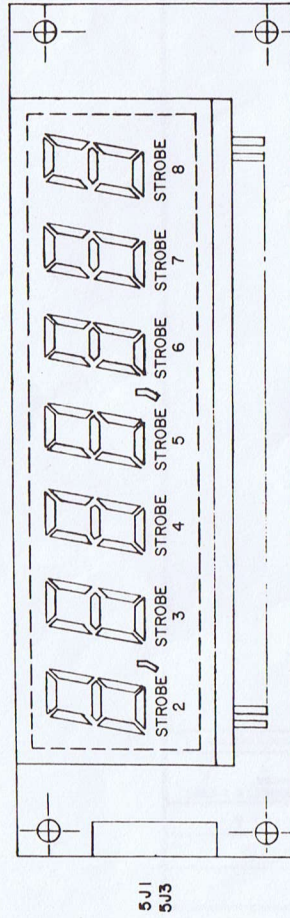
TOLERANCES	QTY.	ASSEMBLY ON
UNLESS OTHERWISE SPECIFIED		
FRACTIONAL — 1/16"		
DECIMAL — .001" — .005"		
ANGULAR — 1° — 5°		
SCREW THREADS — 1/16" — 1/8"		
NAME	WILLIAMS ELECTRONICS, INC.	
ADDRESS	3201 N. CALIFORNIA, CHICAGO, ILL. 60618	
NAME	SPEECH MODULE	
MATERIAL	ASSEMBLY	
DATE	9-28-79	
SCALE	2:1	
APPD.	C-8225	



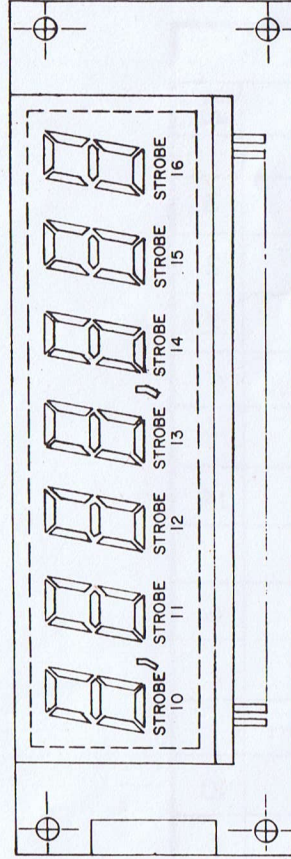
- NOTES:
1. ALL RESISTORS, 1/4 WATT.
 2. ALL CAPACITORS, MFD.
 3. UNLESS OTHERWISE NOTED.

TOLERANCES	QTY.	ASSEMBLY ON
UNLESS OTHERWISE SPECIFIED		
FRACTIONAL — 1/16"		
DECIMAL — .001" — .005"		
ANGULAR — 1° — 5°		
SCREW THREADS — 1/16" — 1/8"		
NAME	WILLIAMS ELECTRONICS, INC.	
ADDRESS	3201 N. CALIFORNIA, CHICAGO, ILL. 60618	
NAME	SPEECH MODULE	
MATERIAL	ASSEMBLY	
DATE	10-2-79	
SCALE	—	
APPD.	—	

PLAYERS #1 & #3



PLAYERS #2 & #4

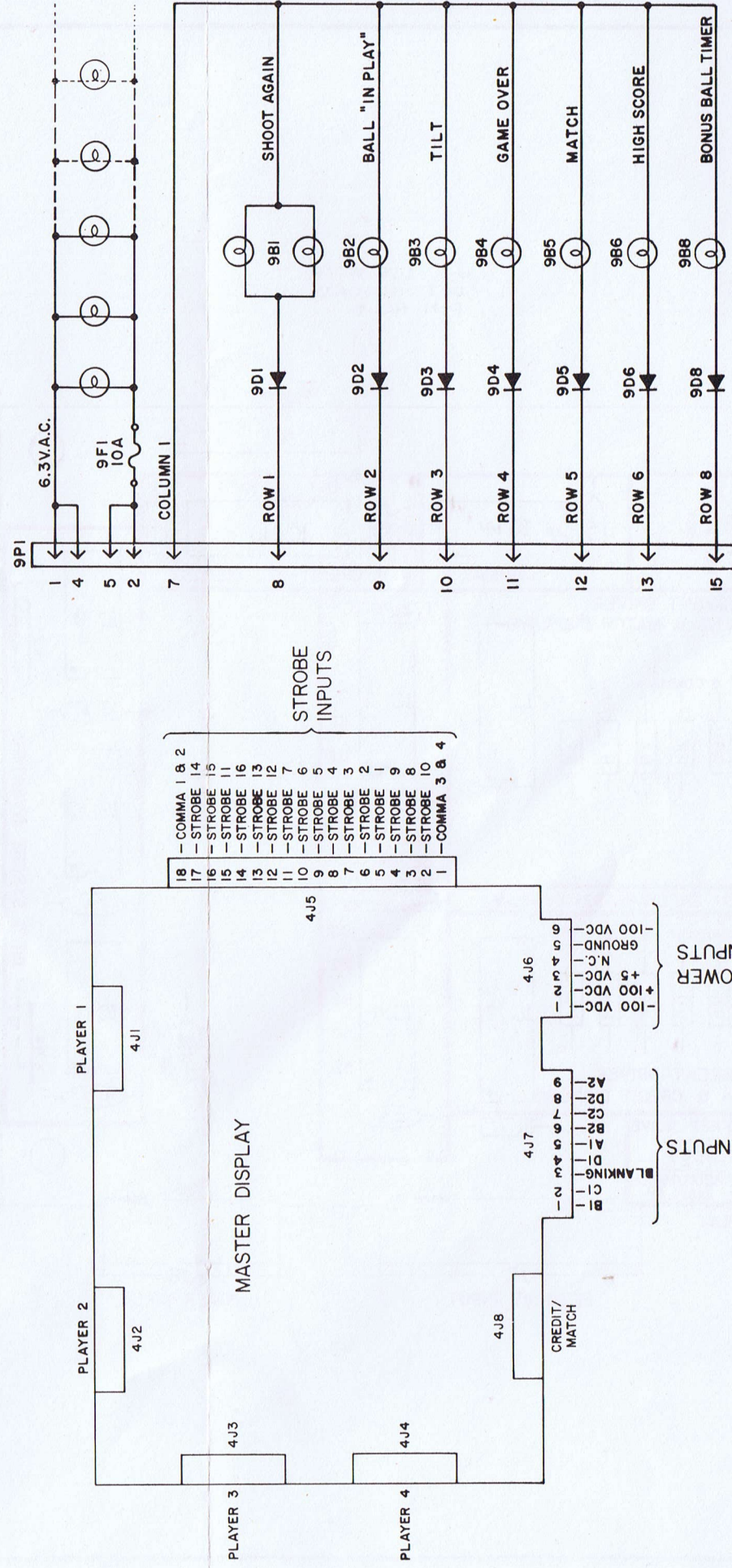
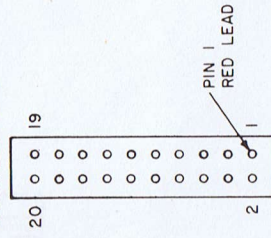


- 4J1/5J1 (PLAYER 1)
4J3/5J3 (PLAYER 3)
- | | |
|----|------------------|
| 1 | 100,000's |
| 2 | -100V KEEP ALIVE |
| 3 | 1,000,000's |
| 4 | f' SEGMENT |
| 5 | N/C |
| 6 | 9 SEGMENT |
| 7 | +100V (N/C) |
| 8 | e' SEGMENT |
| 9 | 10,000's |
| 10 | d' SEGMENT |
| 11 | 1,000's |
| 12 | +100V KEEP ALIVE |
| 13 | 100's |
| 14 | COMMA |
| 15 | 10's |
| 16 | c' SEGMENT |
| 17 | N/C |
| 18 | b' SEGMENT |
| 19 | UNITS |
| 20 | a' SEGMENT |

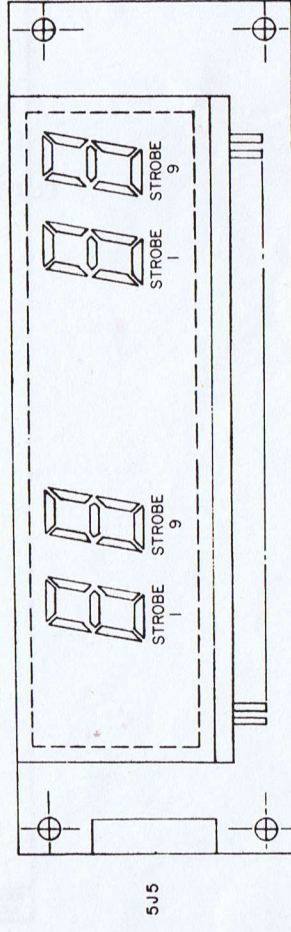
- 4J2/5J2 (PLAYER 2)
4J4/5J4 (PLAYER 4)
- | | |
|----|------------------|
| 1 | 100,000's |
| 2 | -100V KEEP ALIVE |
| 3 | 1,000,000's |
| 4 | f' SEGMENT |
| 5 | N/C |
| 6 | 9' SEGMENT |
| 7 | +100V (N/C) |
| 8 | e' SEGMENT |
| 9 | 10,000's |
| 10 | d' SEGMENT |
| 11 | 1,000's |
| 12 | +100V KEEP ALIVE |
| 13 | 100's |
| 14 | COMMA |
| 15 | 10's |
| 16 | c' SEGMENT |
| 17 | N/C |
| 18 | b' SEGMENT |
| 19 | UNITS |
| 20 | a' SEGMENT |

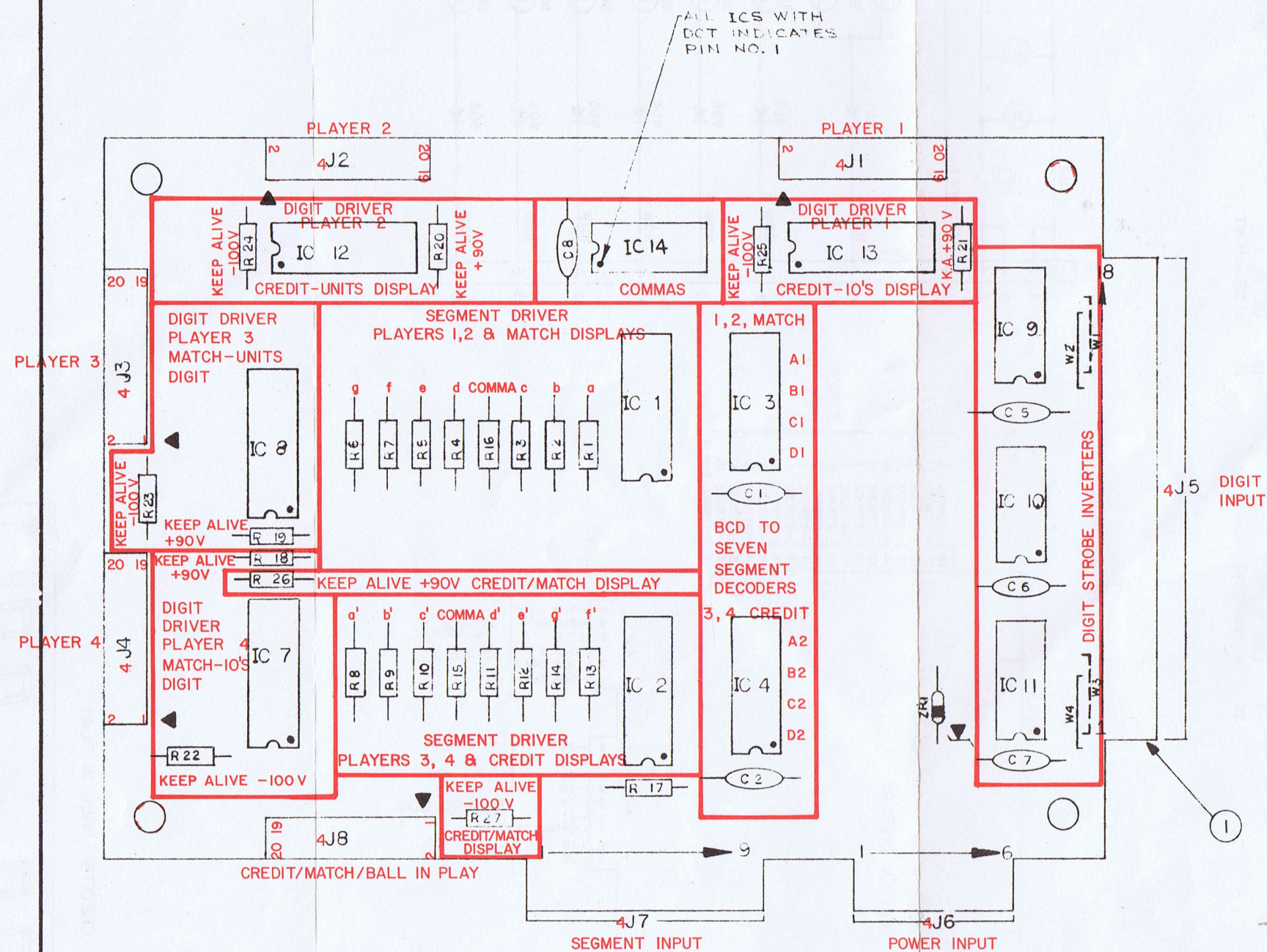
- 4J8/5J5 (CREDIT/MATCH)
- | | |
|----|---------------------|
| 1 | f' Segment (Credit) |
| 2 | -100V Keep Alive |
| 3 | e' Segment |
| 4 | g' Segment |
| 5 | c' Segment |
| 6 | d' Segment |
| 7 | b' Segment |
| 8 | 10's |
| 9 | Units |
| 10 | a' Segment |
| 11 | e' Segment |
| 12 | f' Segment |
| 13 | 10's |
| 14 | d' Segment |
| 15 | +100V Keep Alive |
| 16 | c' Segment |
| 17 | g' Segment |
| 18 | b' Segment |
| 19 | Units |
| 20 | a' Segment |

DETAIL A
4J1 - 4J4, 4J8
5J1 - 5J5
CONNECTORS



CREDITS / BALL IN PLAY





BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D QTY.
1	IC-200F-152-B		BARE P.C. BOARD	1
2	5A-8971	IC9, IC10, IC11	MC14069 HEX. INVERTER	3
3	5A-8970	IC3, IC4	MC14543 BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER	2
4	5A-8969	IC1, IC2	UDN-7180 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
5	5A-8968	IC7, IC8, IC12, IC13	UDN-6184A OR UDN-618A GAS DISCHARGE DISPLAY SEGMENT DR.	4
6		IC14	MC14081 QUAD 2-INPUT AND GATE	1
7	5B-8981	R1-R14	RESISTOR, FC, 10K OHM, 10% 1/2 WATT	14
8	5A-9135	ZR1	IN4740A ZENER DIODE 10V, 5% 1W	1
9	5A-8980	C1, C2, C5 THRU C8	CAPACITOR CERAMIC, 01 MFD, 50V	6
10		W2, W4	JUMPER *22 GA SOLID WIRE	2
11	5A-9086	R17	RESISTOR, FC, 6.8K OHM 10% 1/4 WATT	1
12	5B-8982	R18 THRU R27	RESISTOR, FC, 3 MEG. OHM 10% 1/4 WATT	10
13		J8, J1 THRU J4	20 PIN RIBBON HEADER	5
14		R15, R16	RESISTOR, 15K OHM, 10% 1/2 WATT	2

DIGIT CROSS REFERENCE

DIGIT	7-SEGMENT DECODER/DRIVER	STROBE (DRIVER)
Credit 10's	IC4/IC2	1 (IC13)
Credit Units	IC4/IC2	9 (IC12)
Match 10's	IC3/IC1	1 (IC7)
Match Units	IC3/IC1	9 (IC8)
#1 1,000,000	IC3/IC1	2 (IC13)
#1 100,000's	IC3/IC1	3 (IC13)
#1 10,000's	IC3/IC1	4 (IC13)
#1 1,000's	IC3/IC1	5 (IC13)
#1 100's	IC3/IC1	6 (IC13)
#1 10's	IC3/IC1	7 (IC13)
#1 Units	IC3/IC1	8 (IC13)
#2 1,000,000's	IC3/IC1	10 (IC12)
#2 100,000's	IC3/IC1	11 (IC12)
#2 10,000's	IC3/IC1	12 (IC12)
#2 1,000's	IC3/IC1	13 (IC12)
#2 100's	IC3/IC1	14 (IC12)
#2 10's	IC3/IC1	15 (IC12)
#2 Units	IC3/IC1	16 (IC12)
#3 1,000,000's	IC4/IC2	2 (IC8)
#3 100,000's	IC4/IC2	3 (IC8)
#3 10,000's	IC4/IC2	4 (IC8)
#3 1,000's	IC4/IC2	5 (IC8)
#3 100's	IC4/IC2	6 (IC8)
#3 10's	IC4/IC2	7 (IC8)
#3 Units	IC4/IC2	8 (IC8)
#4 1,000,000's	IC4/IC2	10 (IC7)
#4 100,000's	IC4/IC2	11 (IC7)
#4 10,000's	IC4/IC2	12 (IC7)
#4 1,000's	IC4/IC2	13 (IC7)
#4 100's	IC4/IC2	14 (IC7)
#4 10's	IC4/IC2	15 (IC7)
#4 Units	IC4/IC2	16 (IC7)
#1 Comma	-/IC1	2,5 (IC13)
#2 Comma	-/IC2	10,13 (IC12)
#3 Comma	-/IC1	2,5 (IC8)
#4 Comma	-/IC2	10,13 (IC7)

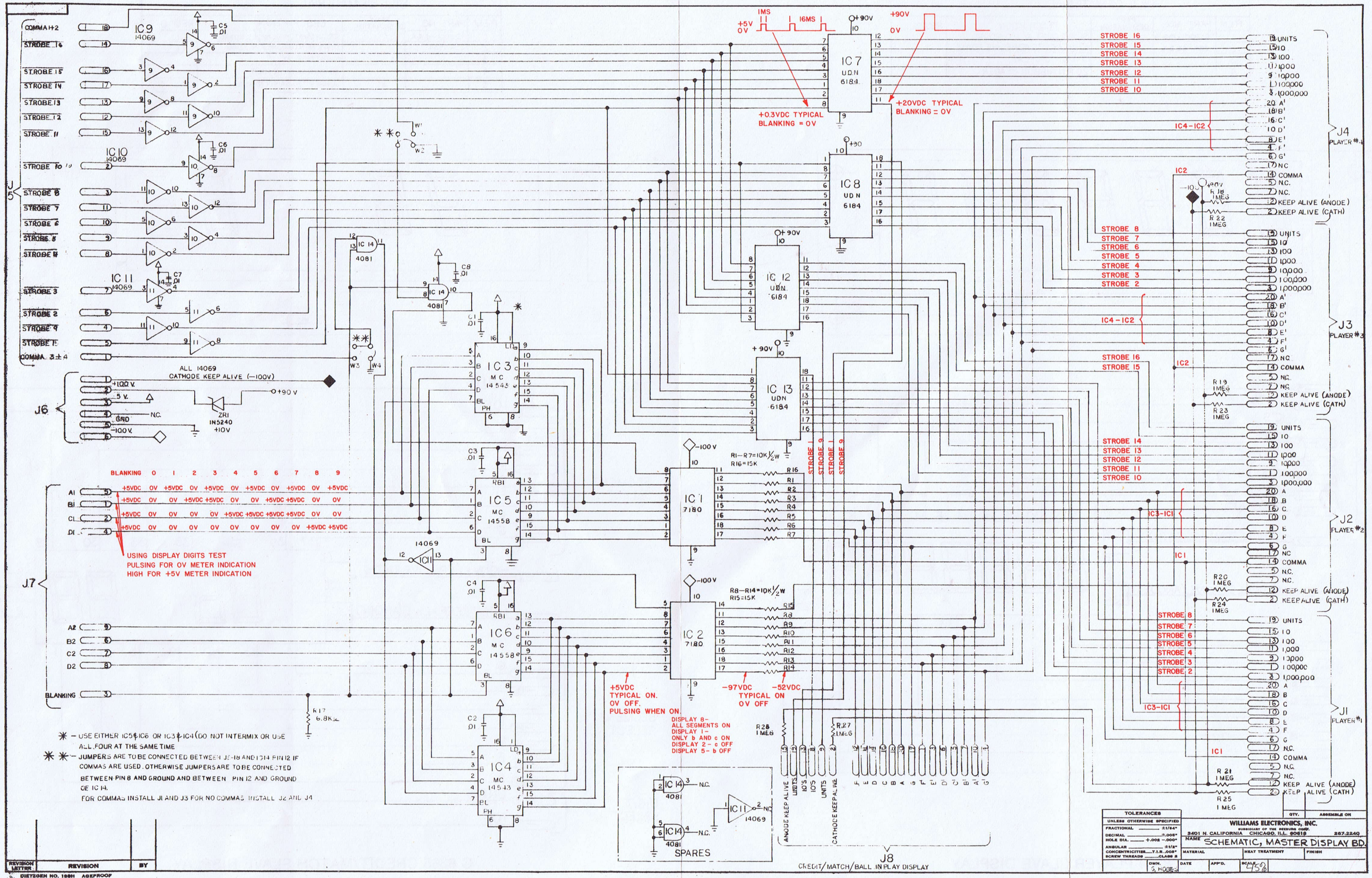
REVISION LETTER	REVISION	BY

TOLERANCES	QTY.	ASSEMBLY ON
UNLESS OTHERWISE SPECIFIED		
FRACTIONAL $\pm 1/64"$		
DECIMAL $\pm .005"$		
HOLE DIA. $+.002$ $-.000"$		
ANGULAR $\pm 1/2^\circ$		
CONCENTRICITIES $\pm .003"$		
SCREW THREADS $\pm .003"$		
OWN. G.H.	DATE 5-23-80	APP'D. SCALE 2:1 5/8/80

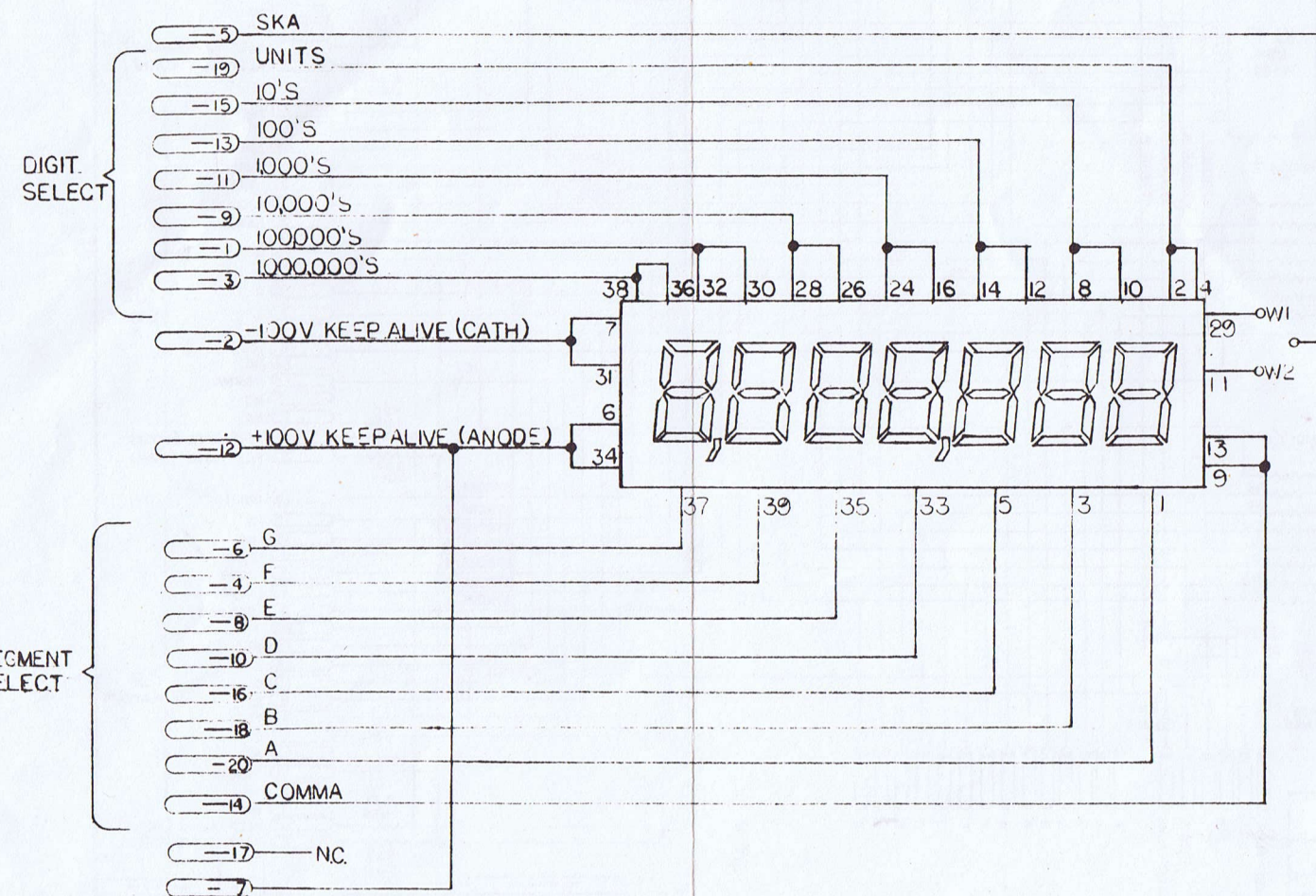
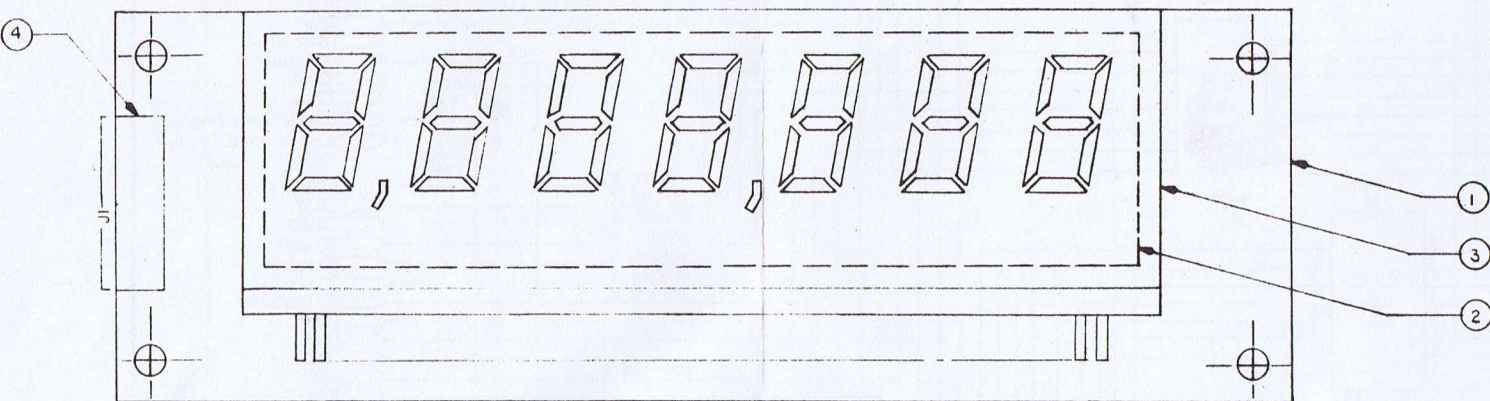
WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF THE SEEBURG CORP. OF DELAWARE
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

NAME MASTER DISPLAY BOARD ASSEMBLY

MATERIAL HEAT TREATMENT FINISH

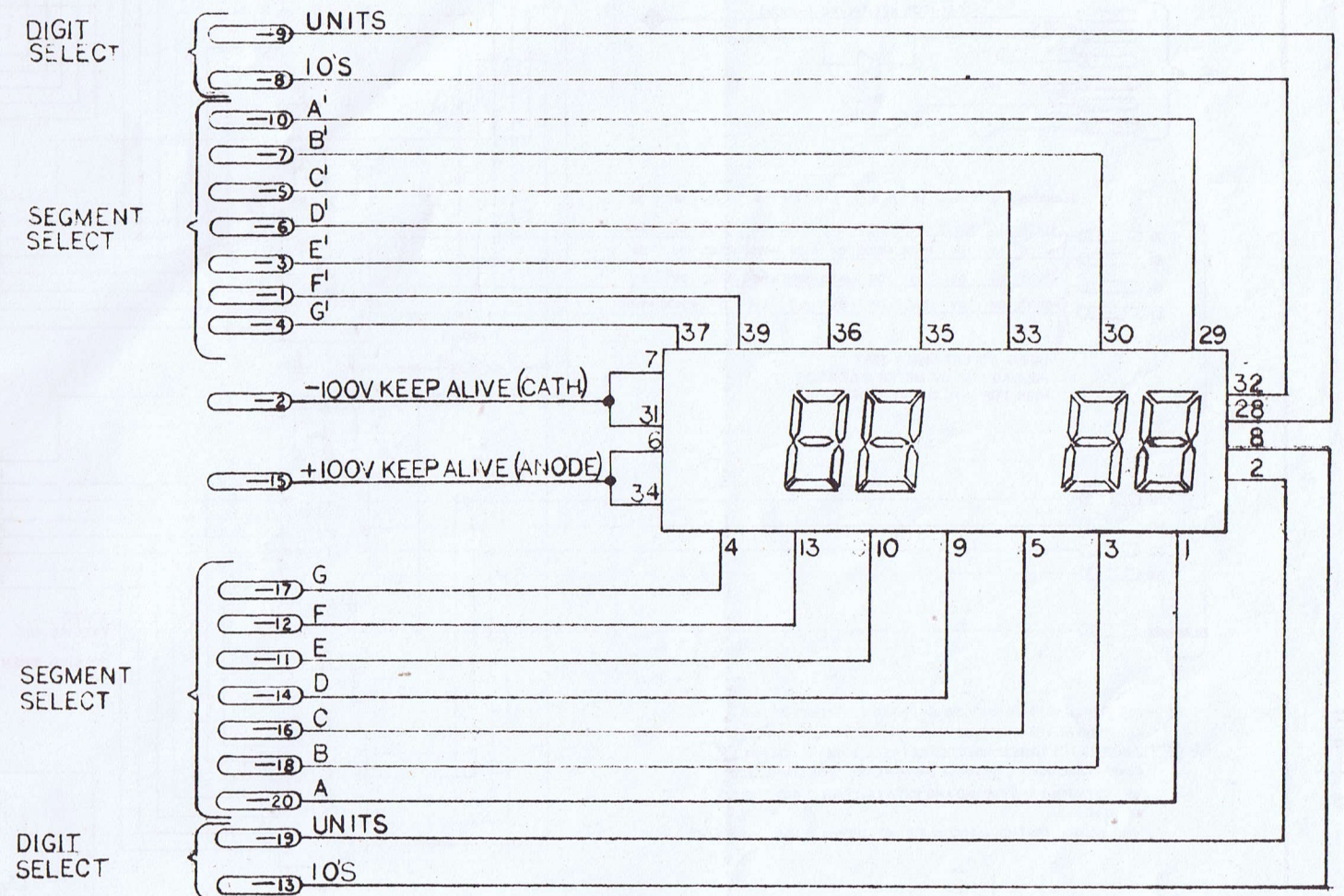
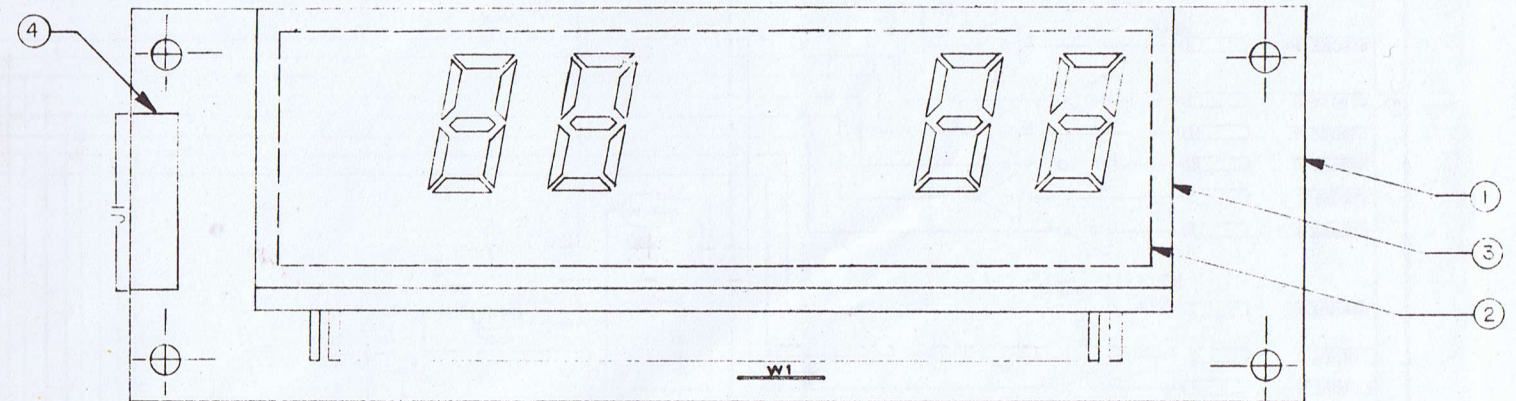


BILL OF MATERIAL				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D.
1	IC-2001-153-A		SLAVE DISPLAY P.C. BOARD	1
2	23A-6534		DISPLAY MTG ADHESIVE FOAM	1
3			7 DIGIT DISPLAY	1
4		J1	20 PIN RIBBON HEADER	1

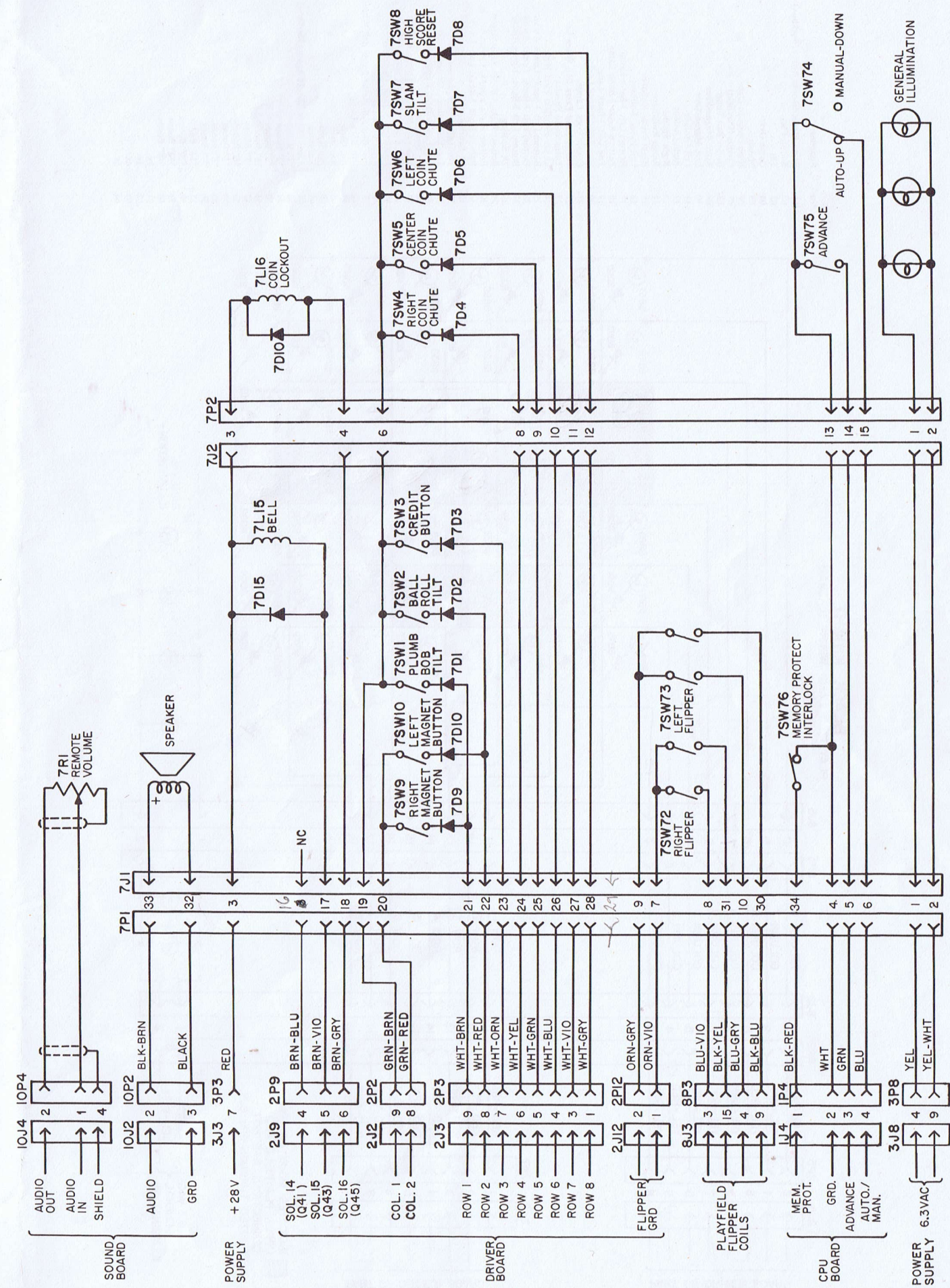


C 8364 PLAYER SLAVE DISPLAY

BILL OF MATERIAL				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D.
1	IC-2001-154-A		CREDIT/MATCH SLAVE P.C. BOARD	1
2	23A-6534		DISPLAY MTG ADHESIVE FOAM	1
3			4 DIGIT DISPLAY	1
4		J1	20 PIN RIBBON HEADER	1
5		W1	JUMPER #20 GA SOLID WIRE	1

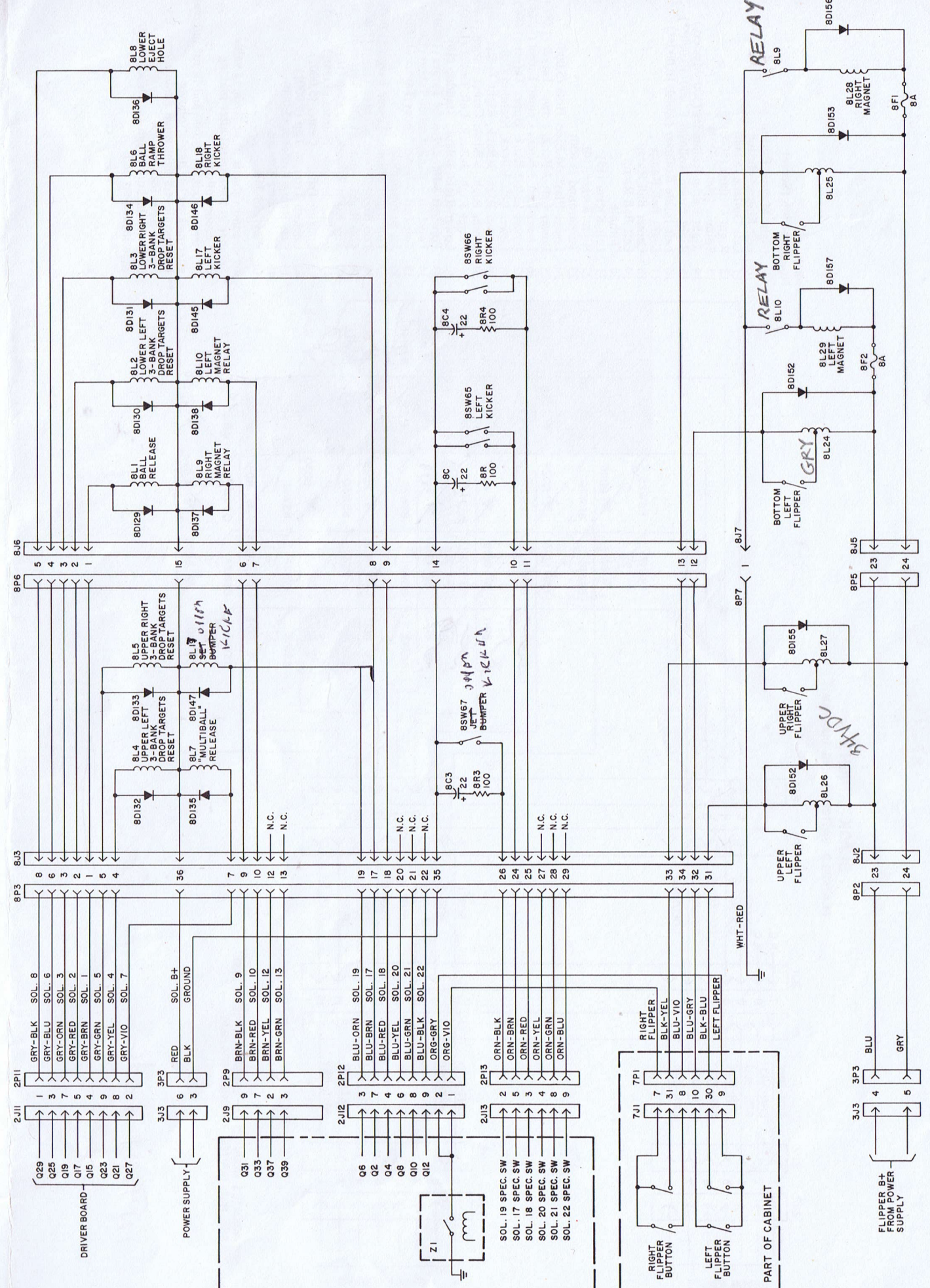
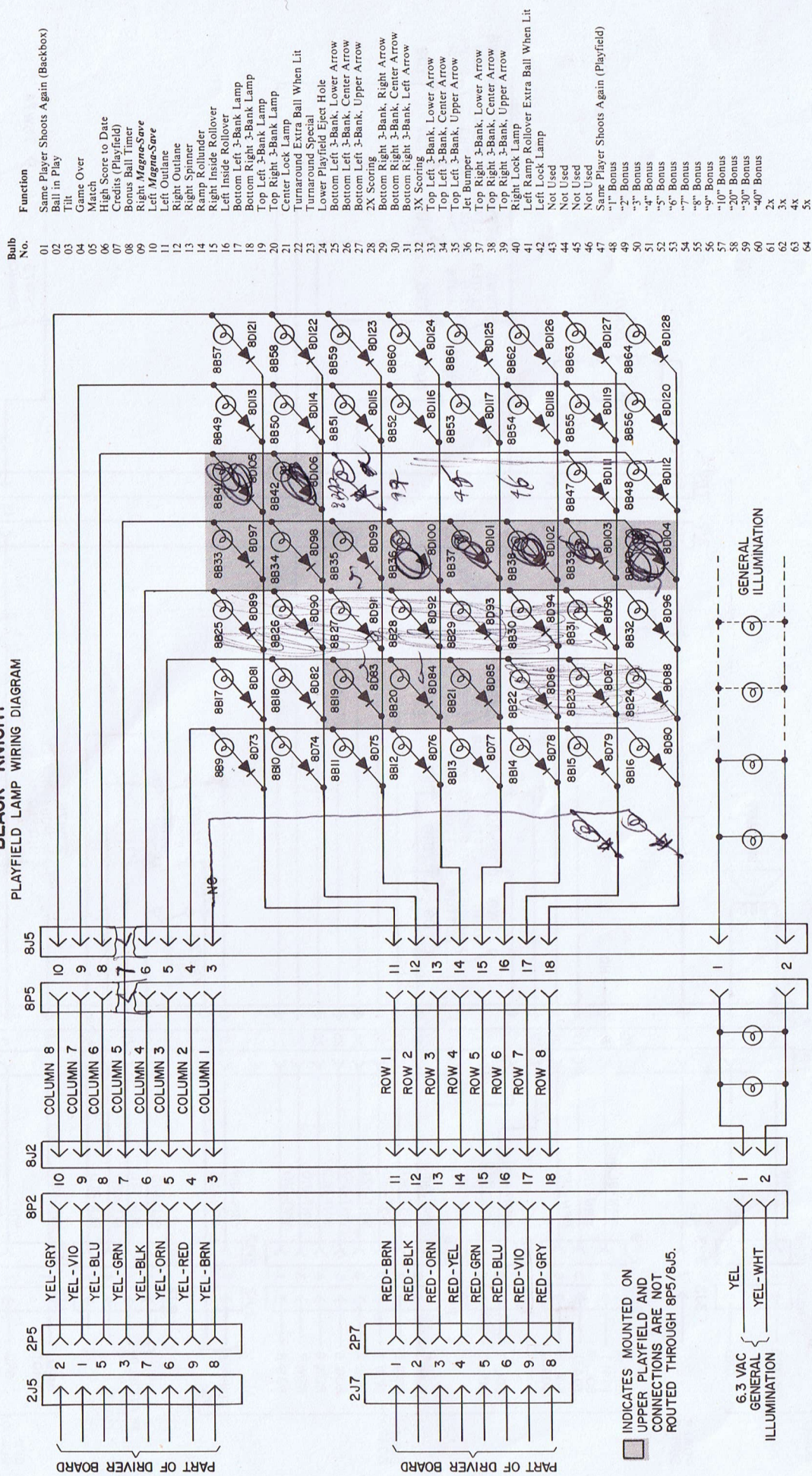


C 8365 CREDIT/MATCH SLAVE DISPLAY

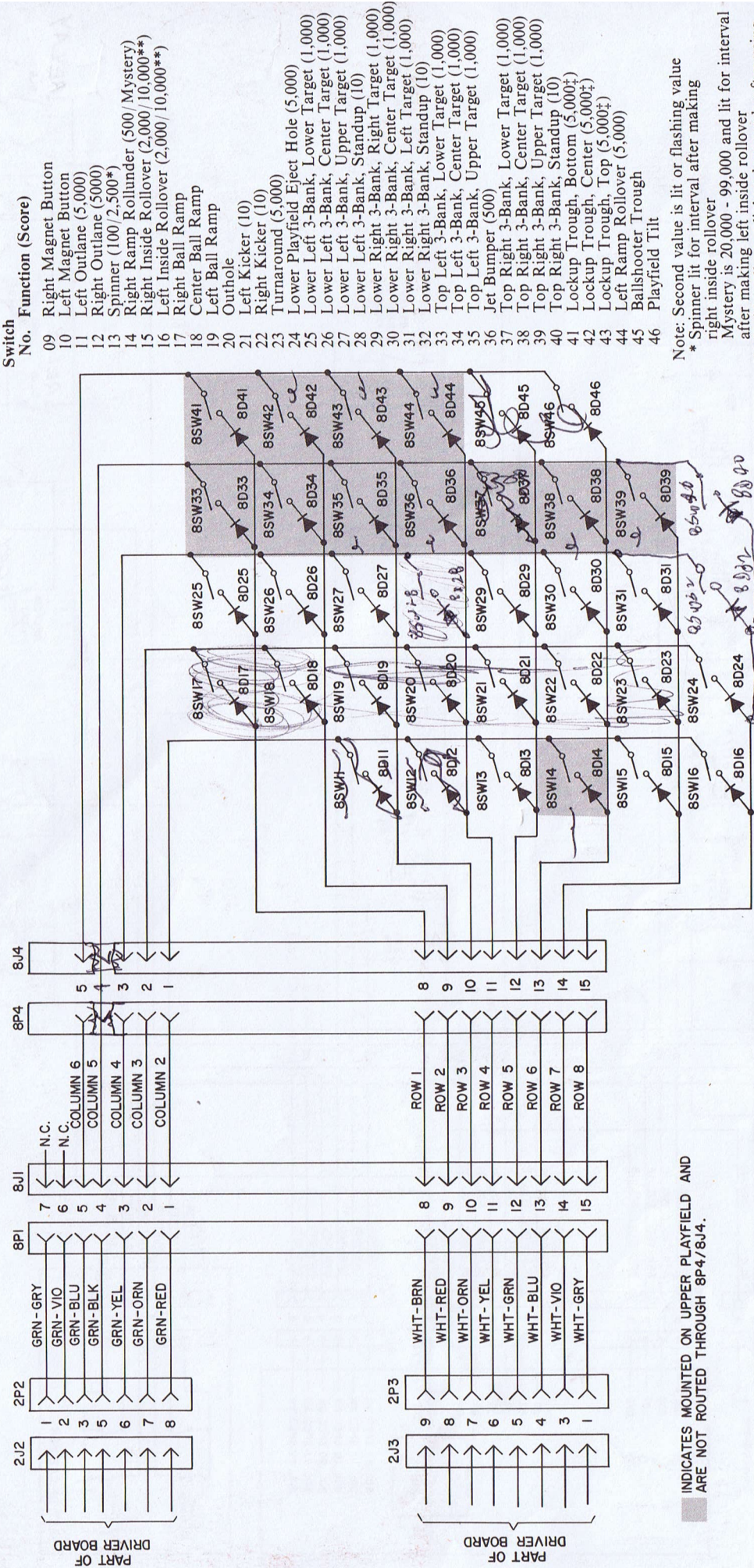


Cabinet Wiring Diagram

BLACK KNIGHT
PLAYFIELD LAMP WIRING DIAGRAM



BLACK KNIGHT
PLAYFIELD SWITCH WIRING DIAGRAM



INDICATES MOUNTED ON UPPER PLAYFIELD AND
ARE NOT ROUTED THROUGH 8P4/8J4.

1N4001 diode

Note: Second value is lit or flashing value
* Spinner lit for interval after making
right inside rollover
Mystery is 20,000 - 99,000 and lit for interval
after making left inside rollover
** Inside rollovers light when made after using
Magna-Save feature
+ Only one lockup trough switch scores for
each locked-up ball