

Williams[®]

16P-515-101
Game No. 515
January, 1983



FOR SERVICE...
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Williams[®] 
ELECTRONICS, INC.
3401 N. California Ave.
Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
(312) 267-2240

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, W20, 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

Must be equipped with zero-ohm resistors or wire jumpers (W9-W16) in place of switch matrix drive series resistors R204-R211.

Sound Board

Must be jumpered for ROM operation and be equipped with Sound ROM 13. (Jumpers W2, W5, W7, W9, W10, W12, and W15 connected; W3, W4, W6, W11, and W13 removed).

Power Supply Board

1. Model D 8345 board required (equipped with relay).
2. Fuse F4 (10A SB) for flipper solenoids must be installed.

Display Boards

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

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Installation

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

- A. Pull five cable connectors from backbox.
- B. Reach into pedestal hole of cabinet, pull up ground strap braid wire, and push it into backbox.
- C. Remove ties securing cabinet and playfield cables to cabinet and pull these cables up through pedestal hole.
- D. Interconnect cabinet and playfield cables with those of backbox. All are shape, size and color-coded:
 - General Illumination Connector: 6-Pin WHITE
 - Switch Connector: 15-Pin WHITE
 - Lamp Connector: 24-Pin WHITE
 - Solenoid Connector: 36-Pin BLACK
 - Cabinet Connector: 36-Pin WHITE
- E. Insert line cord into notch in cabinet. DO NOT PLUG IN AT THIS TIME.
- F. Push Remote Volume Control Cable (GRAY), terminated in a 4-Pin connector, and Transformer Secondary Harness, terminated in four connectors: 2-Pin WHITE, 6-Pin BLUE, 9-Pin WHITE, and 12-Pin WHITE 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 related washers.
- J. Connect ground braid wire under wing nut and washer at bottom of backbox.
- K. Guide Remote Volume Control Harness through harness clips on back of backbox and connect 4 Pin connector to Sound Board 10J4.
- L. Connect Transformer Secondary cable connectors:
 - 6-Pin BLUE (7 wires) to 6-Pin WHITE (7 wires)
 - 12-Pin WHITE to Power Supply 3J1
 - 2-Pin WHITE to Power Supply 3J9
 - 9-Pin WHITE to Sound Board 10J1

Inspection

- A. Check all connectors in backbox for loose wire termination. Reseat any loose wires by pushing in on terminal.
- B. Push on all connectors attached to Master Display, CPU, Driver, and Sound Boards, and check terminations on capacitor and bridge rectifiers at lower right of backbox.
- C. Gently press on all socketed IC packages on CPU and Sound Boards.

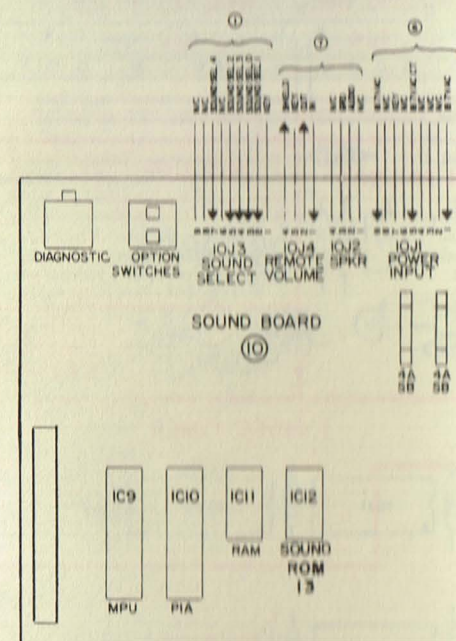
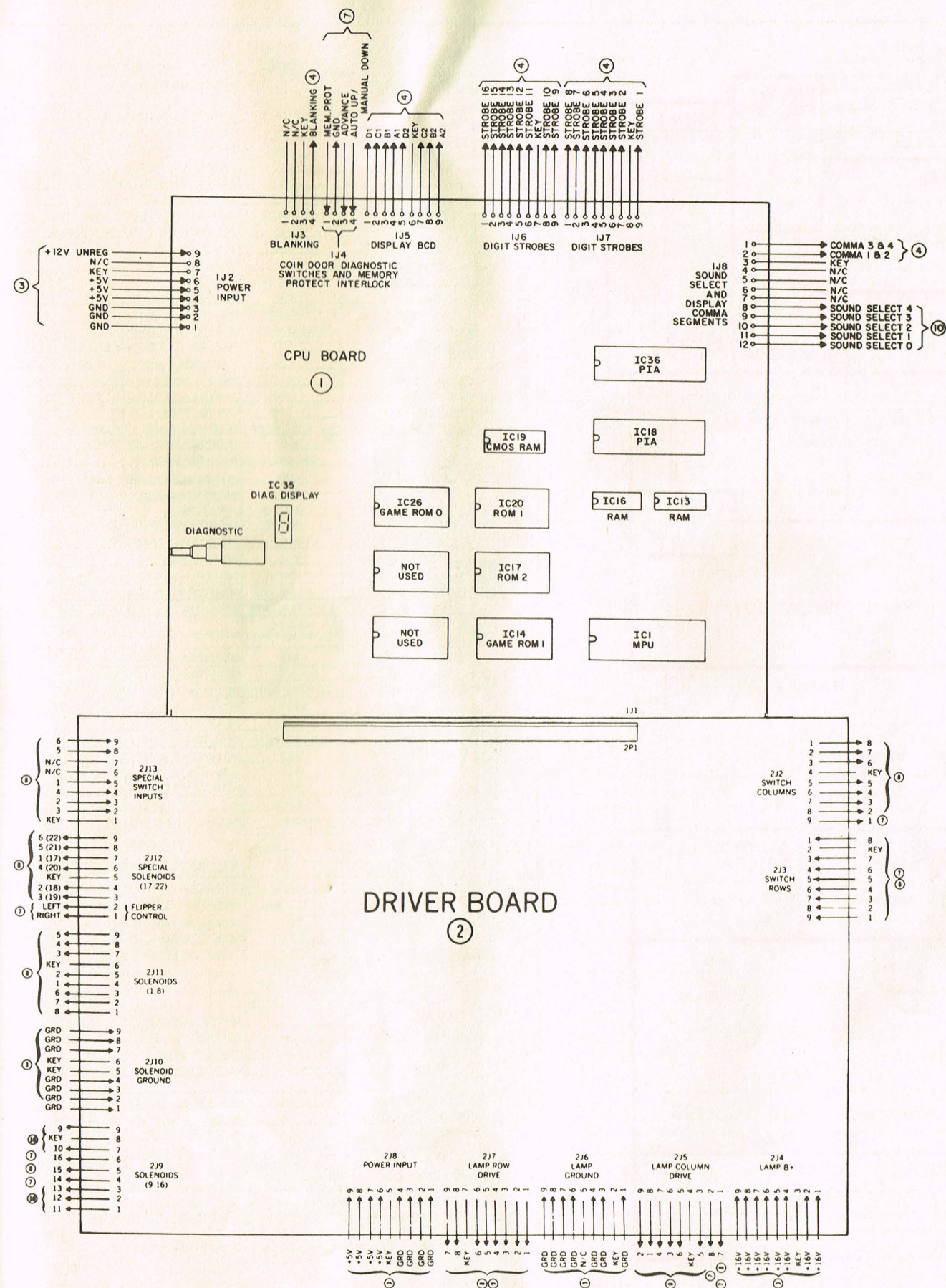
Inspection

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

Power Turn-On and Game Setup

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 line cord, and DO NOT cut off ground pin. Line voltage MUST agree with that specified on the back of cabinet or serious damage to machine could occur. For low-line applications (105 or 210V ac), refer to the power wiring diagram.

- A. With the coin door closed, plug game in and turn it ON. Game should come on in Game Over mode as indicated by Player 1 score reading zero, Game Over lights lit, and High Score to Date alternating with player scores.
- B. If game comes on in the Diagnostic Mode (Credits display showing 04, Ball in Play Display showing 00, and Player 1 display showing game identification) turn game OFF and ON again.
 1. If game now comes on in Game Over mode, bookkeeping and game evaluation totals have been reset to zero.
 2. If game still comes on in Diagnostic Mode, open coin door and turn game OFF, and ON twice. This is an indication of batteries being removed with power OFF or coming loose during shipment. This has also resulted in features reverting to factory settings. Any changes from factory settings must be re-entered using procedures provided in Instruction booklet.
- C. If game still comes on in Diagnostic Mode, refer to troubleshooting procedures in maintenance manual.
- D. Place one ball on playfield next to outhole.
- E. Perform diagnostic tests and make any desired changes to features as described in Instruction booklet.

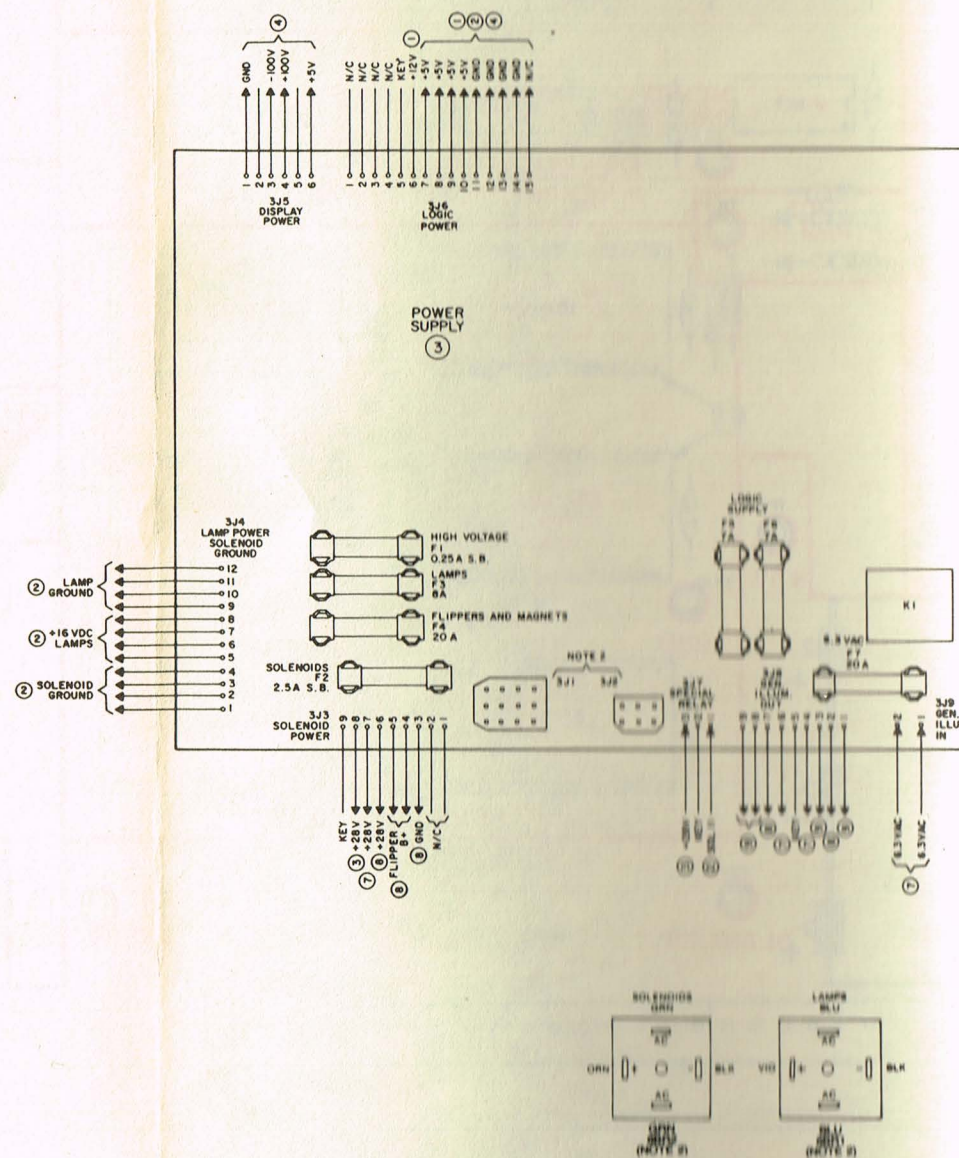


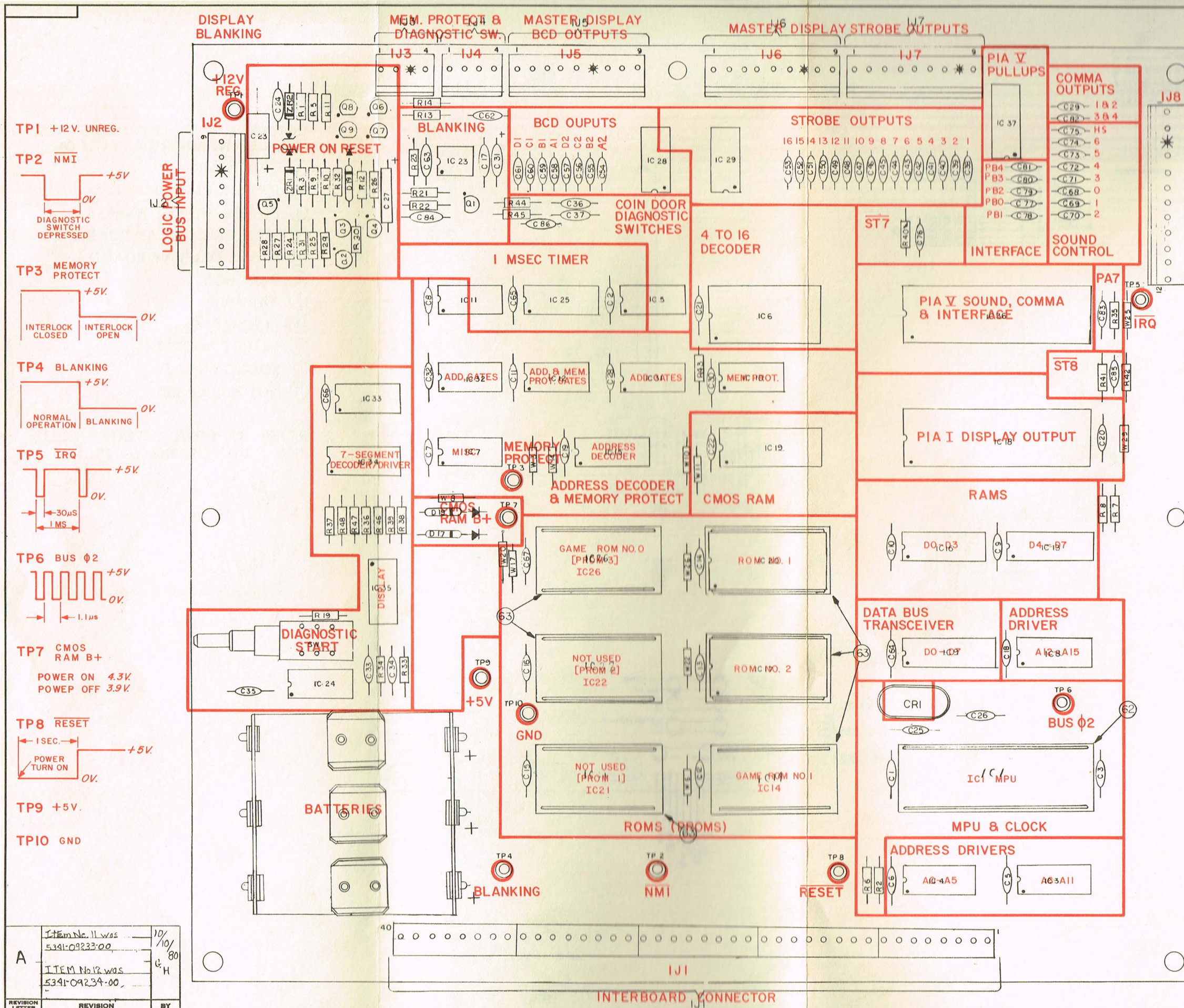
NOTES:

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

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





BILL OF MATERIAL				
ITEM NO.	PART NO.	DESIGNATION	DESCRIPTION	REQD. NO.
1	5764-09465-X0		BARE PC. BOARD CPU	1
2	5370-08989-00	IC3,IC4,IC8	8T97 HEX TRISTATE BUFFER	3
3	5281-09308-X0	IC9	74LS245 OCTAL BUFFER	1
4	5280-09010-00	IC6	74154 4 TO 16 DECODER	1
5	5280-09013-00	IC7	7404 HEX INVERTER	1
6	5281-09235-00	IC11	74LS10 TRIPPLE 3 INVERTER	1
7	5280-08973-00	IC12	7408 QUAD AND	1
8	5340-09409-X0	IC13,IC16	2114-45 1K X4 STATIC RAM	2
9	5281-09246-00	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
10	5341-09553-00	IC20	ROM 2K X8 LOWER	1
11	5341-09554-00	IC17	ROM 4KX8 UPPER	1
12	5430-08972-00	IC18,IC36	MC6821 PIA	2
13	5340-09017-00	IC19	MC 501 CMOS RAM	1
14	5431-09449-00	IC23	MC 1455 PPI TIMER	1
15	5280-09073-00	IC24,IC32,IC33	7400 QUAD 2 INPUT NAND	3
16	5310-09236-00	IC25	4020 CMOS 14 BIT COUNTER	1
17	5310-09237-00	IC10	4071 CMOS QUAD 2 INPUT NOR	1
18	5281-09247-00	IC5,IC31	74150 QUAD 2 INPUT NOR	2
19	5280-09407-X0	IC34	7447 BCD TO 7 SEG LED DISP	1
20	5271-09411-00	IC35	MAN 72A 7 SEG LED DISP	1
21	5019-09238-00	IC28,IC29	13 DIP RES./PACK 4.7K OHM	2
22	5019-09223-00	IC37	15 DIP RES./PACK 10K OHM	1
23	5645-09025-00	DS1,DS2	8 STD DIP SWITCHES	2
24	5075-09018-00	ZR1	IN5996 ZENER DIODE 6.8V	1
25	5075-09059-00	ZR2	IN5990 ZENER DIODE 3.9V	1
26	5070-08919-00	D17,D19	1N4148 DIODE	18
27	5160-08938-00	Q3-Q9	2N4401 PNP TRANSISTOR	7
28	5160-09016-00	Q1,Q2	2N4403 PNP TRANSISTOR	2
29	5070-09266-00	D18	1N5817 DIODE	1
30	5520-09020-00	CRI	CRYSTAL 3.58 MHZ	1
31	5010-09358-00	R5,R9,R20	RESISTOR FC 1K OHM 5% 1/4W	3
32	5010-08983-00	R2,R6-R8,R21,R28	RESISTOR FC 3.3K OHM 5% 1/4W	6
33	5010-08991-00	R13-R18,R29,R33-R35,R40,R42	RESISTOR FC 4.7K OHM 5% 1/4W	13
34	5010-09086-00	R22	RESISTOR FC 6.8K OHM 5% 1/4W	1
35	5010-09036-00	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	5010-09024-00	R1,R3	RESISTOR FC 10K OHM 5% 1/4W	2
39	5010-09241-00	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 10MFD 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,C64-C82,C85,C86	CAPACITOR CERAMIC 470PFD 50V	43
53				
54	SEE NOTE		SWITCH MOMENTARY	2
55	5881-09021-00		BATTERY HOLDER #171	1
56	5791-09026-00	W1	HEADER 09-64-1083 8 PIN	5
57	5791-09028-00	W3,W4	HEADER 09-65-1041 4 PIN	2
58				
59	5791-09027-00	W2,W5-W7	HEADER 09-65-1091 9 PIN	4
60	5791-09043-00	W8	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	5010-09534-00	W3,W6,W8,W10,W11,W14,W17,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

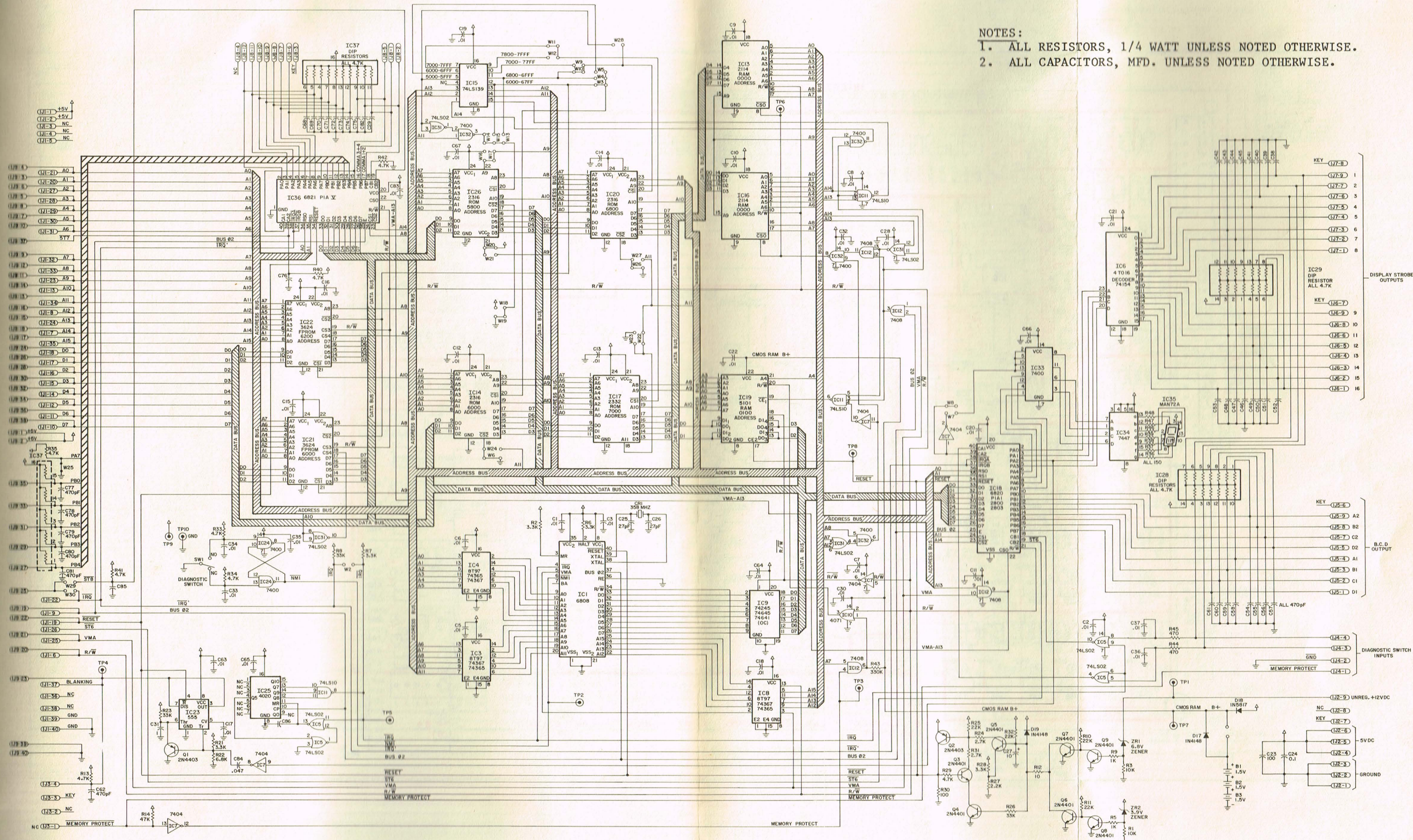
TOLERANCES		QTY.		ASSEMBLY ON	
UNLESS OTHERWISE SPECIFIED					
FRACTIONAL	±1/64"				
DECIMAL	±.005"				
HOLE DIA.	±.005 - .000"				
ANGULAR	±1/8°				
CONCENTRICITY	±.005"				
SCREW THREADS	CLASS 2				

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267-2240

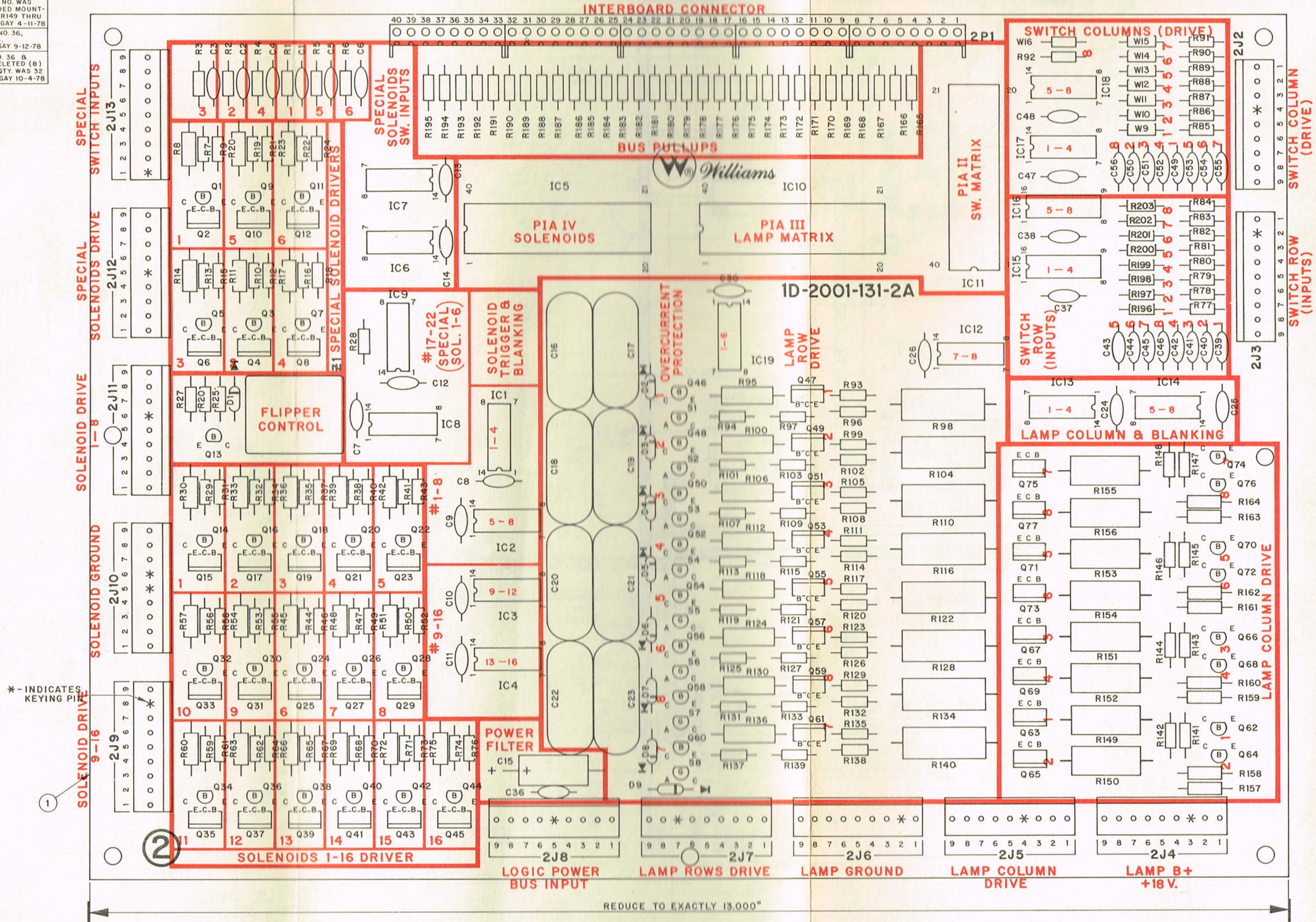
PIN BALL CPU SUB-ASSEMBLY

DATE: 9-20-80
SCALE: D-8342

Item No. 11 was	10/10/80
5341-09233-00	
Item No. 12 was	
5341-09234-00	
REVISION LETTER	REVISION
BY	

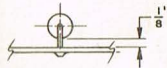


REVISION	REVISION
C	REVISED AND REDRAWN R. GAY 11-28-77
D	ITEM NO. 28, PT. NO. WAS 5A-8999 & ADDED MOUNT- ING NOTE FOR R149 THRU R156. R. GAY 4-11-78
E	DELETED ITEM NO. 36, PT. NO. 5A-8995. E.C.O. R. GAY 9-12-78
F	ADDED ITEM NO. 36 & ITEM NO. 22, DELETED (8) RESISTORS & QTY WAS 32 E.C.O. 4624 R. GAY 10-4-78

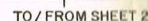


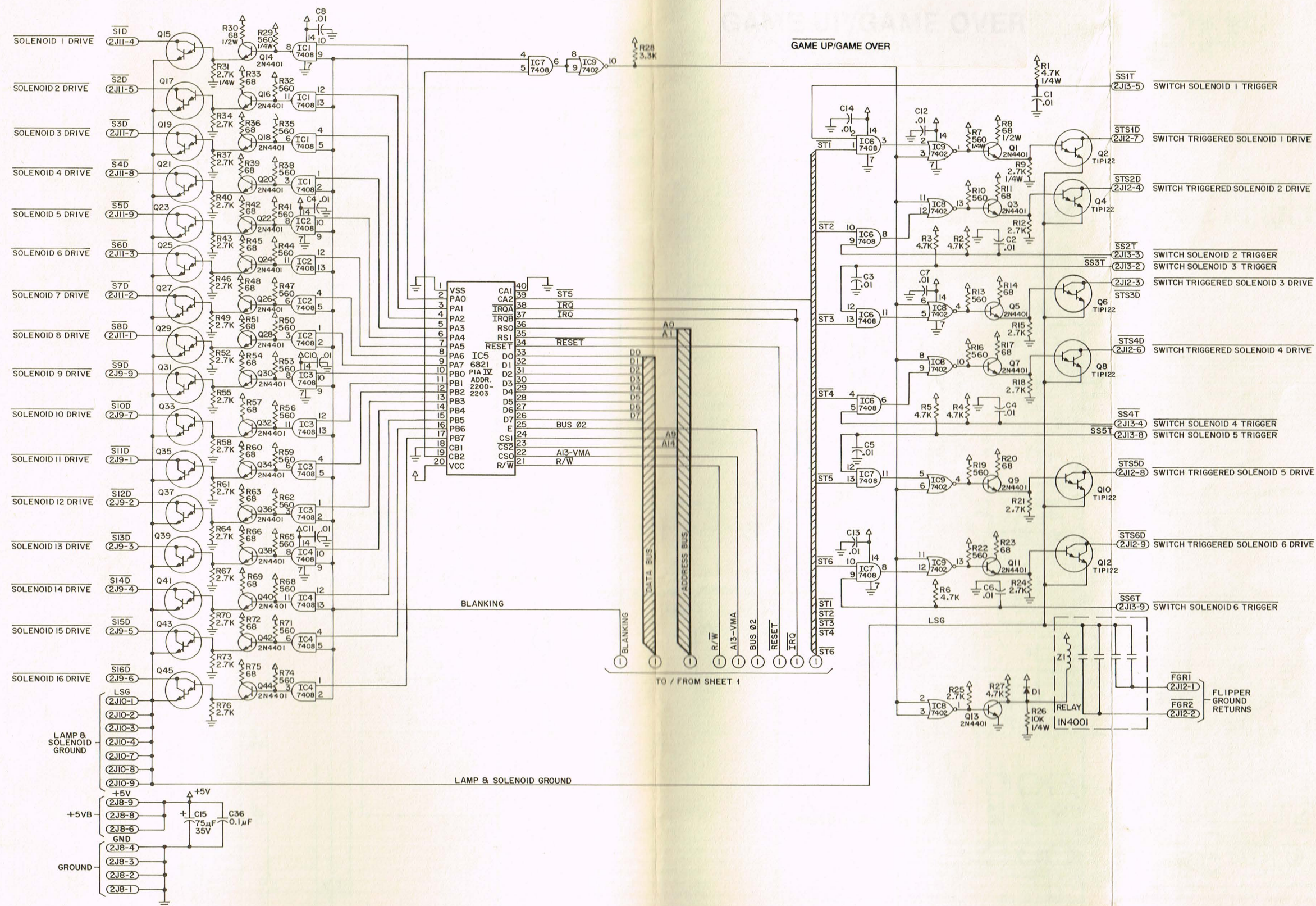
BILL OF MATERIAL				
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-131		BARE P.C. BOARD	1
2	5A-8948	IC8, IC9	N7402 QUADRUPLE 2 INPUT POSITIVE NOR GATE	2
3	5A-8974	IC12, IC17, IC18, IC19	N7406 HEX. INVERTER BUFFER DRIVERS W/ OPEN COLLECTOR HIGH VOLTAGE OUTPUTS	4
4	5A-8973	IC1 THRU IC4, IC6, IC7, IC13, IC14	N7408 QUADRUPLE 2 INPUT POSITIVE 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, 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 C4, 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 R195	RESISTOR, FC, 47 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	R86, R97, R102, R103, R108, R109, R114, R115, R121, R122, R126, R127, R132, R133, R139, R139, R196 THRU R203	RESISTOR, FC, 1 K 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	5
35	5A-9027	2J2 THRU 2J3	9 PIN HEADER	12
36	5A-C534	W9 THRU W16	RESISTOR, FC, 0 OHM, 1/4 W	8

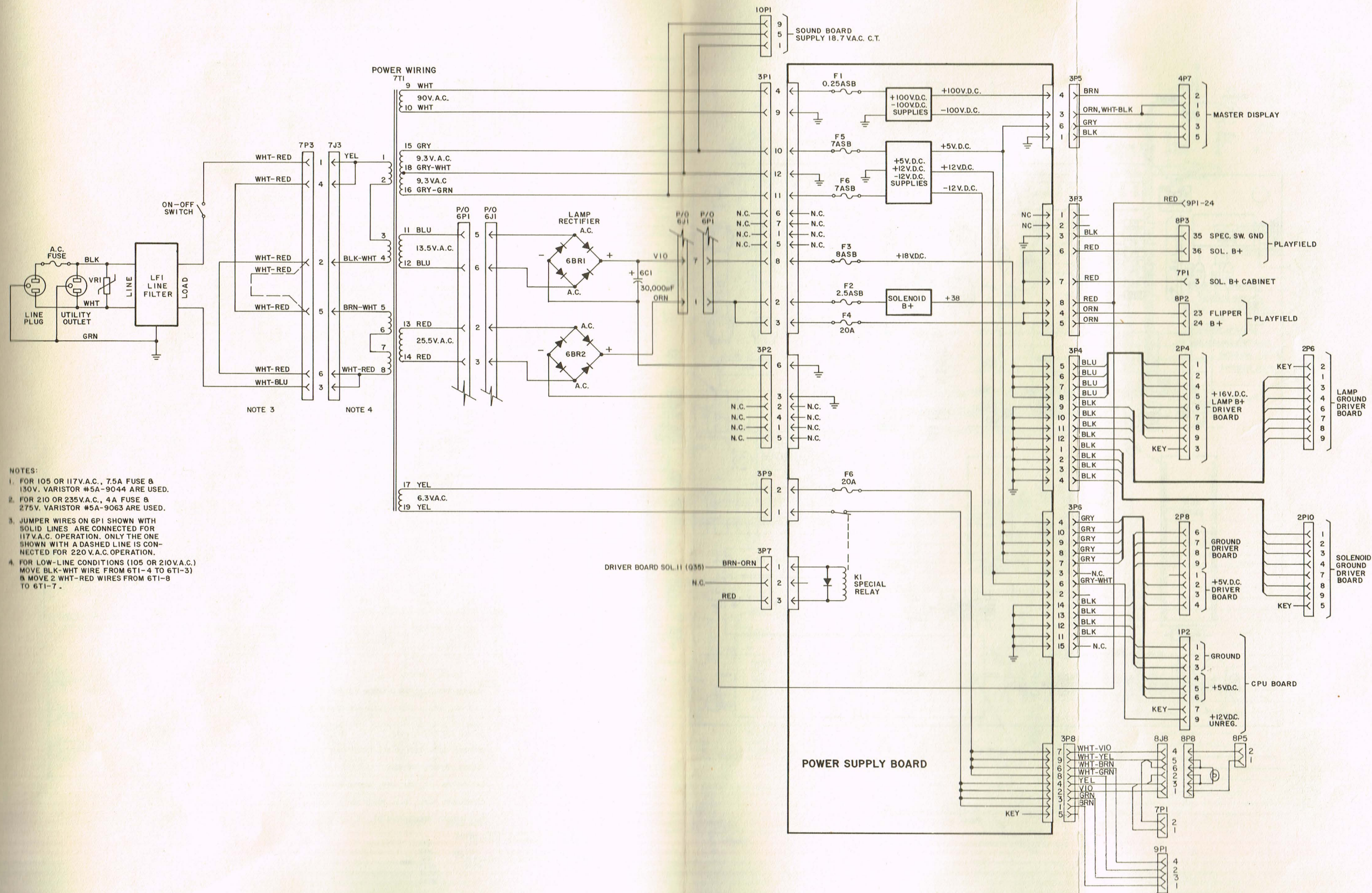
★ R149 THRU R156 MUST BE MOUNTED 1" ABOVE SURFACE OF BOARD.

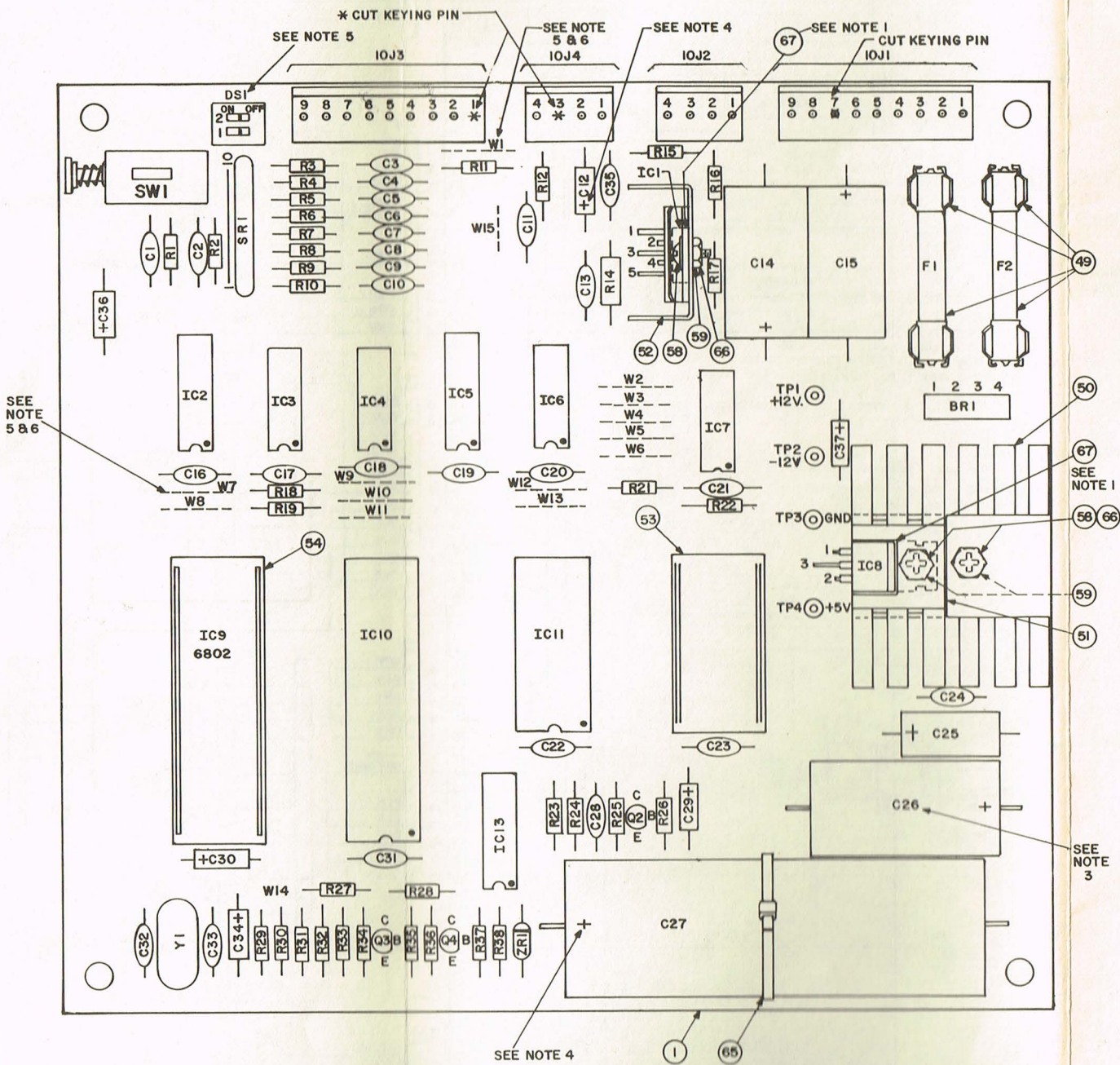


WILLIAMS ELECTRONICS, INC.				
SUBSIDIARY OF XCOR CORPORATION				
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240				
PART NAME	DATE	APP'D.	SCALE	PART NO.
DRIVER BOARD ASSEMBLY	8-16-77		2:1	D-7997









BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	01-2 01-146-6		BARE P.C. BOARD REV F	1
2	5370-09156-00	IC1	TDA 2002 V AUDIO AMPLIFIER	1
3	5280-09012-00	IC2	7442 BCD-DEC DECODER	1
4	5280-09073-00	IC3	7400 QUAD 2 INPUT NAND	1
5	5280-08973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5310-09153-00	IC5	4050 BUFFER	1
7	5310-09154-00	IC6	4068 8 INPUT NAND GATE	1
8	5310-08971-00	IC7	4069 HEX INVERTER	1
9	5250-09157-00	IC8	7805 5 VOLT REG. W/TO 220 CASE	1
10	5430-08972-00	IC10	6821 P.I.A.	1
11	5340-09003-00	IC11	6810 RAM	1
12	5371-09152-00	IC13	1408 D/A CONVERTER	1
13	5160-08938-00	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5075-09018-00	ZR1	1N5996A 6.8V ZENER DIODE	1
16				
17	5100-09357-00	BR1	MDA 200/3N253	1
18	5100-09158-00		BRIDGE RECTIFIER	0
19	5520-09020-00	Y1	3.58 MHz CRYSTAL	1
20	5010-08991-00	R1,R18,R19,R21,R22, R27,R30,R31, R32	RESISTOR, FC, 4.7K OHM, 5% 1/4 WATT	9
21	5010-09036-00	R2 thru R10	RESISTOR, FC, 100 OHM, 5% 1/4W	9
22	5010-09358-00	R12,R15,R28,R36,R38	RESISTOR, FC, 1K OHM, 5% 1/4W	5
23	5010-09181-00	R14	RESISTOR, FC, 1 OHM, 10% 1/2 WATT	1
24	5010-09161-00	R16	RESISTOR, FC, 2.2 OHM, 5% 1/4 WATT	1
25	5010-09361-00	R17	RESISTOR, FC, 220 OHM, 5% 1/2 WATT	1
26	5010-08983-00	R23, R24, R26	RESISTOR, FC, 3.3K OHM, 5% 1/4 WATT	3
27	5010-09179-00	R25	RESISTOR, FC, 3.3M OHM, 5% 1/4 WATT	1
28	5010-09035-00	R29	RESISTOR, FC, 47K OHM, 5% 1/4 WATT	1
29	5010-09034-00	R33, R35, R37	RESISTOR, FC, 10K OHM, 5% 1/4 WATT	3
30	5010-09039-00	R34	RESISTOR, FC, 10 OHM, 5% 1/4 WATT	1
31	5043-08980-00	C1, C16 thru C23, C31	CAPACITOR, CER. .01 MFD. 50V. +80%, -20%	10
32	5043-09065-00	C2 thru C10	CAPACITOR, CER. 470 PFD. 50V. +-20%	9
33	5043-09345-00	C11	CAPACITOR, CER. .001 MFD. +-20% 100V.	1
34	5040-09365-00	C12, C30, C36	CAPACITOR, ELECT. 1 MFD. 63V. -10 +50%	3
35	5043-08996-00	C13, C24, C35	CAPACITOR, CER. .1 MFD. 50V. +-20%	3
36	5040-09165-00	C14	CAPACITOR, ELECT. 1,000 MFD. 16V. +-20%	1
37	5040-09164-00	C15	CAPACITOR, ELECT. 470 MFD. 10V. +-20%	1
38	5040-08986-00	C25	CAPACITOR, ELECT. 100 MFD. 10V. +-20%	1
39	5040-08893-00	C26	CAPACITOR, ELECT. 1,000 MFD. 25V. +-20%	1
40	5040-09376-00	C27	CAPACITOR, ELECT. 4700 MFD. 16V. +-20%	1
41	5043-09180-00	C28	CAPACITOR, CER. 47 PFD. 1K V. +-20%	1
42	5040-09343-00	C29	CAPACITOR, ELECT. 10 MFD. 20V	1
43	5043-09169-00	C32, C33	CAPACITOR, CER. DISC, 27 PFD. 1KV. +-10%	2
44	5041-09163-00	C34	CAPACITOR, TANTALUM 2.2 MFD. 15V. +-20%	1
45	5041-09031-00	C37	CAPACITOR, TANTALUM 1 MFD. 25V. +-20%	1
46	5641-09658-00	SW1	MOMENTARY SWITCH SPDT	1
47	5645-09330-00	DS1	2 STD. DIP SWITCH	1
48	5731-06314-00	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5732-09178-00		FUSEHOLDER	4
50	5705-09172-00		HEAT SINK THERMALLOY #6072B	1
51	5705-09173-00		HEAT SINK THERMALLOY #6071B	1
52	5705-09199-00		HEAT SINK THERMALLOY #6030	1
53	5700-09004-00		24 PIN SOCKET	1
54	5700-08985-00		40 PIN SOCKET	1
55	5791-09027-00	10J1, 10J3	9 PIN MALE CONNECTOR 09-65-1091	2
56	5791-09028-00	10J2, 10J4	4 PIN MALE CONNECTOR 09-65-1041	2
57				
58	4006-01003-06		6-32x3/8" P-PH-S	3
59	4406-01117-00		6-32 HEX NUT	3
60	5010-09534-00		0 OHM RESISTOR	A/R
61	5824-09248-00	TP1 THR TP4	TERMINAL #1502-1	4
62	5010-09363-00	R11	RESISTOR, FC, 5.6K OHM 5% 1/4 WATT	1
63				
64	5019-09362-00	SR1	RESISTOR, 4.7K OHM 10 PIN SIP	1
65	03-7520-1		TIE WRAP	1
66	4703-00007-00		#6 EXT. LOCKWASHER	3
67	20-9229		THERMAL COMPOUND	.01

NOTES:

1. USE THERMAL COMPOUND BETWEEN IC1 AND IC8, AND HEAT SINKS.

2. CAUTION: AVOID STATIC DISCHARGE DAMAGE TO MOS LOGIC.

3. SYMBOLS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY. DO NOT SCREEN OR STAMP.

4. OBSERVE INDEX MARK OF ALL INTEGRATED CIRCUITS;

DIODES D1, D2, AND ZR1;

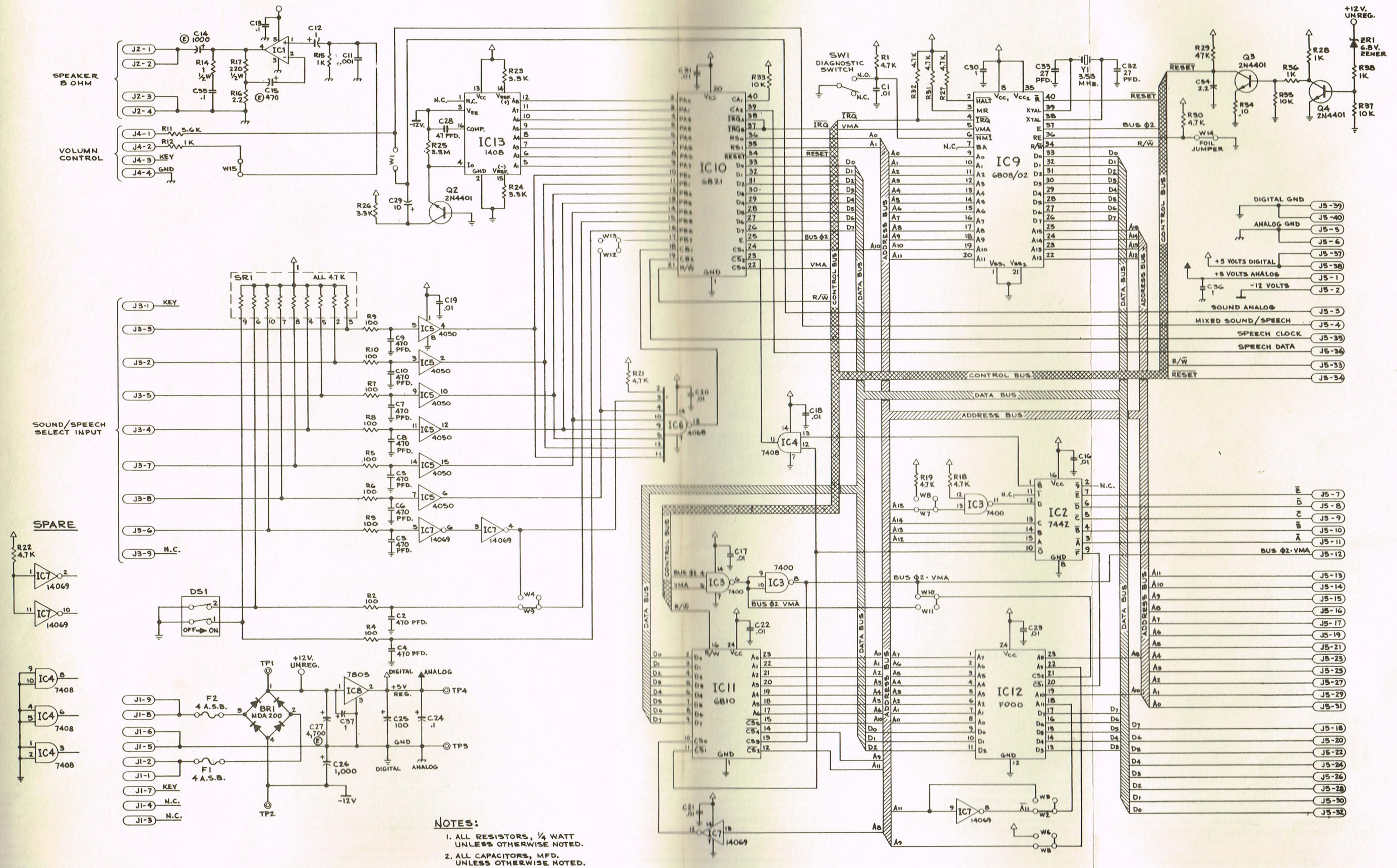
CAPACITORS C12, C14, C15, C25, C26, C27;

CONNECTORS 10J1, 10J2, 10J4, 10J3, 10J5;

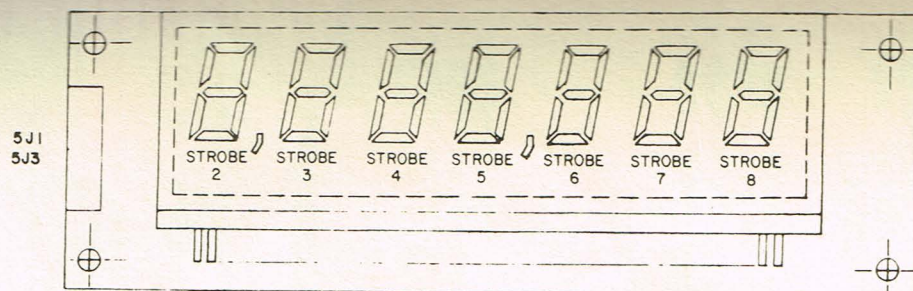
POSITION OF TRANSISTORS Q1, Q2, Q3, Q4.

5. JUMPERS

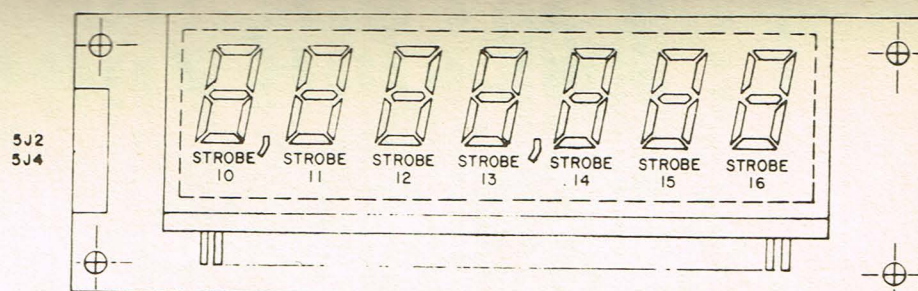
W2) W3)
W5) W4)
W9) IN W6) OUT
W10) W11)
W12) W13)



PLAYERS #1



PLAYERS #2



4J1/5J1 (PLAYER 1)

1	100,000's
2	-100V KEEP ALIVE
3	1,000,000's
4	f SEGMENT
5	N/C
6	g 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

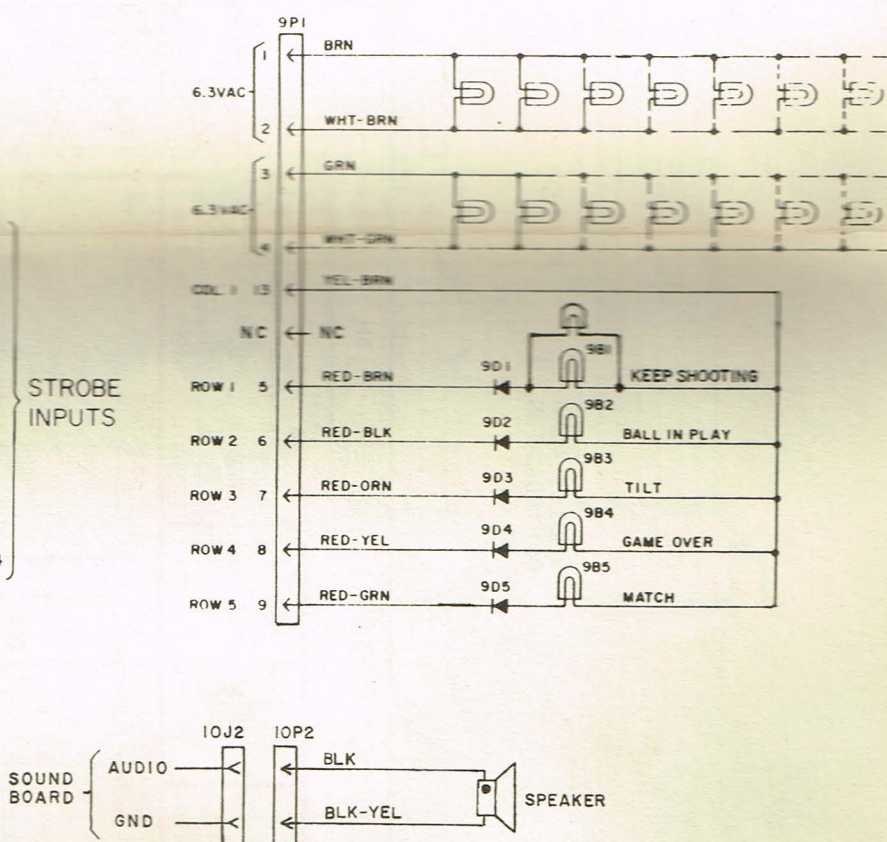
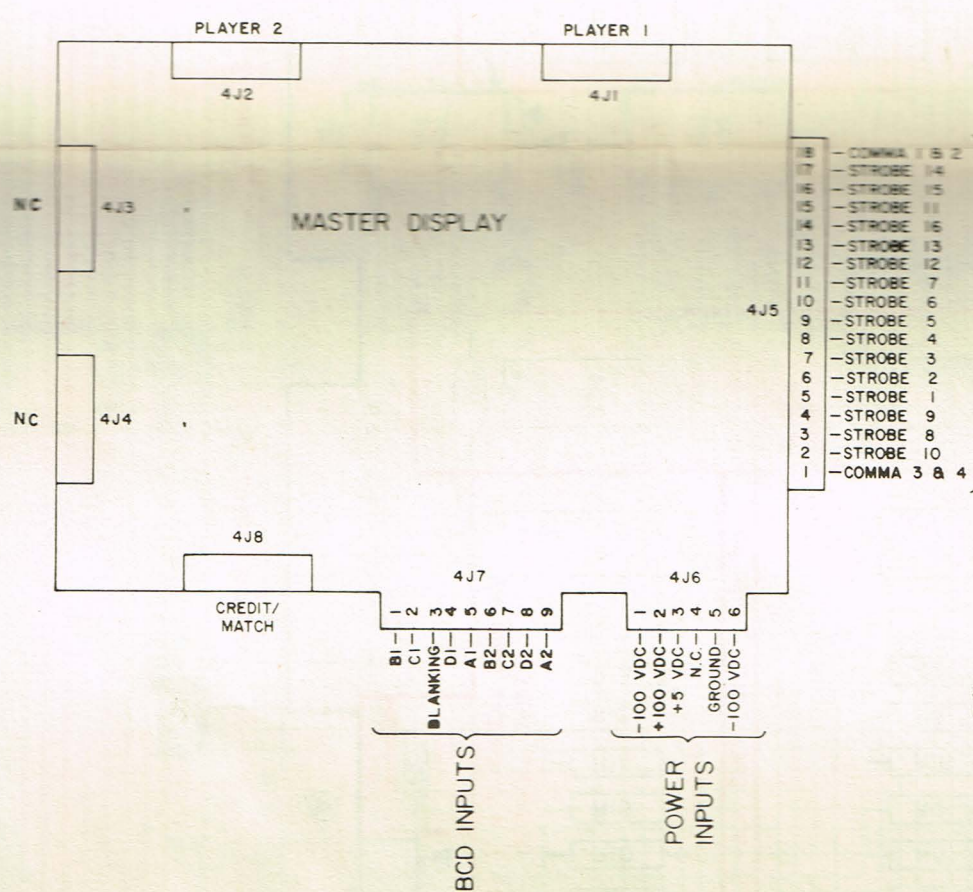
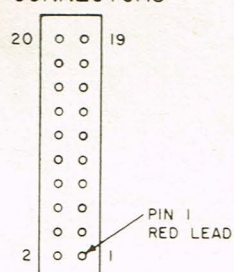
4J2/5J2 (PLAYER 2)

1	100,000's
2	-100V KEEP ALIVE
3	1,000,000's
4	f' SEGMENT
5	N/C
6	g' 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

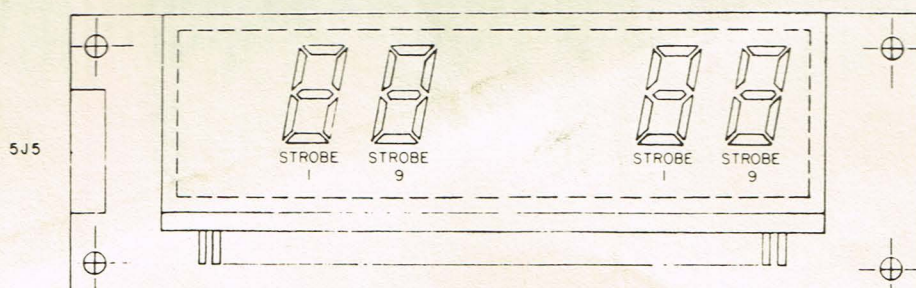
4J8/5J5 (CREDIT/MATCH)

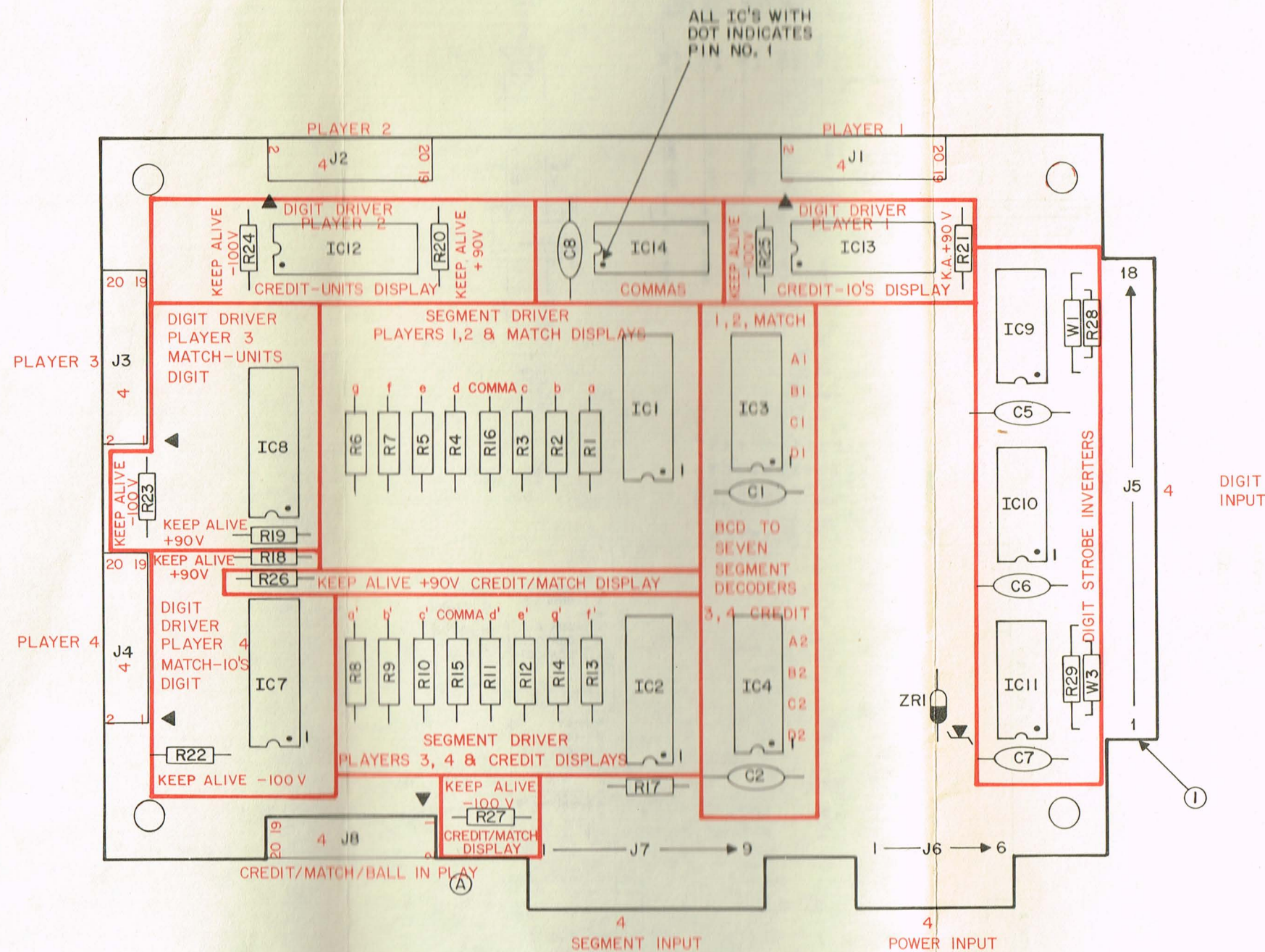
1	f' Segment (Credit)
2	-100V Keep Alive
3	e' Segment
4	g' Segment
5	c' Segment
6	d' Segment
7	b' Segment
8	10's
9	Units
10	a' Segment
11	e Segment
12	f Segment
13	10's
14	d Segment
15	+100V Keep Alive
16	c Segment
17	g Segment
18	b Segment
19	Units
20	a Segment

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



CREDITS / BALL IN PLAY

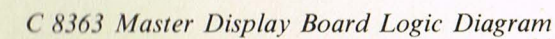




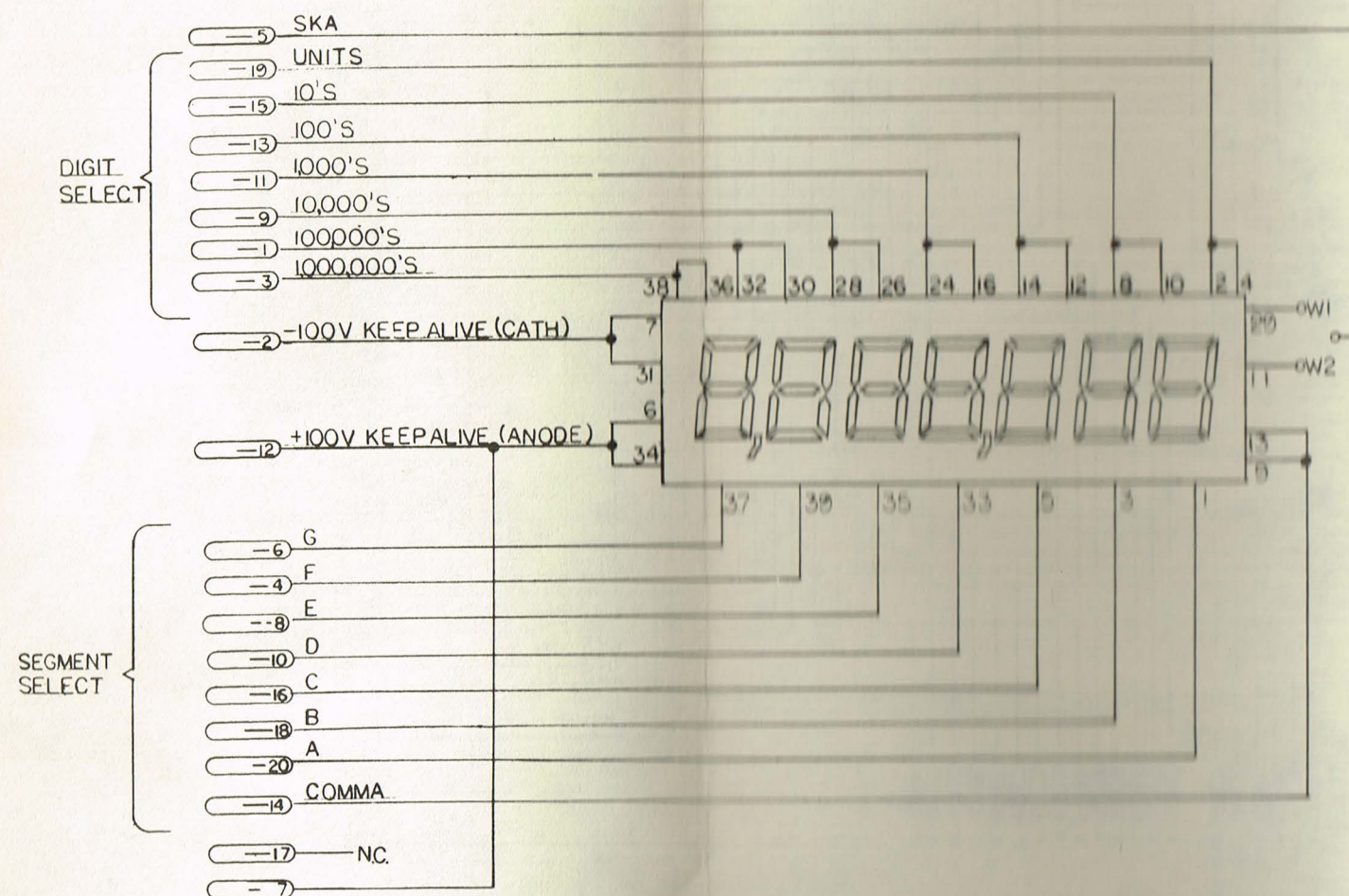
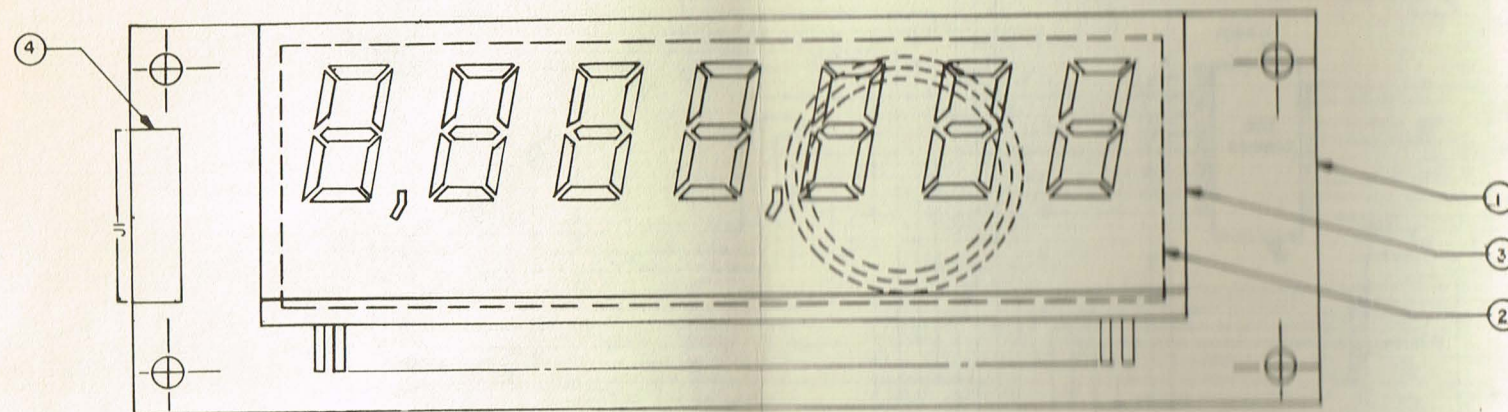
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5760-09461		BARE P.C. BOARD	1
2	5310-08971	IC9, IC10, IC11	MC14069 HEX INVERTER	3
3	5310-08970	IC3, IC4	MC14543 BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER	2
4	5680-08969	IC1, IC2	UDN-7180 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
5	5680-08968	IC7, IC8, IC12, IC13	UDN-6184A OR UDN-6118A GAS DISCHARGE DISPLAY SEGMENT DR.	4
6	5310-09450	IC14	MC14081 QUAD 2-INPUT AND GATE	1
7	5010-08981	R1-R14	RESISTOR, FC, 10K OHM, 5%, 1/2 WATT	14
8	5075-09135	ZR1	IN4740A ZENER DIODE 10V, 5%, 1 WATT	1
9	5043-08980	C1, C2 C5 THRU C8	CAPACITOR, CERAMIC, 0.01 MFD., 50V, +80 -20%	6
10	5010-09035	R28, R29	RESISTOR, FC, 47K OHM, 5%, 1/4 WATT	2
11	5010-09086	R17	RESISTOR, FC, 6.8K OHM, 5%, 1/4 WATT	1
12	5010-08982	R18 THRU R27	RESISTOR, FC, 3 MEG. OHM, 5%, 1/4 WATT	10
13	5791-09437	J1 THRU J4, J8	20 PIN RIBBON HEADER	5
14	5010-09149	R15, R16	RESISTOR, FC, 15K OHM, 5%, 1/2 WATT	2
15	5010-09534	W1, W3	RESISTOR, 0 OHM	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)

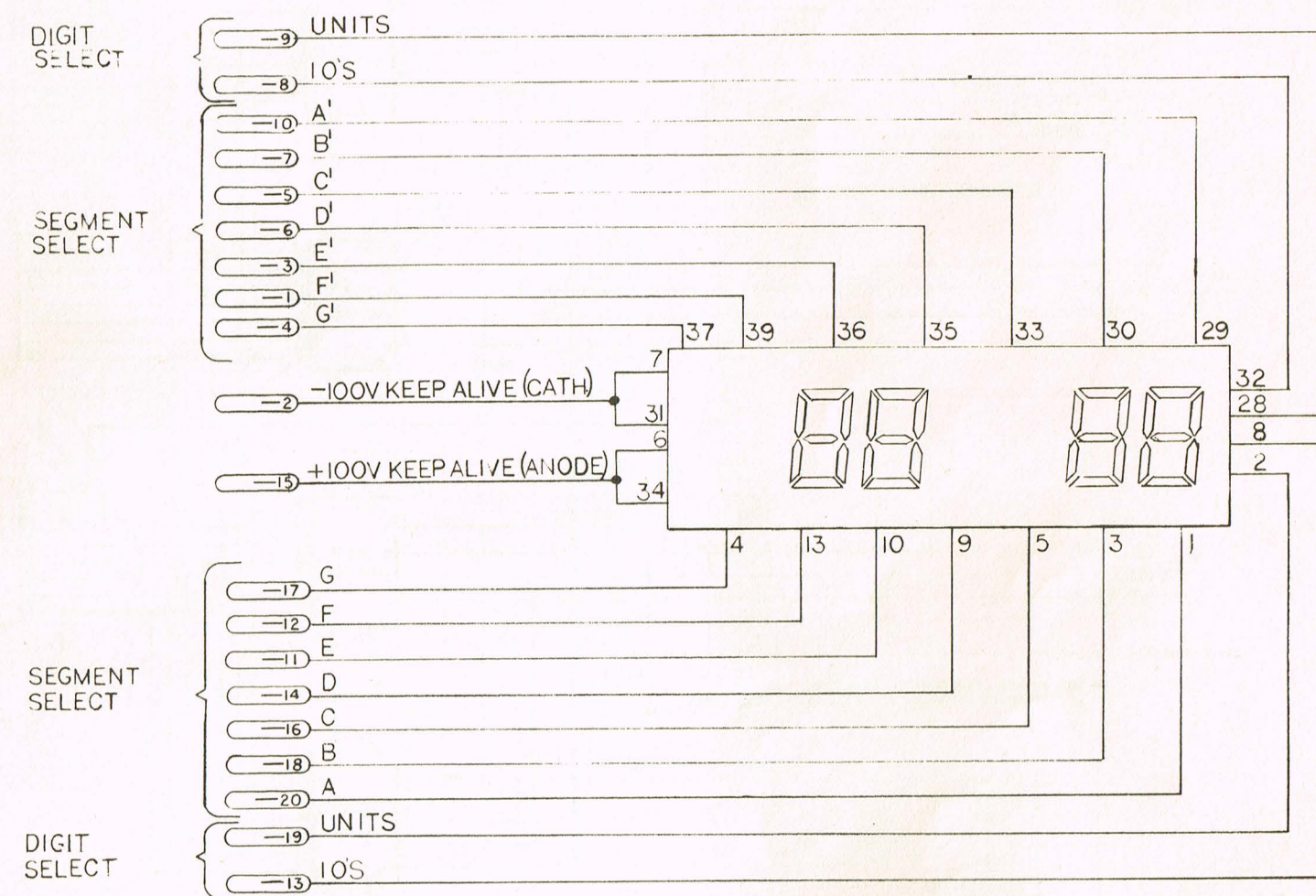
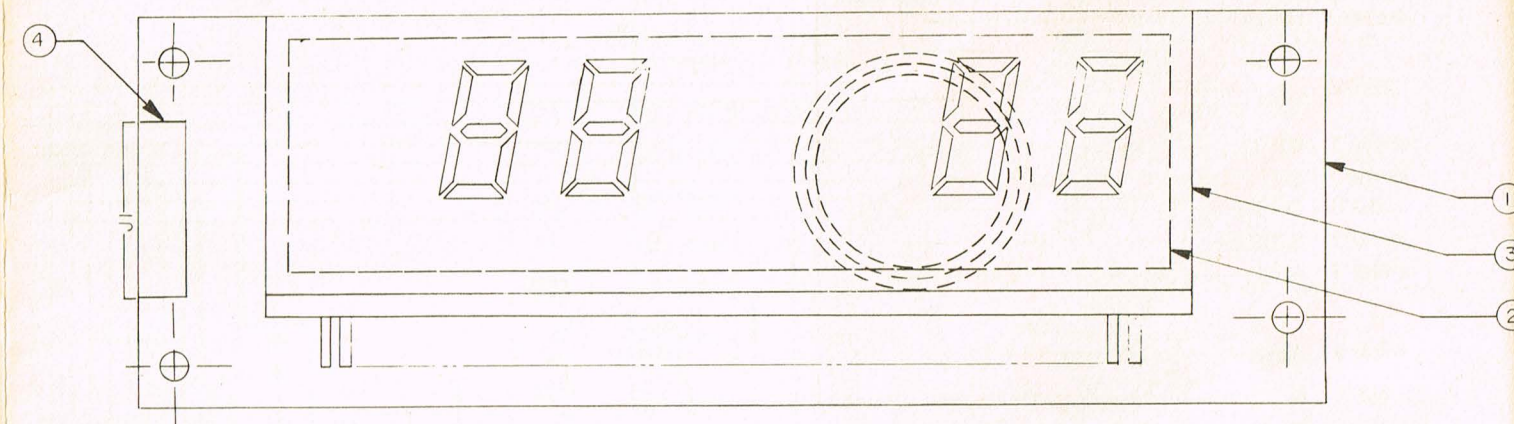


BILL OF MATERIAL				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D
1	5161-09448-XP		SLAVE DISPLAY P.C. BOARD	1
2	23-6545		DISPLAY MTG ADHESIVE FOAM	1
3	5610-09448-XP		7 DIGIT DISPLAY	1
4	5781-09438-XP	J1	20 PIN RIBBON HEADER	1
5	03-1513-2		CAPLUG	1

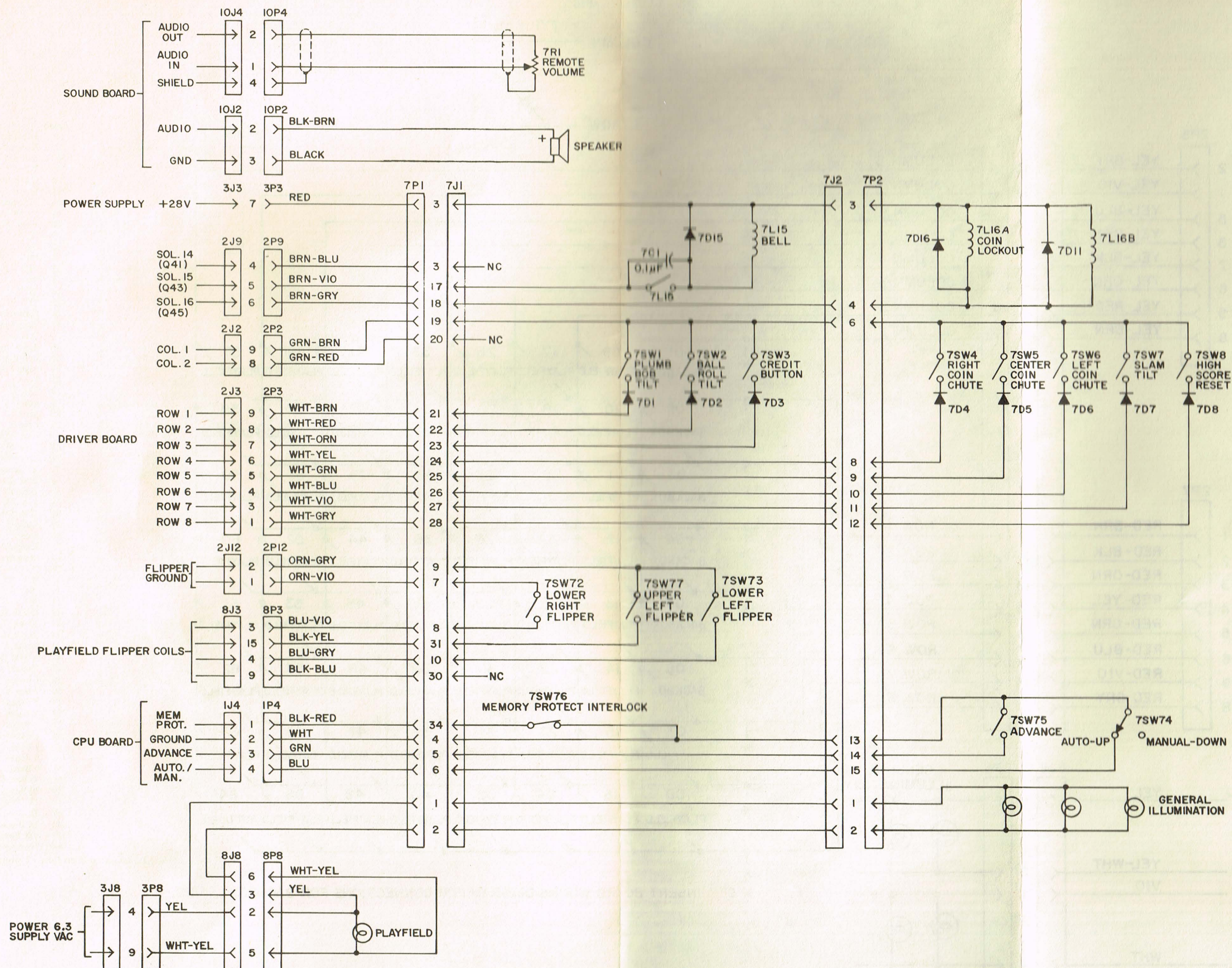


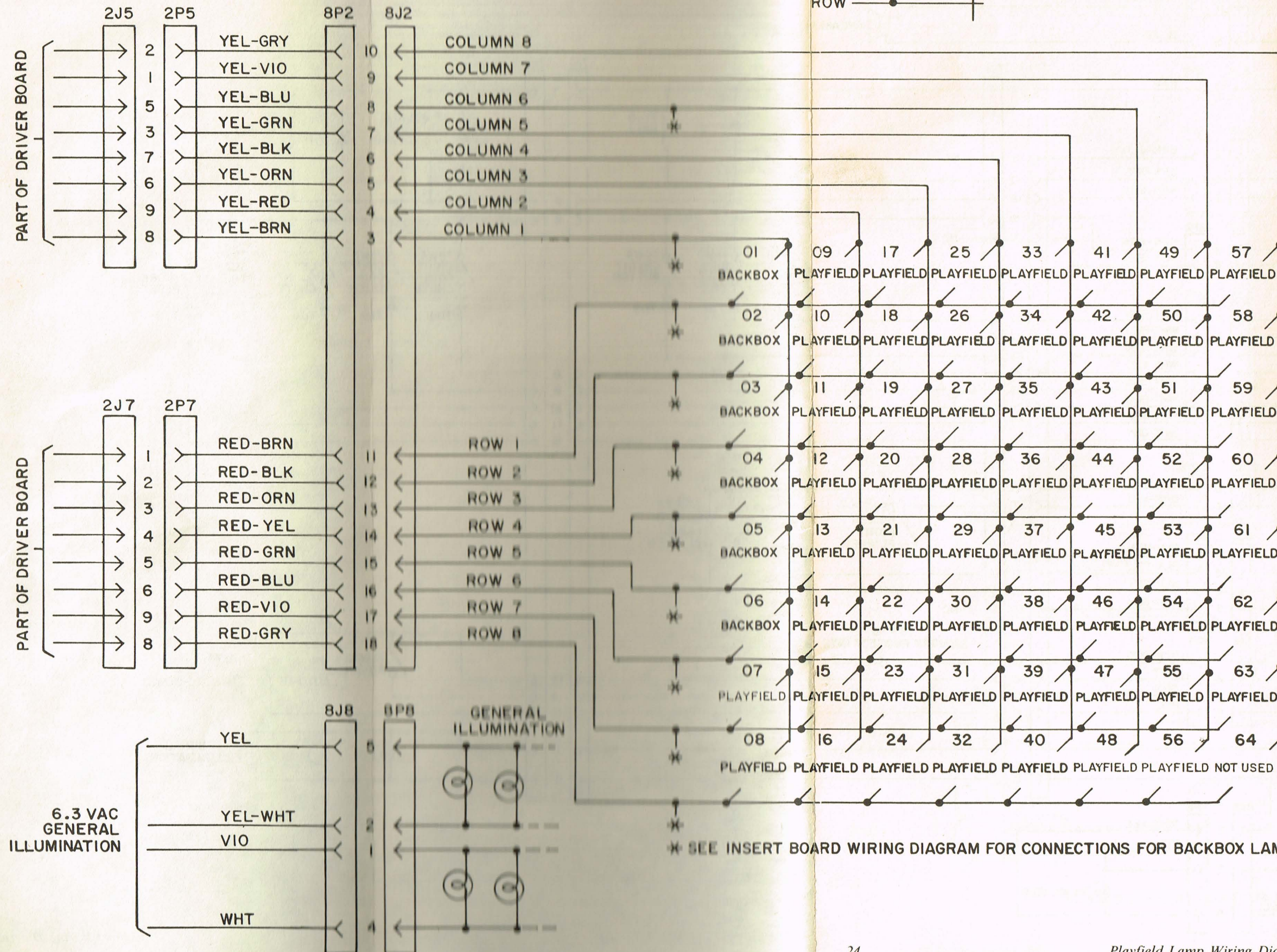
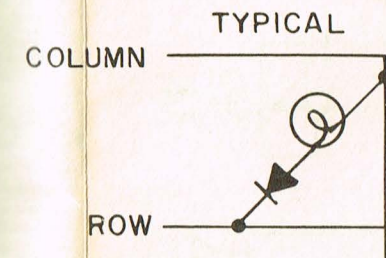
C 8364 PLAYER SLAVE DISPLAY

BILL OF MATERIAL				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D
1	5161-09448-00		CREDIT/MATCH SLAVE P.C. BOARD	1
2	23-6545		FOAM DISPLAY - BACK	1
3	5610-09448-00		4 DIGIT DISPLAY	1
4	5781-09438-00	J1	20 PIN RIBBON HEADER	1
5	23-6546		FOAM DISPLAY - FRONT	1
6	03-1513-2		CAPLUG	1



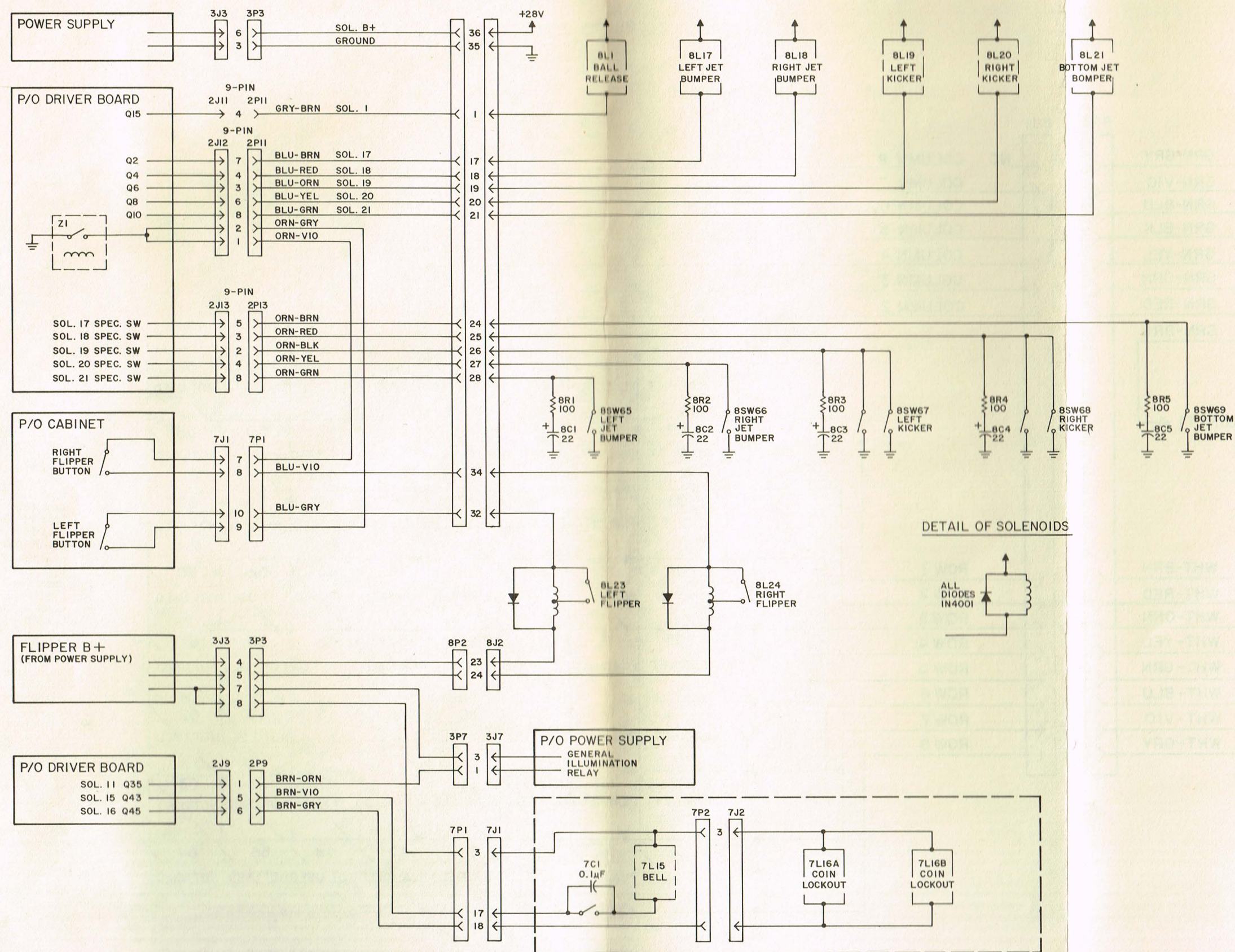
C 8365 CREDIT/MATCH SLAVE DISPLAY

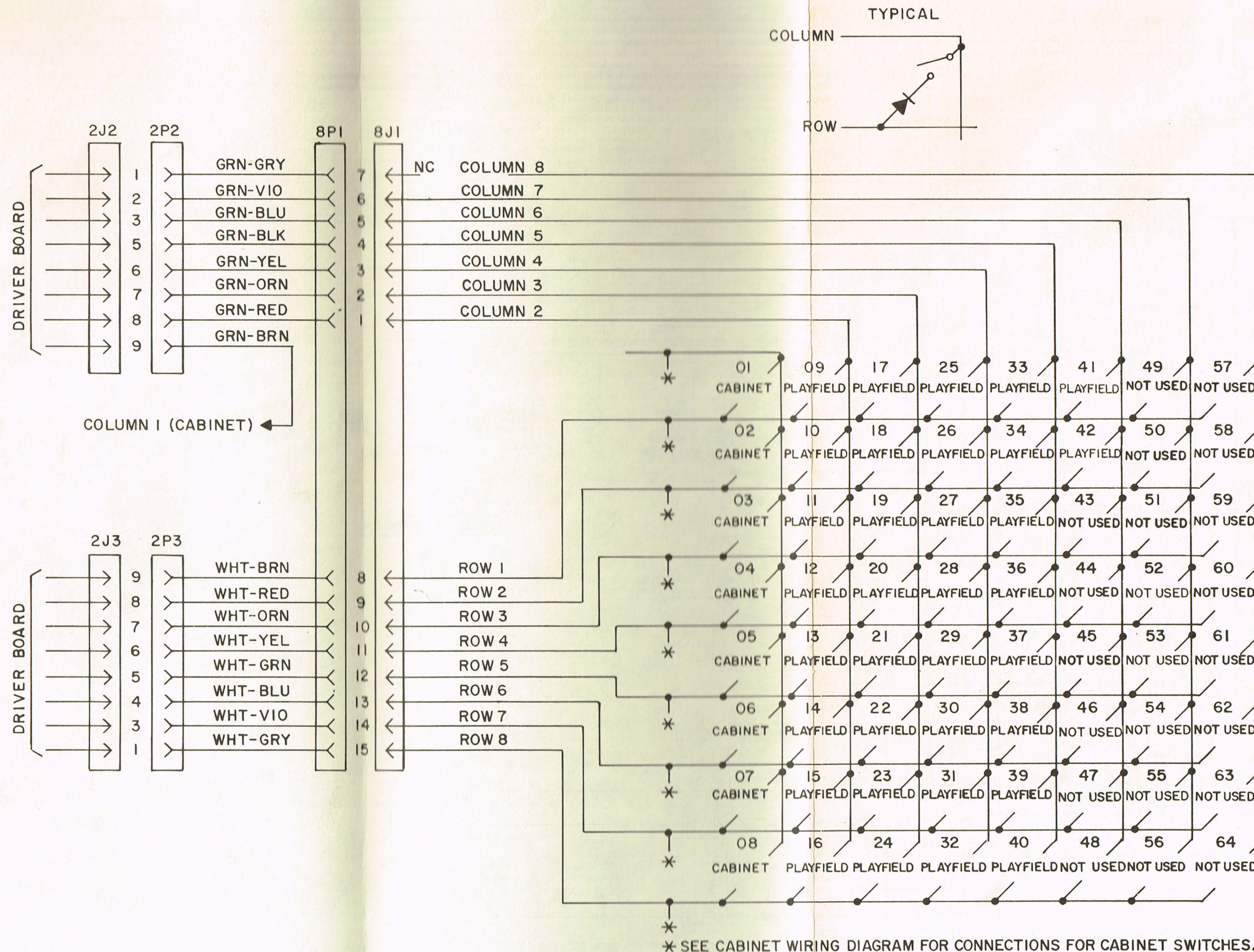




Lamp No.	Function
*01	Keep Shooting
*02	Ball in Play
*03	Tilt
*04	Game Over
*05	Match
*06	High Score
07	50,000 When Lit
08	Keep Shooting
09	"F"
10	"A"
11	"N"
12	"T"
13	"A"
14	"S"
15	"Y"
16	Turn Around Left
17	Turn Around Right
18	Left Drain Lane
19	Right Drain Lane
20	Left Flipper Return Lane
21	Right Flipper Return Lane
22	Lane 1
23	Lane 2
24	Lane 3
25	Lane 4
26	Lane 5
27	Lane 30,000
28	Lane 60,000
29	Lane 90,000
30	All Score Multi-Arrow
31	Time 2X
32	Time 3X
33	Time 4X
34	Time 5X
35	Ramp T
36	Ramp I
37	Ramp M
38	Ramp E
39	"T"
40	"I"
41	"M"
42	"E"
43	10,000 Turn Around
44	20,000 Turn Around
45	30,000 Turn Around
46	40,000 Turn Around
47	50,000 Turn Around
48	100,000 Turn Around
49	1 Bonus
50	2 Bonus
51	3 Bonus
52	4 Bonus
53	5 Bonus
54	6 Bonus
55	7 Bonus
56	8 Bonus
57	9 Bonus
58	10 Bonus
59	20 Bonus
60	2X Bonus Multiplier
61	3X Bonus Multiplier
62	5X Bonus Multiplier
63	10X Bonus Multiplier
64	Not Used

*These Lamps are on Insert Door, all others are on Playfield.





Switch No. Function* (Score)

01	Plumb Bob Tilt
02	Ball Roll Tilt
03	Credit Button
04	Right Coin Switch
05	Center Coin Switch
06	Left Coin Switch
07	Slam Tilt
08	High Score Reset
09	"F" 1000*
10	"A" 1000*
11	"N" 1000*
12	"T" 1000*
13	"A" 1000*
14	"S" 1000*
15	"Y" 1000*
16	Left Turnaround*†
17	Right Turnaround*†
18	Left Drain Lane 5000 + 1 Bonus Advance
19	Right Drain Lane 5000 + 1 Bonus Advance
20	Left Flipper Return Lane 1000 (10,000 When Lit)
21	Right Flipper Return Lane 1000 (10,000 When Lit)
22	Lane 1 1000*
23	Lane 2 1000*
24	Lane 3 1000*
25	Lane 4 1000*
26	Lane 5 1000*
27	Lower Left Standup Target 10
28	Upper Left Standup Target 10
29	Upper Top Right Standup Target 10
30	Upper Center Right Standup Target 10
31	Upper Bottom Right Standup Target 10
32	Lower Right Standup Target
33	Top Left Jet Bumper 1000
34	Right Jet Bumper 1000
35	Bottom Left Jet Bumper 1000
36	Ramp Standup Target Timetube 5000 **
37	Left Kicker 10
38	Right Kicker 10
39	Outhole
40	Flipper Lane Change
41	Playfield Tilt
42	Left Lane Switch 5000††
43-64	Not Used

* 2000 with full bonus.

† Score lit value when both switches are made in direction of lit arrow and advances mushroom jump value to 10K, 20K, 30K, 40K, 50K, 100K. Making with 100K lit lights special. Making in wrong direction reduces value.

** Lights flashing letter in T-I-M-E.

†† Advances mushroom jump value to 10K, 20K, 30K, 40K, 50K, 100K.

