Williams®

16P-503-101
Game No. 503
April, 1981

JUNGLE LORD

or service call TOLL-FREE:
00-621-4765
In Illinois call
800-972-7898

Williams®
ELECTRONICS, INC.

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

FOREWORD

This instruction and drawing set provides essential installation information unique to JUNGLE LORD. 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, 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

Either earlier model D 7997 or later model D 8341 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. Later D 8341 boards do not use series resistors in the switch matrix.

Sound Board

1. D 8224 required for speech
2. Must be jumpered for white-labeled sound ROM operation and be equipped with Sound ROM 3. (Jumpers W2, W5, W7, W9, W10, W12, and W15 connected; W3, W4, W6, W8, W11, and W13 removed).

Power Supply Board

1. D 8345 board (equipped with relay) 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 5T5031 (IC7), 5T5032 (IC5), and 5T5033 (IC6) Speech ROMs.

CONTENTS

Williams ELECTRONICS, INC.

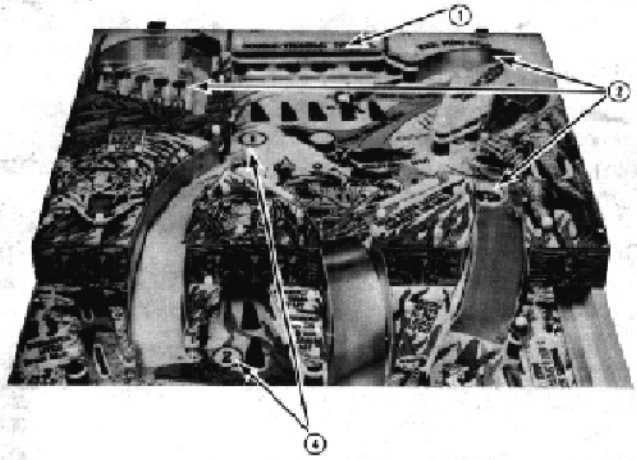
16P-503-102
February, 1981

JUNGLE LORD

SUMMARY OF FEATURES

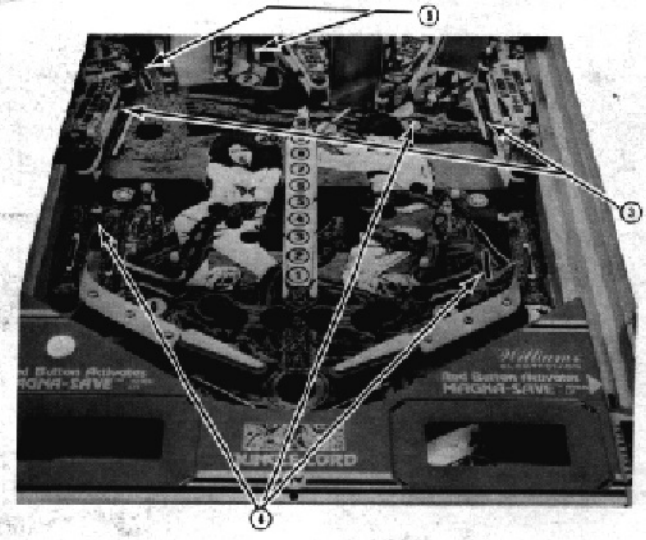
In the Williams tradition, Jungle Lord is loaded with new features, both for player appeal and reliability. This summary sheet is provided to give you a better initial understanding of the game.

PLAYER FEATURES



① Double Trouble™ Scoring

The five bank drop targets located on the upper playfield start with one target showing. Hit that target and two targets appear; knock those down and three emerge, and on to four and then five. Demolishing the last sequence of five targets qualifies the player for **Double Trouble** scoring. A single target pops up; make it for 10,000 and **Double Trouble** targets pop up one at a time at random and must be hit within a certain time period before they drop. The first target hit collects 20,000 points, doubles to 40,000 for the second target, on to 80,000 for the third, to a maximum of 160,000. Any target not hit in time drops the scoring back to 10,000. For even more interesting playfield action, it is even possible to achieve 2X scoring with **Double Trouble**.



② Multi-Ball™ Play

The mini-playfield with a captive mini-ball and four lanes spell out LORD. Making one of the two upper playfield eject holes kicks the mini-ball out to roll down one of the four lanes lighting a letter in LORD. Going down the #4 inside rollover lights the red arrow at the bottom of the right ramp; going up the ramp into the eject hole gives two kicks on the mini-playfield. Completing a lower playfield 3-bank (adjustable) also spots a letter in LORD. When LORD is completely lit, **Multi-Ball** play is enabled. A shot to either of the two top playfield eject holes locks up the ball in play. A second ball is released to be shot onto the playfield. As soon as the second ball is shot, the eject hole releases the locked up ball for 2-ball, 35 second (adjustable) **Multi-Ball** play. Should one of the two balls drain with time left, then another shot to the eject hole will kick out the drained ball for more **Multi-Ball** shooting time. Completely re-lighting LORD during **Multi-Ball** play scores Special.

③ Magna-Save™ Feature

Hitting any drop target on the lower level banks will light timer lights for the **Magna Save** feature. Build up to five time units on each side of the playfield for use in saving draining balls. Players direct the number of seconds used for **Magna Save** via the left and right red control buttons forward of the flipper control buttons for spectacular playfield saves.

④ 2X Scoring

Hitting the variously placed number targets and rollovers clearly marked 1, 2, 3, 4, and 5 with one ball gives a shooter double scoring for the remainder of that balls play.

⑤ Bonus X and Drain Shield

The inside bottom rollover lanes, marked 4 and 5, light the timed green arrow located in front of the turnaround for bonus multiplier. Making the turnaround shot within a certain period of time collects 2X, 3X, 5X to 10X. When 10X is made, if the ball rolls down either rollover lane again, the amber arrow in front of the horseshoe is lit and that spots the left or right drain shield. Whenever the drain shield is lit and the ball drains on the lit side, the ball is returned to the shooter and play continues. Making the horseshoe through the difficult left entrance shot gives a player an automatic drain shield.

TECHNICAL FEATURES

Drop Targets
5-Bank targets are individually reset and simultaneously released similar to Alien Poker drop targets to allow drop target memory. 3 Bank targets are similar to those used in Black Knight. Both types of target banks use blade-type switches that remain closed with the target down.

Ball Ramp Mechanism
For the 2-Ball **Multi-Ball** feature, microswitches are used on the ball ramp. These switch mechanisms are essentially adjustment-free and will provide problem-free operation.

Lower Flippers Hotter
The power for the upper playfield flippers is routed through the lower flipper EOS switches. No power to an upper flipper until the lower flipper EOS switch opens means stronger lower playfield flippers. Power for the upper flippers is in series with the low-impedance lower flipper pull-in winding, providing weaker action appropriate to the small upper playfield.

New Design Power Supply Board
The fuse card is gone; the Special "BLACKOUT" relay is mounted on the board. General Illumination 6.3 VAC is routed through the Power Supply.

Driver Board
As in Black Knight, complex playfield features result in numerous closed switches. This requires that the switch matrix column drive series resistors (R204 thru R211) on the Driver Board be replaced with zero-ohm resistors or jumpers.

PLAY ADJUSTMENTS

Function 31 - **Multi-Ball** timer - Continuously adjustable from 15 to 99 seconds. Adjusting the timer affects average ball time and the difficulty of winning a special. The factory recommended setting is 35 seconds.

Function 32 - Special Difficulty - The moderate factory setting of 00 allows letters in LORD to be spotted during **Multi-Ball** play by completing a 3-bank, with the conservative 01 setting, letters in LORD are spotted only from the mini-playfield during **Multi-ball** play.

Function 33 - **Double Trouble** timing - This adjustment controls the time a player has to make the **Double Trouble** drop target before it is released. Setting it to a higher number results in increased player scores; a lower setting in decreased player scores.

Function 34 - **Double Trouble** reset timing (0-99) - This adjustment controls the "penalty" time before a target is reset when not made before it is released during a **Double Trouble** scoring sequence.

Function 35 - **Multi-Ball** play difficulty - With conservative 01 setting, the last letter in LORD cannot be spotted by completing a 3-bank of drop targets. This will make achieving **Multi-Ball** play more difficult.

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 five 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 five 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 wires under wing nut and washer at bottom of backbox.

K. Loosely position remote volume cable and Sound Board power cable in harness and plug connector 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 termination. 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 lose wire termination. Reseat any loose wires by pushing in on the termination.

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.

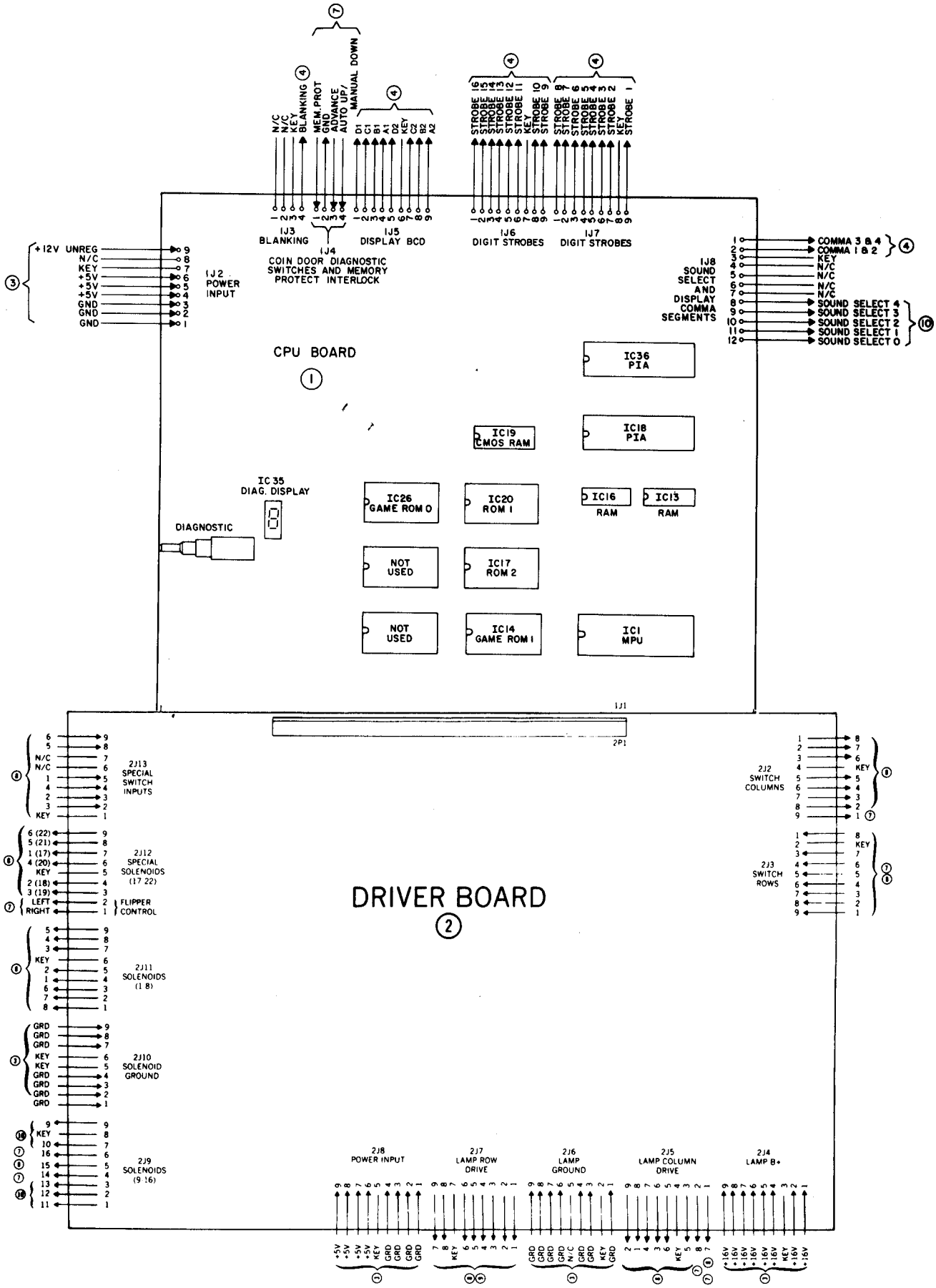
a. If the game now comes on in the game over mode the bookkeeping and game evaluation totals have been reset to zero.

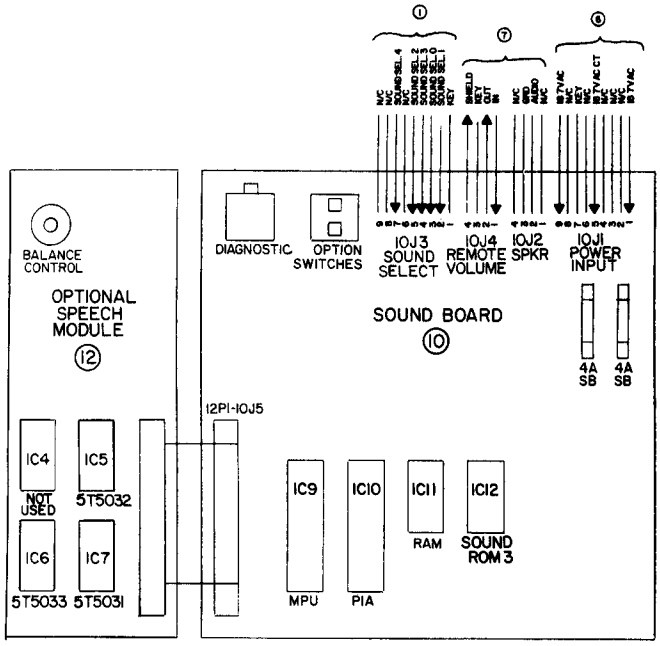
b. If the game still comes on in the diagnostic mode, open the coin door and turn the game OFF, and ON twice. This is an indication of the batteries being removed with the power OFF or coming loose during shipment. This has also resulted in features reverting to factory settings. Any changes from factory settings must be reentered using procedures provided in the instruction booklet.

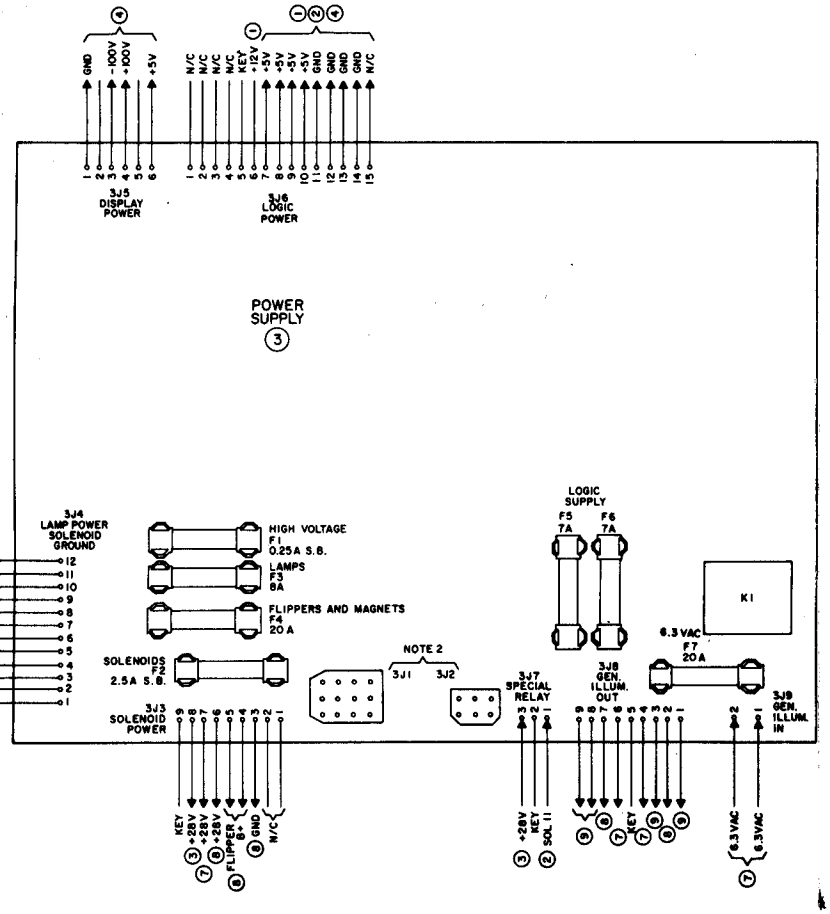
3. If the game still comes on in the diagnostic mode, refer to troubleshooting procedures in the maintenance manual.

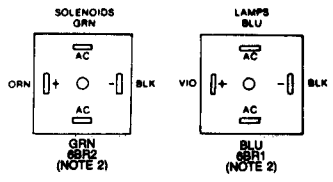
4. Insert mini-ball through opening in plastic at the upper left corner of the upper playfied and place two balls on playfield next to outhole.

5. Perform diagnostic tests and make any desired changes to features as described in the instruction booklet.


CPU BOARD
1
IC36 PIA
IC19 CMOS RAM
IC18 PIA
IC35 DIAG. DISPLAY
DIAGNOSTIC
IC26 GAME ROM 0
IC20 ROM 1
IC16 RAM
IC13 RAM
NOT USED
IC17 ROM 2
NOT USED
IC14 GAME ROM 1
IC1 MPU
1J1
2P1
1J2 POWER INPUT
1J3 BLANKING
1J4 COIN DOOR DIAGNOSTIC SWITCHES AND MEMORY PROTECT INTERLOCK
1J5 DISPLAY BCD
1J6 DIGIT STROBES
1J7 DIGIT STROBES
1J8 SOUND SELECT AND DISPLAY COMMA SEGMENTS
+12V UNREG
N/C
KEY
+5V
+5V
+5V
GND
GND
GND
COMMA 3 & 4
COMMA 1 & 2
SOUND SELECT 4
SOUND SELECT 3
SOUND SELECT 2
SOUND SELECT 1
SOUND SELECT 0
DRIVER BOARD
2
2J13 SPECIAL SWITCH INPUTS
2J12 SPECIAL SOLENOIDS (17 22)
LEFT FLIPPER
RIGHT CONTROL
2J11 SOLENOIDS (1 8)
2J10 SOLENOID GROUND
2J9 SOLENOIDS (9 16)
2J2 SWITCH COLUMNS
2J3 SWITCH ROWS
2J8 POWER INPUT
2J7 LAMP ROW DRIVE
2J6 LAMP GROUND
2J5 LAMP COLUMN DRIVE
2J4 LAMP B+
LAMP GROUND
+16 VDC LAMPS
SOLENOID GROUND

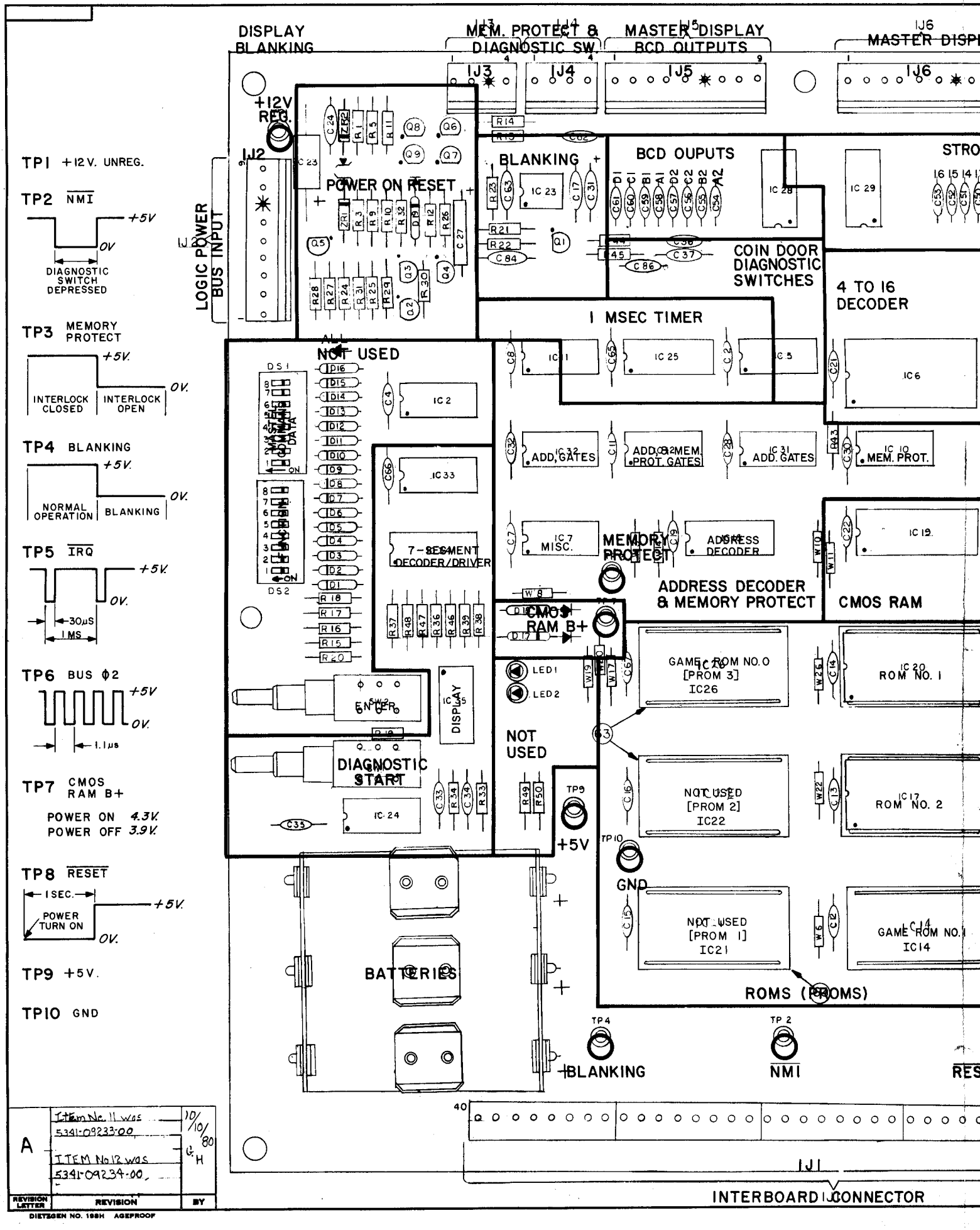






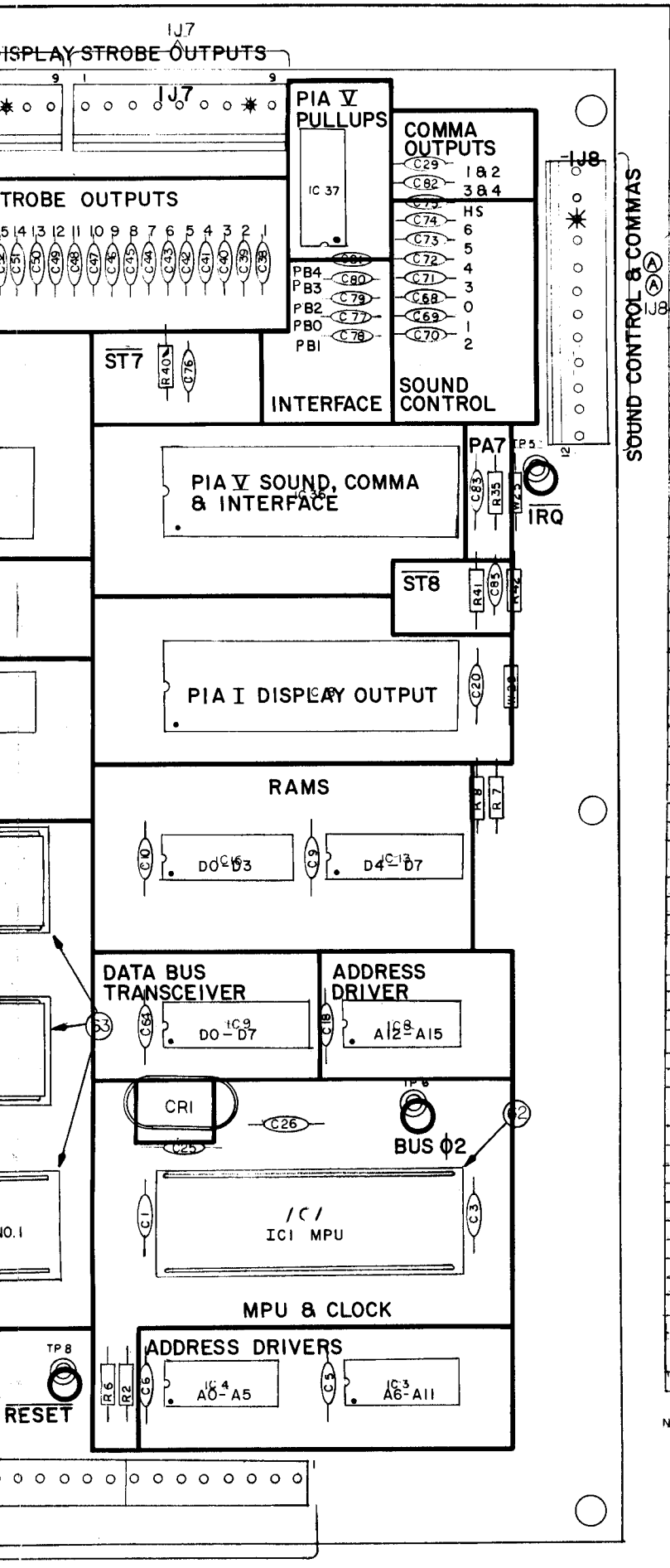
NOTES:

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.



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

DIETZGEN NO. 198H AGEPROOF

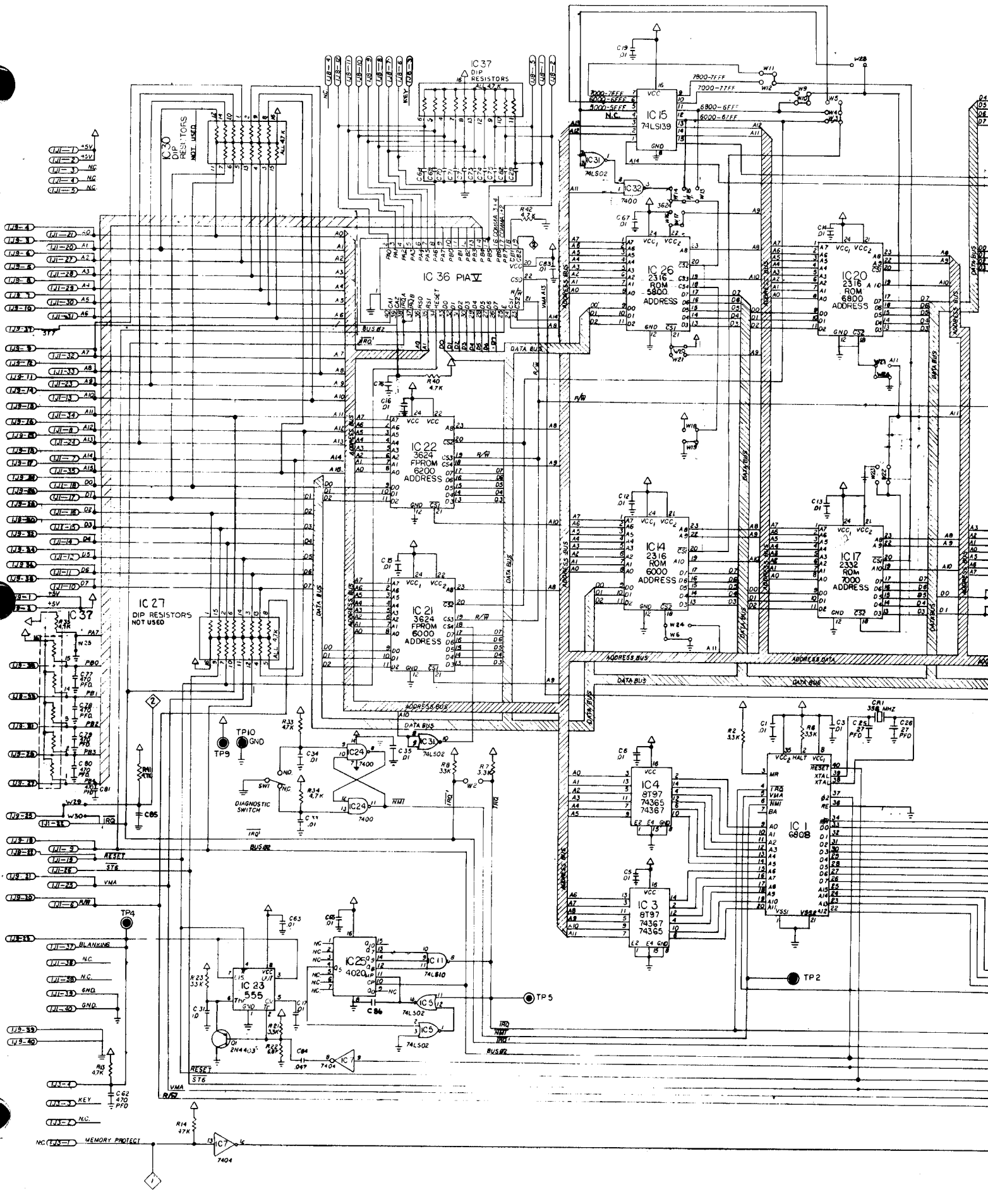


BILL OF MATERIAL

ITEM NO	PART NO	PART DESIGNATION	DESCRIPTION	REQD NO
1	5764-09465-X0		BARE P.C. BOARD CPU	1
2	5280-09408-X0	IC2	74125 HEX TRISTATE BUFFER	1
3	5370-08989-00	IC3,IC4,IC8	8T97 HEX TRISTATE BUFFER	3
4	5281-09308-X0	IC9	74LS245 OCTAL BUFFER	1
5	5280-09010-00	IC6	74154 4 TO 16 DECODER	1
6	5280-09013-00	IC7	7404 HEX INVERTER	1
7	5281-09235-00	IC11	74LS10 TRIPPLE 3 INVERTER	1
8	5280-08973-00	IC12	7408 QUAD AND	1
9	5340-09409-X0	IC13,IC16	2114-45 1K X4 STATIC RAM	2
10	5281-09246-00	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
11	5341-09553-00	IC20	ROM 2K X8 LOWER	1
12	5341-09554-00	IC17	ROM 4K X8 UPPER	1
13	5430-08972-00	IC18,IC36	MC6821 PIA	2
14	5340-09017-00	IC19	MC 5101 CMOS RAM	1
15	5431-09449-00	IC 23	MC 1455 PI TIMER	1
16	5280-09073-00	IC24,IC32,IC33	7400 QUAD 2 INPUT NAND	3
17	5310-09236-00	IC25	4020 CMOS 14 BIT COUNTER	1
18	5310-09237-00	IC10	4071 CMOS QUAD 2 INPUT NOR	1
19	5281-09247-00	IC5,IC31	74LS02 QUAD 2 INPUT NOR	2
20	5280-09407-X0	IC34	7447 BCD TO 7 SEG LED DISP	1
21	5671-09411-00	IC 35	MAN 72A 7 SEG LED DISP	1
22	5019-09238-00	IC28, IC29	13 DIP RES./PACK 4.7K OHM	2
23	5019-09223-00	IC37	15 DIP RES/PACK 10K OHM	1
24	5645-09025-00	DS1,DS2	8 STD DIP SWITCHES	2
25	5075-09018-00	ZR1	IN5996 ZENER DIODE 6.8V	1
26	5075-09059-00	ZR2	IN5990 ZENER DIODE 3.9V	1
27	5070-08919-00	D1-D17,D19	IN4148 DIODE	18
28	5160-08938-00	Q3-Q9	2N4401 NPN TRANSISTOR	7
29	5190-09016-00	Q1,Q2	2N4403 PNP TRANSISTOR	2
30	5070-09266-00	D18	IN5817 DIODE	1
31	5520-09020-00	CR1	CRYSTAL 3.58 MHZ	1
32	5010-09358-00	R5,R9,R20	RESISTOR FC 1K OHM 5% 1/4W	3
33	5010-08983-00	R2,R6-R8,R21,R28	RESISTOR FC 3.3K OHM 5% 1/4W	6
34	5010-08991-00	R13-R18,R29, R33-R35,R40-R42	RESISTOR FC 4.7K OHM 5% 1/4W	13
35	5010-09086-00	R22	RESISTOR FC 6.8K OHM 5% 1/4W	1
36	5010-09036-00	R19,R30	RESISTOR FC 100 OHM 5% 1/4W	2
37	5010-09187-00	R36-R39,R46-R50	RESISTOR FC 150 OHM 5% 1/4W	9
38	5010-09113-00	R23,R26	RESISTOR FC 33K OHM 5% 1/4W	2
39	5010-09034-00	R1,R3	RESISTOR FC 10K OHM 5% 1/4W	2
40	5010-09241-00	R25,R32,R10,R11	RESISTOR FC 22K OHM 5% 1/4W	4
41	5010-08998-00	R27	RESISTOR FC 2.2K OHM 5% 1/4W	1
42	5010-09039-00	R12	RESISTOR FC 10 OHM 5% 1/4W	1
43	5010-09442-00	R43	RESISTOR FC 330K OHM 5% 1/4W	1
44	5010-08997-00	R24,R31	RESISTOR FC 27K OHM 5% 1/4W	2
45	5010-09083-00	R44,R45	RESISTOR FC 470 OHM 5% 1/4W	2
46	5043-08980-00	C1-C22,C28,C30 C32-C37,C63-C67 C83	CAPACITOR CERAMIC .01MFD 50V	36
47	5040-08986-00	C23	CAPACITOR ELECT. 100 MFD 10V	1
48	5043-08996-00	C24	CAPACITOR CERAMIC 1 MFD 50V	1
49	5043-09169-00	C25 C26	CAPACITOR CERAMIC 27 PFD 1KV	2
50	5041-09243-00	C27	CAPACITOR TANT. 10 MFD 10V	1
51	5041-09031-00	C31	CAPACITOR TANT. 1MFD 25V	1
52	5043-09030-00	C84	CAPACITOR CERAMIC .047MFD 50V	1
53	5043-09065-00	C29,C38-C62 C68-C82,C85,C86	CAPACITOR CERAMIC 470PFD 50V	43
54	5671-09019-00	LED1,LED2	LED RED	2
55	SEE NOTE	SW1,SW2	SWITCH MOMENTARY	2
56	5881-09021-00		BATTERY HOLDER #171	1
57	5791-09026-00	IJ1	HEADER 09-64-1083 8 PIN	5
58	5791-09028-00	IJ3, IJ4	HEADER 09-65-1041 4 PIN	2
59				
60	5791-09027-00	IJ2, IJ5-IJ7	HEADER 09-65-1091 9 PIN	4
61	5791-09043-00	IJ8	HEADER 09-65-1121 12 PIN	1
62	5700-08985-00		40 PIN IC SOCKET	1
63	5700-09004-00		24 PIN IC SOCKET	6
64	5010-09534-00	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

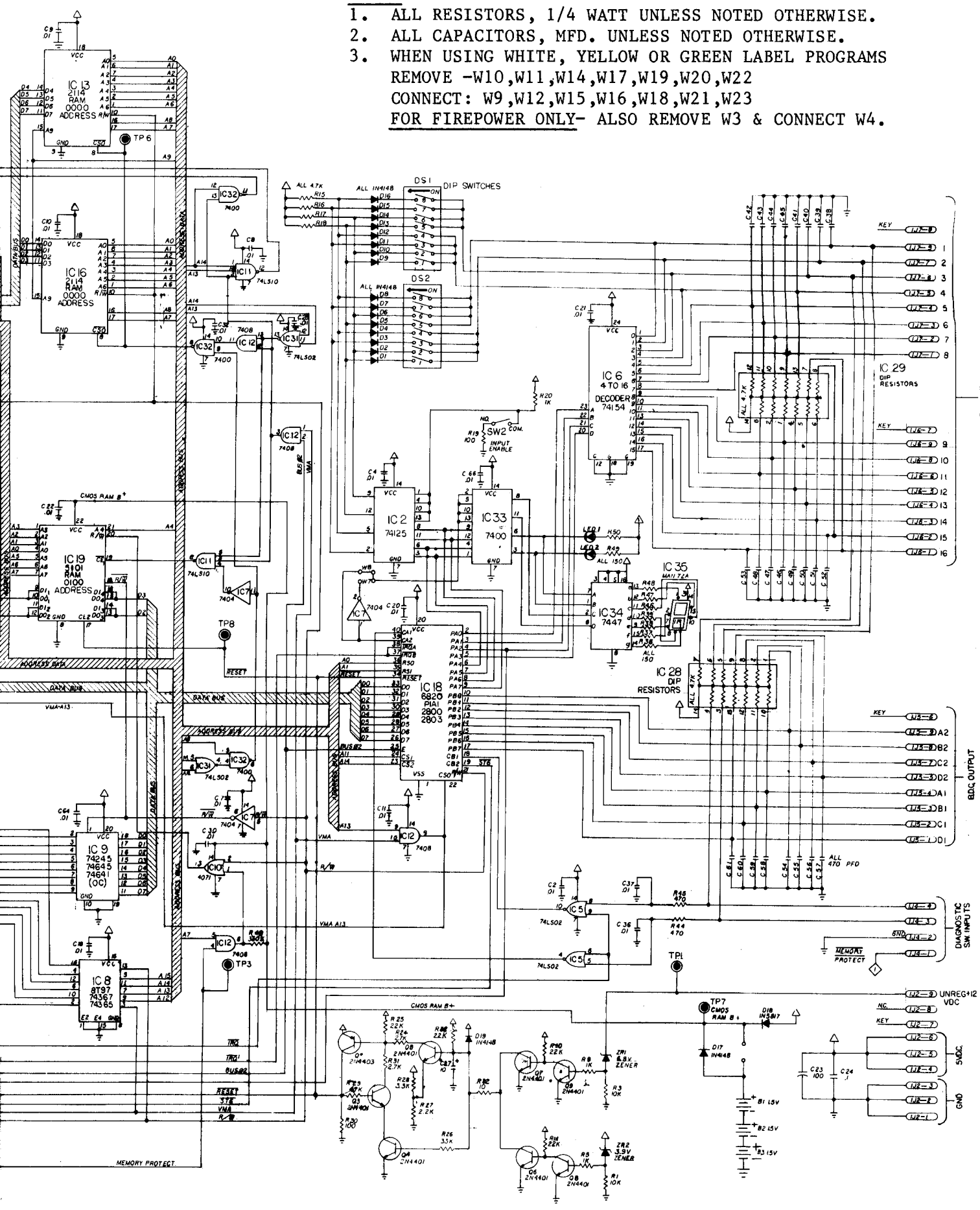
NOTE: USE EITHER 5641-09312-00, 5641-09024-00 OR 5641-09371-00

TOLERANCES		QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED	WILLIAMS ELECTRONICS, INC.		
FRACTIONAL ±1/64"	SUBSIDIARY OF THE SEEBURG CORP.		
DECIMAL .xx ±.005"	3401 N. CALIFORNIA CHICAGO, ILL. 60618		267-2240
HOLE DIA. +.002 -.000"	NAME PIN BALL CPU SUB-ASSEMBLY		
ANGULAR ±1/2°	MATERIAL	HEAT TREATMENT	FINISH
CONCENTRICITIES T.I.R. .005"			
SCREW THREADS CLASS 2			
DWN. S. HOBBS	DATE 9-20-80	APP'D.	SCALE D-8342


IC 1 6808
IC 3 8T97 74367 74365
IC 4 8T97 74365 74367
IC 14 2316 ROM 6000 ADDRESS
IC 15 74LS139
IC 17 2332 ROM 7000 ADDRESS
IC 20 2316 ROM 6800 ADDRESS
IC 21 3624 FPROM 6000 ADDRESS
IC 22 3624 FPROM 6200 ADDRESS
IC 23 555
IC 25 4020
IC 26 2316 ROM 5800 ADDRESS
IC 27 DIP RESISTORS NOT USED
IC 30 DIP RESISTORS NOT USED
IC 36 PIA
IC 37 DIP RESISTORS ALL 47K
DIAGNOSTIC SWITCH
ADDRESS BUS
DATA BUS
BUS #2
RESET
VMA
R/W
IRQ
NMI
MEMORY PROTECT
BLANKING
KEY

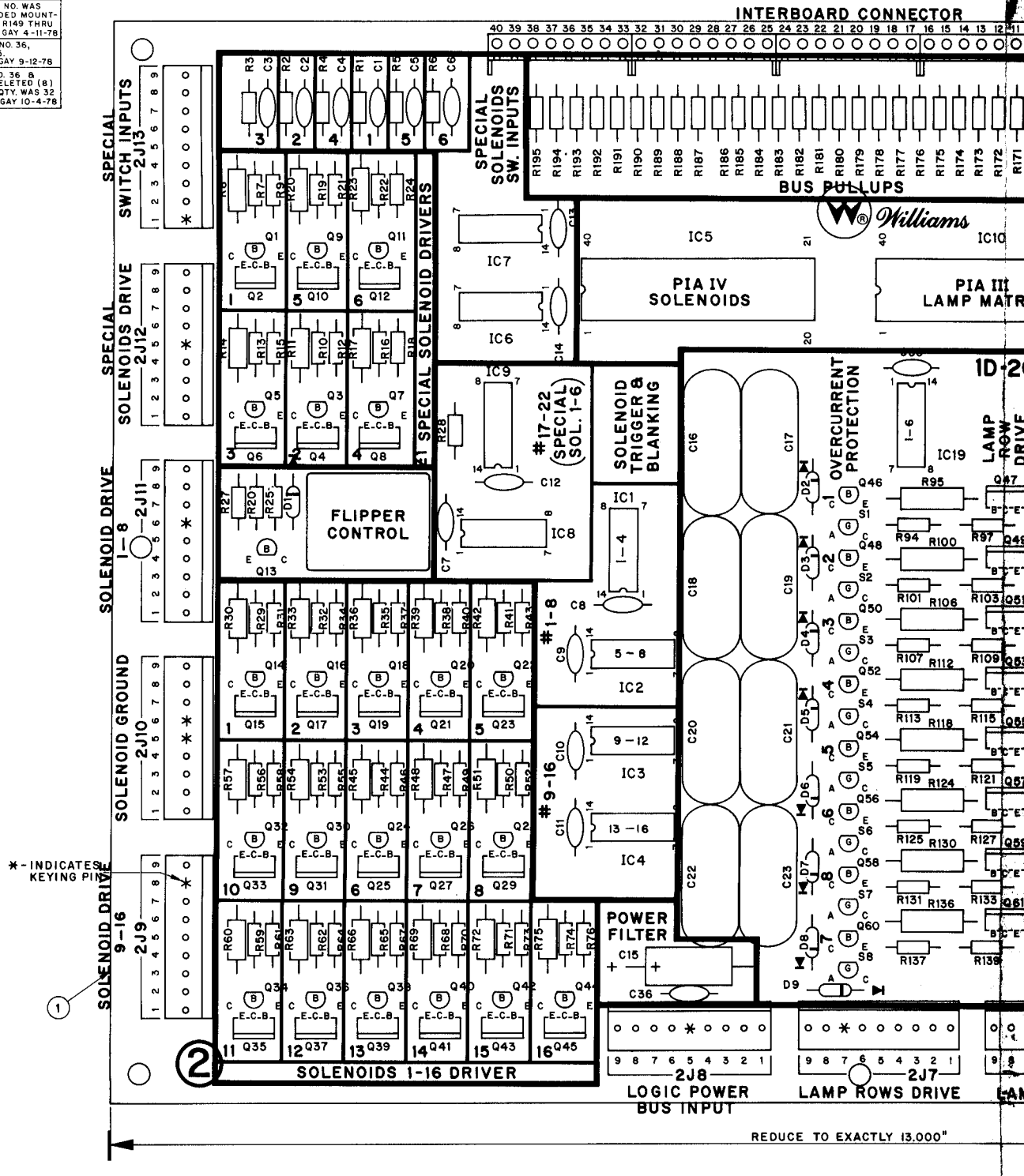
NOTES:

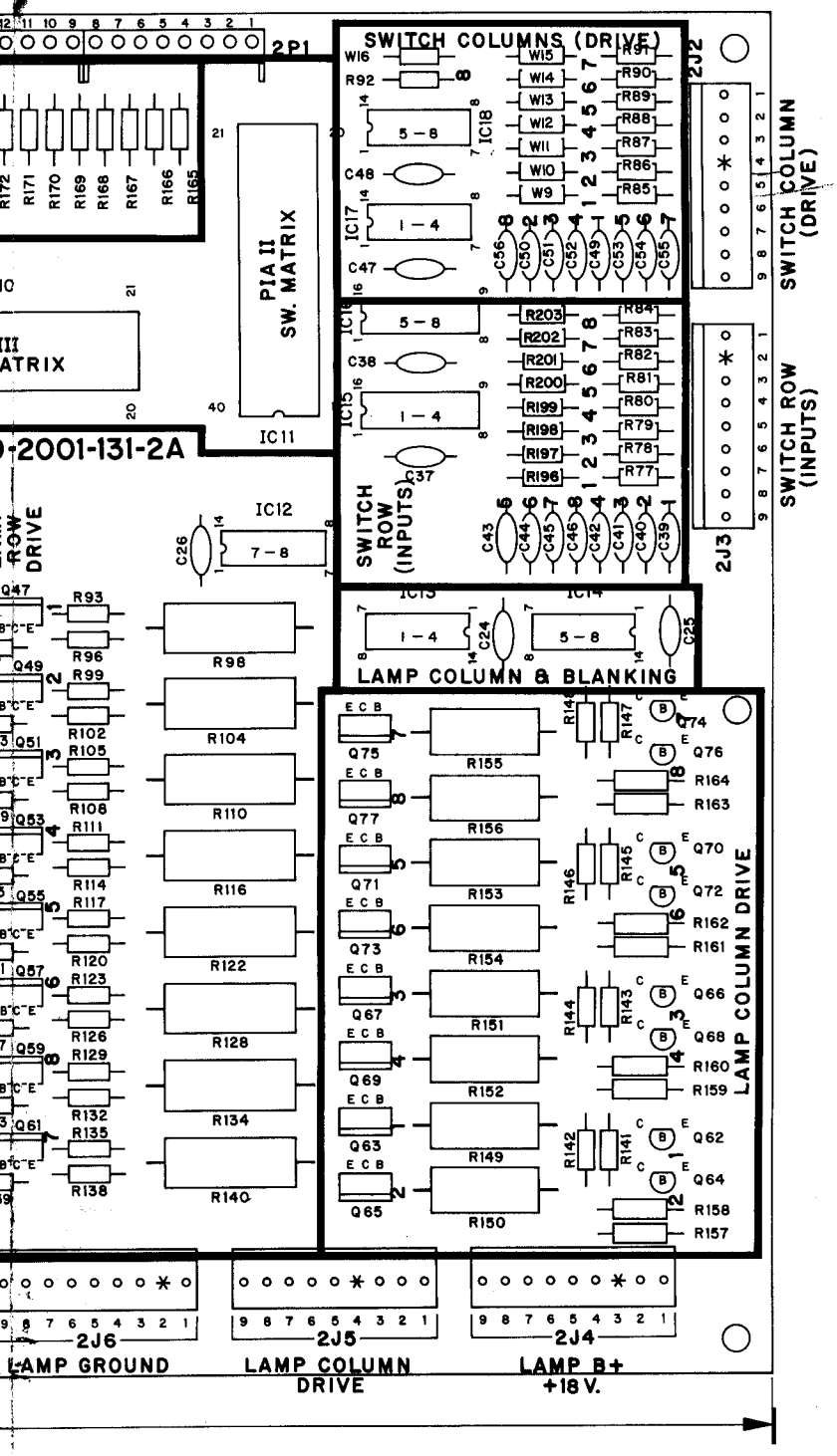
1. ALL RESISTORS, 1/4 WATT UNLESS NOTED OTHERWISE.
2. ALL CAPACITORS, MFD. UNLESS NOTED OTHERWISE.
3. WHEN USING WHITE, YELLOW OR GREEN LABEL PROGRAMS
   REMOVE -W10,W11,W14,W17,W19,W20,W22
   CONNECT: W9,W12,W15,W16,W18,W21,W23
   FOR FIREPOWER ONLY- ALSO REMOVE W3 & CONNECT W4.



CPU Board Logic Diagram

REVISION LETTER	REVISION
C	REVISED AND REDRAWN R.GAY 11-28-77
D	ITEM NO. 28, PT. NO. WAS 5A-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 & ITEM NO. 22, DELETED (8) RESISTORS & QTY. WAS 32 E.C.O. 4624 R.GAY 10-4-78

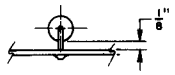




BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	16-2001-131		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. INVENTER 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 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	C27 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, 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, 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-8534	W9 THRU W16	RESISTOR, FC, 0 OHM, 1/4W	8

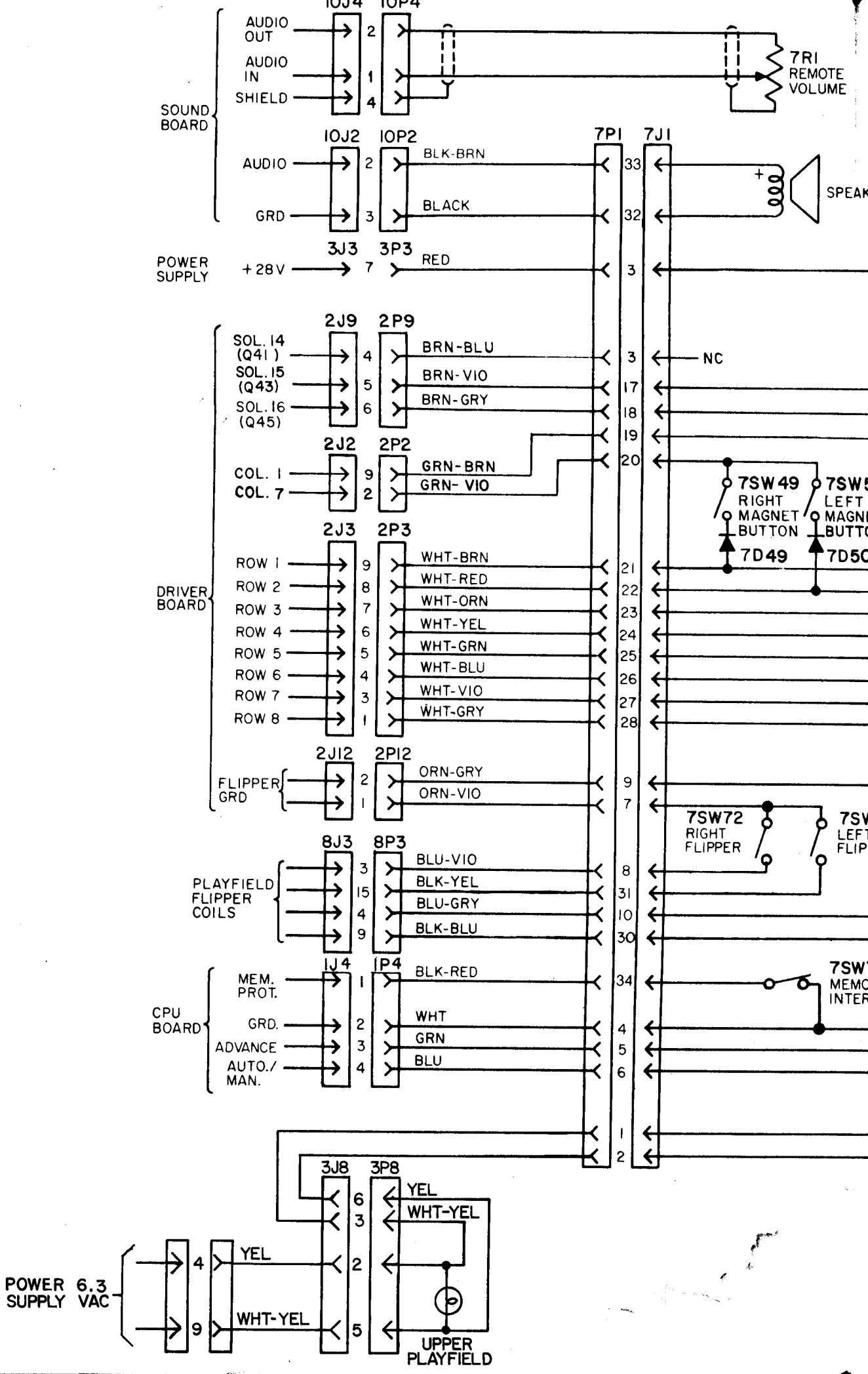
★ R149 THRU R156 MUST BE MOUNTED 1/8" ABOVE SURFACE OF BOARD.



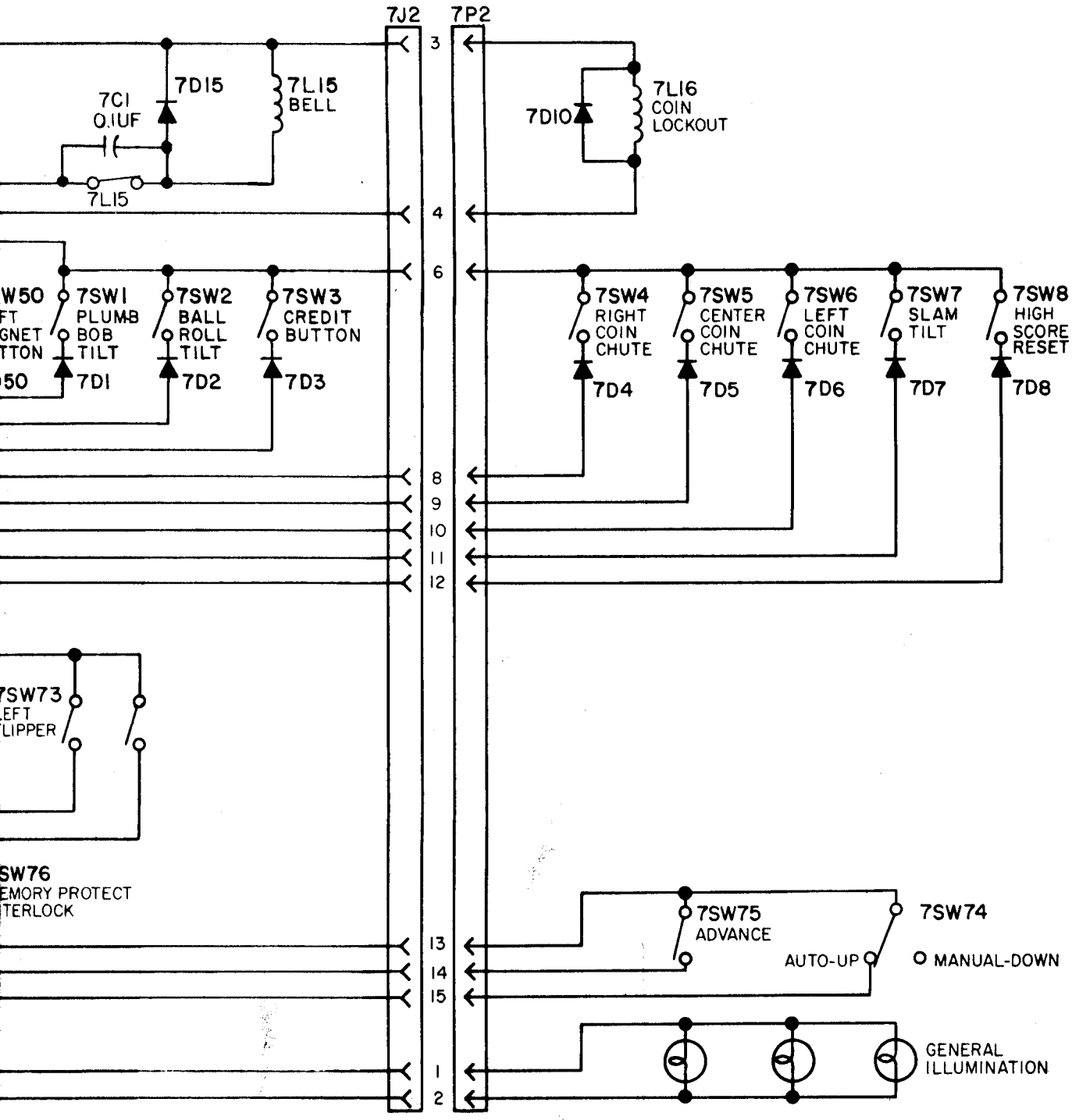
WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF XCOR CORPORATION
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

PART NAME: DRIVER BOARD ASSEMBLY

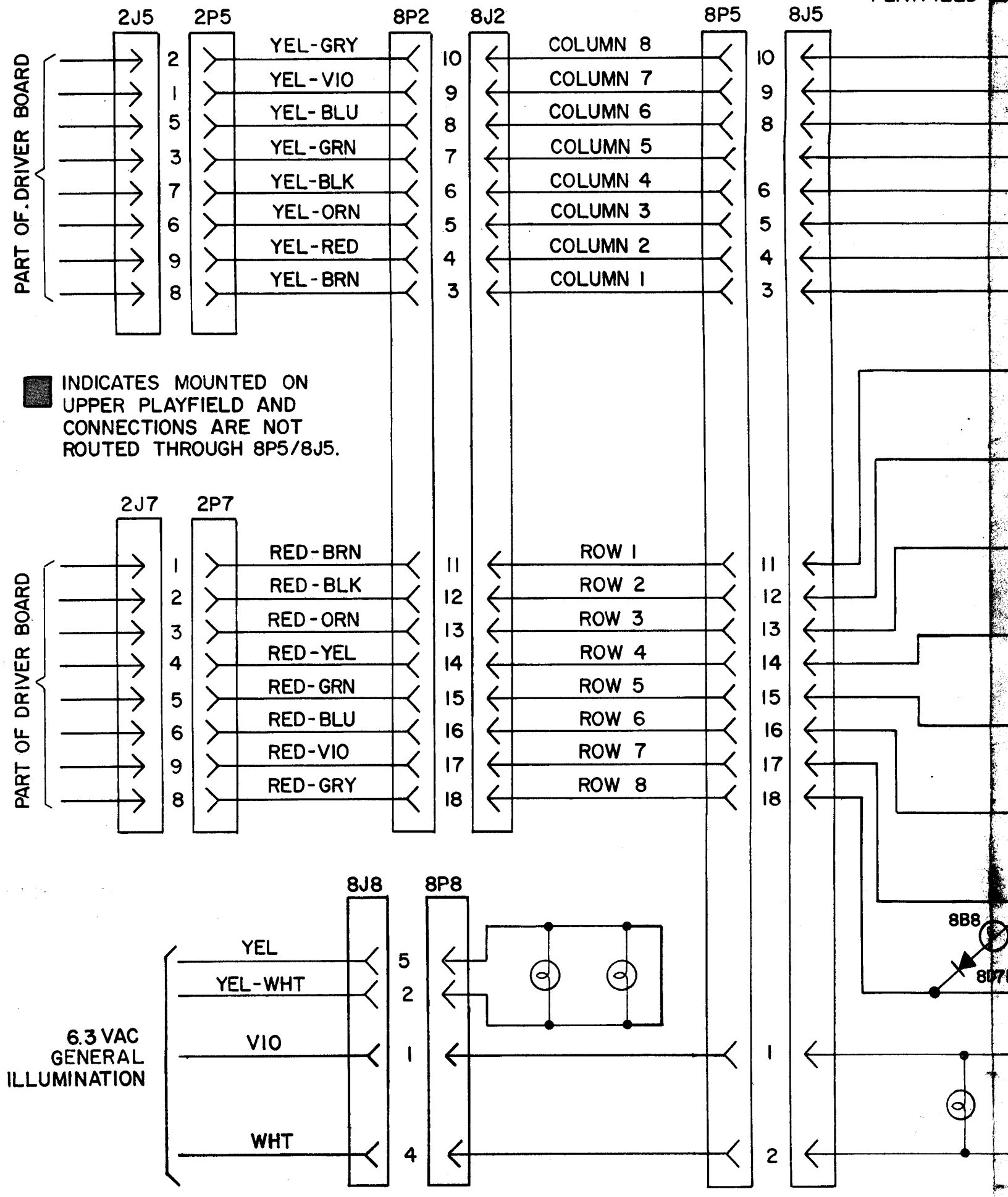
DWN.	DATE	APP'D.	SCALE	PART NO.
R. Gay	8-16-77		2=1	D-7997


10J4
10P4
AUDIO OUT
AUDIO IN
SHIELD
SOUND BOARD
7R1
REMOTE VOLUME
10J2
10P2
AUDIO
GRD
BLK-BRN
BLACK
7P1
7J1
SPEAK
POWER SUPPLY
3J3
3P3
+28V
RED
2J9
2P9
SOL. 14 (Q41)
SOL. 15 (Q43)
SOL. 16 (Q45)
BRN-BLU
BRN-VIO
BRN-GRY
NC
2J2
2P2
COL. 1
COL. 7
GRN-BRN
GRN-VIO
7SW49
RIGHT MAGNET BUTTON
7D49
2J3
2P3
DRIVER BOARD
ROW 1
ROW 2
ROW 3
ROW 4
ROW 5
ROW 6
ROW 7
ROW 8
WHT-BRN
WHT-RED
WHT-ORN
WHT-YEL
WHT-GRN
WHT-BLU
WHT-VIO
WHT-GRY
2J12
2P12
FLIPPER GRD
ORN-GRY
ORN-VIO
7SW72
RIGHT FLIPPER
8J3
8P3
PLAYFIELD FLIPPER COILS
BLU-VIO
BLK-YEL
BLU-GRY
BLK-BLU
1J4
1P4
CPU BOARD
MEM. PROT.
GRD.
ADVANCE
AUTO./ MAN.
BLK-RED
WHT
GRN
BLU
3J8
3P8
YEL
WHT-YEL
POWER SUPPLY 6.3 VAC
UPPER PLAYFIELD

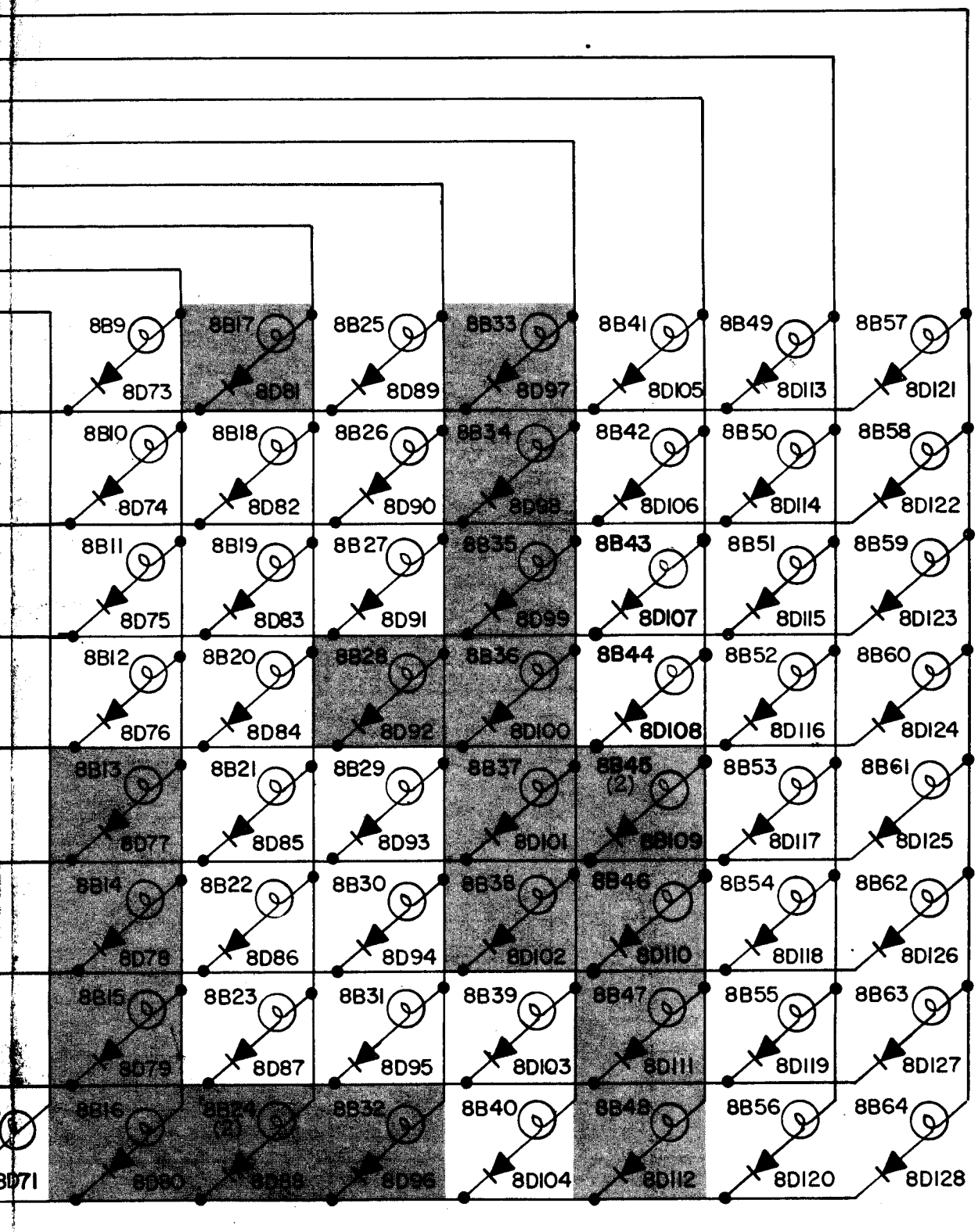
EAKER

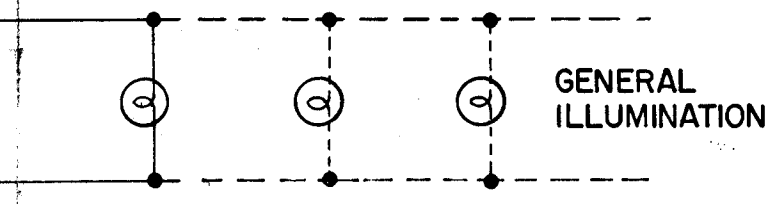


CABINET WIRING DIAGRAM


2J5
2P5
8P2
8J2
8P5
8J5
PART OF DRIVER BOARD
2
1
5
3
7
6
9
8
YEL-GRY
YEL-VIO
YEL-BLU
YEL-GRN
YEL-BLK
YEL-ORN
YEL-RED
YEL-BRN
10
9
8
7
6
5
4
3
COLUMN 8
COLUMN 7
COLUMN 6
COLUMN 5
COLUMN 4
COLUMN 3
COLUMN 2
COLUMN 1
10
9
8
6
5
4
3
INDICATES MOUNTED ON UPPER PLAYFIELD AND CONNECTIONS ARE NOT ROUTED THROUGH 8P5/8J5.
2J7
2P7
PART OF DRIVER BOARD
1
2
3
4
5
6
9
8
RED-BRN
RED-BLK
RED-ORN
RED-YEL
RED-GRN
RED-BLU
RED-VIO
RED-GRY
11
12
13
14
15
16
17
18
ROW 1
ROW 2
ROW 3
ROW 4
ROW 5
ROW 6
ROW 7
ROW 8
11
12
13
14
15
16
17
18
8J8
8P8
YEL
YEL-WHT
VIO
WHT
5
2
1
4
6.3 VAC GENERAL ILLUMINATION
1
2
8B8
8B7

NGLE LORD
AMP WIRING DIAGRAM



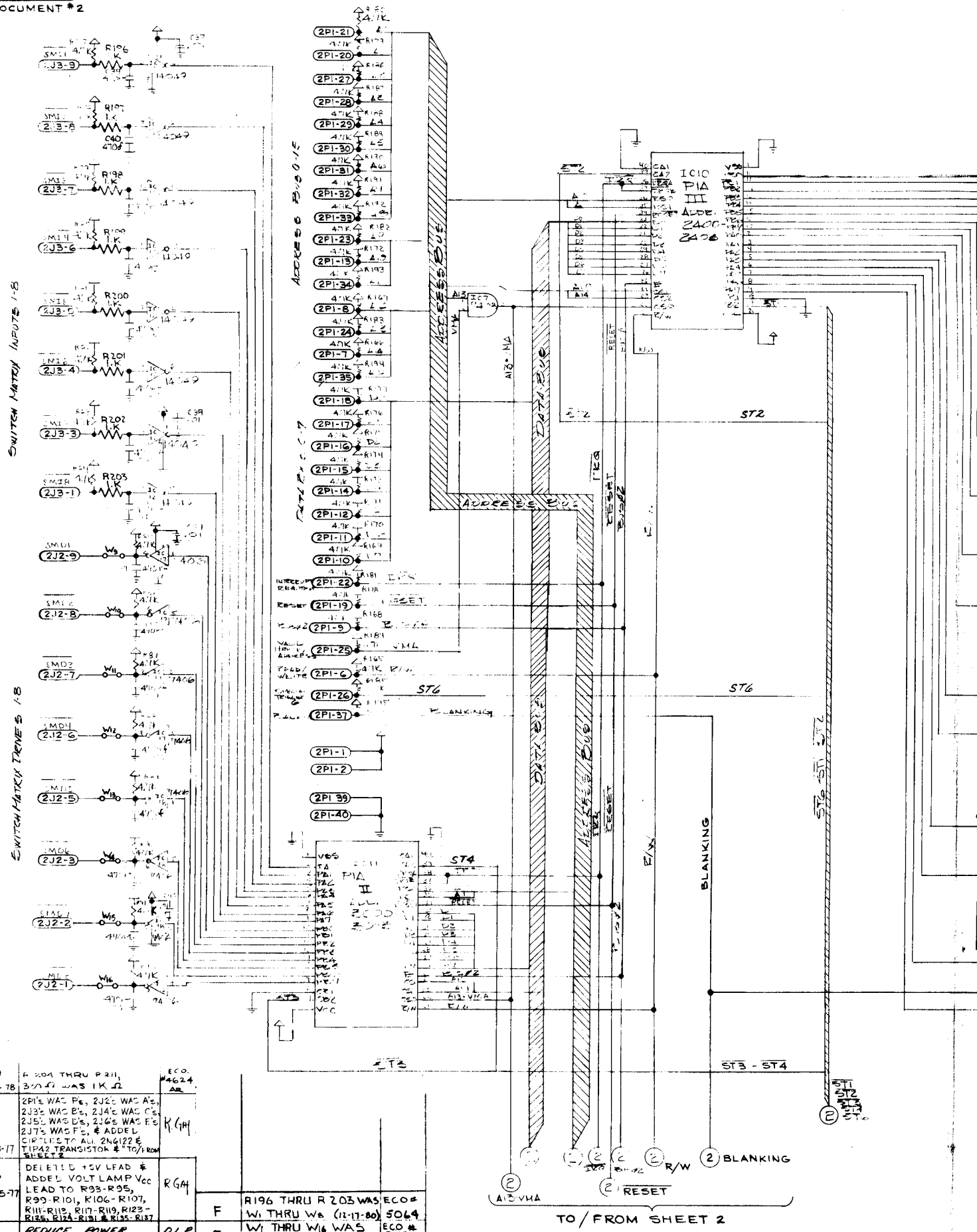


Bulb No.	Function
01	Same Player Shoots Again (B
02	Ball in Play
03	Tilt
04	Game Over
05	Match
06	High score to date
07	***Multi-Ball*** Timer
08	Right magnet Lamp #1 (Bottom)
09	Right magnet Lamp #2
10	Right magnet Lamp #3
11	Right magnet Lamp #4
12	Right magnet Lamp #5 (top)
13	"L"
14	"O"
15	"R"
16	"D"
17	#1 Target
18	#2 Target
19	#3 Target
20	#4 Rollover
21	#5 Rollover
22	Left Drain Shield
23	Right Drain Shield
24	Mini-field Illumination (X2)
25	Right 3-Bank
26	2X Scoring
27	Keep Shooting (Playfield)
28	Mini-field Special
29	Left 3 Bank
30	Loop Spots Letter
31	Loop Spots X Value
32	Mini-field Illumination
33	5-Bank #1 Arrow (Left)
34	5-Bank #2 Arrow
35	5-Bank #3 Arrow
36	5-Bank #4 Arrow
37	5-Bank #5 Arrow (Right)
38	Mini-field Illumination
39	Left magnet #1 (Bottom)
40	Left magnet #2
41	Left Magnet #3
42	Left Magnet #4
43	Left Magnet #5 (Top)
44	Extra Kick When Lit
45	Lock Lamps (X2)
46	***Double-Trouble*** Lamp
47	Mini-field Illumination
48	Mini-field Illumination
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	"30" Bonus
61	2X
62	3X
63	5X
64	10X

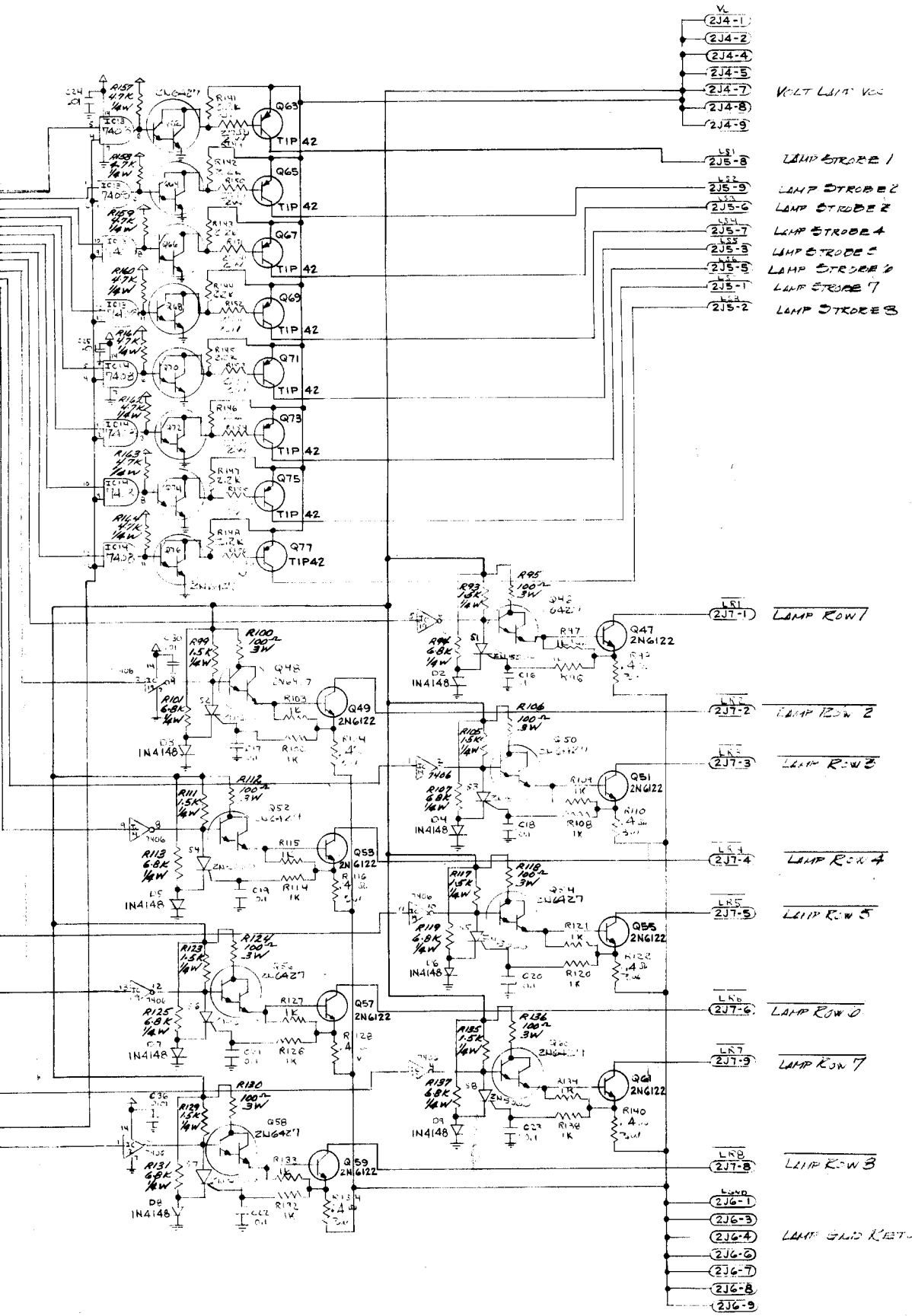
Playfield Lamp Wiring Diagram

16-7997

DOCUMENT #2



REVISION LETTER	REVISION	BY			
D 10-4-78	R 204 THRU R 211, 3.01Ω WAS 1K Ω		ECO #4624 AR		
C 10-28-77	2P1's WAS P's, 2J2's WAS A's, 2J3's WAS B's, 2J4's WAS C's, 2J5's WAS D's, 2J6's WAS E's 2J7's WAS F's & ADDED CIRCUITS TO A13 2N6122 & TIP42 TRANSISTOR & "TO/FROM SHEET 2"	RGH			
B 8-25-77	DELETED +5V LEAD & ADDED VOLT LAMP Vcc LEAD TO R93-R95, R99-R101, R106-R107, R111-R113, R117-R119, R123-R125, R129-R131 & R135-R137	RGH	F	R196 THRU R 203 WAS W1 THRU W8 (12-17-80)	ECO # 5064
A 8-16-77	REDUCE POWER SUPPLY CURRENT	DLP	E	W1 THRU W16 WAS R196 THRU R 211	ECO # 5013 TAM/TM

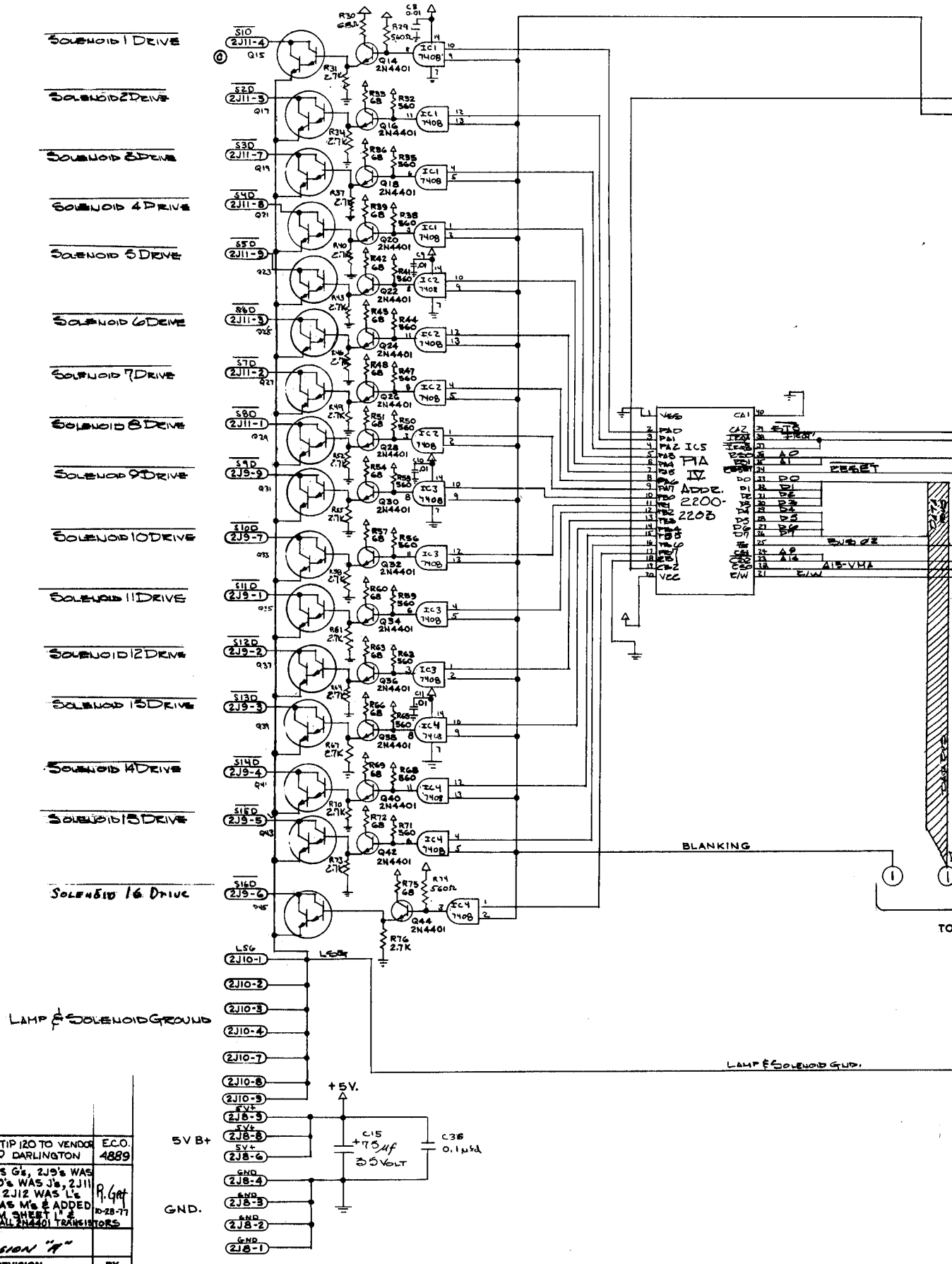


TOLERANCES	WILLIAMS ELECTRONIC MFG. CORP.				
UNLESS OTHERWISE SPECIFIED	SUBSIDIARY OF THE BEARUP CORP.				
FRACTIONS ± 1/64	3401 N. CALIFORNIA CHICAGO 18, ILL. CORNELIA 7-2240				
DECIMALS ± .005	NAME SCHEMATIC, DRIVER BOARD				
.XXX ± .002	MATERIAL		HEAT TREATMENT		FINISH
HOLES − .000					
ANGULAR ± 1/2°	DRWN. WJB	DATE 7-7-77	APP'D.	SCALE	16-7997

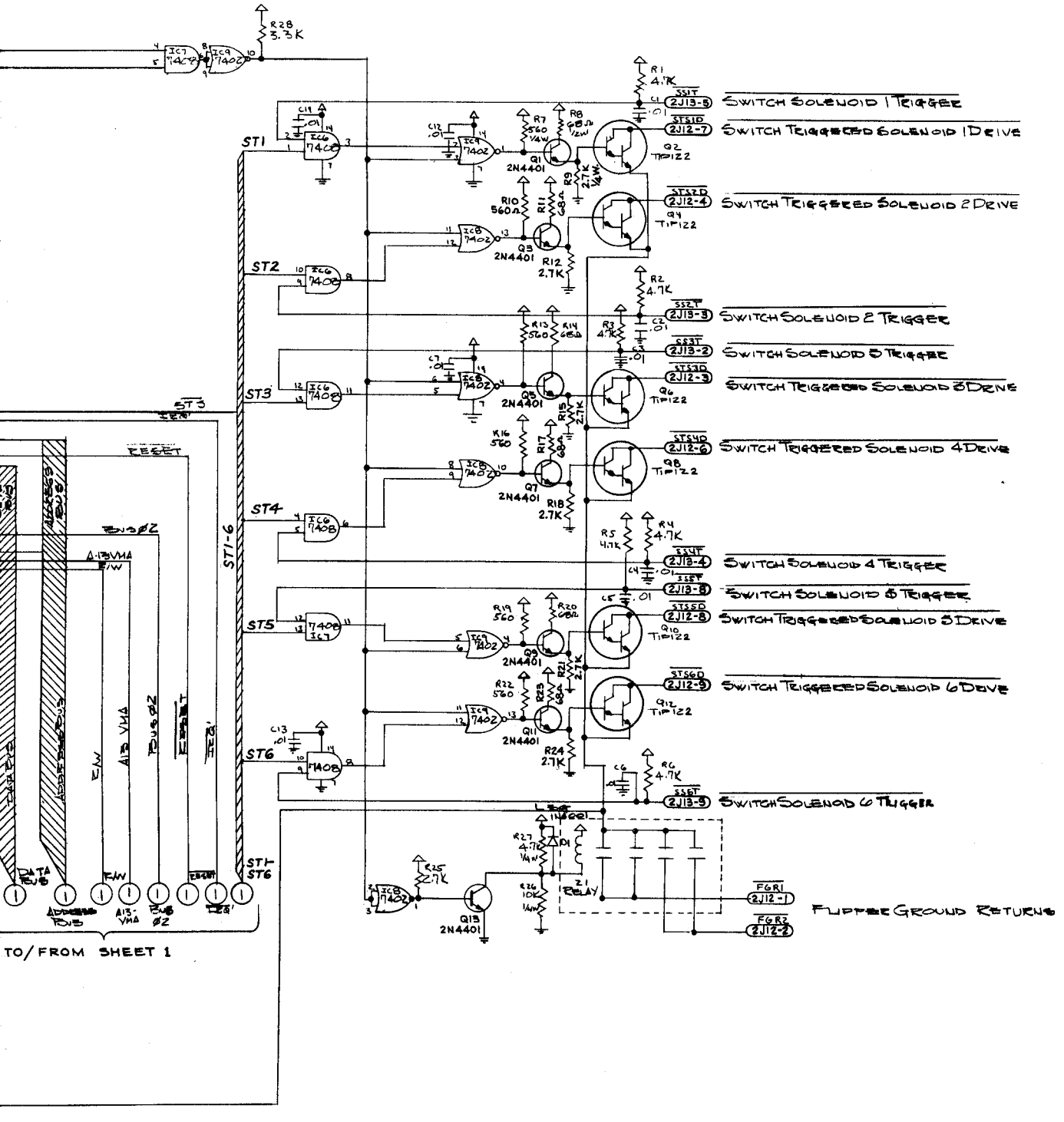
Q'TY | ASSEMBLE ON

Driver Board Logic Diagram
(Sheet 1 of 2) 11/12

16D-7997
DOCUMENT #2



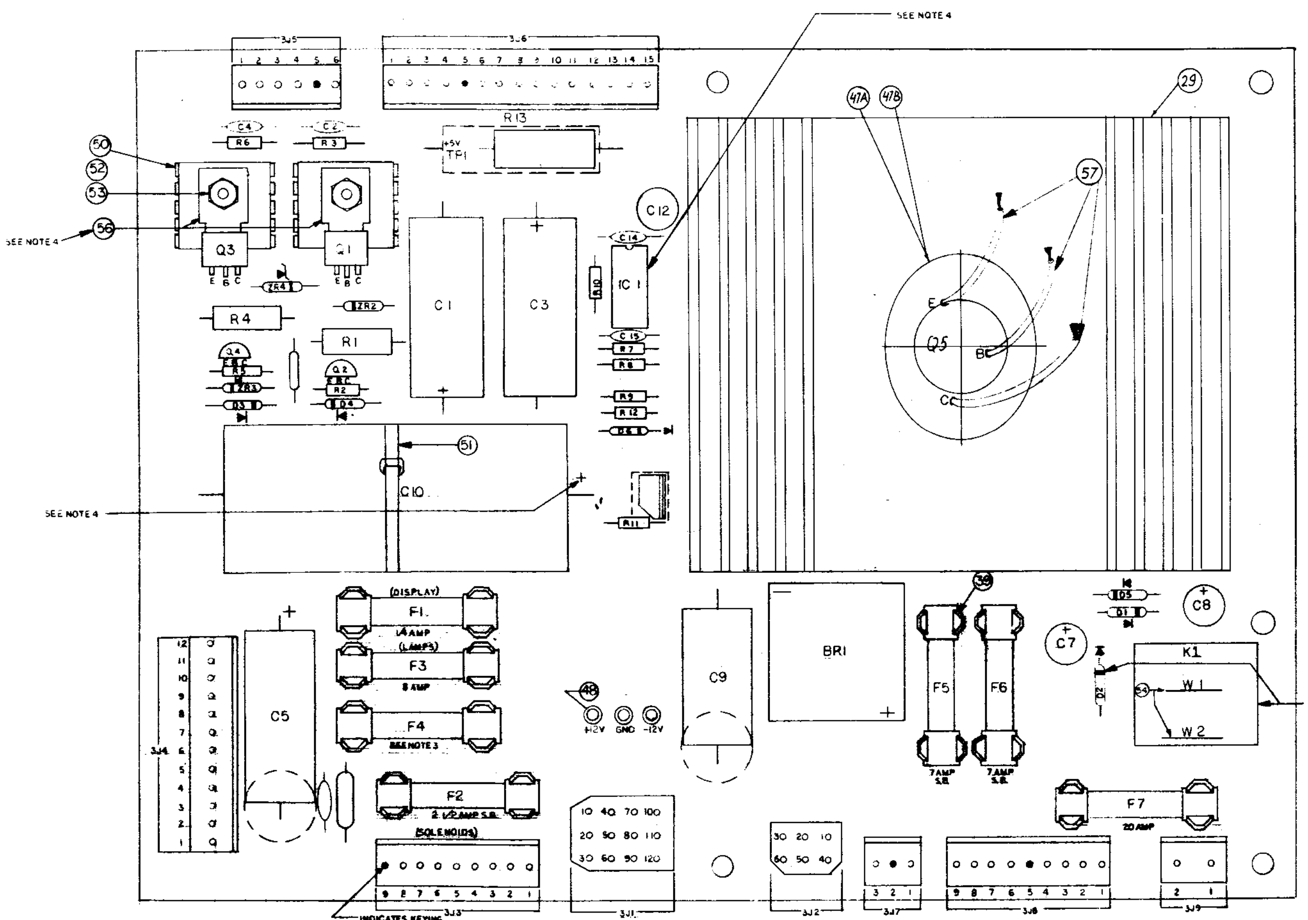
REVISION LETTER	REVISION	BY
C	CHANGE TIP 120 TO VENDOR SELECTED DARLINGTON	ECO. 4889
B	2J8's WAS G's, 2J9's WAS H's, 2J10's WAS J's, 2J11 WAS K's, 2J12 WAS L's, 2J13's WAS M's & ADDED # TO/FROM SHEET 1" & CIRCLES TO ALL 2N4401 TRANSISTORS	R. Graf 10-28-77
A 8-24-77	REVISION "A"	



TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ± 1/64, DECIMALS ± .005, + .002, HOLES − .000, ANGULAR ± 1/2°	WILLIAMS ELECTRONIC MFG. CORP. SUBSIDIARY OF THE SEEBURG CORP.	QTY	ASSEMBLE ON
	3401 N. CALIFORNIA CHICAGO 18, ILL. CORNELIA 7-2840		
	NAME SCHEMATIC, DRIVER BOARD		
	MATERIAL / HEAT TREATMENT / FINISH		
DWN. WMB	DATE 7-5-77 APP'D.	SCALE	16D-7997

SHEET 2 OF 2

Driver Board Logic Diagram (Sheet 2 of 2) 13



BILL OF MATERIAL

	ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
EX.	1	5765-09468-XX		BARE P.C. BOARD	1
EX.	2	5013-09426-00	R7	RESISTOR 2.15K ±1% 1/4W METAL FILM	1
EX.	3	5013-09427-00	R8	RESISTOR 4.99K ±1% 1/4W METAL FILM	1
EX.	4	5010-09428-00	R11	RESISTOR 1.5K ±2% 1/4W CARBON FILM	1
	5	5010-09085-00	R10	RESISTOR 1.5K ±5% 1/4W	1
EX.	6	5010-09541-00	R9	RESISTOR 2.7K ±2% 1/4W	1
EX.	7	5010-09508-00	R12	RESISTOR 270 OHMS ±2% 1/4W CARBON FILM	1
EX.	8	5012-09429-00	R13	POWER RESISTOR 42 OHMS ±5% 5W	1
EX.	9	5010-09536-00	R1, R4	RESISTOR 39K ±5% 1W	2
	10	5010-09061-00	R2, R5	RESISTOR 680 OHMS ±1/2W	2
	11	5010-09069-00	R3, R6	RESISTOR 330K 5% 1/2W	2
EX.	12	5040-09419-00	C10	CAP ELECTROLYTIC 18,000 MFD 20V AXIAL	1
EX.	13	5040-09420-00 5040-08893-00	C9	CAP ELECTROLYTIC 1000 MFD 25V RADIAL OR AXIAL	1
EX.	14	5040-09423-00	C12	CAP ELETROLYTIC 330MFD 10V RADIAL	1
	15	5043-9065-00	C15	CAPACITOR 470 pf.	1
	16	5040-9053-00	C1, C3	CAPACITOR 100 MFD ELECT. 150V	2
	17	5040-9070-00 5043-09537-00	C5	CAPACITOR 100 MFD ELECT. 100V OR RADIAL.	1
EX.	18	5070-09446-00	C14	CAPACITOR 1MFD 50V DISC.	1
SEE NOTE 2	19	5070-06258-00	D1, D2, D3, D4, D5, D6	DIODE, 1N4001	6
	20	5075-09059-00	ZR1, ZR3	ZENER, 1N5990 3.9VZ ±5%	2
	21	5075-09060-00	ZR2, ZR4	ZENER, 1N4764 100V ±5%	2
	22	5060-09424-00	IC1	VOLTAGE REGULATOR MC1723 PC	1
EX.	23	5043-09443-00	C2, C4, C6	CAPACITOR 0.1uF 200V DISC	3
EX.	24	5040-09421-00	C7	CAPACITOR 100 uF 25V RADIAL	1
	25	5164-09057-00	Q1	TRANSISTOR, SDS-201 NPN	1
	26	5164-09056-00	Q4	TRANSISTOR MPS D02 NPN	1
	27	5194-09058-00	Q3	TRANSISTOR, SDS 202 PNP	1
	28	5194-09055-00	Q2	TRANSISTOR, MPS D52 PNP	1
	29	5705-04431-00		HEAT SINK	
	30	5791-09067-00	3J5	CONNECTOR, 6 PIN(H)	1
	31	5791-09074-00	3J6	CONNECTOR, 15 PIN(H)	1
	32	5791-09027-00	3J9, 3J3	CONNECTOR, 9 PIN(H)	2
	33	5791-09038-00	3J2	CONNECTOR, 6 PIN(H)	1
	34	5162-09425-00	Q5	TRANSISTOR, POWER, 2N6087 NPN	
	35	5791-09043-00	3J4	CONNECTOR, 12 PIN(H)	1
SEE NOTE 2 EX.	36	5791-09435-00	3J7	CONNECTOR, 3 PIN(H)	1
	37	5791-09436-00	3J9	CONNECTOR, 2 PIN(H)	1
	38	5791-09068-00	3J1	CONNECTOR, 12 PIN	1
	39	5733-09178-00		FUSE HOLDER	14
	40	5731-09128-00	F2	FUSE 2-1/2 AMP S.B.	1
	41	5730-09071-00	F3	FUSE 8 AMP	
	42	5730-06508-00 5730-06567-00	F4	FUSE 10 AMP, 15 AMP	1
	43	5730-09127-00	F7	FUSE 20 AMP	1
	44	5731-08761-00	F1	FUSE, 20 AMP	1
	45	5017-09061-00	VR1	VARISTOR	1
	46A	5700-09445-00		SOCKET	
	47B	5701-09538-00		MICA INSULATOR	
SEE NOTE 2	47	5580-09555-00	K1	RELAY 24VDC 10AMP DPDT	1
SEE NOTE 2	48	5824-09248-00		TERMINAL #1502-1 (TEST POST)	3
EX.	49	5100-09418-00	BR-1	BRIDGE RECTIFIER 35AMPS 100V	1
	50	5705-09042-00		HEAT SINK	2
	51	3A-7520-1		TIE WRAP	1
	52	4005-01016-07		5-40 X 7/16 RH. MECH. SCREW	2
	53	4405-01117-00		5-40 HEX NUT	2
	54		W1, W2	JUMPER #18 AWG	2
EX.	55	5040-09422-00	C8	CAPACITOR 47 UF 50V RADIAL	1
	56	20-9229		THERMAL COMPOUND	
EX.	57			LEAD WIRE #18 AWG (3)	3
	58	5731-09432-00	F6, F5	FUSE 7A SB 250V	2

DRAWING	REVISION & NO.				
PCB	0				
SCHEMATIC	0				
PCA	0				
PL	0				

REVISION DRAWINGS: SCHEMATIC 168786-00

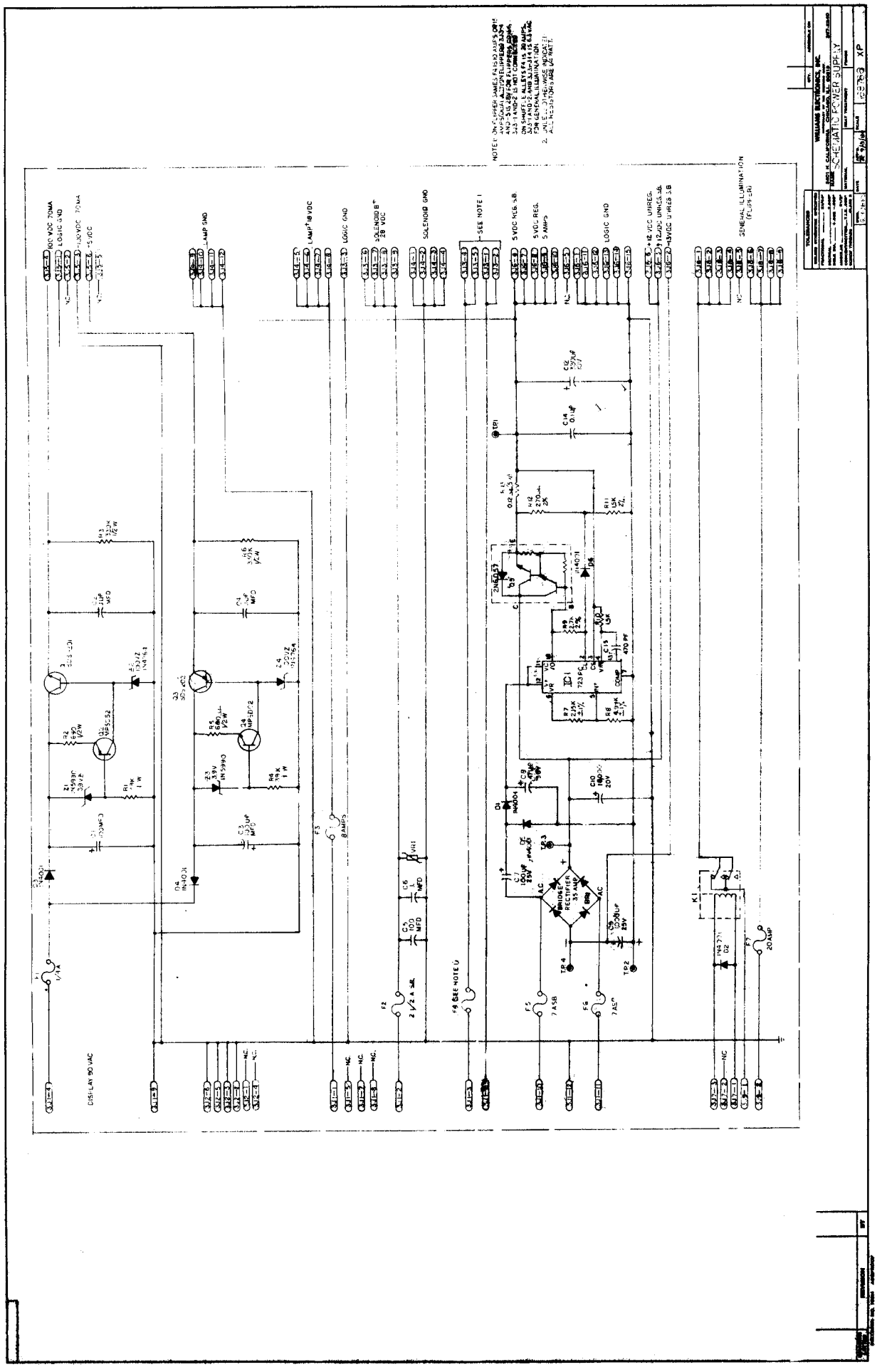
NOTES:
1. HEAT SINK COMPOUND MUST BE APPLIED BE APPLIED BETWEEN TRANSISTOR AND HEAT SINK.
2. FOR BLACKOUT AND FUTURE GAMES WITH SAME FEATURE REMOVE JUMPERS (W1 AND W2) AND INSERT RELAY K1, DIODE D2 AND 3J7
3. ON FLIPPER GAMES F4 IS 10 AMPS OR (DUAL ACTION FLIPPERS) 15 AMPS ON SHUFFLE ALLEYS F4 IS 20 AMPS.
4. OBSERVE INDEX MARK OF INTEGRATED CIRCUIT, POLARITY OF CAPACITORS, DIODES AND POSITION OF TRANSISTORS.
5. REFERENCE DWGS: SCHEMATIC 16-8786

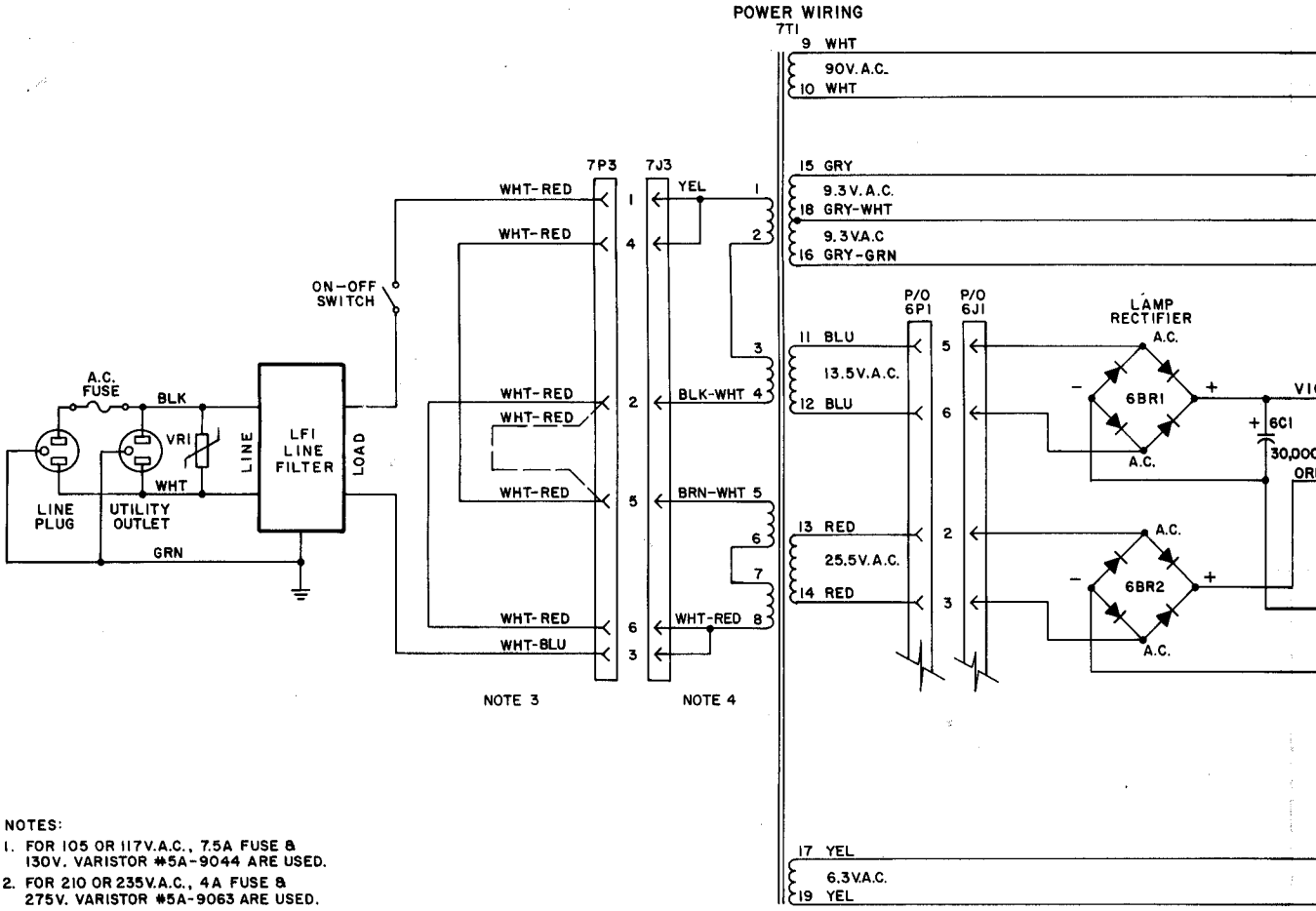
REVISION LETTER	REVISION	BY
A 9-23-80	ITEM #42 PART NO. WAS 5730-06508-00 5730-06567-00 & DESCRIPTION CHANGE ITEM #47 DESCRIPTION CHANGE. ITEM #8 PART NO. WAS 5010-09429-00 ITEM #19 PT. NO. WAS 5010-09421-00 ITEM #23 REVISED DESCRIPTION ITEM #41 PART NO. WAS 5730-09071-00	G.H.

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

NAME: POWER SUPPLY BOARD SUB-ASSEMBLY

DWN. G. HOBBS DATE 9-27-80

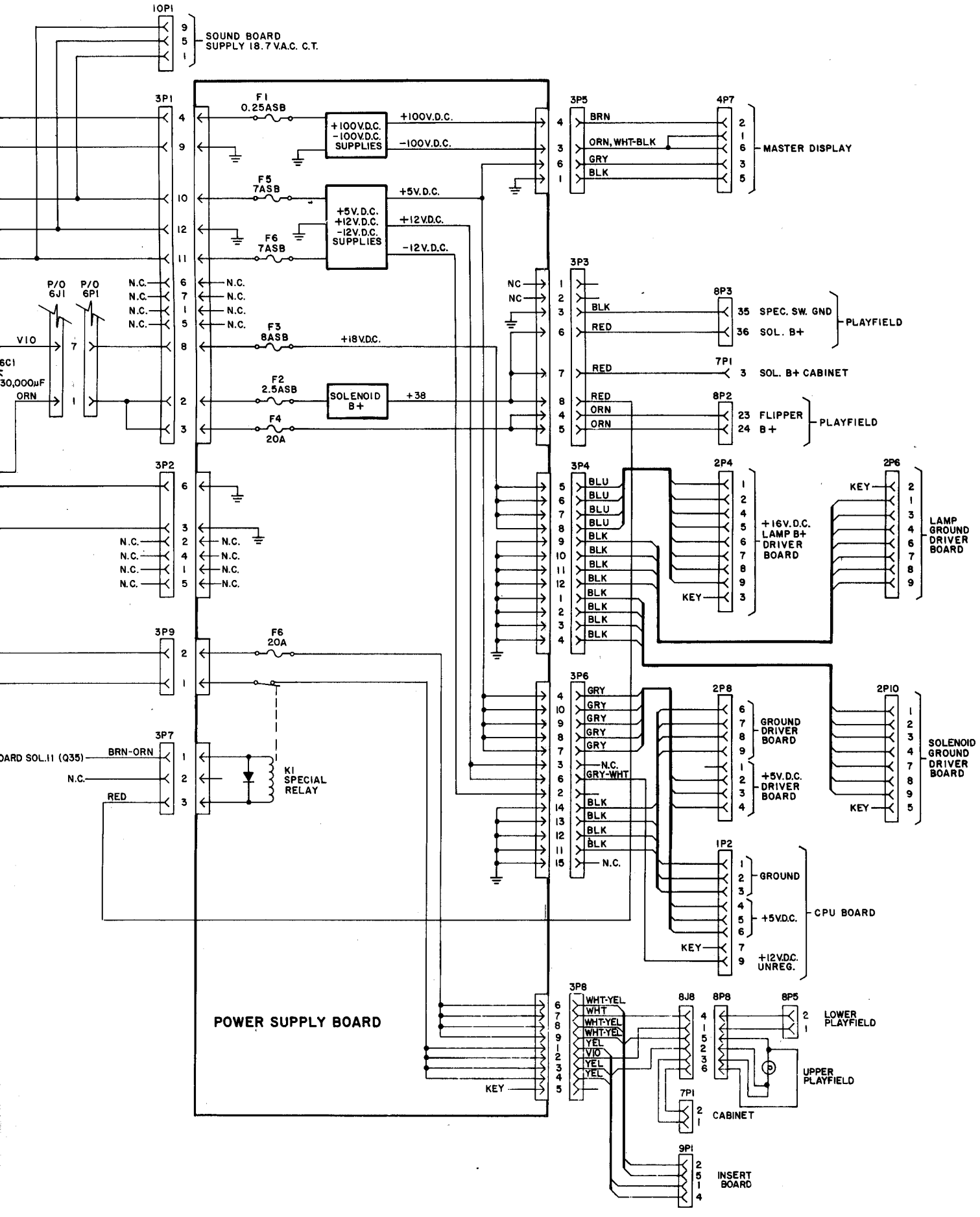

SCHEMATIC POWER SUPPLY
WILLIAMS ELECTRONICS, INC.
XP
DISPLAY 90 VAC
LAMP GND
LOGIC GND
SOLENOID GND
SEE NOTE 1
SVDC REG. 5 AMPS
LOGIC GND
SEE NOTE 6
BRIDGE RECTIFIER 35 AMPS
20 AMP
8 AMPS
7 ASB



NOTES:

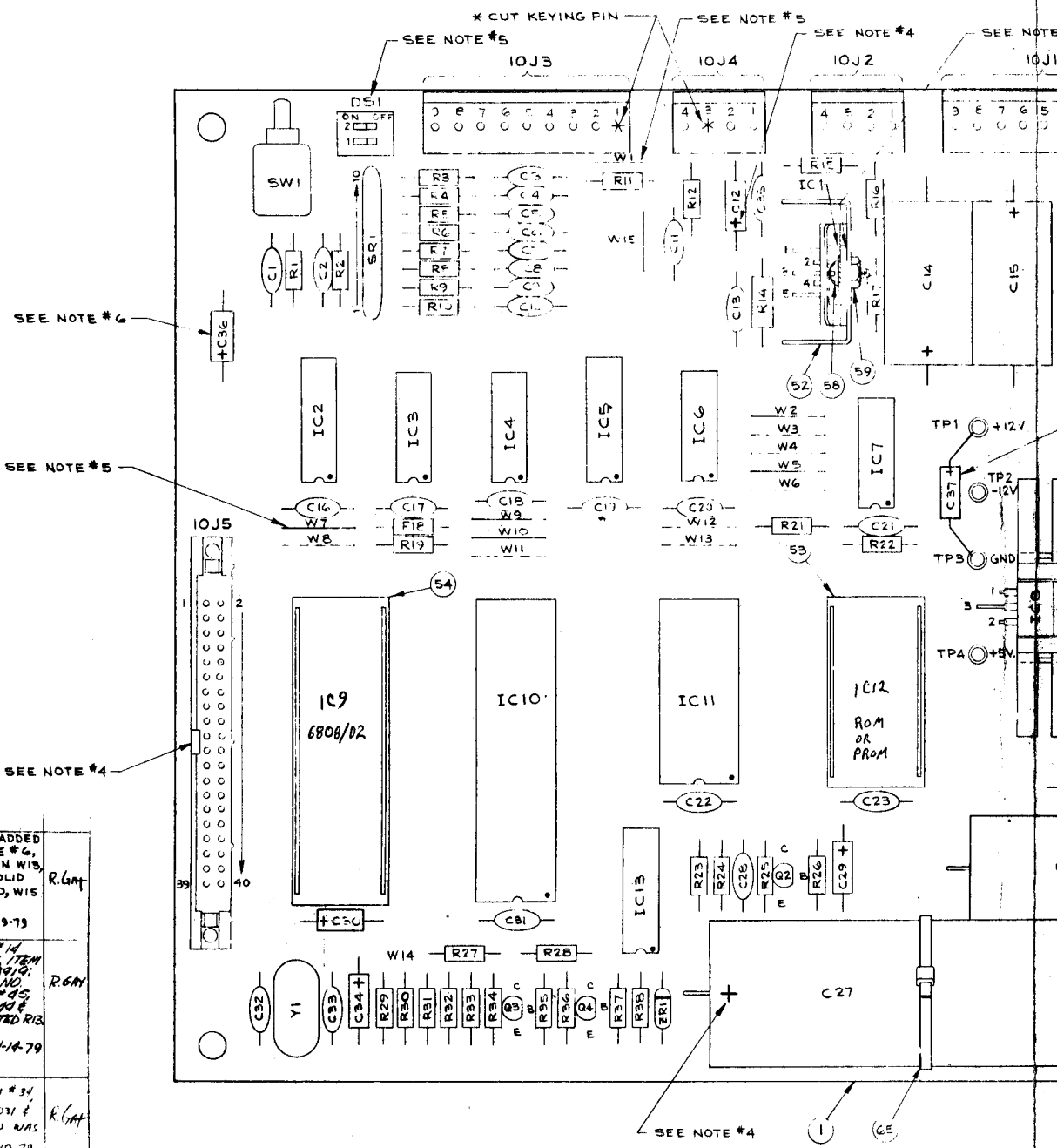
1. FOR 105 OR 117V.A.C., 7.5A FUSE & 130V. VARISTOR #5A-9044 ARE USED.
2. FOR 210 OR 235V.A.C., 4A FUSE & 275V. VARISTOR #5A-9063 ARE USED.
3. JUMPER WIRES ON 6P1 SHOWN WITH SOLID LINES ARE CONNECTED FOR 117V.A.C. OPERATION. ONLY THE ONE SHOWN WITH A DASHED LINE IS CONNECTED FOR 220 V.A.C. OPERATION.
4. FOR LOW-LINE CONDITIONS (105 OR 210V.A.C.) MOVE BLK-WHT WIRE FROM 6T1-4 TO 6T1-3) & MOVE 2 WHT-RED WIRES FROM 6T1-8 TO 6T1-7.

DRIVER BOARD S



Power Wiring Diagram
15

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPT
58			6-32 x 3/8" BINDER
59			6-32 HEX NUT
60		W1, W2, WE, W7, W9, W10, W15	WIRE JUMPER 22 WIRE WITH INSU
61	5A-9248	TP1 THR TP4	TERMINAL # 50
62	5A-9363	R11	RESISTOR, FF, 5% 1/4 WATT
64	5A-9362	SR1	RESISTOR, 4.7 10 PIN SIP
65	3A-7520-1		TIE WRAP



REVISION LETTER	REVISION	BY
E	REVISED NOTES, ADDED ITEM #45 & NOTE #6, RELOCATED W15, IN W13, DASH LINE WAS SOLID LINE & ITEM #60, W15 WAS W18 E.C.O. 11-19-79	R.GAY
D	DELETED ITEM #14 PT. NO. 5A-9016, ITEM #18 PT. NO. 5A-8910, 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.GAY
C	ADDED C36, ITEM #34 PT NO WAS 5A-9031 & QTY WAS 1, & C30 WAS .01 MFD. E.C.O. 9760 10-29-79	R.GAY
B	DELETED ITEM #62 ADDED R1 & R12 TO ITEM # 11 QTY WAS 7 10-5-79	K.S.
A	ITEM #11, ADDED 5A-9363 ITEM #62, ADDED 5A-9363 ITEM #64 ADDED 5A-9362 10-4-79	K.S.

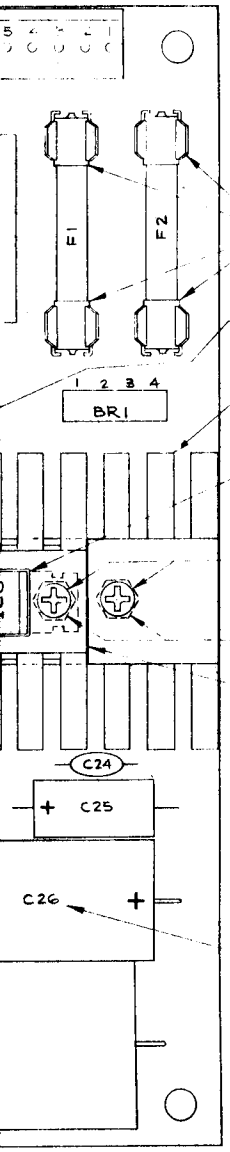
DIETZGEN NO. 188H AGEPROOF

IPTION	REQ'D. NO.
ER HEAD SCREW	3
T	3
22 GAUGE SULATION	7
502-1	4
C, 5.6 K OHM T	1
.7 K OHM	1
	1

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
48	5A 6314	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5A-9178		FUSE HOLDER	4
50	5A-9172		HEAT SINK THERMALLOY *6072B	1
51	5A-9173		HEAT SINK THERMALLOY *6071B	1
52	5A-9199		HEAT SINK THERMALLOY *6030	1
53	5A-9004		24 PIN SOCKET	1
54	5A-8985		40 PIN SOCKET	1
55	5A-9027	10J1, 10J3	9 PIN MALE CONNECTOR	2
56	5A-9028	10J2, 10J4	4 PIN MALE CONNECTOR	2
57	5A-9349	10J5	40 PIN RIBBON HEADER	1

TE #1

0J1



NOTES:

1. USE THERMAL COMPOUND BETWEEN IC'S AND HEAT SINK.
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. DS1 - 1 SELECTS SOUNDS/NOTES
   2 SELECTS SPEECH/NO SPEECH (W9/W4)

   W4 - SPEECH MODULE STATUS
   IN - SPEECH MODULE NOT ATTACHED
   OUT - SPEECH MODULE ATTACHED

   W14 - MPU INTERNAL RAM ENABLE

   W7 & W8-MEMORY MAP CONTROL

   W12 & W13 - PB7 STATUS CONTROL (W13 NEVER USED)

   W4 & W9 - PB5 STATUS CONTROL

6. SOLDERED ON TOP OF BOARD
   INSTAL THESE JUMPERS FOR FOLLOWING GAMES:

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

WORLD CUP
DISCO FEVER
CONTACT
POKER-NO
PHOENIX
ARISTOCRAT SHUFFLE
POMPELLI SHUFFLE
KING TUT SHUFFLE
TAURUS SHUFFLE
} SOUND ROM 1

W15, W8, W12, W4, W1, W2, W5, W10, FOR:

FLASH
STELLAR WARS
TRI ZONE
TIME WARP
} SOUND ROM 1 5A-9198

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

GORGAR } SOUND ROM 2 - ST-0960

IC 12 SELECTION STRAPPING:

(2K x 8)	(1K x 8)	(512 x 8)
W2 -	W3	W3 -
W5 - IN	W9 - IN	W6 - IN
W10	W11	W11

BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	IC-2001-146-3		BARE P.C. BOARD	1
2	5A-9156	IC1	TDA 2002 V AUDIO AMPLIFIER	1
3	5A-9012	IC2	7442 BCD-DEC DECODER	1
4	5A-9073	IC3	7400 QUAD 2 INPUT NAND	1
5	5A-8973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5A-9153	IC5	4050 BUFFER	1
7	5A-9154	IC6	4068 8 INPUT NAND GATE	1
8	5A-8971	IC7	14069 HEX INVERTER	1
9	5A-9157	IC8	7805 5 VOLT REG. W/TO220 CASE	1
10	5A-8972	IC10	6821 P.I.A.	1
11	5A-9003	IC11	6810 RAM	1
12	5A-9152	IC13	1408 D/A CONVERTER	1
13	5C-8938	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5A-9018	ZR1	1N5996 6.8V. ZENER DIODE	1
16				
17	5A-9158 OR 5A-9357	BR1	MDA 200/3N253 BRIDGE RECTIFIER	1
18	5A-9020	Y1	3.58 MHz CRYSTAL	1
19	5B-8991	R1, R18, R19, R21, R22, R27, R30, R31, R32	RESISTOR, FC, 4.7K OHM 5% 1/4 WATT	9
20	5B-9036	R2 THRU R10	RESISTOR, FC, 100 OHM 10% 1/4 WATT	9
21	5A-8984	R12, , R15, R28, R36, R38	RESISTOR, FC, 1K OHM 10% 1/4 WATT	5
22	5A-9181	R14	RESISTOR, FC, 1 OHM 10% 1/2 WATT	1
23	5A-9161	R16	RESISTOR, FC, 2.2 OHM 10% 1/4 WATT	1
24	5A-9361	R17	RESISTOR, FC, 220 OHM 10% 1/2 WATT	1
25				
26	5B-8983	R23, R24, R26	RESISTOR, FC, 3.3K OHM 10% 1/4 WATT	3
27	5A-9179	R25	RESISTOR, FC, 3.3 M OHM 10% 1/4 WATT	1
28	5A-9359	R29	RESISTOR, FC, 47 K OHM 5% 1/4 WATT	1
29	5B-8817	R33, R35, R37	RESISTOR, FC, 10 K OHM 10% 1/4 WATT	3
30	5B-9039	R34	RESISTOR, FC, 10 OHM 10% 1/4 WATT	1
31	5A-8980	C1, C16 THRU C23 C31	CAPACITOR, CERAMIC, .01 MFD. 50 V. ±20%	11
32	5A-9065	C2 THRU C10	CAPACITOR, CERAMIC, 470 PFD. 50 V. ±20%	9
33	5A-9345	C11	CAPACITOR, CERAMIC, .001 MFD. 20% 100 V.	1
34	5A-9365	C12, C30, C36	CAPACITOR, ELECTROLYTIC 1 MFD. 63 V. -10/+ 50%	3
35	5A-8996	C13, C24, C35	CAPACITOR, CERAMIC, .1 MFD. 50 V. ±20%	3
36	5A-9165 5A-9165-1	C14	CAPACITOR, ELECTROLYTIC, 800 MFD. 16 V. OR 1,000 MFD. 15 V. ±20%	1
37	5A-9164 5A-9164-1	C15	CAPACITOR, ELECTROLYTIC, 500 MFD. 15 V. OR 470 MFD. 25 V. ±20%	1
38	5A-8986	C25	CAPACITOR, ELECTROLYTIC, 100 MFD. 10 V. ±20%	1
39	5A-8893	C26,	CAPACITOR, ELECTROLYTIC, 1,000 MFD. 25 V. ±20%	1
40	5A-9046	C27	CAPACITOR, ELECTROLYTIC, 12,000 MFD. 16 V. ±20%	1
41	5A-9180	C28	CAPACITOR, CERAMIC, 47 PFD. 1K V. ±20%	1
42	5A-9343	C29	CAPACITOR, ELECTROLYTIC, 10 MFD. 25 V. LOW LEAK ±20%	1
43	5A-9169	C32, C33	CAPACITOR, CERAMIC DISC, 27 PFD. 1K V. ±10%	2
44	5A-9163	C34	CAPACITOR, TANTALUM, 2.2 MFD. 15 V. ±20%	1
45	5A-9031	C37	CAPACITOR, TANTALUM, 1 MFD. 25 V. ±20%	1
46	5A-9024	SW1	MOMENTARY SWITCH SPDT	1
47	5A-9330	DS1	2 STD. DIP SWITCH	1

TOLERANCES	QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED		
FRACTIONAL ±1/64"		
DECIMAL .XX ±.005"		
HOLE DIA. +.003 -.000"		
ANGULAR ±1/2°		
CONCENTRICITIES .Y.I.R. .005"		
SCREW THREADS CLASS 2		

WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF THE SEEBURG CORP.
3401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240

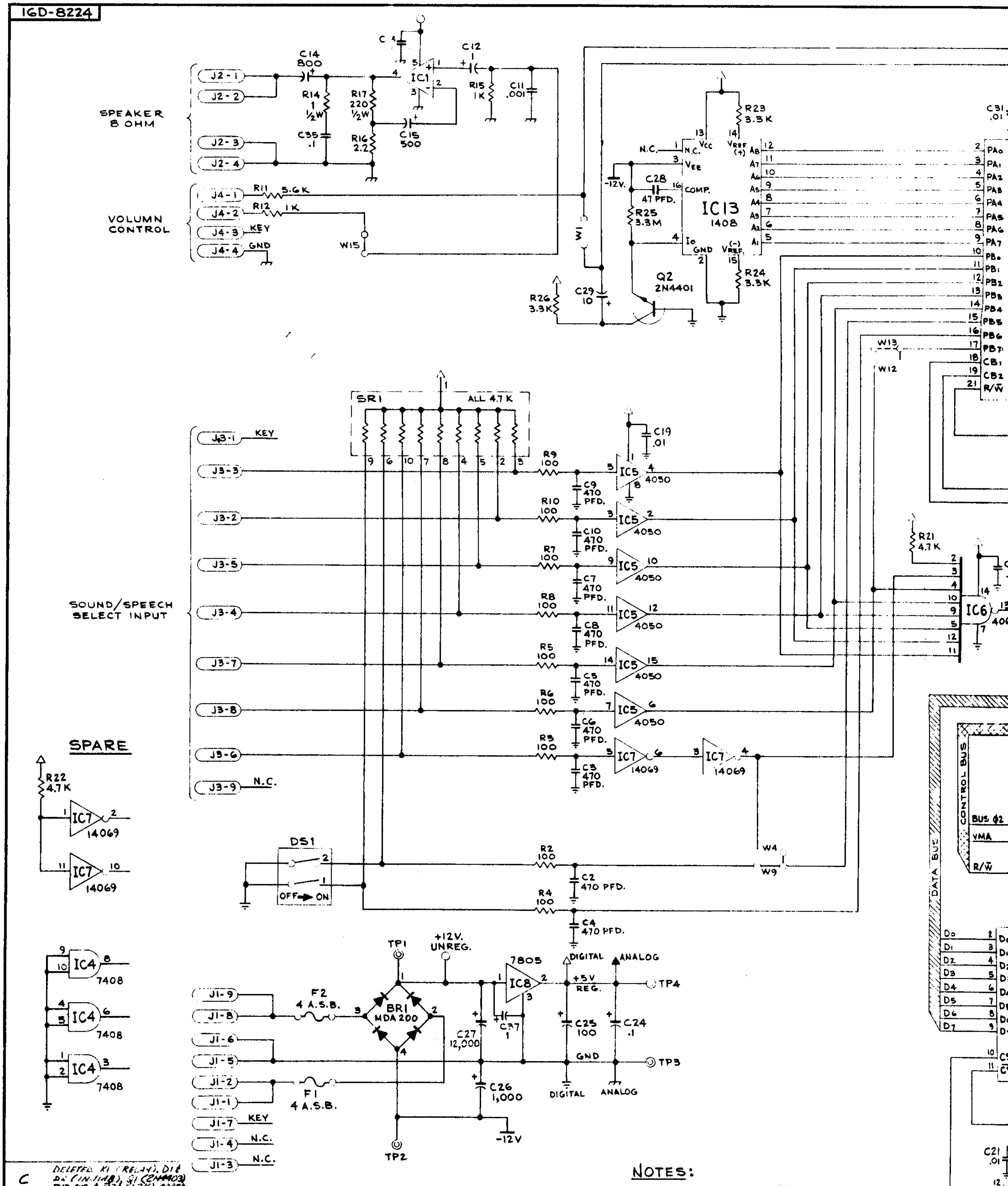
NAME SOUND BOARD SUB-ASSEM

MATERIAL	HEAT TREATMENT	FINISH

DWN. RGM | DATE 9-23-79 | APP'D. | SCALE 2:1 | D-8228

Sound Board Assembly Drawing

16D-8224

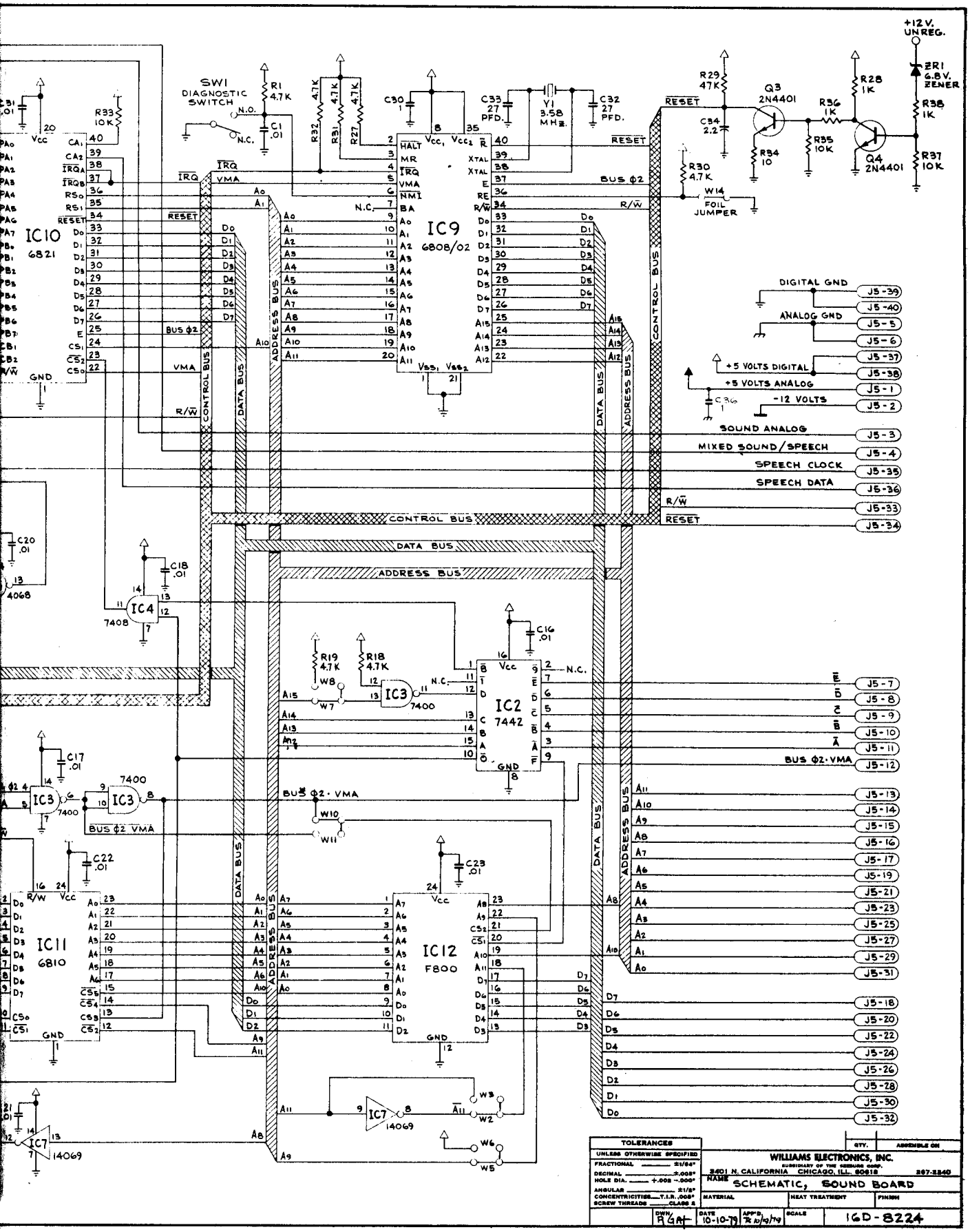


C	DELETED K1 (RELAY), D1 & D2 (IN-148), Q1 (2N4403) R13 (10) & R20 (1.2K) ADDED W15 E.C.O. 4764 11-14-79	R.G.			
B	ADDED C35, C20 WAS .01 MFD 10-23-79	R.G.			
A	10/23/79 C12, C14, C15, POLARITY REVERSED	T	D	ADDED C37 & IN W13, DASH LINE WAS SOLID LINE E.C.O. 11-19-79	R.G.M.
REVISION LETTER	REVISION	BY	REVISION LETTER	REVISION	BY

DIETZGEN NO. 186H AGEPROOF

NOTES:

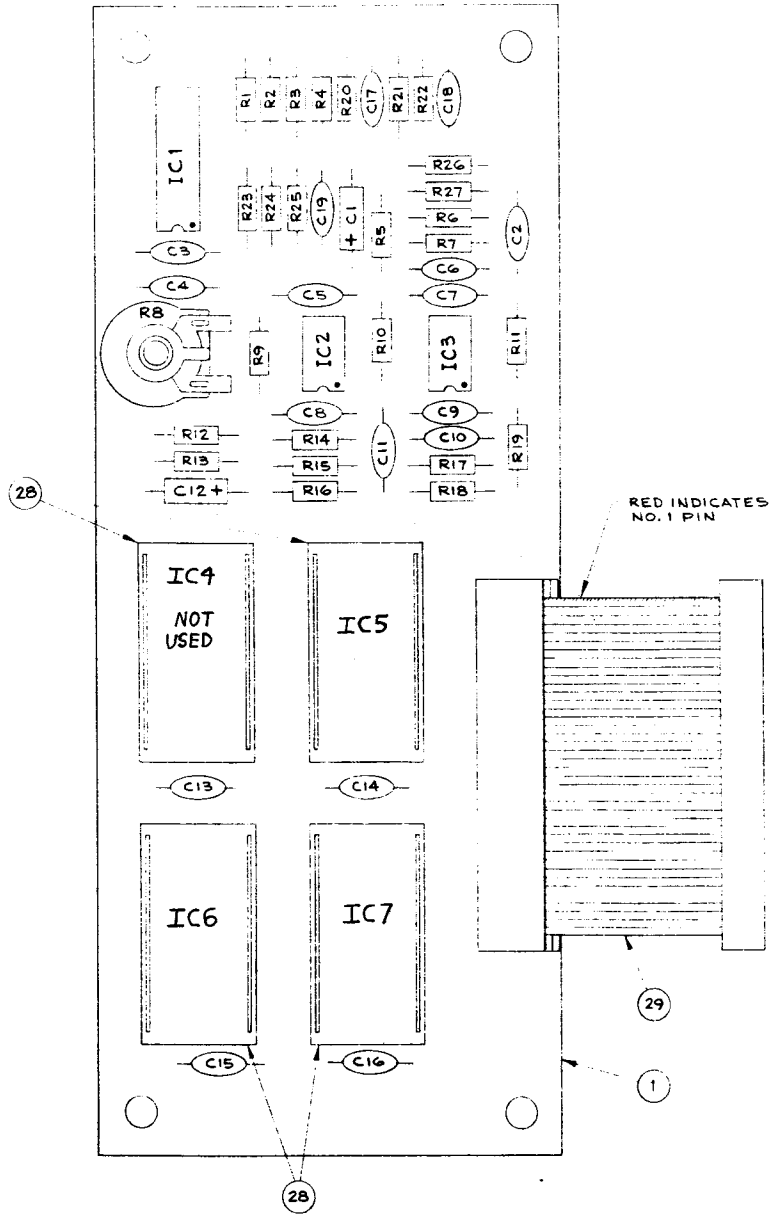
1. ALL RESISTORS, ¼ WATT UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS, MFD. UNLESS OTHERWISE NOTED.



TOLERANCES			
UNLESS OTHERWISE SPECIFIED		QTY.	ASSEMBLE ON
FRACTIONAL ±1/64"	WILLIAMS ELECTRONICS, INC.		
DECIMAL ±.005"	SUBSIDIARY OF THE GENERAL CORP.		
HOLE DIA. +.003 -.000"	3401 N. CALIFORNIA CHICAGO, ILL. 60618		267-2340
ANGULAR ±1/2°	NAME SCHEMATIC, SOUND BOARD		
CONCENTRICITIES T.I.R. .005"	MATERIAL	HEAT TREATMENT	FINISH
SCREW THREADS CLASS 2			
DWN. RGA	DATE 10-10-79	APP'D. 10/19/79	SCALE
			16D-8224

Sound Board Logic Diagram

C-8225



BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	IC-2001-148-2		BARE P.C. BOARD	1
2	5A-9334	IC1	3417 CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR	1
3	5A-9321	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, 3.3 K OHM 10% 1/4 WATT	1
7	5B-8817	R5, R16	RESISTOR, FC, 10 K OHM 10% 1/4 WATT	2
8	5A-8773	R6	RESISTOR, FC, 18 K OHM 5% 1/4 WATT	1
9	5A-9353	R7	RESISTOR, FC, 6.2 K OHM 5% 1/4 WATT	1
10	5A-9324	R9, R10, R11, R15, R18, R19	RESISTOR, FC, 27 K OHM 10% 1/4 WATT	6
11	5B-8997	R12, R13	RESISTOR, FC, 2.7 K 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, 1.2 K 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, 2.2 M. 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, 1 MFD. 20% 25 VOLT	1
20	5A-8980	C2, C3, C5, C7, C8, C9, C13 THRU C16	CAPACITOR, CERAMIC, .01 MFD. +80%-20% 50 VOLT	10
21	5A-9030	C4	CAPACITOR, CERAMIC, .047 MFD. 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, 10 MFD. 20% 25 VOLT LOW LEAK	1
26	5A-9263	C17	CAPACITOR, .33 MFD. 20% 200 VOLT	1
27	5A-8996	C18, C19	CAPACITOR, CERAMIC, .1 MFD. 20% 25 VOLT	2
28	5A-9004		24 PIN SOCKET	4
29	5A 9354	J1	RIBBON CABLE ASSEM	1

REVISION LETTER	REVISION	BY

TOLERANCES
UNLESS OTHERWISE SPECIFIED
FRACTIONAL ± 1/64"
DECIMAL .X ± .005" .XX ± .010"
HOLE DIA +.002 -.000"
ANGULAR ± 1/2°
CONCENTRICITIES T.I.R. .003"
SCREW THREADS CLASS 2

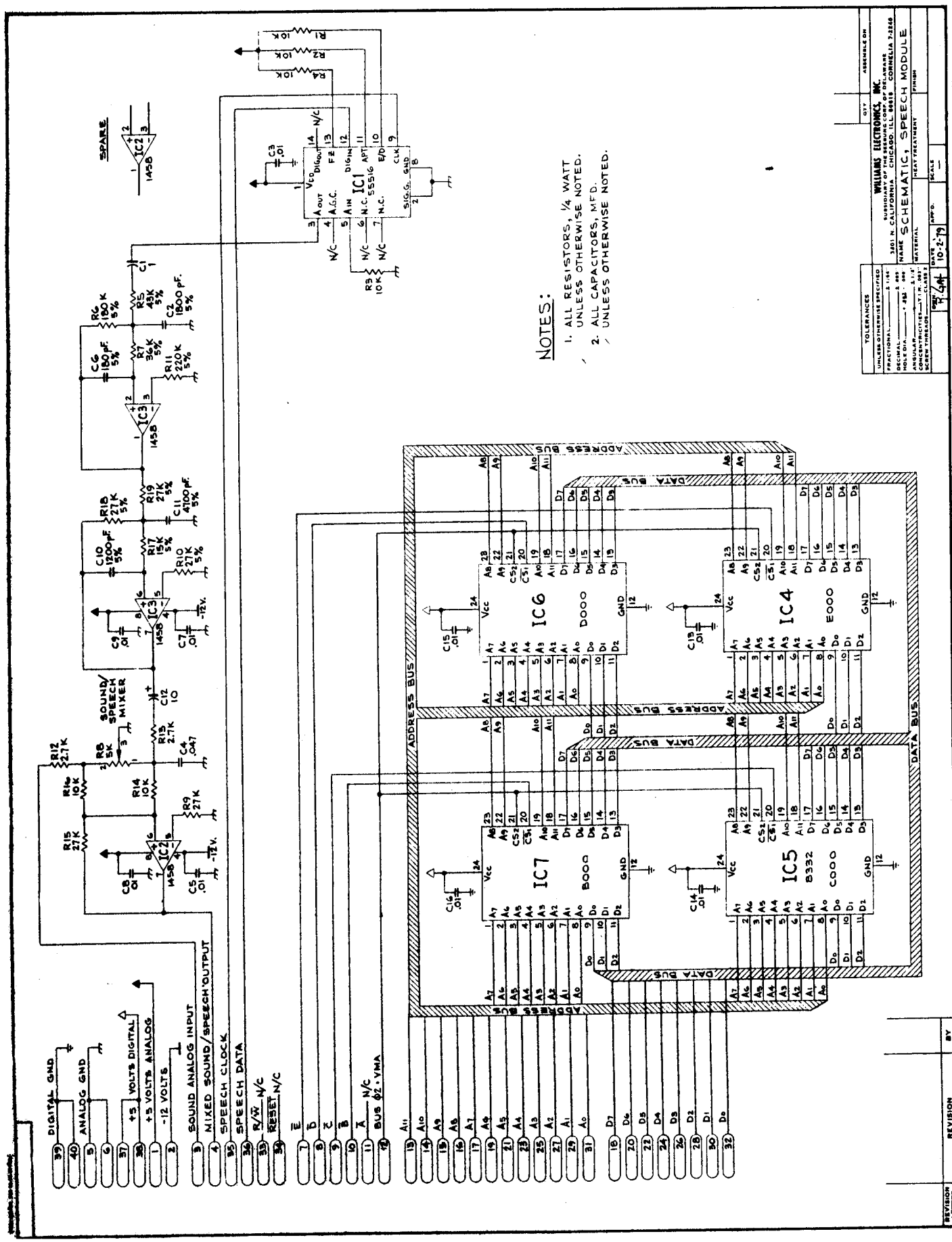
QTY. ASSEMBLE ON

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

NAME SPEECH MODULE ASSEMBLY

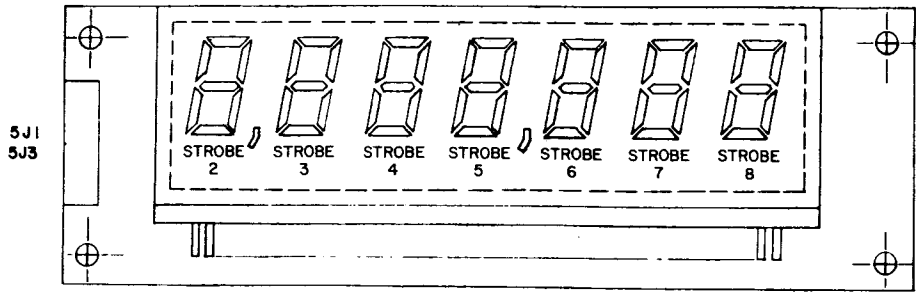
MATERIAL | HEAT TREATMENT | FINISH

DWN RGH | DATE 9-28-79 | APP'D. | SCALE 2:1 | C-8226

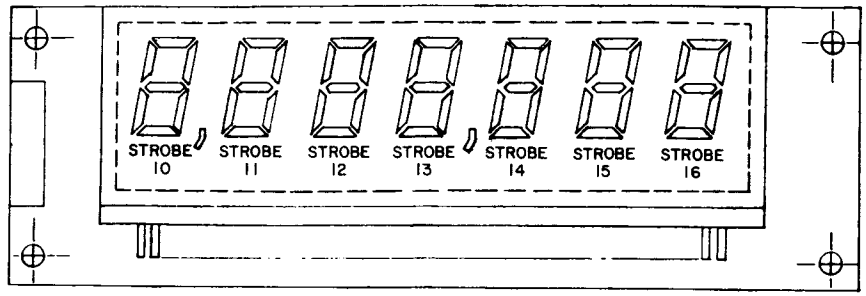


C 8228 Speech Module Assembly and Logic Diagrams

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	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

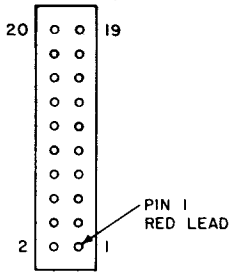
4J2/5J2 (PLAYER 2)
4J4/5J4 (PLAYER 4)

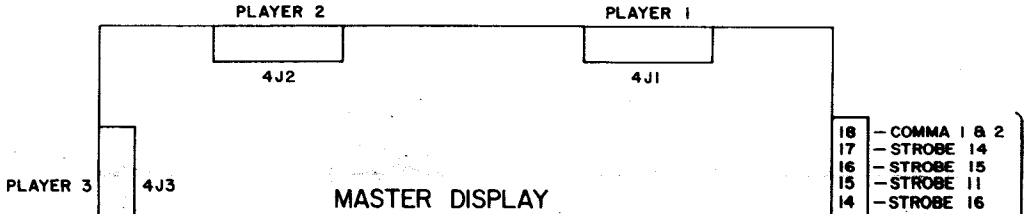
1	100,000's
2	-100V KEEP ALIVE
3	1,000,000's
4	f' SEGMENT
5	N/C
6	g' SEGMENT
7	+100V (N/C)
8	e' SEGMENT
9	10,000's
10	d' SEGMENT
11	1,000's
12	+100V KEEP ALIVE
13	100's
14	COMMA
15	10's
16	c' SEGMENT
17	N/C
18	b' SEGMENT
19	UNITS
20	a' SEGMENT

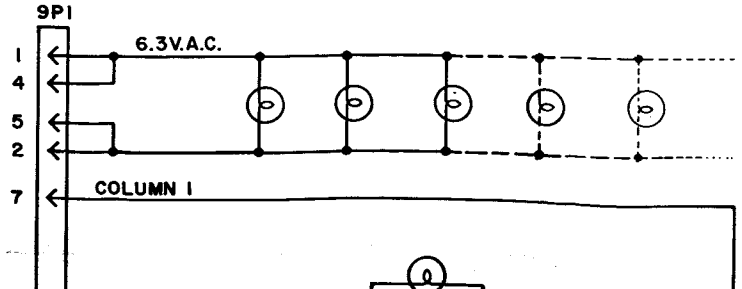
4J8/5J5 (CREDIT/MATCH)

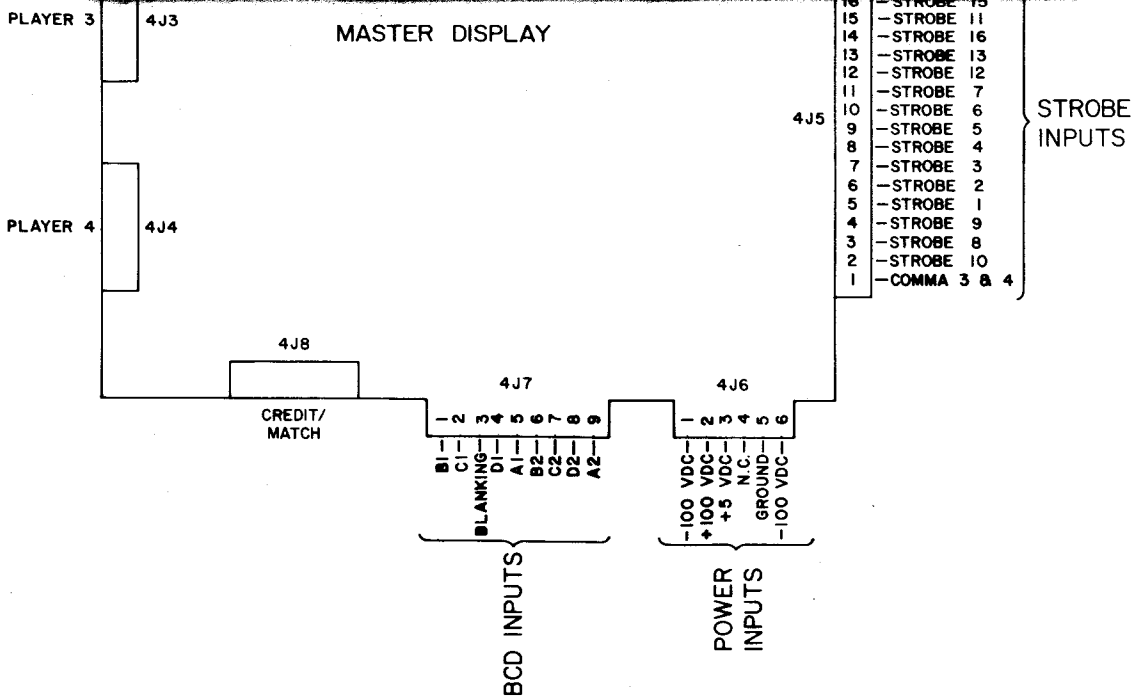
1	f' Segment (Credit)	
2	-100V Keep Alive	
3	e' Segment	Credit
4	g' Segment	
5	c' Segment	
6	d' Segment	
7	b' Segment	
8	10's	
9	Units	
10	a' Segment	
11	e Segment	Match
12	f Segment	
13	10's	
14	d Segment	
15	+100V Keep Alive	
16	c Segment	Match
17	g Segment	
18	b Segment	
19	Units	
20	a Segment	

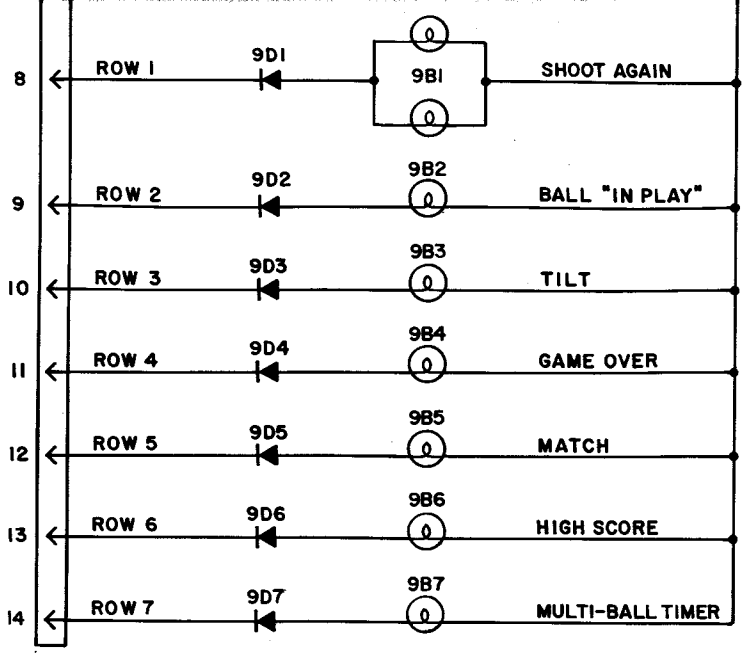
DETAIL A
4J1 – 4J4, 4J8
5J1 – 5J5
CONNECTORS



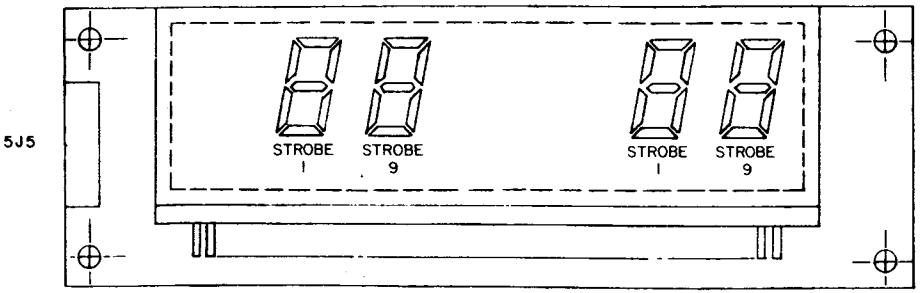


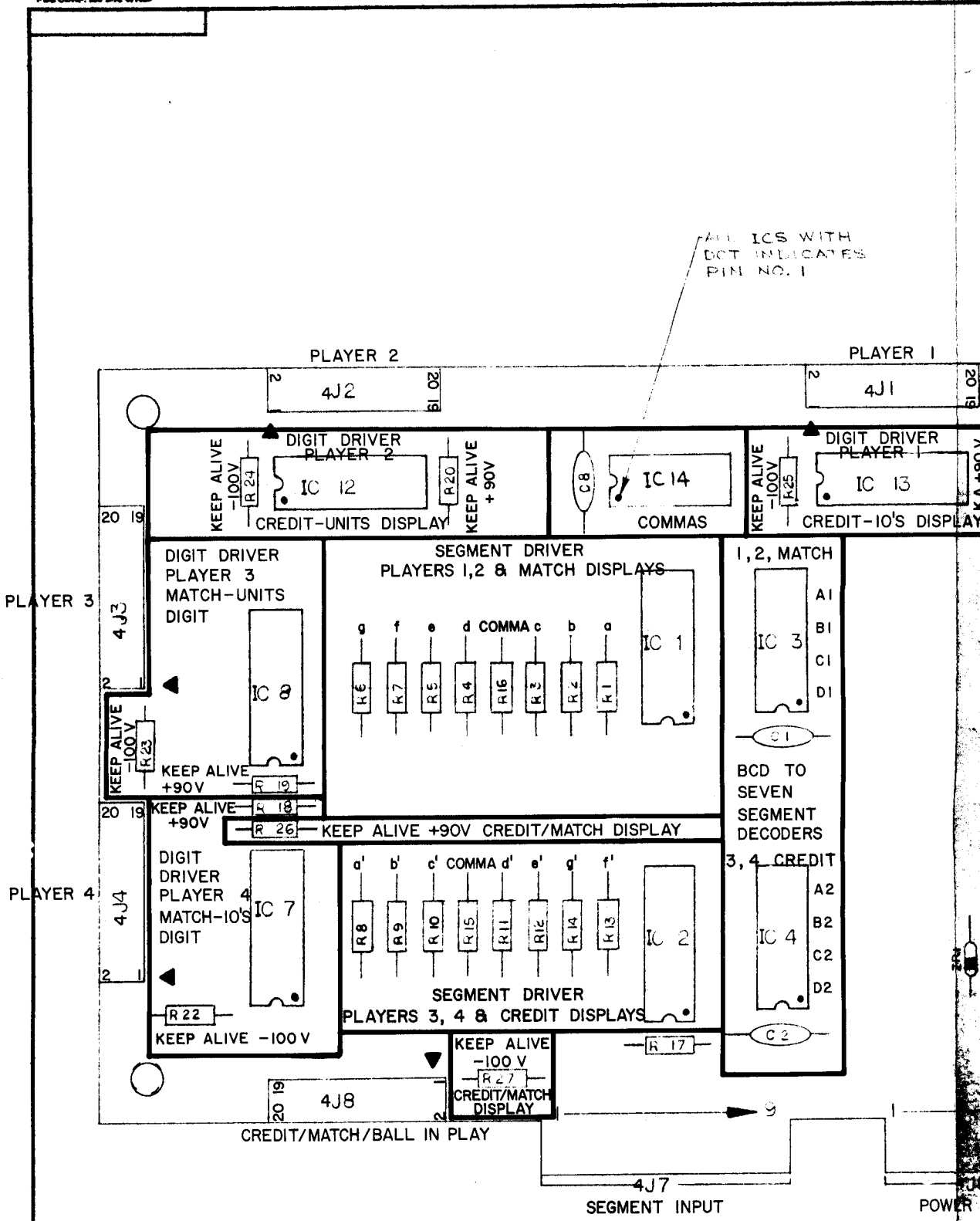






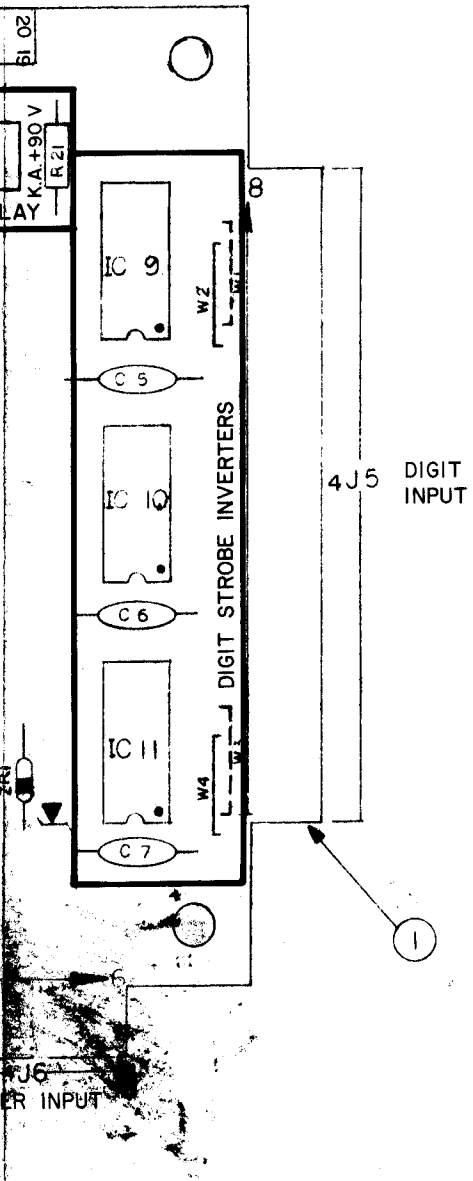
CREDITS / BALL IN PLAY




ALL ICS WITH DOT INDICATES PIN NO. 1
PLAYER 2
PLAYER 1
4J2
4J1
DIGIT DRIVER PLAYER 2
KEEP ALIVE -100V
R24
IC 12
R20
KEEP ALIVE +90V
CREDIT-UNITS DISPLAY
C8
IC 14
COMMAS
DIGIT DRIVER PLAYER 1
KEEP ALIVE -100V
R25
IC 13
CREDIT-10'S DISPLAY
PLAYER 3
4J3
DIGIT DRIVER PLAYER 3 MATCH-UNITS DIGIT
IC 8
KEEP ALIVE -100V
R23
KEEP ALIVE +90V
R19
SEGMENT DRIVER PLAYERS 1,2 & MATCH DISPLAYS
g f e d COMMA c b a
R6 R7 R5 R4 R16 R3 R2 R1
IC 1
1, 2, MATCH
IC 3
A1 B1 C1 D1
C1
BCD TO SEVEN SEGMENT DECODERS
KEEP ALIVE +90V
R18
R26
KEEP ALIVE +90V CREDIT/MATCH DISPLAY
PLAYER 4
4J4
DIGIT DRIVER PLAYER 4 MATCH-10'S DIGIT
IC 7
R22
KEEP ALIVE -100V
a' b' c' COMMA d' e' g' f'
R8 R9 R10 R15 R11 R12 R14 R13
IC 2
SEGMENT DRIVER PLAYERS 3, 4 & CREDIT DISPLAYS
3, 4 CREDIT
IC 4
A2 B2 C2 D2
C2
R17
KEEP ALIVE -100V
R27
CREDIT/MATCH DISPLAY
4J8
CREDIT/MATCH/BALL IN PLAY
9
1
4J7
SEGMENT INPUT
POWER
REVISION LETTER
REVISION
BY

BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	LC-200F-152-B		BARE P.C. BOARD	1
2	5A-8971	IC 9, IC 10, IC 11	MC 14069 HEX. INVERTER	3
3	5A-8970	IC 3, IC 4	MC 14543 BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER	2
4	5A-8969	IC 1, IC 2	UDN-7180 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
5	5A-8968	IC 7 IC 8 IC 12 IC 13	UDN-6184A OR UDN-6118A GAS DISCHARGE DISPLAY SEGMENT DR.	4
6		IC 14	MC 14081 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 THUR R27	RESISTOR, FC 3 MEG. OHM 10% 1/4 WATT	10
13		J8, J1 THUR 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)

TOLERANCES	QTY.	ASSEMBLE ON
UNLESS OTHERWISE SPECIFIED	WILLIAMS ELECTRONICS, INC.	
FRACTIONAL ± 1/64"	SUBSIDIARY OF THE SEEBURG CORP. OF DELAWARE	
DECIMAL ± .005"	3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240	
HOLE DIA. + .002 — .000"	NAME MASTER DISPLAY BOARD ASSEMBLY	
ANGULAR ± 1/2°	MATERIAL	HEAT TREATMENT / FINISH
CONCENTRICITIES T.I.R. .003"		
SCREW THREADS CLASS 2		
DWN. G.H.	DATE 5-23-80	APP'D.
SCALE 2:1 50%		