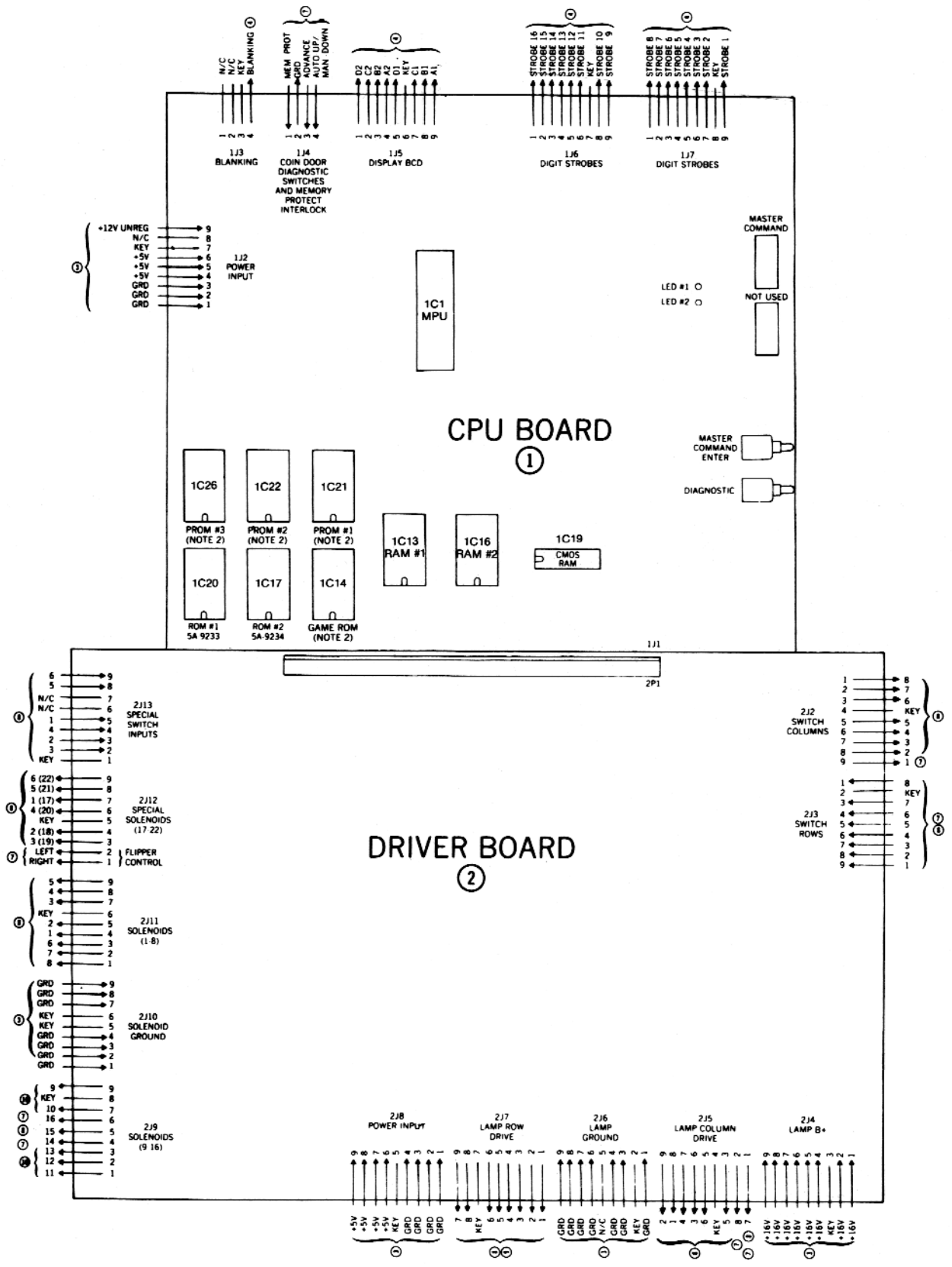
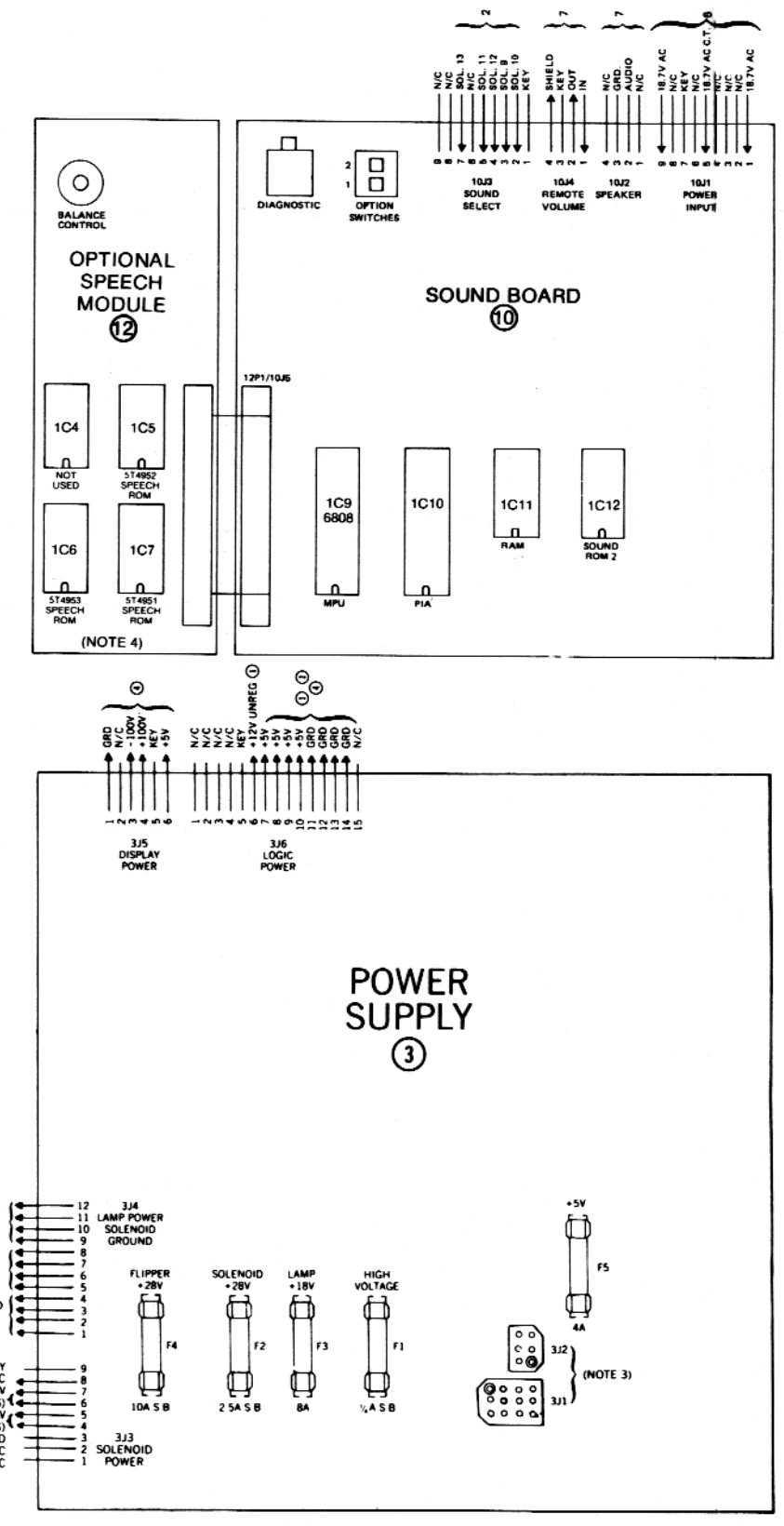
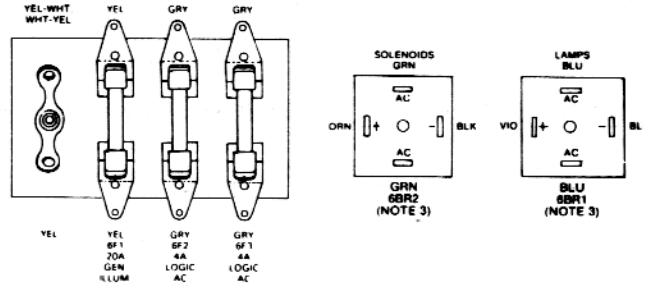


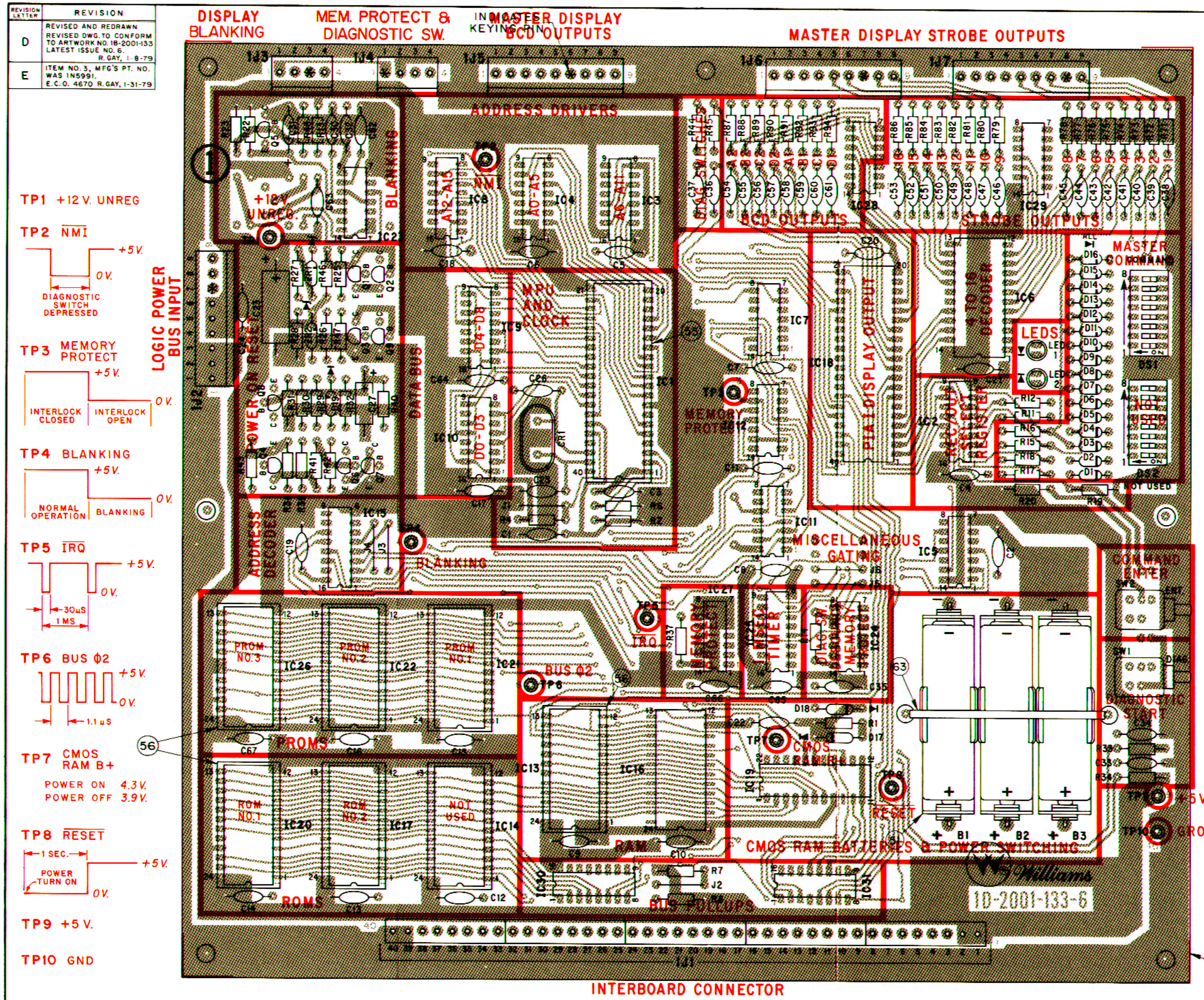




**NOTES:**

1. CONNECTIONS ARE INDICATED BY CIRCLED NUMBERS AS FOLLOWS:
   - (1) CPU BOARD
   - (2) DRIVER BOARD
   - (3) POWER SUPPLY BOARD
   - (4) MASTER DISPLAY BOARD
   - (5) SLAVE DISPLAY BOARD
   - (6) BACKBOX
   - (7) CABINET
   - (8) PLAYFIELD
   - (9) INSERT BOARD
   - (10) SOUND BOARD
   - (11) NOT ASSIGNED
   - (12) SPEECH MODULE
2. WHEN GAME ROM IS USED, PROM #1, PROM #2, AND PROM #3 ARE NOT USED.
3. REFER TO POWER WIRING DIAGRAM (PAGE 23) FOR CONNECTIONS TO 3P1, 3P2, 6BR1, 6BR2, 6F1, 6F2, AND 6F3.
4. FOR FRENCH SPEECH THE FOLLOWING ROMS ARE USED ON SPEECH MODULE:

   1C4-5T4957
   1C5-5T4955
   1C6-5T4956
   1C7-5T4954

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




TP1 +12 V. UNREG

TP2 $\overline{\text{NMI}}$




TP3 MEMORY PROTECT




TP4 BLANKING




TP5 $\overline{\text{IRQ}}$




TP6 BUS Φ2




TP7 CMOS RAM B+

POWER ON 4.3V.
POWER OFF 3.9V.

TP8 $\overline{\text{RESET}}$




TP9 +5 V.

TP10 GND

## BILL OF MATERIAL

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 1 | 1B-2001-133-6 | | BARE P.C. BOARD | 1 |
| 2 | 5A-8990 | IC 2 | 8T28 QUAD BUFFER/RECEIVER | 1 |
| 3 | 5A-8989 | IC3, IC4, IC8 | 8T97 HEX. TS BUFFER | 3 |
| 4 | 5A-9010 | IC6 | 74154 4 TO 16 DECODER | 1 |
| 5 | 5A-9013 | IC7 | 7404 HEX. INVERTER | 1 |
| 6 | 5A-9235 | IC11 | 74LS10 TRIPLE 3 INPUT NAND | 1 |
| 7 | 5A-8973 | IC12 | 7408 QUAD AND | 1 |
| 8 | 5A-9003 | IC13, IC16 | MC6810 RAM | 2 |
| 9 | 5A-9246 | IC15 | 74LS139 DUAL 2 TO 4 LINE DECODER | 1 |
| 10 | 5A-_____ | IC17 | ROM 2K X 8 LOWER | 1 |
| 11 | 5A-8972 | IC18 | MC6821 PIA | 1 |
| 12 | 5A-9017 | IC19 | CMOS RAM 5101-1 | 1 |
| 13 | 5A-_____ | IC20 | ROM 2K X 8 UPPER | 1 |
| 14 | 5C-9002 | IC23 | MC3456/556 DUAL TIMER | 1 |
| 15 | 5A-9073 | IC24 | 7400 QUAD 2 INPUT NAND | 1 |
| 16 | 5A-9236 | IC25 | 4020 CMOS 14 BIT COUNTER | 1 |
| 17 | 5A-9237 | IC27 | 4071 CMOS QUAD 2 INPUT OR | 1 |
| 18 | 5A-9247 | IC5 | 74LS02 QUAD 2 INPUT NOR GATE | 1 |
| 19 | 5A-9238 | IC28, IC29 | 13 DIP RESISTOR/PACK, 4.7 K OHM | 2 |
| 20 | 5A-9239 | IC30, IC31 | 15 DIP RESISTOR/PACK, 4.7 K OHM | 2 |
| 21 | 5B-9025 | DS1, DS2 | 8 STN. DIP SWITCH | 2 |
| 22 | 5A-9018 | ZR1 | 1N5996 ZENER DIODE | 1 |
| 23 | 5A-9240 | ZR2 | 1N5990 ZENER DIODE | 1 |
| 24 | 5A-8919 | D1 THRU D17, D19 | 1N4148 DIODE, SILICON | 19 |
| 25 | 5C-8938 | Q1, Q2, Q3, Q6 THRU Q9 | 2N4401 TRANSISTOR | 9 |
| 26 | 5C-9016 | Q4, Q5 | 2N4403 TRANSISTOR | 2 |
| 27 | 5A-9020 | CR1 | CRYSTAL, 3.58 MHZ | 1 |
| 28 | 5B-8984 | R20, R25, R26, R48, R71 THRU R94 | RESISTOR, FC, 1 K OHM 10% 1/4 W. | 28 |
| 29 | 5B-8983 | R2, R6, R7, R8, R23, R30 | RESISTOR, FC, 3.3 K OHM 10% 1/4 W. | 6 |
| 30 | 5B-8991 | R4, R13 THRU R19, R33, R34, R41 | RESISTOR, FC, 4.7 K OHM 10% 1/4 W. | 11 |
| 31 | 5A-9033 | R1 | RESISTOR, FC, 680 OHM 5% 1/4 W. | 1 |
| 32 | 5B-9036 | R11, R12, R42 | RESISTOR, FC, 100 OHM 10% 1/4 W. | 3 |
| 33 | 5B-9113 | R22, R40 | RESISTOR, FC, 33 K OHM 5% 1/4 W. | 2 |
| 34 | 5B-9034 | R27, R28, | RESISTOR, FC, 10 K OHM 10% 1/4 W. | 2 |
| 35 | 5A-9241 | R29, R38, R46, R47 | RESISTOR, FC, 22 K OHM 10% 1/4 W. | 4 |
| 36 | 5A-8998 | R31 | RESISTOR, FC, 2.2 K OHM 10% 1/4 W. | 1 |
| 37 | 5A-9039 | R32 | RESISTOR, FC, 10 OHM 10% 1/4 W. | 1 |
| 38 | 5A-9242 | R37 | RESISTOR, FC, 300 K OHM 10% 1/4 W. | 1 |
| 39 | 5A-8997 | R39, R43 | RESISTOR, FC, 2.7 K OHM 10% 1/4 W. | 2 |
| 40 | 5B-9083 | R44, R45 | RESISTOR, FC, 470 OHM 10% 1/4 W. | 2 |
| 41 | 5A-8980 | C1 THRU C21, C30, C33 THRU C37, C63 THRU C67 | CAPACITOR, CERAMIC, .01 MFD. 50 V. | 28 |
| 42 | 5A-8986 | C23 | CAPACITOR, ELECT., 100 MFD. 10 V. | 1 |
| 43 | 5A-8996 | C22, C24 | CAPACITOR, CERAMIC, .1 MFD. 50 V. | 2 |
| 44 | 5A-9169 | C25, C26 | CAPACITOR, CERAMIC, 27 PFD. 1K V. | 2 |
| 45 | 5A-9243 | C27 | CAPACITOR, TANT., 10 MFD. 10 V. | 1 |
| 46 | 5A-9031 | C31 | CAPACITOR, TANT., 1 MFD. 25 V. | 1 |
| 47 | 5A-9030 | C32 | CAPACITOR, CERAMIC, .047 MFD. 50 V. | 1 |
| 48 | 5A-9065 | C38 THRU C62 | CAPACITOR, CERAMIC, 470 PFD. 50 V. | 25 |
| 49 | 5A-9019 | LED1, LED 2 | LED, RED | 2 |
| 50 | 5A-9024 | SW1, SW2 | SWITCH, SPDT MOMENTARY | 2 |
| 51 | 5A-9021 | | BATTERY HOLDER #171 | 1 |
| 52 | 5A-9026 | 1J1 | HEADER 09-64-1083 | 5 |
| 53 | 5A-9028 | 1J3, 1J4 | HEADER 09-65-1041 | 2 |
| 54 | 5A-9027 | 1J2, 1J5, 1J6, 1J7 | HEADER 09-65-1091 | 4 |
| 55 | 5A-8985 | | 40 PIN IC SOCKET | 1 |
| 56 | 5A-9004 | | 24 PIN IC SOCKET | 7 |
| 57 | | J1 THRU J6 | WIRE JUMPER 22 GUAGE WIRE WITH INSULATION | 6 |
| 58 | | TP1 THRU TP10 | TERMINAL #1502-1 | 10 |
| 59 | 5A-9250 | IC1 | MC6808 MICROPROCESSOR | 1 |
| 60 | | IC14 | GAME ROM | 0 |
| 61 | 5A-9015 | IC21, IC22, IC26 | PROM 512 X 8 7641/6341 | 2/3 |
| 62 | 5A-9022 | B1, B2, B3 | BATTERY, ALKALINE, 1.5 V. | 3 |
| 63 | 5701-09308 | E1, E2 | 16 PIN IC SOCKET HDR. | 1 |
| 64 | 5A-9266 | D18 | IN5817 DIODE | 1 |
| 65 | 5A-9086 | R95 | RESISTOR, 6.8K OHM 10% 1/4 W | 1 |

* WHEN USED IC14 REPLACES IC21, IC22 AND IC26

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

PART NAME: CPU BOARD ASSEMBLY

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



*CPU Board Assembly Drawing*

| REVISION LETTER | REVISION | |
|---|---|---|
| A | ECO-4863 | 4/18/80 |

**NOTES:**

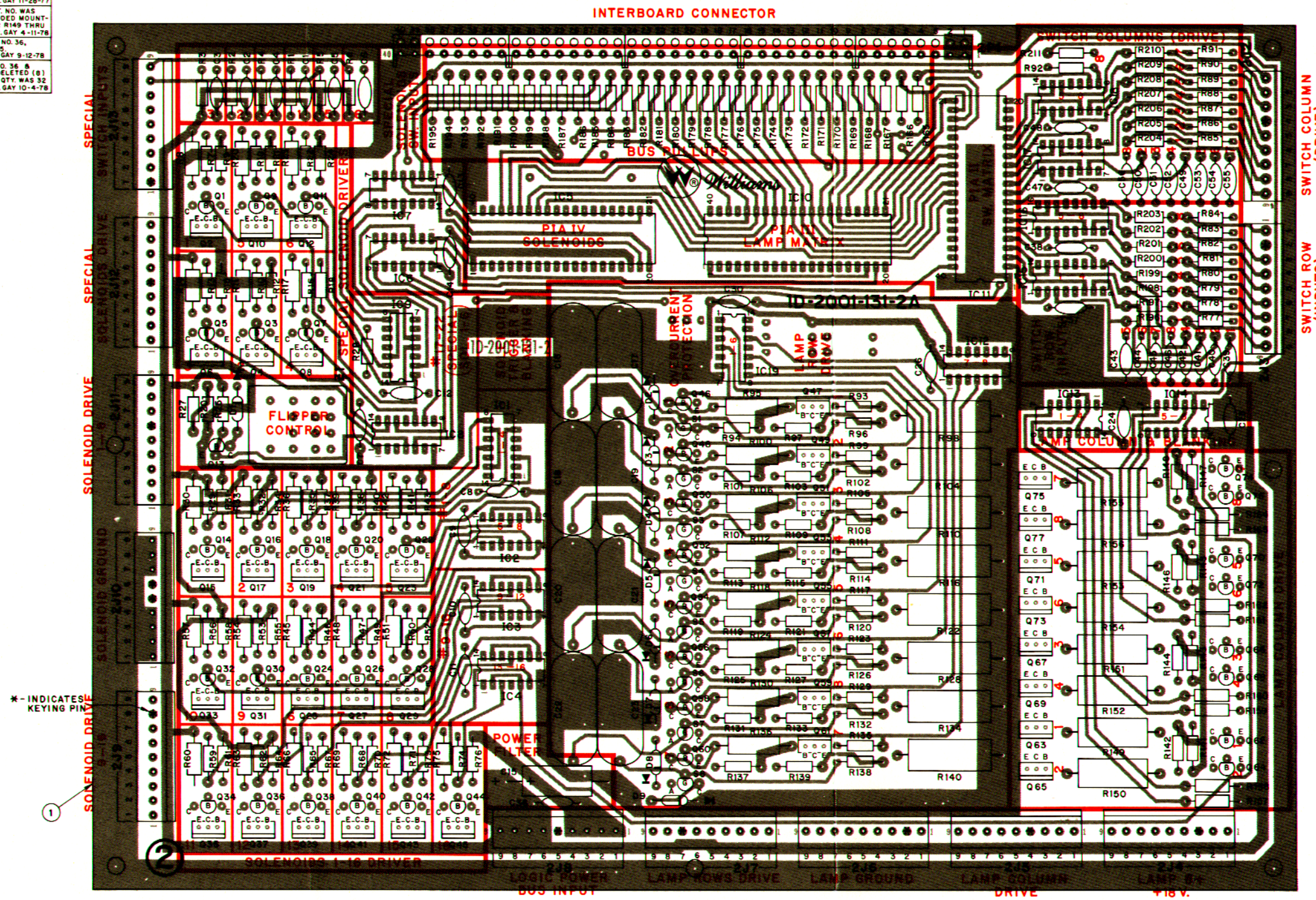
1. ALL RESISTORS 1/4W UNLESS OTHERWISE INDICATED.
2. ALL CAPACITORS ARE MFD UNLESS OTHERWISE INDICATED.
3. *WITH 6802 FOR IC1, IC13 MAY BE REMOVED AND MPU INTERNAL RAM ENABLED BY ADDING R4 AND REMOVING JUMPER J1.
   **WITH 6808 FOR IC1, IC13 MUST BE USED, R4 NOT USED, AND JUMPER J1 MUST BE CONNECTED.
4. WHEN IC14 GAME ROM IS USED IN PLACE OF PROMs JUMPER J3 MUST BE CONNECTED AND J4 REMOVED (IC14 ADDRESS $6000_{16}$). WHEN IC14 GAME ROM AND PROMs ARE USED JUMPER J4 MUST BE CONNECTED AND J3 REMOVED (IC14 ADDRESS $6800_{16}$).

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

| PART NAME | | | | |
|---|---|---|---|---|
| SCHEMATIC, CPU BOARD | | | | |
| DWN. R. Gay | DATE 2-13-79 | APP'D. | SCALE 2=1 | PART NO. 16D-8163 |

*CPU Board Logic Diagram*
*9*

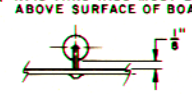
| REVISION LETTER | REVISION |
|---|---|
| C | REVISED AND REDRAWN R. GAY 11-28-77 |
| D | ITEM NO. 28, PT. NO. WAS 5A-8999-8, ADDED MOUNTING NOTE FOR R149 THRU R156. R. GAY 4-11-78 |
| E | DELETED ITEM NO. 36, PT. NO. 5A-8985, E.C.O. R. GAY 9-12-78 |
| F | ADDED ITEM NO. 36 & ITEM NO. 22, DELETED (8) RESISTORS & (2) 5A-8943.32 E.C.O. 4624 R. GAY 10-4-78 |




## BILL OF MATERIAL

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 1 | 18-2001-131 | | 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 | 6 |
| 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, 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% ¼ W | 62 |
| 21 | 5A-8983 | R27 | RESISTOR, FC, 3.3 K OHM 10% ¼ 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, 1 K OHM 10% ¼ 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% ¼ 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% ¼ 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% ¼ W | 23 |
| 26 | 5A-8817 | R26 | RESISTOR, FC, 10 K OHM 10% ¼ W | 1 |
| 27 | 5A-8998 | R141 THRU R148 | RESISTOR, FC, 2.2 K OHM 10% ¼ 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% ¼ W | 8 |
| 31 | 5A-9086 | R94, R101, R107, R113, R119, R125, R131, R137 | RESISTOR, FC, 6.8 K OHM 10% ¼ W | 8 |
| 32 | 5A-9037 | R98, R104, R110, R116, R122, R128, R134, R140 | RESISTOR, WIREWOUND, .4 OHM 10% 5 WATT | 8 |
| 33 | 5A-8994 | 21 | 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 2J13 | 9 PIN HEADER | 12 |
| 36 | 5A-9001 | R204 THRU R211 | RESISTOR, FC, 330 OHM 10% ¼ W | 8 |

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



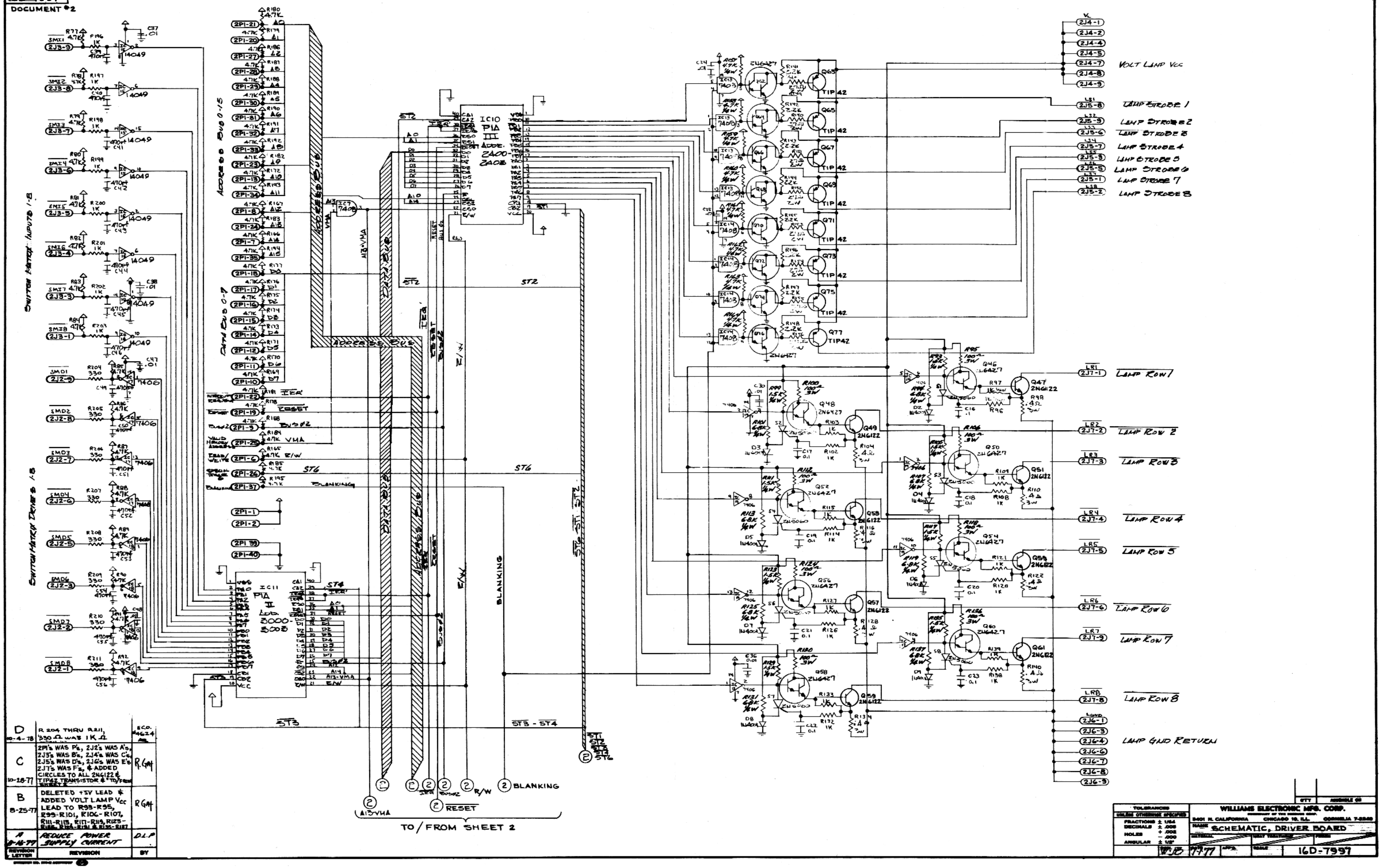

WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF VCOS CORPORATION
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

PART NAME: DRIVER BOARD ASSEMBLY

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

DOCUMENT #1

16D-7997
DOCUMENT #2




| REVISION LETTER | REVISION | BY | ECO. |
|---|---|---|---|
| D 10-4-78 | R 204 THRU R211, 330 Ω WAS 1K Ω | | M4624 |
| 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 CIRCLES TO ALL 2N6122 & TIP42 TRANSISTOR & "TO/FROM SHEET 2" | R.GAY | |
| 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 | R.GAY | |
| A 8-16-77 | REDUCE POWER SUPPLY CURRENT | D.L.P. | |

| TOLERANCES UNLESS OTHERWISE SPECIFIED | |
|---|---|
| FRACTIONS | ± 1/64 |
| DECIMALS | ± .005 |
| HOLES | + .005 − .000 |
| ANGULAR | ± 1/2° |

WILLIAMS ELECTRONIC MFG. CORP.
3401 N. CALIFORNIA CHICAGO 18, ILL. CORNELIA 7-2340
NAME SCHEMATIC, DRIVER BOARD
MATERIAL — HEAT TREATMENT — FINISH
DRWN. WJB 7-7-77 APPD. — SCALE — 16D-7997
QTY — ASSEMBLE ON

*Driver Board Logic Diagram*
*(Sheet 1 of 2) 11*

16D-7997
DOCUMENT #2

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

LAMP & SOLENOID GROUND

PIA IV ADDR. 2200-2203

TO/FROM SHEET 1

BLANKING

LAMP & SOLENOID GND.

+5V.

5V B+

GND.

C15 +75μf 35VOLT

C36 0.1μfd

SWITCH SOLENOID 1 TRIGGER
SWITCH TRIGGERED SOLENOID 1 DRIVE
SWITCH TRIGGERED SOLENOID 2 DRIVE
SWITCH SOLENOID 2 TRIGGER
SWITCH SOLENOID 3 TRIGGER
SWITCH TRIGGERED SOLENOID 3 DRIVE
SWITCH TRIGGERED SOLENOID 4 DRIVE
SWITCH SOLENOID 4 TRIGGER
SWITCH SOLENOID 5 TRIGGER
SWITCH TRIGGERED SOLENOID 5 DRIVE
SWITCH TRIGGERED SOLENOID 6 DRIVE
SWITCH SOLENOID 6 TRIGGER

FLIPPER GROUND RETURNS

| 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. Gatt 10-28-77 |
| A 8-28-77 | REVISION "A" | |

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ± 1/64, DECIMALS ± .005, HOLES + .005 - .000, ANGULAR ± 1/2°

WILLIAMS ELECTRONIC MFG. CORP.
SUBSIDIARY OF THE SEEBURG CORP.
3401 N. CALIFORNIA CHICAGO 18, ILL. CORNELIA 7-8840

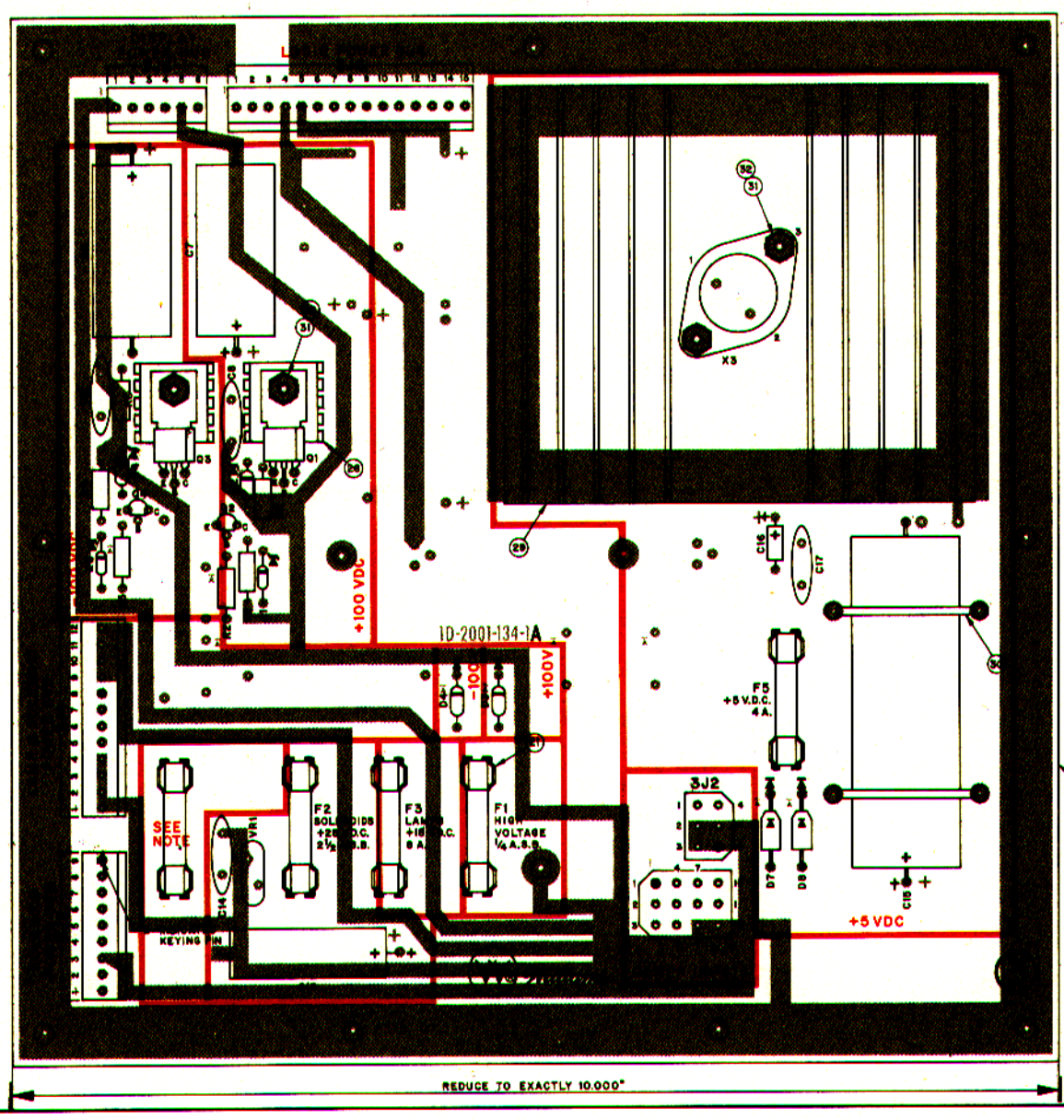
NAME: SCHEMATIC, DRIVER BOARD
MATERIAL | HEAT TREATMENT | FINISH
DRAWN WHB 7.5.77 | APPD. | SCALE | 16D-7997
QTY | ASSEMBLE ON

SHEET 2 OF 2



*Driver Board Logic Diagram (Sheet 2 of 2)*

| REVISION LETTER | REVISION |
|---|---|
| | REVISED AND REDRAWN R. GAY 7-14-78 |

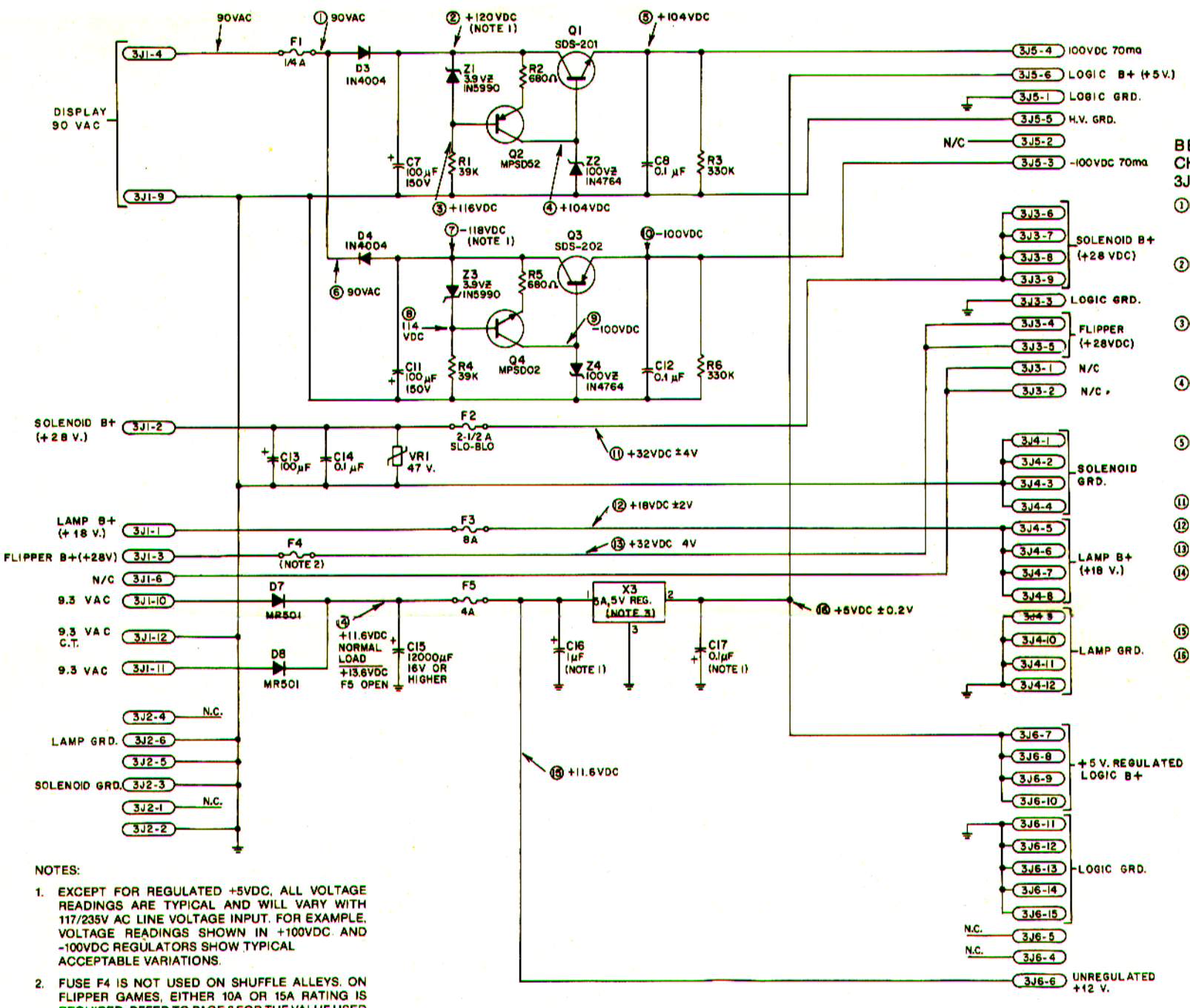



## BILL OF MATERIAL

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 1 | 1D-2001-134 | | BARE P.C. BOARD | 1 |
| 2 | 5A-9049 | X3 | 5 AMP, 5 VOLT POSITIVE VOLTAGE REGULATOR | 1 |
| 3 | 5A-9067 | Q1 | SDS-201 NPN TRANSISTOR | 1 |
| 4 | 5C-9055 | Q2 | MPSD52 PNP TRANSISTOR | 1 |
| 5 | 5A-9068 | Q3 | SDS-202 PNP TRANSISTOR | 1 |
| 6 | 5C-9056 | Q4 | MPSD05 NPN TRANSISTOR | 1 |
| 7 | 5B-5064 | D3, D4 | IN4001 DIODE | 2 |
| 8 | 5B-9046 | D7, D8 | MR501 DIODE | 2 |
| 9 | 5A-9059 | Z1, Z3 | IN5990 ZENER DIODE | 2 |
| 10 | 5A-9060 | Z2, Z4 | IN4764 ZENER DIODE | 2 |
| 11 | 5B-9064 | VR1 | VARISTOR | 1 |
| 12 | 5B-9062 | R1, R4 | RESISTOR, FC, 39K OHM 10% 1/4 W | 2 |
| 13 | 5B-9061 | R2, R5 | RESISTOR, FC, 680 OHM 10% 1/4 W | 2 |
| 14 | 5B-9063 | R3, R6 | RESISTOR, FC, 330 K OHM 10% 1/4 W | 2 |
| 15 | 5A-9065 | C7, C11 | CAPACITOR, ELECT, 100 MFD. 150 V. | 2 |
| 16 | 5A-9070 | C12 | CAPACITOR, ELECT, 100 MFD. 100 V. | 1 |
| 17 | 5A-9048 | C13 | CAPACITOR, ELECT, 15,000 MFD. 16 V. | 1 |
| 18 | 5A-9072 | C9, C12, C14, C17 | CAPACITOR, CERAMIC, .1 MFD. 500 V. | 4 |
| 19 | | | | |
| 20 | 5A-9051 | C16 | CAPACITOR, ELECT., 1 MFD. 65V. | 1 |
| 21 | 5A-9052 | | FUSEHOLDER | 10 |
| 22 | 5A-9066 | J1 | 18 PIN CONNECTOR | 1 |
| 23 | 5A-9067 | J2 | 6 PIN HEADER CONNECTOR | 1 |
| 24 | 5A-9027 | J3 | 9 PIN HEADER CONNECTOR | 1 |
| 25 | 5A-9043 | J4 | 12 PIN HEADER CONNECTOR | 1 |
| 26 | 5A-9036 | J5 | 15 PIN HEADER CONNECTOR | 1 |
| 27 | 5A-9074 | J6 | 6 PIN CIRCUIT CONNECTOR | 1 |
| 28 | 5A-9042 | | HEAT SINK | 2 |
| 29 | 5B-9041 | | 4" X 4 5/8" HEAT SINK | 1 |
| 30 | 3A-7980-1 | | TIE WRAP | 2 |
| 31 | | | 6-40 X 5/16 R.H. MECH. SCREW | 4 |
| 32 | | | 6-40 HEX. NUT | 4 |
| 33 | 5A-9761 | F1 | S.B. FUSE 1/4 AMP. | 1 |
| 34 | 5A-9188 | F2 | S.B. FUSE 2.5 AMP. | 1 |
| 35 | 5A-9071 | F3 | FUSE 8 AMP. | 1 |
| 36 | 5A-6909 OR 5A-5867 | F4 | FUSE 10 AMP. (FLIPPER) FUSE 15 AMP. (DUAL ACTION FLIPPER) | 1 |
| 37 | 5A-9514 | F5 | S.B. FUSE 4 AMP. | 1 |

WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF NOOR CORPORATION
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2840

PART NAME: POWER SUPPLY BOARD ASSEMBLY
DWN. D.D.G. | DATE 6-15-77 | APP'D. | SCALE 6-1 | PART NO. D-7999
DOCUMENT #1




**LEGEND**

BEFORE MAKING VOLTAGE CHECKS PERFORM CHECK OF 3J1 INPUT VOLTAGES.

①⑥ OV INDICATES F1 BLOWN. CHECK FOR SHORTED D3, D4; C7, C11; OR C8, C12.

②⑦ OV INDICATES OPEN D3, D4. LOW VOLTAGE INDICATES FAULTY C7, C11.

③⑧ IF VOLTAGE IS HIGH WITH RESPECT TO ② OR ⑦, Z1, Z3, OR R1, R4 FAULTY.

④⑨ IF OV Q2, Q4 OR R2, R5 FAULTY. IF OTHERWISE ABNORMAL Z2, Z4 FAULTY.

⑤⑩ OV OR SAME READING AS ② OR ⑦ INDICATES FAULTY Q1 OR Q3.

⑪ OV INDICATES F2 BLOWN

⑫ OV INDICATES F3 BLOWN

⑬ OV INDICATES F4 BLOWN

⑭ LOW VOLTAGE INDICATES OPEN D7 OR D8; C15, C16, OR C17. OR X3 FAULTY

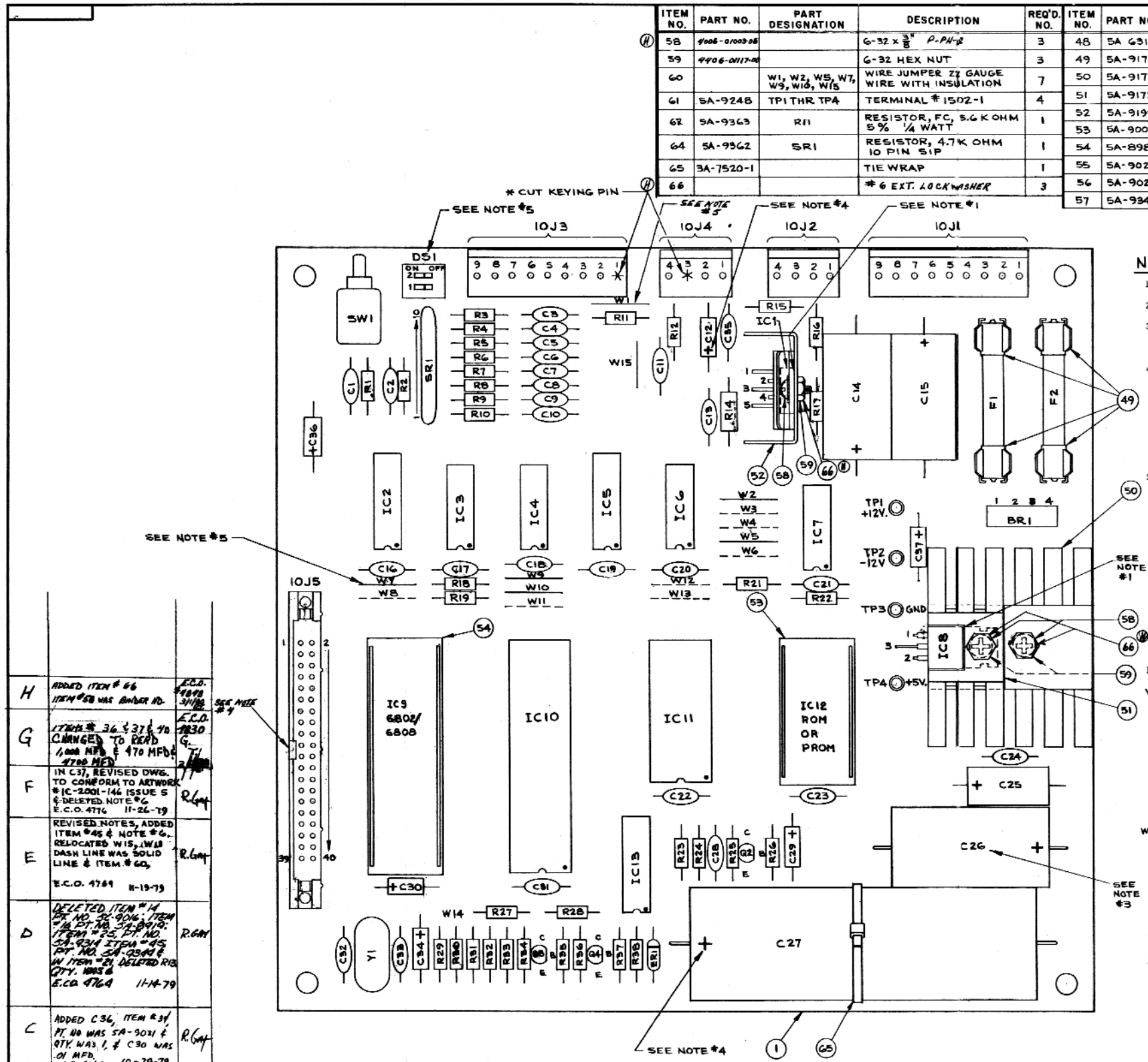
⑮ OV INDICATES F5 BLOWN

⑯ ABNORMAL INDICATES X3 FAULTY

NOTES:

1. EXCEPT FOR REGULATED +5VDC, ALL VOLTAGE READINGS ARE TYPICAL AND WILL VARY WITH 117/235V AC LINE VOLTAGE INPUT. FOR EXAMPLE, VOLTAGE READINGS SHOWN IN +100VDC AND -100VDC REGULATORS SHOW TYPICAL ACCEPTABLE VARIATIONS.
2. FUSE F4 IS NOT USED ON SHUFFLE ALLEYS. ON FLIPPER GAMES, EITHER 10A OR 15A RATING IS REQUIRED. REFER TO PAGE 2 FOR THE VALUE USED IN THIS GAME.
3. ACCEPTABLE REPLACEMENTS FOR X3, 5V REGULATOR ARE AS FOLLOWS:

   78H05
   LAS1405




| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| (H) 58 | 4006-01003-08 | | 6-32 x 3/8" P-PH-S | 3 |
| 59 | 4406-01117-00 | | 6-32 HEX NUT | 3 |
| 60 | | W1, W2, W5, W7, W9, W10, W15 | WIRE JUMPER 22 GAUGE WIRE WITH INSULATION | 7 |
| 61 | 5A-9248 | TP1 THR TP4 | TERMINAL #1502-1 | 4 |
| 62 | 5A-9363 | R11 | RESISTOR, FC, 5.6 K OHM 5% 1/4 WATT | 1 |
| 64 | 5A-9362 | SR1 | RESISTOR, 4.7K OHM 10 PIN SIP | 1 |
| 65 | 3A-7520-1 | | TIE WRAP | 1 |
| 66 | | | #6 EXT. LOCKWASHER | 3 |

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 48 | 5A 6314 | F1, F2 | 4 AMP SLOW BLOW FUSE | 2 |
| 49 | 5A-9178 | | FUSEHOLDER | 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 |

## NOTES:

1. USE THERMAL COMPOUND BETWEEN IC8 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, C23, 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)
   W1 - 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

INSTAL THESE JUMPERS FOR FOLLOWING GAMES:

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

SOUND ROM 1: WORLD CUP, DISCO FEVER, CONTACT, POKERINO, PHOENIX, ARISTOCRAT SHUFFLE, POMPEII SHUFFLE, KING TUT SHUFFLE, TAURUS SHUFFLE

W15, W8, W12, W4, W1, W2, W5, W10, FOR: (G)

SOUND ROM 1: FLASH, STELLAR WARS, TRI ZONE, TIME WARP — 5A-9198

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

GORGAR — SOUND ROM 2 - 5T-4960

IC 12 SELECTION STRAPPING:

| (2K x 8) | (4K x 8) | (512 x 8) |
|---|---|---|
| W2 | W3 | W3 |
| W5 IN | W5 IN | W6 IN |
| W10 | W10 | 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 | TDA2002 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-9089 | R34 | RESISTOR, FC, 10 OHM 10% 1/4 WATT | 1 |
| 31 | 5A-8980 | C1, C16 THRU C23 C34 | 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 (G) | 5D40-09145-00 | C14 | CAPACITOR, ELECTROLYTIC, 1,000 MFD. 16 V. ±20% | 1 |
| 37 (G) | 5D40-09169-00 | C15 | CAPACITOR, ELECTROLYTIC, 470 MFD. 16V. ±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 (A) | 5D40-09176-00 | C27 | CAPACITOR, ELECTROLYTIC, 4700 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. 12% | 1 |
| 43 | 5A-9149 | 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-9380 | DS1 | 2 STD. DIP SWITCH | 1 |

| REVISION LETTER | REVISION | BY |
|---|---|---|
| H | ADDED ITEM # 66 ITEM #58 WAS ORDER NO. | E.C.O. #8019 3/1/80 |
| G | ITEMS #36 & 37 & 47 CHANGED TO READ 1,000 MFD & 470 MFD & 4700 MFD | E.C.O. #7830 G. T/L |
| F | IN C37, REVISED DWG. TO CONFORM TO ARTWORK #IC-2001-146 ISSUE 5 & DELETED NOTE #6. E.C.O. 4776 11-26-79 | R.Gray |
| E | REVISED NOTES, ADDED ITEM #45 & NOTE #6. RELOCATED W15, W18 DASH LINE WAS SOLID LINE & ITEM #60, E.C.O. 4769 11-19-79 | R.Gray |
| D | DELETED ITEM #14 PT. NO. 5A-9016, ITEM #16 PT. NO. 5A-8910; ITEM #25, PT. NO. 5A-9343 ITEM #45 PT. NO. 5A-03947 & IN ITEM #21, DELETED R18 QTY. WAS 8 E.C.O. 4764 11-14-79 | R.Gray |
| C | ADDED C36, ITEM #37 PT. NO WAS 5A-9031 & QTY. WAS 1, & C30 WAS .01 MFD, E.C.O. 4760 10-29-79 | R.Gray |
| B | DELETED ITEM #62 ADDED R11 & R12 TO ITEM #19 QTY. WAS 9 10-5-79 | R.G. |
| | ITEM #17, ADDED 5A-9357 ITEM #62, ADDED PT. NO. ITEM #63, ADDED PT. NO. | |
| A | 10-4-79 | R.G. |

DIETZGEN NO. 196H AGEPROOF

| TOLERANCES | QTY. | ASSEMBLED ON |
|---|---|---|
| UNLESS OTHERWISE SPECIFIED: FRACTIONAL ±1/64" DECIMAL .XX ±.005" HOLE DIA. .XXX +.005 -.000" ANGULAR ±1/2° CONCENTRICITY .Y I.D. .000" SCREW THREADS CLASS 2 | | |

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

NAME: SOUND BOARD SUB-ASSEM

MATERIAL | HEAT TREATMENT | FINISH

DRAWN R.Gray DATE 9-23-79 APP'D. | SCALE 2:1 | D-8223



*Sound Board Assembly Drawing*

16D-8224

SPEAKER 8 OHM
J2-1
J2-2
J2-3
J2-4
C14 1000 (E)
C13 .1
C12 1
C11 .001
IC1
R14 1 1/2W
R17 220 1/2W
R15 1K
R16 2.2
C15 470 (E)
C35 .1

VOLUMN CONTROL
J4-1
J4-2
J4-3 KEY
J4-4 GND
R11 5.6K
R13 1K
W15

W1
C28 47 PFD.
R25 2.3M
R23 3.3K
R24 3.3K
IC13 1408
Q2 2N4401
R26 3.3K
C29 10
-12V.

IC10 6821
C31 .01
R33 10K
SW1 DIAGNOSTIC SWITCH
R1 4.7K
C1 .01
IRQ
RESET
BUS Φ2
VMA
R/W
CONTROL BUS
DATA BUS
ADDRESS BUS

IC9 6808/02
R32 4.7K
R31 4.7K
R21 4.7K
C30 1
C33 27 PFD.
C32 27 PFD.
Y1 3.58 MHz.
R29 47K
C34 2.2
Q3 2N4401
R28 1K
R36 1K
R34 10
R35 10K
Q4 2N4401
ZR1 6.8V. ZENER
R38 1K
R37 10K
+12V. UNREG.
R30 4.7K
W14 FOIL JUMPER

DIGITAL GND J5-39
ANALOG GND J5-40
J5-5
J5-6
+5 VOLTS DIGITAL J5-37
+5 VOLTS ANALOG J5-38
-12 VOLTS J5-1
C36 1 J5-2
SOUND ANALOG J5-3
MIXED SOUND/SPEECH J5-4
SPEECH CLOCK J5-35
SPEECH DATA J5-36
R/W J5-33
RESET J5-34

SOUND/SPEECH SELECT INPUT
J3-1 KEY
J3-3
J3-2
J3-5
J3-4
J3-7
J3-8
J3-6
J3-9 N.C.
SR1 ALL 4.7K
R9 100
R10 100
R7 100
R8 100
R5 100
R6 100
R3 100
C9 470 PFD.
C10 470 PFD.
C7 470 PFD.
C8 470 PFD.
C5 470 PFD.
C6 470 PFD.
C3 470 PFD.
C19 .01
IC5 4050
IC7 14069

SPARE
R22 4.7K
IC7 14069

DS1 OFF ON
R2 100
R4 100
C2 470 PFD.
C4 470 PFD.
W4
W9

IC4 7408
IC4 7408
IC4 7408

TP1
+12V. UNREG.
BRI MDA 200
F2 4 A.S.B.
F1 4 A.S.B.
IC8 7805
+5V REG.
DIGITAL
ANALOG
TP4
TP3
TP2
C27 4,700
C37 1
C25 100
C24 .1
C26 1,000
-12V
J1-9
J1-8
J1-6
J1-5
J1-2
J1-1
J1-7 KEY
J1-4 N.C.
J1-3 N.C.

W13
W12
R21 4.7K
C20 .01
IC6 4068
IC4 7408
C18 .01

R19 4.7K
R18 4.7K
W8
W7
IC3 7400
IC2 7442
C16 .01
N.C.
BUS Φ2 · VMA
W10
W11
C17 .01
C22 .01
IC11 6810
IC12 F800
C23 .01
C21 .01
IC7 14069
W2
W5
W6

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

| REVISION LETTER | REVISION | BY |
|---|---|---|
| C | DELETED K1 (RELAY), D1 & D2 (1N4148), Q1 (CONNECTS R20, R10 & R28 (12K) TO +5 VOLTS) E.C.O. 4764 11-14-79 | R.G. |
| B | ADDED C36, & C30 WAS .01 MFD. 10-29-79 | R.G. |
| A | 10/22/79 C12, C14, C15, POLARITY REVERSED | R |

| REVISION LETTER | REVISION | BY |
|---|---|---|
| E | C14 WAS 800, C18 WAS 500, C27 WAS 12,000 E.C.O. 4764 | R.W. 4-23-80 |
| D | ADDED C31 & IN W15, W15 E.C.O. 4764 SOLID LINE 11-19-79 | R.G.M. |

DIETZGEN NO. 196H AGEPROOF

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64"
DECIMAL .X ±.005" .XX ±.010" .XXX ±.002"
ANGULAR ±1/2°
CONCENTRICITY T.I.R. .005" MAX.
SCREW THREADS CLASS 2

WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF THE WILLIAMS ASSO.
2401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240
NAME SCHEMATIC, SOUND BOARD
MATERIAL | HEAT TREATMENT | FINISH
DRWN. R.G.M. DATE 10-10-79 APP'D. R.W. 10/10/79 SCALE
16D-8224

*Sound Board Logic Diagram*
15/16

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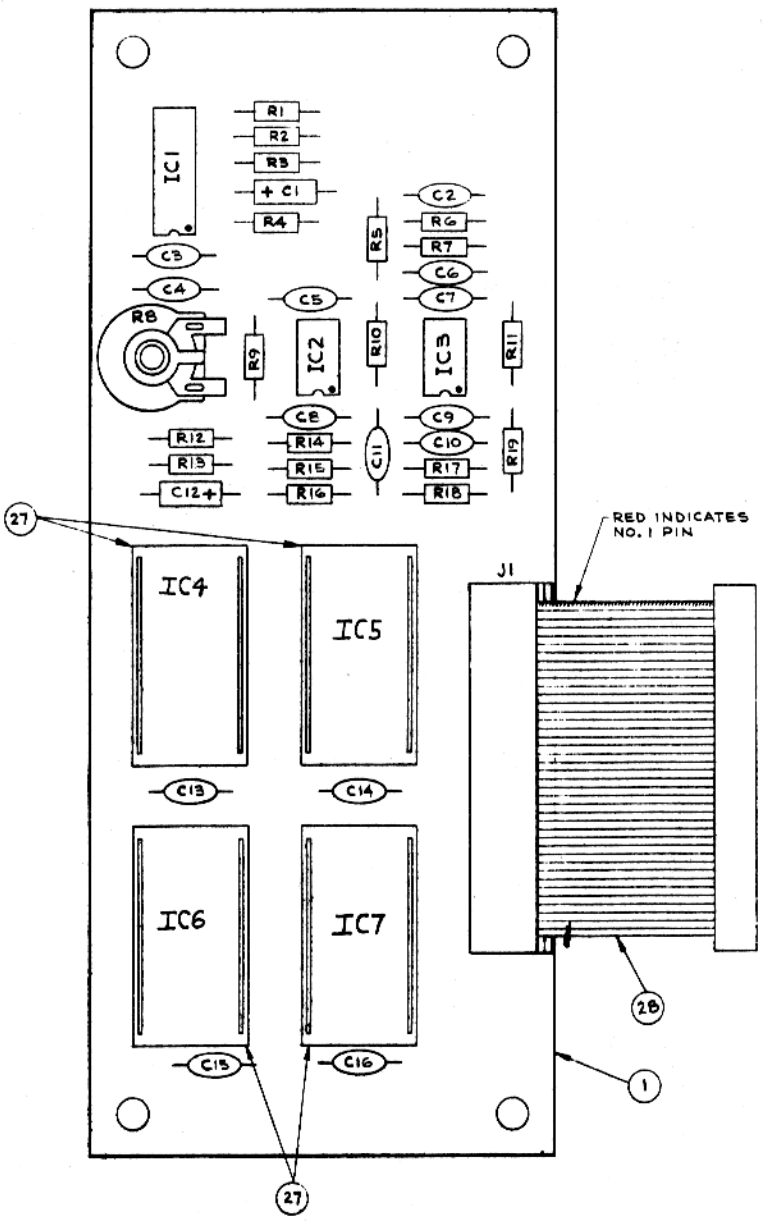



ITEM # 2 PT. NO WAS 5A-9351, ITEM # 11 ADDED PT. NO., ITEM # IN ACCRD WAS 30V. 10-4-79 R.G

| REVISION LETTER | REVISION | BY |
|---|---|---|

## BILL OF MATERIAL

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 1 | IC-2001-1473 | | BARE P.C. BOARD | 1 |
| 2 | 5A-9335 | IC1 | 55516 CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR | 1 |
| 3 | 5A-9321 | IC2, IC3 | 1458 DUAL OP-AMP. | 2 |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | 5A-8846 | R11 | RESISTOR, FC, 220 K OHM 5% 1/4 WATT | 1 |
| 11 | 5B-8817 | R1, R2, R3, R4, R14, R16 | RESISTOR, FC, 10 K OHM 10% 1/4 WATT | 6 |
| 12 | 5A-8824 | R5 | RESISTOR, FC, 43 K OHM 5% 1/4 WATT | 1 |
| 13 | 5A-9333 | R6 | RESISTOR, FC, 180 K OHM 5% 1/4 WATT | 1 |
| 14 | 5A-9342 | R7 | RESISTOR, FC, 36 K OHM 5% 1/4 WATT | 1 |
| 15 | 5A-9185 | R8 | POTENTIOMETER, 5K OHM | 1 |
| 16 | 5A-9324 | R9, R10, R 5, R18, R19 | RESISTOR, FC, 27 K OHM 10% 1/4 WATT | 6 |
| 17 | 5B-8997 | R12, R13 | RESISTOR, FC, 2.7 K OHM 10% 1/4 WATT | 2 |
| 18 | 5A-8772 | R17 | RESISTOR, FC, 15 K OHM 5% 1/4 WATT | 1 |
| 19 | 5A-9030 | C4 | CAPACITOR, .047 MFD. 20% 50 VOLT | 1 |
| 20 | 5A-9350 | C6 | CAPACITOR, CERAMIC, 180 PFD. 5% 100 VOLT | 1 |
| 21 | 5A-8980 | C3, C5, C7, C8, C9, C13 THRU C16 | CAPACITOR, CERAMIC, .01 MFD. +80%-20% 50 VOLT | 9 |
| 22 | 5A-9031 | C1 | CAPACITOR, TANTALUM, 1 MFD. 20% 25 VOLT | 1 |
| 23 | 5A-9347 | C2 | CAPACITOR, CERAMIC, 1800 PFD. 5% 50 VOLT | 1 |
| 24 | 5A-9343 | C12 | CAPACITOR, ELECTROLYTIC, 10 MFD. 20% 20 VOLT LOW LEAK | 1 |
| 25 | 5A-9348 | C11 | CAPACITOR, CERAMIC, 4700 PFD. 5% 50 VOLT | 1 |
| 26 | 5A-9346 | C10 | CAPACITOR, CERAMIC, 1200 PFD. 5% 50 VOLT | 1 |
| 27 | 5A-9004 | | 24 PIN SOCKET | 4 |
| 28 | 5A-9352 | J1 | RIBBON CABLE ASSEM. | 1 |

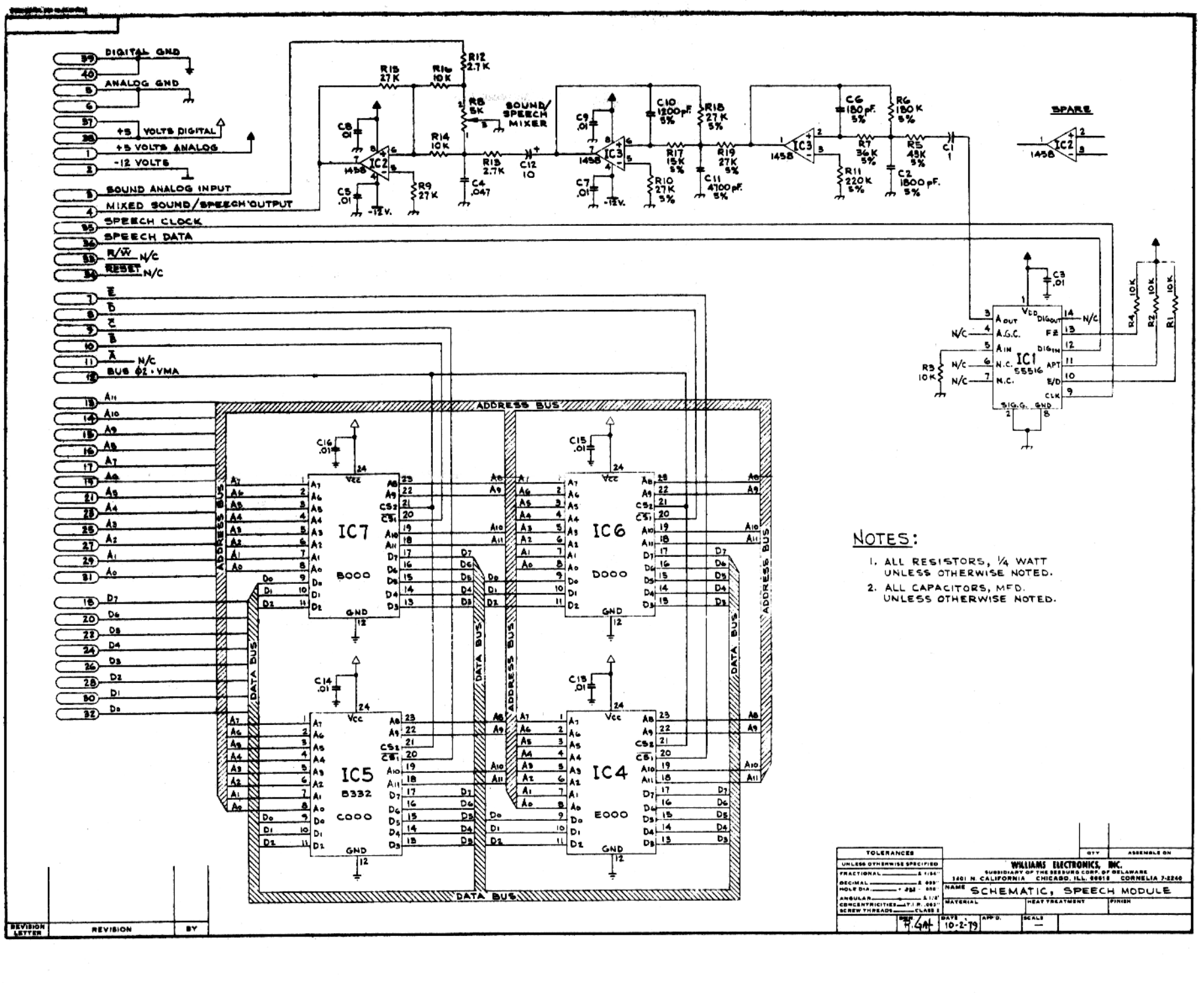
| TOLERANCES | QTY | ASSEMBLE ON |
|---|---|---|
| UNLESS OTHERWISE SPECIFIED | | |
| FRACTIONAL ± 1/64" | | |
| DECIMAL ± .005" | | |
| HOLE DIA + .002 - .000" | | |
| ANGULAR ± 1/2° | | |
| CONCENTRICITIES T.I.R. .003" | | |
| SCREW THREADS CLASS 2 | | |

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

NAME SPEECH MODULE ASSEM.

| MATERIAL | HEAT TREATMENT | FINISH |
|---|---|---|
| | | |

DWN. R.G. | DATE 9-28-79 | APP'D. | SCALE 2:1 | C-8228




NOTES:

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

| REVISION LETTER | REVISION | BY |
|---|---|---|

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

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

NAME SCHEMATIC, SPEECH MODULE

| MATERIAL | HEAT TREATMENT | FINISH |
|---|---|---|
| | | |

DWN. R.G.M. | DATE 10-2-79 | APP'D. | SCALE — |

## DIGIT CROSS-REFERENCE

| DIGIT | 7-SEGMENT DECODER | STROBE |
|---|---|---|
| Master 1 (Left) | IC5 | 15 |
| Master 2 | IC5 | 16 |
| Master 3 | IC5 | 7 |
| Master 4 (Right) | IC5 | 8 |
| #1 100,000 | IC5 | 1 |
| #1 10,000 | IC5 | 2 |
| #1 1,000 | IC5 | 3 |
| #1 100 | IC5 | 4 |
| #1 10 | IC5 | 5 |
| #1 Units | IC5 | 6 |
| #2 100,000 | IC5 | 9 |
| #2 10,000 | IC5 | 10 |
| #2 1,000 | IC5 | 11 |
| #2 100 | IC5 | 12 |
| #2 10 | IC5 | 13 |
| #2 Units | IC5 | 14 |
| #3 100,000 | IC8 | 1 |
| #3 10,000 | IC8 | 2 |
| #3 1,000 | IC8 | 3 |
| #3 100 | IC8 | 4 |
| #3 10 | IC8 | 5 |
| #3 Units | IC8 | 6 |
| #4 100,000 | IC8 | 9 |
| #4 10,000 | IC8 | 10 |
| #4 1,000 | IC8 | 11 |
| #4 100 | IC8 | 12 |
| #4 10 | IC8 | 13 |
| #4 Units | IC8 | 14 |

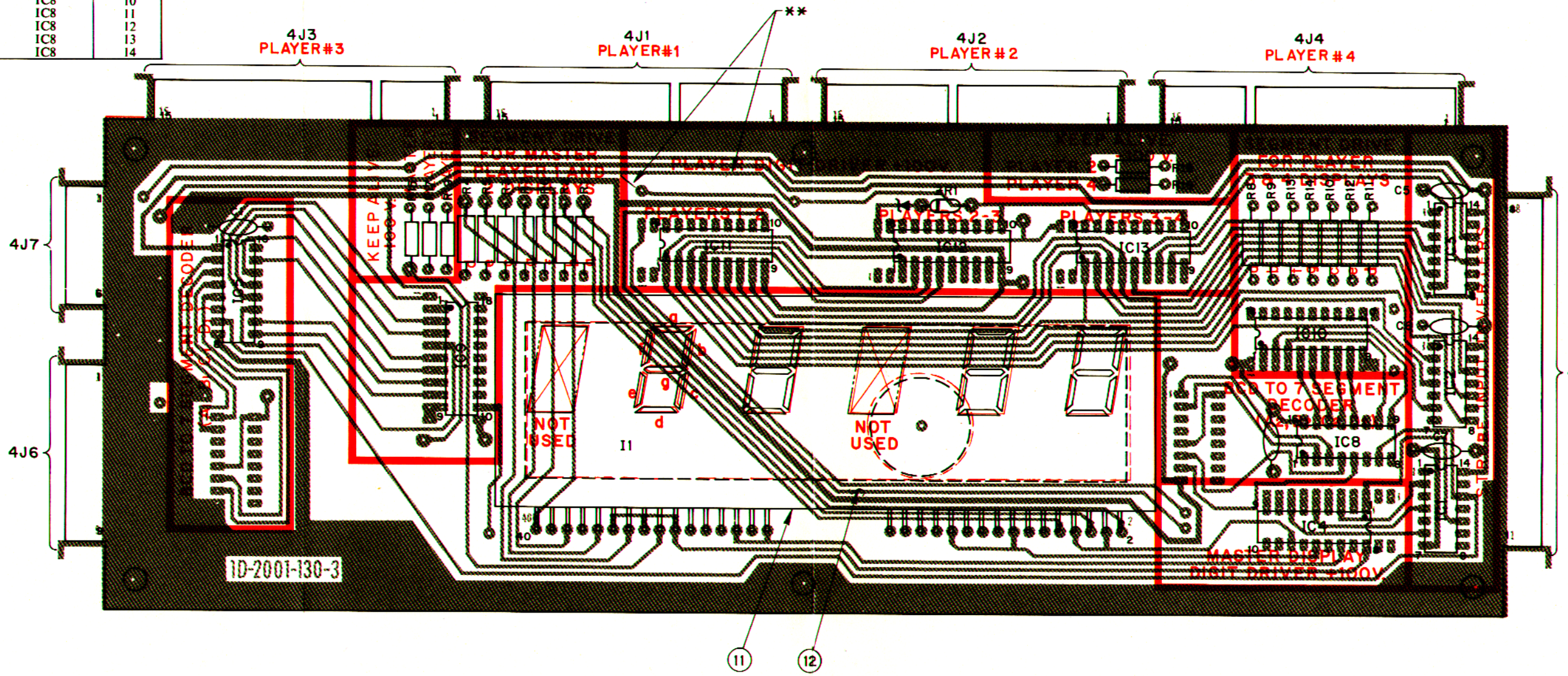
**NOTES:**

* - IF IC11, IC12, IC13 & IC14 ARE DIONICS-512 DRIVERS THEN R1 - R14 ARE 5A-9149 RES., F.C., 15K OHM ±10% ½ W. ZR1 NOT USED.

** - CUT & JUMP ON +100V. NOT IMPLEMENTED.

## BILL OF MATERIAL

| | ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|---|
| | 1 | 1D-2001-130-3 | | BARE P.C. BOARD | 1 |
| | 2 | 5A-8971 | IC1, IC2, IC3 | MC14069 HEX. INVERTER | 3 |
| | 3 | 5A-8970 | IC5, IC8 | MC14543 BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER | 2 |
| | 4 | 5A-8969 | IC9, IC10 | UDN-7180 GAS DISGHARGE DISPLAY SEGMENT DRIVER | 2 |
| * | 5 | 5A-8968 | IC4, IC11, IC12, IC13 | UDN-6184 GAS DISCHARGE DISPLAY DIGIT DRIVER | 2 |
| * | 6 | 5B-8981 | R1 THRU R14 | RESISTOR, FC, 10K OHM 10% ½ W | 14 |
| | 7 | 5B-8982 | R15 THRU R19 | RESISTOR, FC, 3 MEG OHM 10% ¼ W | 5 |
| | 8 | 5A-9135 | ZR1 | IN4740A ZENER DIODE, 10V. 5% 1W | 1 |
| | 9 | 5A-8980 | C1, C4 THRU C7 | CAPACITOR, CERAMIC, .01 MFD. 50 V. | 5 |
| ** | 10 | | | JUMPER, #22 GA. SOLID WIRE | 1 |
| | 11 | 5B-8966 | I1 | 6 DIGIT DISPLAY | 1 |
| | 12 | 23A 6542 | | DISPLAY MTG. ADHESIVE FORM | 1 |




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



*D8000 Master Display Board Assembly Drawing (IC Drivers)*

16D-8000
DOCUMENT #2

STROBE 8 (4J5-2) STROBE 7 (4J5-3) STROBE 14 (4J5-14) STROBE 13 (4J5-16) STROBE 12 (4J5-17) STROBE 11 (4J5-13) STROBE 10 (4J5-12) STROBE 9 (4J5-15) STROBE 16 (4J5-4) STROBE 15 (4J5-5) STROBE 6 (4J5-11) STROBE 5 (4J5-10) STROBE 4 (4J5-9) STROBE 3 (4J5-8) STROBE 2 (4J5-7) STROBE 1 (4J5-6)
4J5-1 N.C. 4J5-18 N.C.
C7 .01, C5 .01, C6 .01 — IC1, IC3, IC2 — 14069

* USE EITHER IC6 & IC7 OR IC5 & IC8 (DO NOT INTERMIX OR USE ALL FOUR AT THE SAME TIME).

IC5 MC14543 * — C1 .01
IC6 MC14558 * — C2 .01
IC7 MC14558 * — C3 .01
IC8 MC14543 * — C4 .01
IC1 14069

4J7-1 CATHODE KEEP ALIVE (-100 V.D.C.)
4J7-2 +100 V.
4J7-3 +5 V.D.C.
4J7-4 N.C.
4J7-5 GND
4J7-6 -100 V.
ZR1 ***

BCD SEG. DATA
A1 (4J6-5) B1 (4J6-1) C1 (4J6-2) D1 (4J6-4)
A2 (4J6-9) B2 (4J6-6) C2 (4J6-7) D2 (4J6-8)
BLANKING (4J6-3)

IC4 UDN 6184 OR DI-0512 — +100 V.
GD1 — NOT USED, 31/33, 25/27, NOT USED, 9/13, 3/5
R15 3 MEG.

IC9 7180 — -100 V.
R1 R2 R3 R4 R5 R6 R7 — ALL 10K **

IC10 7180 — -100 V.
R8 R9 R10 R11 R12 R13 R14 — ALL 10K **

NOTES:
** IF IC4, IC11, IC12, IC13 ARE DI-0512, R1-R14 ALL 15K.
*** IF IC4, IC11, IC12, IC13 ARE UDN-6184, +100 V. TRACE IS CUT AND ZR1 ADDED.

IC13 UDN-6184 OR DI-0512 — +100 V.
4J4-8 UNITS, 4J4-9 10's, 4J4-10 100's, 4J4-12 1,000's, 4J4-13 10,000's, 4J4-14 100,000's } PLAYER #4
4J4-7 a, 4J4-6 b, 4J4-3 c, 4J4-1 d, 4J4-2 e, 4J4-5 f, 4J4-4 g } SEGMENTS
R16 3 MEG. — 4J4-15 CATHODE KEEP ALIVE, 4J4-11 KEY

IC12 UDN-6184 OR DI-0512 — +100 V.
4J3-8 UNITS, 4J3-7 10's, 4J3-2 100's, 4J3-3 1,000's, 4J3-5 10,000's, 4J3-6 100,000's } PLAYER #3
4J3-9 a, 4J3-10 b, 4J3-13 c, 4J3-15 d, 4J3-14 e, 4J3-11 f, 4J3-12 g } SEGMENTS
R17 3 MEG. — 4J3-1 CATHODE KEEP ALIVE, 4J3-4 KEY

IC11 UDN-6184 OR DI-0512 — +100 V.
4J2-2 UNITS, 4J2-3 10's, 4J2-4 100's, 4J2-5 1,000's, 4J2-14 10,000's, 4J2-15 100,000's } PLAYER #2
4J2-13 a, 4J2-12 b, 4J2-8 c, 4J2-6 d, 4J2-7 e, 4J2-11 f, 4J2-10 g } SEGMENTS
R18 3 MEG. — 4J2-1 CATHODE KEEP ALIVE, 4J2-9 KEY

4J1-1 UNITS, 4J1-2 10's, 4J1-3 100's, 4J1-4 1,000's, 4J1-5 10,000's, 4J1-7 100,000's } PLAYER #1
4J1-8 a, 4J1-9 b, 4J1-12 c, 4J1-14 d, 4J1-13 e, 4J1-10 f, 4J1-11 g } SEGMENTS
R19 3 MEG. — 4J1-15 CATHODE KEEP ALIVE, 4J1-6 KEY

| REVISION LETTER | REVISION | BY |
|---|---|---|
| G | 2)-NE584,(4)-NE585 & R20, R21, R22 REMOVED. * * AND * * * NOTES ADDED. | A.V. 1/22/74 |
| F | 4J1-15, 4J2-1, 4J3-1 4J4-15 & 4J7-1 WAS "KEEP ALIVE (-100 V.D.C.)" | R.GAY |
| E | REVISED STROBE CONNECTOR | R.G. |
| D | CHANGE CONNECTOR DESIGNATIONS | DDG |
| C | 4J1's WAS A's, 4J2's WAS B's, 4J3's WAS C's, 4J4's WAS D's, 4J5's WAS E's, 4J6's WAS F's, 4J7's WAS G's, IN PLAYERS #1 THRU #4, UNITS WAS 100,000's, 10's WAS 10,000's, 100's WAS 1,000's, 1,000's WAS 100's, 10,000's WAS 10's & 100,000's WAS UNITS, ADDED "8" EACH DIGIT & "NOT USED" & DELETED "BLANK" P-28-71 REDRAWN & REVISED | R.GAY |

TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ± 1/64, DECIMALS ± .005 + .002 — .000, HOLES ± .005 + .002 — .000, ANGULAR ± 1/2°
WILLIAMS ELECTRONIC MFG. CORP. — SUBSIDIARY OF THE WILLIAMS CORP. — 3401 N. CALIFORNIA CHICAGO 18, ILL. CORNELIA 7-5840
NAME SCHEMATIC, MASTER DISPLAY BD.
MATERIAL — HEAT TREATMENT — FINISH
DRWN. R.GAY — DATE 9-26-71 — APP'D. — SCALE — 16D-8000 DOCUMENT #2

*D8000 Master Display Board Logic Diagram (IC Drivers) 19*

D-8168

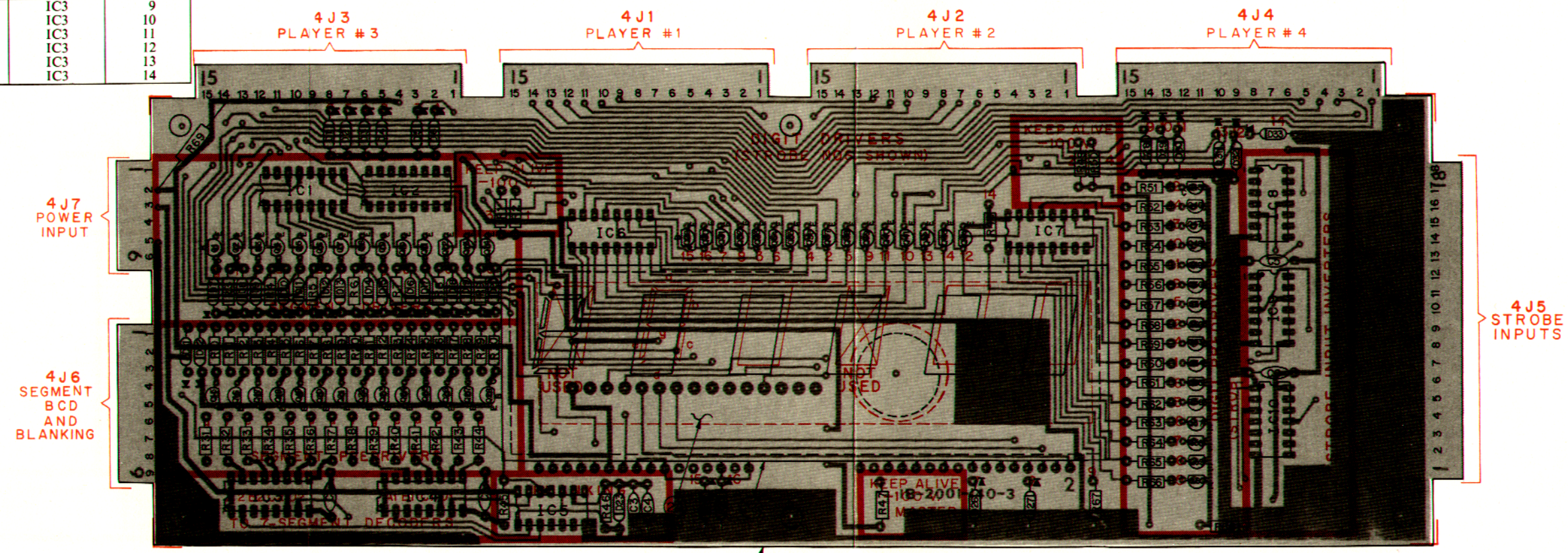
## DIGIT CROSS-REFERENCE

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

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 17 | 5A-8774 | R45, R67 | RESISTOR, FC, 22 K OHM 10% 1/4 W | 2 |
| 18 | 5A-9035 | R10, R12, R13, R15, R16, R18, R19, R21, R22, R24, R25, R27, R26, R30 | RESISTOR, FC, 47K OHM 10% 1/4 W | 14 |
| 19 | 5A-9162 | R3 THRU R9, R11, R14, R17, R20, R23, R26, R29, R46 | RESISTOR, FC, 100K OHM 10% 1/4 W | 15 |
| 20 | 5A-9218 | R1, R2, R47, R49, R50 | RESISTOR, FC, 2.2 M OHM 10% 1/4 W | 5 |
| 21 | 5A-8980 | C1, C2, C5, C6 | CAPACITOR, CERAMIC, .01 MFD. 50 V. | 4 |
| 22 | 5A-9065 | C3, C4 | CAPACITOR, CERAMIC, 470 PFD. 50 V. | 2 |
| 23 | 5B-8966 | I1 | 6-DIGIT DISPLAY | 1 |
| 24 | 23A-6542 | F1 | DISPLAY MOUNTING ADHESIVE FOAM | 1 |
| 25 | 5A-9285 | R69 | RESISTOR, FC, 180 OHM 5% 1/2 W | 1 |

## BILL OF MATERIAL

| ITEM NO. | PART NO. | PART DESIGNATION | DESCRIPTION | REQ'D. NO. |
|---|---|---|---|---|
| 1 | 18-2000-140-3 | | BARE P.C. BOARD | 1 |
| 2 | 5A-9221 | IC1 | 15 DIP RESISTOR/PACK 2.2 K OHM | 1 |
| 3 | 5A-9222 | IC2 | 15 DIP RESISTOR/PACK 1 K OHM | 1 |
| 4 | 5A-8970 | IC3, IC4 | MC14543 7 SEGMENT DRIVER | 2 |
| 5 | 5A-9213 | IC5 | 4012 CMOS DUAL 4 INPUT NAND GATE | 1 |
| 6 | 5A-9220 | IC6 | 15 DIP RESISTOR/PACK 2.2 K OHM | 1 |
| 7 | 5A-9223 | IC7 | 15 DIP RESISTOR/PACK 10 K OHM | 1 |
| 8 | 5A-9267 | IC8, IC9, IC10 | 4069 LOW PWR. HEX. INVERTER | 3 |
| 9 | 5A-9216 | Q1 THRU Q14 Q45 THRU Q60 | HIGH VOLTAGE NPN TRANSISTOR MPS-A42 | 30 |
| 10 | 5A-9217 | Q15 THRU Q44 | HIGH VOLTAGE PNP TRANSISTOR MPS-A92 | 30 |
| 11 | 5A-8785 | D1 THRU D20 D24 THRU D33 | IN4003 DIODE, SILICON | 30 |
| 12 | 5A-8919 | D21, D22, D23 | IN4148 DIODE, SILICON | 3 |
| 13 | 5A-9224 | R68 | RESISTOR, FC, 270 OHM 10% 1/4 W | 1 |
| 14 | 5A-9219 | R51 THRU R66 | RESISTOR, FC, 8.2 K OHM 10% 1/4 W | 16 |
| 15 | 5A-8817 | R48 | RESISTOR, FC, 10 K OHM 10% 1/4 W | 1 |
| 16 | 5A-9032 | R31 THRU R44 | RESISTOR, FC, 12 K OHM 10% 1/4 W | 14 |




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

| PART NAME | | | | |
|---|---|---|---|---|
| DISCRETE MASTER DISPLAY BD. ASSEM. | | | | |
| DWN. A.V. | DATE 5-8-79 | APP'D. | SCALE 2=1 | PART NO. D-8168 |



*D8169 Master Display Board Assembly Drawing (Discrete Drivers)*

16D-8169

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

PLAYER #1 — PLAYER #2 — PLAYER #3 — PLAYER #4

IC1 DIP RESISTORS (2.2 K) — IC2 DIP RESISTORS (1K) — IC3 MC 14543 — IC4 MC 14543 — IC5 4012 — IC6 DIP RESISTORS (22 K) — IC7 DIP RESISTORS (10 K) — IC8 — IC9 — IC10 — ALL 4069

GD1 — NOT USED — 31/33 — 25/27 — 9/13 — 3/5

ALL IN4003 — D1 D2 D3 D4 D5 D6 D24 D25 D26 D27 — D28 D29 D30 D32 D31 D33

ALL IN4003 — D3 D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20 D21 D22

ALL MPS-A92 — ALL MPS-A42

BLANKING 4J6-3 — A 4J6-5 — B 4J6-1 — C 4J6-2 — D 4J6-4 — A2 4J6-9 — B2 4J6-6 — C2 4J6-7 — D2 4J6-8

4J7-1 N.C. — 4J7-2 +100 V. R69 180, ½ W. +5V. — 4J7-3 — 4J7-4 N.C. — 4J7-5 GND — 4J7-6 -100 V.

STROBE 14 4J5-14 — STROBE 13 4J5-16 — STROBE 12 4J5-17 — STROBE 11 4J5-18 — STROBE 10 4J5-12 — STROBE 9 4J5-15 — STROBE 8 4J5-2 — STROBE 7 4J5-3 — STROBE 16 4J5-4 — STROBE 15 4J5-5 — STROBE 6 4J5-11 — STROBE 5 4J5-10 — STROBE 4 4J5-9 — STROBE 3 4J5-8 — STROBE 2 4J5-7 — STROBE 1 4J5-6 — N.C. 4J5-18 — N.C. 4J5-1

| REVISION LETTER | REVISION | BY |
|---|---|---|
| A | AT 4J7-2 CONNECTION R69 ADDED E.C.O. 479 | 2-23-79 A.V. |

TOLERANCES UNLESS OTHERWISE SPECIFIED

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA CHICAGO, ILL. 60618

NAME SCHEMATIC, DISCRETE MASTER DISPLAY BOARD

MATERIAL — HEAT TREATMENT — FINISH

DRWN R.G.H. 3-21-79 — APPD. — SCALE — 16D-8169

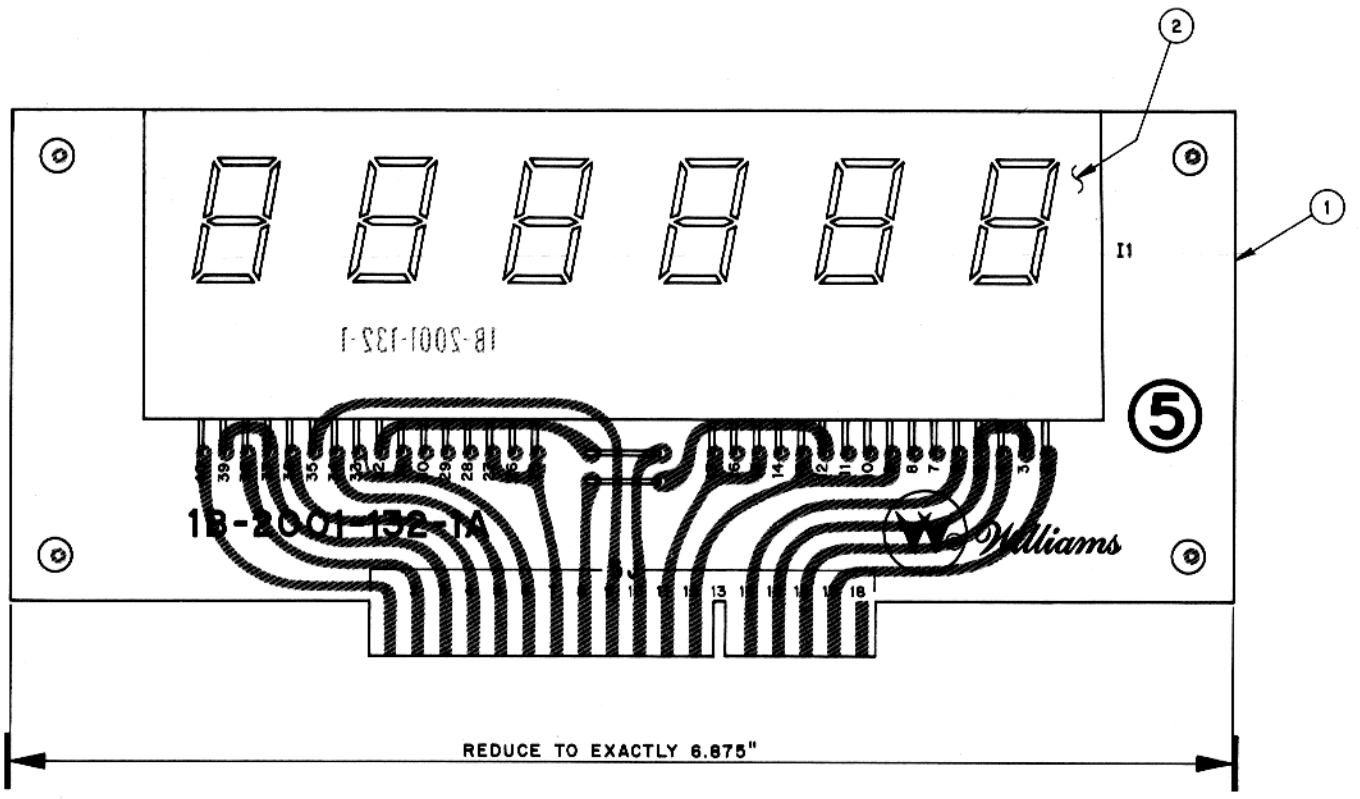
DIETZGEN NO. 1888M ASEPROOF

*D8169 Master Display Board Logic Diagram (Discrete Drivers) 21*

| REVISION LETTER | REVISION |
|---|---|
| | REVISED AND REDRAWN R.GAY 7-19-78 |

## BILL OF MATERIAL

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

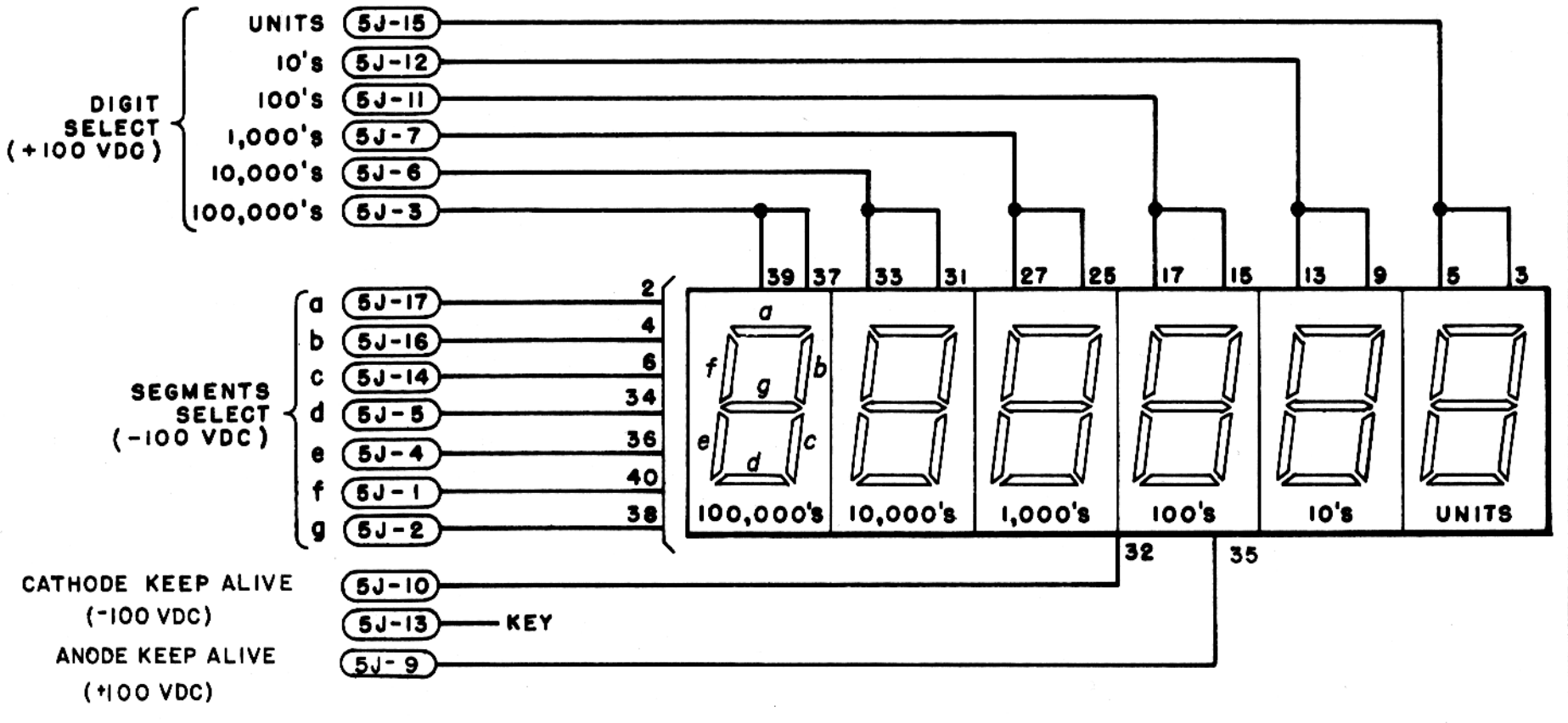



| WILLIAMS ELECTRONICS, INC. SUBSIDIARY OF XCOR CORPORATION 3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240 | | | | |
|---|---|---|---|---|
| PART NAME SLAVE DISPLAY BOARD ASSEMBLY | | | | |
| DWN. R. Gay | DATE | APP'D. | SCALE 2=1 | PART NO. C-8019 |

DOCUMENT #1







## SLAVE DISPLAY BOARD