



INSTRUCTION MANUAL

NIGHT MOVES
(GAME #C101)
(2 BALL GAME)
INSTRUCTION MANUAL

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GAME PROMS:
C101/PROM 1
C101/PROM 2

SOUND PROMS:
C101/DROM 1
C101/YROM 1

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I. INSTALLATION

A. SET-UP

1. Carefully remove the game from the carton.
2. Unlock glass top from rear of cabinet, lift from rear of cabinet and slide toward you slightly (1/2" to 1"), remove top glass assembly.
3. Using the leg adjusters, level the playfield and set the pitch. Recommended pitch is 6°.

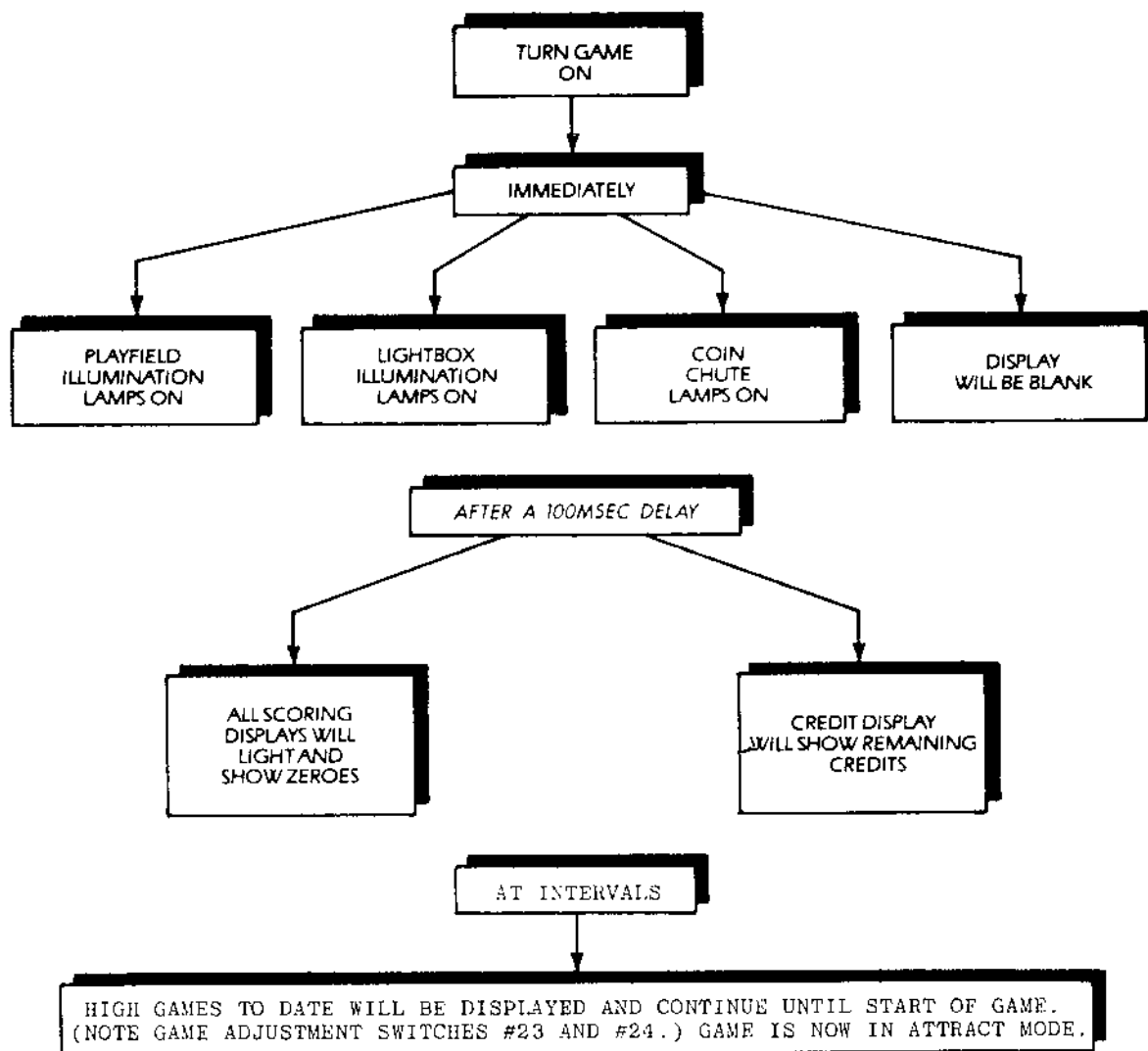
B. CHECK-OUT

1. To access cabinet parts and playboard underside, lift up the front of the playboard and swing away from you to an upright position, maintain this position with the prop stick.
2. Check that all cables are clear of moving parts.
3. Check for any loose wires.
4. Check switches for loose solder or other foreign matter.

5. Be certain all fuses are firmly seated.
6. Check transformer for any foreign matter across terminals.
7. Be sure that Transformer Panel power input connector A12J7, corresponds to the supply voltage.
8. Check the setting of the normally open tilt switch on the underside of the playfield. One blade should be free-floating with a weight on the end.
9. The plumb-bob tilt can be adjusted by loosening the clip and raising the plumb-bob to increase its sensitivity, or lowering it to decrease its sensitivity.
10. Reinstall the top glass assembly.
11. Plug the line-cord into a properly grounded 3-wire receptacle ONLY!
12. Refer to Section VI to make all necessary game adjustments.
13. CAUTION! If this game has been subjected to extreme cold, allow to warm up to room temperature.

II. INITIALIZATION, III. GAME OPERATION

II. INITIALIZATION



III. GAME OPERATION

A. GAME START

Two balls must be in the ball return trough to start a game.

1. Insert coins into coin chute.
 - a. Coin chute tune is played.
 - b. Total credits are displayed in the center of the lower display.
2. Press Credit Button to start game.
 - a. Credit tune is played.
 - b. Total credits displayed decrease by one.

3. All playfield features reset.

4. The first player score display flashes two zeros.

B. FIRST PLAYER

1. First player's score display flashes two zeros.
2. The other player's displays are now blank.
3. The ball-in-play is displayed in the center of the upper display.

III. GAME OPERATION

4. When the ball enters the outhole, any bonus earned is scored.

C. ADDITIONAL PLAYERS

1. Additional players are indicated by two zeros (not flashing) in each corresponding player's display.
2. After the maximum number of players are added, or no more credits remain, the Credit Button has no effect.
3. Additional players can be added anytime during the first ball in play.

D. EXTRA BALLS

1. When the SHOOT AGAIN lamp is lit, neither the player-up nor the ball-in-play changes when the ball enters the outhole.
2. Only one extra ball per ball-in-play is given.

E. TILT MODE

1. Tilting the game results in a loss of ball in play.
2. When the game is tilted, all the playfield lamps go off.
3. All accumulated bonus and bonus multipliers are lost.

F. SLAM MODE

1. If the normally open slam switch (located inside front door) is closed, the entire game is ended for all players.
2. The entire switch matrix is inactive for three seconds.
3. If the match feature exists (dependent on Switch #26), a replay can be won even if the game is slammed.
4. Game returns to the attract mode.

G. GAME OVER

1. A random match number appears in the ball-in-play display. If this number matches the last two digits in any player's score, a replay (dependent on SWITCH #26) is awarded.
2. The High Games To Date are periodically displayed, dependent on Switches #23 and #24. When the Highest Game To Date is beaten, an award (dependent on Switches #23 and #24) is given.
3. All of the drop targets will reset (when used).

IV. GAME PLAY AND SCORING

Night Moves™

HOW TO PLAY

C-L-U-B SPOT TARGETS R-I-O SPOT TARGETS

- SCORE 10,000 POINTS WHEN FLASHING OR ROTATING.
- SCORE 1000 POINTS OTHERWISE.
- COMPLETING EITHER SPOT TARGET SEQUENCE FLASHES A RANDOM "COLLECT BONUS" LAMP, ADVANCES "N-I-G-H-T-MOVES" BONUS LAMPS AND RESETS RESPECTIVE SPOT TARGETS TO INITIAL FLASHING STATE.
- COMPLETION OF "N-I-G-H-T-MOVES" WILL LIGHT TOP RIGHT SPOT TARGET SPECIAL LAMP.

TOP RIGHT SPOT TARGET

- SCORE 5000 POINTS.
- AWARD SPECIAL WHEN LIT.

LEFT AND RIGHT HOLES

- SCORE 10,000 POINTS.
- IF "LOCK" LAMP IS FLASHING:

CAPTURE BALL.

TURN ON LOCK LAMP.

FLASH OPPOSITE "SWITCH" LAMP.

RELEASE A NEW BALL TO THE SHOOTER LANE.

- IF "SWITCH" LAMP IS FLASHING:
CAPTURE BALL.
TURN ON LOCK LAMP.
TURN OFF OPPOSITE HOLE LOCK LAMP.
TURN OFF "SWITCH" LAMP.
FLASH OPPOSITE "SWITCH" LAMP.
KICK BALL OUT OF OPPOSITE HOLE.
- IF "COLLECT BONUS" LAMP IS FLASHING
SCORE 50,000 POINTS FOR EACH
"N-I-G-H-T-MOVES" LAMP LIT.
- SCORE BONUS TIMES 2 IF "2X" LAMP IS LIT.

TOP "LITE 2X" ROLLOVERS

- SCORE 10,000 POINTS WHEN LIT.
- 3000 POINTS UNLIT
- LIGHT "2X" PLAYFIELD LAMP WHEN LIT ("2X" LIGHT OFF) AND SPOT 1 LETTER IN "B-A-L-L" ("2X" LIGHT ON).

UPPER RIGHT SIDE ROLLOVER

- SCORE 3000 POINTS.
- IF "RELEASE" LAMP IS FLASHING, RELEASE CAPTIVE BALL FOR MULTIBALL PLAY.

IV. GAME PLAY AND SCORING

SPINNER

- SCORE 25,000 POINTS WHEN FLASHING OR 5000 POINTS UNLIT.

UPPER LEFT SIDE "DISPLAY FEATURE AWARD" ROLLOVER

- SCORE FLASHING VALUE OR 50,000 POINTS.
- POSSIBLE "DISPLAY FEATURE AWARDS" ARE:

LIGHT RIGHT SPOT TARGET SPECIAL.

LIGHT EXTRA BALL LAMP.

SCORE 500,000 POINTS.

LIGHT "2X" BONUS LAMP.

COLLECT 4X BONUS

WIN EXTRA BALL.

DOUBLE ENTIRE SCORE.

- INITIALIZE "DISPLAY FEATURE AWARD" SEQUENCE IF NOT ALREADY STARTED.

RETURN ROLLOVERS

- SCORE 3000 POINTS.
- AWARD EXTRA BALL WHEN LIT.
- FLASH SPINNER LAMP (25,000 WHEN FLASHING) FOR A TIME PERIOD.
- INITIALIZE "DISPLAY FEATURE AWARD" SEQUENCE IF NOT ALREADY STARTED.

OUTLANE ROLLOVERS

- SCORE 50,000 POINTS.
- AWARD EXTRA BALL WHEN LIT.

RIGHT FLIPPER SWITCH

- ROTATE LIT "EXTRA BALL" AND/OR "R-O-C-K" LAMPS.
- ALSO FREEZES TOP "LITE 2X" LAMP.

R-O-C-K ROLLOVERS

- SCORE 10,000 POINTS WHEN LIT OR 5000 POINTS UNLIT.
- IF "R-O-C-K" SEQUENCE IS COMPLETED:
LIGHT AN EXTRA BALL LAMP OR SCORE 100,000 POINTS IF AN EXTRA BALL LAMP HAS ALREADY BEEN LIT OR WON.

POP BUMPERS

- SCORE 30 POINTS
- TOGGLE "MULTIBALL RELEASE" LAMP ON OR OFF IF A BALL IS CAPTURED.

KICKING RUBBERS

- SCORE 30 POINTS.
- TOGGLE "MULTIBALL RELEASE" LAMP ON OR OFF IF A BALL IS CAPTURED.



V. SOUND, VI. GAME ADJUSTMENTS

V. SOUND

The Sound Board installed in this game has been programmed for sound/speech.

VI. GAME ADJUSTMENTS

A. CONTROL BOARD SWITCH ADJUSTMENTS

NOTE: The following switch adjustments pertaining to **SYSTEM 80B** only. There are 32 switches on the control board which permit adjustment of the game parameters. These switches are contained in four packages of eight switches each, as shown below.

COIN CHUTE COMBINATIONS SYSTEM 80B

SWITCHES					COIN CHUTE ADJUSTMENTS
S1	S2	S3	S4	S5	Left Coin Chute
S9	S10	S11	S12	S13	Right Coin Chute
S17	S18	S19	S20	S21	Center Coin Chute
					CREDITS/COINS
OFF	OFF	OFF	OFF	OFF	1/1
OFF	OFF	OFF	OFF	ON	2/1
OFF	OFF	OFF	ON	OFF	3/1
OFF	OFF	OFF	ON	ON	4/1
OFF	OFF	ON	OFF	OFF	5/1
OFF	OFF	ON	OFF	ON	6/1
OFF	OFF	ON	ON	OFF	7/1
OFF	OFF	ON	ON	ON	8/1
OFF	ON	OFF	OFF	OFF	9/1
OFF	ON	OFF	OFF	ON	10/1
OFF	ON	OFF	ON	OFF	1/2
OFF	ON	OFF	ON	ON	2/2
OFF	ON	ON	OFF	OFF	3/2
OFF	ON	ON	OFF	ON	4/2
OFF	ON	ON	ON	OFF	5/2
OFF	ON	ON	ON	ON	6/2
ON	OFF	OFF	OFF	OFF	7/2
ON	OFF	OFF	OFF	ON	8/2
ON	OFF	OFF	ON	OFF	9/2
ON	OFF	OFF	ON	ON	10/2
ON	OFF	ON	OFF	OFF	1/3
ON	OFF	ON	OFF	ON	2/3
ON	OFF	ON	ON	OFF	1/4
ON	OFF	ON	ON	ON	3/4
ON	ON	OFF	OFF	OFF	1/5

*All of the above do not give credits until the last coin is inserted.

SWITCH 6 HIGH GAMES TO DATE CONTROL
ON ... RESET HIGH GAMES #2-#5 ON POWER OFF
OFF ... NO EFFECT

SWITCH 7 ATTRACT MODE SOUND
ON ... ENABLED
OFF ... DISABLED

ADDITIONAL COIN CHUTE COMBINATIONS CREDIT INCENTIVES

ALL OF THE BELOW CANNOT HAVE 9 CREDITS
ADDED BASED ON SWITCH 30

SWITCHES					Left Coin Chute	Right Coin Chute	Center Coin Chute							
S1	S2	S3	S4	S5 -										
S9	S10	S11	S12	S13										
S17	S18	S19	S20	S21 -										
					COIN/CREDIT GIVEN	COIN/CREDIT GIVEN	COIN/CREDIT GIVEN	COIN/CREDIT GIVEN	COIN/CREDIT GIVEN	COIN/CREDIT GIVEN	TOTAL COIN/ TOTAL CREDIT			
ON	ON	OFF	OFF	ON	1st/1	2nd/2				-	2/3			
ON	ON	OFF	ON	OFF	1st/0	2nd/1	3rd/1	4th/1			4/3			
ON	ON	OFF	ON	ON	1st/0	2nd/1	3rd/0	4th/2		=	4/3			
ON	ON	ON	OFF	OFF	1st/1	2nd/1	3rd/1	4th/2		=	4/5			
ON	ON	ON	ON	OFF	1st/1	2nd/2	3rd/1	4th/3		=	4/7			
ON	ON	ON	ON	OFF	1st/1	2nd/2	3rd/2	4th/2		=	4/7			
ON	ON	ON	ON	ON	1st/0	2nd/0	3rd/1	4th/0	5th/1	=	5/2			

SWITCH 8 AUTO-PERCENTAGE CONTROL
ON ... ENABLED
OFF ... DISABLED (NORMAL HIGH SCORE MODE)

SWITCH 14 COIN CHUTE LEFT AND RIGHT CONTROL
ON ... SAME
OFF ... SEPARATE

SWITCHES 15 16 MAXIMUM CREDITS
OFF OFF 8
OFF ON 10
ON OFF 15
ON ON 20

SWITCH 22 PLAYFIELD SPECIAL
ON ... EXTRA BALL
OFF ... SPECIAL

SWITCHES 23 24 HIGHEST GAME TO DATE AWARDS
OFF OFF NONE (NOT DISPLAYED)
OFF ON NONE
ON OFF 2 REPLAY
ON ON 3 REPLAY

SWITCH 25 BALLS/GAME
ON 3
OFF 5

SWITCH 26 MATCH
ON ON
OFF OFF

SWITCH 27 REPLAY LIMIT
ON 1
OFF NO LIMIT

SWITCH 28 NOVELTY
ON SCORE 500,000 IN PLACE OF EXTRA BALL AND SPECIAL.
OFF NORMAL

SWITCH 29 GAME MODE
ON EXTRA BALL
OFF REPLAY

SWITCH 30 3RD COIN CHUTE
CREDIT CONTROL
ON ADD 9
OFF NO EFFECT

SWITCHES 31 32 EXTRA BALL FREQUENCY

3-BALL	SWITCH 31	SWITCH 32	5-BALL
6	OFF	OFF	10
8	OFF	ON	13
9	ON	OFF	15
10	ON	ON	17

VI. GAME ADJUSTMENTS

B. SOUND ADJUSTMENTS

The speaker(s) output is controlled by the potentiometer mounted on a bracket located inside the cabinet next to the front door hinge.

Turning the potentiometer counter clockwise will decrease the volume. Turning it clockwise will increase the volume.

C. POST ADJUSTMENTS

The posts located just above the right and left outlanes can be positioned for liberal/conservative play. The smaller opening produces a more conservative play.

VII. BOOKKEEPING AND SELF TEST

The circuitry in this game helps the Operator perform many Bookkeeping and Self/Test functions. These functions are accessed by the Self/Test Switch inside the front door.

Section VII A., details the Bookkeeping system, while Section VII B., details the Self/Test operation. The Flow Chart in Section VII D., gives the general order and function of both Bookkeeping and Self/Test steps.

A. BOOKKEEPING SYSTEM 80B

- See Flow Chart for Bookkeeping Assignments (1-15).

I. STEPPING THROUGH BOOKKEEPING

1. Press the SELF-TEST button inside the front door.

"TEST MODE" should appear in the upper display.

2. Press the SELF-TEST button again. Step 1 and its information will be displayed.
3. Pressing the SELF-TEST button will increment the bookkeeping step number and appropriate information will be displayed.

Pressing the SELF-TEST button after Step 15 will start the SELF-TEST function (Step 16-21). At this point Bookkeeping cannot be re-entered by pressing the SELF-TEST

button. To reenter, turn the game OFF/ON or activate the slam switch. The game will return to the attract mode. Then press the SELF-TEST button.

4. To exit from Bookkeeping at any time:

- a. Turn power OFF/ON or
- b. Activate Slam Switch.

II. HOW TO SET BOOKKEEPING INFORMATION TO ZERO

1. For a Particular Bookkeeping Step

Applicable only to:

- Step 1 - Left chute coins
- Step 2 - Right chute coins
- Step 3 - Center chute coins

- a. Advance Bookkeeping so the step to be zeroed is displayed.
- b. Press the credit button. Notice information replaced by zeros.

2. Zeroing All Bookkeeping Steps

Except coin chutes (Steps 1,2 and 3), Auto-Percentaging setting (Step 6), Replay Levels (Steps 11-13), and Highest Game To Date Score (Step 14).

- a. Go to Step 15 (average playing time).
- b. Press the credit button. The message "Bookkeeping Cleared" will be displayed.
- c. Zeroing is complete.

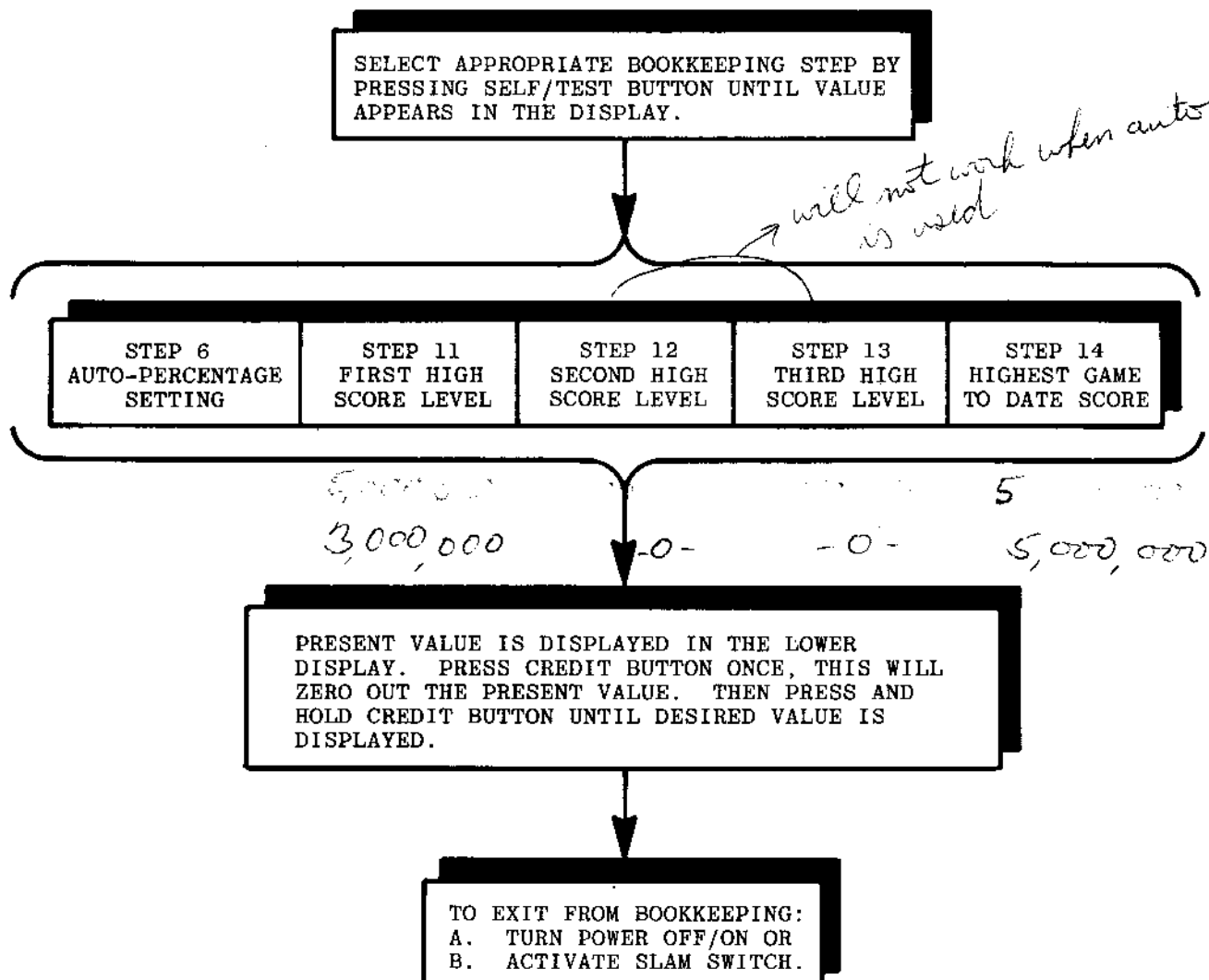
HOW TO USE AUTOMATIC REPLAY PERCENTAGING

Move Control Board switch #8 to the on position to enable Auto-Percentaging. Set the desired percent payout while in Step 6 of bookkeeping (See Page 9). When Auto-Percentaging is enabled, only the first High Score Replay Level is used. The second and third levels are ignored.

Periodically the first Replay Level will be adjusted by 100,000 points at a time. After 10,000 games have been played, the Total Plays (Step 4), Total Replays (Step 5), and Game Time (Step 15) bookkeeping values are reset to 0 (Refer to Page 10).

VII. BOOKKEEPING AND SELF TEST

III. HOW TO SET/RESET AUTO-PERCENTAGE SETTING, HIGH SCORE LEVELS OR HIGH GAME TO DATE SCORES.

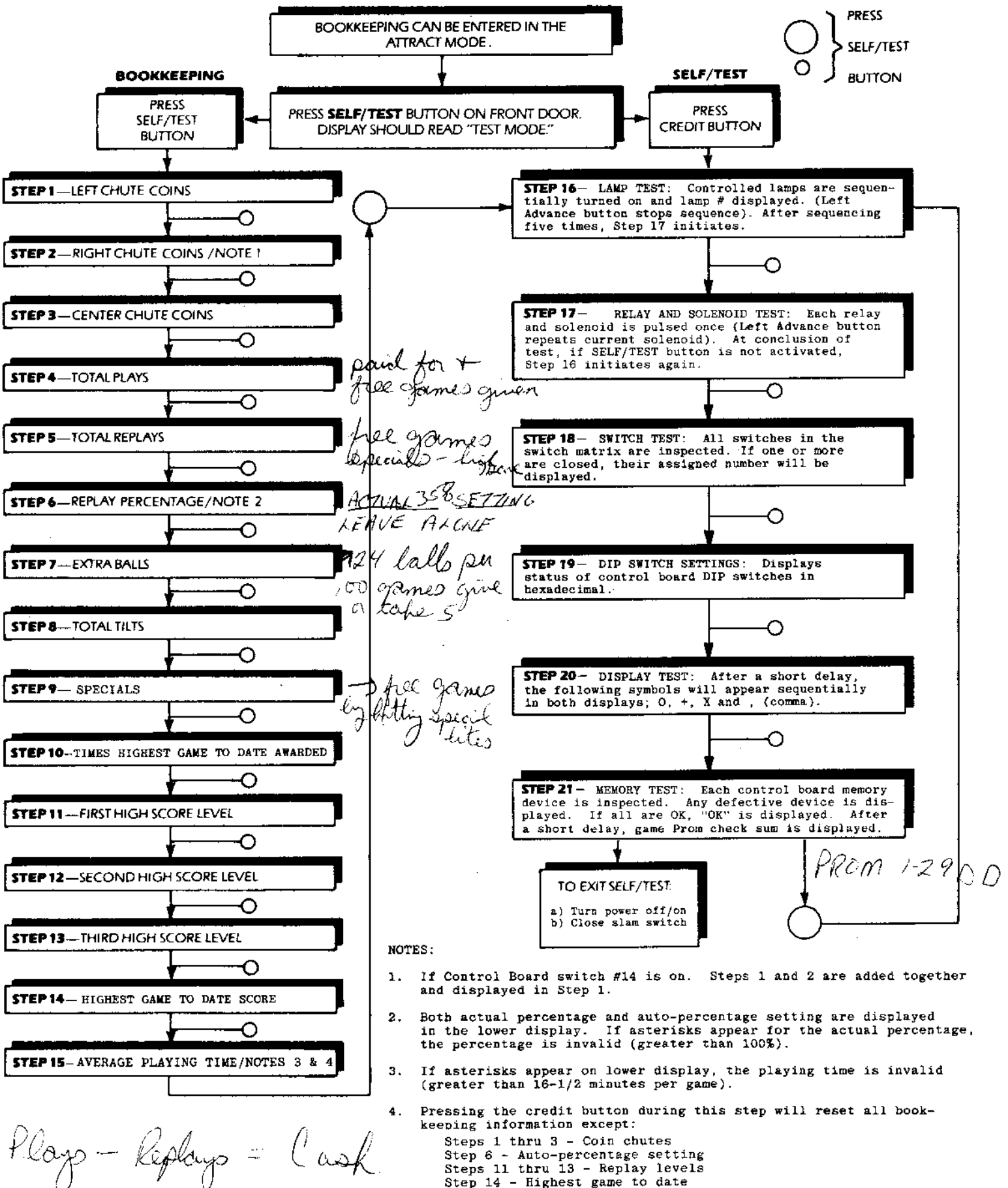


NOTES:

1. Step 11 must be a lower score than Step 12. Step 12 must have a lower score than Step 13. Otherwise, the scores will not be recognized.
2. If Step 12 or Step 13 is not desired, set those scores to zero.
3. If Step 14 is reset, all High Games to Date scores are reset.
4. High Score Levels may range from 100,000 to 9,900,000 in increments of 100,000.
5. Only the first High Score Level is used when auto-percentaging (switch 8) is enabled.

VII. BOOKKEEPING AND SELF TEST

B. FLOW CHART



VII. BOOKKEEPING AND SELF TEST

C. SELF/TEST

- Steps 16 through 21 are SELF/TEST or game tests the operator can use for quick troubleshooting.
- All the tests are explained in the flow chart.
- To advance to the next test, press the SELF/TEST switch.
- Each test can be repeated by pressing the credit button.

- b. Solenoid Test-Each solenoid on the playfield is sequentially pulsed. The solenoid number displayed identifies which solenoid is being tested. The following chart lists solenoid assignments.

NUMBER DISPLAYED	ASSIGNMENT	A3 DRIVER BOARD TRANSISTOR ASSIGN. SEE SCHEMATIC
Sol.1	Top Left Domes	Q60
Sol.2	Top Left Hole	Q57/Q58
Sol.3	Bottom Left Dome	Q54
Sol.4	Bottom Right Domes	Q55
Sol.5	Top Right Hole	Q61/Q62
Sol.6	Ball Release	Q63/Q64
Sol.7	Top/Right Side Domes	Q56
Sol.8	Knocker	Q53
Sol.9	Outhole	Q59

STEP 16—LAMP TEST

- a. Lamp Test-Lamps are sequentially strobed. Lamp assignment numbers appear in the lower display.

The Left Advance button stops lamp sequencing for repeated flashing of active lamp.
(Single Step Mode).

Lamp number (L9, L16, etc.) can be referenced to the Driver Board Schematic where the specific transistor for each lamp can be identified.

STEP 18—SWITCH TEST

- a. If all switches are open, "ALL SWITCHES OPEN" appears in the lower display. (Note: Slam switch is not part of this test.)
- b. If any switch(es) are closed, their corresponding matrix location will appear sequentially in the lower display.

STEP 19—DIP SWITCH SETTINGS

- a. The status of the Control Board (A1) switches appears in the lower display.

DISPLAYED HEXADECIMAL	DECIMAL	BINARY
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

STEP 17—RELAY AND SOLENOID TEST

- a. Relay Test-All relays are pulsed in the following order with their corresponding lamp driver number appearing in the lower display.

The left advance button stops sequencing for repeated activation of relay or solenoid.
(Single Step Mode).

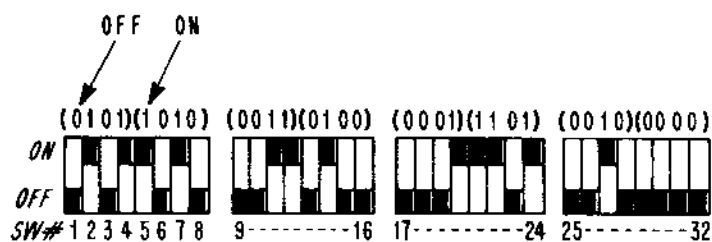
A3 Driver Board Transistor
Assignment (See Schematic)

Q (Game Over) Relay.....A3J3 PIN- $\bar{A}$ (Q1)
T (Tilt) Relay.....A3J3 PIN- $\bar{B}$ (Q2)
(Any other relays which may be used).

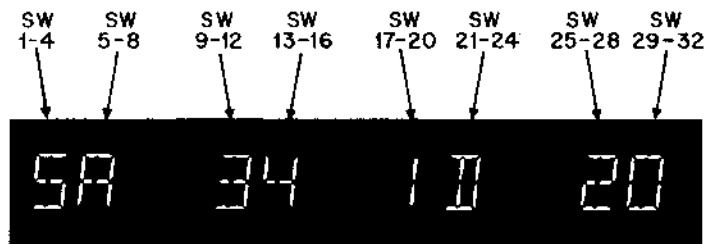
VII. BOOKKEEPING AND SELF TEST

CONTROL BOARD (A1) SWITCHES

EXAMPLE



DISPLAYED



Checking Switches

- 1) Switch all odd number switches to the ON position, and all even switches to the OFF position. Press credit button. Display should now show:



1 = closed switch - on
0 = open switch - off

- 2) Switch all even numbered switches to the ON position and all odd switches to the OFF position. Press credit button. Display should now show:



STEP 20—DISPLAY TEST

After a short delay, the following characters will appear sequentially in all digit positions; O, +, X and , (comma).

STEP 21—MEMORY TEST

Each control based memory device is checked. If all are good, an "OK" will be displayed.

If a memory chip located on the A1 Control Board is defective, its number will be displayed. If no devices are found to be defective, "OK" is displayed in the lower display. Then after a short delay the Game Prom check sum will be displayed.

VIII. THEORY OF OPERATION

This section will cover only the differences between System 80A and System 80B. Figure 1 is a block diagram indicating the interconnections between the modules of System 80B.

A. CONTROL BOARD (A1)

The Piggyback Board eliminates the need for the ROMS (U2-U3) and the game prom (PROM 1) used in System 80A. The new game prom for each game is a 2764 EPROM labeled with the game number. This device is plugged into the Piggyback Board which is soldered into the Control Board.

The use of the Alphanumeric Display eliminates the need for Z19, Z21, Z22, Z23, Z24, Z25 (System 80A Display Control), and connector A1J3. The Control Board transmits information to the Display Board via a data bus (DATA 0 - DATA 7) and control lines (LD1, LD2, and RESET) from A1J2 to 1A4J1. The state of the LD1 and LD2 lines determine whether the upper or lower display tube receives the information on the data bus.

B. POWER SUPPLY (A2)

The new Power Supply develops a regulated +5V DC only and supplies it to the Control Board (VCC), Display Board (VSS), and Sound Board (VCC).

C. DISPLAY BOARD (A4)

This board takes the place of the four and seven digit displays used in System 80A games. During game play the upper display contains the scores of players one and two along with the ball in play (center). The lower display contains the scores of players three and four along with the amount of credits remaining (center). During Game Over the display information alternates between the scores from the previous game and the current High Games To Date.

The Display Board incorporates two vacuum fluorescent display tubes and three display controllers (U1-U2-U3). Each tube consists of a filament, grids (digits), and anodes (segments). U1 controls the digits of the upper display tube. U2 controls the digits of the lower display tube. U3 controls the segments of both tubes. When power is supplied to the game, the Control Board sends a negative going reset pulse to the base of Q1. This resets the display system. The digit information is multiplexed using an internal clock in U1 to control the refresh rate. This makes it appear as if all the digits are being enabled at once.

VIII. THEORY OF OPERATION

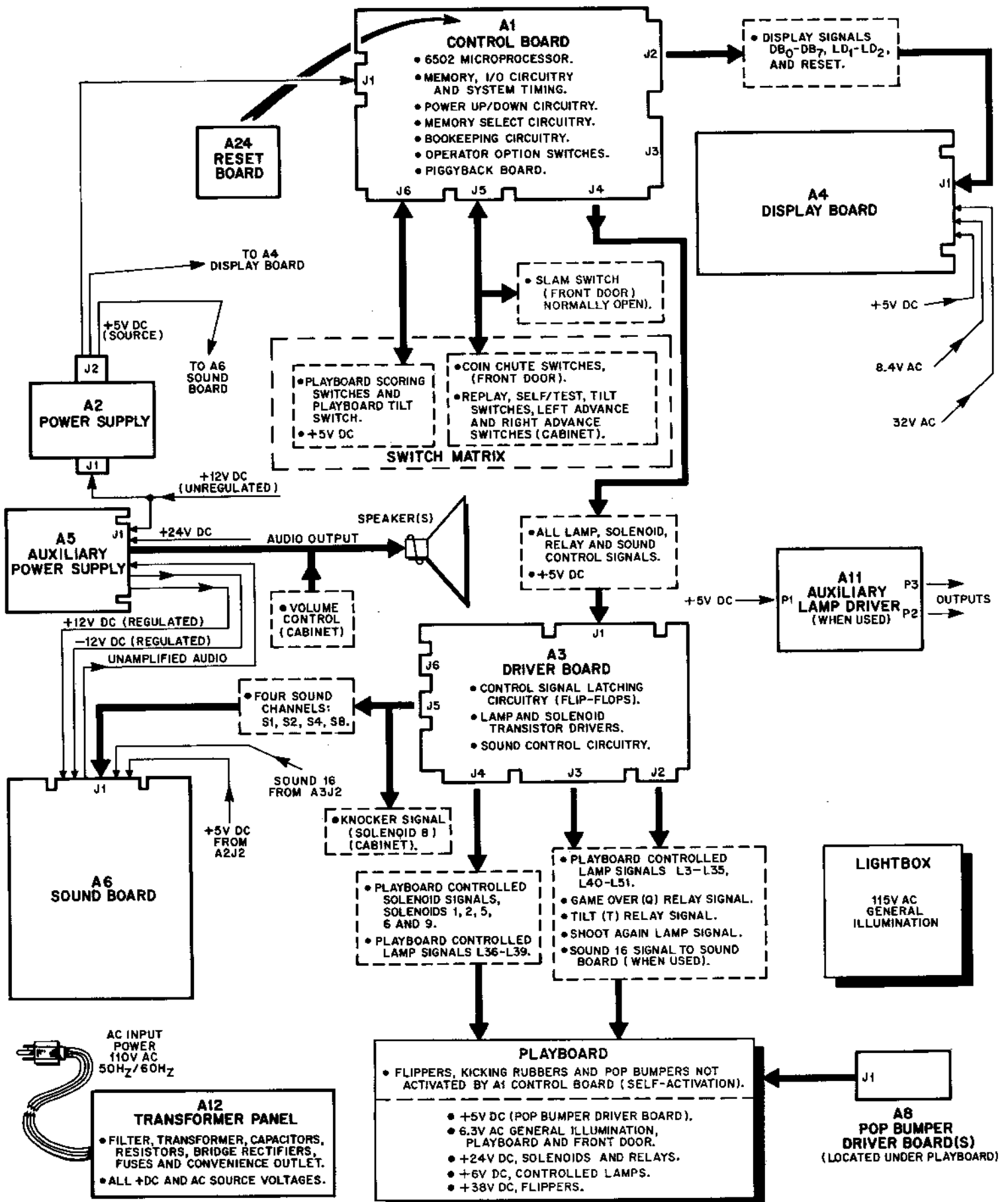


FIGURE 1. SYSTEM 80B BLOCK DIAGRAM

VIII. THEORY OF OPERATION

The Display Board is supplied with 32V AC from the transformer panel. Voltages VGG, VDD, and VCO are then developed from this input. The transformer panel also supplies 8.4V AC to the display tube filaments.

The filaments are biased 9.1V DC above VGG (VCO) by the zener diode VR1. Figure 2 shows the basic drive circuitry and waveform for a single digit and segment of the display.

commands from the game Control Board, and a low level audio output, which is sent to the MA-767 Auxiliary Power Supply Board for amplification.

The Sound Board requires three supply voltages: +5V DC, +12V DC and -12V DC. In addition a power up reset signal is required from the Control Board.

SYSTEM CLOCK

A 4 MHz oscillator is configured with R11, R12, C14, C15, C22, XTAL-1 and T1. This 4 MHz clock is divided by 4 to a 1 or 2 MHz clock for both processor's clock input, pin 37 of N1 and T3. A 250 KHz signal from S1 pin 11 is the clock for the programmable timer section consisting of N5, H5, T5 and K5, pin 2.

INPUT CODE LATCH SYSTEM

Eight input lines from the Control Board come in on A6P1 and are pulled up by S1P1 and sent to the two input code latches A3 and B2, one for each microprocessor system. A2, pin 8, becomes a logic high when any of it's inputs are low. This output is connected to pin 11 of the input code latches (A3 and B2). A positive edge at pin 11 causes A3 and B2 to latch the data at their inputs. A2 pin 8 is also connected to the clock inputs of two flip flops, A4 pin 3 and A4 pin 11. When A2 pin 8 goes high, both flip flops are clocked, setting both $\bar{Q}$ outputs low. The $\bar{Q}$ outputs, A4 pin 6 and pin 8, are connected to both of the 6502's active low interrupt request lines, T3 and N1, pin 4. The $\bar{Q}$ outputs of A4 will stay low until the associated 6502 reads its input port therefore clearing the interrupt.

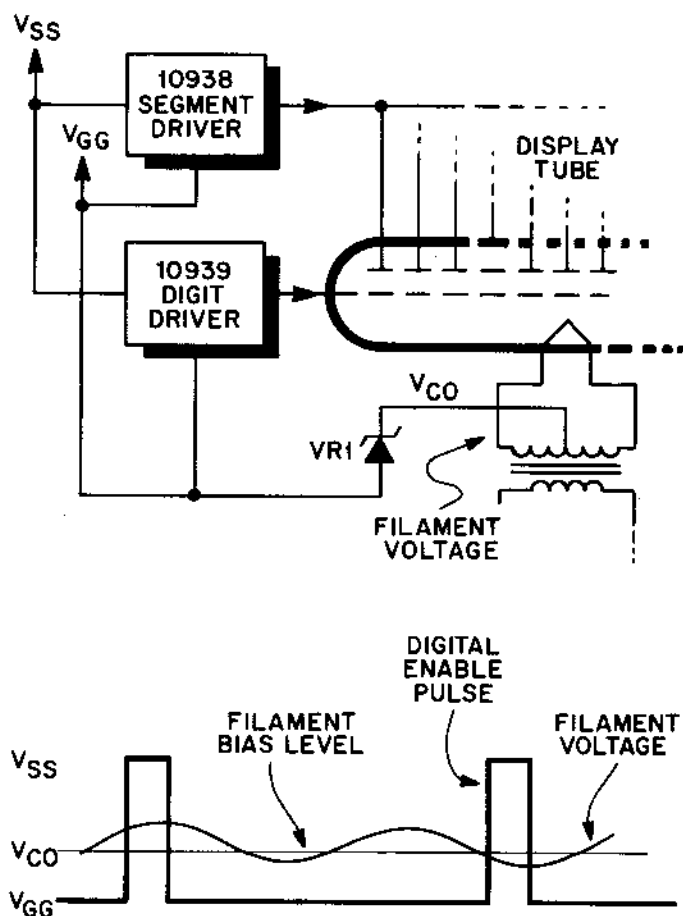


FIGURE 2. BASIC DRIVE CIRCUIT

D. SOUND BOARD (1A6)

The MA-886-719 Sound Board consists of two 6502 microprocessor systems, a dual DAC, input ports to receive

VIII. THEORY OF OPERATION

SYSTEM EPROMS

The sound board is designed to accommodate different types of EPROMS. Jumpers JP1, 2, 3 and 4 should be set to the proper position based on the EPROM being used, (See Schematic Diagram).

RESET

The Sound Board receives an external reset signal from A1J2 pin 24. This active low reset signal is pulled up by R34 and sent to G5, pin 1 (2-input AND gate). However, if a manual reset is desired, pushing switch SW2 will reset the processor.

MAIN SUMMER

The main summer consists of R13 through R17 and B1, pins 12, 13 and 14. B1 pin 14 is the main output

from the Sound Board, at A6P2 pin 9, and will swing plus or minus 5V peak to peak.

E. AUXILIARY SOUND BOARD (A20)

The Auxiliary Sound Board MA-1033 consists of a YM2151 (U1) sound generator, a YM3014 (U2) DAC, and a LM324 op-amp (U3). The master sound board (A6), controls the YM2151 (U1) sound chip by sending commands via the data bus of the master sound board's T3 micro-processor. The YM2151 responds to these commands and serially sends sound data to the YM3014 DAC by means of the CLK, SD, and SH2 lines. The DAC converts this serial data into an analog signal which is buffered and amplified by U3, a LM324 op-amp. This analog signal is then sent back to the main summer of the master sound board (A6).

IX. GENERAL INFORMATION

A. PRINTED CIRCUIT BOARDS ARE DESIGNATED AS FOLLOWS:

A1 - Control Board
A2 - Power Supply
A3 - Driver Board
A4 - Display Board
A5 - Auxiliary Power Supply
A6 - Sound Board
A7 - Diode Board
A8 - Pop Bumper Driver Board
A11 - Auxiliary Lamp Driver
A13 - Resistor Board
A16 - Transistor Driver Board
A17 - Diode Board
A19 - Switching Diode Board
A20 - Auxiliary Sound Board
A22 -
A24 - Reset Board

B. WIRE COLORS ARE SHOWN AS NUMBERS:

0 Black
1 Brown
2 Red
3 Orange
4 Yellow
5 Green
6 Blue
7 Violet
8 Gray
9 White

For example, 688 is a BLUE-GRAY-GRAY striped wire.

Printed circuit board connectors will be labeled AX-JX. For example, A3-J4 is the connector J4 on the driver board (A3).

C. FUSES

TRANSFORMER PANEL FUSES

F1	Sound/Speech Power Supply (A6)...	12V AC	....	1/2 Amp
F2	Power Supply (A2).....	10V AC	....	6-1/4 Amp SLO-BLO
F3	Display.....	32V AC	....	1/4 Amp SLO-BLO
F4	Solenoids (+24V DC).....	28V AC	....	8 Amp SLO-BLO
F5	Controlled Lamps.....	8V AC	....	10 Amp SLO-BLO
F6	Playboard Illumination.....	6.3V AC	....	8 Amp SLO-BLO
F8	Primary Power.....	110V AC	....	5 Amp SLO-BLO
		220V AC	....	2-1/2 Amp SLO-BLO
F9	Display Filament.....	8.4V AC	....	1 Amp
F9A	Display Filament.....	8.4V AC	....	1 Amp
F20	Input Line.....	110V AC	....	8 Amp SLO-BLO
		220V AC	....	4 Amp SLO-BLO

PLAYBOARD FUSES

F10	Outhole.....	1 AMP SLO-BLO
F11	Top Left Hole, Top Right Hole, Ball Release.....	1 AMP SLO-BLO
F12	Left Pop Bumper.....	2 AMP SLO-BLO
F13	Right Pop Bumper.....	2 AMP SLO-BLO

250V MSL 2

IX. GENERAL INFORMATION

D. COIL CHART

SOLENOID COILS					
PART NUMBER	GENERAL USAGE	RESISTANCE (OHMS)	NUMBER OF TURNS	WIRE GAUGE	WRAPPER COLOR
A-1496	KICKING TARGET KICKING RUBBERS POP BUMPERS	2.95	635	#23	Yellow
A-4893	UP KICKER POP BUMPERS BALL KICKER	2.1	535	#22	Red
A-5194	UP KICKER GONG KICKING TARGETS POP BUMPERS	4.5	780	#24	Blue
A-5195	CONTACT KICKER KNOCKER HOLE KICKER OUTHOLE	11.6	1305	#26	White
A-16570	BALL RELEASE HOLE KICKER	15.5	1450	#27	Green
A-17875	FLIPPERS	2.8/40	560/1100	#24/31	Yellow
A-17891	5 BANK RESET	3.35	850	#22	White
A-18102	3 BANK RESET, 7 BANK RESET USES 2	9.0	1430	#24	Red
A-18318	4 BANK RESET	6.7	1130	#24	Orange
A-19300	BALL KICKER	7.8	1075	#25	Orange
A-20095	SUPER FLIPPER	1.55/35.5	450/900	#22/31	Red
A-21741	UP KICKER	2.5	575	#23	Orange
A-25959	FLIPPER (48V DC)	3.85/202	720/3325	#24/33	Red
A-26646	FLIPPER (48V DC)	4.57/201	725/3470	#25/33	Blue
A-26649	SKULL	28.5	1524	#30	YELLOW
RELAY COILS					
A-16890	Q AND T RELAYS	231.0	4000	#35	Orange
A-20558	GATE RELAY	156.0	3400	#34	White
A-18642	MEMORY/ DROP TARGETS	58.0	1590	#33	White
A-19508	MEMORY/ DROP TARGETS	35.0	1250	#32	YELLOW

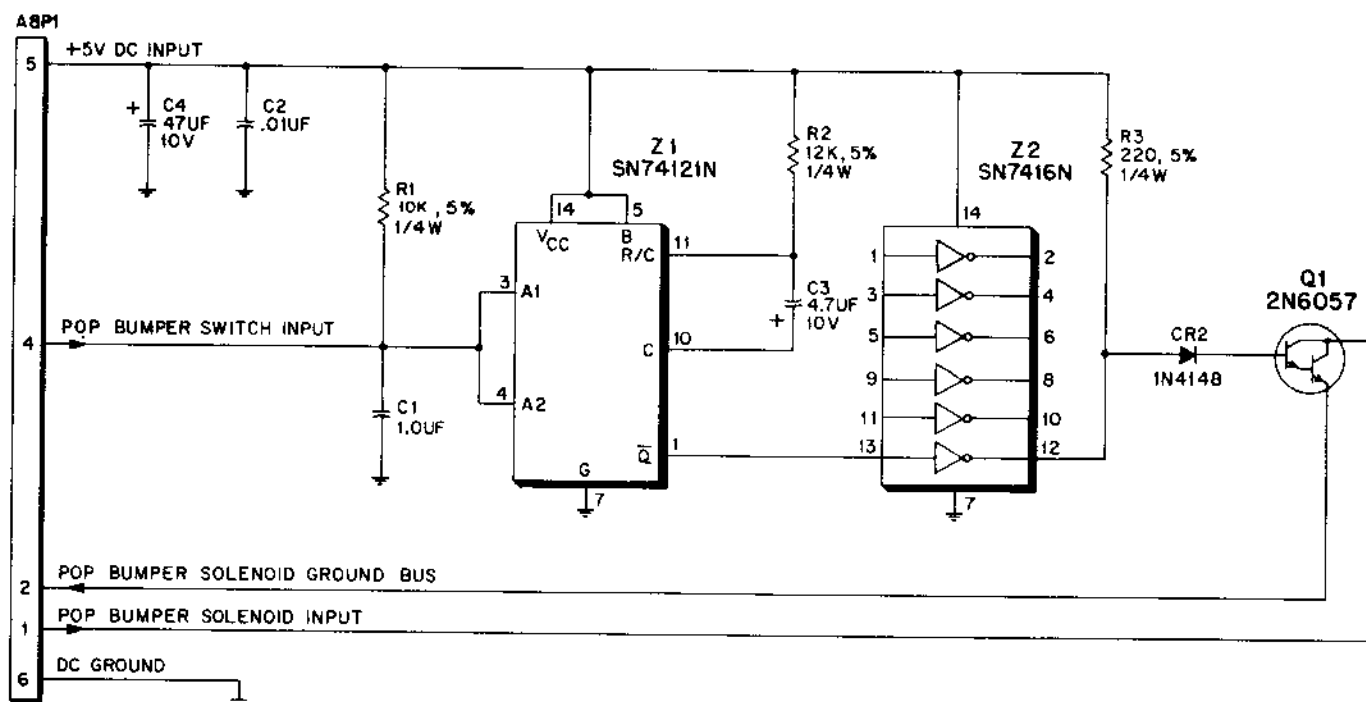
*Coils may vary from game to game. Check game manual for exact coil usage.

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

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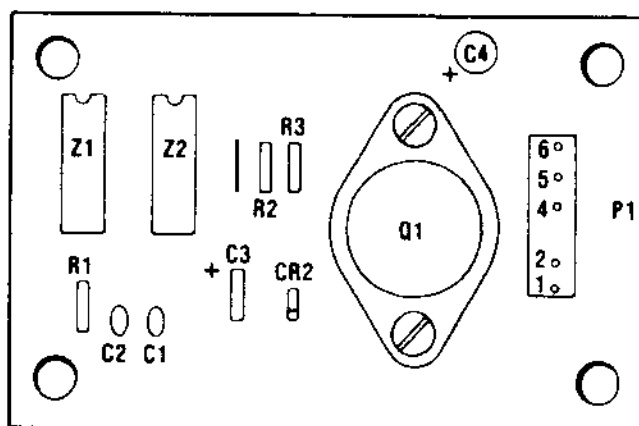
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X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



POP BUMPER DRIVER BOARD (A8) SCHEMATIC DIAGRAM

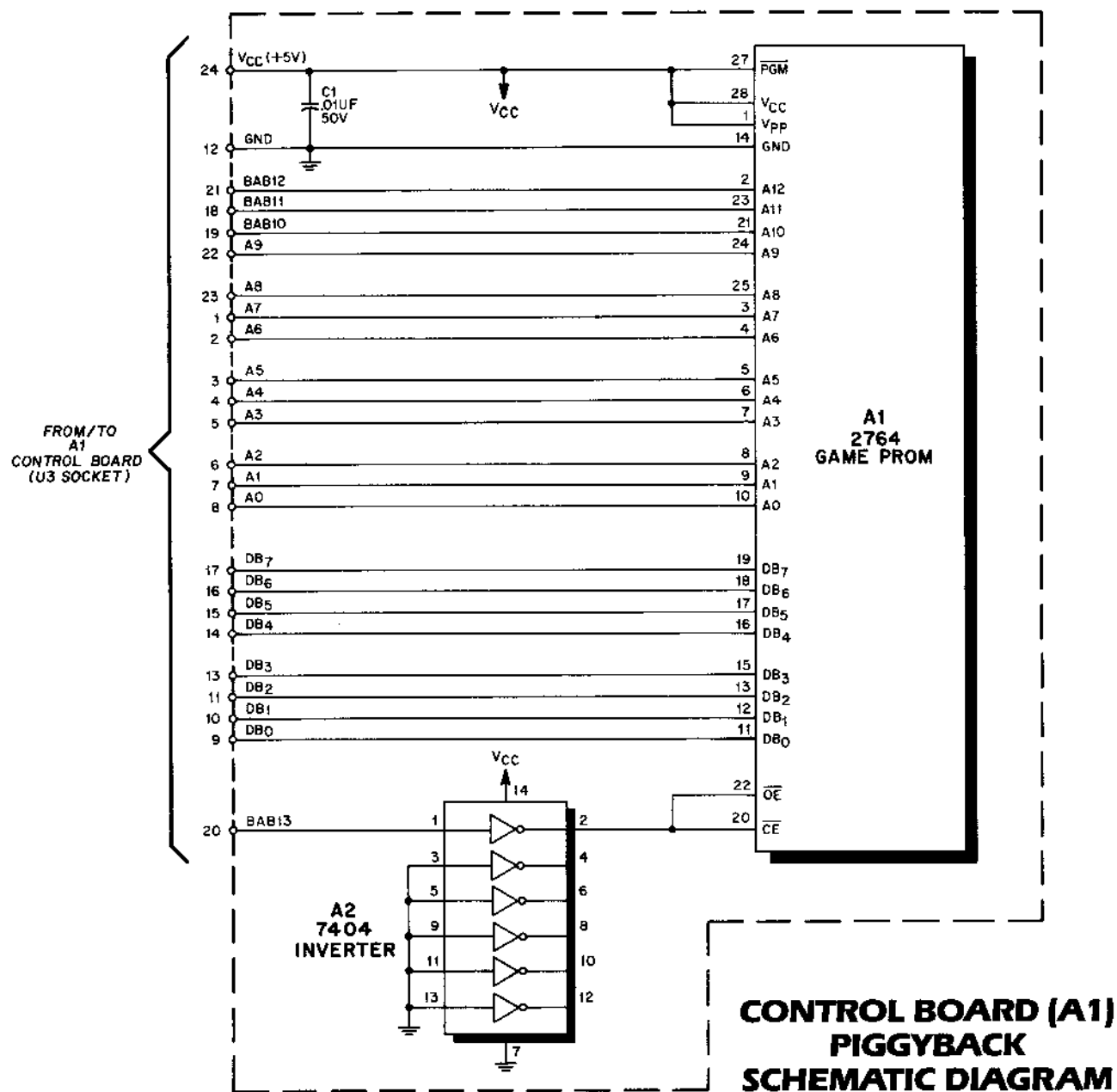
POP BUMPER DRIVER BOARD (A8) COMPONENT LOCATION



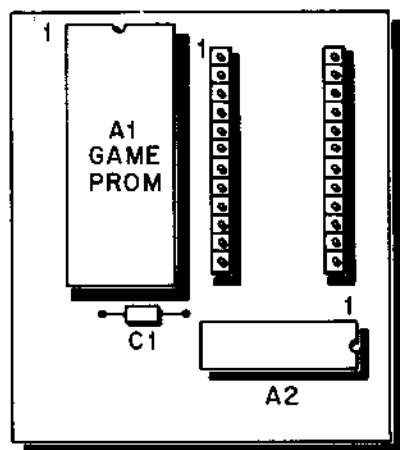
POP BUMPER DRIVER BOARD (A8) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	POP BUMPER DRIVER BOARD	A-19741
C1	Capacitor, 1 UF, 50V, Non-Polarized	XO-294
C2	Capacitor, .01 UF, 100V	XO-202
C3	Capacitor, 4.7 UF, 10%, 10V Tantalum, Axial	XO-226
C4	Capacitor, 47 UF, 10V	XO-227
CR2	Diode 1N4148	XO-261
P1	Connector	XO-879
R1	Resistor, 10K ohm, 1/4W, 5%	XO-18
R2	Resistor, 12K ohm, 1/4W, 5%	XO-9
R3	Resistor, 220 ohm, 1/4W, 5%	XO-21
Q1	Transistor, Darlington 2N6057	XO-311
Z1	IC SN74121N	XO-417
Z2	IC SN7416N	XO-405

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



CONTROL BOARD (A1), PIGGYBACK COMPONENT LOCATION

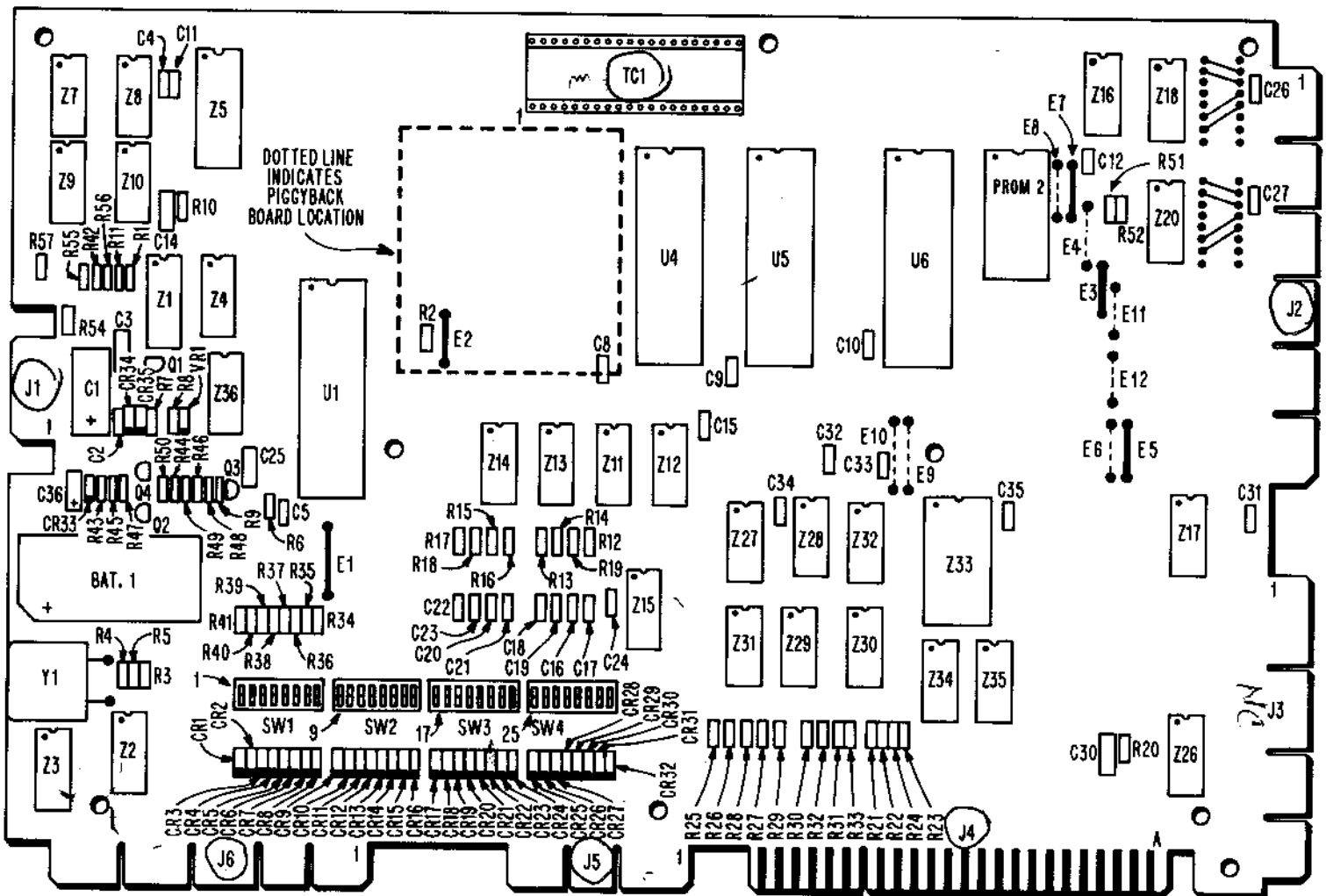


CONTROL BOARD (A1), PIGGYBACK PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
A1	Control Board (A1), Piggyback	MA689
A2	Game Prom, 2764	XO-489
C1	IC, 7404 Inverter	XO-402
	Capacitor, .01uF, +80% -20%, 50V	XO-229
	Socket, 28 Pin	XO-536
	Header, 12 Pos. (2)	XO-858
	Bumper (3)	RP1

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

CONTROL BOARD (A1) COMPONENT LOCATION



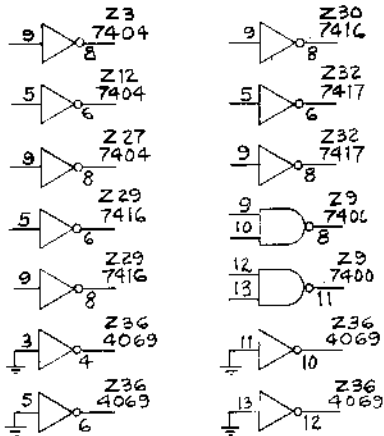
CONTROL BOARD (A1) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
	CONTROL BOARD	MA-1133			
Bat. 1	Battery-3.6V NI-CAD	XO-458	R47	Resistor, 24K ohm, 5%, 1/4W	XO-10
C1	Capacitor, 100 mfd., 10V	XO-211	SW1-SW4	Dip Switch 100B-692	XO-505
C2, C4, C5,	Capacitor, .01 mfd., 50V	XO-229	TC1	Socket, 40 Pin 640379-3	XO-530
C8-C12,			U1	CPU R6502 P	XO-360
C15-C24,			U4, U5, U6	PIUOT R6532P	XO-361
C26, C27,			VR1	Diode-3.0V, 5% 1N5225B or 1N5987B	XO-269
C31-C35			Y1	Crystal, 3.579545 MHZ	XO-456
C3, C14, C25,	Capacitor, .1 mfd., 50V	XO-230	Z1	IC-Cmos-Dual 1 Shot SCL4528BE	XO-414
C30			Z2	IC-Dual Flip Flop SN7474N	XO-423
C36	10 mfd., 10V, TNT-AX CAP	XO-209	Z3, Z11, Z12,	IC-Hex Inverter SN7404N	XO-402
CR1-CR35	Diode, GP 1N4148	XO-261	Z16, Z17,		
Q1, Q4	Transistor-PNP MPS-A70	XO-309	Z26, Z27, Z34,		
Q2, Q3	Transistor, NPN (Motorola 2N4400)	XO-313	Z35		
R1, R6	Resistor, 3.0K ohm, 5%, 1/4W	XO-23	Z4	IC-Cmos-Quad 2 Input "And" SCL4081BE	XO-401
R11-R24			Z5	IC-Static Ram 55101-L	XO-356
R42, R45,			Z7	IC-Hex Inverter SN74LS04N	XO-418
R46, R48,			Z8	IC-2 Input "Nor" SN7402N	XO-421
R51, R52,			Z9, Z13, Z14	IC-2 Input "Nand" SN7400N	XO-420
R54-R57			Z10	IC-Open Collector Inverter SN74LS05N	XO-411
R2, R34-R41	Resistor, 4.7K ohm, 5%, 1/4W	XO-7	Z15	IC-2 Input "Or" SN7432N	XO-407
R3, R43, R49	Resistor, 5.6K ohm, 5%, 1/4W	XO-19	Z18, Z20	IC-"D" Flip Flop SN74175N	XO-410
R4, R5, R44	Resistor, 2.0K ohm, 5%, 1/4W	XO-14	Z33	IC-4-16 Decoder SN74154N	XO-409
R7	Resistor, 62 ohm, 5%, 1/4W	XO-3	Z28	IC-2 to 4 Decoder SN74LS139N	XO-419
R8, R50	Resistor, 180 ohm, 5%, 1/4W	XO-24	Z29, Z30	IC-Hex Inverter-OC/HV SN7416N	XO-405
R9	Resistor, 1K ohm, 5%, 1/4W	XO-5	Z31	IC-2 Input "And" SN7408N	XO-404
R10	Resistor, 2.7M ohm, 5%, 1/4W	XO-13	Z32	IC-Hex Buffer-OC SN7417N	XO-406
R25-R33	Resistor, 620 ohm, 5%, 1/4W	XO-4	Z36	IC-Cmos SCL4069B	XO-424
				Socket 24 Pin 640361-3	XO-529

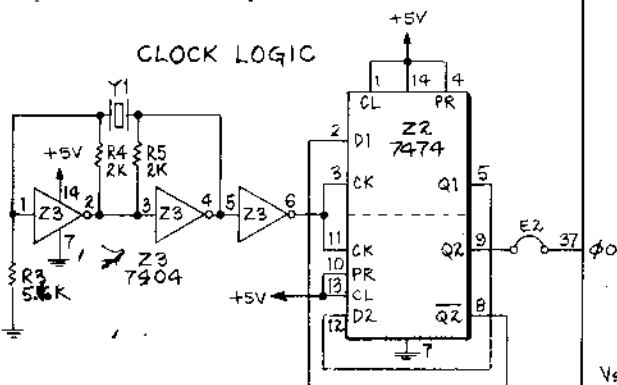
CONTROL BOARD (A1), PIGGYBACK MA689

NOTE: UNLESS OTHERWISE INDICATED;
 1. RESISTORS ARE $\pm 5\%$, 1/4W.
 2. CAPACITORS ARE .01UF, 50V.
 3. DIODES ARE TYPE 1N4148.
 4. REF. DESIGNATION Z6 NOT USED.

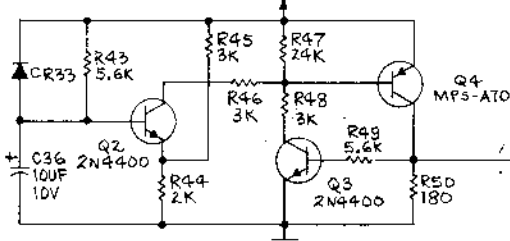
SPARE GATES



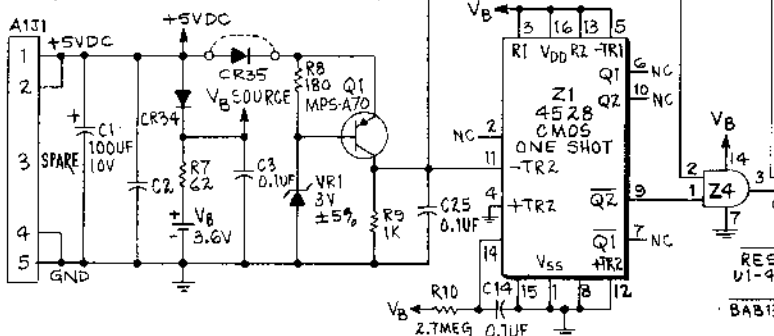
CLOCK LOGIC



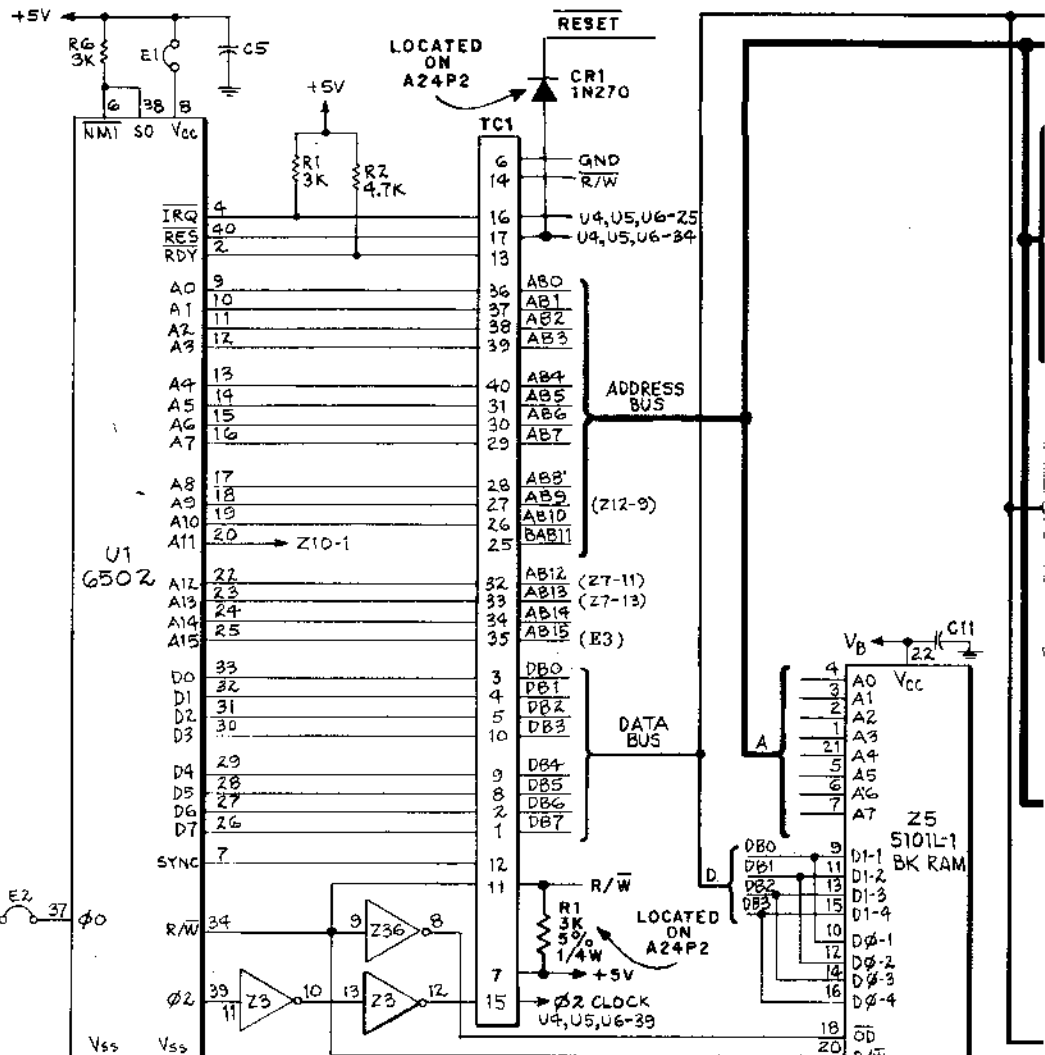
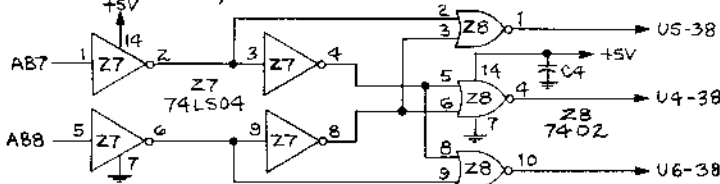
DELAY CIRCUIT



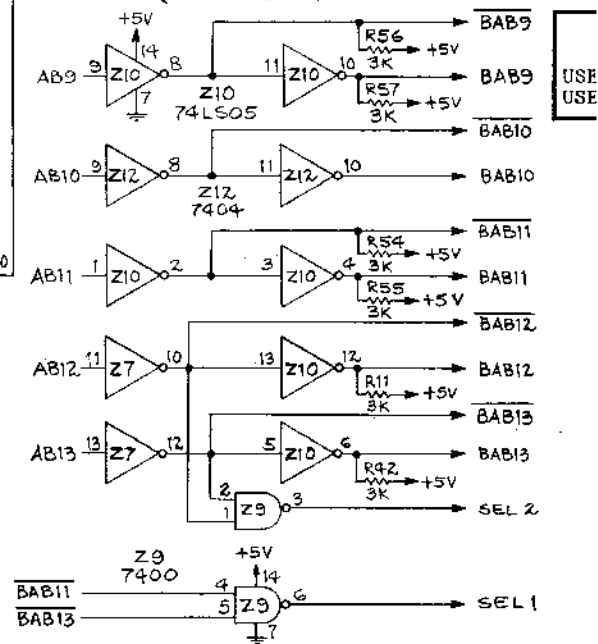
UP/DOWN MEMORY PROTECT LOGIC



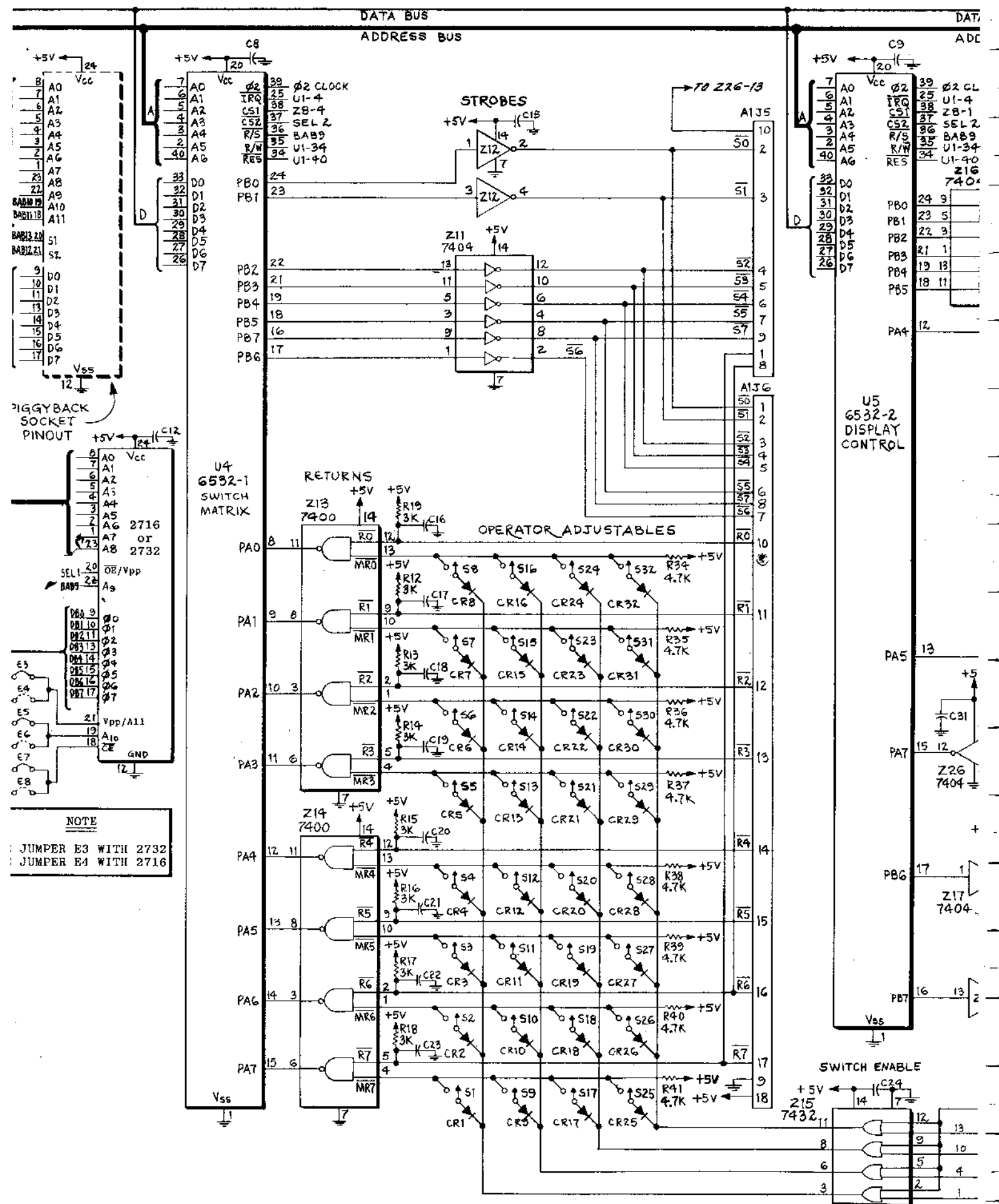
INPUT/OUTPUT DEVICE SELECTION



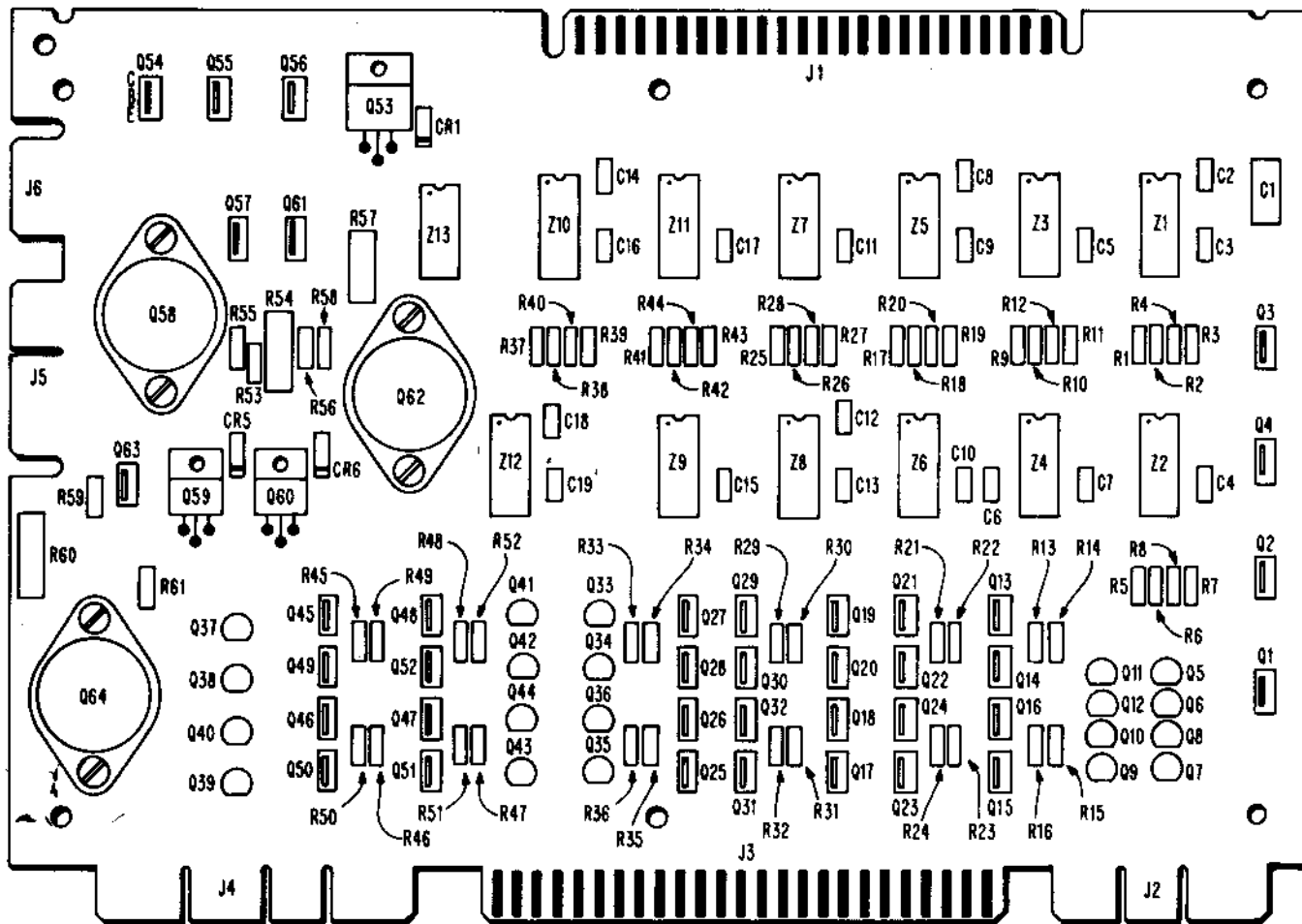
PROM SELECTION



X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



DRIVER BOARD (A3) COMPONENT LOCATION



DRIVER BOARD (A3) PARTS LIST

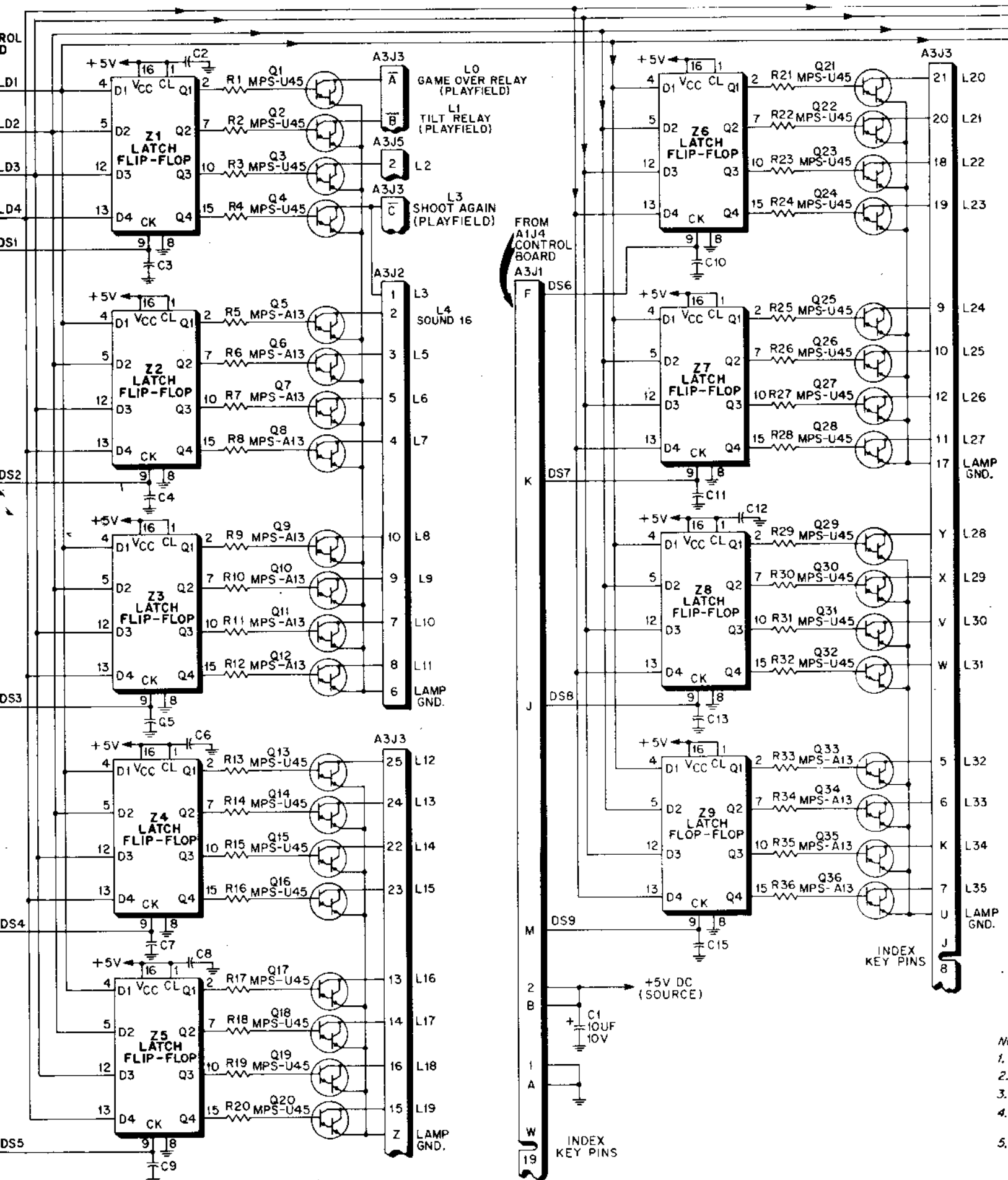
REFERENCE	DESCRIPTION	PART NUMBER
	DRIVER BOARD	MA-295
C1	Capacitor, 10 mfd., 10V Tantalum	XO-209
C2-C19	Capacitor, .01 mfd., 50V Ceramic	XO-229
CR1, CR5, CR6	Diode—Silicon 1N4148	XO-261
R1-R53, R61, R55, R56, R58, R59	Resistor 10K ohm, 5%, 1/4W	XO-5
R54, R57, R60	Resistor, 91 ohm, 5%, 1W	XO-158
Q1-Q4, Q13- Q32, Q45-Q52, Q54-Q57, Q61, Q63	Transistor, NPN, Darlington MPS-U45	XO-306
Q5-Q12, Q33-Q44	Transistor, NPN, Darlington MPS-A13	XO-304
Q53, Q59, Q60	Transistor, NPN, Darlington 2N6043	XO-303
Q58, Q62, Q64	Transistor, NPN, 2N3055	XO-301
Z1-Z12	IC—Quad "D" Latch Flip Flop SN74175N	XO-410
Z13	IC—Hex Inverter SN7404N	XO-402
	Insulator—Thermalloy 43-03-4	XO-523
	Jumper (3)	XO-469

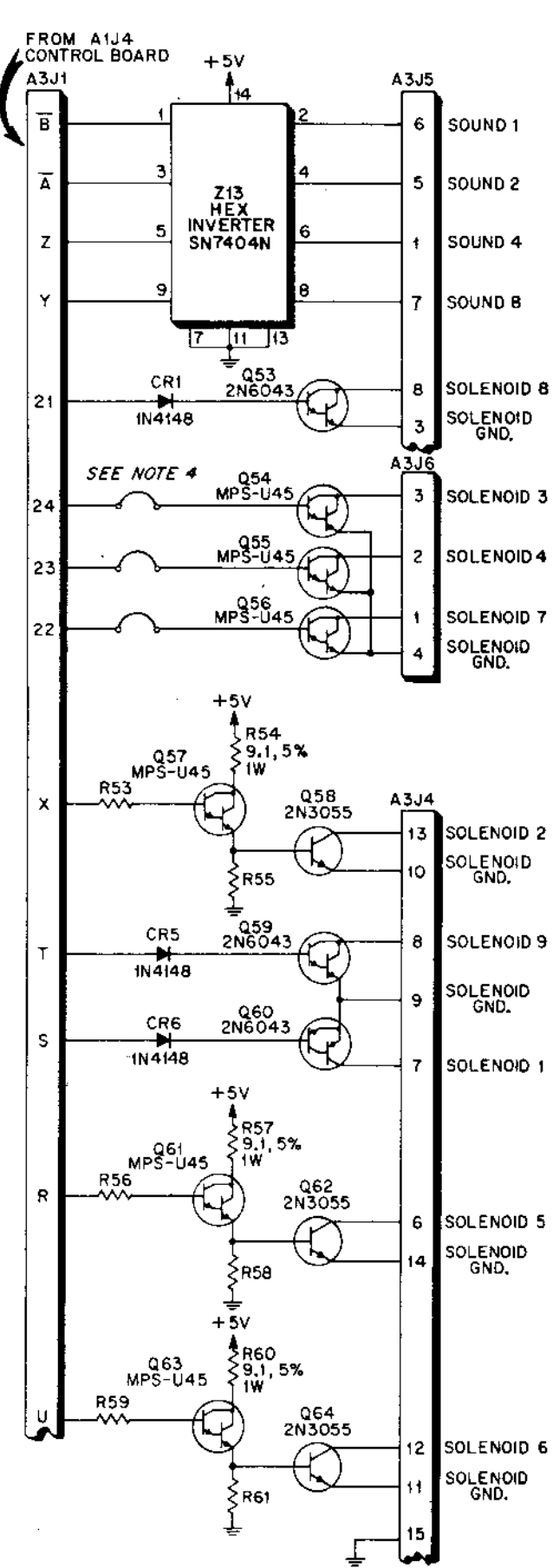
NOTE:

1. JUMPER WIRES REPLACED DIODES CR2, CR3 AND CR4 FOR SYSTEM BOA AND BOB GAMES.
2. TRANSISTOR TYPES MPS-U45 AND MSD-U45 ARE INTERCHANGEABLE.

FROM
A1J4
CONTROL
BOARD
A3J1

7 LD1
6 LD2
4 LD3
5 LD4
C DS1
3 DS2
E DS3
D DS4
H DS5





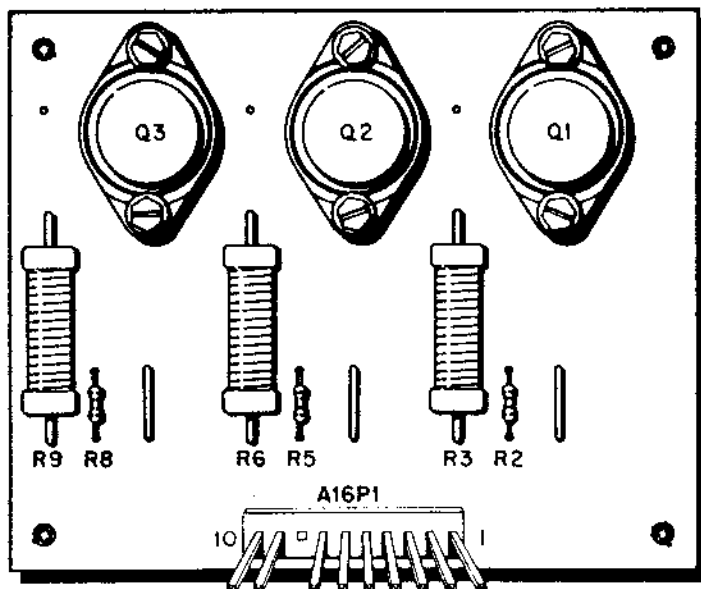
NOTE: UNLESS OTHERWISE INDICATED;

1. RESISTORS ARE 1000 OHM, $\pm 5\%$, 1/4W.
2. CAPACITORS ARE .01UF, $\pm 20\%$, 50V.
3. INTEGRATED CIRCUITS ARE SN74175N.
4. JUMPER WIRES REPLACED DIODES CR2, CR3 AND CR4 FOR SYSTEM 80A AND 80B GAMES.
5. TRANSISTOR TYPES MPS-U45 AND NOS-U45 ARE INTERCHANGEABLE.

DRIVER BOARD (A3) SCHEMATIC DIAGRAM

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

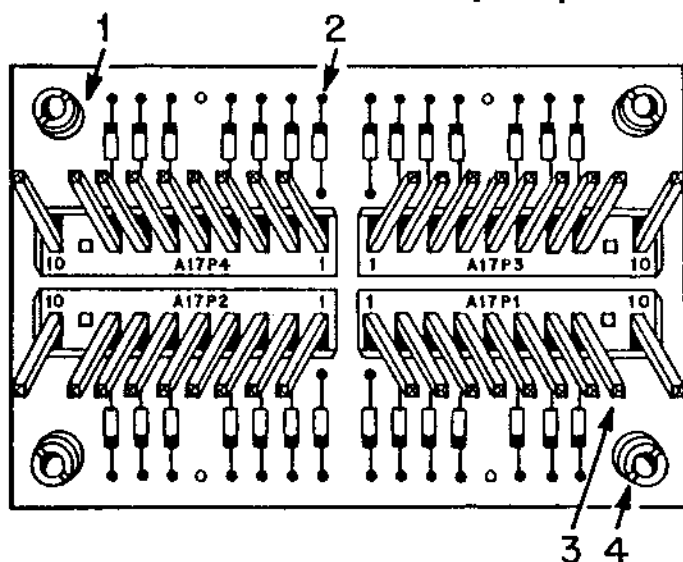
TRANSISTOR DRIVER BOARD (A16) COMPONENT LOCATION



TRANSISTOR DRIVER BOARD (A16) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Transistor Driver Board Assembly (1A16)	MA-1293
Q1,Q2,Q3	Transistor, MJ2955	XO-799
R2,R5,R8	Resistor, 4.7K Ohm, 5%, 1/4W	XO-7
R3,R6,R9	Resistor, 4 Ohm, 5%, 5W	XO-878
P1	10 Position Connector	XO-879
	Circuit Board Support (4)	MP-40
	Jumper (3)	XO-469

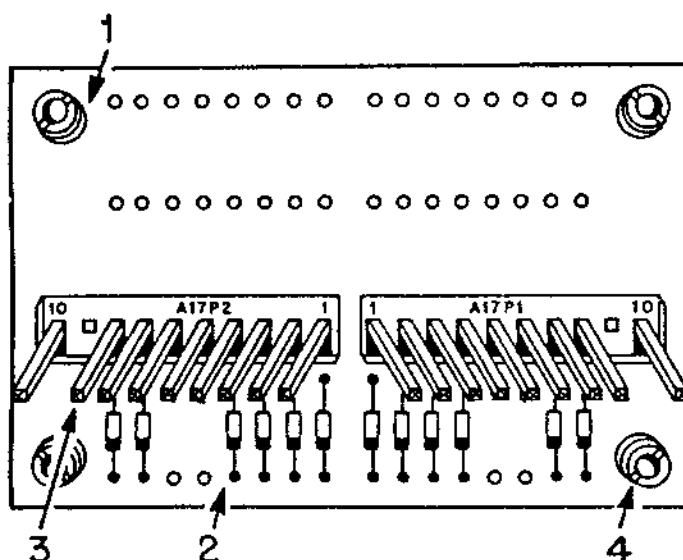
DIODE BOARD (A17)



DIODE BOARD (A17)

ITEM	DESCRIPTION	PART NO.
1	Diode Board Assembly (1A17)	MA-1216
2	Diode, 1N270 (28)	XO-265
3	10 Position Connector (4)	XO-879
4	Spacer (4)	23894

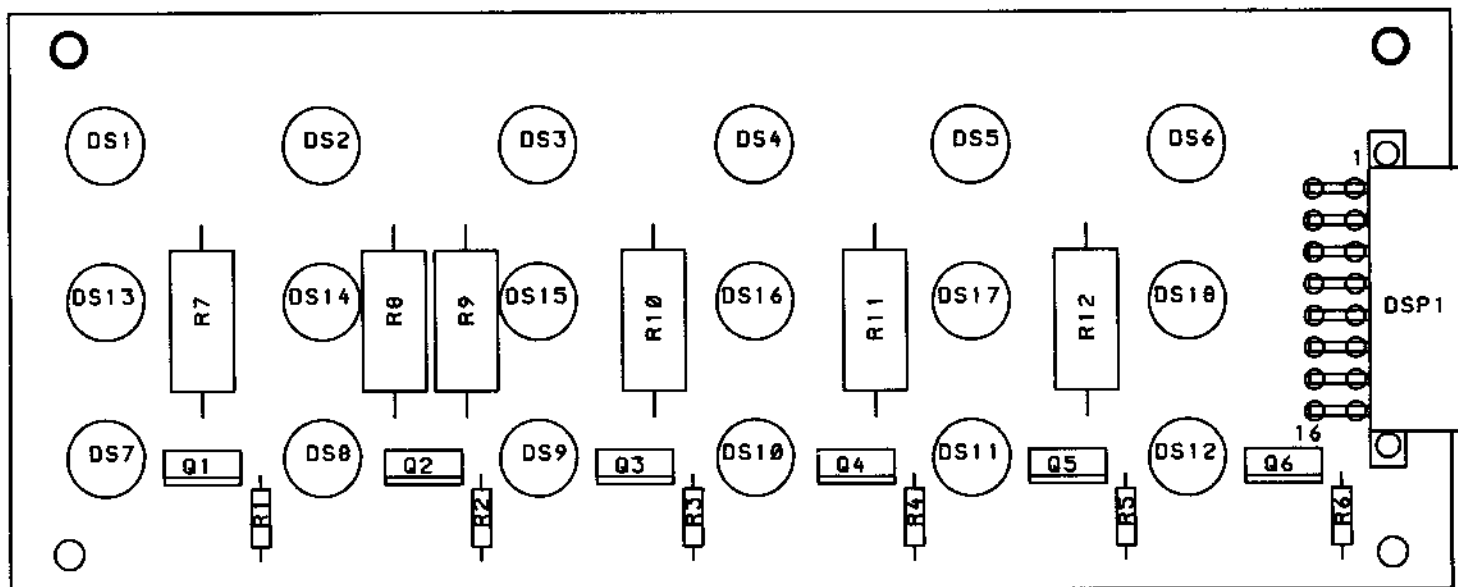
DIODE BOARD (A17)



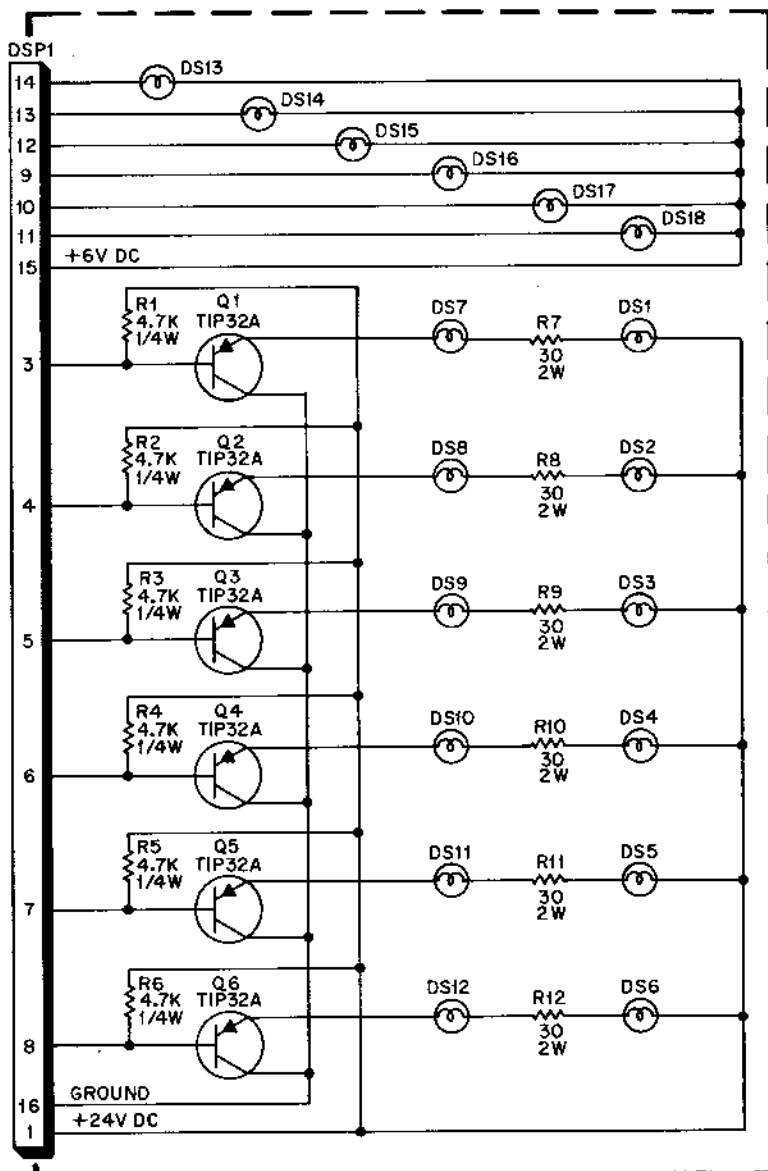
DIODE BOARD (A17)

ITEM	DESCRIPTION	PART NO.
1	Diode Board Assembly (2A17)	MA-1314
2	Diode, 1N270 (12)	XO-265
3	10 Position Connector (4)	XO-879
4	Spacer (4)	23984

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



LAMP BOARD COMPONENT LOCATION

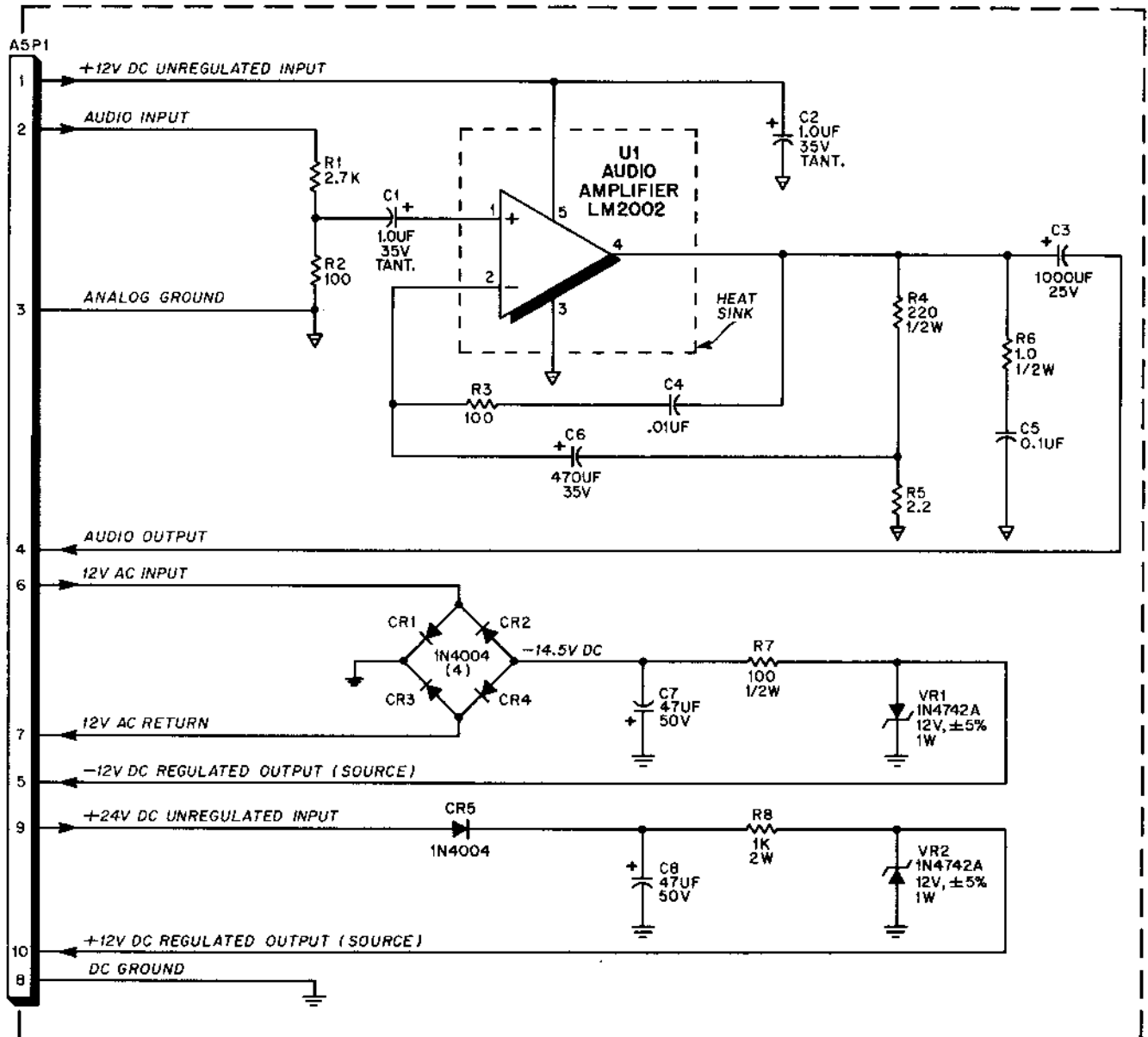


**LAMP BOARD
SCHEMATIC DIAGRAM**

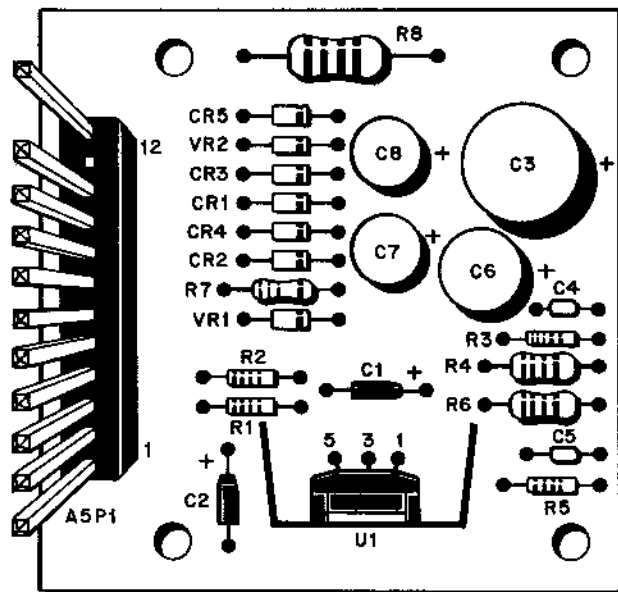
LAMP BOARD PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
DSP1	Lamp Board Assembly Header (16 Pin)	MA-1303
DS1-DS18	Lamp, #44	XO-961
Q1-Q6	Transistor, TIP32A	LA0
R1-R6	Resistor, 4.7K Ohm, 5%, 1/4W	XO-946
R7-R12	Resistor 30 Ohm, 5%, 2W	XO-7
	Lamp Socket (18)	XO-155
		XO-962

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



**AUXILIARY POWER SUPPLY (A5)
COMPONENT LOCATION**



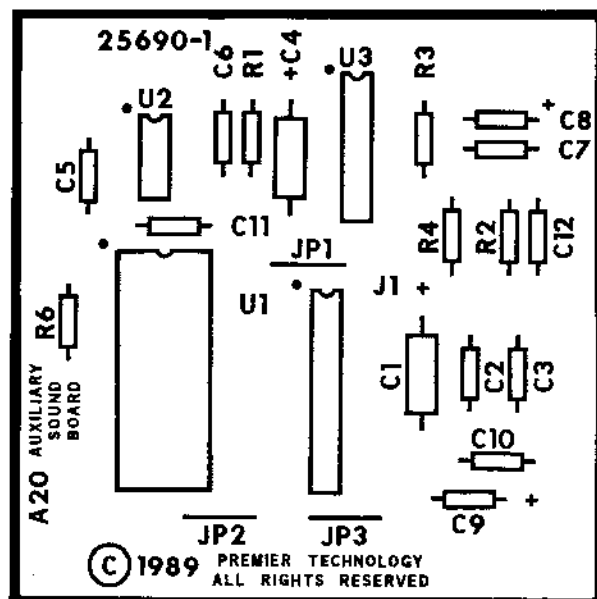
**AUXILIARY POWER SUPPLY (A5)
SCHEMATIC DIAGRAM**

**AUXILIARY POWER SUPPLY (A5)
PARTS LIST**

REFERENCE	DESCRIPTION	PART NUMBER
C1, C2	Auxiliary Power Supply	MA-1017
C3	Capacitor, 1UF, 10%, 35V, TANT	XO-715
C4	Capacitor, 1000UF, 25V	XO-874
C5	Capacitor, .01UF, +80% -20%, 50V	XO-229
C6	Capacitor, 0.1UF, +80% -20%, 50V	XO-230
C7, C8	Capacitor, 470UF, 35V	XO-284
CR1-CR5	Capacitor, 47UF, 50V	XO-210
U1	Diode, 1N4004	XO-254
R1	Resistor, 2.7K Ohm, 5%, 1/4W	XO-6
R2, R3	Resistor, 100 Ohm, 5%, 1/4W	XO-28
R4	Resistor, 220 Ohm, 5%, 1/2W	XO-185
R5	Resistor, 2.2 Ohm, 5%, 1/4W	XO-595
R6	Resistor, 1 Ohm, 5%, 1/2W	XO-593
R7	Resistor, 100 Ohm, 5%, 1/2W	XO-52
R8	Resistor, 1K Ohm, 5%, 2W	XO-627
U1	Audio Amplifier, LM2002	XO-550
VR1, VR2	Diode, Zener, 1N4742A, 12V, +5%, 1W	XO-257
	Heat Sink	XO-472
	12 Position Connector	XO-879

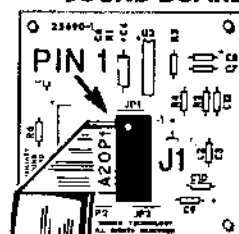
X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

AUXILIARY SOUND BOARD (A20) COMPONENT LOCATION



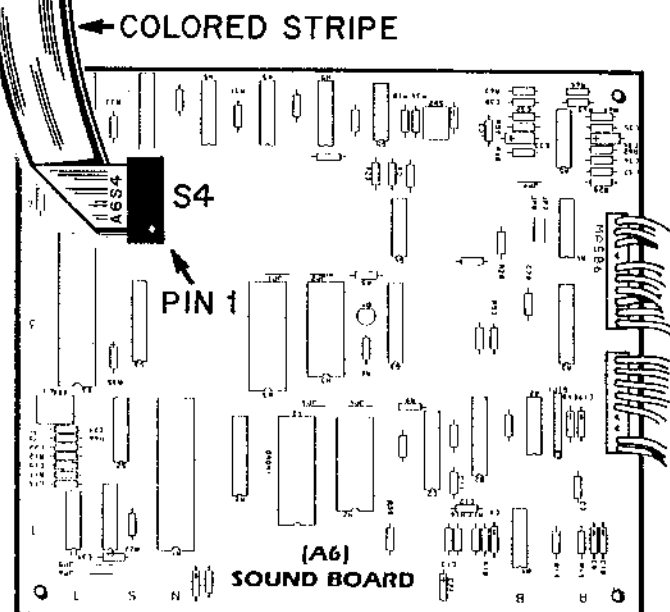
RIBBON CABLE ORIENTATION

(A20)
AUXILIARY
SOUND BOARD



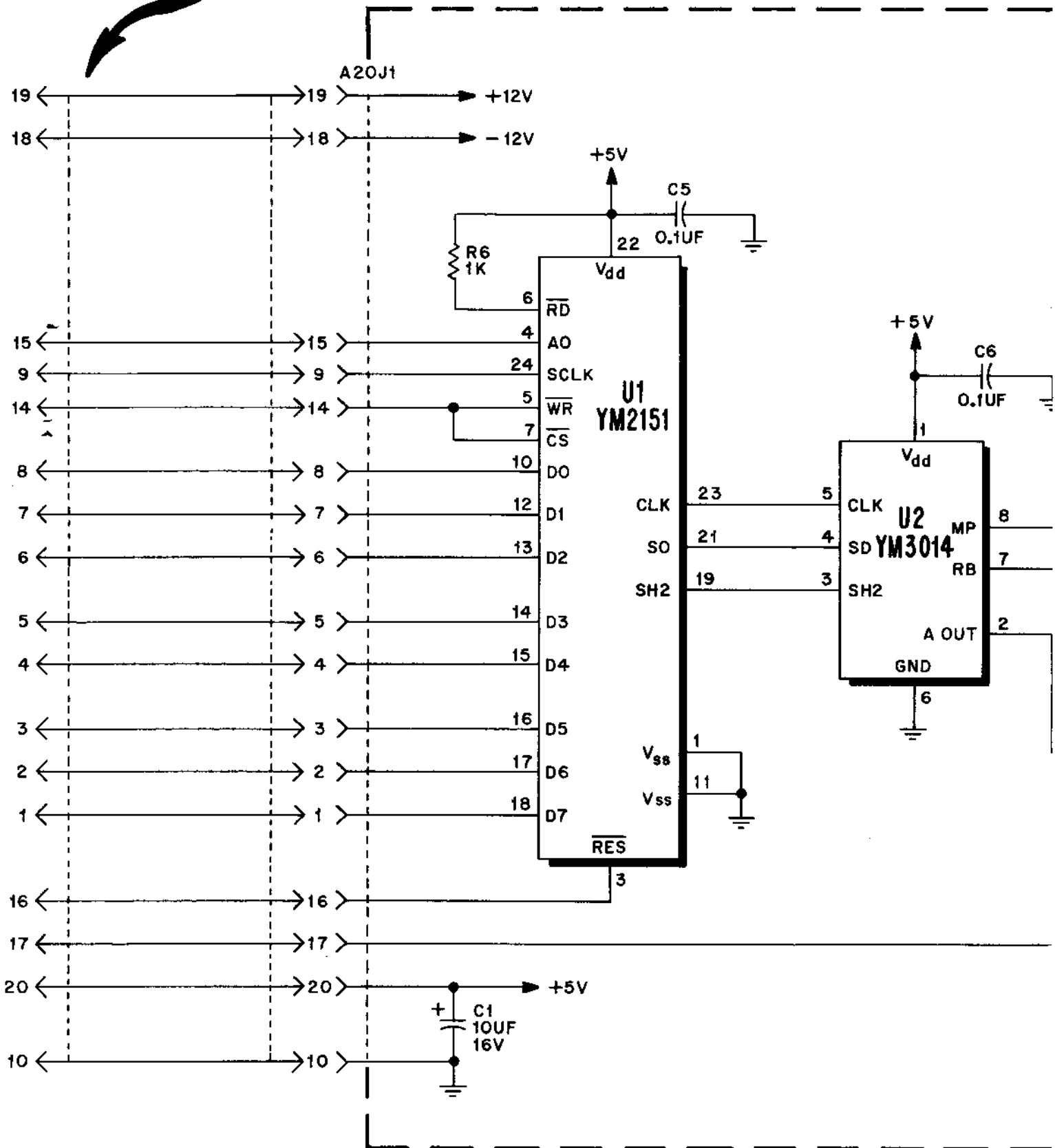
AUXILIARY SOUND BOARD (A20) PARTS LIST

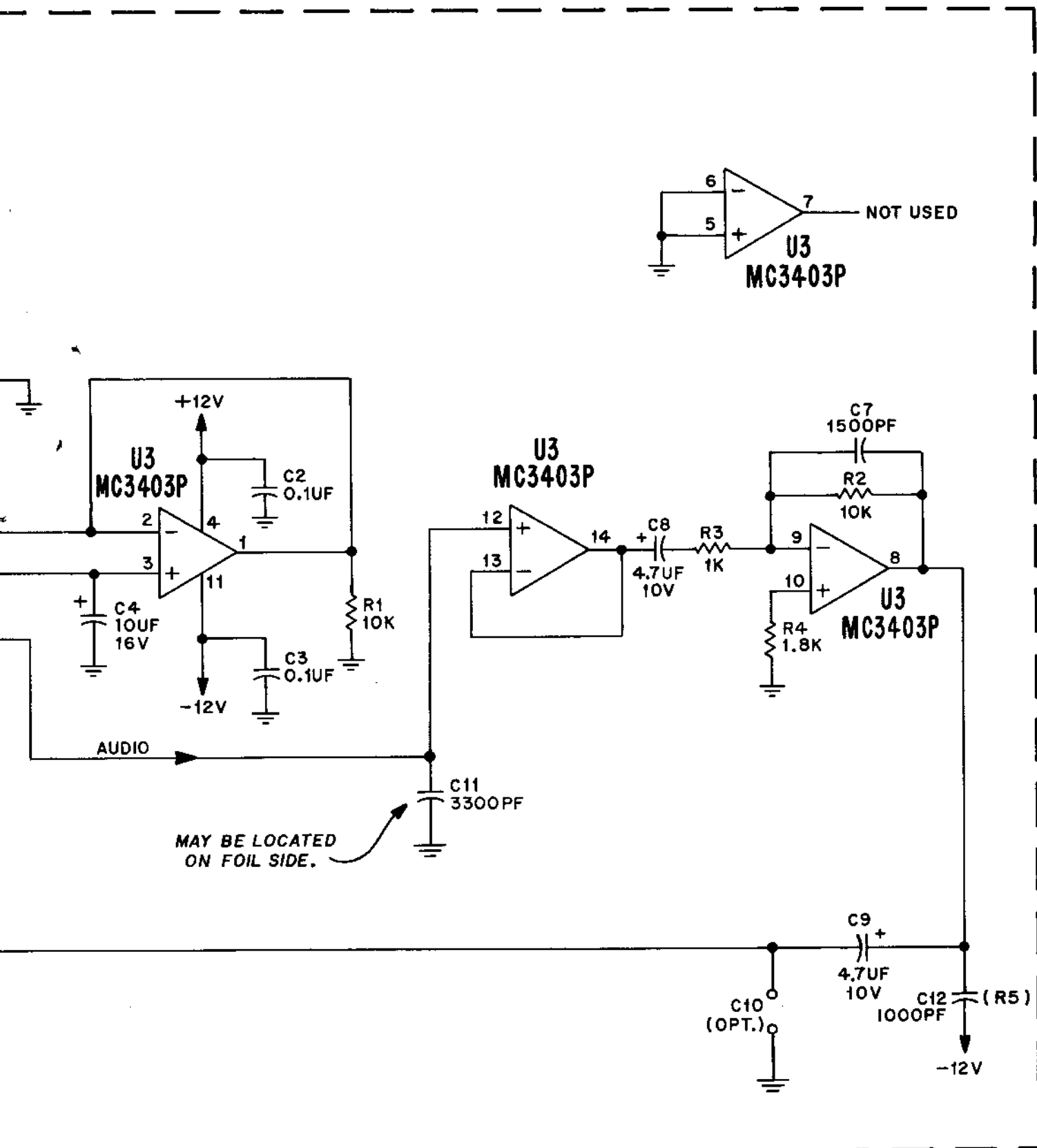
REFERENCE	DESCRIPTION	PART NUMBER
	AUXILIARY SOUND BOARD	MA-1294
C1, C4	CAPACITOR, 10UF, +80%-20%, 16V	XO-846
C2, C3, C5, C6	CAPACITOR, 0.1UF, +80%-20%, 50V	XO-230
C7	CAPACITOR, 1500PF, 5%, 50V	XO-954
C8, C9	CAPACITOR, 4.7UF, 10%, 10V	XO-226
C11	CAPACITOR, 3300PF, 10%, 100V	XO-600
C12 (R5)	CAPACITOR, 1000PF, 10%, 100V	XO-296
R1	RESISTOR, 10K OHM, 5%, 1/4W	XO-18
R2	RESISTOR, 10K OHM, 1%, 1/4W	XO-956
R3, R6	RESISTOR, 1K OHM, 5%, 1/4W	XO-5
R4	RESISTOR, 1.8K OHM, 5%, 1/4W	XO-37
U1	IC, SOUND CHIP, YM2151	XO-882
U2	IC, SERIAL DAC, YM3014	XO-883
U3	IC, QUAD OP-AMP, MC3403P	XO-953
	JUMPER, 22 GAUGE (3)	XO-469
	SOCKET, 20 PIN DIP	XO-491
	SOCKET, 24 PIN DIP	XO-529
	RIBBON CABLE	25699



26164

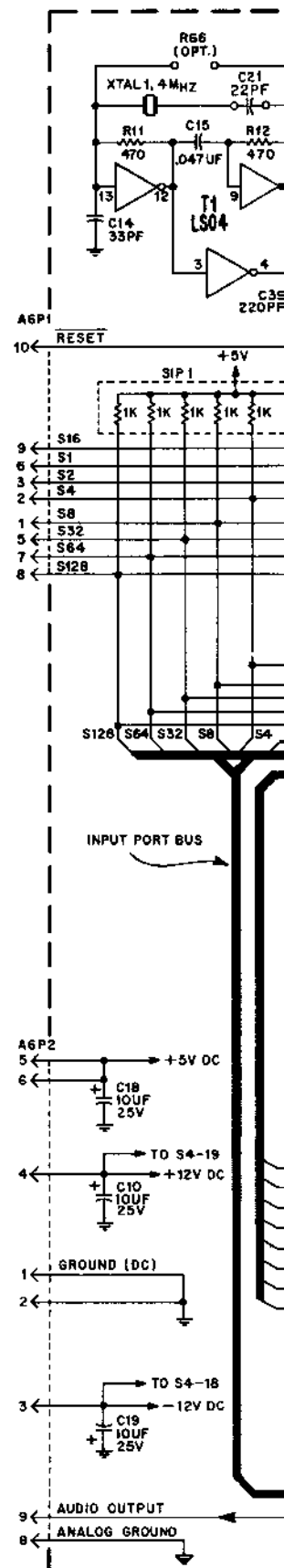
25699 RIBBON CABLE
(TO S4 EXPAND SOCKET
MA-886-713 SOUND BOARD)





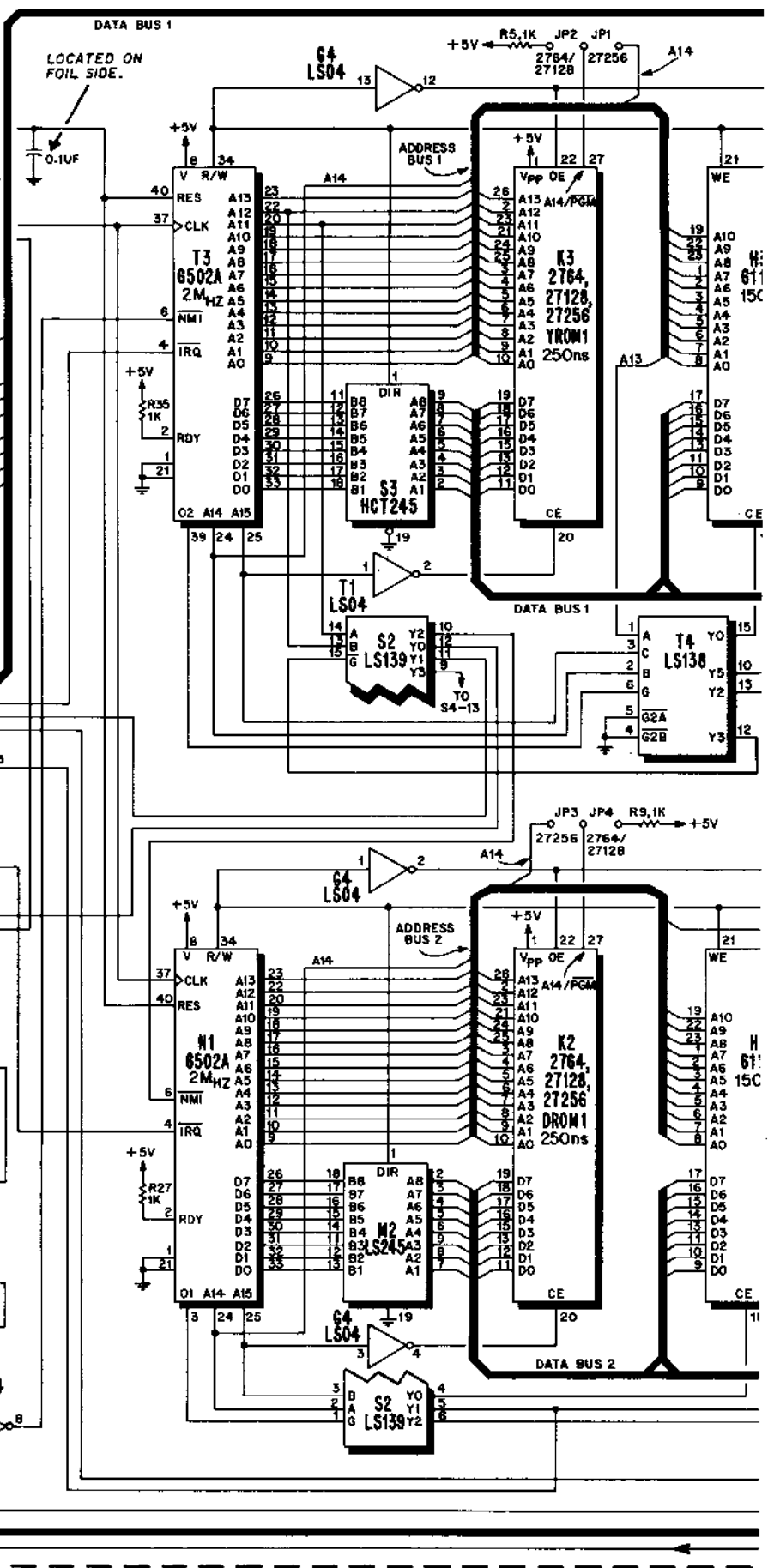
AUXILIARY SOUND BOARD (A20) SCHEMATIC DIAGRAM

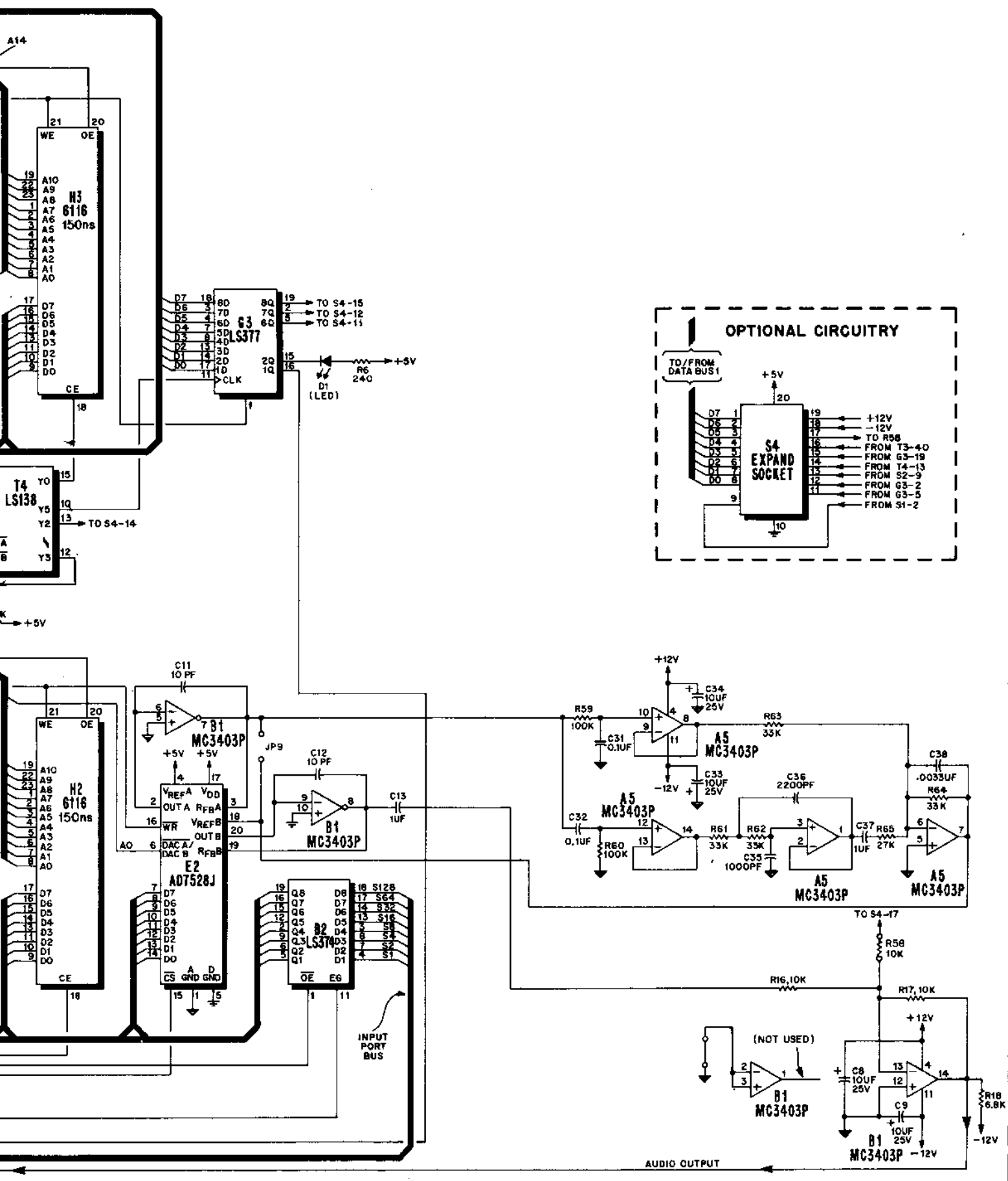
SOUND BOARD (A6) COMPONENT LOCATION



SOUND BOARD (A6) PARTS LIST

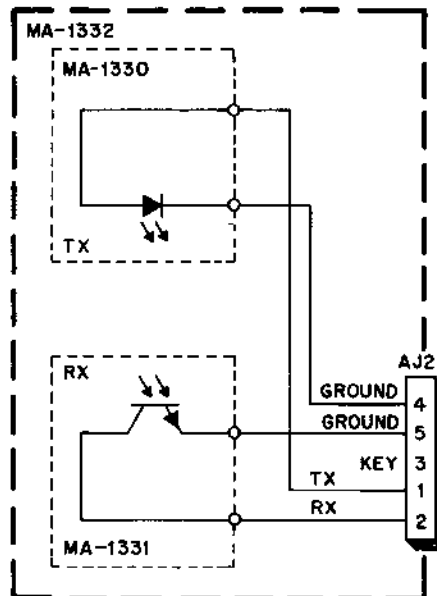
REFERENCE	DESCRIPTION	PART NUMBER	REFERENCE	DESCRIPTION	PART NUMBER
C13,C37	Sound Board Assembly (1A6)	MA-886-719	R61,R62,R63, R64	Resistor, 33K Ohm, 5%, 1/4W	XO-43
C8,C9,C10	Capacitor, 1UF, 20%, 50V (Non. Polyr.)	XO-716	R59,R60	Resistor, 100K Ohm, 5%, 1/4W	XO-45
C18,C19,C24	Capacitor, 10UF, 20% 25V (Tantalum)	XO-127	R65	Resistor, 27K Ohm, 5%, 1/4W	XO-11
C33,C34 AND THREE UNMARKED CAPACITORS			A2	IC, 7430, 8 Input NAND Gate	XO-643
C11,C12	Capacitor, 10PF, +80%-20%, 50V	XO-635	A3,B2,S5	IC, 74LS374, Octal "D" Flip Flop	XO-96
C14,C22	Capacitor, 33PF, 10%, 100V	XO-896	A4	IC, 74LS74, Dual "D" Flip Flop	XO-434
C15	Capacitor, .047UF, 20%, 50V	XO-638	A5	IC, MC3403P, Quad Op-Amp	XO-953
C21	Capacitor, .22PF, 10%, 50V	XO-633	B1	IC, MC3403P, Quad Op-Amp	XO-953
C28 AND FOURTEEN UNMARKED CAPACITORS	Capacitor, 0.1UF, +80%-20%, 50V	XO-230	E2	IC, AD7528J, Multiplier DAC	XO-647
C31,C32	Capacitor, 0.1UF, 10%, 50V	XO-784	G3	IC, 74LS377, Octal "D" Flip Flop	XO-97
C35	Capacitor, 1000PF, 10%, 100V	XO-286	G4,T1	IC, 74LS04, Hex Inverter	XO-418
C36	Capacitor, 2200PF, 10%, 100V	XO-289	G5	IC, 74HC08, Quad 2 Input "AND" Gate	XO-872
C38	Capacitor, .0033UF, 10%, 100V	XO-600	H2,H3	IC, 6116UP-15, 2K X 8 RAM	XO-928
C39	Capacitor, 220PF, 10%, 100V	XO-694	H5,K5,N5	IC, 74LS161, Synchronous Presettable Binary Counter	XO-440
D1	Diode, MV5752, (1KD, Red)	XO-270	S1,T5	IC, Specified Per Game	
R5,R9,R10, R27,R28,R31, R33,R35	Resistor, 1K Ohm, 5%, 1/4W	XO-5	K2,K3	IC, 74LS245, Octal Bus Transceiver	XO-79
R6	Resistor, 240 Ohm, 5%, 1/4W	XO-173	M2	IC, 6502A, CPU	XO-893
R11,R12	Resistor, 470 Ohm, 5%, 1/4W	XO-35	N1,T3	IC, 74LS139, Dual 1 of 4 Decoder	XO-419
R21,R25	Resistor, 3K Ohm, 5%, 1/4W	XO-23	S2	IC, 74HC245, Octal Bus Transceiver	XO-891
R16,R17,R58	Resistor, 10K Ohm, 5%, 1/4W	XO-18	S3	IC, 74LS138, 1 of 8 Decoder	XO-437
R18	Resistor, 6.8K Ohm, 5%, 1/4W	XO-8	T4	Resistor Pack 8 x 1K Ohm	XO-493
R20,R34	Resistor, 4.7K Ohm, 5%, 1/4W	XO-7	S1P 1	Switch, Pushbutton	XO-897
			XTAL 1	Crystal, 4 MHZ	XO-366
			A6P1,A6P2	Connector (2)	XO-879
				28 Pin Dip Socket (2)	XO-536
				Jumper, 22 Gauge (6)	XO-469
				20 Pin Dip Socket	XO-491





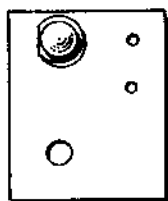
SOUND BOARD (A6) SCHEMATIC DIAGRAM

OPTO LED TRANSMITTER BOARD SCHEMATIC DIAGRAM

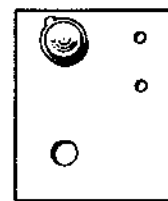


OPTO PHOTOTRANSISTOR RECEIVER BOARD SCHEMATIC DIAGRAM

OPTO LED TRANSMITTER BOARD COMPONENT LOCATION



OPTO PHOTOTRANSISTOR RECEIVER BOARD COMPONENT LOCATION



OPTO LED TRANSMITTER BOARD PARTS LIST

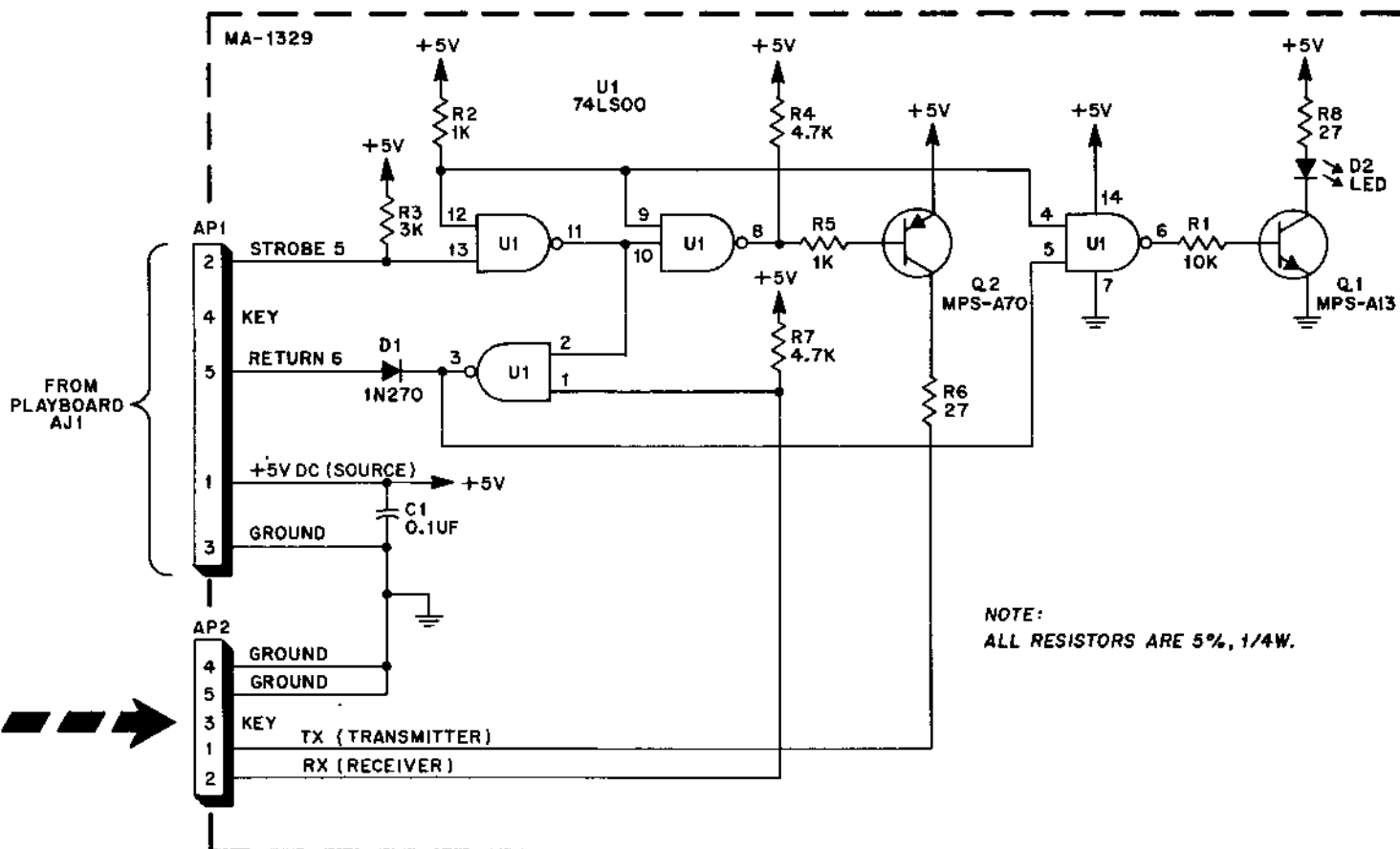
REFERENCE	DESCRIPTION	PART NUMBER
TX	Opto LED Transmitter Assembly	MA-1330
	Plastic Transmitter LED	XO-994

OPTO PHOTOTRANSISTOR RECEIVER BOARD PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Opto Phototransistor Receiver Assembly	MA-1331
RX	Plastic Phototransistor	XO-993

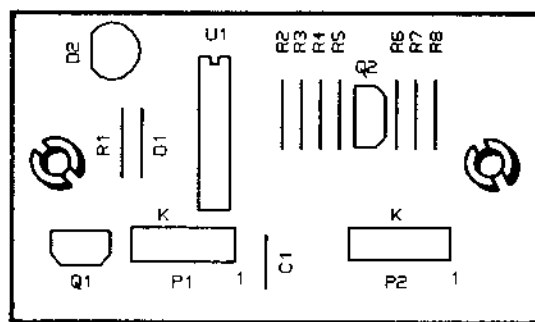
DESCRIPTION	PART NUMBER
Bracket And Optic Boards Assembly	MA-1332
Optical Switch Bracket	26680

C DIAGRAMS, PARTS LISTS



OPTICAL INTERFACE BOARD SCHEMATIC DIAGRAM

OPTICAL INTERFACE BOARD COMPONENT LOCATION

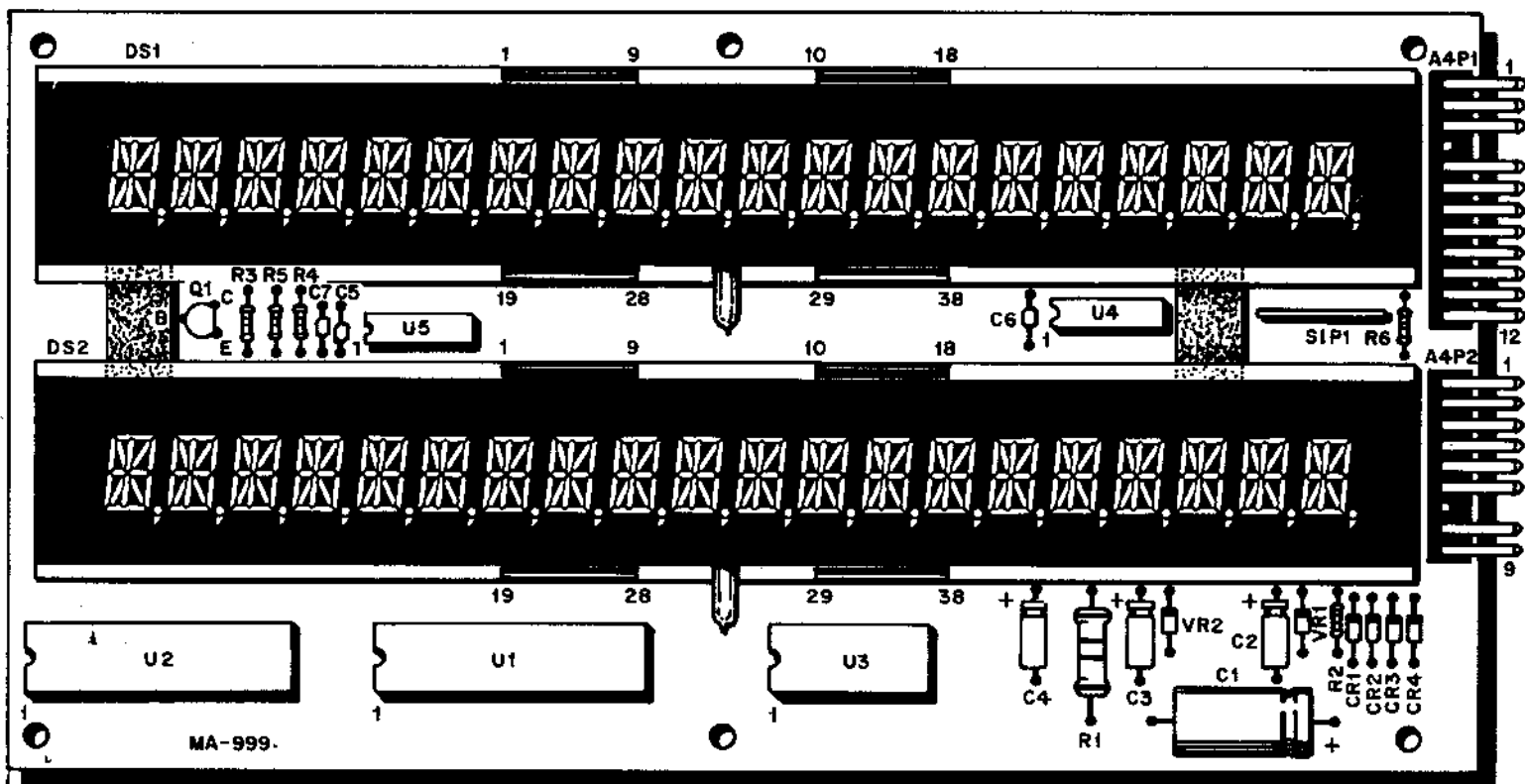


OPTICAL INTERFACE BOARD PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
AP1, AP2	Optical Interface Board Assembly	MA-1329
C1	5 Pin "Right Angle" Header	XO-996
D1	Capacitor, 0.1UF, +80-20%, 50V	XO-230
D2	Diode, 1N270	XO-265
Q1	Diode, MV5752, (LED, Red)	XO-270
Q2	Transistor, MPS-A13	XO-304
R1	Transistor, MPS-A70	XO-309
R2, R5	Resistor, 10K Ohm, 5%, 1/4W	XO-18
R3	Resistor, 1K Ohm, 5%, 1/4W	XO-5
R4, R7	Resistor, 3K Ohm, 5%, 1/4W	XO-23
R6, R8	Resistor, 4.7K Ohm, 5%, 1/4W	XO-7
U1	Resistor, 28 Ohm, 5%, 1/4W	XO-997
	IC, Quad "AND" Gate, 74LS00	XO-427
	Support, SRS-8-6N, (2)	23984

X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS

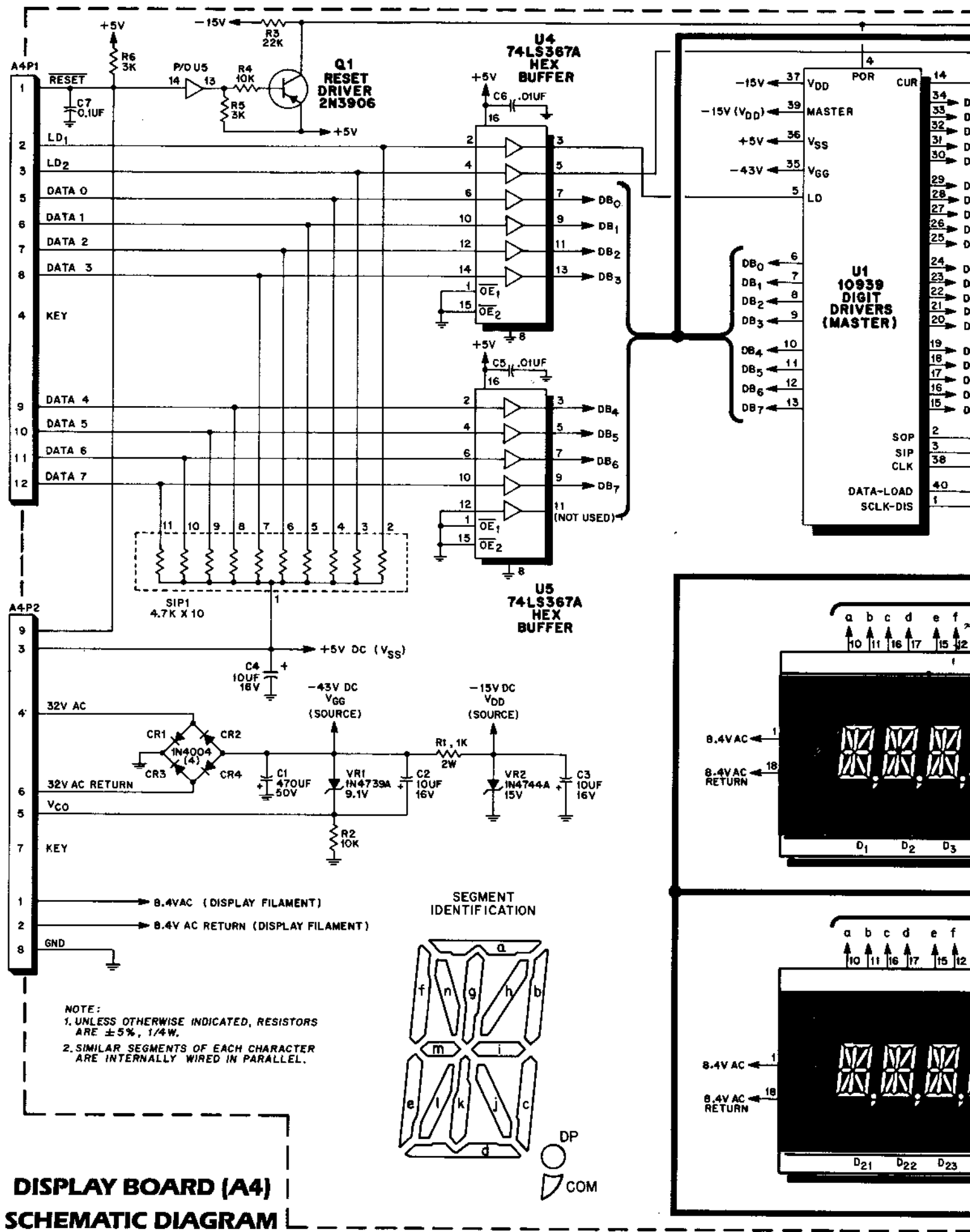
DISPLAY BOARD (A4) COMPONENT LOCATION

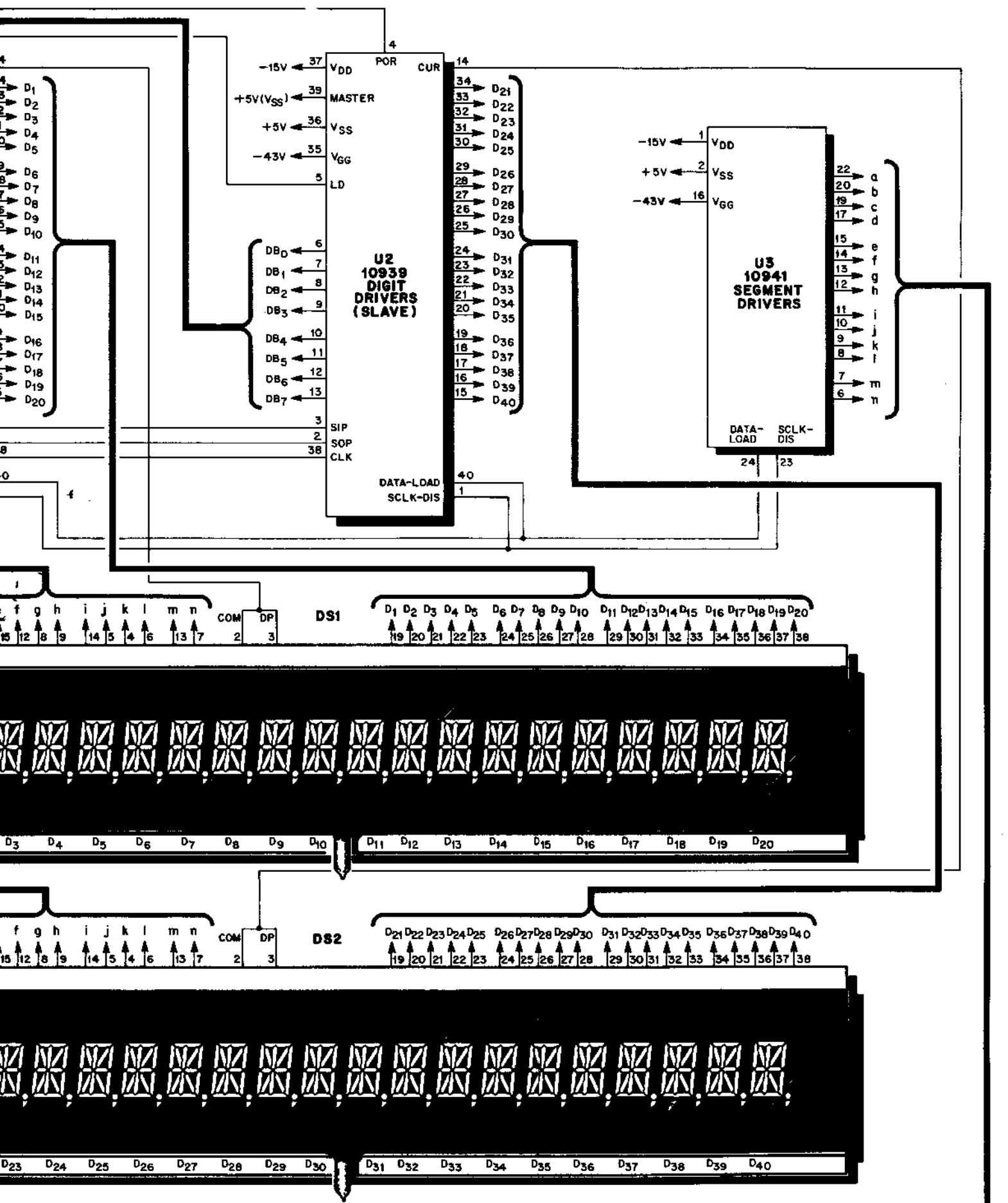


DISPLAY BOARD (A4) PARTS LIST

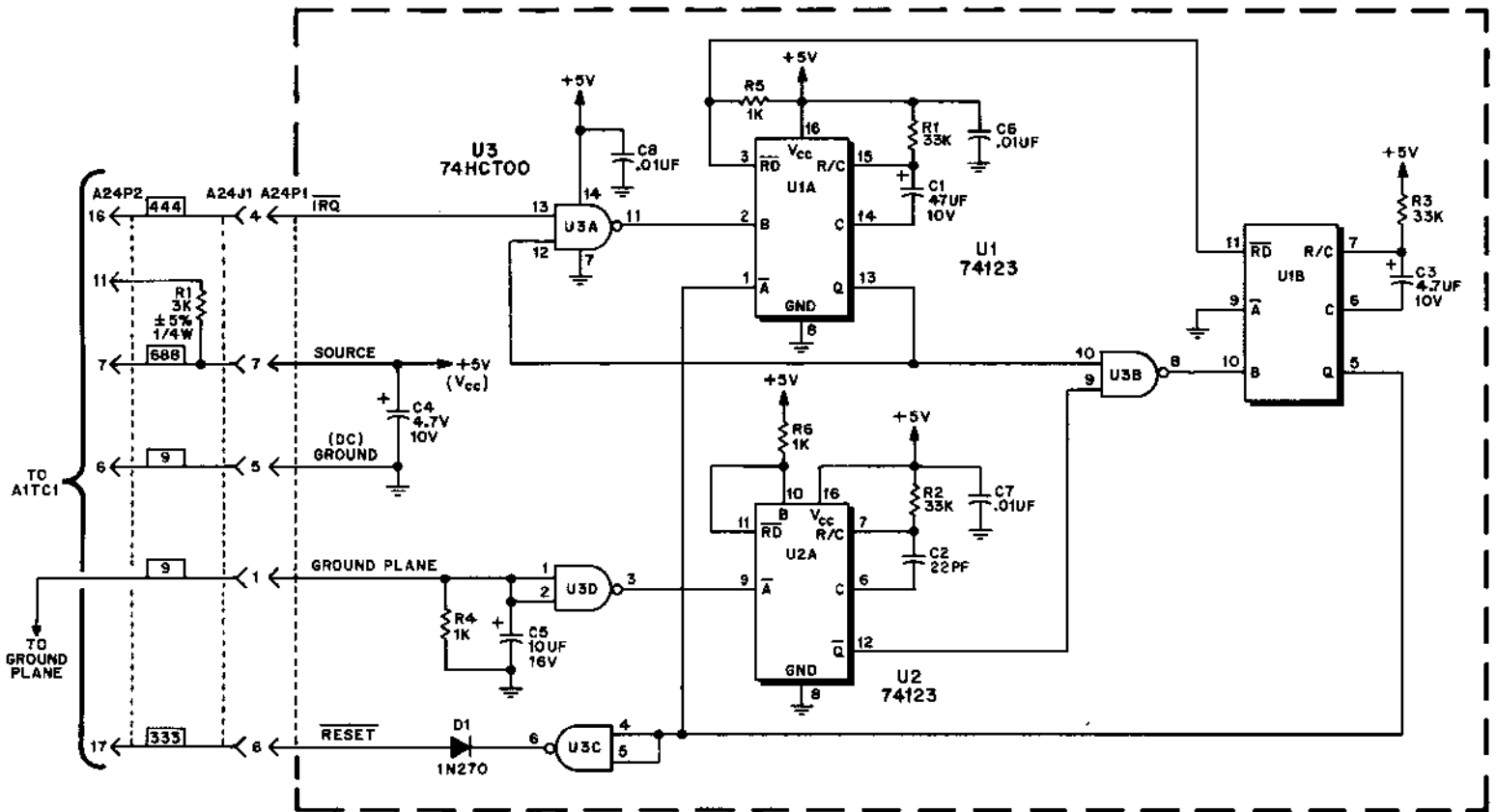
REFERENCE	DESCRIPTION	PART NUMBER
	Display Board Assembly	MA-999
C1	Capacitor, 470UF, 50V	XO-847
C2,C3,C4	Capacitor, 10UF, 16V, +80%-20%	XO-846
C5,C6	Capacitor, .01UF, +80%-20%	XO-229
C7	Capacitor, 0.1UF, +80%-20%	XO-230
CR1-CR4	Diode, 1N4004	XO-254
DS1,DS2	Display, Alphanumeric	XO-901
Q1	Transistor, PNP, Reset Driver, 2N3906	XO-588
R1	Resistor, 1K Ohm, 5%, 2 W, WW	XO-627
R2,R4	Resistor, 10K Ohm, 5%, 1/4 W	XO-18
R3	Resistor, 22K Ohm, 5%, 1/14 W	XO-42
R5,R6	Resistor, 3K Ohm, 5%, 1/4 W	XO-23
SIP1	Resistor Pack, 11 Pin SIP, 4.7K Ohm x 10	XO-869
U1,U2	IC, Digit Drivers, 10939P	XO-841
U3	IC, Segment Drivers, 10941P	XO-842
U4,U5	IC, Hex Buffer, 74LS367A	XO-444
VR1	Diode, Zener, 9.1V, 1N4739A	XO-881
VR2	Diode, Zener, 15V, 1N4744A	XO-843
A4P1	12 Position Connector	XO-880-124
A4P2	9 Position Connector	XO-880-097
	Tape, Neoprene (2)	24290

X. WIRING AND SCHEMATIC



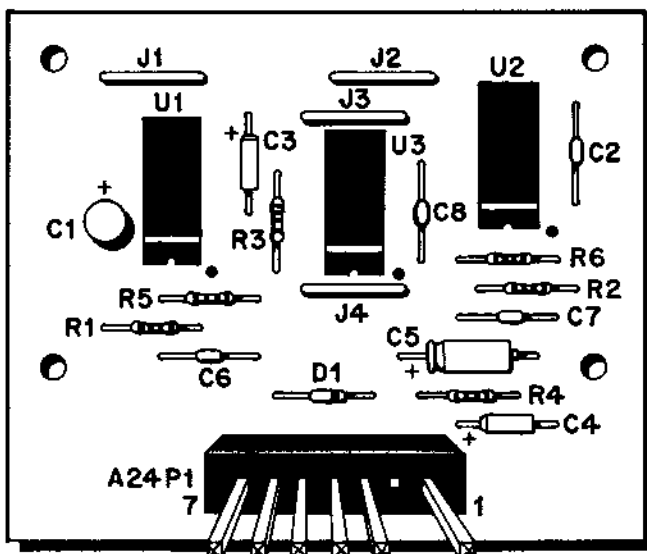


X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



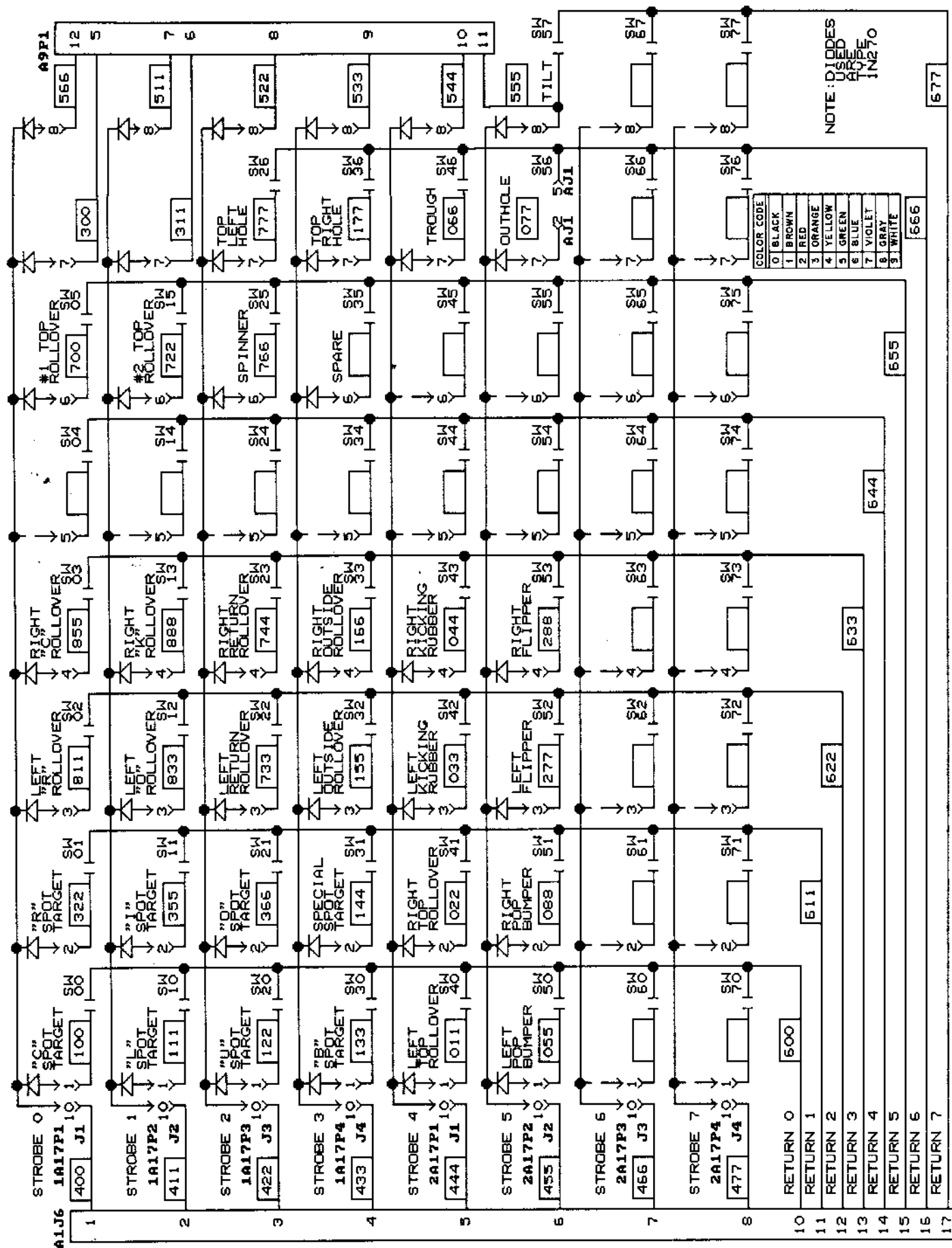
RESET ANTI-STATIC BOARD SCHEMATIC DIAGRAM

RESET/ANTI-STATIC BOARD (A24) COMPONENT LOCATION

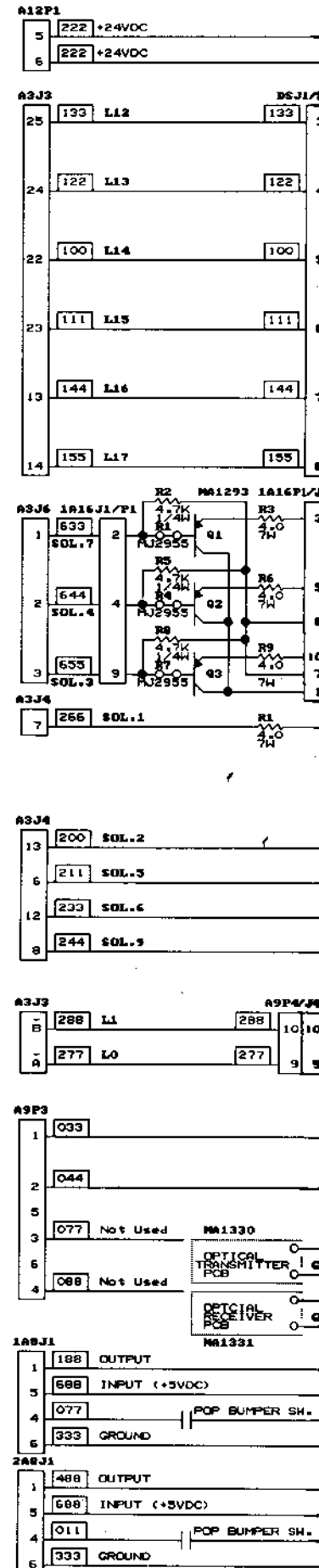
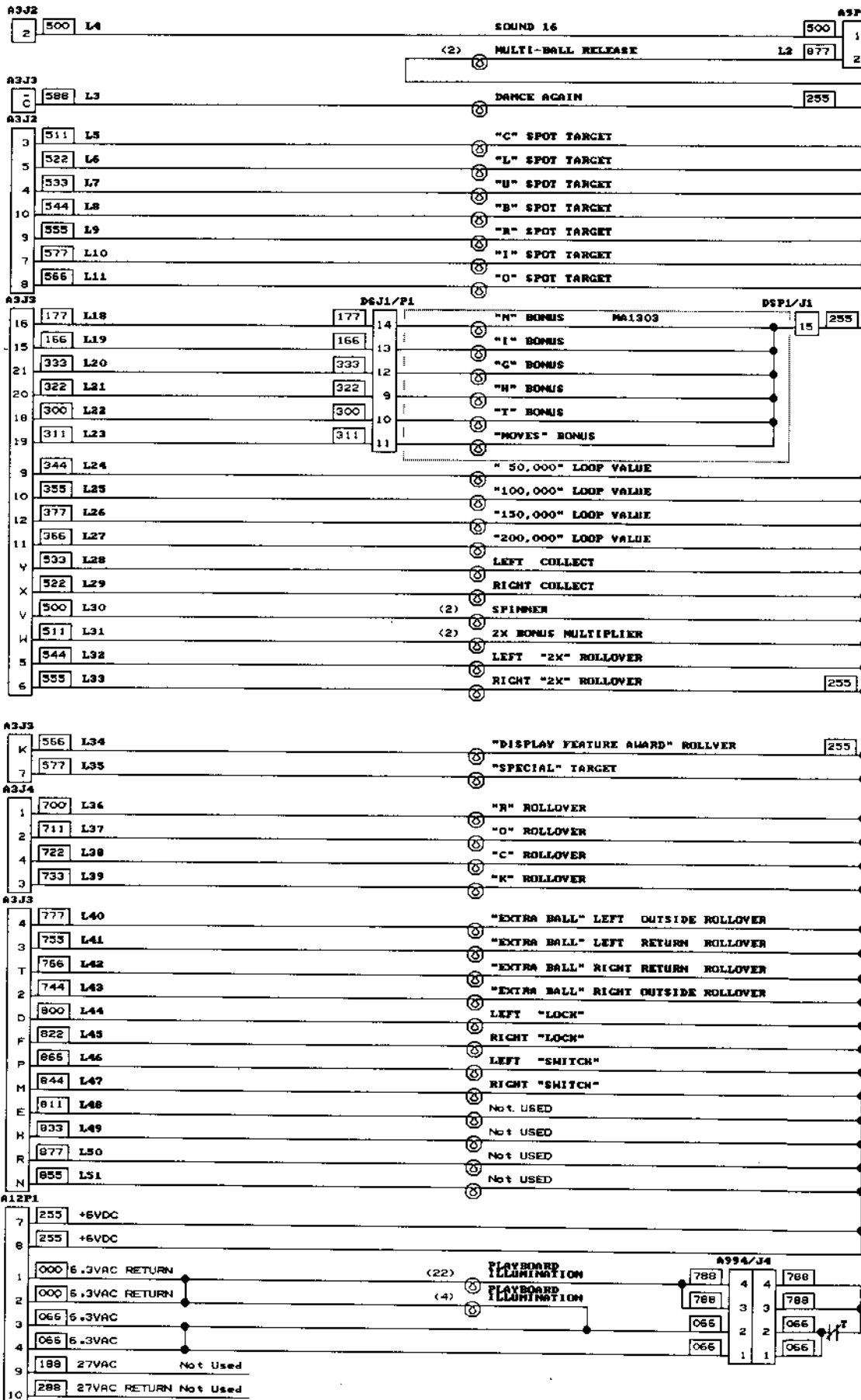


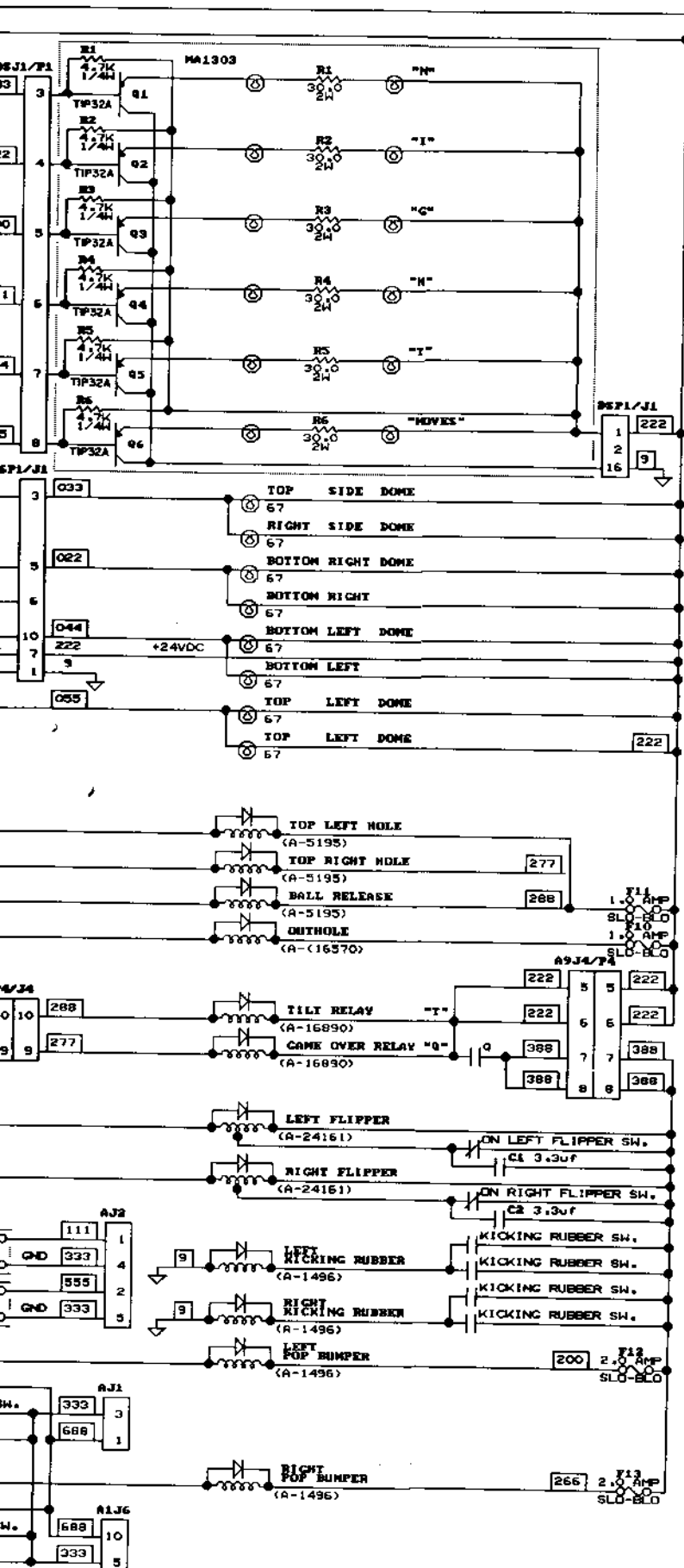
RESET/ANTI-STATIC BOARD (A24) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Reset/Anti-Static Board Assembly	MA-1143
A24P1	Connector, 7 Pin	XO-879
C1	Capacitor, 47UF, 10V, EL-RD	XO-227
C2	Capacitor, 22PF, 50V, 20%, CM-AX	XO-633
C3, C4	Capacitor, 4.7UF, 10V, TANT-AX	XO-226
C5	Capacitor, 10UF, 16V, E1-AX	XO-846
C6-C8	Capacitor, .01UF, 50V, CM-AX	XO-229
D1	Diode, 1N270	XO-265
R1-R3	Resistor, 33K OHM, $\pm 5\%$, 1/4W	XO-43
R4-R6	Resistor, 1K OHM, $\pm 5\%$, 1/4W	XO-5
U1, U2	IC, 74123	XO-398
U3	IC, 74HCT00	XO-887
A24P2/ A24J1	Cable Assembly	MA-1144
J1-J4	Jumpers	XO-469



X. WIRING AND SCHEMATIC





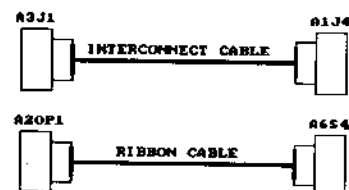
A1J2		A4J1
24	300 RESET	300
8	311 LD1	311
16	322 LD2	322
2	800 DATA 0	800
6	811 DATA 1	811
7	822 DATA 2	822
1	833 DATA 3	833
10	844 DATA 4	844
14	855 DATA 5	855
15	866 DATA 6	866
9	877 DATA 7	877

A2J2		A4J2
3	688 + 5VDC	688
10	300 RESET	300
6	100 32VAC	100
7	111 32VAC RETURN	111
9	133 VCO	133
8	122 8.4VAC (FIL.)	122
10	144 8.4VAC	144
1	9 GROUND	9

A3J3		1A18J1
17	9 L12-19	9
17	9 L20-27	9
U	9 L28-35	9
S	9 L40-43	9
C	9 L44-51	9
5	9 L36-39	9
9	9 SOL.1 & 9	9
10	9 SOL.2	9
11	9 SOL.6	9
14	9 SOL.5	9

A3J6		1A18J2
4	9 SOL.3, 4 & 7	9
6	9 LO-11	9
2	9 POP BUMPER	9
2	9 POP BUMPER	9
1	9 TRANSISTOR DRIVER	9
15	9 CONTROLLED LAMP	9
	L. KICKING RUBBER	9
	R. KICKING RUBBER	9

COLOR CODE			
0	BLACK	5	GREEN
1	BROWN	6	BLUE
2	RED	7	VIOLET
3	ORANGE	8	GRAY
4	YELLOW	9	WHITE

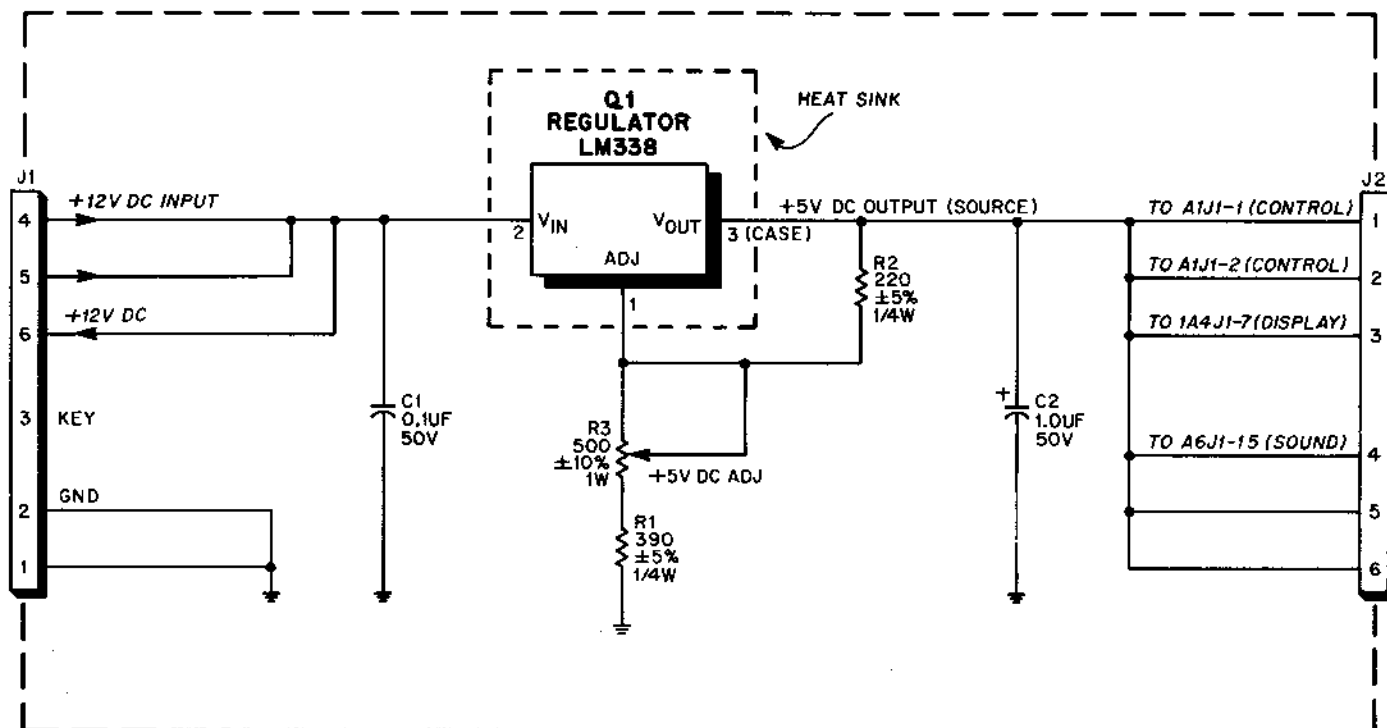


**PLAYBOARD
SOLENOIDS AND ILLUMINATION
SCHEMATIC DIAGRAM**

SERVICE NOTES

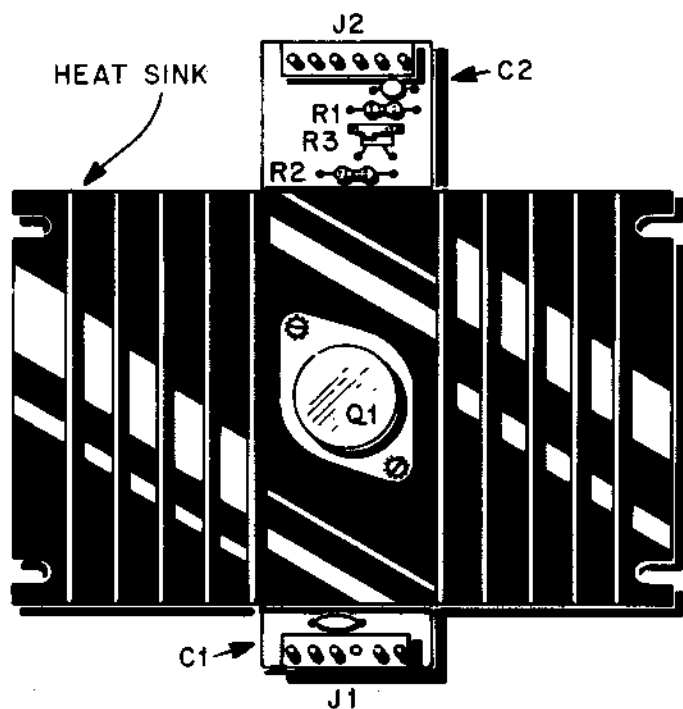
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X. WIRING AND SCHEMATIC DIAGRAMS, PARTS LISTS



POWER SUPPLY (A2) SCHEMATIC DIAGRAM

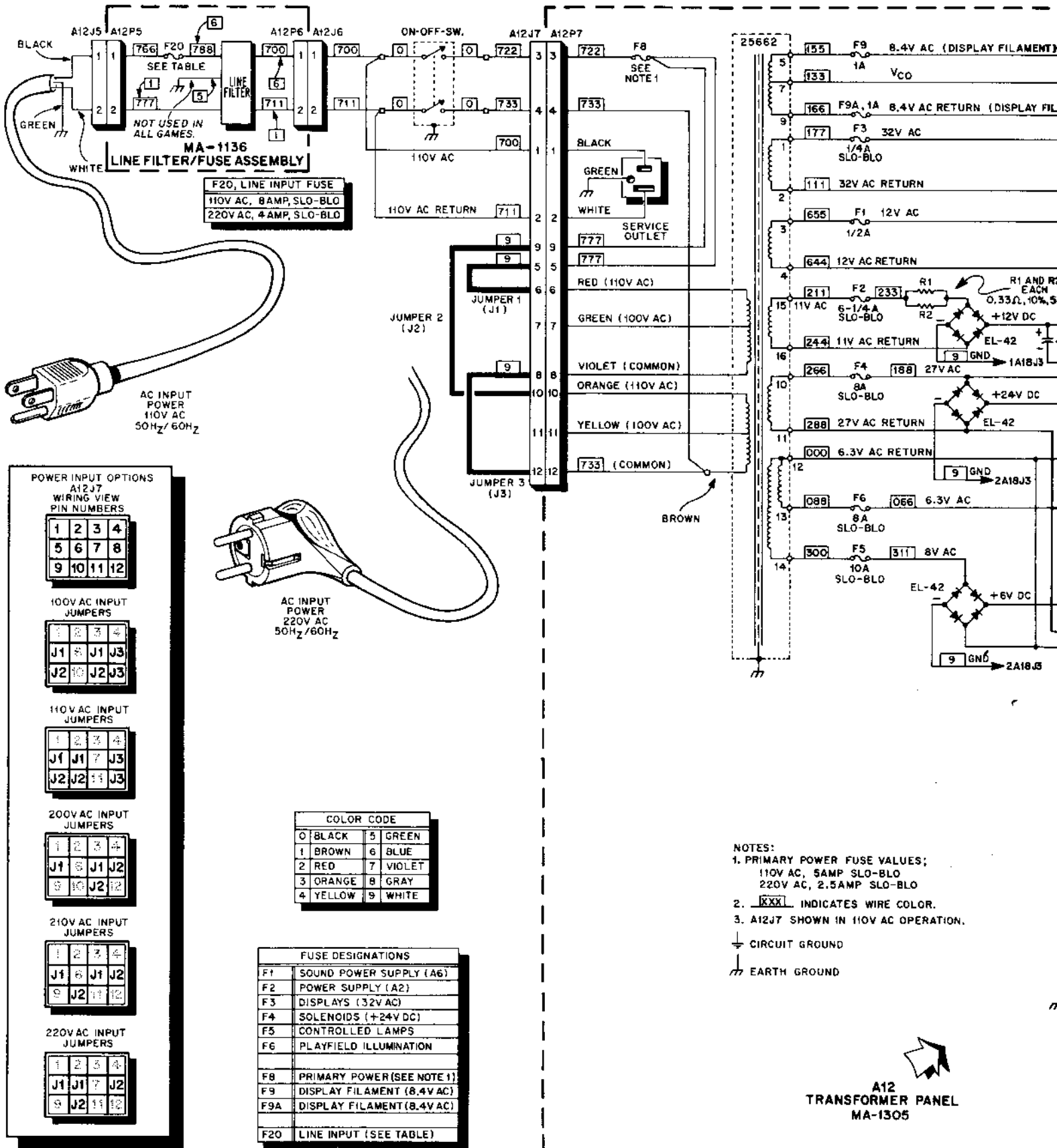
**POWER SUPPLY (A2)
COMPONENT LOCATION**



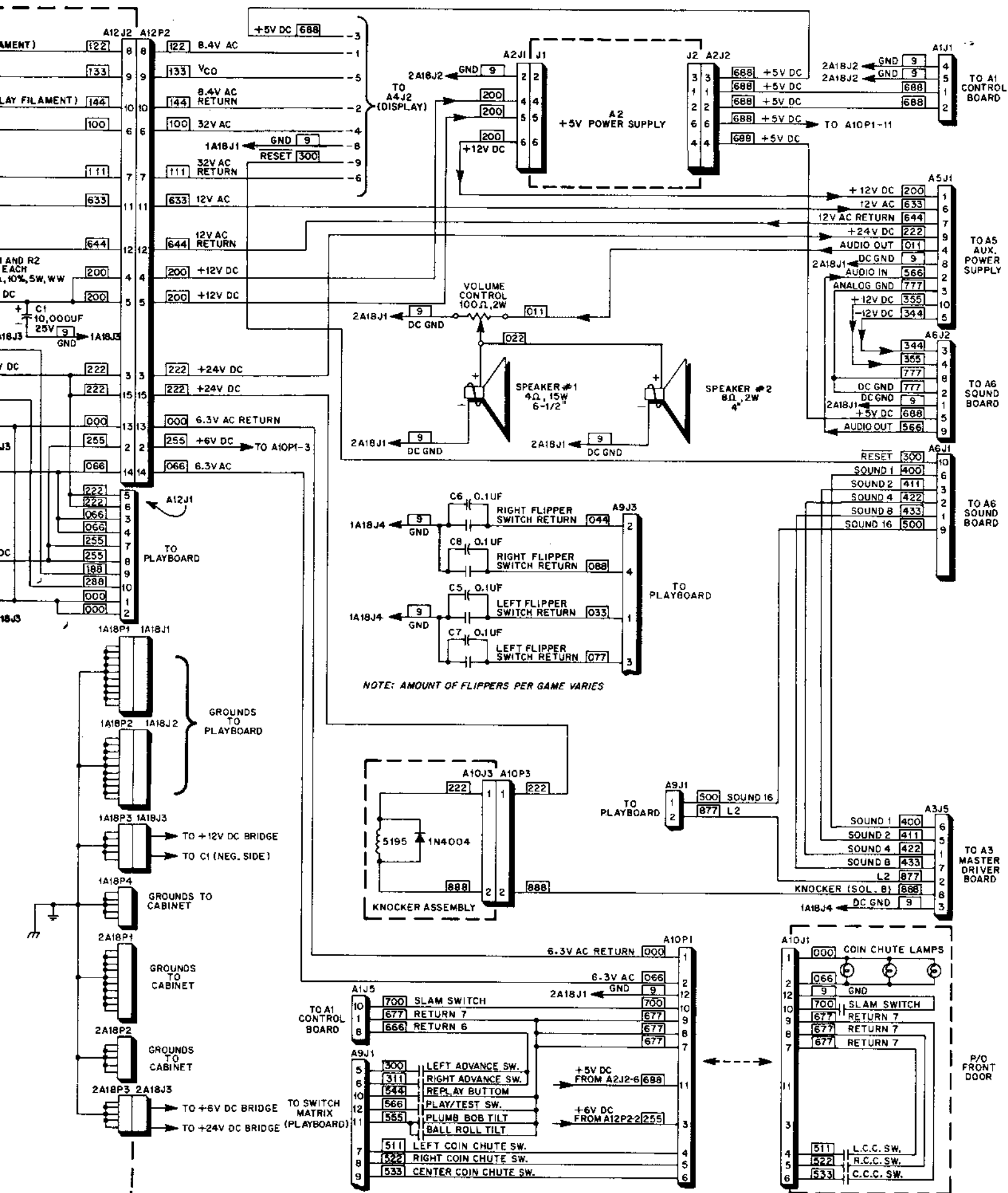
POWER SUPPLY (A2) PARTS LIST

REFERENCE	DESCRIPTION	PART NUMBER
	Power Supply (A2)	MA-831
C1	Capacitor, 0.1uF, +80% -20%, 50V	XO-230
C2	Capacitor, 1uF, 10%, 50V	XO-217
J1, J2	Connector, 6 Pin	XO-879
Q1	Regulator, LM338, (5 Amp)	XO-839
R1	Resistor, 390 ohm, 5%, 1/4W	XO-845
R2	Resistor, 220 ohm, 5%, 1/4W	XO-21
R3	Resistor, (Pot) 500 ohm, 10%, 1W	XO-112
	Heat Sink	XO-534
	Insulator, (Regulator)	XO-522
	Insulator, (Regulator)	XO-523

X. WIRING AND SCHEMATIC



TRANSFORMER PANEL/CABINET
SCHEMATIC/WIRING DIAGRAM



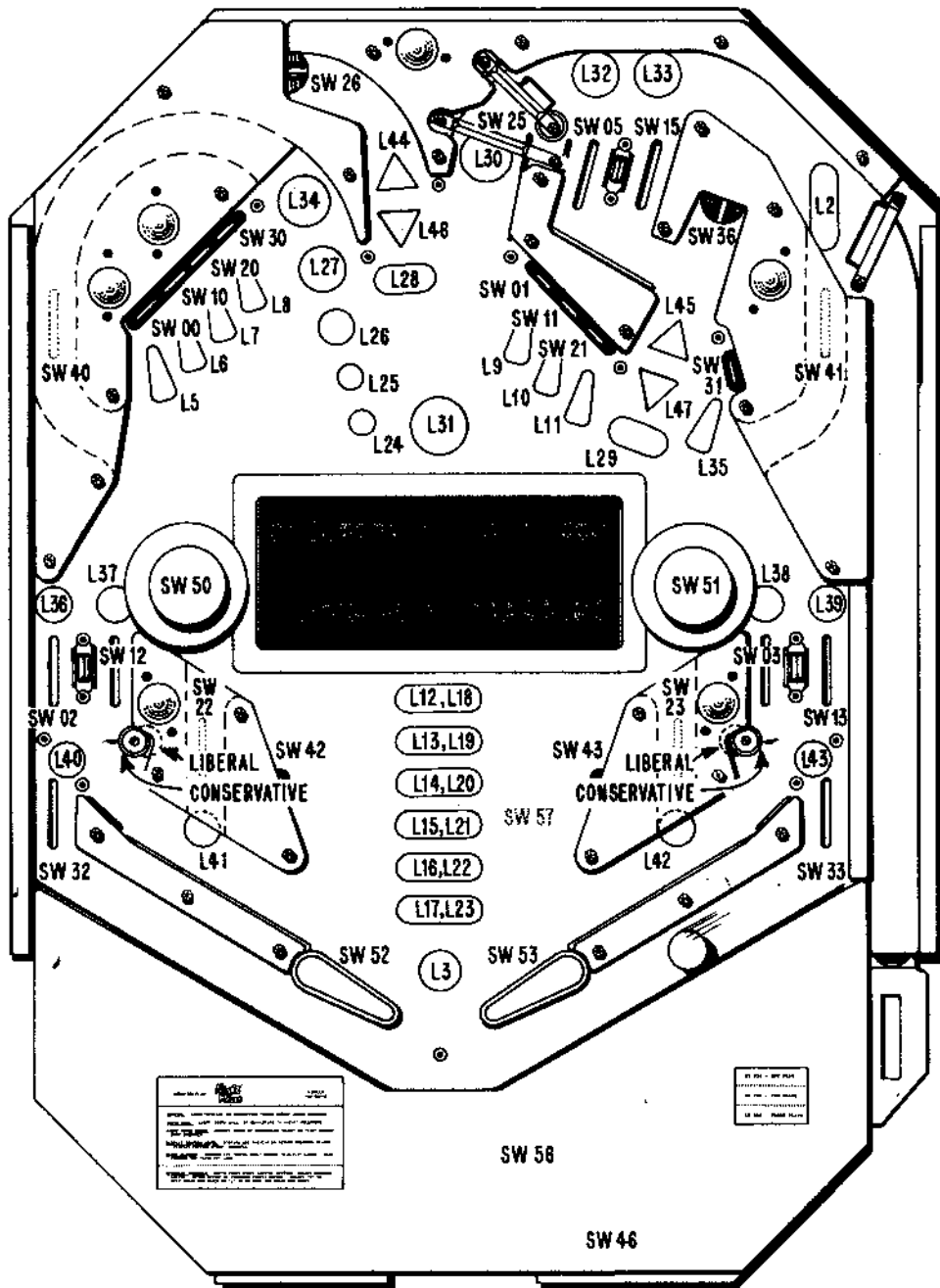
XI. PARTS INFORMATION

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PLAYBOARD PARTS	
RUBBER RINGS AND MISCELLANEOUS PARTS.....	54
BALL HOLE KICKER PARTS	
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XI. PARTS INFORMATION

PLAYBOARD SWITCH AND LAMP ASSIGNMENTS



LAMP NUMBER LAMP ASSIGNMENT

L3	DANCE AGAIN
L5	"C" SPOT TARGET
L6	"L" SPOT TARGET
L7	"U" SPOT TARGET
L8	"B" SPOT TARGET
L9	"R" SPOT TARGET
L10	"I" SPOT TARGET
L11	"O" SPOT TARGET
L12	"N"
L13	"I"
L14	"G"
L15	"H"
L16	"T"
L17	"MOVES"
L18	"N" BONUS
L19	"I" BONUS
L20	"G" BONUS
L21	"H" BONUS
L22	"T" BONUS
L23	"MOVES" BONUS
L24	"50,000" LOOP VALUE
L25	"100,000" LOOP VALUE
L26	"150,000" LOOP VALUE
L27	"200,000" LOOP VALUE
L28	LEFT COLLECT
L29	RIGHT COLLECT
L30	SPINNER
L31	2X BONUS MULTIPLIER
L32	LEFT "2X" ROLLOVER
L33	RIGHT "2X" ROLLOVER
L34	DISPLAY FEATURE AWARD
L35	LEFT "SPECIAL" TARGET
L36	"R" ROLLOVER
L37	"O" ROLLOVER
L38	"C" ROLLOVER
L39	"K" ROLLOVER
L40	"EXTRA BALL" LEFT OUTSIDE ROLLOVER
L41	"EXTRA BALL" LEFT RETURN ROLLOVER
L42	"EXTRA BALL" RIGHT RETURN ROLLOVER
L43	"EXTRA BALL" RIGHT OUTSIDE ROLLOVER
L44	LEFT "LOCK"
L45	RIGHT "LOCK"
L46	LEFT "SWITCH"
L47	RIGHT "SWITCH"

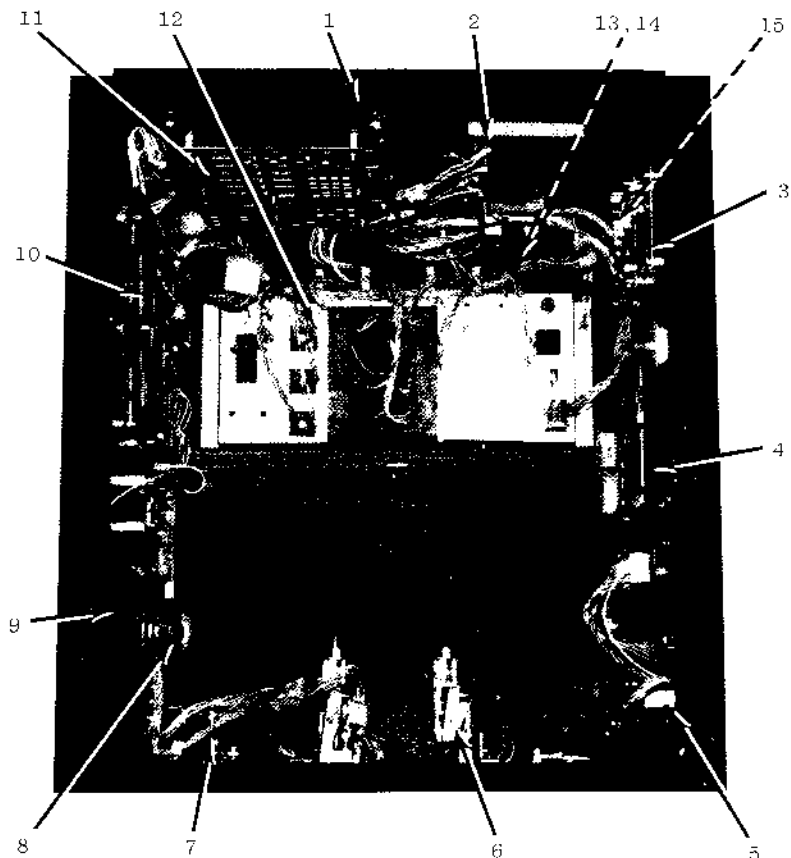
SWITCH MATRIX NUMBER SWITCH ASSIGNMENT PART NO.

SW 00	"C" Spot Target (With Bracket)	254602
SW 01	"R" Spot Target (With Bracket)	254602
SW 02	Left "R" Rollover	25824
SW 03	Right "C" Rollover	25824
SW 05	#1 Top Rollover	25824
SW 10	"L" Spot Target (With Bracket)	254602
SW 11	"I" Spot Target (With Bracket)	254602
SW 12	Left "O" Rollover	25824
SW 13	Right "K" Rollover	25824
SW 15	#2 Top Rollover	25824
SW 20	"U" Spot Target (With Bracket)	254602
SW 21	"O" Spot Target (With Bracket)	254602
SW 22	Left Return Rollover	25824
SW 23	Right Return Rollover	25824
SW 25	Spinner	19354
SW 26	Top Left Hole	18085
SW 30	"B" Spot Target (With Bracket)	254602
SW 31	Special Spot Target	254601
SW 32	Left Outside Rollover	25824
SW 33	Right Outside Rollover	25938
SW 36	Top Right Hole	18085
SW 40	Left Top Rollover	25824
SW 41	Right Top Rollover	25824
SW 42	Left Kicking Rubber Scoring Switch Actuating Switch And Bracket (2)	18808 22224
SW 43	Right Kicking Rubber Scoring Switch Actuating Switch And Bracket (2)	18808 22224
SW 46	Trough	25938
SW 50	Left Pop Bumper	21353
SW 51	Right Pop Bumper	21353
SW 52	Left Flipper	26432
SW 53	Right Flipper	26433
SW 56	Outhole Assembly	MA-1332
SW 57	Tilt (With Bracket)	9141

XI. PARTS INFORMATION

CABINET PARTS

ITEM	DESCRIPTION	PART NO.
1	Cabinet Base	26636
2	Fuse Holder And Filter Assembly	MA-1311
	Fuse Holder	EL-78
	F20, 8A, SLO-BLO (100V AC)	EL-26
	F20, 4A, SLO-BLO (220V AC)	EL-33
	Line Filter	EL-50
3	Printed Circuit Board Assembly	MA-1312
	Pop Bumper Driver Board (2)	19741
	Transistor Driver Board (A16)	MA-1293
4	Printed Circuit Board Assembly	MA-1309
	Auxiliary Power Supply (A5)	MA-1017
	Auxiliary Sound Board (A20)	MA-1294
	Power Supply (A2)	MA-831
	Sound Board (A6)	MA-886-C101
5	Knocker Assembly	MA-12
6	Front Door Assembly	MA-1290
	Cashbox	25309
	Cashbox Cover	25315
7	Volume Control, 100 Ohm, 2W	XO-199
	Switch, PLAY/TEST	EL-57
	Mounting Bracket	24149
8	Carbon Tilt Bob	MH-30
	Strike Plate	358
	Tilt Bob Wire	357
	Bracket	22043
9	Speaker, 4 OHM, 6-1/2"	EL-83
10	Printed Circuit Board Assembly	MA-1307
	Control Board (A1)	MA-1133
	Reset/Anti-Static (A24)	MA-1143
11	Printed Circuit Board Assembly	MA-1308
	Master Driver (A3)	MA-295
12	Transformer Panel Assembly	MA-1305
	Bridge Rectifier (3)	EL-42
	Cable Assembly (Secondary)	MA-1220
	Capacitor, 10,000UF, 25V	XO-830
	Fuse Block (8 Pos.)	EL-10
	Fuse Cover	23805
	Fuses	
	F1, 1/2 Amp	EL-28
	F2, 6-1/4 Amp, SLO-BLO	EL-29
	F3, 1/4 Amp, SLO-BLO	EL-5
	F4, 8 Amp, SLO-BLO	EL-26
	F5, 10 Amp, SLO-BLO	EL-36
	F6, 8 Amp, SLO-BLO	EL-26
	F8, 5 Amp, SLO-BLO (110V AC)	EL-8
	F8, 2.5 Amp, SLO-BLO (220V AC)	EL-21
	F9, 1 Amp	F1-3
	F9A, 1 Amp	EL-3
	Ground Bus Assembly (2)	25374
	Service Outlet	18133
	Resistor, 0.33 OHM, 10%, 5W	XO-154
	Wire-wound (2)	
	Transformer	25662
13	Line Cord	23365
	Cover Plate	23364
14	On/Off Switch	23799
	Switch Plate	18769
15	3" Leg Adjuster (4)	MA-21

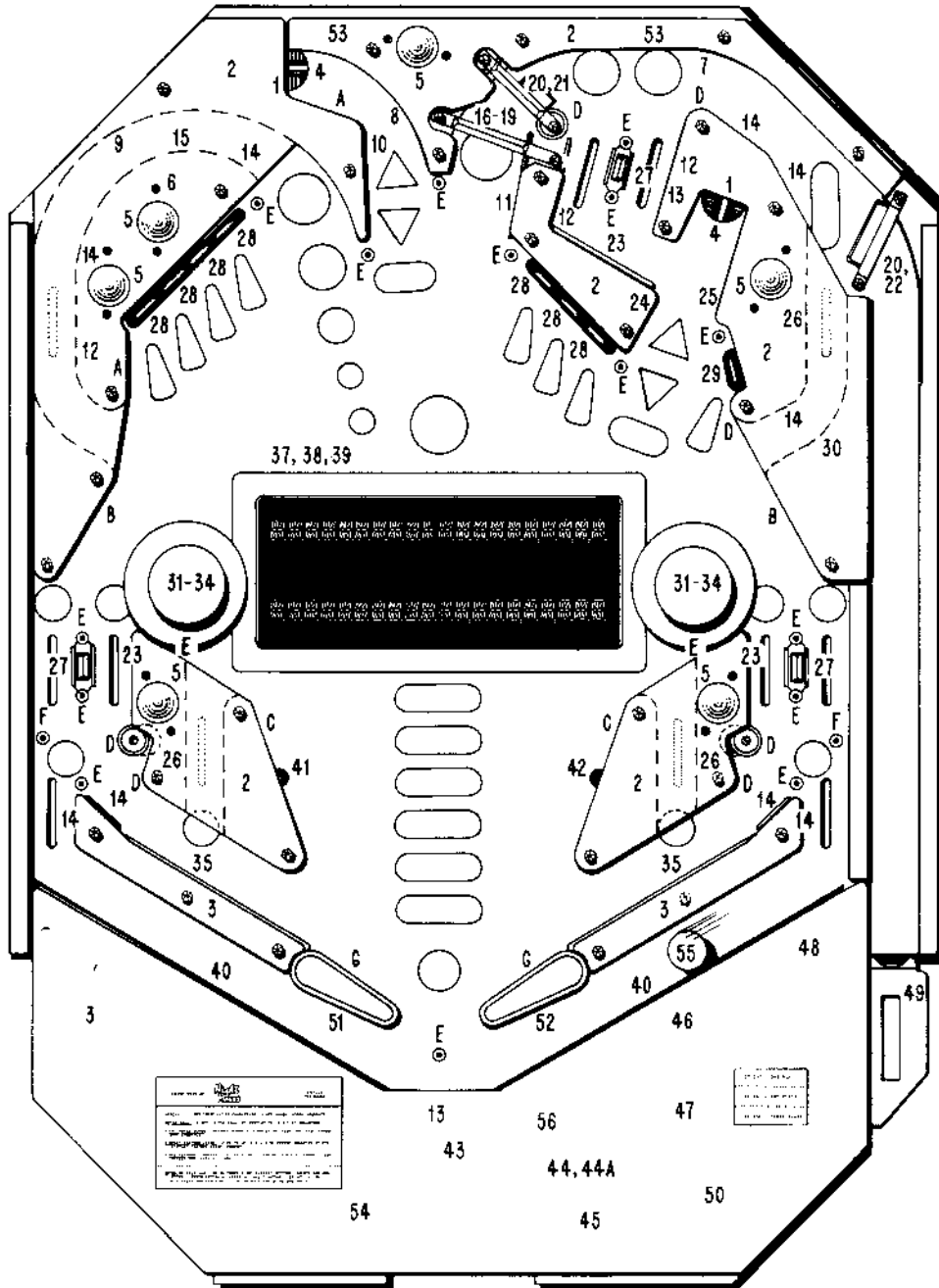


NOT SHOWN

Upper Cabinet Assembly	MA-1313
Playboard Assembly	MA-1304
Male Slip Lock Hinge (2)	26533
Lock Assembly	23975
Prop Stick Rod	26654
Ball Shooter Assembly	26652
Speaker, 4 OHM, 4"	24644
Left Flipper Button	26664
Switch Assembly	
Right Flipper Button	26665
Switch Assembly	
Push Button, Black (2)	26662
Left And Right Flipper	
Start And Initial	26666
Button Switch (3)	
Push Button, Red (3)	26662U
Top Screened Glass	26650

XI. PARTS INFORMATION

PLAYBOARD PARTS INFORMATION



PARTS LIST

ITEM	DESCRIPTION	PART NO.
1	Ball Snubber (2)	16038
2	Plastic Shield Set	26602
3	Plastic Shield Set	26603
4	Ball Hole Kicker Assembly (2) (See Exploded View Illustration)	MA-444
5	Plastic Dome, Red (6)	26293U
6	Plastic Rivet (12)	MP-10
7	Flat Rail	26614
8	Flat Rail	26605
9	Flat Rail	26610
10	Ball Guide Rail	17106
11	Ball Guide Rail	26604
12	Ball Guide Rail (3)	4831
13	Ball Deflector (2)	21158
14	Ball Guide Rail (9)	17650
15	Ball Guide Rail	13782
16	Target Shield	14043
17	Swinging Target Assembly	24494
18	Switch Rod	20406
19	Nylon Washers (2)	20407
20	Gate Shield (2)	17300
21	Rollunder Gate Wireform	26601
22	Rollunder Gate Wireform	22112
23	Ball Guide Rail (3)	4832
24	Ball Guide Rail	21961
25	Ball Guide Rail	25348
26	Ball Guide Rail (3)	4833
27	Rollover Guide, White (3)	15646Z
28	Spot Target Assembly, White (7)	25460Z
29	Spot Target Assembly, Red	25460U
30	Flat Rail	26606
31	Pop Bumper Cap, Yellow (2)	10434T
32	Pop Bumper Skirt, White (2)	10433Z
33	Pop Bumper Body And Socket (2)	MA-27
34	Pop Bumper Trim Platter (2)	25732
35	Ball Guide Rail (2)	25347
36	Ball Guide Rail (2)	11703
37	Playboard Window	26620
38	Sponge Rubber Washer (8)	21219B
39	Mounting Bracket (9)	26630
40	Fence (2)	26612
41	Contact Kicker Assembly	MA-135A
42	Contact Kicker Assembly	MA-135
43	Handle Strip	26600
44	Ball Gate Unit	MA-1320
44A	Shaft, Cams And Spacer Assembly	26322
45	Flat Rail	26607
46	Flat Rail	26609
47	Flat Rail	26608
48	Fork Plate	26626
49	Ball Shooter Gauge	26613
50	Ball Kicker Assembly	26547
51	Left Flipper Assembly	MA-1139E
52	Right Flipper Assembly	MA-1140G
53	Slip Joint Hinge (2)	26534
54	Optical Interface Board	MA-1329
55	1-1/16" Steel Ball (2)	21864
56	Optical TX/RX Assembly (Outhole Switch SW 56)	MA-1332

RUBBER RINGS

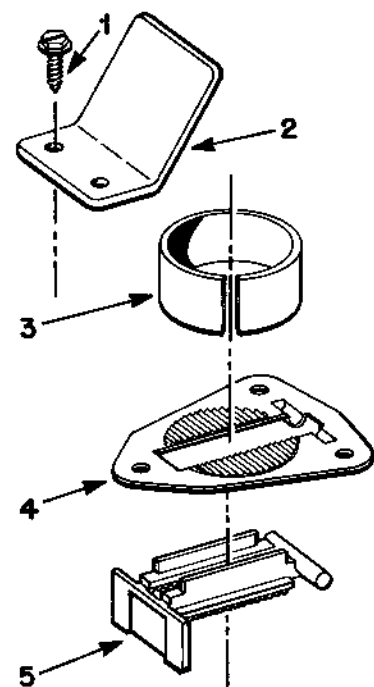
ITEM	DESCRIPTION	PART NO.
A	1" (2)	10219
B	1-1/2" (2)	10220
C	2-1/2" (2)	10222
D	5/16" (7)	10217
E	Mini-Post (15)	15705
F	Sm. Mini-Post (2)	14793
G	Flipper, Red (2)	13151

MISCELLANEOUS PARTS

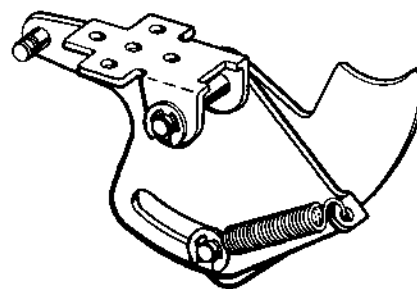
DESCRIPTION	PART NO.
Mini-Post Screw	14792
Plastic Support Post	20635P
Plastic 1" Post	11561P
Mini-Post Screw	25161
Plastic Post, 1-3/16"	11562P
"T" Relay	MA-25
"Q" Relay	MA-23

XI. PARTS INFORMATION

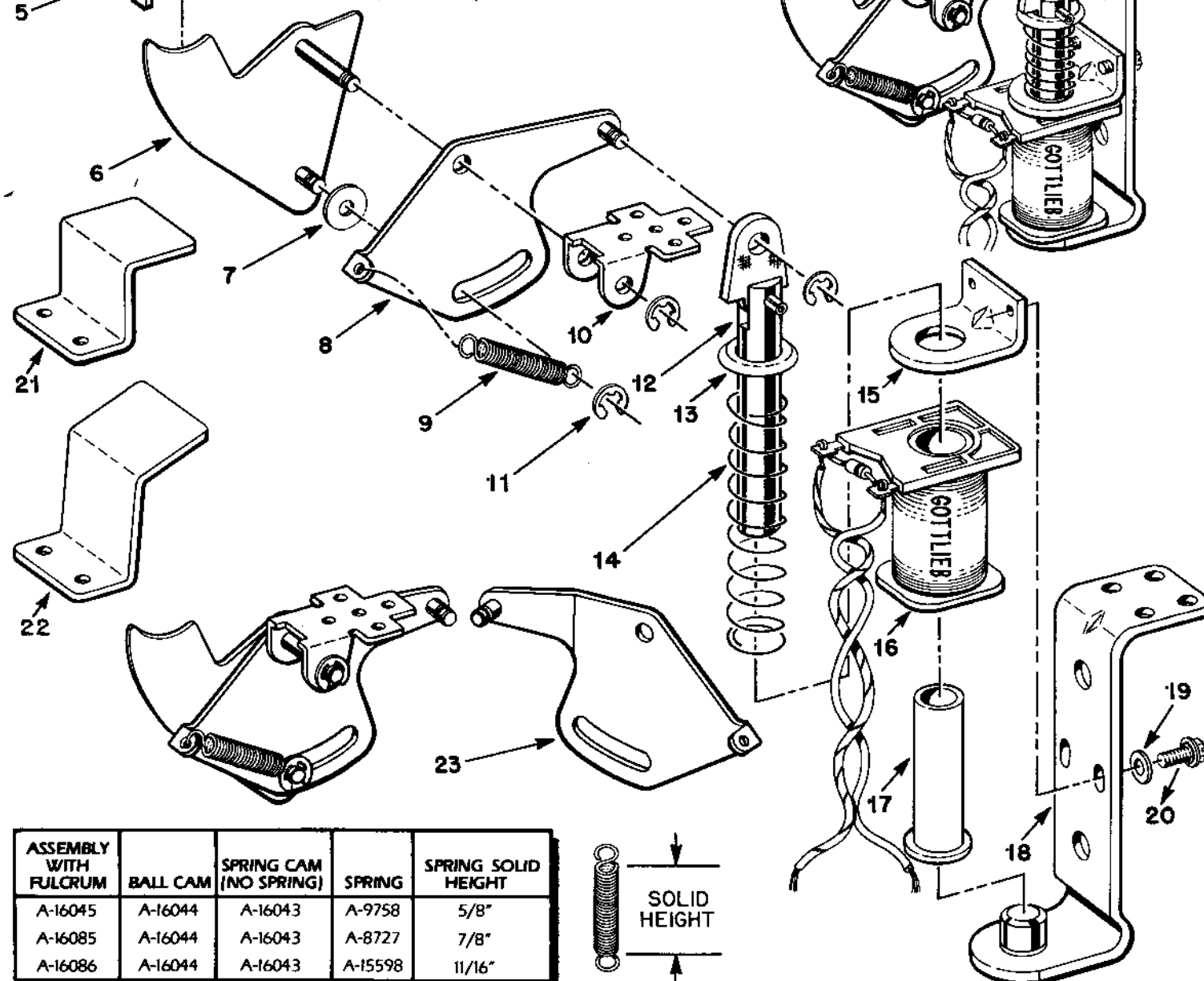
BALL HOLE KICKER PARTS



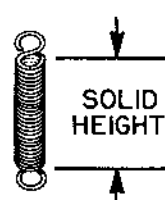
ITEM	DESCRIPTION	PART NO.
1	6 x 1/2" HWHMS (2)	FA-270
2	Ball Snubber	16038
3	Metal Hole Liner	11151
4	Hole Base Plate	15707
5	Hole Switch Arm	15708
	(Specify Color)	
6	Ball Cam (See Tables)	
7	Nylon Washer	6443
8	Spring Cam (See Tables)	
9	Spring (See Tables)	
10	Fulcrum	15819
11	E-Ring (3)	FA-682
12	Link And Plunger Assy.	22234
13	Spring Retaining Washer	22233
14	Spring	1636
15	Mounting Bracket	15409
16	Coil With Diode	
	(Specify Game)	
17	Coil Sleeve	5064
18	Coil Stop And Mounting Bracket	20597
19	#8 Washer (2)	FA-617
20	8-32 x 5/16" HWHMS SEMS(2)	FA-67
21	Ball Snubber	21532
22	Ball Snubber	21159
23	Spring Cam (15° OFFSET)	18993
	(See Table)	



ASSEMBLY WITH FULCRUM	BALL CAM	SPRING CAM (NO SPRING)	SPRING	SPRING SOLID HEIGHT
A-15827	A-15822	A-15826	A-9758	5/8"
A-15828	A-15822	A-15826	A-15598	11/16"
A-16083	A-15822	A-15826	A-8727	7/8"
A-25842	A-15822	A-18993	A-15598	11/16"



ASSEMBLY WITH FULCRUM	BALL CAM	SPRING CAM (NO SPRING)	SPRING	SPRING SOLID HEIGHT
A-16045	A-16044	A-16043	A-9758	5/8"
A-16085	A-16044	A-16043	A-8727	7/8"
A-16086	A-16044	A-16043	A-15598	11/16"



SERVICE NOTES

IMPORTANT NOTICE

THIS SHIPMENT HAS BEEN CAREFULLY INSPECTED AND PROPERLY PACKED BEFORE LEAVING FACTORY.

WE CANNOT ASSUME RESPONSIBILITY FOR BREAKAGE THAT MAY OCCUR IN TRANSPORTATION. IF THIS SHIPMENT IS DAMAGED IN ANY WAY, IMMEDIATELY NOTIFY THE CARRIER AND FILE DAMAGE REPORT SO THAT A SATISFACTORY ADJUSTMENT CAN BE MADE BY THEM.

For more information
Write or Call:
International Concepts Inc.
4500 Main Street
20th Century Towers
Suite 900
Kansas City, MO 64111
Phone (816)932-5373

PARTS : 816-932-5373
BOB BOCKHOUT

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference."