

16-540-101  
June 11, 1985



# COMET

**INSTRUCTION  
MANUAL**

*Williams*<sup>®</sup>  
**ELECTRONICS GAMES, INC.**





# System-9 ROM Summary

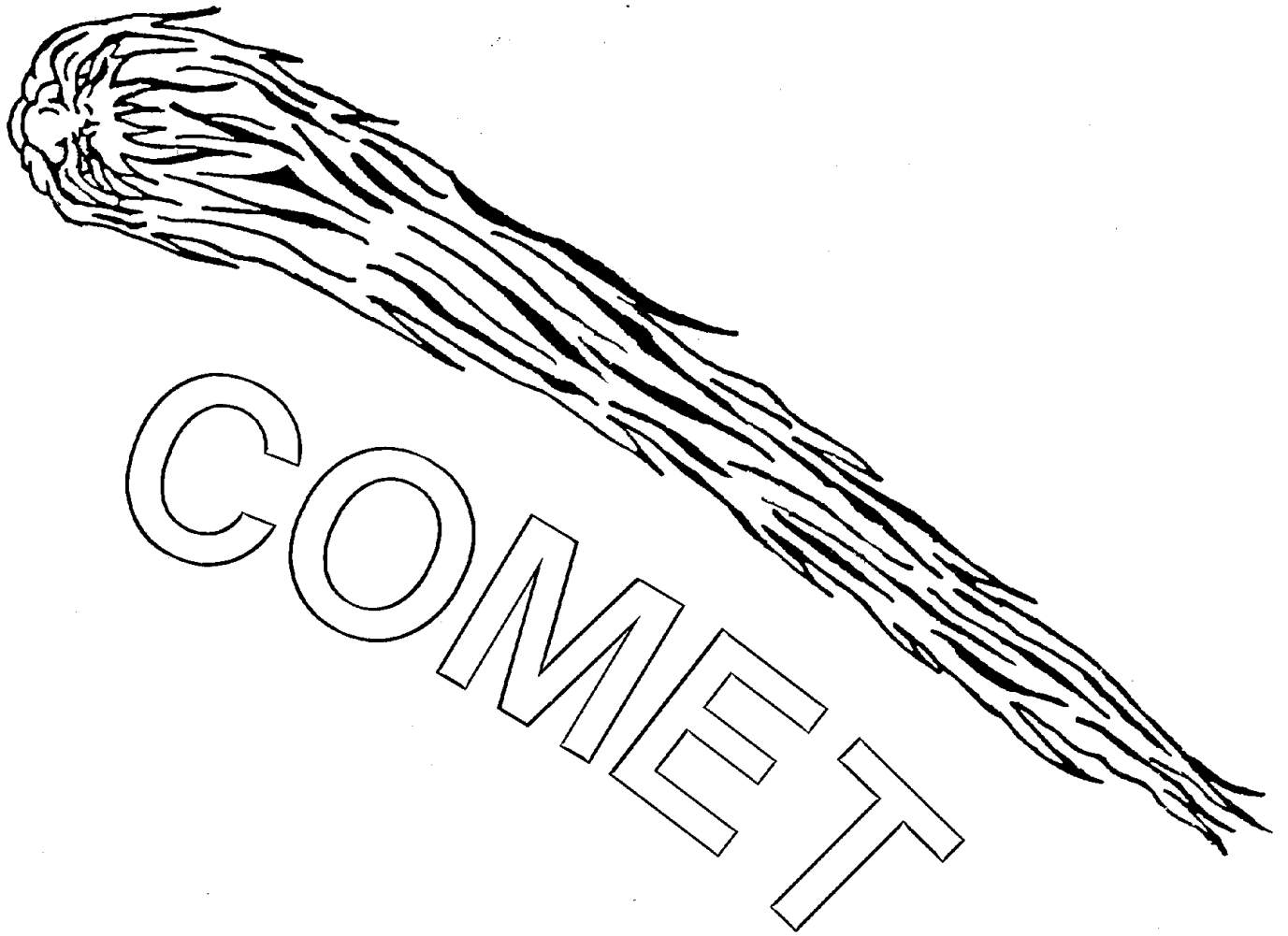
IC	DESCRIPTION	TYPE	NUMBER	BOARD	PART NO.
Game ROM 1	ROM 16Kx8	27128	U20	CPU	A-5343-10840
Game ROM 2	ROM 4Kx8	2732	U19	CPU	Not Used
Sound ROM	ROM 16Kx8	27128	U49	CPU	A-5343-10841
Speech ROM	ROM 4Kx8	2732*	U4	Speech	A-5343-10842
Speech ROM	ROM 4Kx8	2732*	U5	Speech	A-5343-10843
Speech ROM	ROM 4Kx8	2732*	U6	Speech	A-5343-10844
Speech ROM	ROM 4Kx8	2732*	U7	Speech	A-5343-10845

\*Type 2532 ROMs may also be used for the speech ROMs.

**NOTICE TO ORDER REPLACEMENT ROMS** from your authorized **WILLIAMS ELECTRONICS GAMES** distributor, specify (1) part number (if available), (2) ROM label color, (3) REV level (revision number) on the label, and (4) which game the ROM is used in.

**System-9 Solenoid Table**

SOL. NO.	FUNCTION	SOLENOID TYPE	WIRE COLOR	CONNECTIONS		DRIVER TRANS.	SOLENOID PART NO.
				CPU BOARD	PLAYFIELD/CABINET		
01	Outhole	controlled	GRY-BRN	1J11-1	8P3-1	Q47	SA-23-850-DC
02	Drop Target	controlled	GRY-RED	1J11-3	8P3-2	Q48	SA-5-24-750-DC
03	"Funhouse" Eject Hole	controlled	GRY-ORN	1J11-4	8P3-3	Q49	SG1-23-850-DC
04	"Corkscrew" Flashers	controlled	GRY-YEL	1J11-5	8P3-4	Q50	#63 flashlamps
05	"Cycle Jump" Flashers	controlled	GRY-GRN	1J11-6	8P3-5	Q39	#63 flashlamps
06	"Cycle Jump" Eject-Hole	controlled	GRY-BLU	1J11-7	8P3-6	Q40	SG1-23-850-DC
07	Player-3 Flashers	controlled	GRY-VIO	1J11-8	8P3-7	Q41	#63 flashlamps
08	Player-1 Flashers	controlled	GRY-BLK	1J11-9	8P3-8	Q42	#63 flashlamps
09	Player-4 Flashers	controlled	BRN-BLK	1J12-1	8P3-9	Q54	#63 flashlamps
10	Player-2 Flashers	controlled	BRN-RED	1J12-2	8P3-10	Q55	#63 flashlamps
11	General Illumination	controlled	BRN-ORN	1J12-4	3P7-1	Q56	5580-09555-00
*12	Not Used	controlled	BRN-YEL	1J12-5	8P3-12	Q57	-
13	Insert Illumination	controlled	BRN-GRN	1J12-6	8P3-13	Q58	-
14	Not Used	controlled	BRN-BLU	1J12-7	8P3-14	Q59	-
15	Knocker	controlled	BRN-VIO	1J12-8	7P1-17	Q60	SA-4-23-850-DC
16	Coin-Lockout Coil	controlled	BRN-GRY	1J12-9	7P1-18,7P2-4	Q61	SM-35-4000-DC
*17	Left Kicker	special #1	BLU-BRN	1J19-7	8P3-17	Q75	SG1-23-850-DC
*18	Right Kicker	special #2	BLU-RED	1J19-4	8P3-18	Q77	SG1-23-850-DC
*19	Upper Jet-Bumper	special #3	BLU-ORN	1J19-3	8P3-19	Q79	SG1-23-850-DC
*20	Left Jet-Bumper	special #4	BLU-YEL	1J19-6	8P3-20	Q81	SG1-23-850-DC
*21	Lower Jet-Bumper	special #5	BLU-GRN	1J19-8	8P3-21	Q83	SG1-23-850-DC
*22	Not Used	special #6	BLU-BLK	1J19-9	8P3-22	Q85	-
—	Flipper (Not Used)	-	BLK-BLU	1J19-2	7P1-30	-	-
—	Right Flipper*	-	ORN-VIO	1J19-1	7P1-7	-	FL23/600-30/2600-50VDC
—	Left Flipper*	-	ORN-GRY	1J19-2	7P1-9	-	FL23/600-30/2600-50VDC



## **INSTRUCTION MANUAL**

**including procedures for...**

- **operation**
- **bookkeeping**
- **adjustment**
- **diagnostics**

*Williams*<sup>®</sup>   
**ELECTRONICS GAMES, INC.**

*Williams*<sup>®</sup>   
ELECTRONICS GAMES, INC.

brings you

COMET



**FIRST CHANCE**

to score

**1,000,000**

with a

**SINGLE SHOT!**

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# CHAPTER 1 Game Overview

System-9 ROM Summary

Connector Code

System-9 Control Locations

Replacing System-9 Circuitboards

## System-9 ROM Summary

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## CONNECTOR CODE

**WILLIAMS USES A SPECIAL TECHNIQUE** to name jacks and plugs. Each connector receives a number, a letter, and a number. A hyphen separates the jack or plug designation from the pin number.

- J-designations refer to the male part of a connector.
- P-designations refer to the female part of a connector.
- 1J1 is board 1, jack 1 (a CPU Board jack).
- 3P6 is board 3, plug 6 (a Power-Supply plug).  
*For example, 1J1-3 refers to a connector at board 1, specifies the jack (male or board) side of the connector, identifies the connector as number one on the board, and stipulates pin number three.*
  
- The prefix numbers for System-9 games are as listed below:
  - 1-CPU Board
  - 2-(not assigned)
  - 3-Power-Supply Board
  - 4-Master-Display Board
  - 5-Slave-Display Board
  - 6-Backbox
  - 7-Cabinet
  - 8-Playfield
  - 9-Insert Board
  - 10-(not assigned)
  - 11-(not assigned)
  - 12-Speech Board
  - 13-(not assigned)
  - 14-(not assigned)
  - 15-Flipper Power-Supply

**THE SOUND DIAGNOSTIC-SWITCH** is on the CPU Board near the batteries. This switch is used to initiate the Sound-Section Test. Refer to **Diagnostic Procedures**.

**THE SOUND-SPEECH MIXER POT** is only found in talking games; it is on the Speech Board. This pot permits the operator to balance sound and speech to suit the game location.

## Replacing System-9 Circuitboards

**CPU BOARD.** Your System-9 CPU Board (D-10535) must be equipped with the ROMs specified in the **ROM Summary**. Only jumpers W2, W5, W6, W7 and W9 should be connected. (Substitute W1 for W2, when a 6802 microprocessor is used, instead of a 6808 microprocessor.)

**DISPLAY BOARDS.** Use the D-10749 Master Display Board with C-8364 7-digit Slave Displays. One C-8365 4-digit Slave Display is also necessary.

**POWER-SUPPLY BOARD.** Use the D-8345 board (equipped with a relay).

## System-9 Control Locations

**THE ON-OFF SWITCH** is on the bottom of the cabinet near the right-front leg, as you face the game.

**THE VOLUME CONTROL** is accessible through the coin door on the left cabinet-wall.

**DIAGNOSTIC/GAME-SETTING SWITCHES.** ADVANCE, AUTO-UP/MANUAL-DOWN, and HIGH-SCORE RESET switches are located on the inside of the coin door. Refer to **Game-Adjustment Procedure** and **Diagnostic Procedures** for operation.

**THE MEMORY-PROTECT SWITCH** is on the inside of the coin-door frame. This switch must be open to clear bookkeeping totals and to make game adjustments. It automatically opens when the coin door opens.

**ALL CIRCUIT BOARDS** are in the backbox.

**THE CPU-DIAGNOSTIC SWITCH** is on one edge of the CPU Board near a microprocessor (large, socketed) chip. This switch operates the Memory-Chip Test explained in **Diagnostic Procedures**.



# CHAPTER 2 Performance & Operating Data

Game Play

Game Operation

Game Setup

Check Your Bookkeeping Totals

High Scores

Bookkeeping Table

How To Make Game Adjustments

Game-Adjustment Table

Game Pricing

Pricing Table

## Game Play

**Top Lanes 1-9-8-6  
& Playfield  
Scoring  
Multiplier  
(red x2, x3, x5)**

- Making 1-9-8-6... scores 50,000 and lights playfield multiplier for an adjustable timed (20 sec) interval. The following scoring can occur then:

1st ball	red x2
2nd ball	red x3
3rd ball	red x5
4th ball	red x3
5th ball	red x5

**Also, when Extra Ball play occurs:**

**Dunk the Dummy  
& Bonus Multiplier  
(green 2x, 3x,  
4x, 5x)**

- Hitting "Dummy" drop target exposes its bullseye for a timed interval. Hitting bullseye, before drop target resets, advances bonus multiplier: First time—2x; second time—3x; third time—4x; fourth time—5x;...thereafter, scores 20,000 for each additional hit.

**Corkscrew**

- Making 4 Duck Bank... lights *CORKSCREW*. "Ride" the Corkscrew to collect *DUCK* Bonus.

**Funhouse**

- Making 4 Rabbit Bank... lights *FUNHOUSE*. "Drop" into Funhouse Eject hole to collect *RABBIT* Bonus.

**COMET Ride**

- Completing BOTH Ducks and Rabbits Banks... activates *COMET* ramp for higher scores, *EXTRA BALLS*, and *SPECIALS*. "Riding" the *COMET*, when lit, scores 30,000 and advances scoring to 50,000. The second *COMET* ride scores 50,000, lights 100K and *EXTRA BALL*. Third *COMET* ride scores 100K and lights *EXTRA BALL*. Fourth *COMET* ride scores 100K and lights *SPECIAL*. Each scoring advance must be achieved within its time limit, or the scoring advance resets itself to 30K.

**Cycle Jump  
& Playfield  
Multiplier**

- Landing in Lower Ring scores 10,000 (or 20,000, when lit). Landing in the Center Ring scores 20,000 (or 50,000, when lit). Landing in the Upper Ring scores 30,000 (or 200,000, when lit). Passage through the LEFT Flipper return lane lights all three rings. On the last ball, if x5 Playfield Multiplier is lit, landing in the lighted Upper Ring scores 1,000,000.

**Cycle Jump  
& Extra Ball**

- Completing BOTH Ducks and Rabbits Banks the 2nd time... activates the Cycle Jump for *EXTRA BALL* action: (A) Lights Lower Cycle Jump Ring for 5 sec; (B) Then, lights Center Ring for 10 sec; (C) Finally, the Upper Ring for 15 sec. If *EXTRA BALL* is not made within specified time(s), the sequence starts over again.

**Corkscrew  
& Special**

- Completing BOTH Ducks and Rabbits Banks the 3rd time... lights *SPECIAL*. "Ride" the Corkscrew to score the *SPECIAL* or the *EXTRA BALL*, when lit.

# Game Operation

**GAME-OVER MODE.** Mode Indication: The Player 1 score shows 00, player scores display the high scores, and the GAME-OVER lamp lights. All playfield lamps cycle in **Attract Mode**.

**CREDIT POSTING.** Insert coins. A sound is produced and the number of credits is displayed. If maximum credits\* are exceeded by coin (or high score), credits are posted correctly. But the coin-lockout coil de-energizes until the remaining credits are below the maximum. No credits can be won (and coins are rejected), while the coin-lockout coil is de-energized.

**GAME START.** Push the Credit button. (For a multiple-ball game, game start will not occur, unless a ball is resting on each ball ramp switch.) A startup tune plays, a ball is served, and the Credit display decreases by one. Player 1 display (00) flashes, until the first scoring-switch is made. The Ball-In-Play display shows 1. Additional players may enter the game by pushing the Credit button, before Ball 2 is displayed.

**TILT.** With the first closure of the ball-roll or playfield tilts, or the third\* closure of the plumb-bob tilt, the player loses the rest of that turn. Activating the slam tilt on the coin door ends the entire game and starts the **Game-Over Mode**.

**END OF GAME.** Match digits\* appear in the Ball-In-Play display. Credit\* is awarded for a match. Match, high score, and game-over sounds are made as appropriate. One replay is awarded for each high score the player beat in the displays.\*

\* indicates adjustable feature.

## Game Setup

### WARNING

This game must be plugged into a properly grounded outlet to prevent shock hazard and to assure proper game operation. DO NOT use a "cheater" plug to defeat the ground pin on the line cord plug, and DO NOT cut off the ground pin.

**ENTERING GAME-OVER MODE.** With the coin door closed, plug the game in and turn it ON. The game should come on in **Game-Over Mode** (described earlier), ready to play.

1. If the game comes on in the **Bookkeeping Mode** (Credits display showing 04, Ball-In-Play display showing 00, and Player 1 display showing the game identification number) turn the game OFF and then ON again.

A. If the game now comes on in **Game-Over Mode**, bookkeeping totals have been reset to zero.

B. If the game still comes on in **Bookkeeping Mode**, open the coin door and turn the game OFF and ON twice. (A game without battery power will revert to factory settings.) Any changes from factory settings must be re-entered.

2. If the game *always* comes on in **Bookkeeping Mode**, troubleshoot the game. With the game OFF, check for a *minimum* of 3.5VDC at pin 24 of the CMOS RAM (chip U18) on the CPU Board.

A. **Less than 3.5VDC.** Replace the three AA alkaline cells.

B. **No voltage.** Replace diode D3 (type 1N4148) on the CPU Board, ensuring that its polarity is correct. Now, recheck the voltage at pin 24 of chip U18.

## Check Your Bookkeeping Totals

### BOOKKEEPING MODE, FUNCTIONS 01-17, 42-48

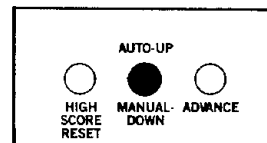
#### IN SUMMARY...

#### BOOKKEEPING TOTALS SHOW YOU AT A GLANCE

whether game settings are bringing you a satisfactory return on your investment! Think of your bookkeeping totals as a unique way to keep your game the *earnings leader!*

**A PLAYER WILL BE DISCOURAGED** if he can't achieve game features. Use your bookkeeping totals to help you decide whether players can achieve the proper percentage of free plays. We've found that 30 percent is usually satisfactory. The adjustments that alter this percentage are *replay scores, specials, matches, high score, game features, and number of balls.*

**ENTERING BOOKKEEPING MODE.** Here's the *step-by-step procedure...* Inside the coin door is a bracket with three pushbutton switches. Set the AUTO-UP/MANUAL-DOWN (center) switch to AUTO-UP. Press the ADVANCE switch once to view your bookkeeping totals on the displays. Test 04 is indicated in the Credits display, Function 00 in the Ball-In-Play display, and the game identification number in the Player 1 display.



**Diagnostic Switches**

## BOOKKEEPING MODE IN DETAIL...

1. Keeping the AUTO-UP/MANUAL-DOWN switch in AUTO-UP, press ADVANCE to display desired functions in the Ball-In-Play display. (Refer to the **Bookkeeping Table**.)
2. Now, write down the corresponding totals (number of coins and total paid-credits) from the Player 1 display. (To view a previous total, after advancing past it, use MANUAL-DOWN setting, and press ADVANCE until the desired function appears).
3. Use MANUAL-DOWN, and press ADVANCE to display Function 50 in the Ball-In-Play display.
4. Returning to **Game-Over Mode**:
  - A. Use AUTO-UP, and press ADVANCE.
  - B. OR: To zero bookkeeping totals *and* return to **Game-Over Mode**, (1) use AUTO-UP, (2) press the Credit button to display 35 in the Player 1 display, and (3) press ADVANCE.

2. Press the Credit button until the Player 1 display is blank.
3. Use AUTO-UP and press ADVANCE to enter **Game-Over Mode**.

### Using The High-Score feature ...

1. Enter function 12.
2. Press the Credit button until scores appear in *all four* Player score displays.
3. Use AUTO-UP and ADVANCE to enter function 13. One of function 13's five sub-functions will show in the Player 2 display. Sub-function 0 shows the number of credits won from the high-score feature (in the Player 1 display). Sub-functions 1 through 4 show (and allow you to adjust) the four backup high scores. These are the values that are restored when you press *and hold* the HIGH-SCORE RESET button.
4. Use AUTO-UP and press the Credit button to change any of these values. At **Game-Over Mode**, one credit will be awarded for each of the top four scores that's beaten. The maximum number of credits awarded for a high score is determined by function 40.
5. To use the high-score feature *without awarding credits*, set function 40 to 0.

## HIGH SCORES

**Function 12 determines whether the game remembers the high scores.**

### No High-Score Feature ...

1. Enter function 12.

**Bookkeeping Table**

FUNCTION	PLAYER 1 DISPLAY	PLAYER 2 DISPLAY
00	Game Identification (2540 and ROM-revision no.)	—
01	Coins, Left Chute (closest to coin-door hinge)	—
02	Coins, Center Chute	—
03	Coins, Right Chute	—
04	Total Paid-Credits	—
05	Special Credits	—
06	Replay-Score Credits	—
07	Match Credits	—
08	Total Games Played (Player for Display: % of Replays)	5+6+7+13
09	Total Extra Balls	—
10	Ball Time in Minutes	—
11	Total Balls Played	—
12	High Scores	—
13	Backup High-Scores } (see High Scores discussion)	—
14	Replay-Level 1	0; 1, 2, 3, 4
15	Replay-Level 2	Times Exceeded
16	Replay-Level 3	Times Exceeded
17	Replay-Level 4	Times Exceeded
42	Collected a Million Points	—
43	Qualified for Extra Ball from 2 Duck/Rabbit Banks	—
44	Qualified for Extra Ball from COMET Ramp	—
45	Qualified for Special from COMET Ramp	—
46	Qualified for Special from 2 Duck/Rabbit Banks	—
47	No. of times Ducks/Rabbits made	—
48	No. of times Dummy dunked	—

**Using only one High Score...**

1. Enter function 12.
2. Press the Credit button until a score appears in the Player 1 display. The other displays should be blank.
3. Use AUTO-UP and ADVANCE to enter function 13. In the Player 2 display, function 13 shows the number of credits won from the high-score feature. The Player 1 display shows (and allows you to adjust) the backup high-score. *(This value is restored when you press and hold HIGH-SCORE RESET.)*
4. Use AUTO-UP and the Credit button to change the backup high-scores. At **Game-Over Mode**, the number of credits indicated by function 40 will be awarded if the player beats the high score.
5. To use the high-score feature *without awarding credits*, set function 40 to 0.

# How To Make Game Adjustments

## GAME-ADJUSTMENT PROCEDURE, FUNCTIONS 13-41

*Coin door must be open to change settings*

### ADJUSTMENT PROCEDURE SUMMARIZED...

**USE THE DIAGNOSTIC SWITCHES.** With the AUTO-UP/MANUAL-DOWN switch set to AUTO-UP, press the ADVANCE switch twice. The GAME ADJUSTMENTS routine will come up on the displays. Press ADVANCE to go through the functions shown in the **Game-Adjustment Table**.

### ADJUSTMENT PROCEDURE IN DETAIL...

1. Use AUTO-UP and press ADVANCE. Test 04 is indicated in the Credits display, function 00 in the Ball-In-Play display, and the game identification number in the Player 1 display.

Continued on page 8

**Game-Adjustment Table**

FUNCTION	DESCRIPTION	FACTORY SETTING <sup>1</sup>
12	High Scores	(see above) <sup>4</sup>
13	Backup High Score(s) (High score credits awarded—function 40)	3,000,000
14 <sup>2,3</sup>	First Replay-Level	1,200,000
15 <sup>2,3</sup>	Second Replay-Level or Second-Highest Score	00
16 <sup>2,3</sup>	Third Replay-Level or Third-Highest Score	00
17 <sup>2,3</sup>	Fourth Replay-Level or Fourth-Highest Score	00
18	Maximum Credits	30
19	Standard and Custom Pricing-Control	01/09
20	Left Coin-Slot Multiplier	01/09
21	Center Coin-Slot Multiplier	00/18
22	Right Coin-Slot Multiplier	01/45
23	Coin Units Required For Credit	01/05
24	Units Required For Bonus Credit	00/45
25	Minimum Coin-Units	00
26	Match	00
	00: Standard Match (awards 10% replays)	
	01: Match OFF	
27	Special	00
	00: Awards Credit	
	01: Awards Extra Ball	
	02: Awards points	
28	Replay	00
	00: Awards Credit	
	01: Awards Extra Ball	
	02: No award	
29	Maximum Plumb-Bob Tilts (including warnings)	03
30	Number of Balls (including bonus ball)	03
31	Game-Adjustment #1: "Dunk the Dummy" Time May be any setting between the limits of 10 and 30 seconds	20
32	Game Adjustment #2: "Cycle Jump" (Extra Ball shot) Setting                      Sec Bottom      Sec Middle      Time Ring Lit            Ring Lit            Sec Top Ring Lit	01
	00: Liberal                      10                      15                      20	
	01: Moderate                      08                      10                      15	
	02: Conservative                      05                      08                      10	
33	Game Adjustment #3: Time for multiple scoring May be any setting between the limits of 10 and 30 seconds	20

**Game-Adjustment Table (Continued)**

FUNCTION	DESCRIPTION	FACTORY SETTING <sup>1</sup>																																																																
34	<p>Game Adjustment #4: Background/Attract Mode Sound</p> <table border="0"> <tr> <td></td> <td>Background Sound</td> <td>Attract Mode Sound</td> <td>Spot Ducks/Rabbits Double Target</td> </tr> <tr> <td>Setting</td> <td></td> <td></td> <td></td> </tr> <tr> <td>00</td> <td>On</td> <td>On</td> <td>On</td> </tr> <tr> <td>01</td> <td>Off</td> <td>On</td> <td>On</td> </tr> <tr> <td>02</td> <td>On</td> <td>Off</td> <td>On</td> </tr> <tr> <td>03</td> <td>Off</td> <td>Off</td> <td>On</td> </tr> <tr> <td>04</td> <td>On</td> <td>On</td> <td>Off</td> </tr> <tr> <td>05</td> <td>Off</td> <td>On</td> <td>Off</td> </tr> <tr> <td>06</td> <td>On</td> <td>Off</td> <td>Off</td> </tr> <tr> <td>07</td> <td>Off</td> <td>Off</td> <td>Off</td> </tr> <tr> <td>1x</td> <td colspan="3">Knocker used in some fireworks</td> </tr> <tr> <td>2x</td> <td colspan="3">Knocker used in more fireworks</td> </tr> <tr> <td>3x</td> <td colspan="3">Knocker used in more fireworks</td> </tr> <tr> <td>4x</td> <td colspan="3">Knocker used in more fireworks</td> </tr> <tr> <td>5x</td> <td colspan="3">Knocker used in more fireworks</td> </tr> <tr> <td></td> <td colspan="3">(x = 0, 1, 2, 3, ... 7 from above for desired sounds)</td> </tr> </table>		Background Sound	Attract Mode Sound	Spot Ducks/Rabbits Double Target	Setting				00	On	On	On	01	Off	On	On	02	On	Off	On	03	Off	Off	On	04	On	On	Off	05	Off	On	Off	06	On	Off	Off	07	Off	Off	Off	1x	Knocker used in some fireworks			2x	Knocker used in more fireworks			3x	Knocker used in more fireworks			4x	Knocker used in more fireworks			5x	Knocker used in more fireworks				(x = 0, 1, 2, 3, ... 7 from above for desired sounds)			00
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5x	Knocker used in more fireworks																																																																	
	(x = 0, 1, 2, 3, ... 7 from above for desired sounds)																																																																	
35	<p>Game Adjustment #5: Time to make "Roller-Coaster" bonus May be any setting between the limits of 10 and 20 seconds</p>	15																																																																
36	<p>Game Adjustment #6: Memory for "Cycle-Jump" Extra Ball shot <i>Operating Mode:</i> To light Cycle-Jump Extra Ball lamps requires hitting all ducks and all rabbits <i>2 times per:</i></p> <table border="0"> <tr> <td>Setting</td> <td>Memory State</td> <td></td> </tr> <tr> <td>00</td> <td>Off</td> <td>Game.</td> </tr> <tr> <td>01</td> <td>On</td> <td>Game.</td> </tr> <tr> <td>02</td> <td>Off</td> <td>Ball.</td> </tr> <tr> <td>03</td> <td>On</td> <td>Ball.</td> </tr> </table>	Setting	Memory State		00	Off	Game.	01	On	Game.	02	Off	Ball.	03	On	Ball.	01																																																	
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38	<p>Game Adjustment #8: Memory for the three Special lamps <i>Operating Mode:</i> To light Special lamps requires hitting all ducks and all rabbits <i>3 times per:</i></p> <table border="0"> <tr> <td>Setting</td> <td>Memory State</td> <td></td> </tr> <tr> <td>00</td> <td>Off</td> <td>Game.</td> </tr> <tr> <td>01</td> <td>On</td> <td>Game.</td> </tr> <tr> <td>02</td> <td>Off</td> <td>Ball.</td> </tr> <tr> <td>03</td> <td>On</td> <td>Ball.</td> </tr> </table>	Setting	Memory State		00	Off	Game.	01	On	Game.	02	Off	Ball.	03	On	Ball.	01																																																	
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50	<p>Special Function 15: Auto-Cycle Mode 35: Zero bookkeeping totals 45: Restore factory settings &amp; zero bookkeeping totals</p>																																																																	

**NOTES**

- The second factory-setting value is with jumper W5 on the CPU Board removed.
- Functions 14 through 17 (replay levels) may be set to any multiple of 100,000 points. Setting function 40 to zero with function 13 set to *any score but zero* permits the high-score feature to operate but no credits are awarded.
- Setting functions 14 through 17 (replay levels) to zero disables the replay-score point.
- High scores are displayed or suppressed by adjusting function 12. Use AUTO-UP and press ADVANCE repeatedly until the number of high scores you wish to show (0, 1, 2, or all 4) appears on the displays. Now return to **Game-Over Mode**.

2. To raise the function number in the Ball-In-Play display, use AUTO-UP and push ADVANCE. To lower the function number, use MANUAL-DOWN and push ADVANCE.
3. With the desired function indicated in the Ball-In-Play display, raise the value in the Player 1 display by using AUTO-UP and pressing the Credit button. Repeat this step until all adjustments have been made.
4. Hold down ADVANCE until Function 50 is indicated in the Ball-In-Play display. From Function 50, you can return to **Game-Over Mode** or restore factory settings. Perform either of the following as desired.
  - A. To return to **Game-Over Mode**, use AUTO-UP and press ADVANCE.
  - B. or: To restore factory settings and zero bookkeeping totals:
    1. Use AUTO-UP and press the Credit button until 45 is indicated in the Player 1 display.
    2. Press ADVANCE. The game returns to Test 04, function 00.
    3. Use MANUAL-DOWN and press ADVANCE to indicate function 50.
    4. Return to **Game-Over Mode** by using AUTO-UP and pressing ADVANCE.
    5. Press *and hold* HIGH-SCORE RESET to replace all high scores with factory settings.

## A FEW SUGGESTIONS

### Choose one or more...

- HIGHEST SCORE** (function 13). For a greater challenge, raise the HIGHEST SCORE. For a lesser challenge, reduce it.
- REPLAY LEVELS** (functions 14-17). As with the HIGHEST SCORE feature, raising these values permits *fewer* possible free game chances. Reduce them to allow *more* free game awards.
- SELECT GAME PRICING** (functions 19-25) using standard or custom settings.
- MATCH** (function 26). For more free games awarded, turn on the MATCH feature. For fewer free games awarded, turn it off.
- ADJUST SPECIAL AND REPLAY** (functions 27 and 28) to award an Extra Ball, Credit or points: The choice is yours...and the adjustment is easy!
- MAXIMUM PLUMB-BOB TILTS** (function 29). At the factory setting, the first two tilts produce a warning "growl." The third costs a player the rest of his turn. (1 = conservative/3 = factory/9 = liberal)

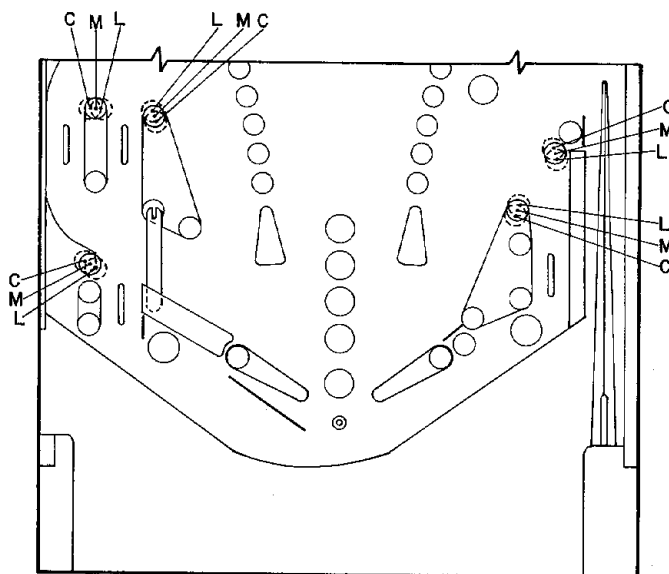
- NUMBER OF BALLS** (function 30). For a longer game, increase the number of balls to five (The factory setting is usually three). For a shorter game, decrease the number of balls.

## OTHER ADJUSTMENTS...

**YOU CAN ALSO ADJUST THE PLAYFIELD.** How does the playfield affect average time per credit? Three ways...By playfield pitch, playfield level, and post position.

**PLAYFIELD PITCH AND LEVEL.** Set the front and rear leg-levelers for a pitch of five to seven degrees. Check your work by placing a small level across the upper and lower portions of the playfield.

**PLAYFIELD POSTS** that affect ball time are near the *side drain-lanes*. Their position sets the probability of a ball's draining.



## PLAYFIELD POSTS

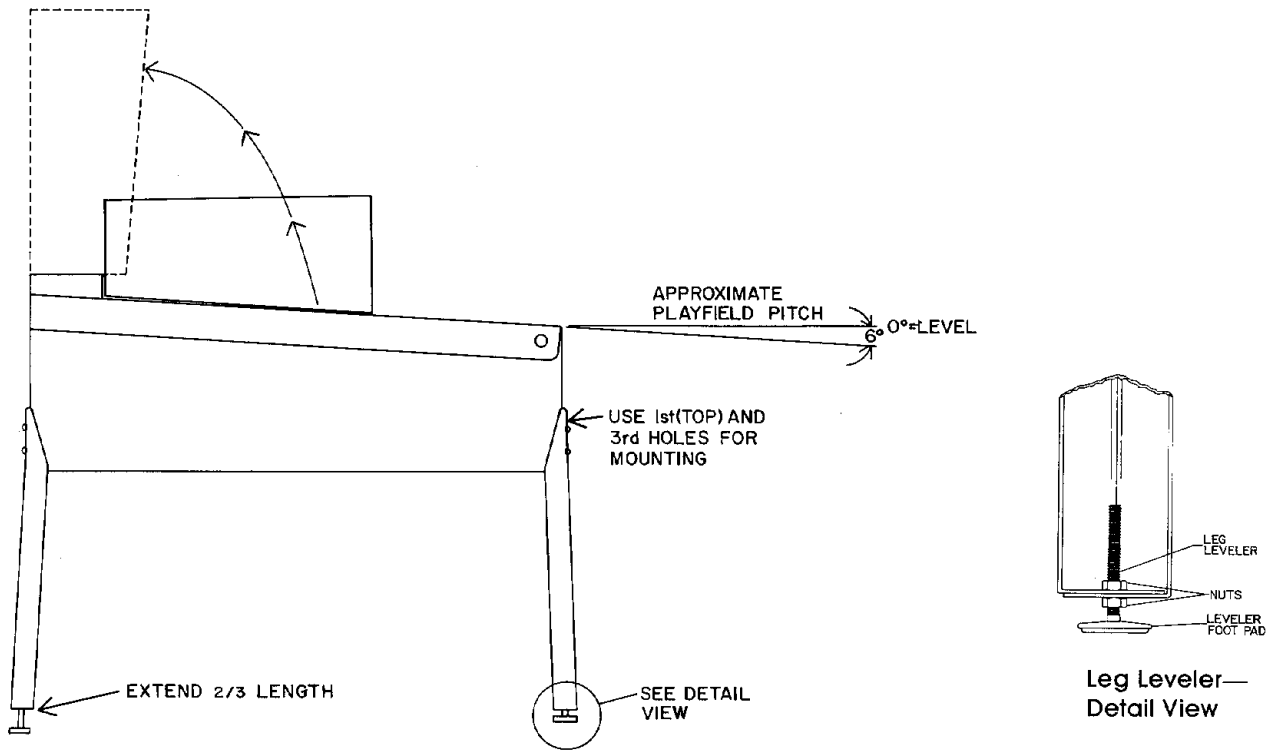
Position post as indicated for desired play:

C = Conservative.

M = Moderate.

L = Liberal.





## CABINET SETUP AND PLAYFIELD ADJUSTMENTS

1. Attach rear legs to cabinet, using leg bolts.
2. Attach front legs, using leg bolts in the 1st (top) and 3rd holes.
3. Reach into the cabinet and backbox and check the mating of the interconnecting cables, matching several wire colors at each connector. Take out the power cord, routing it in the notch on back of cabinet top.
4. Raise the hinged backbox into position. Ensure that the interconnecting cables are free to move (not kinked or pinched). Secure the backbox with mounting bolts through the bottom holes into the threaded fasteners in the cabinet.
5. Extend the rear leg levelers to approximately  $\frac{2}{3}$  length below the leg bottom. Level (side-to-side) the playfield, and firmly tighten the upper nut on the leg leveler shaft to maintain this level setting.
6. Adjust front leg levelers for proper playfield level and playfield pitch (incline) of approximately 6 degrees.

## Game Pricing

**PRICING FUNCTIONS.** Functions 19 through 24 are the functions related to game pricing. (Refer to the **Game-Adjustment Table** for the Description and Factory Setting of these functions.)

**PRICING MADE EASY.** Function 19 allows the operator to select either *Standard* or *Custom* game pricing.

1. *Standard Pricing:* Use the CREDIT button to enter a digit from 1 through 12 (in the rightmost Player 1 display), which matches the desired Standard game pricing listed in the **Pricing Table**. This automatically sets the remaining functions (20 through 24) for the selected Standard.
2. *Custom Pricing:* When Standard pricing is not applicable, use the CREDIT button to enter a 0 in the Player 1 display for function 19. Press ADVANCE to enter function 20, then use the CREDIT button to enter the desired Custom pricing factor from the **Pricing Table**. Use this method to enter the factors for functions 21 through 24.

**Pricing Table**

COUNTRY	COIN-DOOR MECHANISM L, CENTER, R	GAMES/PRICE	FUNCTION					
			19	20	21	22	23	24
USA CANADA	25¢, —, 25¢	*1/25¢, 4/\$1	1	1	0	1	1	0
		•1/50¢, 2/\$1	3	1	4	1	2	0
		2/25¢, 8/1	0	2	0	2	1	0
		1/25¢, 3/50¢, 6/\$1	0	1	0	1	1	2
		1/25¢, 5/\$1	0	1	0	1	1	4
WEST GERMANY	1DM, 2DM, 5DM	•1/1DM, 2/2DM, 6/5D MARK	2	6	12	30	5	0
		1/2x 1DM, 1/2DM, 3/5DM	0	3	6	15	5	0
		2/1DM, 5/2DM, 14/5DM	0	13	26	65	5	65
FRANCE	1F, 5F, 10F	•1/3x1F, 2/5F, 5/10 FRANC	4	2	10	20	5	20
NETH. ANTILLES	25¢, —, 1G	1/25¢, 4/1 GUILDER	0	1	1	4	1	0
NETHERLANDS	25¢, —, 1G	1/25¢, 5/1 GUILDER	0	1	0	5	1	0
BELGIUM	5F, —, 20F	•1/2x5F, 1/1x10F, 2/1x20F	8	1	4	4	2	0
BELGIUM	5F, 20F, 20F	•1/2x5F, 1/1x10F, 2/1x20F	8	1	4	4	2	0
SWITZERLAND	1F, 2F, 5F	1/1F, 3/2F, 7/5 FRANC	0	2	6	14	2	0
SWITZERLAND	1F, —, 2F	•1/F, 3/2 FRANC	7	3	0	6	2	0
JAPAN	100Y, —, 100Y	2/100 YEN	0	4	0	4	2	0
JAPAN	—, 100Y, —	•2/100 YEN	3	1	4	1	2	0
ITALY	100L, —, 100L	•1/200 LIRE	3	1	4	1	2	0
AUSTRALIA	20¢, —, \$1	•1/40¢, 3 \$1	5	1	0	6	2	0
NEW ZEALAND	20¢, —, 20¢	•1/2x20¢	3	1	4	1	2	0
UNITED KINGDOM	10P, 50P, 20P	1/10P, 5/50, 2/20 PENCE	0	1	5	2	1	0
UNITED KINGDOM	10P, 50P, 10P	•1/10P, 5/50 PENCE	6	1	5	1	1	0
ARGENTINA	10¢, 10¢, 10¢	1/1 TOKEN	0	1	1	1	1	0
AUSTRIA	5SCH, —, 10SCH	2/5SCH, 5/10SCHILLINGS	0	2	0	5	1	0
AUSTRIA	1SCH, 5SCH, 10SCH	2/5x1SCH, 2/5SCH, 5/10SCH	0	2	10	25	5	0
CHILE	TOKEN, —, TOKEN	•1/1 TOKEN	1	1	0	1	1	0
DENMARK	1KR, 5KR, 10KR	1/2x1KR, 3/5KR, 7/10 KRONE	0	1	6	14	2	0
FINLAND	1MKA, —, 1MKA	•1/1 MARKKA	1	1	0	1	1	0
NORWAY	1KR, —, 1KR	1/2x1KR, 3/5 KRONE	0	1	0	1	2	5
SWEDEN	1KR, —, 1KR	•1/2x1 KRONA	3	1	4	1	2	0

**NOTES:** \* Factory Setting.

\*\* Setting with W5 cut.

• Indicates Standard settings (Adjust *only* function 19).

Functions:

19—Pricing Control.

20—Left Chute Multiplier.

21—Center Chute Multiplier.

22—Right Chute Multiplier.

23—Units required for 1 Credit.

24—Units required for a Bonus Credit.

**THE GAMES: PRICE RATIO** is equivalent to the ratio  $X : VC$ , where:

$X$  = COIN-SLOT MULTIPLIER (the number at function 20, 21 or 22)

$V$  = COIN VALUE

$C$  = COIN UNITS REQUIRED FOR CREDIT (the number at function 23)

For example (assuming quarter chutes) at factory settings, the variables produce 1 : 25x1 or one game for 25¢.

**UNITS REQUIRED FOR BONUS CREDIT** (function 24)

determines the number of games that must be purchased before a free game is awarded. The factory setting for this function is 0, which means the function is disabled. *One good way to increase revenue is to adjust this function. That is, award bonus credits when players deposit several coins at once. For example...1/25, 3/50, 6/\$1.*

**MINIMUM COIN-UNITS** (function 25) determines the number of games that must be purchased before play may begin. The factory setting for this function is 0. *This 0 means that the MINIMUM COIN-UNITS feature is disabled.*

# CHAPTER 3 Troubleshooting, Maintenance & Parts

A Word About Troubleshooting

Introducing Game Diagnostics

Diagnostic Procedures

ROM/Sounds Table

System-9 Solenoid Table

System-9 Lamp-Matrix Table

System-9 Switch-Matrix Table

Maintain That Profitable Game!

Playfield Solenoid/Switch Wiring Diagram

Backbox PC Boards Wiring Diagram

Playfield Parts and Switches Diagrams

Solenoids/Flashers - Rubber Parts and Lamps Diagrams

System 9 Cabinet Wiring

Miscellaneous Playfield Assemblies

## A Word About Troubleshooting

**WILLIAMS PROVIDES EXTENSIVE DIAGNOSTICS** in the games it manufactures. These can be a dramatic timesaver in your servicing work. Familiarity with the service literature can also enhance troubleshooting. *In the few instances when you can't find the problem using built-in diagnostics, these rules of thumb should help...*

● **GIVE YOUR GAME A VISUAL INSPECTION** in the suspected area. *Bad connections are common in older games.* Are the plug-in chips firmly seated in their sockets? Are connectors securely attached?

● **THINK OVER THE SYMPTOMS** and then jot them down. *Keeping notes pins down the details of your problem and prevents wasted time going over the same tests.*

● **YOUR ANALYSIS SHOULD REVEAL** which tools you need: *Multimeter (analog or digital), logic probe, oscilloscope, or other diagnostic equipment.* Gather your tools.

● **CHECK YOUR VOLTAGES.** Check regulated and unregulated DC voltages first at the output of the power supply. If any DC voltage is missing, check your AC voltage at the fuse (with reference to its return line to the transformer). Use your **Power-Wiring Diagram** and **Backbox-Wiring Diagram** to find the fuse's location.

● **SWAP INTERCHANGEABLE BOARDS** and chips that relate to your problem.

● **ONCE YOU'VE ISOLATED THE SUSPECTED CIRCUIT** use your logic probe or oscilloscope to test for normal operation.

# Introducing Game Diagnostics

## ROM/Sounds Table

**TESTS ITSELF!** Your top-earning **WILLIAMS** pinball game will never be down for long. Built-in tests cover just about everything that could go wrong with a pinball game...*a complete status report including in-depth examinations of RAM, ROM, and CMOS memory chips, displays, lamps, solenoids, switches, and sounds.*

**NO TEST EQUIPMENT IS REQUIRED** to perform these tests! Just put the AUTO-UP/MANUAL-DOWN switch in the MANUAL-DOWN position and press ADVANCE once. This initiates the display test.

Use AUTO-UP and press ADVANCE once more for each successive test.

**MEMORY TESTS** are accessed from the CPU board. Simply turn the game on and press the CPU DIAGNOSTIC switch near the microprocessor (*large, socketed*) chip. The CPU board will perform a checksum comparison to assess the health of your memory chips. Then, an on-board LED readout reports back to you...

## Diagnostic Procedures

### DISPLAY TEST

1. Use MANUAL-DOWN and press ADVANCE. Displays should indicate all 0s.
2. Use AUTO-UP. Displays should sequence from all 0s through all 9s. Comma segments should come on when the odd digits are displayed.
3. To stop cycling, use MANUAL-DOWN. Press ADVANCE to step through the tests one number at a time. Use AUTO-UP to resume cycling.

### SOUND TEST

1. (*From Display Test*) Use AUTO-UP and press ADVANCE. Test 00 should be indicated in the Credits display and the Match display should sequence from 00 through 06. A different sound should be produced for each number.
2. To continuously pulse a single sound, use MANUAL-DOWN. Press ADVANCE to step through sounds one at a time. Use AUTO-UP to resume sequencing.
3. Press the SOUND DIAGNOSTIC-SWITCH. Now listen for the following words. Missing or damaged words indicate the failure of a particular ROM as shown below. For part-ordering information, see the **ROM Summary** at the beginning of this manual.

WORDS/SOUNDS	ROM NO.	TYPE	BOARD
Turkey	U4	2732	Speech
C'mon, get me	U4	2732	Speech
Hey	U4	2732	Speech
(train whistle)	U4-U6-U5	2732	Speech
Ah-h-h	U6-U5	2732	Speech
(1st laugh)	U5	2732	Speech
(roller coaster)	U7	2732	Speech
(splash)	U7-U49	2732	Speech/CPU
(2nd laugh)	U49	27128	CPU
A million	U49	27128	CPU
(explosion)	U49	27128	CPU

### LAMP TEST

1. Refer to your game's **Lamp-Matrix Table** for lamp numbers and wiring. CPU-Board connections at jacks 1J6 (rows) and 1J7 (columns) are also shown there.
2. (*From Sound Test*) Use AUTO-UP and press ADVANCE. Test 01 should be indicated in the Credits display and all feature-lamps should flash.

### SOLENOID TEST

1. Refer to your **Solenoid Table** for solenoid numbers and wiring. CPU-Board connections at jacks 1J11 and 1J12 are also shown there.
2. (*From Lamp Test*) Use AUTO-UP and press ADVANCE. Test 02 should be indicated in the Credits display. The Ball-In-Play display sequences from 01 through 25. Corresponding solenoids are pulsed. The flipper relay is de-energized with sub-test 25.
3. Special solenoids (jet bumpers, kickers, etc.) *are not pulsed during the Solenoid Test*. Instead, you must check these solenoids manually. Press on their trigger switches or pull their switch-trigger lines low.
4. To continuously pulse a single solenoid, use MANUAL-DOWN. Press ADVANCE to step through controlled solenoids one at a time. Use AUTO-UP to resume sequencing.

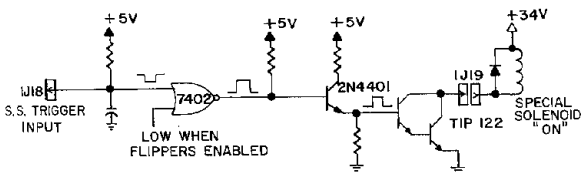
## System-9 Solenoid Table

SOL. NO.	FUNCTION	SOLENOID TYPE	WIRE COLOR	CONNECTIONS		DRIVER TRANS.	SOLENOID PART NO.
				CPU BOARD	PLAYFIELD/CABINET		
01	Outhole	controlled	GRY-BRN	1J11-1	8P3-1	Q47	SA-23-850-DC
02	Drop Target	controlled	GRY-RED	1J11-3	8P3-2	Q48	SA-5-24-750-DC
03	"Funhouse" Eject Hole	controlled	GRY-ORN	1J11-4	8P3-3	Q49	SG1-23-850-DC
04	"Corkscrew" Flashers	controlled	GRY-YEL	1J11-5	8P3-4	Q50	#63 flashlamps
05	"Cycle Jump" Flashers	controlled	GRY-GRN	1J11-6	8P3-5	Q39	#63 flashlamps
06	"Cycle Jump" Eject-Hole	controlled	GRY-BLU	1J11-7	8P3-6	Q40	SG1-23-850-DC
07	Player-3 Flashers	controlled	GRY-VIO	1J11-8	8P3-7	Q41	#63 flashlamps
08	Player-1 Flashers	controlled	GRY-BLK	1J11-9	8P3-8	Q42	#63 flashlamps
09	Player-4 Flashers	controlled	BRN-BLK	1J12-1	8P3-9	Q54	#63 flashlamps
10	Player-2 Flashers	controlled	BRN-RED	1J12-2	8P3-10	Q55	#63 flashlamps
11	General Illumination	controlled	BRN-ORN	1J12-4	3P7-1	Q56	5580-09555-00
*12	Not Used	controlled	BRN-YEL	1J12-5	8P3-12	Q57	-
13	Insert Illumination	controlled	BRN-GRN	1J12-6	8P3-13	Q58	-
14	Not Used	controlled	BRN-BLU	1J12-7	8P3-14	Q59	-
15	Knocker	controlled	BRN-VIO	1J12-8	7P1-17	Q60	SA-4-23-850-DC
16	Coin-Lockout Coil	controlled	BRN-GRY	1J12-9	7P1-18,7P2-4	Q61	SM-35-4000-DC
*17	Left Kicker	special #1	BLU-BRN	1J19-7	8P3-17	Q75	SG1-23-850-DC
*18	Right Kicker	special #2	BLU-RED	1J19-4	8P3-18	Q77	SG1-23-850-DC
*19	Upper Jet-Bumper	special #3	BLU-ORN	1J19-3	8P3-19	Q79	SG1-23-850-DC
*20	Left Jet-Bumper	special #4	BLU-YEL	1J19-6	8P3-20	Q81	SG1-23-850-DC
*21	Lower Jet-Bumper	special #5	BLU-GRN	1J19-8	8P3-21	Q83	SG1-23-850-DC
*22	Not Used	special #6	BLU-BLK	1J19-9	8P3-22	Q85	-
—	Flipper (Not Used)	-	BLK-BLU	1J19-2	7P1-30	-	-
—	Right Flipper*	-	ORN-VIO	1J19-1	7P1-7	-	FL23/600-30/2600-50VDC
—	Left Flipper*	-	ORN-GRY	1J19-2	7P1-9	-	FL23/600-30/2600-50VDC

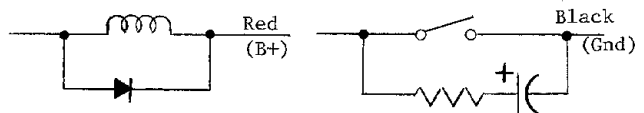
### \*NOTES

- Special-switch connections for solenoids 17 through 21 are as follows:  
 17—ORN-BRN—1J18-5, 8P3-24  
 18—ORN-RED—1J18-3, 8P3-25  
 19—ORN-BLK—1J18-2, 8P3-26  
 20—ORN-YEL—1J18-4, 8P3-27  
 21—ORN-GRN—1J18-8, 8P3-28
- FLIPPER COILS.** This game requires 50-volt flipper coils. For proper operation, the replacement part listed MUST be used.
- Flipper-button connections:  
 Right—ORN-VIO—1J19-1, 7P1-7  
 Left—ORN-GRY—1J19-2, 7P1-9  
 Not Used—BLK-BLU—1J19-2, 7P1-30
- On German games, the solenoid-12 wiring is used for the token-dispenser solenoid.
- Typical circuits for solenoids and special switches follow.

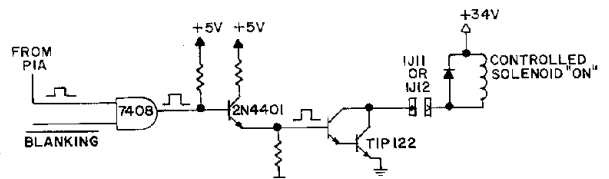
### SPECIAL-SOLENOID LOGIC FOR "ON" STATE



**IN THE SOLENOID-OFF STATE,** (1) the switch trigger (e.g., Kicker switch) goes low. (2) Meanwhile, the PIA line remains high. (3) The rest of the signals reverse their states. (These six solenoids aren't pulsed during the Solenoid Test. Instead, you must check them manually: Press on their trigger switches or ground their switch-trigger lines.)



### CONTROLLED-SOLENOID LOGIC FOR "ON" STATE



**IN THE SOLENOID-OFF STATE,** (1) the enable line goes low. (2) Meanwhile the BLANKING signal remains high. (3) The rest of the signals reverse their states.

### System 9 Lamp-Matrix Table

ROW \ COLUMN	1	2	3	4	5	6	7	8
	YEL-BRN 1J7-1	YEL-RED 1J7-2	YEL-ORN 1J7-3	YEL-BLK 1J7-4	YEL-GRN 1J7-6	YEL-BLU 1J7-7	YEL-VIO 1J7-8	YEL-GRY 1J7-9
1	RED-BRN 1J6-1 Game Over Lamp 1	Cork-screw Special 9	Rabbit Target #4 17	Cycle-Jump 20K 25	Duck-Outhole Bonus 33	Rabbit-Outhole Bonus 41	<b>COMET</b> Ramp 30K 49	One Million 57
2	RED-BLK 1J6-2 Match 2	Duck Target #1 10	Advance Bonus Mult. 18	Cycle-Jump 50K 26	Duck-Bonus #1 34	Rabbit-Bonus #1 42	50K 50	Win a Million 58
3	RED-ORN 1J6-3 Tilt 3	Duck Target #2 11	Collect Duck Bonus 19	Cycle-Jump 200K 27	Duck-Bonus #2 35	Rabbit-Bonus #2 43	100K Lts Extra Ball 51	One Million 59
4	RED-YEL 1J6-5 High-Scores 4	Duck Target #3 12	Top Lanes 1 20	C-Jump Ex Ball (Btm) 28	Duck-Bonus #4 36	Rabbit-Bonus #4 44	100K Lts Special 52	Ride Again (Pfld) 60
5	RED-GRN 1J6-6 Ride Again 2X (Bkbox) 5	Duck Target #4 13	Top Lanes 9 21	C-Jump Ex Ball (Mid) 29	Duck-Bonus #8 37	Rabbit-Bonus #8 45	All Scores 2X 53	2X 61
6	RED-BLU 1J6-7 Ball-In-Play 6	Rabbit Target #1 14	Top Lanes 8 22	C-Jump Ex Ball (Top) 30	Duck-Bonus #16 38	Rabbit-Bonus #16 46	All Scores 3X 54	3X 62
7	RED-VIO 1J6-8 <b>COMET</b> Eyes 7	Rabbit Target #2 15	Top Lanes 6 23	Right Drain Spcl. 31	Duck-Bonus #32 39	Rabbit-Bonus #32 47	All Scores 5X 55	4X 63
8	RED-GRY 1J6-9 <b>COMET</b> Eyes 8	Rabbit Target #3 16	Collect Rabbit Bonus 24	Left Drain Spcl. 32	All Rabbits Down 40	All Ducks Down 48	C'screw Extra Ball 56	5X 64

### System 9 Switch-Matrix Table

ROW \ COLUMN	1	2	3	4	5	6	7	8
	GRN-BRN 1J8-1	GRN-RED 1J8-2	GRN-ORN 1J8-3	GRN-YEL 1J8-4	GRN-BLK 1J8-5	GRN-BLU 1J8-7	GRN-VIO 1J8-8	GRN-GRY 1J8-9
1	WHT-BRN 1J10-9 Plumb-Bob Tilt 1	C'screw Rollover 9	Rabbit Target #4 17	C-Jump Lwr-Ring Eject 25	L-Left Standup Sw 33	Left Jet-Bumper 41	Playfield Tilt 49	Not Used 57
2	WHT-RED 1J10-8 Ball-Roll Tilt 2	Duck-Target #1 10	Advance Bonus X (Eye) 18	C-Jump Ctr-Ring Sw 26	U-Left Standup Sw 34	Lower Jet-Bumper 42	<b>COMET</b> Ramp/Lwr Sw 50	Not Used 58
3	WHT-ORN 1J10-7 Credit Button 3	Duck-Target #2 11	C'screw Lower Sw 19	C-Jump Upr-Ring Sw 27	U-Right Standup Sw 35	Left-Outside Lane 43	Not Used 51	Not Used 59
4	WHT-YEL 1J10-6 Right Coin 4	Duck-Target #3 12	Top Lanes 1 20	<b>COMET</b> Ramp/Upr Sw 28	Left-Ctr Standup Sw 36	Left-Inside Lane 44	Not Used 52	Not Used 60
5	WHT-GRN 1J10-5 Center Coin 5	Duck-Target #4 13	Top Lanes 9 21	"Dummy Dunk" Dr Target 29	L-Right Standup Sw 37	Outhole 45	Not Used 53	Not Used 61
6	WHT-BLU 1J10-3 Left Coin 6	Rabbit-Target #1 14	Top Lanes 8 22	LANE-CHANGE?" Sw 30	Center Standup Sw 38	Plunger Switch 46	Not Used 54	Not Used 62
7	WHT-VIO 1J10-2 Slam Tilt 7	Rabbit-Target #2 15	Top Lanes 6 23	Right Drain Spcl 31	C-Right Standup Sw 39	Left Kicker 47	Not Used 55	Not Used 63
8	WHT-GRY 1J10-1 High-Score Reset 8	Rabbit Target #3 16	Funhouse (Eject Hole) 24	Left Drain Spcl 32	Upper Jet-Bumper 40	Right Kicker 48	Not Used 56	Not Used 64



## SWITCH TEST

1. Refer to the **Switch-Matrix Table** for switch numbers and wiring. CPU-Board connections at jacks 1J8 (columns) and 1J10 (rows) are also shown there.

2. (From *Solenoid Test*) Use AUTO-UP and press ADVANCE. Test 03 should be indicated in the Credits display with the switch numbers sequencing in the Ball-In-Play display.

As a switch number is displayed, a sound is produced. As a switch is opened, its number is removed from the sequence. When all switches are open, the Ball-In-Play display is blank and the sounds stop.

3. **HOLD DOWN EACH SWITCH** so its number is shown at least twice. A sound is produced and a switch number is momentarily indicated in the Ball-In-Play display.

**ROW PROBLEMS.** If two switches of a row are indicated with only one switch closed, check for a short between the column wires.

**FOR MULTIPLE INDICATIONS,** check for a short between row wires.

4. **PLAYFIELD OR CPU BOARD?** To determine whether the problem is in the playfield or the CPU Board, remove connectors 1P8 and 1P10 from the CPU Board. Now enter the Switch Test. Use a jumper wire to simulate switch operation.

For example, in the Switch-Matrix Table, notice that placing a jumper between 1J10-pin 9 and 1J8-pin 2 should produce an indication of switch 09 being closed.

## AUTO-CYCLE MODE

1. The **Auto-Cycle Mode** permits you to check intermittent problems in the playfield, backbox, cabinet, and CPU Board.
2. Set function 50 of Test 04 (**Bookkeeping Mode**) to 15.
3. Press ADVANCE to start the **Auto-Cycle Mode**. This mode repeatedly sequences through the Display Test, Sound Test (00), Lamp Test (01), and Solenoid Test (02).
4. This sequence is repeated, until the game is turned off and on.

## SYSTEM-9 MEMORY-CHIP TEST

Press the DIAGNOSTIC button on the CPU Board. The CPU Board's seven-segment display provides the following indications:

INDICATION	PROBABLE CAUSE
0	Test passed (game returns to <b>Game-Over Mode</b> )
1	CPU-Board lockup; also check memory-protect circuit and U18 CMOS RAM for stuck bits
2	U20 Game ROM 1 faulty
3	U20 Game ROM 1 faulty
4	U19 Game ROM 2 faulty
5	Blanking-signal stuck, coin door closed, memory-protect circuit faulty, or U18 CMOS RAM faulty
7 None	System Failure U20 Game ROM 1 faulty

**IF YOUR GAME IS LOCKED UP,** you may have a bad power supply. The 5-volt logic supply is the first one you should check. Then, check the 12-volt supply, which is used to reset your microprocessor. Test for both DC and AC. *Here's why...*

**NORMAL RIPPLE FIGURES.** You may find a few millivolts of AC at the regulated-DC power outputs. Depending on their rated output, unregulated DC supplies can produce over 100 millivolts of AC. Power supplies with leaky electrolytics produce substantially more ripple than this.

**TESTING CAPACITORS.** Testing the power supply's capacitors by substitution is very easy and reasonably cheap. Unless a capacitor is obviously bad (bubbling, swollen, or dripping), start by replacing the largest one.

**SAFETY FIRST!** Before removing capacitors, *discharge them* by shunting them with a 10K, 1W resistor.

**FOR 7 INDICATION,** occasionally, the following components can contribute to this problem: U21; components in the IRQ circuit; broken leads on C9 (22 mfd) in the Reset circuit; loosely seated ICs on the CPU Board.

## SOUND-SECTION TEST FOR SYSTEM 9

1. **PRESS THE DIAGNOSTIC BUTTON SW2** on the CPU Board. Several electronic sounds should be produced. This sequence of sounds is repeated until the game is turned OFF and back ON.
2. **NO SOUND IN DIAGNOSTIC TEST** (but sounds are present in the Self Test): Check the sound-select inputs (pins 2 through 9 of U 13) to see if they pulse during Test 00.
3. **NO SOUND:** Check the -12V supply voltage on the CPU Board. If this voltage is low (or AC ripple seems too high)...
  - A. Check the gray and gray-green transformer secondary wires for 18.7 VAC;
  - B. Check the -12V supply filter-capacitor C7 on the CPU Board for excessive AC (over 0.75 VAC).
4. **STILL NO SOUND:** Turn the volume control all the way up. With the game turned on, momentarily place a powered-up AC soldering-pencil on the center tap of the volume control. **DO NOT** use a soldering iron of over 40 watts. Cordless models do **NOT** work for this test.
  - A. **If you hear a low hum**, the power-amplifier chip (TDA2002), volume control, and speaker are okay.
  - B. **If you don't hear a hum**, try the test again with the volume control turned halfway up.

## Maintain That Profitable Game!

**CHECK AND ADJUST PLAYFIELD ACTION** at regular intervals. *Look for problems; don't wait for players to report!* Preventive maintenance catches problems, before games are damaged and the location loses revenue. Check all playfield mechanisms and parts; tighten any loose parts, before they break.

**DIRT SLOWS DOWN THE BALL.** And as the balls slow, so do the quarters. Protect your investment! Clean and wax the playfield at least once a week. At the same time, clean and check the ball(s), replacing any with defects. If the playfield shows wear, use touchup enamel paint to restore the design, and cover the affected area with mylar.

**FLIPPERS ARE THE MOST IMPORTANT PLAYFIELD FEATURE.** They should always operate at full strength. *Test the end-of-stroke (EOS) switch:*

1. Jump the unbanded end of the diode on the flipper coil to the center terminal of the coil.
2. Operate the flipper button.
3. If this technique restores proper operation, the EOS switch contacts require proper servicing. File and burnish the high-current EOS switch contacts *only*.

4. Now adjust both blades (actuating and stationary) together so the flipper pawl opens the EOS switch when the flipper is in the up position.
5. Adjust both switch blades toward each other for good conduction. *Poor strength can also be caused by dirty or misadjusted flipper-button switches.*

**JET BUMPER AND KICKER SWITCHES** must be adjusted for fast response to increase playfield action. On the new drop targets, the back-up blade should be lubricated with **Williams' Drop Target Switch Lubricant** (P/N 20A-8886), or an equivalent light machine lubricant. *This promotes reliable dropping.* Also, lubricate friction points on spinning-target assemblies.

**NORMALLY, NEVER BURNISH OR FILE A LOW-CURRENT BLADE SWITCH.** *Here's the right way to clean and adjust its gold-plated contacts:*

1. Insert a piece of paper currency, slip of paper, or a business card between contact points.
2. Apply firm pressure to both blades while pulling the paper through.
3. Adjust the stationary blade: The contacts should touch when the actuating blade is depressed halfway during the switch's action. *This allows self-cleaning action for the remaining half of travel.*
4. Adjust the actuating blade: It should begin travel at the start of switch activation.

## MAINTENANCE CHECKLIST...

### ● DROP TARGETS

- Replace broken parts, or adjust loose parts.
- Restore wires disconnected from switches or coils.

### ● PLAYFIELD PROBLEMS

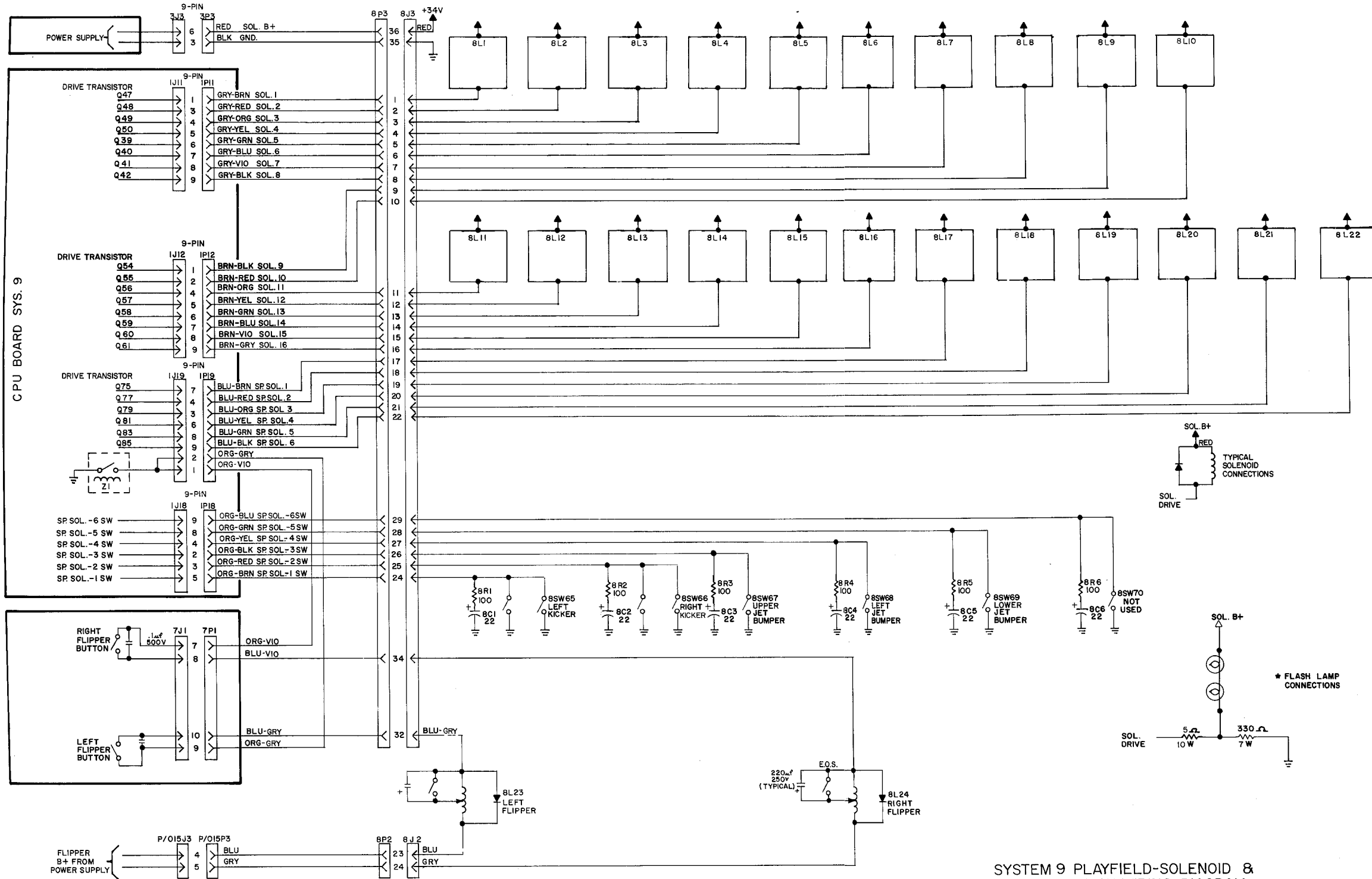
- Regularly check screws and nuts for tightness.
- Replace dirty or worn rubber and plastic parts.
- Check the ball-shooter plunger for proper alignment and smooth operation.
- Do your tilt mechanisms work properly?
- Chipped and worn playfields should be patched or replaced. Careful application of putty and touchup paint can work wonders!
- How well do those flippers align with their ball guides?

### ● LAMPS

- Do they flicker? Don't they light? Check sockets and wiring.
- Replace burned-out bulbs and clean dirty ones.

### ● BACKBOX

- Are those socketed chips properly seated?
- Check for loose connectors and replace damaged ones.
- Are the circuit boards tightly bolted down?
- Check the wiring harness for nicks where it bends over cabinet edges.



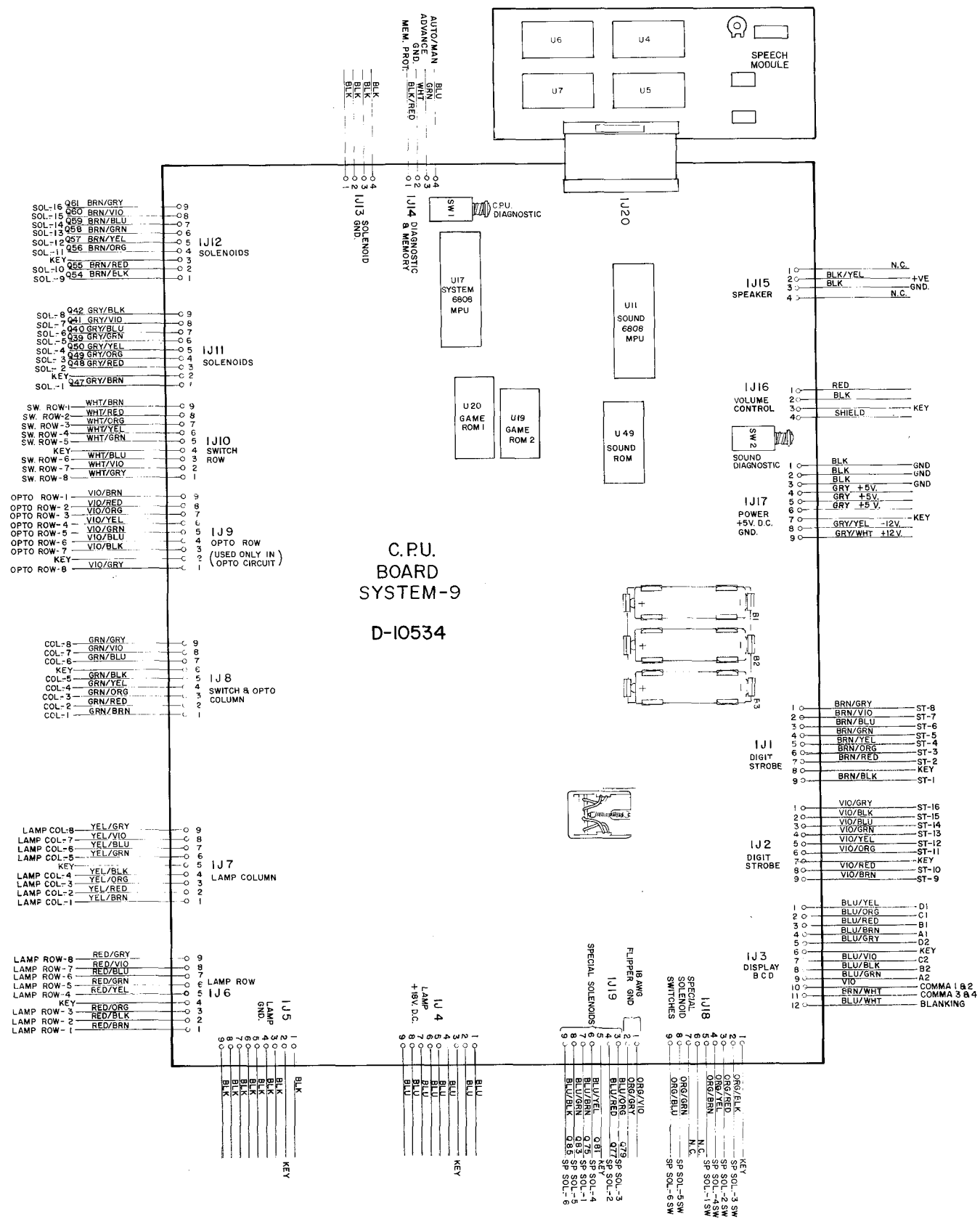
SYSTEM 9 PLAYFIELD-SOLENOID & SPECIAL-SWITCH WIRING DIAGRAM

### SOLENOID LIST

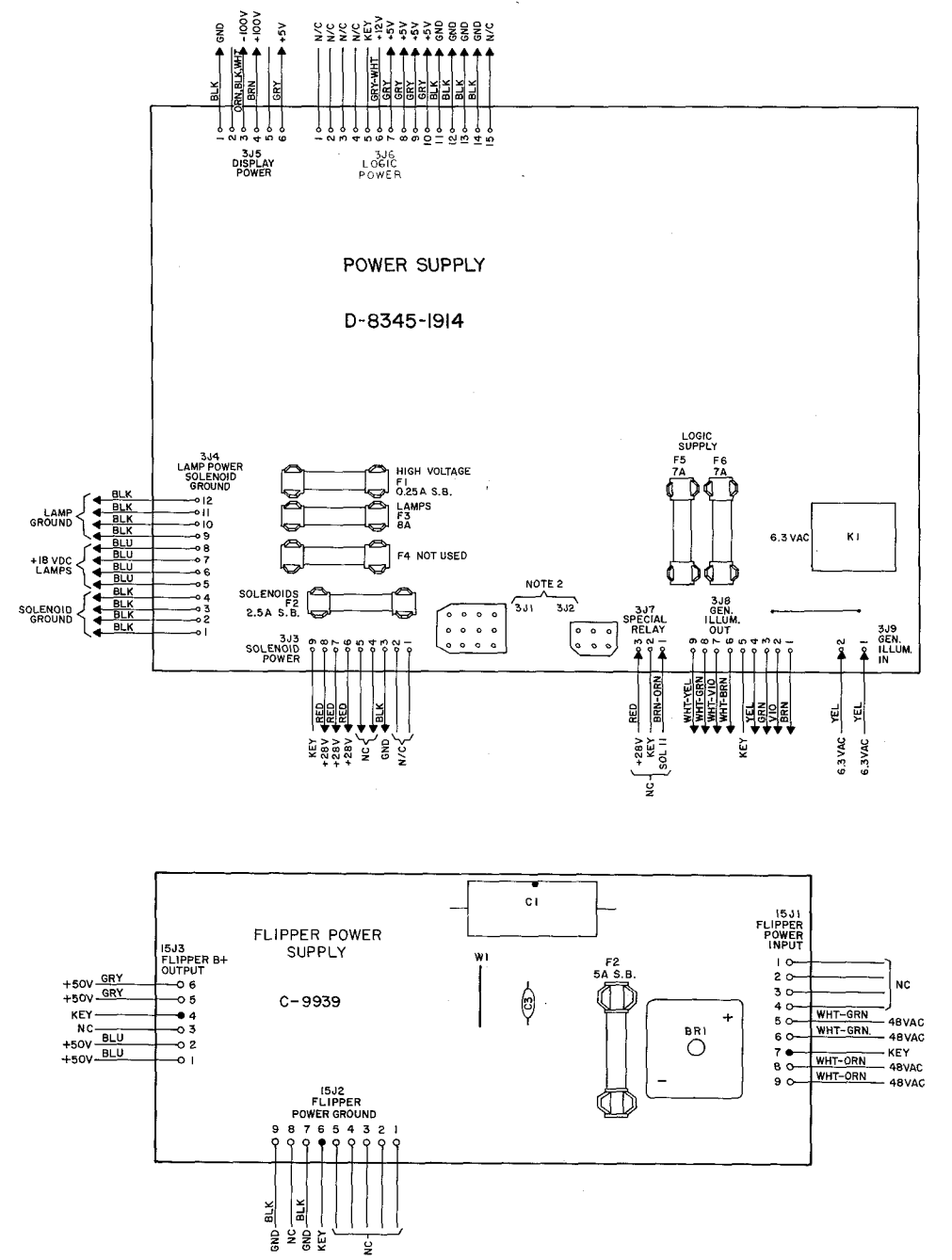
DESIGNATION	DESCRIPTION
8L1	Outhole
8L2	Drop Target
8L3	Fun House Eject
8L4	Corkscrew Flashers
8L5	Cycle Jump Flashers
8L6	Cycle Jump Eject
8L7	Player 1 Flashers
8L8	Player 4 Flashers
8L9	Player 2 Flashers
8L10	General Illumination
8L11	Token Dispenser (Int'l Only)
8L12	Not used
8L13	Not used
8L14	Knocker
8L15	Coin Lockout
8L16	Left Kicker
8L17	Right Kicker
8L18	Upper Jet Bumper
8L19	Left Jet Bumper
8L20	Lower Jet Bumper
8L21	Not used
8L22	Left Flipper
8L23	Right Flipper
8L24	Not used

### SPECIAL SWITCH LIST

DESIGNATION	DESCRIPTION
8SW65	Upper Jet Bumper
8SW68	Left Jet Bumper
8SW69	Lower Jet Bumper
8SW70	Not used



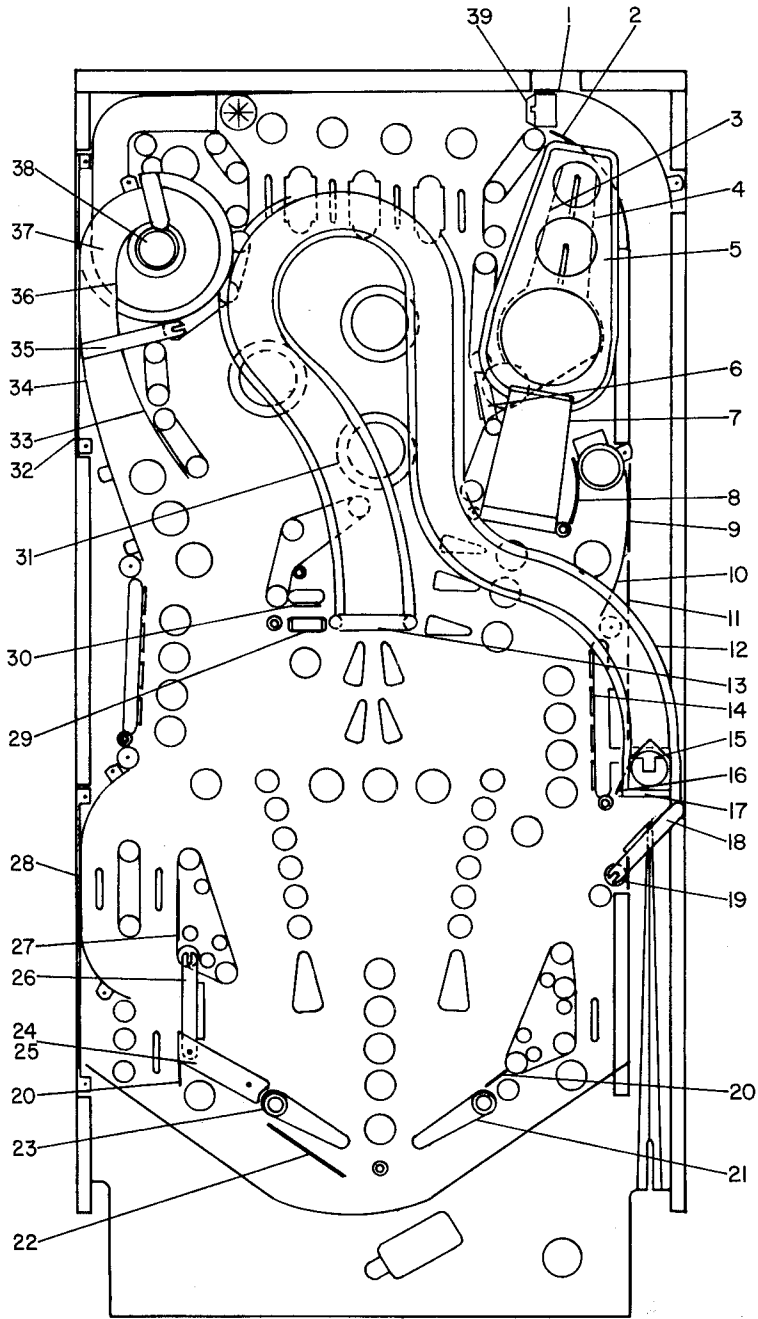
C.P.U. BOARD SYSTEM 9



Backbox PC Boards Wiring Diagrams

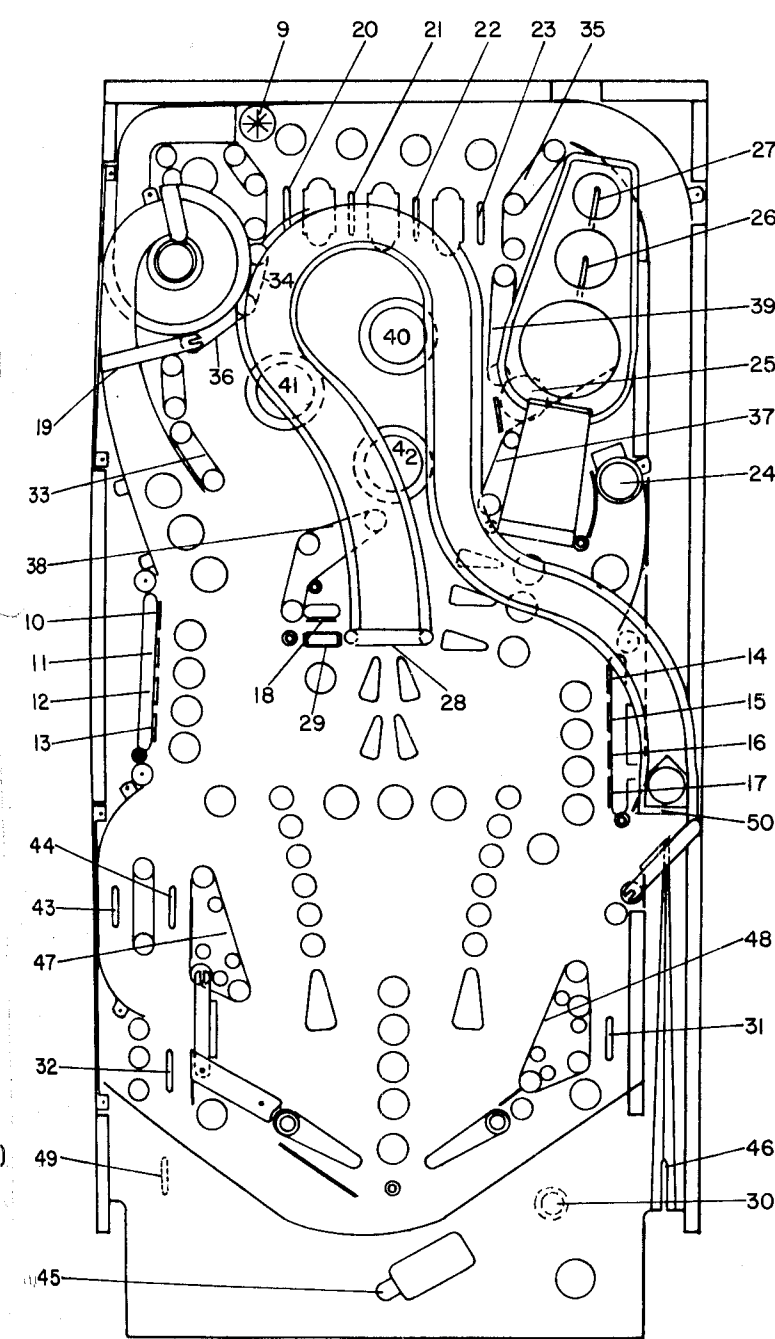
# PLAYFIELD PARTS

ITEM	PART NO.	DESCRIPTION
1	C-10728	Ball Guide Assembly
2	12-6655	Wire Ball Guide
3	B-10715	Ball Guide Assembly
4	B-10714	Ball Guide Assembly
5	C-10784	Hole Cycle Jump Asse
6	A-10827	Ball Gate
a)	01-6936	Bracket
b)	12-6565	Wireform
7	B-10740	Cycle Jump Ramp
8	12-6654	Wire Ball Guide
9	12-6466-12	Wire Ball Guide
10	B-10727	Ball Guide
11	12-6466-24	6" Wire Ball Guide
12	03-7936	COMET Ride Plastic
13	A-10734	COMET Entrance Gate
a)	01-8112	Bracket
b)	12-6658	Wireform
c)	12-6659	Actuator
d)	03-7796-1	Plastic Washer
14	A-9268	Target Assembly
15	A-10735	COMET Exit Gate
a)	01-8114	Bracket
b)	12-6660	Wireform
c)	12-6661	Actuator
d)	03-7796-1	Plastic Washer
16	12-6466-4	1" Wire Ball Guide
17	01-8109	Ramp Support
18	A-10789	Ball Gate Assembly
a)	01-6812-1	Bracket
b)	12-6671	Wireform
19	12-6466-4	1" Wire Ball Guide
20	12-6466-3	3/4" Wire Ball Guide
21	C-9952-R	Right Flipper Assembly
22	12-6466-12	Anti Rebound Wire
23	C-9953-L	Left Flipper Assembly
24	A-10747	Ball Guide Plastic
25	A-10712	Ball Guide Assembly
26	A-10744	Ball Gate Assembly
a)	01-8119	Bracket
b)	12-6671	Wireform
27	12-6466-8	Wire Ball Guide
28	B-10713	Ball Guide Assembly
29	D-9612	Drop Target Assembly
30	A-9618	Stand up Target Asser
31	B-9414	Jet Bumper Assembly <sup>top</sup>
32	B-10713	Ball Guide
33	12-6665	Wire Ball Guide
34	C-10750	Ball Guide
35	A-10751	Ball Gate
a)	01-6644	Bracket
b)	12-6663	Wireform
c)	12-6620	Actuator
36	12-6656	Ball Guide Wire
37	03-7938	Corkscrew Plastic
38	B-10738	Plastic Tube Assembly
39	A-8244	Rebound Gate



# SWITCHES

SWITCH	PART NO.	LOCATION/FUNCTION
1	A-8476	Plumb Bob Tilt
2	B-6572	Ball Roll Tilt
3	B-8536	Credit Button
4	5647-10141-00	Right Coin Switch
5	5647-10141-00	Ctr Coin Switch (Int'l only)
6	5647-10141-00	Left Coin Switch
7	SW-1A-127	Slam Tilt
8	5647-09957-00	High Score Reset
9	B-10516	Corkscrew Rollover
10	A-9268	#1 Duck Target
11	A-9268	#2 Duck Target
12	A-9268	#3 Duck Target
13	A-9268	#4 Duck Target
14	A-9268	#1 Rabbit Target
15	A-9268	#2 Rabbit Target
16	A-9268	#3 Rabbit Target
17	A-9268	#4 Rabbit Target
18	A-9618	Advance Bonus X (EYE)
19	B-8307	Corkscrew Exit Switch
20	B-8410	Top Lane "1"
21	B-8410	Top Lane "9"
22	B-8410	Top Lane "8"
23	B-8410	Top Lane "6"
24	A-9381-R	Fun House Eject
25	A-9381-R	Cycle Jump Lwr Ring Eject
26	B-8410	Cycle Jump Center Ring
27	B-8410	Cycle Jump Upper Ring
28	B-8307	COMET Ramp Entry Switch
29	A-9613	"Dummy Dunk" Target
30	B-9951	Lane Change
31	B-8410	Right Drain Special
32	B-8410	Left Drain Special
33	B-4834-J	Lower Left Standup Switch
34	B-4834-J	Upper Left Standup Switch
35	B-4834-J	Upper Right Standup Switch
36	B-4834-J	Left Center Standup Switch
37	A-4834-K	Lower Right Standup Switch
38	B-4834-J	Center Standup Switch
39	A-4834-K	Center Right Standup Switch
40	A-7459-7	Upper Jet Bumper
41	A-7459-7	Left Jet Bumper
42	A-7459-7	Lower Jet Bumper
43	B-8410	Left Outside Lane
44	B-8410	Left Inside Lane
45	A-10417	Outhole
46	B-8677	Plunger Switch
47	B-8309	Left Kicker
48	B-8309	Right Kicker
49	B-8306	Playfield Tilt
50	B-8307	COMET Ramp Exit Switch
51-64	NOT USED	NOT USED



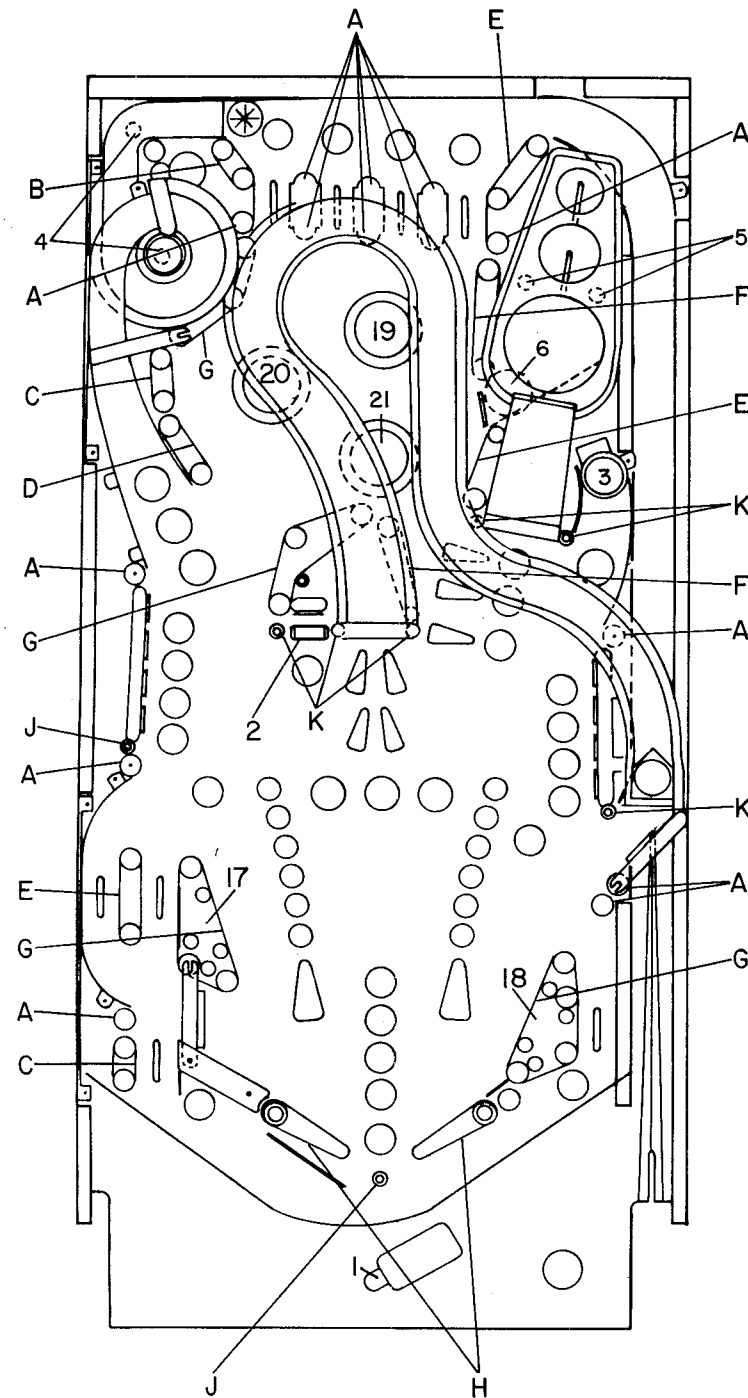
Rollovers: A-5844-46 Switch #46  
 A-5844-52 Switch #26, 27  
 A-5844-35 Switch # 20-23, 31, 32, 43, 44

## SOLENOIDS/FLASHERS

ITEM	PART NO.	LOCATION/FUNCTION
1	SA-23-850-DC	Outhole
2	SA-5-24-750-DC	Drop Target
3	SG1-23-850-DC	Fun House Eject
4	#63 Flashlamps	Corkscrew Flashers
5	#63 flashlamps	Cycle Jump Flashers
6	SG1-23-850-DC	Cycle Jump Eject
7	#63 flashlamps	Player 2 Flashers
8	#63 flashlamps	Player 1 Flashers
9	#63 flashlamps	Player 4 Flashers
10	#63 flashlamps	Player 3 Flashers
11	5580-09555-00	General Illumination
12	NOT USED	—
13	NOT USED	—
14	NOT USED	—
15	SA-4-23-850-DC	Knocker
16	SM-35-4000-DC	Coin-Lockout
17	SG1-23-850-DC	Left Kicker
18	SG1-23-850-DC	Right Kicker
19	SG1-23-850-DC	Upper Jet Bumper
20	SG1-23-850-DC	Left Jet Bumper
21	SG1-23-850-DC	Lower Jet Bumper
22	NOT USED	—
	FL23/600-30/2600-50VDC	Right Flipper
	FL23/600-30/2600-50VDC	Left Flipper

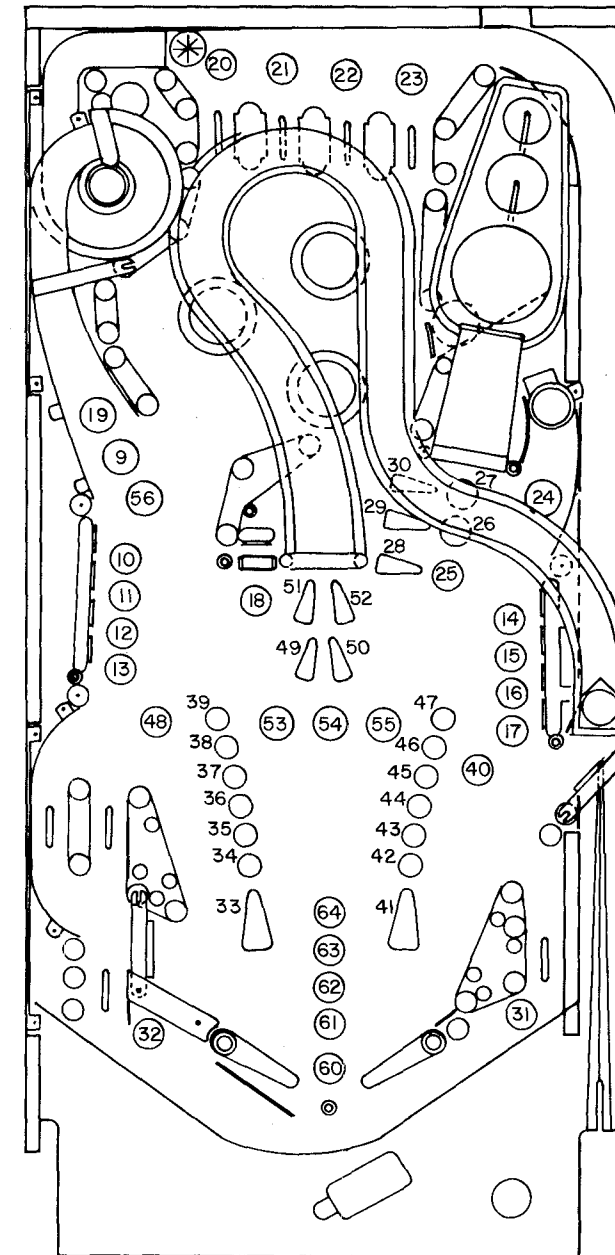
## RUBBER PARTS

ITEM	PART NO.	DESCRIPTION
A	23-6300	5/16" Ring
B	23-6301	3/4" Ring
C	23-6302	1" Ring
D	23-6303	1 1/4" Ring
E	23-6304	1 1/2" Ring
F	23-6305	2" Ring
G	23-6306	2 3/8" Ring
H	23-6519-4	Ring-Red
J	23-6535	Bumper
K	23-6556	Sleeving



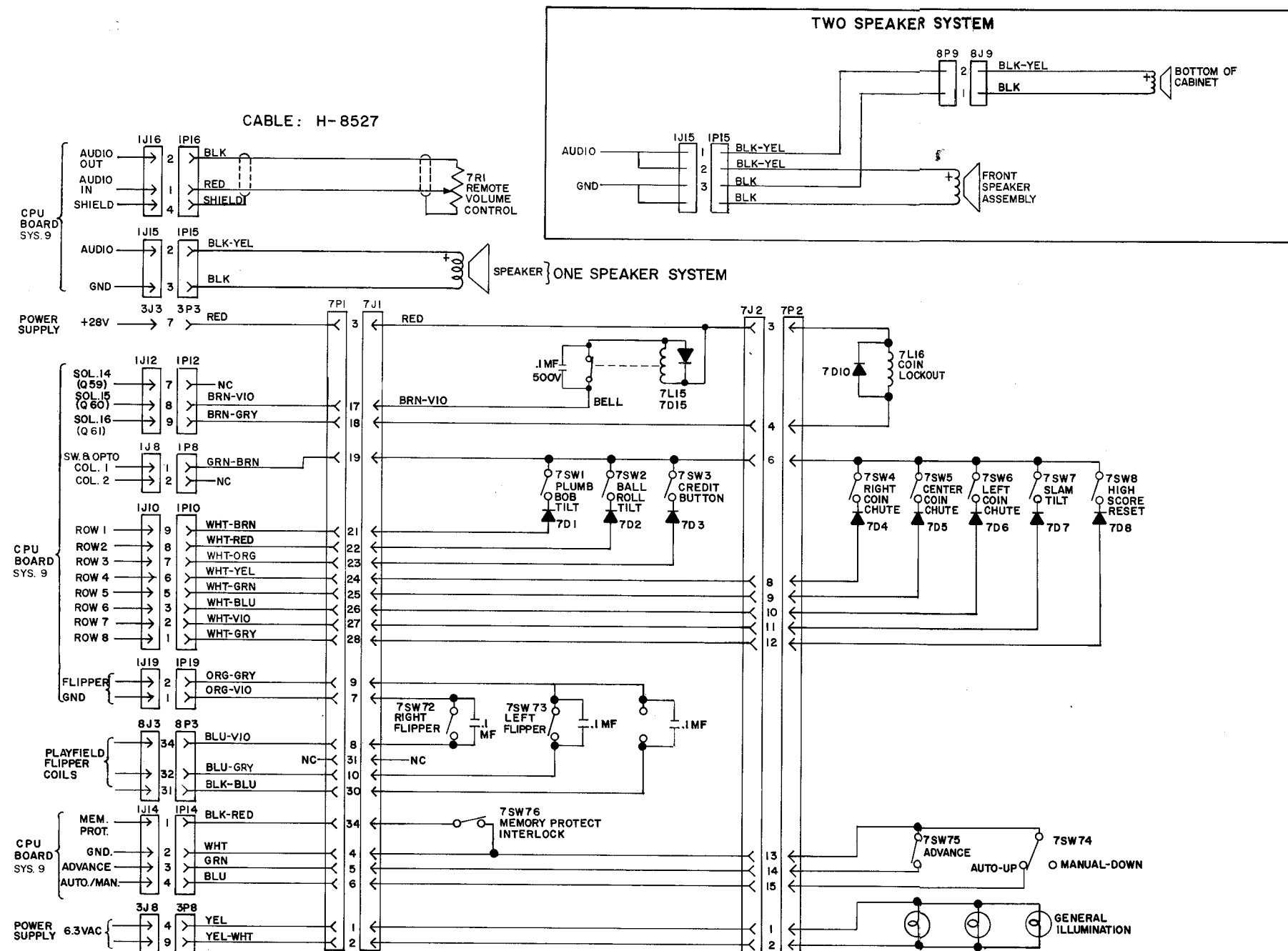
## LAMPS

### LAMP LOCATION/DESCRIPTION



1	Game Over (Backglass)
2	Match (Backglass)
3	Tilt (Backglass)
4	High Score to Date (Backglass)
5	Ride Again (Backglass)
6	Ball-in-Play (Backglass)
7	COMET Eyes (Backglass)
8	COMET Eyes (Backglass)
9	Corkscrew Special
10	#1 Duck Target
11	#2 Duck Target
12	#3 Duck Target
13	#4 Duck Target
14	#1 Rabbit Target
15	#2 Rabbit Target
16	#3 Rabbit Target
17	#4 Rabbit Target
18	Duck Advance Bonus
19	Collect Duck Bonus
20	Top Lane "1"
21	Top Lane "9"
22	Top Lane "8"
23	Top Lane "6"
24	Collect Rabbit Bonus
25	Cycle Jump 20K
26	Cycle Jump 50K
27	Cycle Jump 200K
28	Cycle Jump Extra Ball (lwr)
29	Cycle Jump Extra Ball (mid)
30	Cycle Jump Extra Ball (top)
31	Right Drain Special
32	Left Drain Special
33	Duck Outhole Bonus
34	X 1 Duck Bonus
35	X 2 Duck Bonus
36	X 4 Duck Bonus
37	X 8 Duck Bonus
38	X 16 Duck Bonus
39	X 32 Duck Bonus
40	All Rabbits Down
41	Rabbit Outhole Bonus
42	X 1 Rabbit Bonus
43	X 2 Rabbit Bonus
44	X 4 Rabbit Bonus
45	X 8 Rabbit Bonus
46	X 16 Rabbit Bonus
47	X 32 Rabbit Bonus
48	All Ducks Down
49	COMET Ramp 30K
50	COMET Ramp 50K
51	COMET Ramp 100K, Lights Extra Ball
52	COMET Ramp 100K, Lights Special
53	All Scores X2
54	All Scores X3
55	All Scores X5
56	Corkscrew Extra Ball
57	ONE MILLION (Cycle Jump)
58	Win a Million (Backglass)
59	NOT USED
60	Ride Again (Playfield)
61	2X
62	3X
63	4X
64	5X

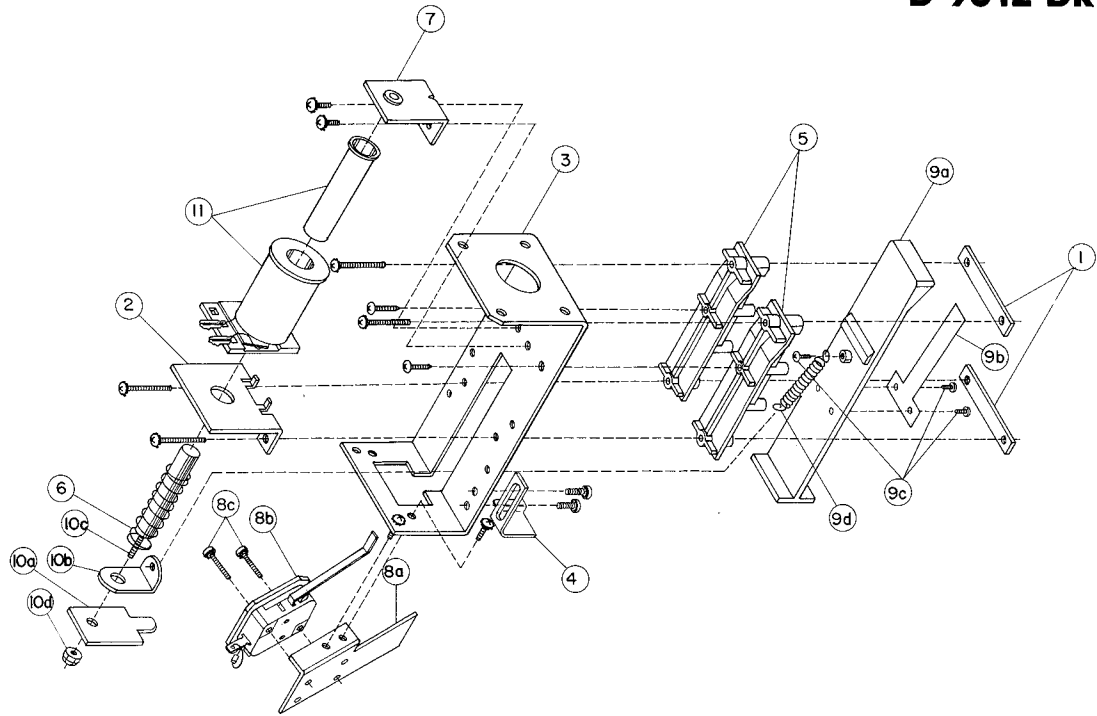




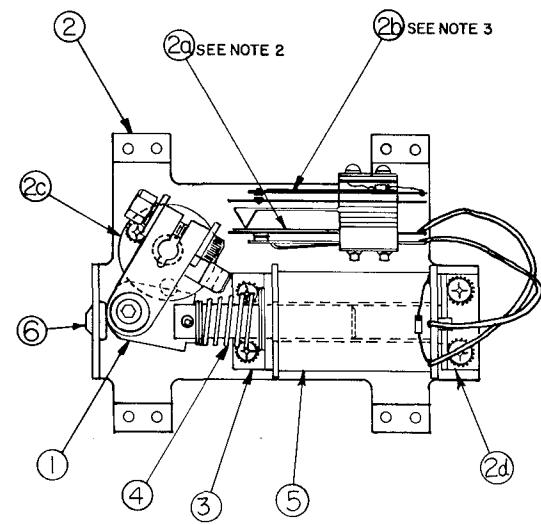
SYSTEM 9 CABINET WIRING DIAGRAM

NOTE:  
Additional details about the General Illumination circuit appear on the later illustration entitled "Power Wiring Diagram".

## D-9612 DROP TARGET ASSEMBLY



ITEM	PART NO.	DESCRIPTION
1	01-7572	Target Retaining Bracket
2	01-7689	Coil Support Bracket
3	01-7575-1	Drop Target Frame
4	01-7688	Adjustment Bracket
5	03-7479	Drop Target Guide
6	10-128	Kicker Spring
7	A-9548	Coil Stop Assembly
8	A-9613	Switch & Bracket Assembly
8a	01-7618	Microswitch Bracket
8b	17-1042	Microswitch w/o diode
8c	4004-01003-10	4-40 x 5/8 Mach Screw
9	B-9534	Drop Target Assembly
9a	03-7773-4	Drop Target
9b	01-7037	Target Backup Blade
9c	4104-01001-04	4 x 1/4 S Mach Screw
9d	10-364	Retractor Spring
10	B-9744	Reset Finger Assembly
10a	01-7570	Reset Finger
10b	01-7571	Spring Holder
10c	02-3972	Drop Target Plunger
10d	4410-01132-00	10-32 Nut ESN
11	SA5-24-750-DC	Coil Assembly

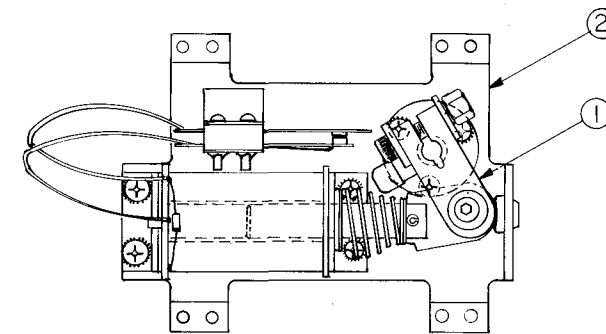


## C-9952-R FLIPPER ASSEMBLIES

ITEM	PART NO.	DESCRIPTION
1	B-10655-R	Crank Link Assembly
2	C-9954-R	Flipper Base/Lane Change Assembly
2a	03-7811	End of Stroke (EOS) Switch
2b	SW-1A-150	Lane Change Switch
2c	03-7568	Flipper Bushing
2d	A-10280	Flipper Stock Bracket Assembly
3	01-7695	Solenoid Bracket
4	10-376	Coil Plunger Spring
5	FL 23/600-30/2600	Flipper Coil
6	23-6577	Bumper Plug

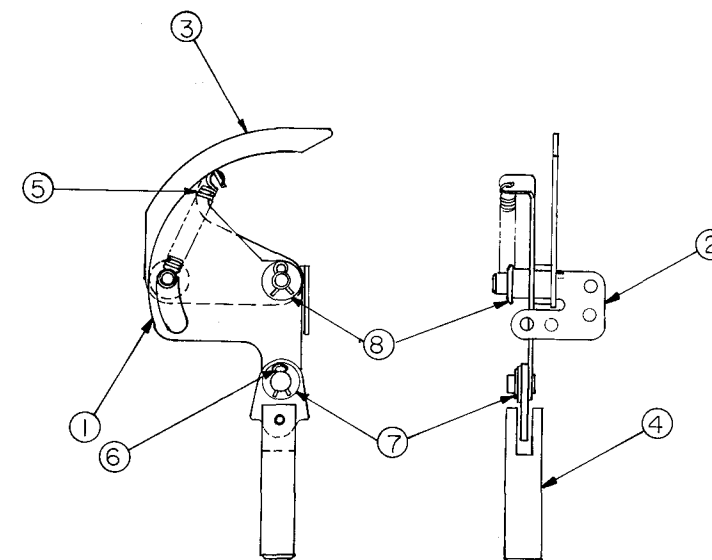
### NOTES:

- Each Flipper Assembly is mounted below the playfield, in conjunction with the plastic flipper and shaft (20-9250) and flipper rubber (23-6519) (on the upper side of the playfield).
- The tip of the EOS Switch must travel .015 (+.010, -.000 inch), before the contacts fully open with the flipper in the actuated position. The EOS Switch contacts must have a gap of .062 (±.015) inch. Any adjustment of the EOS Switch must be made at a minimum distance of .25 inch from the switch body.
- The Lane Change Switch must have a gap of .046 (±.015) inch, when fully open.
- All moving elements of the assembly must operate freely without any evidence of binding.
- Coil plunger spring must fit within the four lugs of the solenoid bracket.
- For coil replacement, remove solenoid bracket, (item 3) to prevent screw damage.
- Use Loctite when reassembling flipper stop bracket screws.
- When using bumper plug on older flipper assemblies, readjust flipper position.
- Solid color grey (or blue) wire connects to the banded end of the diode, mounted on the connector end of flipper coil (item 5). Wire with trace color connects to the unbanded end of the diode.

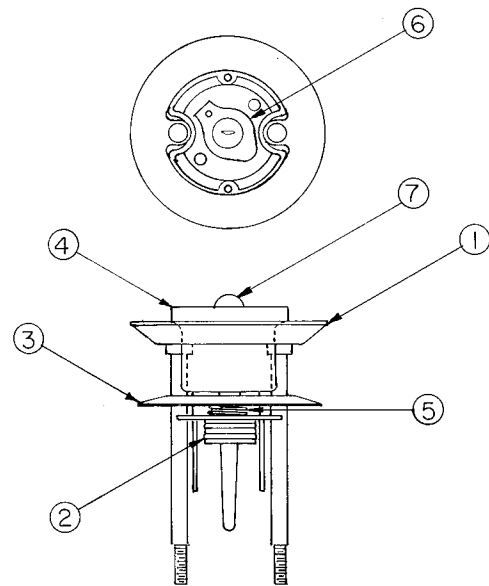


## C-9953-L UNIQUE PARTS

ITEM	PART NO.	DESCRIPTION
1	B-10655-L	Crank Link Assembly, Left
2	C-9957-L	Flipper Sub Base Assembly

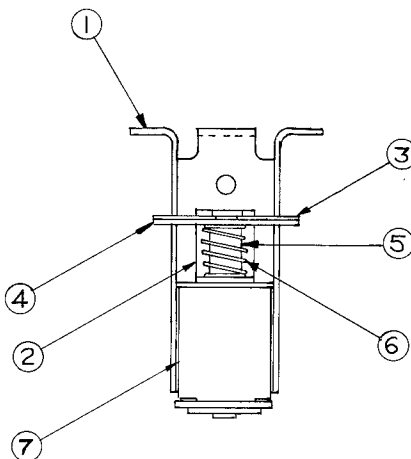


## B-9414 JET BUMPER ASSEMBLY



ITEM	PART NO.	DESCRIPTION
1	A-4754	Bumper Ring Assembly
2	03-6009-A5	Bumper Base
3	03-6035-5	Bumper Wafer
4	03-7443-5	Bumper Body
5	10-7	Bumper Spring
6	24-6416	Bumper Socket
7	24-6549	#44 Bulb

## B-9415 JET BUMPER COIL ASSEMBLY



ITEM	PART NO.	DESCRIPTION
1	B-7417	Bracket and Stop Assembly
2	01-1747	Coil Retaining Bracket
3	01-5492	Armature Link Steel
4	01-5493	Armature Link Bakelite
5	02-3406-1	Coil Plunger
6	10-326	Armature Spring
7	SG1-23-850-DC	Solenoid Coil

## B-9361-R-3 BALL EJECT ASSEMBLY—RIGHT

ITEM	PART NO.	DESCRIPTION
1	A-6949-R	Spring Plate
2	A-6950-R	Mounting Bracket Assembly
3	A-7471-R	Eject Cam Assembly
4	A-5103	Coil Plunger Assembly
5	10-362	Spring-Eject
6	12-6227	Hair Pin Clip
7	4700-00030-00	17/64 x 1/2 x 15G
8	4700-00103-00	17/64 x 1/2 x .015

## Miscellaneous Playfield Assemblies

## **CHAPTER 4 Schematic & Assembly Drawings**

**Speech Board Parts List and Diagram**

**Speech Board Schematic Diagram**

**CPU-Board Parts List and Diagram**

**D-10535 CPU-Board Logic Diagram  
(Sheet 1 of 3)**

**D-10535 CPU-Board Logic Diagram  
(Sheet 2 of 3)**

**D-10535 CPU-Board Logic Diagram  
(Sheet 3 of 3)**

**D-8345 Power-Supply Parts List and Diagram**

**D-8345 Power-Supply Schematic Diagram**

**C-8365 Slave-Display Diagram**

**D-10749 Master Display Board Parts List and Diagram**

**D-10749 Master Display Board Schematic Diagram**

**Backbox Insert Board Wiring Diagram**

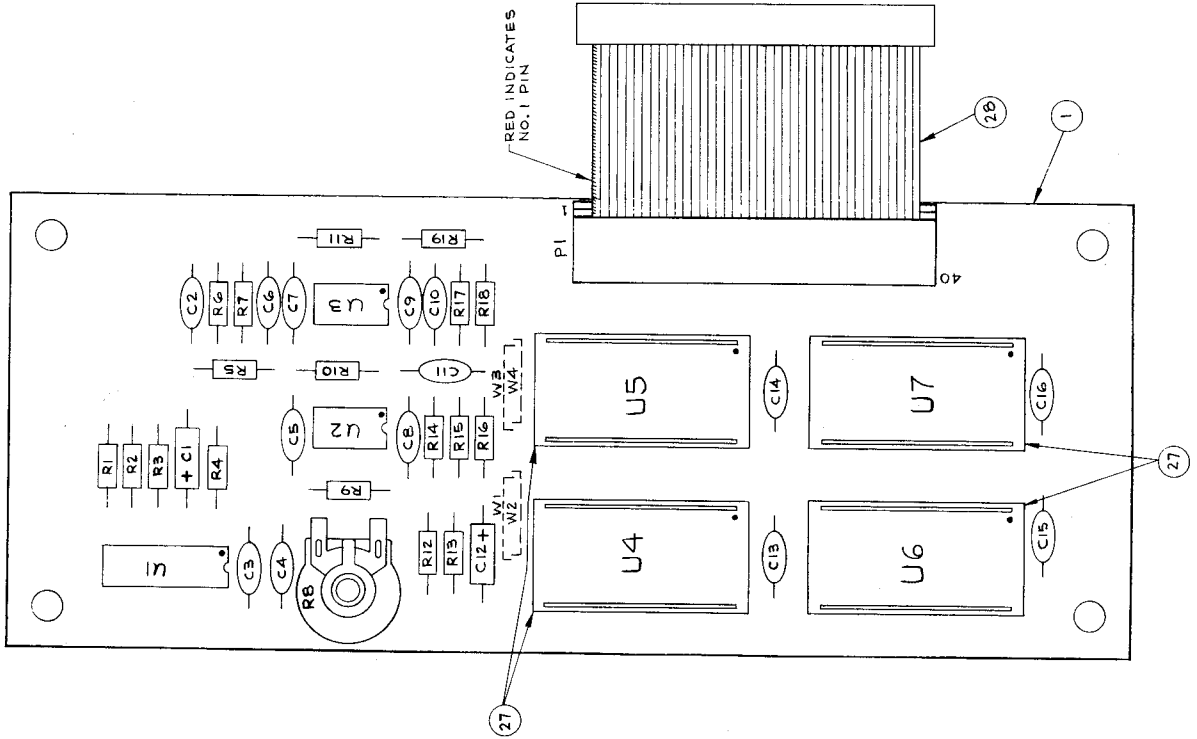
**Power-Wiring Diagram**

**BILL OF MATERIAL**

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQD. NO.
1	10665-00		BARE P.C. BOARD	1
2	5370-	U1	555HZ CONTINUOUSLY VARIABLE SLOPE DELTA MODULATOR	1
3	02691-00	U2, U3	1458 DUAL OP-AMP.	2
4	5010-09534-00	W2, W4	RESISTOR, C.F., 0 OHM	2
5				
6				
7				
8				
9				
10	5010-08896-00	R11	RESISTOR, FC, 220 K OHM 5% 1/4 WATT	1
11	5010-09334-00	R4, R2, R3, R4, R14, R16	RESISTOR, FC, 10 K OHM 5% 1/4 WATT	6
12	5010-08824-00	R5	RESISTOR, FC, 45 K OHM 5% 1/4 WATT	1
13	5010-09333-00	R6	RESISTOR, FC, 180 K OHM 5% 1/4 WATT	1
14	5010-09342-00	R7	RESISTOR, FC, 36 K OHM 5% 1/4 WATT	1
15	5010-09345-00	R8	POTENTIOMETER, 5K OHM	1
16	5010-09324-00	R9, R10, R15, R18, R19	RESISTOR, FC, 27 K OHM 5% 1/4 WATT	5
17	08997-00	R12, R13	RESISTOR, FC, 2.7 K OHM 5% 1/4 WATT	2
18	5010-08772-00	R17	RESISTOR, FC, 15 K OHM 5% 1/4 WATT	1
19	5043-09030-00	C4	CAPACITOR, .047 MFD, 20% 50 VOLT	1
20	5046-01370	C6	CAPACITOR, POLYSTYRENE 180 PFD, 5% 100 VOLT	1
21	5043-09043-00	C9, C5, C1, C8, C9, C13 THRU C16	CAPACITOR, CERAMIC, .01 MFD, 150%-20% 50 VOLT	9
22	5047-09031-00	C1	CAPACITOR, TANTALUM, 1 MFD, 20% 25 VOLT	1
23	5046-0847	C2	CAPACITOR, POLYSTYRENE 1800 PFD, 5% 50 VOLT	1
24	5040-09243-00	C12	CAPACITOR, ELECTROLYTIC, 10 MFD, 20% 30 VOLT LOW LEAK	1
25	5046-08348	C11	CAPACITOR, POLYSTYRENE 4100 PFD, 5% 50 VOLT	1
26	5046-08346	C10	CAPACITOR, POLYSTYRENE 1200 PFD, 5% 50 VOLT	1
27	5700-09004-00		24 PIN SOCKET	4
28	5045-09152-00	PI	RIBBON CABLE ASSEM.	1

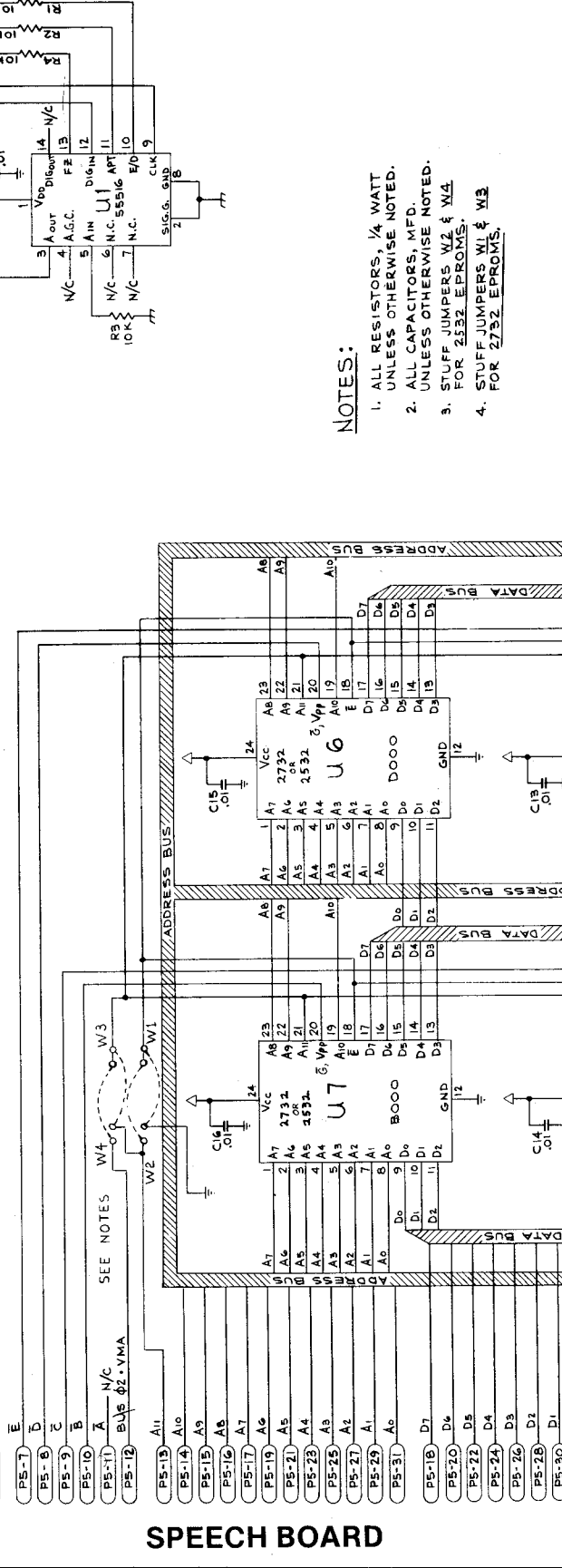
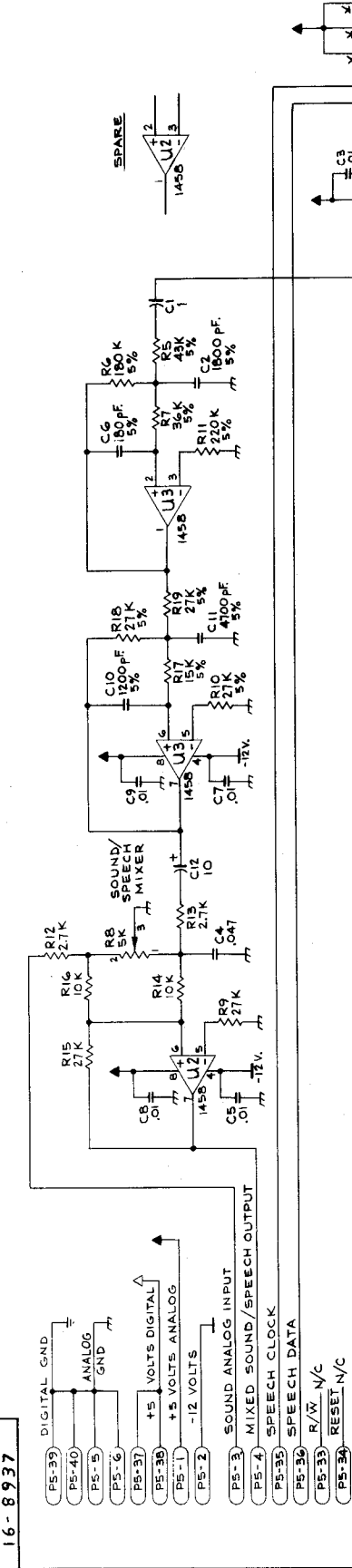
**NOTES:**

- FOR SCHEMATIC, REFER TO DWG. # 16-8937.
- ASSEMBLY IS C-10716-GAME NUMBER.
- INSTALL W1 & W3 FOR ASSEMBLIES USING 2732 ROMS.
- INSTALL W2 & W4 FOR ASSEMBLIES USING 2532 ROMS.
- SEE ROM SUMMARY FOR ROM PART NUMBER.



**Speech Board**

TOLERANCES	1	C-10717
UNLESS OTHERWISE SPECIFIED		
FINISH		
DECIMAL	.001	
HOLE DIA	.002	
ANGLE	45	
SCREEN THREADS	CLASS 2	
MATERIAL	2-27-88	2:1
HEAT TREATMENT		
FINISH		
NAME	SPEECH MODULE SUB-ASSEM.	
ADDRESS	3801 N. CALIFORNIA, CHICAGO, ILL. 60618	
CITY	CHICAGO	
STATE	ILL.	
COUNTRY	U.S.A.	
DATE	2-27-88	
BY	M. LOFFRENGO	
REVISED		
REVISION		
LETTER		
NEW PART RELEASE	3/7/88	
REVISION	3-11-88	
BY		



**NOTES:**

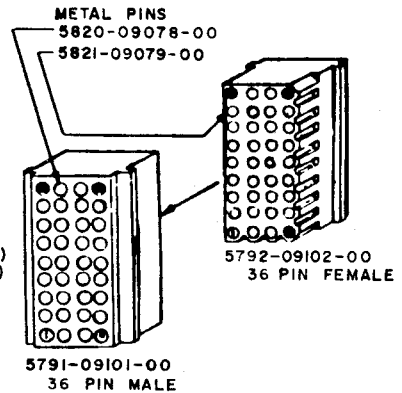
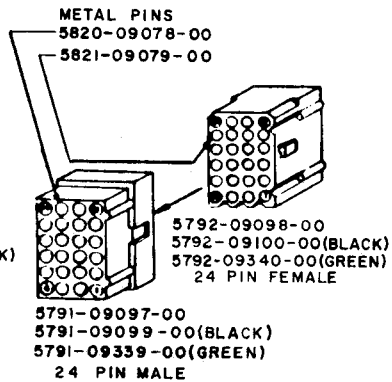
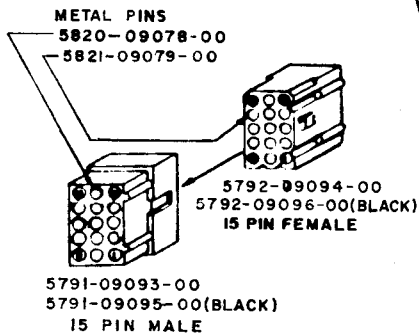
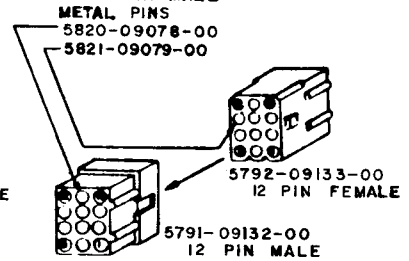
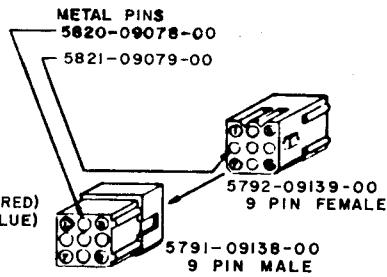
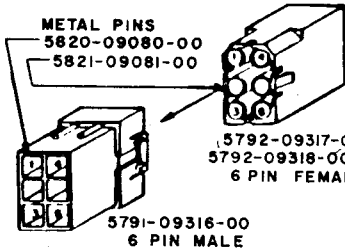
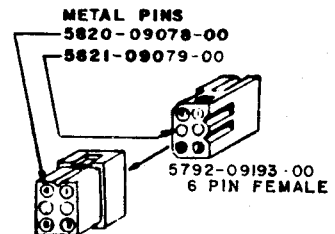
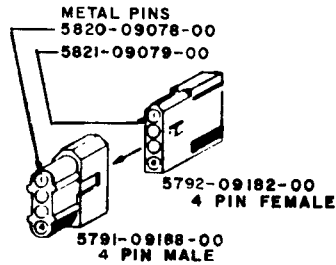
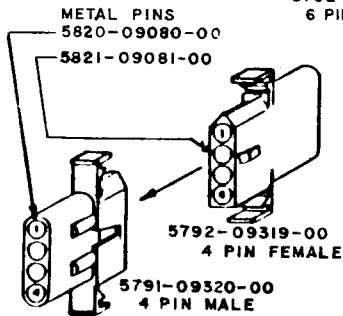
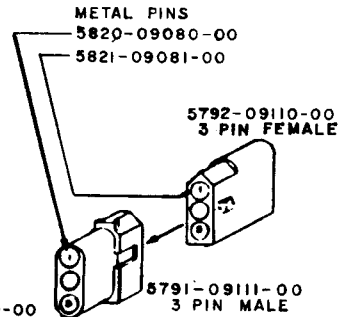
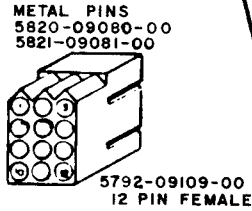
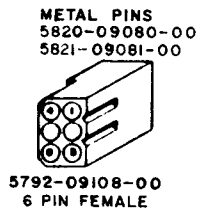
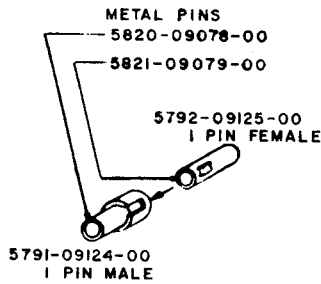
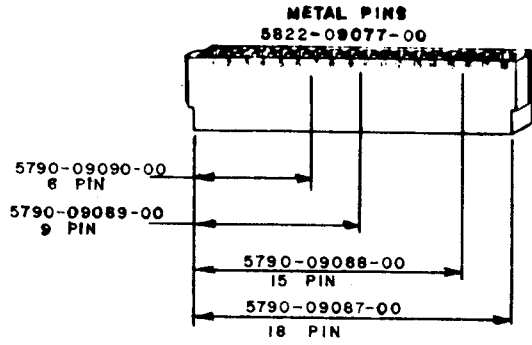
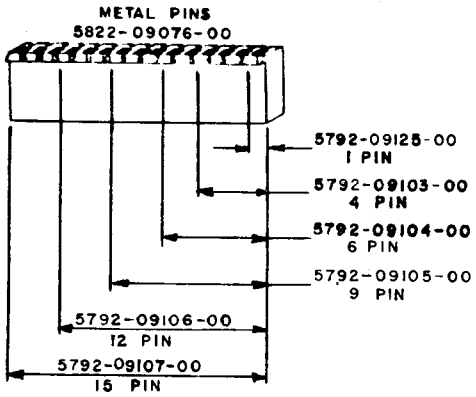
1. ALL RESISTORS, 1/4 WATT UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS, MFD.
3. STUFF JUMPERS W2 & W4 FOR 2532 EPROMS.
4. STUFF JUMPERS W1 & W3 FOR 2732 EPROMS.

TOLERANCES UNLESS OTHERWISE SPECIFIED	RESISTORS	±1%	CAPACITORS	±5%
ANGULAR DIMENSIONS	UNLESS OTHERWISE SPECIFIED			
SCREEN THREADS	UNLESS OTHERWISE SPECIFIED			
MATERIAL	UNLESS OTHERWISE SPECIFIED			
HEAT TREATMENT	UNLESS OTHERWISE SPECIFIED			
DATE	2-27-85	BY	JAW	
REV. NO.	4	SCALE		
QTY.	1	ASSEMBLY DR.		
WILLIAMS ELECTRONICS, INC.				
3401 N. CALIFORNIA				
CHICAGO, ILL. 60641				
CORNELIA 7388				
NAME SCHEMATIC, SPEECH MODULE				
PROJECT NO.				
16-8937				

**SPEECH BOARD**

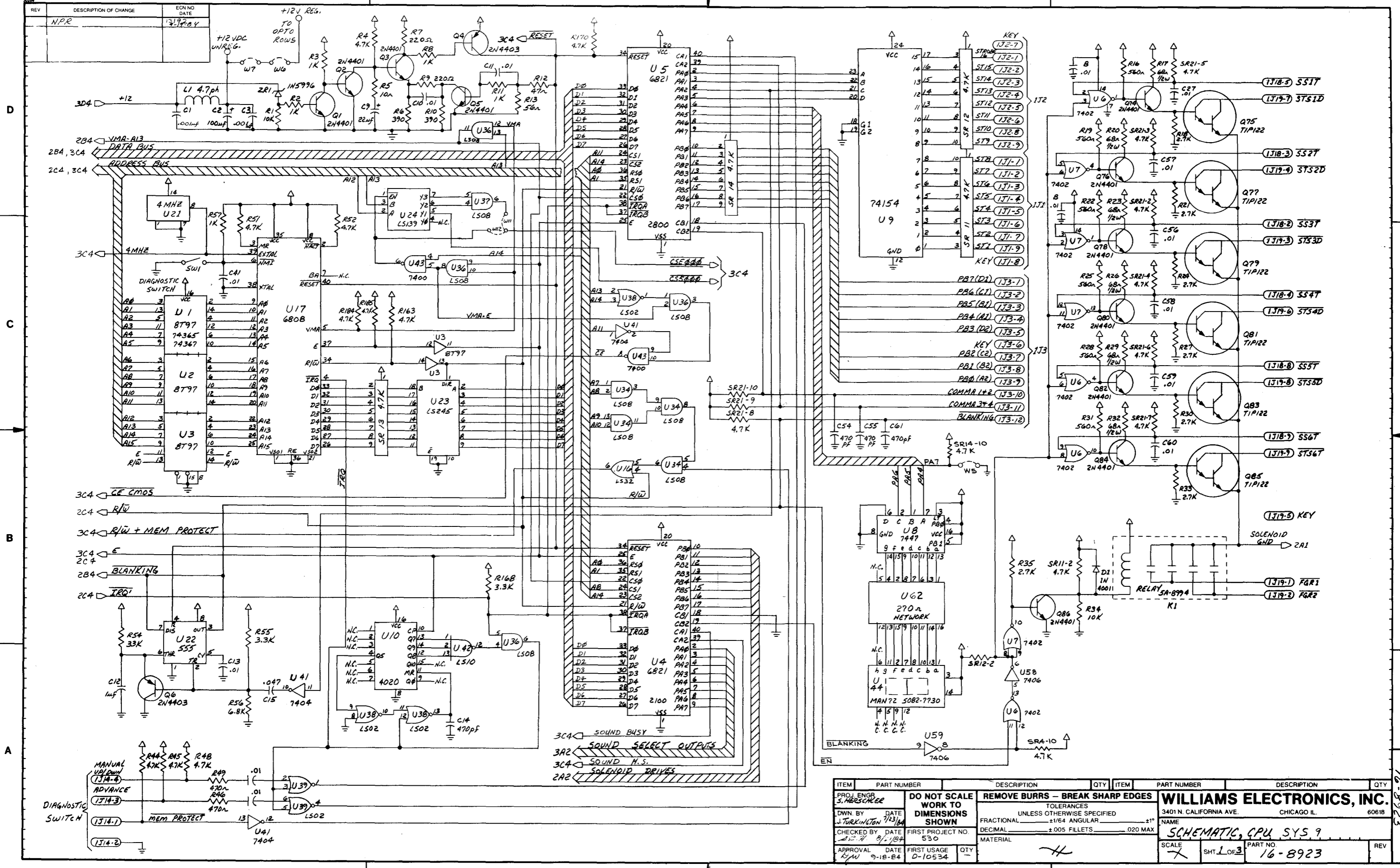
REVISION	BY	DATE
13755		3-1-85
NEW PART RELEASE		

# PLUGS & JACKS





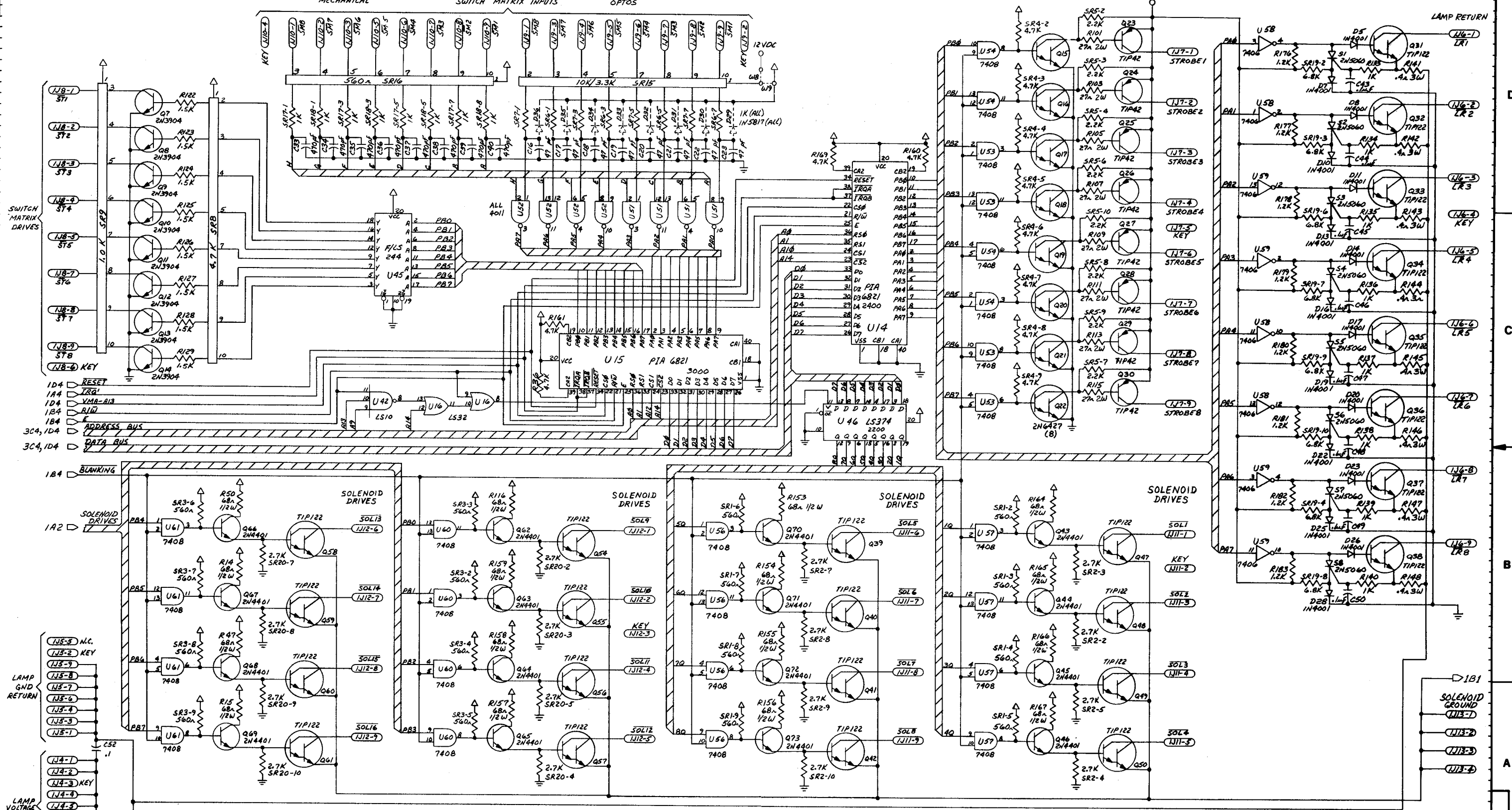
REV	DESCRIPTION OF CHANGE	ECN NO	DATE
NPR		13192	7-17-84



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR	S. HERSCHER	DO NOT SCALE		<b>WILLIAMS ELECTRONICS, INC.</b>			
DWN BY	J. TURKINGTON	WORK TO DIMENSIONS SHOWN		3401 N. CALIFORNIA AVE. CHICAGO IL. 60618			
CHECKED BY	R. W. 8/1/84	FIRST PROJECT NO. 530		NAME: SCHEMATIC, CPU SYS. 9			
APPROVAL	R/W 9-18-84	FIRST USAGE D-10534		SCALE: 1/8" = 1" PART NO. 16-8923			



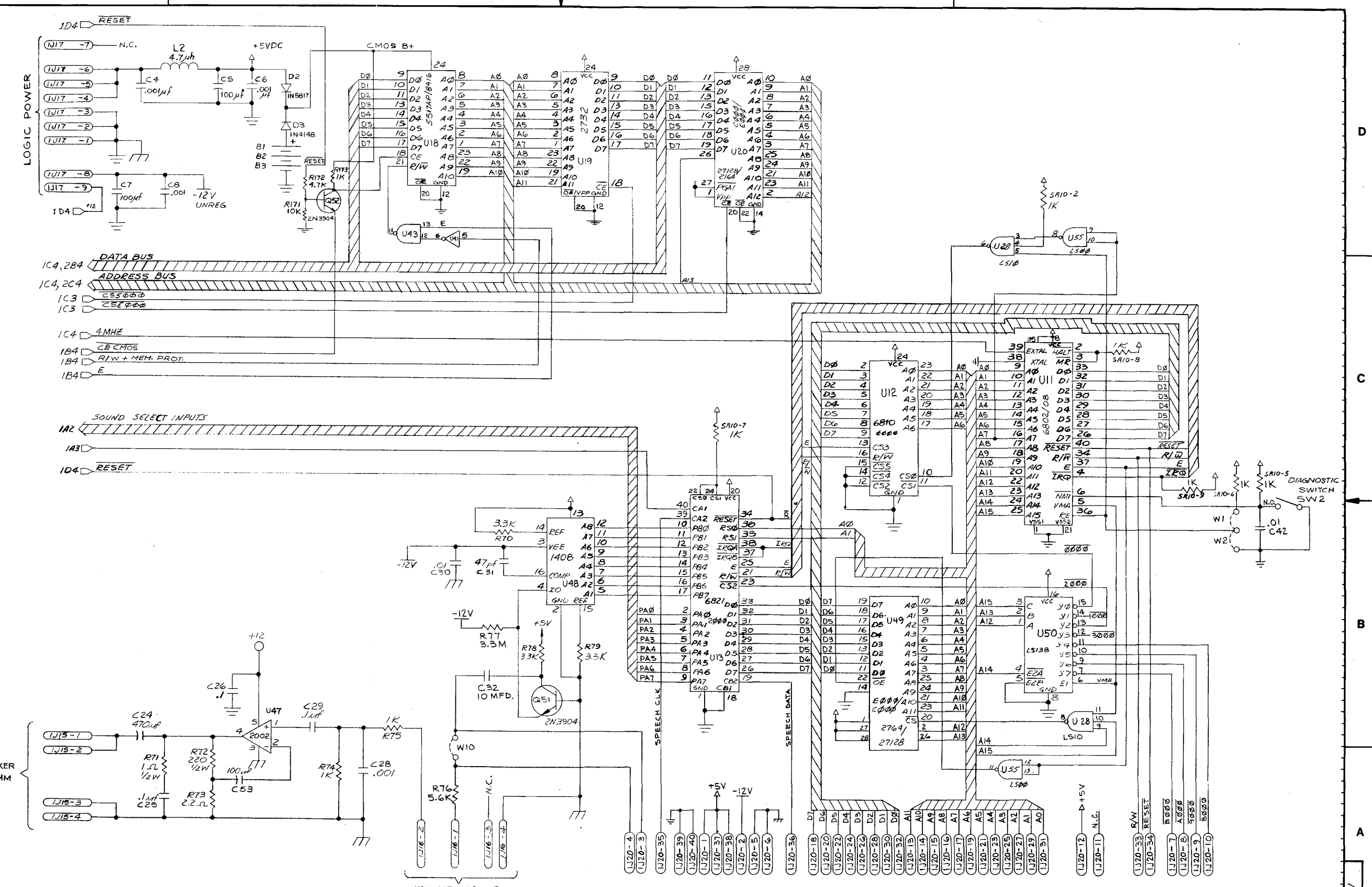
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NPR		DATE
		12182
		2-18-84



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
<b>DO NOT SCALE WORK TO DIMENSIONS SHOWN</b>							
<b>REMOVE BURRS - BREAK SHARP EDGES</b>							
TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONAL ±1/64 ANGULAR ±1° DECIMAL ±.005 FILLETS .020 MAX							
PROJECT ENGR: S. HERSCHLER DOWN BY DATE: J. TURKINGTON 9/18/84 CHECKED BY DATE: [Signature] 9/18/84 APPROVAL DATE: 9-18-84				<b>WILLIAMS ELECTRONICS, INC.</b> 3401 N. CALIFORNIA AVE. CHICAGO, IL. 60618 NAME: SCHEMATIC, CPU SYS 9 SCALE: 7x SHT 2 OF 3 PART NO: 16-8923 REV:			

16-8923

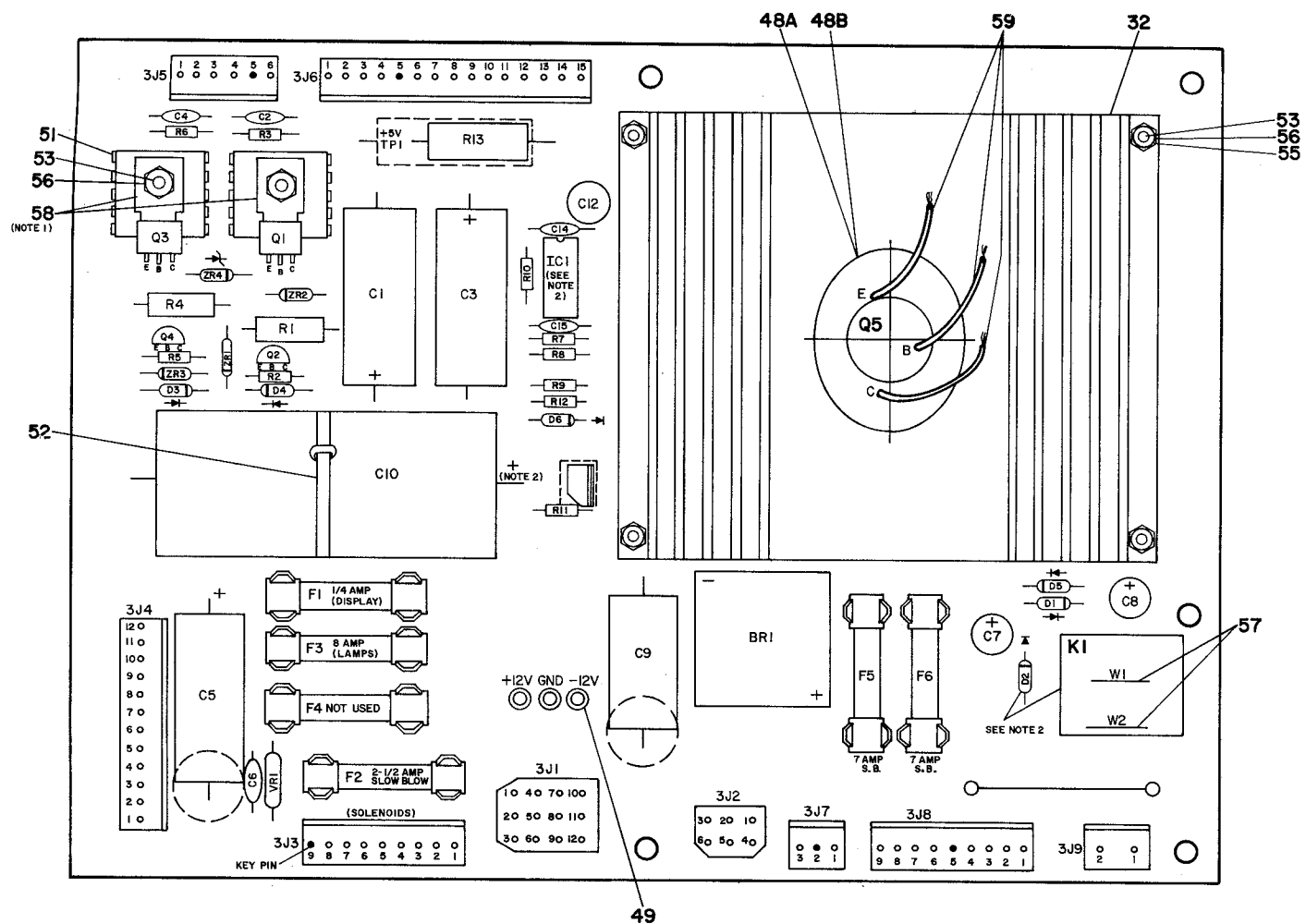
REV	DESCRIPTION OF CHANGE	ECN NO DATE
	NPR	13192 9-17-84



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR S. HERSCHLER		DO NOT SCALE WORK TO DIMENSIONS SHOWN		REMOVE BURRS - BREAK SHARP EDGES		TOLERANCES UNLESS OTHERWISE SPECIFIED	
DWN BY DATE		FIRST PROJECT NO 530		FRACTIONAL ±1/64 ANGULAR ±1°		NAME SCHEMATIC, CPU SYSTEM-9	
CHECKED BY DATE		FIRST USAGE D-10534		DECIMAL ±.005 FILLETS .020 MAX		SCALE 7	
APPROVAL DATE 9.18.84		QTY		MATERIAL		PART NO. 16-8923	
						SHT 3 OF 3	

**WILLIAMS ELECTRONICS, INC.**  
 3401 N. CALIFORNIA AVE. CHICAGO IL. 60618  
 SCALE 7  
 SHT 3 OF 3  
 PART NO. 16-8923  
 R'V

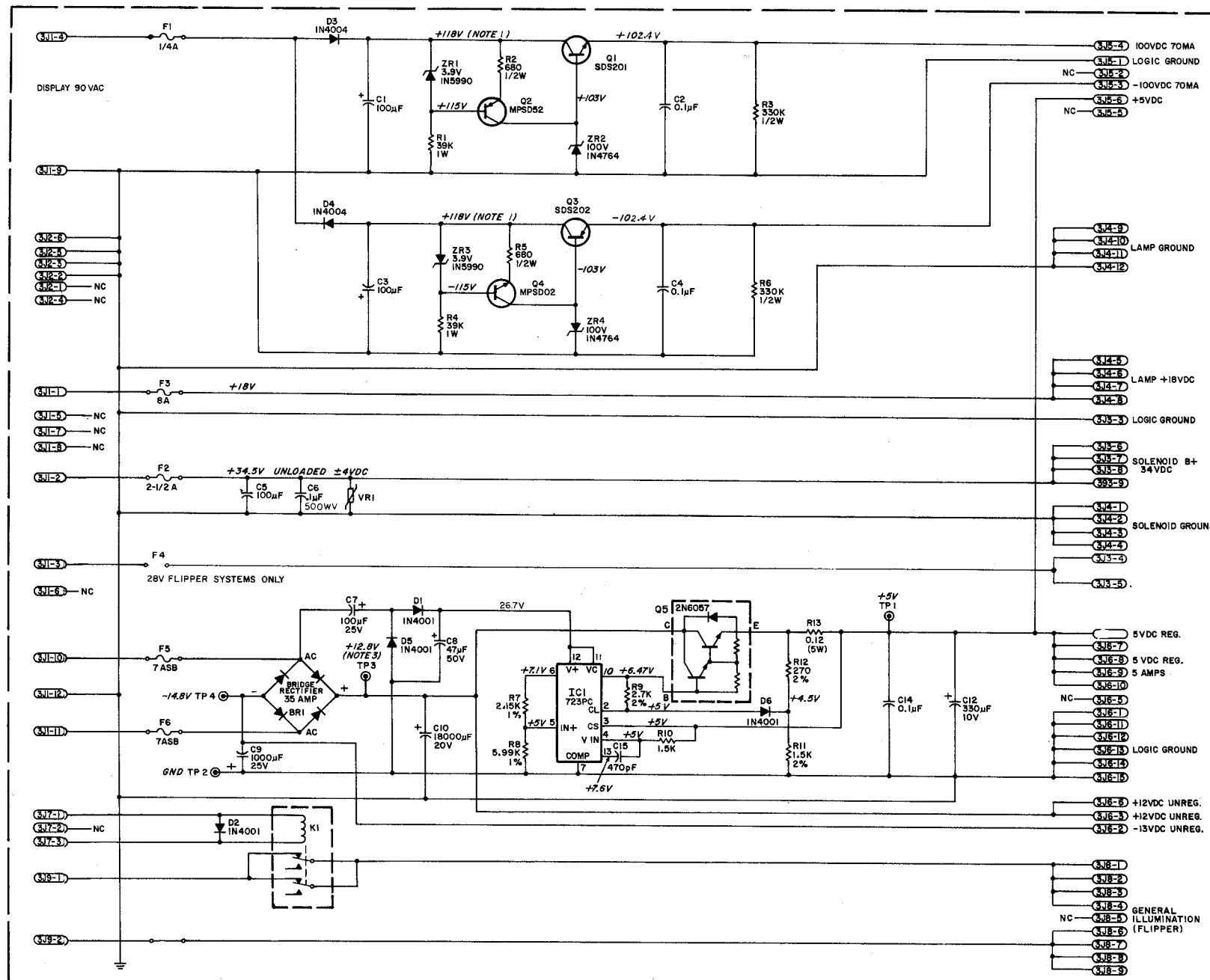
16-8923



1. DISPLAY VOLTAGE MEASURED WITH DIGITS DISPLAY TEST ON & DISPLAYS AT ALL ZEROS.
2. UNLESS OTHERWISE INDICATED ALL RESISTORS ARE IN OHMS ( $\Omega$ ) 1/4 WATT.
3. TP3, UNREG. +12VDC TYPICAL READOUT NOT TO GO LOWER THAN +10.5V OR INTERMITTENT RESET WILL OCCUR.

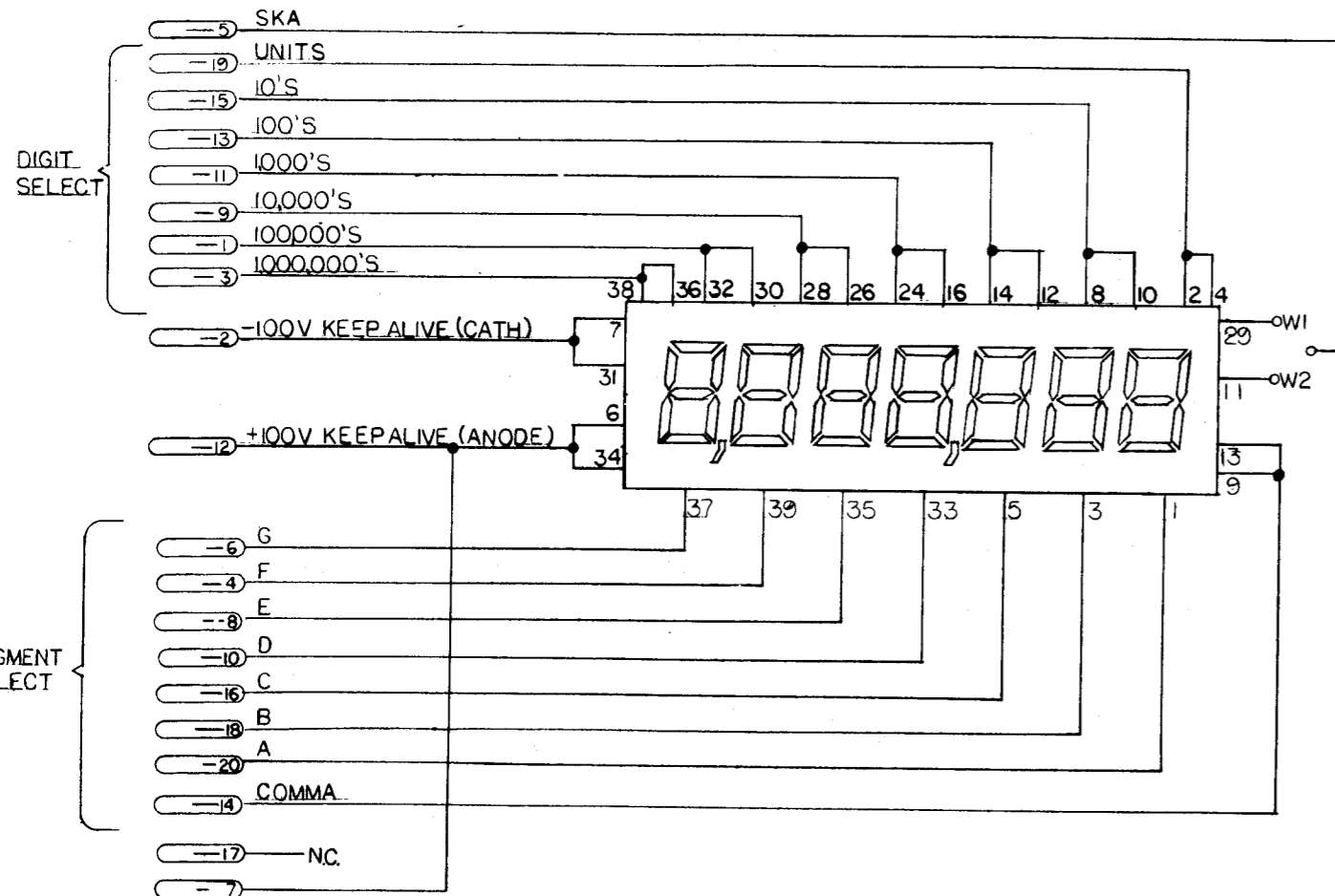
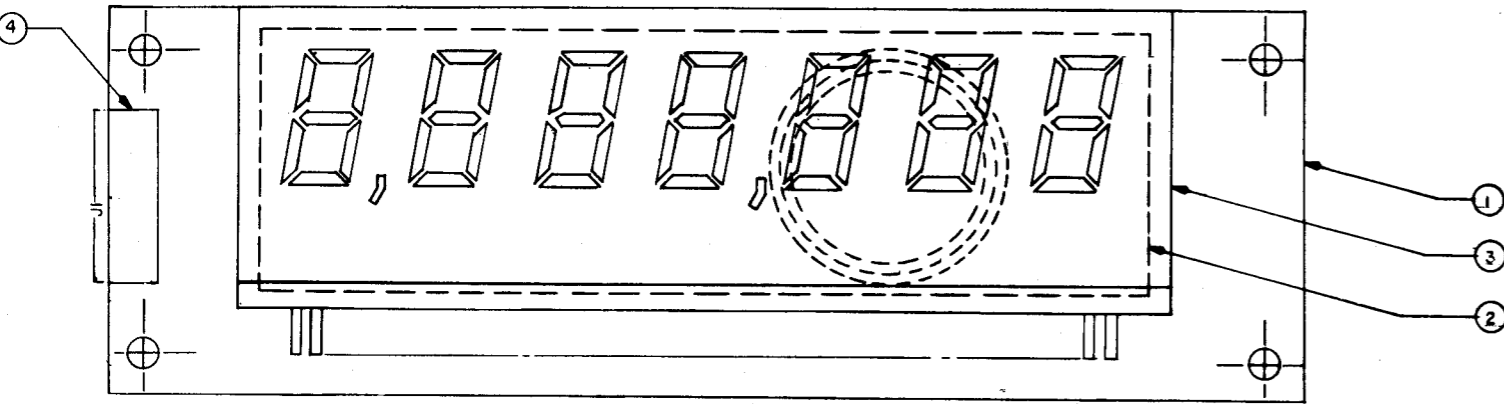
### D-8345 POWER SUPPLY

1	5765-09466-00		Bare P.C. Board	28	5164-09057-00	Q1	Transistor, SDS201 NPN
2	5013-09426-00	R7	Resistor, 2.15K, 1%, 1/4 W, Metal Film	29	5164-09056-00	Q4	Transistor, MPSD02 NPN
3	5013-09427-00	R8	Resistor, 4.99K, 1%, 1/4 W, Metal Film	30	5194-09058-00	Q3	Transistor, SDS202 PNP
4	5010-09428-00	R11	Resistor, 1.5K, 2%, 1/4 W, Carbon Film	31	5194-09055-00	Q2	Transistor, MPSD52 PNP
5	5010-09085-00	R10	Resistor, 1.5K, 2%, 1/4 W	32	5162-09425-00	Q5	Transistor, Power, 2N6057 NPN
6	5010-09541-00	R9	Resistor, 2.7K, 2%, 1/4 W	33	5705-09431-00		Heat Sink
7	5010-09508-00	R12	Resistor, 270 Ohm, 2%, 1/4 W, Carbon Film	34	5791-09074-00	3J6	Connector, 15-pin (H)
8	5012-09429-00	R13	Power Resistor, 0.12 Ohm, 5%, 5 W	35	5791-09027-00	3J3, 3J8	Connector, 9-pin (H)
9	5010-09536-00	R1, R4	Resistor, 39K, 5%, 1 W	36	5791-09038-00	3J2	Connector, 6-pin (H)
10	5010-09061-00	R2, R5	Resistor, 680 Ohm, 2 W	37	5791-09067-00	3J5	Connector, 6-pin (H)
11	5010-09069-00	R3, R6	Resistor, 330K, 5%, 1/2 W	38	5791-09043-00	3J4	Connector, 12-pin (H)
12	5040-09419-00	C10	Capacitor, 18,000 MFD, Elect., 20V, Axial	39	5791-09435-00	3J7	Connector, 3-pin (H)
13	5040-09420-00	C9	Capacitor, 1000 MFD, Elect., 25V, Radial or Axial	40	5791-09436-00	3J9	Connector, 2-pin (H)
14	5040-09423-00	C12	Capacitor, 330 MFD, Elect., 10V, Radial	41	5791-09068-00	3J1	Connector, 12-pin (H)
15	5043-9065-00	C15	Capacitor, 470 pFD	42	5732-09178-00		Fuse Holder
16	5040-9053-00	C1, C3	Capacitor, 100 MFD, Elect., 150V	43	5731-09128-00	F2	Fuse, SB, 2.5 A, 250V
17	5040-09070-00	C5	Capacitor, 100 MFD, Elect., 100V, Axial or Radial	44	5730-09071-00	F3	Fuse, 8 A, 32V
18	5043-09072-00	C2, C4	Capacitor, 0.1 MFD, 500V, Disc	45	5731-08761-00	F4	NOT USED
19	5043-09446-00	C14	Capacitor, 0.1 MFD, 50V, Disc	46	5731-09064-00	F1	Fuse, 1/4 A, 250V
20	5070-06258-00	D1, D2, D5, D6	Diode, 1N4001	47	5017-09064-00	VR1	Varistor
21	5070-09054-00	D3, D4	Diode, 1N4004	48	5700-09445-00		Socket
22	5075-09059-00	ZR1, ZR3	Zener, 1N5990, 3.9V, 5%	49	5701-09652-00		Mica Insulator
23	5075-09060-00	ZR2, ZR4	Zener, 1N4764, 100V, 5%	50	5580-09555-00	K1	Relay, 24VDC, 10A, DPDT
24	5460-09424-00	IC1	Voltage Regulator, MC1723 PC	51	5824-09248-00		Terminal, #1502-1 (Test Post)
25	5043-09443-00	C6	Capacitor, 0.1 MFD, 200V, Disc	52	5100-09418-00	BR-1	Bridge Rectifier, 35A, 100V
26	5040-09421-00	C7	Capacitor, 100 MFD, 25V, Radial	53	5705-09042-00		Heat Sink
27	5040-09422-00	C8	Capacitor, 47 MFD, 50V, Radial	54	03-7947		Tie Wrap
				55	4005-01016-07		5-40 x 1/4" RH Mach Screw
				56	4700-00004-00		.146 x 1/8", 21 Ga
				57	4700-00023-00		Lockwasher, #5, Split
				58	4405-01117-00		5-40 Hex Nut
				59	20-9229		Thermal Compound
				60			Jumper Wire, #18 AWG (3')
				61	5731-09432-00	F6, F5	Fuse, SB, 7 A, 250V
				62	4006-01003-12		6-32 x 3/4 PH Mach Screw



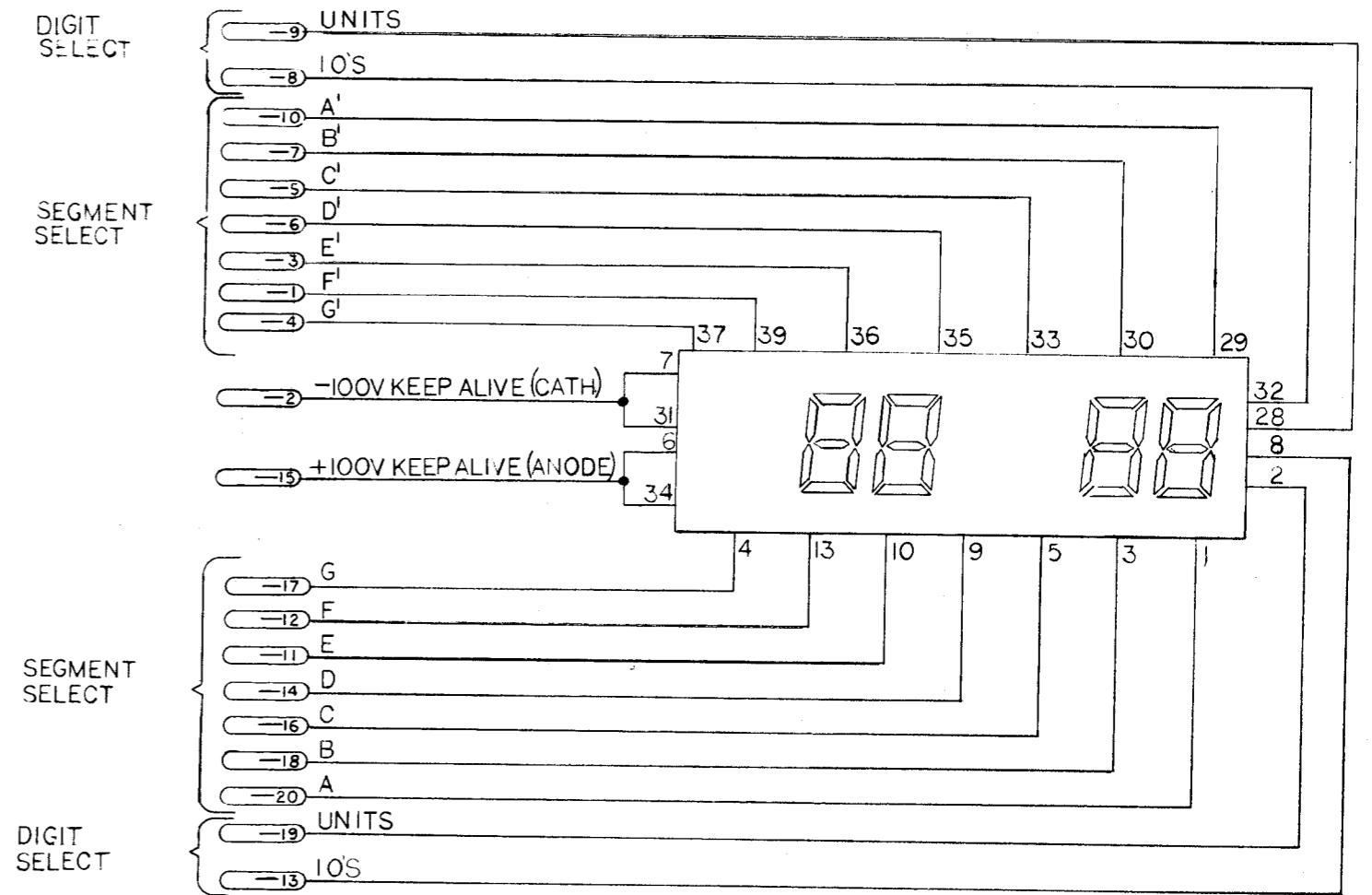
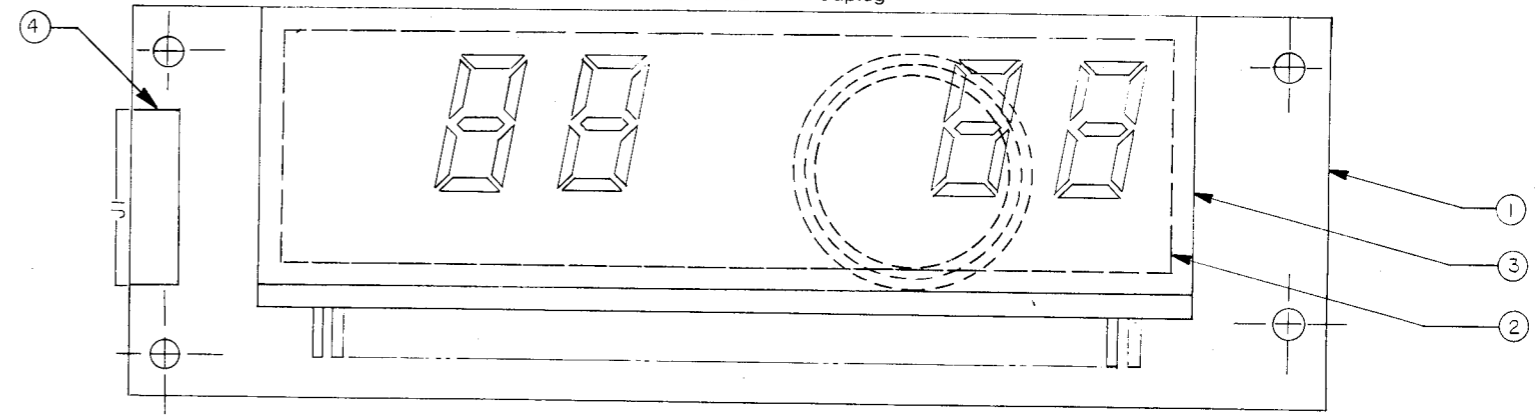
### C-8364 PLAYER SLAVE DISPLAY PANEL

ITEM	PART NO.	DESCRIPTION
1	5670-09439-00	7-Digit Display
2	23-6545	Foam Display Mounting—Back
3	5762-09463-02	Display PC Board
4	5791-09438-00	Display Mounting Plate
5	23-6546	Foam Display Mounting—Front
6	03-7573-2	Caplug



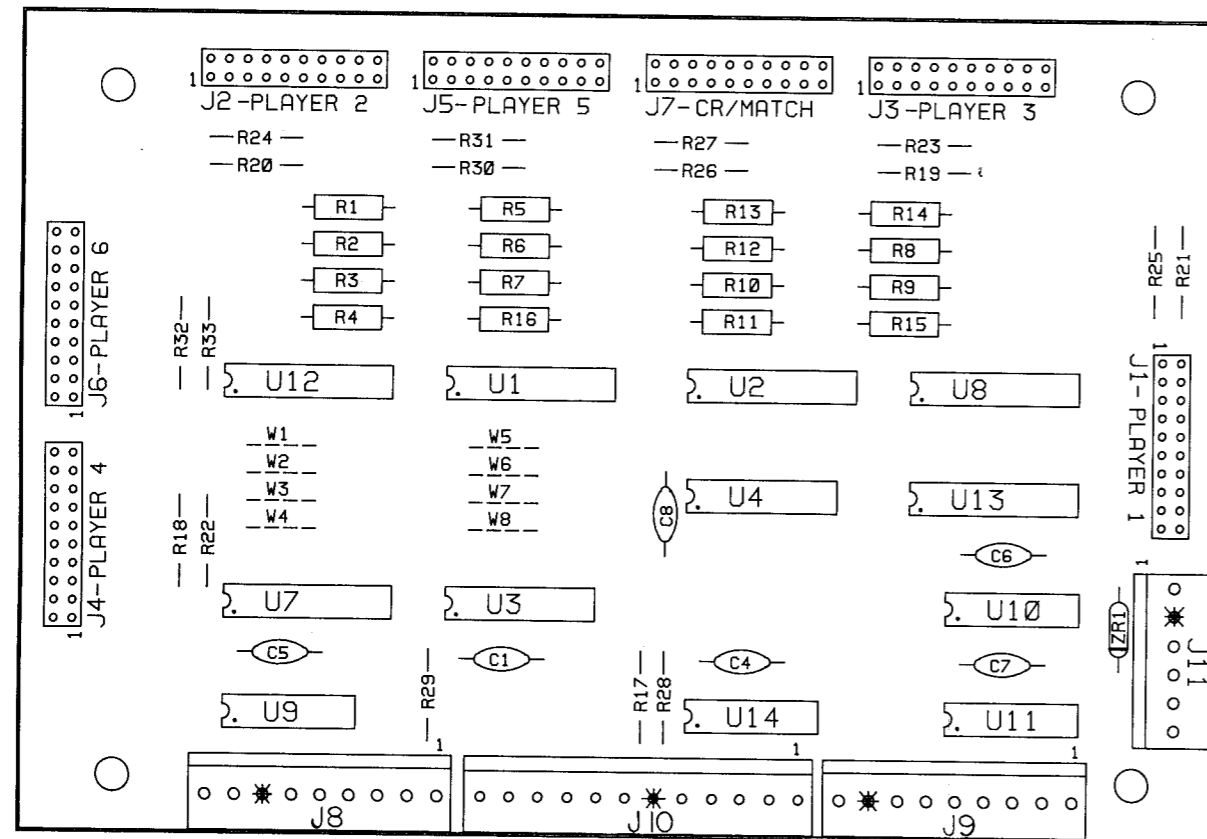
### C-8365 CREDIT/BALL-IN-PLAY DISPLAY PANEL

ITEM	PART NO.	DESCRIPTION
1	5670-09448-00	2/2 Split, 4-Digit Display
2	23-6545	Foam Display Mounting—Back
3	5767-09468-02	Display PC Board
4	5791-09438-00	Display Mounting Plate
5	23-6546	Foam Display Mounting—Front
6	03-7573-2	Caplug



C8364 and C8365 Slave Display Boards Assembly Drawing and Schematic Diagrams

## D-10749 MASTER DISPLAY BOARD

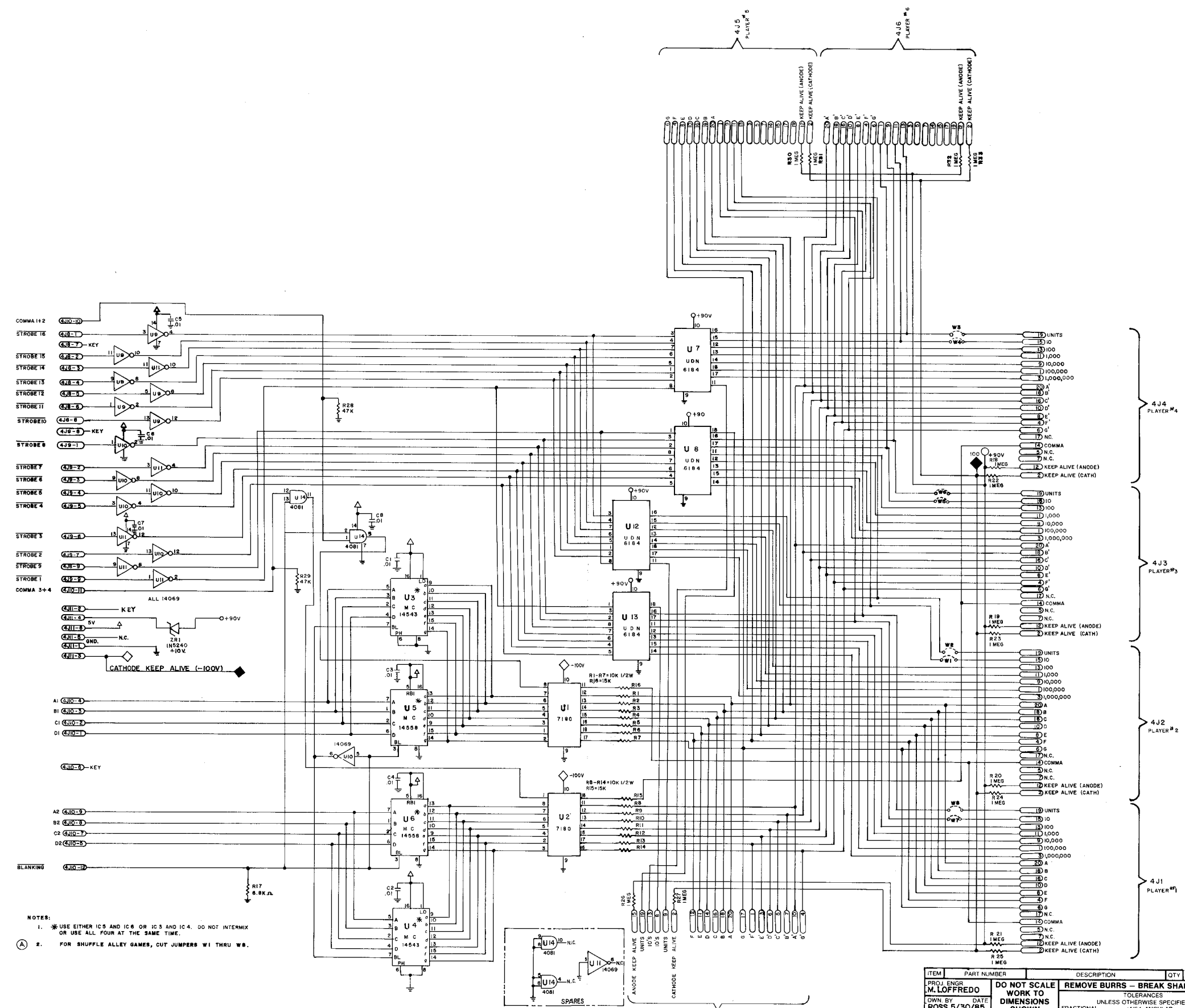


### NOTE:

1. FOR MASTER DISPLAY SCHEMATIC REFER TO : 16-8938
- Ⓐ 2. FOR SHUFFLE ALLEY GAMES, CUT JUMPERS W1 THRU W8.

ITEM	PART NO.	DESIGNATION	DESCRIPTION
1	5760-10846-00		Master Display PC Board
2	5010-08984-00	R1-R14	Resistor, 10K, 1/2W, 5%
3	5010-08982-00	R18-R27, R30-R33	Resistor, 3M, 1/4W, 5%
4	5010-0935-00	R28, R29	Resistor, 47K, 1/4W, 5%
5	5010-09086-00	R17	Resistor, 6.8K, 1/4W, 5%
6	5010-09149-00	R15, R16	Resistor, 15K, 1/2W, 5%
7	5043-08980-00	C1, C4-C8	Cap, .01 MFD, 50V, + 80, - 20
8	5075-09135-00	ZR1	Zener, 1N4740A, 10V, 1W
9	5310-08970-00	U3, U4	IC 4543B, 7 Seg Decoder
10	5310-08971-00	U9-U11	IC 4069B, Hex Inverter
11	5310-09450-00	U14	IC 4081 Quad AND
12	5680-08968-00	U7, U8, U12, U13	IC 6184, Anode Driver
13	5680-08969-00	U1, U2	IC 7180, Cathode Driver
14	5791-09437-00	J1-J7	20 pin Header (2 x 10)
15	5791-10862-06	J11	6 pin Header
16	5791-10862-09	J8, J9	9 pin Header
17	5791-10862-12	J10	12 pin Header
18	5010-09534-00	W1-W8	Resistor 0 ohm

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N.P.R.	14305 11-3-85
A	ADDED NOTE 2	

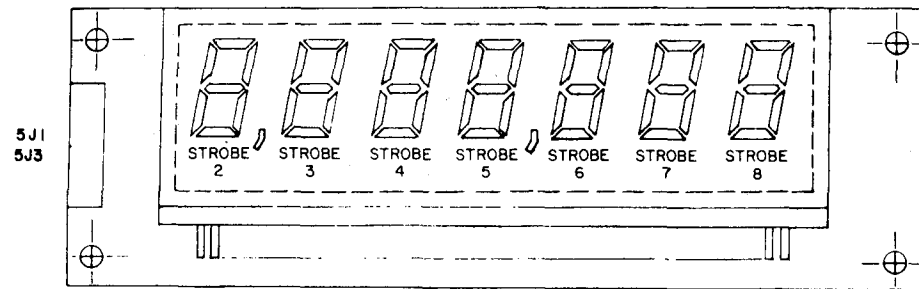


- NOTES:
- USE EITHER IC 5 AND IC 6 OR IC 3 AND IC 4. DO NOT INTERMIX OR USE ALL FOUR AT THE SAME TIME.
  - FOR SHUFFLE ALLEY GAMES, CUT JUMPERS W1 THRU W8.

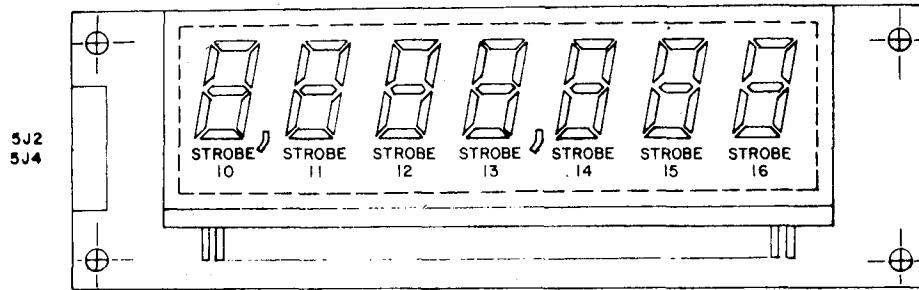
ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR M. LOFFREDO		DO NOT SCALE WORK TO DIMENSIONS SHOWN		REMOVE BURRS - BREAK SHARP EDGES TOLERANCES UNLESS OTHERWISE SPECIFIED		WILLIAMS ELECTRONICS, INC.	
OWN BY DATE ROSS 5/30/85		FIRST PROJECT NO 540		3401 N. CALIFORNIA AVE. CHICAGO, ILL. 60618		NAME MASTER DISPL SCHEM.	
CHECKED BY DATE DATE 6/14/85		FIRST USAGE D-10749		SCALE 1/4" = 1"		REV A	
APPROVAL DATE		QTY		SHEET 1 OF 1		PART NO. 16-8938	

16-8938

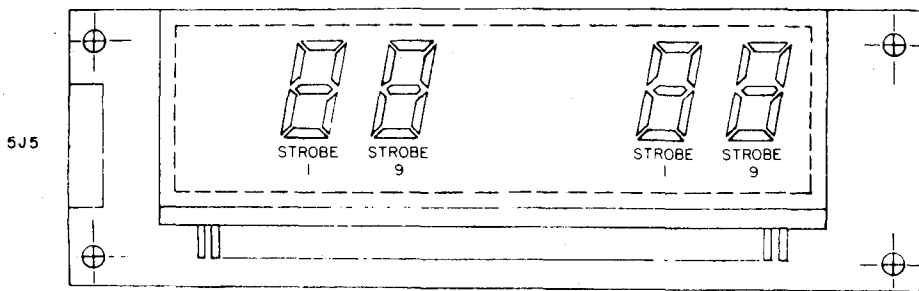
PLAYERS #1 AND 3



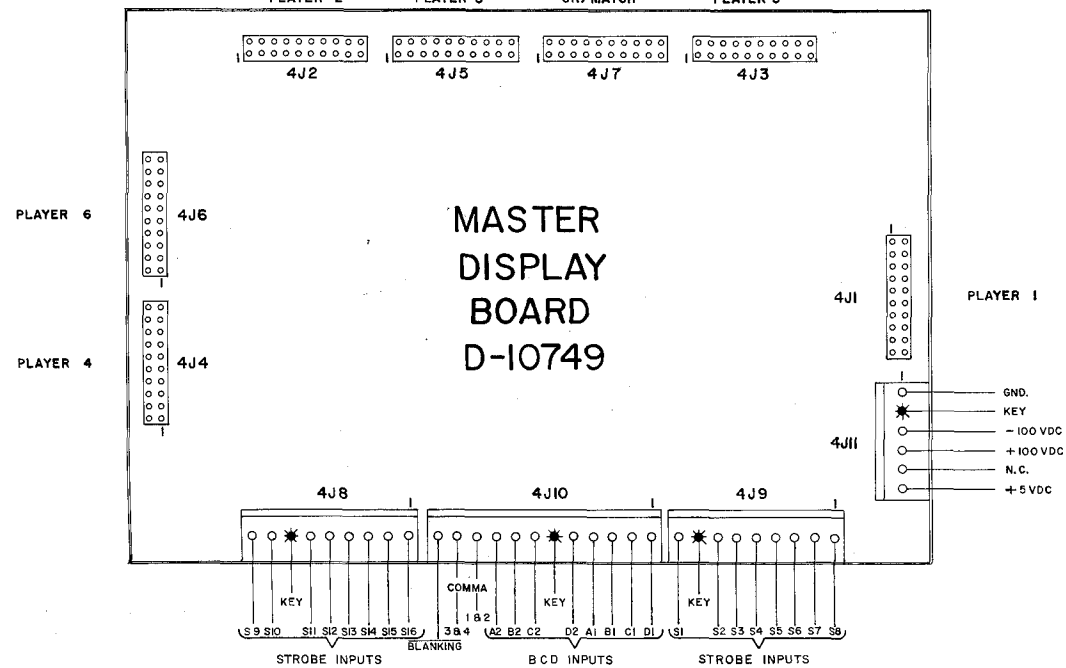
PLAYERS #2 AND 4



CREDITS / BALL IN PLAY



PLAYER 2    PLAYER 5    CR/MATCH    PLAYER 3



4J1/5J1 (PLAYER 1)

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

4J2/5J2 (PLAYER 2)

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

4J7/5J7 (CREDIT/BALL-IN-PLAY)

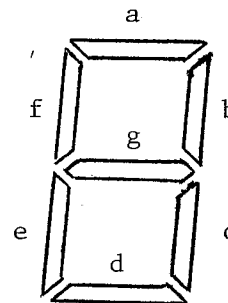
- 1 f' Segment (Credit)
- 2 -100V Keep Alive
- 3 e' Segment
- 4 g' Segment
- 5 c' Segment
- 6 d' Segment
- 7 b' Segment
- 8 10's
- 9 Units
- 10 a' Segment
- 11 e Segment
- 12 f Segment
- 13 10's
- 14 d Segment
- 15 +100V Keep Alive
- 16 c Segment
- 17 g Segment
- 18 b Segment
- 19 Units
- 20 a Segment

Credit

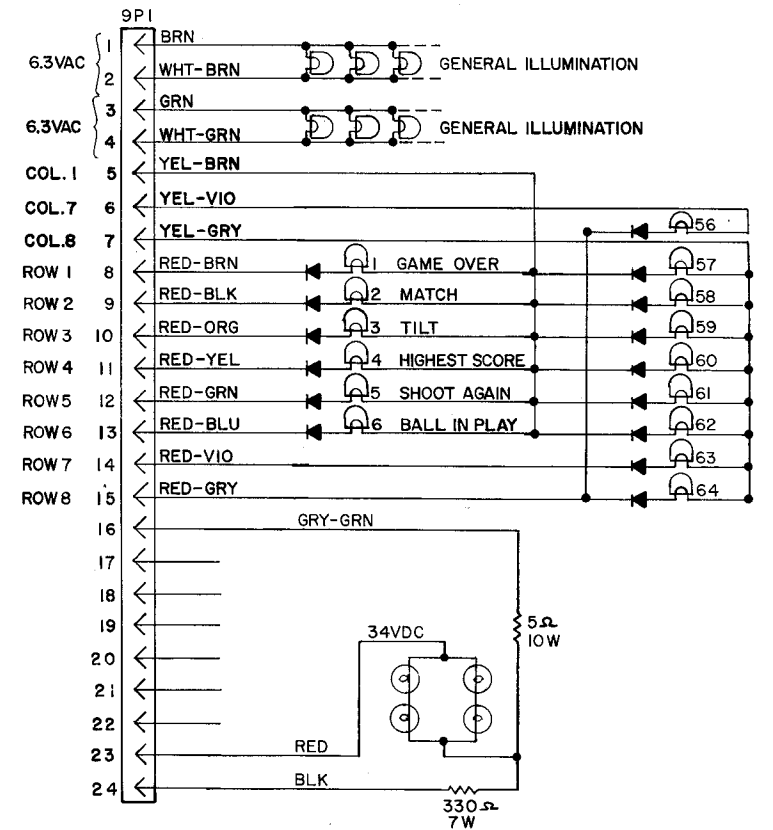
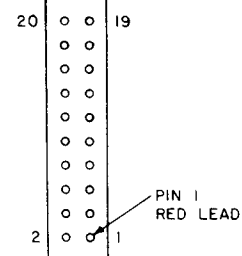
Match

Match

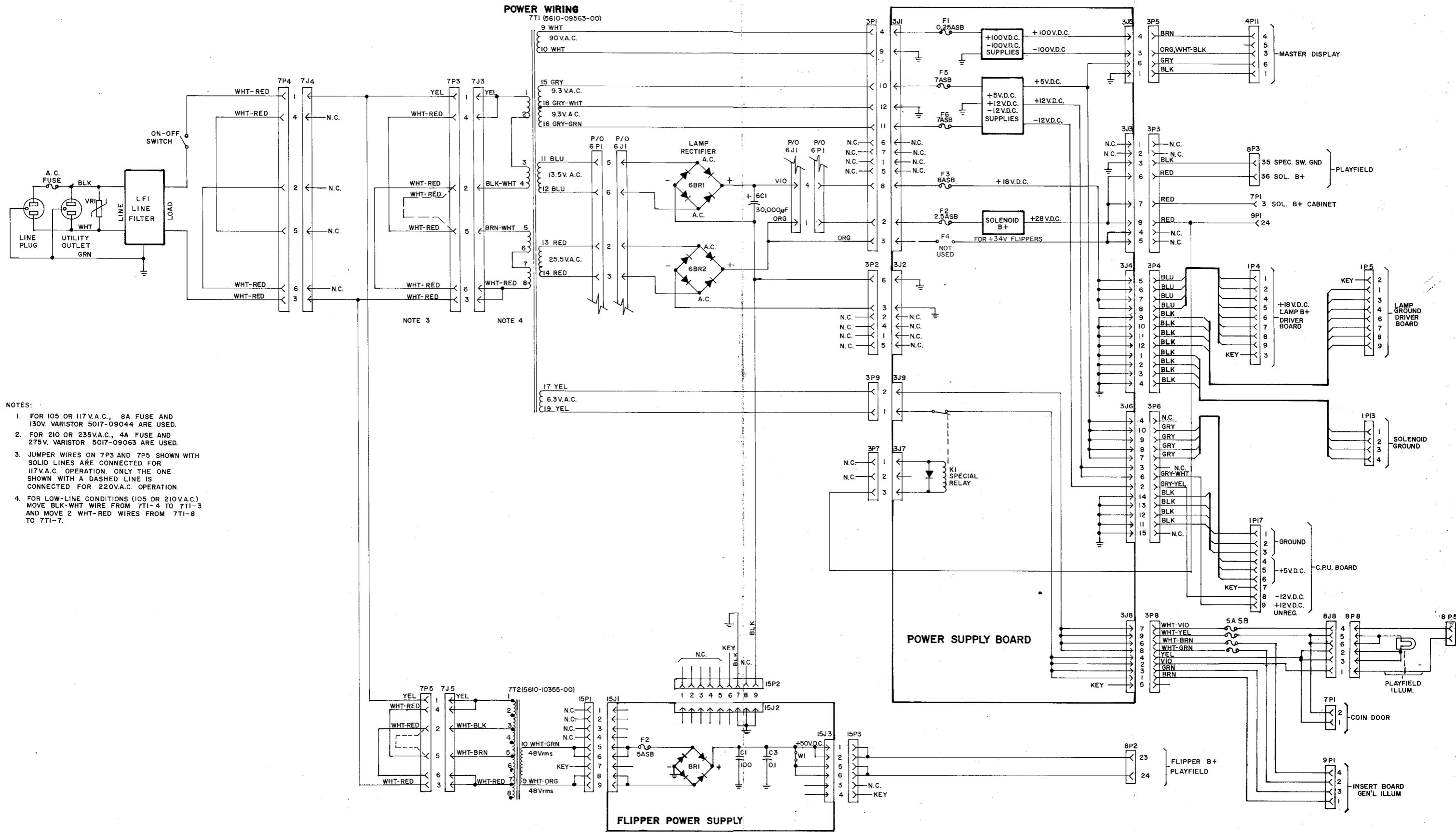
7-Segment  
LED  
Display



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



**POWER WIRING**  
7T1 (5610-09563-00)



- NOTES:**
1. FOR 105 OR 117V.A.C., 8A FUSE AND 130V. VARISTOR 5017-09044 ARE USED.
  2. FOR 210 OR 235V.A.C., 4A FUSE AND 275V. VARISTOR 5017-09063 ARE USED.
  3. JUMPER WIRES ON 7P3 AND 7P5 SHOWN WITH SOLID LINES ARE CONNECTED FOR 117V.A.C. OPERATION. ONLY THE ONE SHOWN WITH A DASHED LINE IS CONNECTED FOR 220V.A.C. OPERATION.
  4. FOR LOW-LINE CONDITIONS (105 OR 210V.A.C.) MOVE BLK-WHT WIRE FROM 7T1-4 TO 7T1-3 AND MOVE 2 WHT-RED WIRES FROM 7T1-8 TO 7T1-7.

**Power Wiring Diagram**