Williams®
ELECTRONICS GAMES, INC.

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STAR TREK®

THE NEXT GENERATION™

OPERATIONS MANUAL

Operations & Adjustments ° Testing & Problem Diagnosis
Parts Information ° Wiring Diagrams & Schematics

Williams Electronics Games, Inc.
3401 N.California
Chicago, Il 60618

ROM Jumper Chart

	W1	W2
1M / 2M / 4M ROM	In	Out

Country DIP Switch Chart

	Sw4	Sw5	Sw6	Sw7	Sw8
American	On	On	On	On	On
European	On	On	Off	On	On
French	On	On	On	Off	Off
German	On	On	On	On	Off
Spanish	On	Off	On	On	On

SOLENOID / FLASHER TABLE

Sol. No.	Function	Solenoid Type	Voltage Connections			Driver Transistor	Drive Connections			Drive Wire Color	Solenoid Part Number Flashlamp Type	
			Playfield	Backbox	Cabinet		Playfield	Backbox	Cabinet		Playfield	Backbox
01*	Left Gun Kicker	High Power	J107-3			Q82	J130-1			Vio-Brn	AE-23-800	
02	Right Gun Kicker	High Power	J107-3			Q80	J130-2			Vio-Red	AE-23-800	
03	Left Gun Popper	High Power	J107-3			Q78	J130-4			Vio-Org	AE-23-800	
04	Right Gun Popper	High Power	J107-3			Q76	J130-5			Vio-Yel	AE-23-800	
05	Left Popper	High Power	J107-3			Q64	J130-6			Vio-Grn	AE-23-800	
06	Plunger	High Power	J107-3			Q66	J130-7			Vio-Blu	AE-23-800	
07	Knocker	High Power		J107-3		Q68		J130-8		Vio-Blk		AE-23-800
08	Kickback	High Power	J107-3			Q70	J130-9			Vio-Gry	AE-23-800	
09	Left Slingshot	Low Power	J107-2			Q58	J127-1			Brn-Blk	AE-26-1200	
10	Right Slingshot	Low Power	J107-2			Q56	J127-3			Brn-Red	AE-26-1200	
11	Trough	Low Power	J107-2			Q54	J127-4			Brn-Org	AE-26-1500	
12	Left Jet Bumper	Low Power	J107-2			Q52	J127-5			Brn-Yel	AE-26-1200	
13	Right Jet Bumper	Low Power	J107-2			Q50	J127-6			Brn-Grn	AE-26-1200	
14	Bottom Jet Bumper	Low Power	J107-2			Q48	J127-7			Brn-Blu	AE-26-1200	
15	Top Divertor	Low Power	J107-2			Q46	J127-8			Brn-Vio	AE-25-1000	
16	Borg Kicker	Low Power	J107-2			Q44	J127-9			Brn-Gry	AL-23-800	
17	Left Gun Motor	Low Power	J118-2			Q42	J126-1			Blk-Brn	A-17562	
18	Right Gun Motor	Low Power	J118-2			Q40	J126-2			Blk-Red	A-17562	
19	Not Used					Q38				Blk-Org		
20	Jets Flasher	Flasher	J107-6			Q36	J126-4			Blk-Yel	#89 (1)	
21	Right Popper Flasher	Flasher	J107-6	J106-5		Q28	J126-5	J125-6		Blu-Grn	#89 (1)	#906 (1)
22	Middle Ramp Flasher	Flasher	J107-6			Q30	J126-6			Blu-Blk	#89 (2)	
23	Shields Flasher	Flasher	J107-6	J106-5		Q34	J126-7	J125-8		Blu-Vio	#906 (3)	#906 (1)
24	Autofire Flasher	Flasher	J107-6			Q32	J126-8			Blu-Gry	#906 (1)	
25	Exit Un. Gnd. Flasher	Gen. Purpose	J107-6	J106-5		Q26	J122-1	J124-1		Blu-Brn	#89 (1)	#906 (1)
26	Right Borg Flasher	Gen. Purpose	J107-6	J106-5		Q24	J122-2	J124-2		Blu-Red	#906 (2)	#906 (1)
27	Left Borg Flasher	Gen. Purpose	J107-6	J106-5		Q22	J122-3	J124-3		Blu-Org	#906 (2)	#906 (1)
28	Center Borg Flasher	Gen. Purpose	J107-6	J106-5		Q20	J122-4	J124-5		Blu-Yel	#906 (2)	#906 (1)
29-36	*See Flipper Circuits*											
37*	Under Divertor Top	Low Power	J107-1			Q16	J4-2			Brn-Wht	AE-25-1000	
38*	Under Divertor Bot.	Low Power	J107-1			Q15	J4-4			Blk-Wht	AE-25-1000	
39*	Top Drop Up	Low Power	J107-1			Q14	J4-5			Org-Wht	AE-26-1200	
40*	Top Drop Down	Low Power	J107-1			Q13	J4-6			Yel-Wht	SM1-26-600	
41*	Romulan Flashers	Low Power	J107-6	J106-5		Q9	J3-2	J3-2		Grn-Wht	#906 (1)	#906 (1)
42*	Right Ramp Flashers	Low Power	J107-6	J106-5		Q10	J3-3	J3-3		Blu-Wht	#89 (1)	#906 (1)

***Note: Controlled from the 8-Driver Board, not the Power Driver Board**

	General Illumination											
01	Shields G.I.	G.I.	J121-1			Q18	J121-7			Wht-Brn	#44	
02	Insert G.I.	G.I.		J120-2		Q10		J120-8		Wht-Org		#555
03	Insert G.I.	G.I.		J120-3		Q14		J120-9		Wht-Yel		#555
04	Playfield G.I.	G.I.	J121-5			Q16	J121-10			Wht-Grn	#44	
05	Return Lane/Coin	G.I.	J121-6		J119-3	Q12	J121-11		J119-1	Wht-Vio	#44	

	Flipper Circuits		Voltage Connections Playfield	Drive Transistors Power	Drive Transistors Hold	Drive Connections Playfield	Drive Wire Colors Power	Drive Wire Colors Hold	Coil Part Number	Coil Colors
(29)	Lower Right Flipper	Lwr. Rt. Power	J907-7 (Blu-Yel)	Q4		J902-13	Blu-Vio		FL-11629	Blue
(30)		Lwr. Rt. Hold	J907-7 (Blu-Yel)		Q11	J902-11		Org-Grn		
(31)	Lower Left Flipper	Lwr. Lt. Power	J907-9 (Gry-Yel)	Q3		J902-9	Blu-Gry		FL-11629	Blue
(32)		Lwr. Lt. Hold	J907-9 (Gry-Yel)		Q9	J902-7		Org-Blu		
(33)	Upper Right Flipper	Up Rt. Power	J907-1 (Blu-Yel)	Q2		J902-6	Blk-Yel		FL-11629	Blue
(34)		Up Rt. Hold	J907-1 (Blu-Yel)		Q7	J902-4		Org-Vio		
35	Not Used	Up Lt. Power	J907-4 (Gry-Yel)	Q1		J902-3	Blk-Blu		Not Used	Not Used
36	Not Used	Up Lt. Hold	J907-4 (Gry-Yel)		Q5	J902-1		Org-Gry		

J4-1 = Tieback Diode
J1XX-X = Power Driver Board, JX-X = 8-driver Board, J9XX-X = Fliptronic II Board

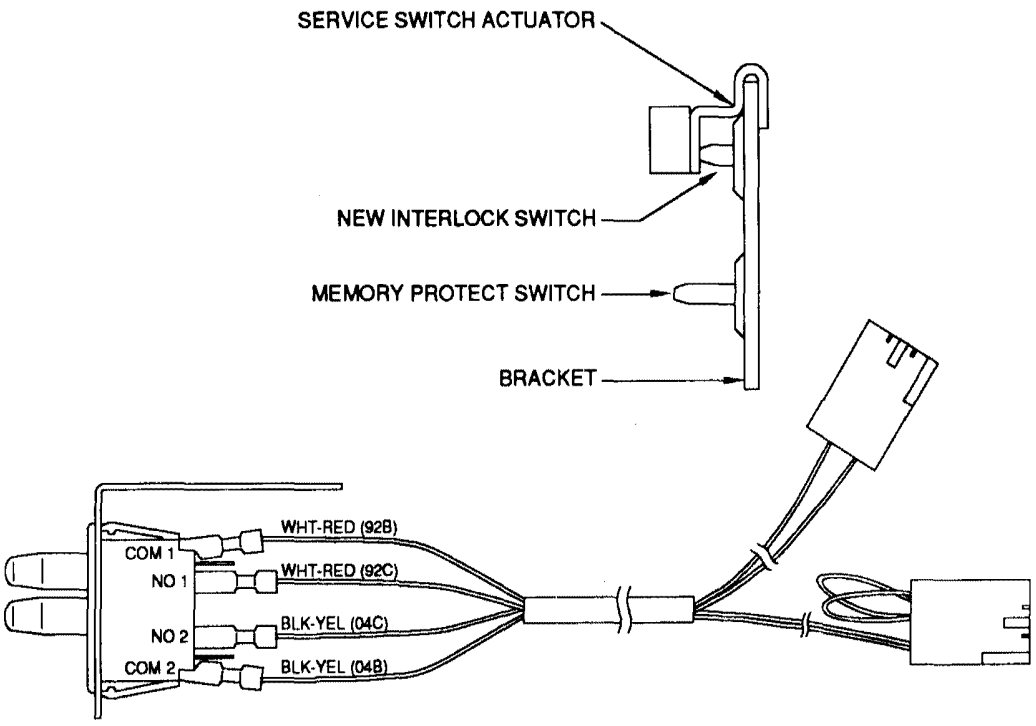
IMPORTANT NOTICE

PLEASE READ

Pinball games are now equipped with a SAFETY FEATURE to prevent shocks from the solenoid circuit when the coin door is opened. A new interlock switch assembly (part no. A-17077), located at the left of the coin door opening, has been added to the game. This assembly is a bracket containing the existing memory protect switch on the bottom and a new interlock switch on the top. When the coin door is opened, this new interlock switch opens, breaking the connection to the +50V and +20V winding of the transformer secondary.

A special tool called the Service Switch Actuator is provided for the serviceman/technician that repairs the game. This tool is painted yellow and located in a bag stapled inside the cabinet. The Service Switch Actuator slips over the interlock switch and holds it closed while the coin door is opened, allowing the serviceman to test and repair the solenoid circuit.

Hold the top interlock switch in, then slide the short end of the Service Switch Actuator over the top of the interlock switch bracket and the long end over the center of the switch plunger to hold it in.



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THE NEXT GENERATION™

Williams Electronics Games, Inc. reserves the rights to make modifications and improvements to its products. The specifications and parts identified in this manual are subject to change without notice.

RULES

Skill Shot	*Squeeze Trigger On The Control Grip To Launch Ball And Select Lit Item In Display.*
U.S.S. Enterprise Missions	*Shoot START MISSION To Begin Each Mission. Shoot Flashing EMBLEMS To Complete Missions.*
Borg Multi-Ball™	*Shoot Flashing Lock Lights and Lock Balls For 3-Ball Multi-Ball™ To Score JACKPOTS.*
Neutral Zones	*Begin Encounter By Hitting 3 Neutral Zone Targets.* *Ferengi: Neutral Zone Target Hits Add Multi-Ball™. Get Jackpots.* *Romulan: Multi-Ball™. Hit Lit Emblems To Dispatch Warbirds Before They Cloak.* *Cardassians: Multi-Ball™. Shoot Neutral Zone For Jackpots.*
Warp Factor	*Shoot WARP LOOP And DELTA QUADRANT RAMP To Increase Warp Speed And Light Special Features.*
Explosive Millions	*Score MILLIONS By Shooting Successive Lit Ramp Shots.*
Command Decisions	*Select The Mission Of Your Choice! CHOOSE MISSION With Flipper Buttons. BEGIN MISSION By Squeezing Trigger.*
Advance In Rank	*Top Lanes Light ADVANCE IN RANK. Shoot ADVANCE IN RANK When Lit. Higher Rank Increases Bonus.*
Holodeck	*Shoot BETA QUADRANT RAMP To Light HOLODECK. Shoot HOLODECK To Begin VIDEO MODE.*

Table Of Contents

Section 1 - Game Operation & Test Information

(System WPC) ROM Summary 1-1
Pinball Game Assembly Instructions 1-2
Pinball Assembly, Playfield Pitch Angle, & Leg Leveler Detail 1-2
Leg Bolt Locations 1-2
Gun Handle Installation 1-3
Line Cord Installation 1-4
Raising the Playfield 1-5
Game Control Locations 1-6
Game Operation 1-7
Menu System Operation & Main Menu 1-8
Bookkeeping Menu 1-9
B.1 Main Audits 1-9
B.2 Earnings Audits 1-9
B.3 Standard Audits 1-10
B.4 Feature Audits 1-11
B.5 Histograms 1-12
B.6 Time-Stamps 1-12
Printouts Menu 1-13
Test Menu 1-14
T.1 Switch Edges 1-14
T.2 Switch Levels 1-14
T.3 Single Switches 1-14
T.4 Solenoid Test 1-15
T.5 Flasher Test 1-15
T.6 General Illumination Test 1-15
T.7 Sound & Music Test 1-16
T.8 Single Lamp Test 1-16
T.9 All Lamp Test 1-16
T.10 Lamp & Flasher Test 1-16
T.11 Display Test 1-16
T.12 Flipper Coil Test 1-17
T.13 Ordered Lamps Test 1-17
T.14 Left Launcher Test 1-17
T.15 Right Launcher Test 1-17
T.16 Left Under Divertor Test 1-17
T.17 Right Under Divertor Test 1-18
T.18 Clear Out Balls Test 1-18
Utilities Menu 1-19
U.1 Clear Audits 1-19
U.2 Clear Coins 1-19
U.3 Reset H.S.T.D. 1-19
U.4 Set Time & Date 1-19
U.5 Custom Message 1-19
U.6 Set Game I.D. 1-19
U.7 Factory Adjustment 1-19
U.8 Factory Reset 1-19
U.9 Preset 1-20
Difficulty Setting Table for U.S., Canadian, French, German & European Games 1-20
Preset Adjustments Table for U.S. & Canadian Games 1-20
Preset Adjustments Table for German Games 1-22
U.10 Clear Credits 1-22
U.11 Auto Burn-in 1-22

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Section One - Game Operation & Test Information Continued...

Adjustment Menu 1-23
A.1 Standard Adjustments 1-23
A.2 Feature Adjustments 1-27
A.3 Pricing Adjustments 1-30
Pricing Table 1-32
A.4 H.S.T.D. Adjustments 1-33
A.5 Printer Adjustments 1-34
Error Messages 1-35
Opto Theory 1-36
CPU Board LED Error Codes 1-36
Sound Board Beep Error Codes 1-36
LED List 1-38
Fuse List 1-39
Maintenance Information 1-40
Lubrication 1-40
Switch Contacts 1-40
Cleaning 1-40
Removing the Gun Assembly 1-41

Section 2 - Game Parts Information

Backbox Assembly 2-2
Cabinet Assembly 2-3
Line Filter/Cordset Application Chart 2-4
Audio Board Assembly 2-5
Fliptronic II Board Assembly 2-6
Dot Matrix Controller Assembly 2-7
Power Driver Assembly 2-8
CPU Board Assembly 2-10
LED 7 Ball Trough Assembly, Opto 7 Ball Trough Assembly, Motor EMI Board 2-11
Flipper Opto PCB Assembly, Prox. Sensor II PCB Assembly 2-12
Coin Door Interface PC Board, Motor EMI PCB Assembly 2-13
8-Driver PCB Assembly 2-14
16-Opto PCB Assembly 2-15
Flipper Assembly 2-16
Kicker Arm Assembly 2-18
Outhole Ball Trough Assembly 2-19
Jet Bumper Assembly, Jet Bumper Coil Assembly 2-20
Gun Assembly 2-21
Ball Popper Assembly 2-22
Ball Popper Assembly 2-23
Divertor Assembly 2-24
Borg Bracket Assembly 2-25
Catapult Assembly 2-26
1-Bank Drop Target Assembly 2-27
Gun Handle Assembly 2-28
Line Filter Assembly 2-29
Bottom Arch Kicker Assembly, Knocker Assembly 2-30
Tilt Mechanism Assembly, Target Assemblies 2-31
U-Trough Assembly, U-Gun Motor Bracket Assemblies 2-32
Posts 2-33
Unique Parts List 2-34
Cable List 2-35
Upper Playfield Parts Location 2-36
Lower Playfield Parts Location 2-38

Section Two - Parts Information Continued...

Rubber Parts Location....2-39
Lamp Matrix....2-40
Lamp Locations....2-41
Switch Matrix....2-42
Switch Location....2-43
Solenoid Table....2-44
Solenoid Location....2-45

Section 3 - Schematics, Wiring Diagrams & Circuit Theory

Connector & Component Identification....3-1
Switch Matrix and Circuit....3-2
Dedicated Switch Circuit....3-3
Lamp Matrix and Circuit....3-4
Solenoid Table....3-5
Solenoid Wiring....3-6
Flashlamp Wiring....3-7
High Power and Low Power Solenoid Circuits....3-8
Flashlamp and Special (General Purpose) Solenoid Circuits....3-9
General Illumination Circuits....3-10
Flipper Circuit Diagram....3-11
Flipper Coil and E.O.S. Switch Circuit Diagrams....3-12
Flipper Cabinet Switch Circuit Diagrams....3-13
Flipper Opto PCB Assembly....3-14
LED and Photo Transistor PCB Assemblies....3-15
Coin Door Interface PCB Assembly....3-16
Coin Door Interface PCB Schematic....3-17
7 Ball Trough Photo Transistor Assembly....3-18
7 Ball Trough LED PCB Assembly....3-19
Proximity Sensor II PCB Assembly....3-20
Eddy Sensor Assembly....3-21
Motor EMI Assembly....3-22
Gun Circuit Diagram....3-23
8-Driver PCB Assembly and Wiring Diagram....3-24
8-Driver PCB Schematic....3-25
16-Opto PCB Assembly....3-26
16-Opto PCB Schematic....3-27
16-Opto PCB Assembly Switch Circuits....3-28
CPU Board Interboard Wiring....3-29
Audio Board Interboard Wiring....3-30
Dot Matrix Controller Board Interboard Wiring....3-31
Fliptronic II Board Interboard Wiring....3-32
Power Driver Board Interboard Wiring....3-33

NOTES

SECTION 1

Game Operation and Test Information

ROM SUMMARY

IC	Type	Location	Board	Part Number
Game ROM 1	27c040	U6	CPU	A-5343-50023-1
Music/Speech ROM	27c040	U2	Audio	A-5343-50023-2
Music/Speech ROM	27c040	U3	Audio	A-5343-50023-3
Music/Speech ROM	27c040	U4	Audio	A-5343-50023-4
Music/Speech ROM	27c040	U5	Audio	A-5343-50023-5
Music/Speech ROM	27c040	U6	Audio	A-5343-50023-6
Music/Speech ROM	27c040	U7	Audio	A-5343-50023-7
Music/Speech ROM	27c040	U8	Audio	A-5343-50023-8

PINBALL GAME ASSEMBLY INSTRUCTIONS

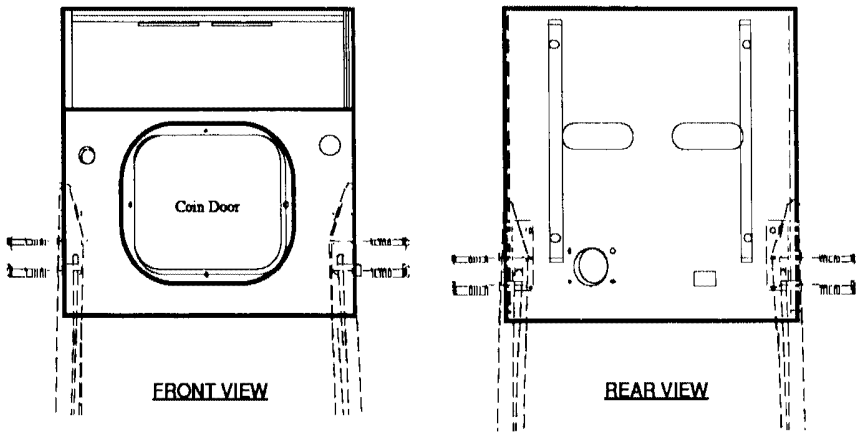
STAR TREK: THE NEXT GENERATION
IS A 6 BALL GAME.

Power:	Domestic 120V @ 60Hz Foreign 230V @ 50Hz Japan 100V @ 50HZ	***Dimensions:***	Width: 29" approx. Depth: 55" approx. Height: 76" approx.
Temp:	32°F to 100° F (0°C to 38°)C	***Weight:***	322 lbs approx. (crated)
Humidity:	Not to exceed 95% relative.		

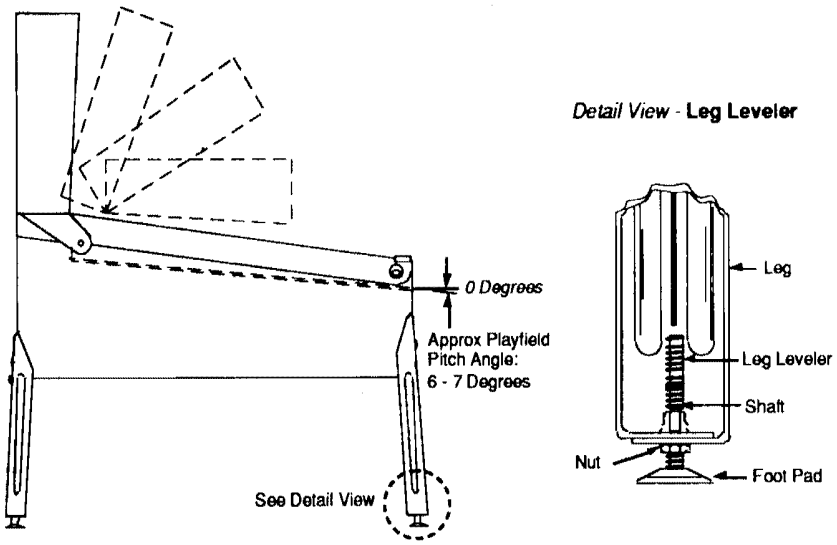
1. Remove all cartons, parts, and other items from the shipping container, and set them aside.

2. Place the cabinet on a support. Remove the leg bolts from the front and rear of the cabinet. Attach rear legs using leg bolts in the center and bottom holes. (See rear view of Leg Bolt Location diagram below.)

3. Leg levelers are among the parts in the cashbox. Install leg levelers (see Pinball Assembly, Playfield Pitch Angle, and Leg Levelers Details diagram below), and attach the front legs using leg bolts in the center and bottom holes. (See front view of Leg Bolt Location diagram below.)



Leg Bolt Location Diagram



Pinball Assembly, Playfield Pitch Angle, and Leg Leveler Details.

4. Reach into the cabinet and backbox and ensure that the interconnecting cables are not kinked or pinched. Be careful to avoid damaging wires at any stage of the assembly process.

5. Raise the hinged backbox upright and latch it into position. Unlock the backbox, and remove the backglass. Remove the shipping screws holding the Insert Panel. Unlatch and open the Insert Panel. Carefully lift up the Speaker Panel and lay it down on the playfield glass. (Be careful not to damage the Dot Matrix Display/Driver.) This allows access to the bolt holes used for securing the backbox upright. To secure the backbox, install the washer-head mounting bolts through the bottom holes of the backbox into the threaded fasteners in the cabinet. Close and latch the Insert Panel. Replace the Speaker Panel. Reinstall the backglass, and lock the backbox.

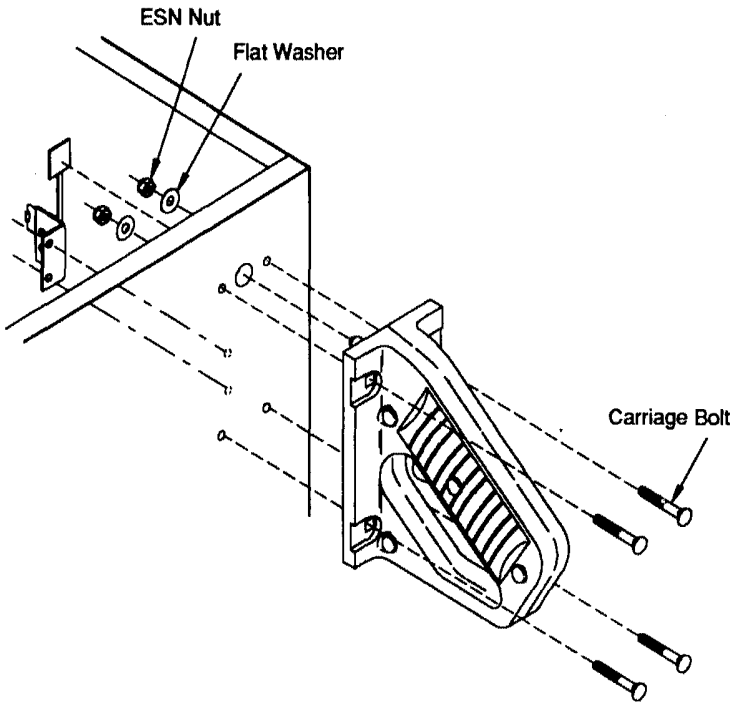
⚠ CAUTION

FAILURE TO INSTALL the backbox mounting hardware properly can cause personal injury. ***NEVER TRANSPORT*** a pinball game with the hinged backbox erect. Always lower the backbox forward onto the playfield cabinet on a layer of protective material to prevent marring or damage and possible personal injury.

6. Extend each leg leveler *slightly* below the leg bottom, so that all four foot pads are extended about the same distance. Remove the cabinet from its support and place it on the floor.

7. Unlock and open the coin door. Move the molding latch lever toward the left side of the game. Lift the front molding off the playfield cover glass return the latch lever toward the right, and close the coin door. Carefully slide the glass downward, until it clears the grooves of the left and right side moldings. Lift the glass up and away from the game. Raise the playfield. (See page 1-5.)

8. The gun handle is mounted inside the cabinet behind the partition. Remove the gun handle from its location and position it on the outside top right corner of the cabinet, (see diagram). Fasten the handle in place with the hardware shipped in the unique parts bag.



9. Lower the playfield. Place a level or an inclinometer on the playfield surface. Adjust the leg levelers for proper playfield level (side-to-side). ***NOTE:*** It is recommended that this measurement be made ON the playfield, not the cabinet nor the playfield cover glass. Tighten the nut on each leg leveler shaft to maintain this setting.

! IMPORTANT !

Playfield pitch angle can affect the operation of the plumb bob tilt. The plumb bob weight is among the parts in the cash box; the operator should install the weight and adjust this tilt mechanism for proper operation, after completion of the desired playfield pitch angle setting. The unit is factory installed for a 6-1/2 degree angle. If an adjustment is necessary, loosen the screw at the bottom of the unit. Move the pointer, one grove at a time to the left or the right, depending on the degree desired. Hold the pointer in place and tighten screw.

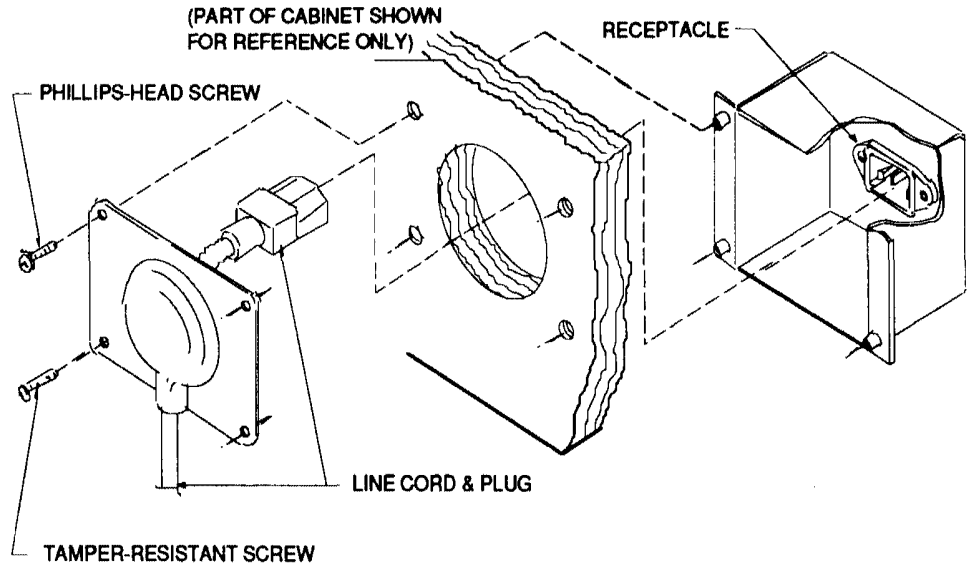
10. Move the game into the desired location; recheck the level and pitch angle of the playfield.

11. Be sure the ***required number*** of balls are installed. This game uses six balls.

12. Install full playfield mylar, if desired. ***NOTE:*** The playfield is coated with a special hardcoat surface and does not require a protective mylar. However, mylars can be purchased through your local Williams Distributor. Specify part number 03-8962-1 for full playfield mylar.

13. Clean and reinstall the playfield cover glass. Prepare the game for player operation.

14. To attach the line cord, remove the envelope stapled to the inside of the cabinet (near the cashbox). Remove the four Phillips-head screws that mount to line cord cover plate to the rear cabinet. Match the prongs on the plug with the holes in the receptacle, and push the line cord securely into place. Make sure the cord is aligned with the indentation on the cover plate (indentation should point toward bottom of the cabinet). Remount line cord cover plate. If desired, four tamper resistant screws have been provided in an enevlope marked "Security Screws" (located in the cashbox) to remount cover plate.



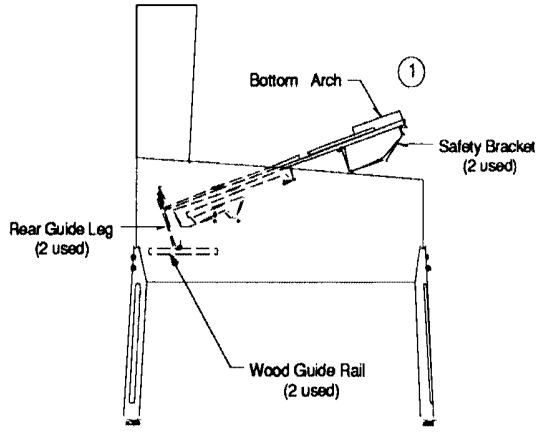
RAISING THE PLAYFIED

⚠ CAUTION

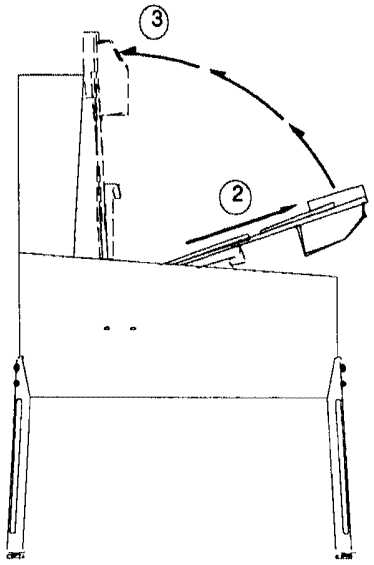
Do not raise the playfield straight up! This game uses a slide assembly to raise and lower the playfield.

To raise the playfield.

1. Grasp bottom arch and carefully lift up playfield only high enough to clear safety brackets. Rear guide legs should not hit wood guide rails or be used to slide out playfield.

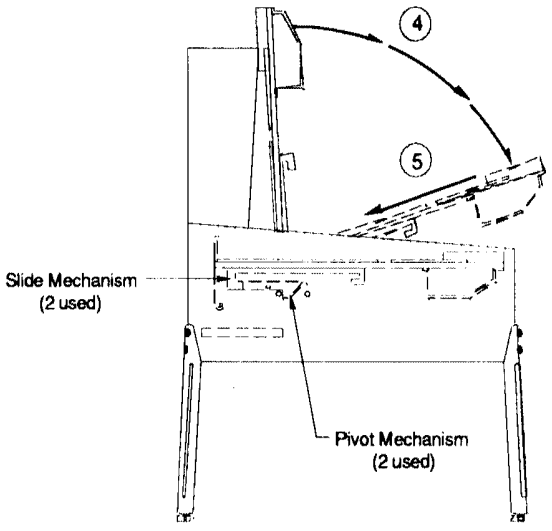


2. Pull the playfield out toward you until it stops (rest position) and raise it approximately 3".
   Be sure playfield is in locked position and does not slide back into the cabinet. If it does, repeat Step 2 before proceeding to Step 3.
3. Rotate playfield to upright service position (lean on backbox) by pulling toward you and up. Listen for the sound of a click; this insures locking and pivoting sequence.



To lower the playfield.

4. Rotate the playfield to the rest position. This unlocks the pivoting mechanism.
5. Push back playfield into cabinet and into playing position.



GAME CONTROL LOCATIONS

Cabinet Switches

The On-Off Switch is on the bottom of the cabinet near the right front leg.
The Start Button is a pushbutton to the left of the coin door on the cabinet exterior. Press the Start button to begin a game, or during the diagnostic mode, to ask for HELP.

Coin Door Buttons

The operator controls all game adjustments, obtains bookkeeping information, and diagnoses problems, using only four pushbutton switches mounted on the inside of the coin door. The Coin Door Buttons have two modes of operation Normal Function and Test Function.

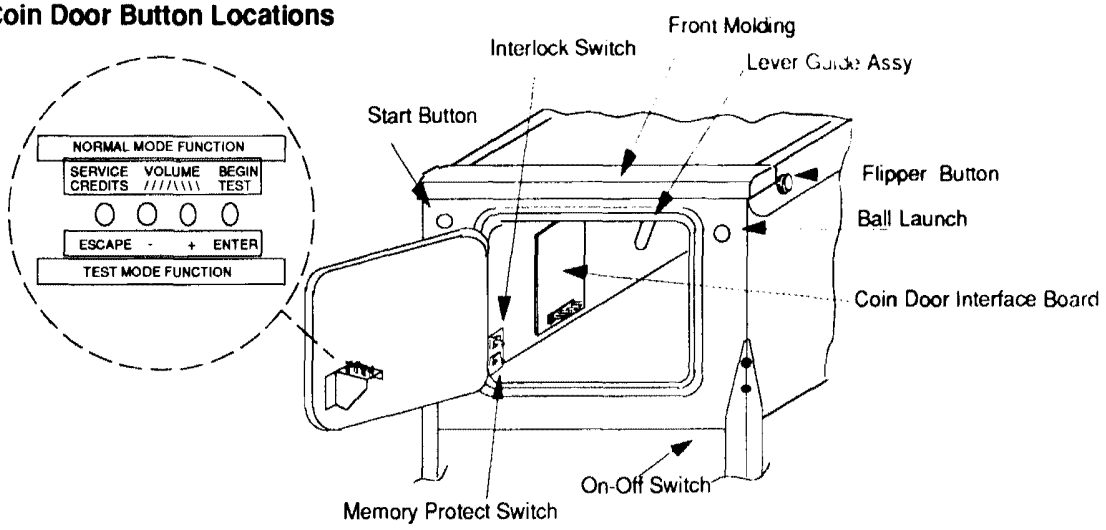
Normal Function

The Service Credits button puts credits on the game that are not included in any of the game audits.
The Volume Up (+)button raises the sound level of the game. Press and hold the button until the desired level is reached.
The Volume Down (-) button lowers the sound level of the game. Press and hold the button until the desired level is reached. See Adjustment A.1 28 to shut sound Off completely.
The Begin Test button starts the Menu System Operation and changes the Coin Door Buttons from Normal Function to Test Function.

Test Function

The Escape button allows you to get out of a menu selection or return to the Attract Mode.
The Up (+) button allows you to cycle forward through the menu selections or adjustment choices.
The Down (-) button allows you to cycle backward through the menu selections or adjustment choices.
The Enter button allows you to get into a menu selection or lock in an adjustment choice.
Holding the Enter button for five seconds, during the Attract Mode, resets the High Scores.

Coin Door Button Locations



GAME OPERATION

⚠ CAUTION

After assembly and installation at its site location, 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. DO NOT cut off the ground pin.

POWERING UP With the coin door closed, plug the game in, and switch it On. In normal operation, Testing shows in the displays as the game performs Start-up Tests. Once the Start-up Tests have been successfully completed the last score is displayed. After which, the game goes into the Attract Mode.

Note: After the game has been on location for a time, the Start-up Tests may contain messages concerning game problems. The section entitled 'Error Messages' contains more details concerning messages displayed at each game turn-on.

Open the coin door and press the Begin Test switch. The display shows the game name, number, and software revision. The message changes. The display shows the sound software revision, the revision level of the system software, and the date the software was revised.

Example: **Game Name** **Sound Rev. L-1**
500XX **Rev. L-X** **SY. 0.X0** **X-X-93**

Press the Enter button to enter the WPC Menu System (refer to the section entitled "Menu System Operation" for more information). Slide the Service Switch Actuator over the top interlock switch located in the bottom left corner of the coin door opening. Perform the entire Test Menu routine to verify that the game is operating satisfactorily.

ATTRACT MODE*. After completing the Test Menu routine, press the Escape button three times to enter the Attract Mode. During the Attract Mode, the score display shows a series of messages informing the player concerning, recent highest scores*, "custom messages*", and the score to achieve to obtain a Replay award*.

CREDIT POSTING. Insert coin(s). A sound is heard for each coin, and the display shows the number of credits purchased. So long as the number of maximum allowable credits* are NOT exceeded by coin purchase or high score, credits are posted correctly.

STARTING A GAME. Press the gun handle trigger once. A startup sound plays, and the credit amount shown in the display decreases by one. The display flashes 00 (until the first playfield switch is actuated), and shows ball 1. If credits are posted, additional players may enter the game by pressing the Start button once for each player, before the end of play on the first ball.

TILTS. Actuating the cabinet tilt switch inside the cabinet ends the current game and then proceeds to the Game Over Mode. With the third closure* of the plumb bob tilt switch, the player loses the remaining play of that ball, but can complete the game.

END OF A GAME. All earned scores and bonuses are awarded. If a player's final score exceeds the specified value, the player receives a designated award for achieving the current highest score. A random digit set* appears in the display. Credit* may be awarded, when the last two digits of any player's score match the random digits. Match, high score, and game over sounds are made, as appropriate.

GAME OVER MODE. The **Game Over** display shows in the display. Then, the high scores flash. The game proceeds to the Attract Mode.

* - Operator-adjustable feature

MENU SYSTEM OPERATION

The Main Menu allows you to choose from several categories, which in turn lead to other menus to choose from. To access the Main Menu, open the coin door and press the Begin Test button, then press the Enter button. Press the Up or Down buttons to cycle through the Main Menu. Press the Enter button to access a menu. Press the Escape button to return to the Main Menu. Press the Start button for HELP at any time.

MAIN MENU

B. Bookkeeping Menu

- B.1 Main Audits
- B.2 Earning Audits
- B.3 Standard Audits
- B.4 Feature Audits
- B.5 Histograms
- B.6 Time-stamps

P. Printouts Menu

- P.1 Earnings Data
- P.2 Main Audits
- P.3 Standard Audits
- P.4 Feature Audits
- P.5 Score Histograms
- P.6 Time Histograms
- P.7 Time-Stamps
- P.8 All Data

T. Test Menu

- T.1 Switch Edges Test
- T.2 Switch Levels Test
- T.3 Single Switches Test
- T.4 Solenoid Test
- T.5 Flasher Test
- T.6 General Illumination Test
- T.7 Sound and Music Test
- T.8 Single Lamps Test
- T.9 All Lamps Test
- T.10 Lamp & Flasher Test
- T.11 Display Test
- T.12 Flipper Coil Test
- T.13 Ordered Lamps Test
- T.14 Left Launcher Test
- T.15 Right Launcher Test
- T.16 Left Under Divertor Test
- T.17 Right Under Divertor Test
- T.18 Clear Out Balls Test

U. Utilities Menu

- U.1 Clear Audits
- U.2 Clear Coins
- U.3 Reset H.S.T.D.
- U.4 Set Time & Date
- U.5 Custom Message
- U.6 Set Game I.D.
- U.7 Factory Adjustments
- U.8 Factory Resets
- U.9 Presets
- U.10 Clear Credits
- U.11 Auto Burn-in

A. Adjustments Menu

- A.1 Standard Adjustments
- A.2 Feature Adjustments
- A.3 Pricing Adjustments
- A.4 H.S.T.D. Adjustments
- A.5 Printer Adjustments

Press Escape
To move out of a menu selection.

Press Enter
To get into a menu selection.

Press Up
Increases sequence; (ex. A.1, A.2, A.3, A.4).

Press Down
Decreases sequence; (ex. A.4, A.3, A.2, A.1).

Use Up or Down to cycle through the selections in a menu.

Use Escape and Enter to move into and out of the selected menu.

Press the Up or Down buttons to cycle through the menu. Press the Enter button to access an audit menu. Press the Escape button to return to the Bookkeeping Menu.

B. BOOKKEEPING MENU

B.1 Main Audits
B.2 Earning Audits
B.3 Standard Audits
B.4 Feature Audits
B.5 Histograms
B.6 Time-Stamps

One Button Audit System. The Bookkeeping Menu is obtainable directly from the Attract Mode. Repeatedly pressing the Enter button, while in the Attract Mode, will cycle through all of the game audits.

B.1 Main Audits

B.1	01	Total Earnings	00
B.1	02	Recent Earnings	00
B.1	03	Free Play Percent	00
B.1	04	Average Ball Time	00
B.1	05	Time Per Credit	00
B.1	06	Total Plays	00
B.1	07	Replay Awards	00
B.1	08	Percent Replays	00
B.1	09	Extra Balls	00
B.1	10	Percent Extra Ball	00

B.2 Earning Audits

B.2	01	Recent Earnings	00
B.2	02	Recent Left Slot	00
B.2	03	Recent Center Slot	00
B.2	04	Recent Right Slot	00
B.2	05	Recent 4th Slot	00
B.2	06	Recent Paid Credits	00
B.2	07	Recent Service Credits	00
B.2	08	Total Earnings*	00
B.2	09	Total Left Slot*	00
B.2	10	Total Center Slot*	00
B.2	11	Total Right Slot*	00
B.2	12	Total 4th Slot*	00
B.2	13	Total Paid Credits*	00
B.2	14	Total Service Credits*	00

* These audits are NOT resettable. They are a record of the earnings of the game since the "CLOCK 1ST SET" Time-stamp.

B.3 Standard Audits

B.3	01	Games Started	00
B.3	02	Total Plays*	00
B.3	03	Total Free Play	00
B.3	04	Free Play Percent	00
B.3	05	Replay Awards	00
B.3	06	Percent Replays	00
B.3	07	Special Awards	00
B.3	08	Percent Special	00
B.3	09	Match Awards	00
B.3	10	Percent Match	00
B.3	11	H.S.T.D. Credits	00
B.3	12	Percent H.S.T.D	00
B.3	13	Extra Ball	00
B.3	14	Percent Extra Ball	00
B.3	15	Tickets Awarded	00
B.3	16	Percent Tickets	00
B.3	17	Left Drains	00
B.3	18	Right Drains	00
B.3	19	Average Ball Time	00
B.3	20	Average Game Time	00
B.3	21	Play Time	00:00:00
B.3	22	Minutes On	00
B.3	23	Balls Played	00
B.3	24	Tilts	00
B.3	25	Replay 1 Awards	00
B.3	26	Replay 2 Awards	00
B.3	27	Replay 3 Awards	00
B.3	28	Replay 4 Awards	00
B.3	29	1 Player Games	00
B.3	30	2 Player Games	00
B.3	31	3 Player Games	00
B.3	32	4 Player Games	00
B.3	33	H.S.T.D. Reset Count	00
B.3	34	Burn-in Time†	00:00:00
B.3	35	1st Replay Level	00
B.3	36	Left Flipper	00
B.3	37	Right Flipper	00

* *"Total Plays" only counts on completed games. A game is considered complete when the final ball begins. Audit information from incomplete games is ignored. Operation for test and service do not affect audits.*

† This audit is not resettable.

B.4 Feature Audits

B.4	01	Time Per Credit	00%	00
B.4	02	Kickbacks Used	00%	00
B.4	03	Return to Duties	00%	00
B.4	04	Buy-in Extra Balls	00%	00
B.4	05	Commanders	00%	00
B.4	06	Captins	00%	00
B.4	07	Beyond Captin	00%	00
B.4	08	CD Time Rifts	00%	00
B.4	09	CD Worn Holes	00%	00
B.4	10	CD Searches	00%	00
B.4	11	CD Simulations	00%	00
B.4	12	CD Challanges	00%	00
B.4	13	CD Rescues	00%	00
B.4	14	CD Asteroids	00%	00
B.4	15	Finals Frontiers	00%	00
B.4	16	Comm. D Reruns	00%	00
B.4	17	Warp 5	00%	00
B.4	18	Warp 6	00%	00
B.4	19	Warp 7	00%	00
B.4	20	Warp 8	00%	00
B.4	21	Warp 9	00%	00
B.4	22	Warp 9.9	00%	00
B.4	23	Skill Missions	00%	00
B.4	24	Skill Flipper	00%	00
B.4	25	Skill Probe	00%	00
B.4	26	Skill Light Lock	00%	00
B.4	27	Skill Warp 4	00%	00
B.4	28	Flipper Skill Made	00%	00
B.4	29	Probe Made	00%	00
B.4	30	Neutral Zones	00%	00
B.4	31	Holodeck 10 Mil	00%	00
B.4	32	Holodeck Video	00%	00
B.4	33	Video Extra Balls	00%	00
B.4	34	Video Ends	00%	00
B.4	35	Poker Wins	00%	00
B.4	36	Poker Loses	00%	00
B.4	37	Videos	00%	00
B.4	38	Lock 1	00%	00
B.4	39	Lock 2	00%	00
B.4	40	Borg Multi-balls	00%	00
B.4	41	1X Jackpots	00%	00
B.4	42	2X Jackpots	00%	00
B.4	43	3X Jackpots	00%	00
B.4	44	Shuttle Specials	00%	00
B.4	45	Bonus Multiplier	00%	00
B.4	46	Missions Played	00%	00
B.4	47	Items Collected	00%	00

B.5 Histograms

B.5	01	0-1.9 Million Scores	00%	00
B.5	02	2-4.9 Million Scores	00%	00
B.5	03	5-9.9 Million Scores	00%	00
B.5	04	10-19 Million Scores	00%	00
B.5	05	20-29 Million Scores	00%	00
B.5	06	30-39 Million Scores	00%	00
B.5	07	40-49 Million Scores	00%	00
B.5	08	50-69 Million Scores	00%	00
B.5	09	70-99 Million Scores	00%	00
B.5	10	100-149 Million Scores	00%	00
B.5	11	150-199 MillionScores	00%	00
B.5	12	200-299 Million Scores	00%	00
B.5	13	Over 300 Million Scores	00%	00
B.5	14	Game Time 0.0-1.0 Mins	00%	00
B.5	15	Game Time 1.0-1.5 Mins	00%	00
B.5	16	Game Time 1.5-2.0 Mins	00%	00
B.5	17	Game Time 2.0-2.5 Mins	00%	00
B.5	18	Game Time 2.5-3.0 Mins	00%	00
B.5	19	Game Time 3.0-3.5 Mins	00%	00
B.5	20	Game Time 3.5-4.0 Mins	00%	00
B.5	21	Game Time 4-5 Mins	00%	00
B.5	22	Game Time 5-6 Mins	00%	00
B.5	23	Game Time 6-8 Mins	00%	00
B.5	24	Game Time 8-10 Mins	00%	00
B.5	25	Game Time 10-15 Mins	00%	00
B.5	26	Game Time Over 15 Mins	00%	00

B.6 Time-Stamps

Time-Stamps Menu allows you to view dates and times that are important to game software.

B.6	01	Current Time
B.6	02	Clock 1st Set
B.6	03	Clock Last Set
B.6	04	Audits Cleared
B.6	05	Coins Cleared
B.6	06	Factory Setting
B.6	07	Last Game Start
B.6	08	Last Replay
B.6	09	Last H.S.T.D. Reset
B.6	10	Champion Reset
B.6	11	Last Printout
B.6	12	Last Service Credit

Press the Up or Down buttons to cycle through the menu. Press the Enter button to access a menu. Press the Escape button to return to the Printouts Menu.

P. PRINTOUTS MENU

(optional board required)

P.1 Earnings Data
P.2 Main Audits
P.3 Standard Audits
P.4 Feature Audits
P.5 Score Histograms
P.6 Time Histograms
P.7 Time-Stamps
P.8 All Data

The Printouts Menu is a combination of the other menus. This menu allows you to access and print information in the available menu selections.

If no printer is attached the the message "Waiting for Printer" appears in the displays.
NOTE: Set the print specification from the Adjustment Menu, A.5 Printer Adjustments.

Use the Service Switch Actuator to hold in the top interlock switch located in the bottom left corner of the coin door opening. The actuator must be in place in order to activate the solenoids and flashlamps.

Press the Up or Down buttons to cycle through the menu. Press the Enter button to access a test. Press the Escape button to return to the Test Menu. **NOTE:** During any test, press the Start button to obtain the wire color, driver number, connector number and fuse location.

T. TEST MENU

T.1 Switch Edges Test
T.2 Switch Levels Test
T.3 Single Switch Test
T.4 Solenoid Test
T.5 Flasher Test
T.6 General Illumination Test
T.7 Sound & Music Test
T.8 Single Lamps Test
T.9 All Lamps Test
T.10 Lamp & Flasher Test
T.11 Display Test
T.12 Flipper Coil Test
T.13 Ordered Lamps Test
T.14 Left Launcher test
T.15 Right Launcher Test
T.16 Left Under Divertor Test
T.17 Right Under Divertor Test
T.18 Clear Out Balls Test

The switch matrix, on the left side of the display, shows the state of all switches. A dot indicates the switch is open, a square indicates the switch is closed. The numbers assigned to each switch indicate where the switch is located in the matrix. The number on the left indicates the column, the number on the right indicates the row. Example - Switch 23 is 2nd column, 3rd row.

A short to ground - on either the row or column wire - appears as a shorted row(s). However, a column wire shorted to ground disappears when all of the indicated row switches are open. A row wire shorted to ground does not disappear.

A shorted diode in the switch matrix can cause other switches to appear closed. These "phantom" switches (though not actually closed), complete a rectangle in the switch matrix. Therefore, if two switches in the same column are closed (example; #22 and #24), and a third switch is pressed in another column but in the same row as one of the first two (example; #32), the "phantom" switch #34 is falsely indicated as closed. The switch with the shorted diode is diagonally opposite the "phantom" switch (in this case #22).

T.1 Switch Edges Test Press each switch one at a time. The name and number of the switch is shown in the display. If a switch other then the one pressed, or no switch at all is indicated, the system has detected a problem with the switch circuit.

T.2 Switch Levels Test This test automatically cycles through all switches that are detected closed. The name and number of each switch that is detected is shown in the display. A filled square indicates the switch's position in the matrix.

T.3 Single Switches Test The Single Switch Test isolates a particular switch by blocking signals from all other switches. Use the Up or Down buttons to select the switch to be tested.

T.4 Solenoid Test The Solenoid Test has three modes - Repeat, Stop, and Run. Only one solenoid should pulse at a time. The system has detected a problem if more then one solenoid pulses, a solenoid comes on and stays on, or no solenoids pulse during the Repeat or Run modes.

Repeat The Repeat mode pulses a single solenoid. After entering this test, Solenoid 1 shows in the display and the corresponding solenoid activates. Press the Up or Down button to cycle through the solenoids, one at a time. The same solenoid pulses until the Up or Down button is pressed. Either press the Escape button to return to the Test Menu, or press the Enter button to move to the next mode.

Stop The Stop mode halts the Solenoid Test. Press Enter during the Repeat mode and the Solenoid Test stops. No solenoids should be activated while the test is stopped. Either press the Escape button to return to the Test Menu, or the Enter button to move to the next mode.

Run The Run mode cycles through the solenoids automatically. The display shows the name and number of the solenoid currently being pulsed.

T.5 Flasher Test This tests the flashlamp part of the solenoid circuit exclusively. This, like the Solenoid Test, has three modes - Repeat, Stop, and Run. During this test only one flashlamp circuit should pulse at a time. The system has detected a problem if more then one circuit pulses, a circuit stays on, or no circuits pulse during the Repeat or Run modes.

Repeat The Repeat mode pulses a single flashlamp. After entering this test the name and number of the first flashlamp circuit shows in the display and the corresponding bulb(s) flash. Press the Up or Down buttons to cycle through all of the flashlamps circuits one at a time. The same circuit pulses until press the Up or Down button is pressed. Either press the Escape button to return to the Test Menu, or press the Enter button to advance to the next mode.

Stop The Stop mode halts the Flasher Test. No flashlamp circuit should be active during this mode. Either press the Escape button to return to the Test Menu, or press the Enter button to advance to the next mode.

Run The Run mode cycles through the flashlamps automatically. The display shows the name and number of the flashlamp circuit currently being pulsed as the corresponding bulb(s) flashes.

T.6 General Illumination Test This test checks all of the General Illumination circuits. There are two modes of operation - Stop and Run.

Stop Press the Up or Down buttons to cycle through the General Illumination Test manually. All illumination is tested first, followed by an individual circuit test. The circuit name and number shows in the display while the corresponding lamps lights. If any other results occur the system has detected an error.

Run Press the Enter button any time during Stop mode and the General Illumination Test cycles through automatically. For each circuit shown in the display the corresponding bulbs should light. If any other results occurs the system has detected a problem.

T.7 Sound and Music Test The Sound and Music Test checks the audio circuits. This test has three modes for testing the sound and music circuits - Run, Repeat, and Stop.

Run The Run mode steps through a sequence of sounds and music. Press the Up or Down buttons during this portion of the Sound and Music test to advance to a particular sound or tune without having to wait for the program to play all the sounds available in the test. A sound or tune should be heard for each name and number that appears in the display. Any other results indicates the system has detected a problem.

Repeat Press the Enter button at any time during the Run mode to cause the program to stop and repeat a particular sound/tune. The same sound should repeat continuously until the Up or Down button is pressed. Any other results indicates the system has detected a problem.

Stop Press the Enter button at any time during the Repeat mode to stop this test altogether. Nothing should be heard. Any other results indicates the system has detected a problem.

T.8 Single Lamp Test The number assigned to each lamp indicates the lamp's position in the matrix. The number on the left indicates the column. The number on the right indicates the row. Example - Lamp 23 means 2nd column, 3rd row.

This test checks each lamp circuit individually. Press the Up or Down button to cycle through this test. For each name and number that is shown in the display the corresponding lamp should light. Any other results indicates the system has detected a problem.

T.9 All Lamps Test This test causes all the controlled lamps to flash at the same time. Every controlled lamp should flash. Any other results indicates the system has detected a problem.

T.10 Lamp and Flasher Test This test causes all the flashlamps and the controlled lamps to flash at the same time. The controlled lamps blink, while the flashlamps cycle from highest to lowest. Any other results indicates the system has detected a problem.

T.11 Display Test This test automatically checks every dot in the Dot Matrix Display. A series of patterns appear in sequence. Each pattern turns on and off a section of dots. Every dot on the matrix display should be turned on and off during this test.

T.12 Flipper Coil Test The Flipper Coil Test has three modes - Repeat, Stop, and Run. Only one Flipper should pulse at a time. The system has detected a problem if more then one flipper pulses, a flipper comes on and stays on, or no flippers pulse during the Repeat or Run modes.

Repeat The Repeat mode pulses a single flipper. After entering this test, flipper coil 01 shows in the display and the corresponding coil activates. Press the Up or Down button to cycle through the flipper coils, one at a time. The same solenoid pulses until the Up or Down button is pressed. Either press the Escape button to return to the Test Menu, or press the Enter button to move to the next mode.

Stop The Stop mode halts the Flipper Coil Test. Press Enter during the Repeat mode and the test stops. No coils should be activated while the test is stopped. Either press the Escape button to return to the Test Menu, or the Enter button to move to the next mode.

Run The Run mode cycles through the flippers automatically. The display shows the name and number of the flipper coil currently being pulsed.

T.13 Ordered Lamps Test The number assigned to each lamp indicates the lamp's position in the matrix. The number on the left indicates the column. The number on the right indicates the row. Example - Lamp 23 means 2nd column, 3rd row.

This test checks each lamp circuit individually. Press the Up or Down button to cycle through the lamps. Lamps light in a clock-wise or counter clock-wise direction starting from the bottom of the playfield. Direction depends on which button, Up or Down, is pressed. For each name and number that is shown in the display the corresponding lamp should light. Any other results indicates the system has detected a problem.

T.14 Left Launcher Test This test checks the switches, motor and the kicker on the left gun assembly.

Press the Enter button and the display shows the status of the switches. This status should correspond to the position of the gun assembly. Press the Up or Down buttons to rotate the gun assembly. Press the Enter button and the gun kicker should fire. Any other results indicates a problem.

T.15 Right Launcher Test This test checks the switches, motor and the kicker on the right gun assembly.

Press the Enter button and the display shows the status of the switches. This status should correspond to the position of the gun assembly. Press the Up or Down buttons to rotate the gun assembly. Press the Enter button and the gun kicker should fire. Any other results indicates a problem.

T.16 Left Under Divertor This test checks the divertor that loads balls into the left ball popper.

Press the Enter button and the left ball popper should kick a ball into the left gun assembly. At the same time, the display should read, "Ball Should Go To Left Popper". If the ball is reloaded into the popper, while still in Left Under Divertor test, it should kick out into the gun assembly again. Any other result for this test indicates a problem.

T.17 Right Under Divertor Test This test checks the divertor that loads balls into the right ball popper.

Press the Enter button and the right ball popper should kick a ball into the right gun assembly. At the same time, the display should read, "Ball Should Go To Right Popper". If the ball is reloaded into the popper, while still in Right Under Divertor test, it should kick out into the gun assembly again. Any other result for this test indicates a problem.

T.18 Clear Out Balls Test The test checks the poppers and kickers that are under the playfield.

Press the Enter button and all balls loaded into the poppers and troughs should be kicked out until there are no balls in any under playfield location. At the same time, the display should read, "Removing All Balls From Under Playfield". Any other results indicates a problem.

NOTE. *As balls roll down the playfield and into the outhole, they will be continually kicked out of the trough.*

Press the Up or Down buttons to cycle through the menu. Press the Enter button to access a utility. Press the Up or Down buttons to see the setting choices. Press the Enter button to lock in a choice. If a mistake is made, press Escape while "Saving Adjustment Value" is in the display. The original setting is retained and the new setting is ignored. Press the Escape button to return to the Utility Menu.

U. Utilities Menu

U.1 Clear Audits
U.2 Clear Coins
U.3 Reset H.S.T.D.
U.4 Set Time & Date
U.5 Custom Message
U.6 Set Game I.D.
U.7 Factory Adjustments
U.8 Factory Resets
U.9 Presets
U.10 Clear Credits
U.11 Auto Burn-in

U.1 Clear Audits Press the Enter button to clear the Standard Audits (except Burn-in Time), Feature Audits, and Histograms.

U.2 Clear Coins Press the Enter button to clear the Earnings Audits.

U.3 Reset H.S.T.D. Press the Enter button to clear the High Score to Date Table and the Grand Champion.

U.4 Set Time and Date Press the Enter button to activate the time and date. Use the Up or Down button to change the value, then press the Enter button to lock in that value. If a mistake is made press the Escape button while "Saving Adjustment Value" is displayed. The new value is ignored and the original value is retained.

U.5 Custom Message Set A.1 20 to ON before trying to write a Custom Message. Press the Enter button to begin entry of the custom message. Use the Up or Down buttons to cycle through letters. Use the Start button to cycle through punctuation marks. Press the Enter button to lock in the desired letter and punctuation. If a mistake is made, use Up and Down to select the "back-arrow" character. The "back-arrow" character is located before the space character and after the number nine. Press Enter while the back-arrow shows to erase the previously entered character. Once the message is complete, press and hold the Enter button until "Message Stored" is displayed.

Press the Escape button to cancel the new message. The message "Press Enter to Reset" appears. If Enter is pressed, the custom message is cleared and no message is displayed. If Escape is pressed, the original message remains intact.

U.6 Set Game I.D. This utility allows for the installation of a message, such as game location, that only appears on printouts. Press the Enter button to activate Set Game I.D.. Use the Up or Down buttons to cycle through letters. Use the Start button to cycle through punctuation marks. Press the Enter button to lock in the desired letter and punctuation.

U.7 Factory Adjustment Press the Enter button to restore the adjustments to factory settings.

U.8 Factory Reset Press the Enter button to restore the adjustments to their factory setting, clear the Audits, H.S.T.D Table, and Custom Message/Game I.D.

U.9 Presets Use the Up or Down buttons to cycle through the available Presets. When the desired Preset is displayed, press the Enter button to lock in that Preset. If a mistake is made, press the Escape button while "Saving Adjustment Value" is displayed. The new value is ignored and the original value is retained.

Game Difficulty Levels The game play difficulty adjustments can be changed to a combination that is MUCH LESS to MUCH MORE difficult than Factory Settings. The Game Difficulty Setting Table lists the adjustments and settings that comprise the individual group.

U.9 01 Install Extra Easy
MUCH LESS difficult than factory setting.

U.9 02 Install Easy
Somewhat LESS difficult than factory setting.

U.9 03 Install Medium
About the SAME as factory setting.

U.9 04 Install Hard
Somewhat MORE difficult than factory setting.

U.9 05 Install Extra Hard
MUCH MORE difficult than factory setting.

Difficulty Setting Table for U.S., Canadian, French, German, and European Games

Adj #	Adj Description	Extra Easy U.9 01	Easy U.9 02	Medium U.9 03 (factory)	Hard U.9 04	Extra Hard U.9 05
A.2 02	Extra Ball Percent	25%	20%	20%	15%	10%
A.2 04	Kickback Setting	Ex. Easy	Medium	Hard	Hard	Ex. Hard
A.2 05	Extra Ball Memory	On	On	On	On	Off
A.2 06	Multi-ball Percent	30%	25%	20%	15%	12%
A.2 07	Command Rerun	Unlimited	Unlimited	Unlimited	1	None
A.2 08	Ferengi Time	20 sec.	15 sec.	10 sec.	10 sec.	8 sec.
A.2 09	Skill Locks Count	Unlimited	Unlimited	2	1	None
A.2 12	Return to Duty	On	On	On	Off	Off

U.9 06 Install 5 Ball
U.9 07 Install 3 Ball Adjustments U.9 06 and U.9 07 can be used to change a game to 3 or 5 ball play, including changing of certain features to the recommended 3- and 5-ball level. The Preset Game Adjustments Table for U.S./Canadian Games lists the adjustments and settings that comprise the individual groups.

Preset Adjustments Table for U.S. and Canadian Games

Adj #	Adj Description	Install 5-ball U.9 06	Install 3-ball U.9 07
A.1 07	Replay Start	1 Billion	450 Million
A.2 02	Extra Ball Percent	15%	20%
A.2 04	Kickback Setting	Hard	Hard
A.2 05	Extra Ball Memory	On	On
A.2 06	Multi-ball Percent	15%	20%
A.2 07	Command Rerun	1	Unlimited
A.2 08	Ferengi Time	10 sec.	10 sec.
A.2 09	Skill Locks Count	1	2
A.2 12	Return to Duty	Off	On

U.9 08 Install Add-A-Ball This option deletes all Free Play awards and replaces them with Extra Ball awards. Individual adjustments are affected, as follows:

Ad	Name	New Setting
A.1 13	Replay Boost	Off
A.1 14	Replay Award	Ex. Ball
A.1 15	Special Award	Ex. Ball
A.1 17	Extra Ball Ticket	No
A.1 19	Match Feature	Off
A.4 04	Champion Credits	00
A.4 05	High Score 1 Credits	00
A.4 06	High Score 2 Credits	00
A.4 07	High Score 3 Credits	00
A.4 08	High Score 4 Credits	00

U.9 09 Install Ticket This option deletes Credit awards and replaces them with Ticket awards. Individual adjustments are affected as follows:

Ad	Name	New Setting
A.1 14	Replay Award	Ticket
A.1 15	Special Award	Ticket
A.1 16	Match Award	Ticket
A.1 17	Ex. Ball Ticket	Yes
A.1 31	Ticket Expan.Brd.	Yes
A.4 02	H.S.T.D. Award	Ticket

U.9 10 Install Novelty This option removes all Free Play and Extra Ball awards. Individual adjustments are affected as follows:

Ad	Name	New Setting
A.1 04	Max. Ex. Ball	Off
A.1 05	Replay System	Fixed
A.1 09	Replay Level 1	Off
A.1 10	Replay Level 2	Off
A.1 11	Replay Level 3	Off
A.1 12	Replay Level 4	Off
A.1 15	Special Award	Points
A.1 19	Match Feature	Off
A.4 01	Highest Score	On
A.4 04	Champion Credits	00
A.4 05	High Score 1 Credits	00
A.4 06	High Score 2 Credits	00
A.4 07	High Score 3 Credits	00
A.4 08	High Score 4 Credits	00

U.9 11 Install Buy-in This option automatically sets game pricing to 1 for 50¢/2 for $1.00 and 1 Coin Buy-in (A.3 19) to YES.

U.9 12 Serial Capture This sets up the printer adjustments for a serial transmission to a laptop computer, (9600 baud, 40 column, no page breaks, serial printer). This option requires the installation of the optional printer kit; part number 63110.

U.9 13 through U.9 16 Not Used

U.9 17 Install German 1 •
U.9 18 Install German 2 •
U.9 19 Install German 3 •
U.9 20 Install German 4 •
U.9 21 Install German 5 •
U.9 22 Install German 6 • Adjustments U.9 17 through U.9 22 are used to modify game pricing and type of game play. The Preset Game Adjustments Table for German/European Games lists the adjustments and settings that comprise the individual groups. ***NOTE:*** German replay starts at 500,000,000.

Preset Adjustments Table for German Games

Adj #	Adj Description	German 1 U.9 17	German 2 U.9 18	German 3 U.9 19	German 4 U.9 20	German 5 U.9 21	German 6 U.9 22
A.1 14	Replay Award	Credit	Ticket	Audit	Credit	Ticket	Audit
A.1 15	Special Award	Credit	Ex. Ball	Points	Credit	Ex. Ball	Points
A.1 16	Match Award	Credit	Ticket	Credit	Credit	Ticket	Credit
A.1 19	Match Feature	7%	7%	Off	7%	7%	Off
A.3 01	Game Pricing	6spiele/5DM	6spiele/5DM	6spiele/5DM	7spiele/5DM	7spiele/5DM	7spiele/5DM
A.4 02	H.S.T.D. Award	Credit	Ticket	Credit	Credit	Ticket	Credit
A.4 04	Champion Credits	03	03	00	03	03	00
A.4 05	H.S.T.D. 1 Credits	01	01	00	01	01	00
A.4 06	H.S.T.D. 2 Credits	00	00	00	00	00	00
A.4 07	H.S.T.D. 3 Credits	00	00	00	00	00	00
A.4 08	H.S.T.D. 4 Credits	00	00	00	00	00	00

• German DIP Switch settings are:

Sw4	Sw5	Sw6	Sw7	Sw8
On	On	On	On	Off

U.9 23 Install French 1*
U.9 24 Install French 2*
U.9 25 Install French 3*
U.9 26 Install French 4*
U.9 27 Install French 5*
U.9 28 Install French 6* Adjustments U.9 23 through U.9 28 are used to modify game pricing and type of play.

*** French DIP Switch settings are:**

Sw4	Sw5	Sw6	Sw7	Sw8
On	On	On	Off	Off

U.10 Clear Credits Press the Enter button to clear the game Credits.

U.11 Auto Burn-in Press the Enter button to activate Auto Burn-in. This utility automatically cycles through several tests. This helps in finding intermittent problems. The tests that Auto Burn-in cycles through are: the Display Test, the Sound and Music Test, the All Lamps Test, the Solenoid Test, the Flashers Test, the General Illumination Test, and the Flipper Coil Test. All of the test run are run concurrently. The time spent on the burn-in cycle, and the total time the game has spent in burn-in are displayed.

Press the Up or Down buttons to cycle through the menu. Press the Enter button to access an adjustment. Press the Up or Down buttons to see the setting choices. Press the Enter button to lock in a setting choice. If a mistake is made, press the Escape button while "Saving Adjustment Value" is in the display. The original value is retained and the new value is ignored. Press the Escape button to return to the Adjustment Menu.

A. ADJUSTMENTS MENU

A.1 Standard Adjustments
A.2 Feature Adjustments
A.3 Pricing Adjustments
A.4 H.S.T.D Adjustments
A.5 Printer Adjustments (optional board required)

A.1 Standard Adjustments

A.1 01 Balls Per Game
A "game" is defined by specifying the number of balls to be played.
Range: 1 to 10.

A.1 02 Tilt Warnings
The number of total actuations of the plumb bob mechanism that can occur before the game is "tilted".
Range: 1 to 10.

A.1 03 Maximum Extra Balls
The number of Extra Balls that a player may accumulate.
Range: 0 to 10.

A.1 04 Maximum Extra Balls/Ball in Play
The number of Extra Balls to be awarded per ball in play.

OFF - No maximum number of Extra Ball per ball in play.
1-10 - 1 through 10 Extra Balls per ball in play.

A.1 05 Replay System
The type of replay system to be used.

Fixed - Replay value is set and does not change during game play.
Auto% - Replay starting value is set but changes every 50 games to comply with the percentage of replays desired.

A.1 06 Replay Percent*
The percentage of replays the players are able to earn when Auto Replay is used.
Range: 5% to 50%.

A.1 07 Replay Start*
Replay start value when Auto% Replay is used.
Range: 15,000,000 to 250,000,000.

*For Auto% Replay.

A.1 08 **Replay Levels***

The number of replay levels used by the Auto% Replay mode. The range of this setting is 1 to 4. When two replay levels are chosen, the second replay level is automatically adjusted to twice the starting replay level. When three of four replay levels are chosen, their values are automatically adjusted to three or four times the starting replay level.

A.1 09 **Replay Level 1****
A.1 10 **Replay Level 2****
A.1 11 **Replay Level 3****
A.1 12 **Replay Level 4****

The value to be used for the 1st through 4th Fixed Replay.
Range: 00 to 250,000,000.

A.1 13 **Replay Boost**

The replay score can be temporarily boosted by the selected amount EACH time the player reaches or exceeds the replay score. This temporary boost is cancelled when credits equal 0, the player inserts another coin, or when Begin Test is pressed.

ON - Score is boosted between 500,000 and 5,000,000 points.
OFF - Replay score is not boosted.

A.1 14 **Replay Award**

The form of award automatically provided when the player exceeds any replay level for either Auto% Replay or Fixed Replay.

Credit - Reaching each Replay level awards credit.
Ticket - Reaching each Replay level awards a ticket.
Ball - Reaching each Replay level awards an Extra Ball.
Audit - Reaching each Replay level awards nothing to the player; it does increase the entry value of the Audit Item(s) maintaining a tally of these awards.

A.1 15 **Special Award**

The award automatically provided when the player scores a special.

Credit - Scoring a Special awards a Credit.
Ticket - Scoring a Special awards a Ticket.
Ball - Scoring a Special awards an Extra Ball.
Points - Scoring a Special awards 1 Million points.

A.1 16 **Match Award**

The award automatically provided when the players wins a match.

Credit - Winning a Match awards a Credit.
Ticket - Winning a Match awards a Ticket.

A.1 17 **Extra Ball Ticket**

A Ticket is awarded when the player earns an Extra Ball.

YES - The player is awarded a Ticket in addition to an Extra Ball.
NO - The player is not awarded a Ticket

*For Auto% Replay; ** For Fixed Replay

A.1 18 Maximum Ticket/Player
The amount of Tickets each player can earn.
Range: 00 to 100.

A.1 19 Match Feature
The desired percentage for the Match Feature occurring at the end of the game.

OFF - Match Feature is not available.
1 - 50%- 1% is 'hard'; 50% is 'extremely easy'. The Match Feature selects a random two-digit number at the end of the game and compares each players score for an identical two digits in the rightmost two positions. A match of these two digit results in an award of a Credit or a Ticket.

A.1 20 Custom Message
The message displayed during the Attract Mode.

YES - A message is displayed
NO - A message is not displayed.

A.1 21 Language
The language the game uses: English, French, or German.

A.1 22 Clock Style
The style of clock the game uses: A.M./P.M. or 24 Hours.

A.1 23 Date Style
The style of date the game uses: Month/Date/Year, or Date/Month/Year.

A.1 24 Show Date and Time
The date and time show in the Attract Mode.

YES - Show the date, time in status report or in the Attract Mode.
NO - Do Not show date, time in status report or in the Attract Mode.

A.1 25 Allow Dim Illumination
The game program dims the General Illumination for special effects and during the Attract Mode.

YES - Dim the General Illumination during the Attract Mode.
NO - Do Not dim the General Illumination.

A.1 26 Tournament Play
Equalize Multiball and Jackpots during multi-player games, (do not carry over to next player).

YES - Keep Multball and Jackpots equal.
NO - Do Not Keep Multiball and Jackpots equal.

A.1 27 Euro. Scr. Format
Use either commas or dots between digits when numbers are displayed.

YES - Dots instead of commas, (example- 1.000.000).
NO - Commas instead of dots, (example- 1, 000, 000).

A.1 28 Minimum Volume Override
The volume can be turned Off.

YES - Volume can be turned Off.
NO - Volume can be turned Down but not Off.

A.1 29 General Illumination Power Saver
This allows the general illumination and controlled lamps to be dimmed following a time interval after a game is played. Power Saver Level (A.1 30) determines dimness of the lamps. Using this feature substantially increases the life of the lamps.
Setting: OFF, 2 to 60 minutes.

A.1 30 Power Saver Level
When General Illumination Power Saver (A.1 29) is set to On, this controls the intensity of the G.I. and controlled lamps once the game has been idle for a specified period of time.
Range: 4 to 7. (4 = dimmest, 7 = brightest)

A.1 31 Ticket Expansion Board
When a Ticket Expansion Board is connected, full control of the ticket dispenser is available. This includes a ticket low/error lamp, resume on ticket jam switch and manual ticket dispense switch.

YES - Ticket Expansion Board is connected.
NO - Ticket Expansion Board is NOT installed in the game.

A.1 32 No Bonus Flips
The activation of flippers during the end of ball "bonus" sequence. Setting to "YES" may extend the life of the flipper mechanisms.

A.1 33 Game Restart
When the Start button is pressed during or after the 2nd ball, the game in progress will end and a new game will begin. This adjustment has three settings to determine how this is handled.

NEVER- Do not allow a new game start until the current game is over.

SLOW - Restart if the Start button is pressed continuously for over 1/2 second. This helps to prevent the unintended restart of game in progress.

INSTANTLY - Restart as soon as the Start button is pressed.

When the Start button is pressed during game over, or during the 1st ball (to add a player), it is always handled instantly.

A.2 Feature Adjustments

A.2 01 Special Percent
The percent of Specials that a game awards.

Settings: OFF = Special is not awarded.
1% to 10% = Percentage of Specials.

A.2 02 Extra Ball Percent
The percent of Extra Balls that a game awards.

Settings: OFF = Extra Ball is not awarded.
1% to 35% = Percentage of Extra Balls.

A.2 03 Timed Plunger
The plunger automatically kicks for the player.

Setting: ON = After 1 to 120 seconds of inactive play, the plunger kicks automatically.
OFF = The plunger does not kick automatically.

A.2 04 Kickback Setting
The Kickback is turned on either at the beginning of a ball or at the beginning of a game.

Settings:
EXTRA EASY = Always on.
EASY = On at ball start.
MEDIUM = On at game start with memory on.
HARD = On at game start with no memory.
EXTRA HARD = Off at ball start.

A.2 05 Extra Ball Memory
The Extra Ball light is either carried over from ball to ball, or reset at ball start.

Setting: ON = The Extra Ball light is carried over from ball to ball.
OFF = The Extra Ball light is reset at ball start.

A.2 06 Multi-ball Percent
The percent of Multi-balls that a game awards.

Settings: 10% to 50% - Percentage of Multi-balls.

A.2 07 Command Reruns
The number of times a mission can be undertaken.

Setting: NONE = Cannot repeat a mission already attempted.
ONE = A mission can be repeated one time.
UNLIMITED = A mission may be repeated an unlimited amount of times.

A2 08 **Ferengi Time**
This determines how long a player can shoot the Neutral Zone for Add-A-Multi-ball.

Settings: 8 seconds to 20 seconds

A.2 09 **Skill Lock Count**
This determines the number of locks the player is allowed to choose off the Skill Shot.

Setting: UNLIMITED = Player may shoot for all of the locks.
NONE = Player may not shoot for any lock.
ONE = Player may shoot for one lock.
TWO = Player may shoot for two locks.

A.2 10 **Buy Extra Ball**
This determines whether or not each player may buy one extra ball for one credit at the end of the game.

Settings: OFF
1 CREDIT

A.2 11 **Buy-in Count**
This determines the number of Buy-ins per game the player is allowed.

Settings: UNLIMITED
1 to 3 BUY-INS

A.2 12 **Return to Duty**
This is a ball saving feature. The ball is returned to the player if it is drained at the beginning of ball-in-play.

Settings: ON = The ball is returned to the player.
OFF = The ball is not returned to the player.

A.2 13 **Attract Mode Sounds**
This determines whether or not the attract mode plays music and speech to attract player.

Settings: ON = The attract mode does have music and speech.
OFF = The attract mode does not have music or speech.

A.2 14 **Video Mode On**
This determines whether or not the hidden video mode is available to the players.

Settings: ON = Hidden video mode is available.
OFF = Hidden video mode is not available.

A.2 15 **Video Mode Attract**
This determines whether the hidden video mode, (if it is available to the player) is part of the attract mode.

Settings: ON = Hidden video mode is part of the attract mode.
OFF = Hidden video mode is not part of the attract mode.

A.2 16 Flipper Plunger

Pressing the flipper button, as well as the trigger, can shoot the ball.

Setting: ON = Pressing the flipper button shoots the ball.
OFF = The plunger does not kick automatically.

A.2 17 Left Launcher Broken

This determines if the software sends a ball to the left launcher if, the divertor under the playfield closest to the coin door, or the ball popper leading to the left launcher, or the left launcher is not functioning.

Settings: ON = Software does not send a ball to the left launcher.
OFF = Software does allow a ball to be sent to the left launcher.

A.2 18 Right Launcher Broken

This determines if the software sends a ball to the right launcher if, the divertor under the playfield farthest from the coin door, or the ball popper leading to the right launcher, or the right launcher is not functioning.

Settings: ON = Software does not send a ball to the right launcher.
OFF = Software does allow a ball to be sent to the right launcher.

A. 3 Pricing Adjustments

A.3 01 **Game Pricing (if set to custom, then 02 to 09 are available)**
The cost of a game is selected from the Standard Pricing Table or by installing Custom pricing.

A.3 02 **Left Coin Units**
A.3 03 **Center Coin Units**
A.3 04 **Right Coin Units**
A.3 05 **4th Slot Units**
The number of coin units purchased by a coin passing through the left, center, right, or fourth coin chute.

A.3 06 **Units/Credits**
Defines the number of coin units required to obtain 1 credit. A coin unit counter in the game program totals the number of coin units purchased through all coin chutes prior to each game. If the total number of these coin units exceeds or matches the Unit per Credit value by a multiple (or more, coin units) of the specified Units per Credit value the Credits display shows the proper number of credits. The coin unit counter retains any remaining coin units, until the start of Ball 2; then the coin unit counter is cleared (its contents are zeroed).

A.3 07 **Units/Bonus**
Additional credits are to be indicated in the credits display, when a certain number of coin units are accumulated.

A.3 08 **Bonus Credits**
The number of credits that are awarded when the Units/Bonus level is achieved.

A.3 09 **Minimum Units**
No credits are to be posted (indicated in the credit display), until the credits unit counter reaches a particular value, by setting this value to 02 (or more).

A.3 10 **Coin Door Type (if set to custom, then 11 to 15 and 20 are available)**
This adjustment is used to pre-set adjustments 11 to 15 based on standard coin doors (U.S.A., German, etc.).

A.3 11 **Collection Text**
The coin system is used to display the Earning Audits.

A.3 12 **Left Slot Value**
A.3 13 **Center Slot Value**
A.3 14 **Right Slot Value**
A.3 15 **4th Slot Value**
The monetary value of the left, center, right, or fourth coin chute.

A.3 16 **Maximum Credits**
The maximum number of credits the game can accumulate, either through game play awards or coin purchases. The range of this setting is 5 through 99. Reaching the specified setting prevents the award of any credits. Factory default is 10.

A.3 17 Free Play

A player can operate the game without a coin (free play) or with a coin.

NO - A coin is necessary for game play.
YES - Game play is free; no coin required.

A.3 18 Hide Coin Audits

The coin audits may, or may not, be displayed.

YES - The coin audits are not displayed.
NO - The coin audits are displayed.
HIDE NAMES - The coin audit value is shown but not the audit name.

A.3 19 1 Coin Buy-in

If the game pricing is set to1 for 50¢/2 for $1.00 the player can be allowed to 'buy-in' a subsequent game for 1 coin. The number of games that may be purchased at this cost is determined by the number of players in the previous game; that is, if the previous game had three players, three credits can be purchased at the rate of one coin per credit.

YES - The player has 10 seconds to buy-in at one coin per game.
NO - The buy-in feature is disabled.

A.3 20 Base Coin Size

This number is used for ticket per coin calculations.

A.3 21 Coin Meter Units

It is possible to connect a coin meter to the knocker coil driver which will log all coins through all slots. This adjustment activates the use of the knocker driver for this purpose, and determines the value of each unit on the meter. For example, to show the total amount of money collected as "total quarters", set this adjustment to "0.25". To show the amount of money collected as "total dollars", set this adjustment to "1.00".

Setting this adjustment to anything other than Off establishes the coin unit for a meter attached to the knocker driver, and overrides use of the knocker during awards.

A.3 22 Dollar Bill Slot

The system normally requires 150 microseconds between coin pulses. This is too long a delay for a fast-pulsing dollar bill validator. This adjustment may be used to tell the game that there is a fast-pulsing dollar bill validator connected to one of the coin switches.

NONE = No validator connected.
LEFT = Validator connected to left slot.
CENTER = Validator connected to center slot.
RIGHT = Validator connected to right slot
FOURTH = Validator connected to fourth.

A.3 23 Minimum Coin Microseconds

This is the minimum width required for coin pulses to be accepted as valid coins. This may be changed to prevent certain kinds of cheating.

Pricing Table

Country	Coin Chutes Left	Center	Right	4th Chute	Games/Coins	Display	Pricing Adjustments A3 02 03 04 05 06 07 08 09
USA	25¢	$1.00*	25¢	$1.00	1/50¢, 2/75¢, 3/$1 [2]	50¢, 75¢, $1.00	
	25¢	$1.00*	25¢	$1.00	1/3X25¢ [2]	USA 1/$0.75	
	25¢	$1.00*	25¢	$1.00	1/50¢, 2/$1 [2]	USA 2/$1.00	
	25¢	$1.00	25¢	$1.00	1/50¢, 3/$1.00 [2]	USA 3/$1.00	
	25¢	$1.00*	25¢	$1.00	1/2x25¢, 2/4x25¢, 3/$1 [2]	3/$1.00 Coin	
	25¢	$1.00*	25¢	$1.00	1/2x25¢, 2/$1.00, 3/$1.50, 6/$2.00 [2]	USA 6/$2.00	
	25¢	$1.00*	25¢	$1.00	1/2x25¢, 2/$1.00, 3/$1.50, 5/$2.00 [2,1]	USA 5/$2.00	
	25¢	$1.00*	25¢	$1.00	1/3x25¢, 1/$1.50, 4/$2.00 [2]	1/.75, 4/$2.00	
	25¢	$1.00*	25¢	$1.00	1/2x25¢, 2/$1.00, 4/$1.50, 6/$2.00 [2]	6/$2. 00 4/$1.50	
	25¢	25¢	25¢	-	1/4x25¢, 6/$5.00	1/1, 6/5	
	25¢	25¢	25¢	-	1/4x25¢	1/$1.00	
Canada	25¢	-	$1.00	-	1/50¢, 2/75¢, 3/$1	CANADA 1	
					1/50¢, 2/$1 [2]	CANADA 2	
Austria	5sch	10sch	10sch	-	1/2x5sch, 3/2x10sch [2]	AUSTRIA	
	5sch	-	10sch	-	2/5sch, 5/10sch	CUSTOM	02 00 05 00 01 00 01 00
Australia	20¢	$1	$1	$2	1/$1, 3/$2 [2]	AUSTRALIA 1	
	20¢	$1	$1	$2	1/$1, 2/$2	AUSTRALIA 2	
U.K.	£1.00	50P	20P	10P	1/3x10P, 2/50P, 4/£1 [2]	U. KINGDOM	
Switzerland	1Fr	2Fr	5Fr	-	1/1Fr, 3/2Fr, 7/5Fr [2]	SWISS 1	
	1Fr	2Fr	5Fr	-	1/2Fr, 2/3Fr, 3/4Fr, 5/5F	SWISS 2	
Belgium	5Fr	20Fr	50Fr	-	1/4x5Fr, 1/20Fr , 3/50Fr [2]	BELGIUM	
Germany	1DM	2DM	5DM	-	1/2DM, 2/3DM, 3/4DM, 5/5DM [1,2]	GER. 1/2DM	
Holland	1G	-	1G	-	1/1G [2]	HOLLAND	
Sweden	1Kr	5Kr	10Kr	-	1/5x1Kr, 1/5kr, 2/10Kr [1,2]	SWEDEN 1	
	5Kr	5kr	5Kr	-	1/5Kr [2]	SWEDEN 2	
France	1Fr	5Fr	10Fr	20Fr	1/3x1Fr, 2/5Fr, 5/10Fr , 10/20Fr [2, 3]	TARIF 1	
	1Fr	5Fr	10Fr	20Fr	1/2x1Fr, 3/5Fr, 7/10Fr ,14/20Fr [2, 3]	TARIF 2	
	1Fr	5Fr	10Fr	20Fr	1/5Fr, 3/10Fr, 7/2x10Fr , 7/20Fr [1,2, 3]	TARIF 3	
	1Fr	5Fr	10Fr	20Fr	2/5Fr, 4/10Fr,9/2x10Fr , 9/20Fr [2,3]	TARIF 4	
	1Fr	5Fr	10Fr	20Fr	2/5Fr, 5/10Fr, 11/2x10Fr , 11/20Fr [2,3]	TARIF 5	
	1Fr	5Fr	10Fr	20Fr	1/5Fr, 3/10Fr , 6/20Fr [2, 3]	TARIF 6	
Italy	500L	500L	500L	-	1/500L [2]	ITALY 1	
	500L	500L	500L	-	1/2x500L, 3/4x500L [1,2]	ITALY 2	
	500L	500L	500L	-	1/500L, 2/1000L	ITALY 3	
Spain	100P	-	500P	-	1/100P, 6/500P [2]	SPAIN	
	25P	-	100P	-	1/25P, 5/100P	CUSTOM	01 00 04 00 01 04 01 00
	25P	-	100P	-	1/25P, 4/100P	CUSTOM	01 00 04 00 01 00 01 00
	25P	-	100P	-	1/2x25P, 2/100P	CUSTOM	01 00 04 00 02 00 01 00
	25P	-	100P	-	1/2x25P, 3/100P	CUSTOM	03 00 12 00 04 00 01 06
Japan	100¥	-	100¥	-	1/100¥ [2]	JAPAN	
Chile	Token	-	Token	-	1/1Token [2]	CHILE	
Denmark	1Kr	5Kr	10Kr	-	1/3x1 Kr, 3/5 Kr, 7/10 Kr [2]	DENMARK	
Finland	1Mka	-	5Mka	-	1/2x1Mka, 3/5Mka [2]	FINLAND 1	
	1Mka	-	5Mka	-	1/3x1Mka, 2/5Mka [2]	FINLAND 2	
New Zealand	$1.00	-	$2.00	-	1/$1, 3/$2	NEW ZEALAND 1	
	$2.00	-	$1.00	-	1/$1, 3/$2, ($2-$1 door)	NEW ZEALAND 2	
Norway	5Kr	-	10Kr	-	1/5Kr, 2/10Kr, 5/20Kr [2]	NORWAY	
Argentina	10¢	10¢	10¢	-	1/1 Token [2]	ARGENTINA	
Greece	10D	20D	50D	-	1/2x10D, 1/20D, 3/50D	GREECE	
Antilles	25¢	25¢	1G	-	1/25¢, 4/1G	ANTILLES	
Netherlands	1Hfl	2.5Hfl	2.5Hfl	-	1/1Hfl, 3/2.5Hfl	NETHERLANDS	
Hungary	10F	10F	20F	-	1/1x20F, 1/2x10F, 3/2x20F [2]	HUNGARY	

Note: 1. Factory Default. 2. Standard Setting - Change by pressing Enter button. 3. Other functions are also affected.
* Only if Bill Acceptor and Center Coin Chute are available.

A.4 H.S.T.D. Adjustments

A.4 01 **Highest Scores**
The game maintains a record of the four highest scores achieved to date.

OFF - No high scores are recorded, or displayed.
ON - The four highest scores are stored in memory and displayed in the Attract Mode.

A.4 02 **H.S.T.D. Award**
The award given for achieving the High Score To Date, or the Champion H.S.T.D.: Credit or a Ticket.

A.4 03 **Champion H.S.T.D.**
The "Highest" High Score can be displayed in the Attract Mode. This score is not cleared when "High Score Reset Every" occurs.

ON - The "Highest" High Score is retained in memory and displayed.
OFF - The "Highest" High Score is not retained.

A.4 04 **Champion Credits**
The number of credits or tickets awarded for a Grand Champion Score.
Range: 00 to 10.

A.4 05 **H.S.T.D. 1 Credits**
A.4 06 **H.S.T.D. 2 Credits**
A.4 07 **H.S.T.D. 3 Credits**
A.4 08 **H.S.T.D. 4 Credits**
The number of credits or tickets awarded whenever a player exceeds the 1st, 2nd, 3rd, or 4th highest score.
Range: 00 to 10.

A.4 09 **High Score Reset Every**
The number of games to be played before an automatic reset of the displayed "Highest Score" occurs. The values provided upon reset are those selected by the operator in the Back-up High Scores.
Range: OFF (disabled); 250 to 20,000.

A.4 10 **Backup Champion**
The Back-up Grand Champion Score.
Range: 00 to 999,000,000.

A.4 11 **Backup H.S.T.D. 1**
A.4 12 **Backup H.S.T.D. 2**
A.4 13 **Backup H.S.T.D. 3**
A.4 14 **Backup H.S.T.D. 4**
The first through the fourth Back-up High Score values. The game automatically restores this value when the High Score Reset Every value is reached.
Range: 00 - 999,000,000.

A.5 Printer Adjustments (optional board required)

A.5 01 **Column Width**
The column width to be printed.
Range: 22 to 80.

A.5 02 **Lines Per Page**
The amount of lines per page.
Range: 20 to 80.

A.5 03 **Pause Every Page**
Choose whether the printer pauses at the end of a page.

YES - The printer does pause.
NO - The printer doesn't pause.

A.5 04 **Printer Type**
Select the type of printer: Parallel, Serial, ADP, Mini-Drucker, or NSM.

A.5 05 **Serial Baud Rate**
Select which baud rate to use for serial or ADP communications (bit rate): 300, 600, 1200, 2400, 4800, or 9600.

A.5 06 **Serial D.T.R. (Data Terminal Ready)**
When a serial printer is used, this line may be connected to a printer output line signaling that the printer is busy.

NORMAL -Normal D.T.R. signal goes low to indicate the printer is not ready.

INVERTED - Inverted D.T.R. (busy) signal goes high to indicate the printer is not ready.

IGNORE -D.T.R. signal is ignored.

ERROR MESSAGES

The WPC game program has the capability to aid the operator and service personnel. At game turn-on, or after pressing the Begin Test switch, once the game has been operating for an extended period, the display may signal with a message, "Press ENTER for Test Report". This indicates the game program has detected a possible problem with the game.

To obtain details of the problem open the coin door and press the Begin Test switch. Press the Enter button to begin displaying the message(s). The following messages apply to your game.

Check Switch ##.

This message indicates that at least one switch was stuck 'On' at game turn-on or has NOT been actuated during ball play (for 90 balls or ≈30 games). The game program compensates the game play requirements affected by each disabled switch to allow 'nearly normal' play. This helps keep your game earning, until the service technician can repair the problem.

To verify the problem, refer to the Test Menu text describing Switch Testing, and check each reported switch using applicable switch tests. Always check switch operation using a ball, to simulate game conditions. Switch problems may often be resolved by adjusting the wire switch actuators, fixing switch circuitry problems, securing loose connectors, etc. Mechanisms using 'opto switches' (drop targets, etc.) need to be checked for proper power connections (+12V dc and ground).

Pinball Missing.

This game normally uses six balls, however, it will operate with less. This message announces that a ball is missing or stuck. When the ball is located, return it to the game via the Outhole. Other possibilities for this problem could be malfunctions of the Ball Trough switches or the Ball Shooter switch.

xxxxx Sw. is Stuck On.

This message indicates that a switch, which is not usually On, remains in the On position after the game is switched On. The stuck switch is essential for game play (for example, a coin chute switch, the slam tilt switch, the plumb bob tilt switch), and should be cleared to permit proper game operation.

Ground Short Row-N, Wht-xxx.

This message indicates that the switch wires being called out are touching a grounded part on the playfield or coin door. The following should be checked:

1. Slam tilt (or other coin door switch) touching the grounded coin door.
2. A leaf-type, playfield switch touching a grounded part.
3. Players poking metallic objects (wires, coat hangers, etc.) into the game.
4. Switch cable insulation pierced or damaged allowing bare wire contact with a grounded part.
5. All switches in a row closing at the same time. ***Note:*** This is NOT a switch problem; however, for most games it is a very rare possibility.

U6 Checksum Error.

The game ROM checksum is invalid. If this occurs replace the game ROM.

Time and Date Not Set.

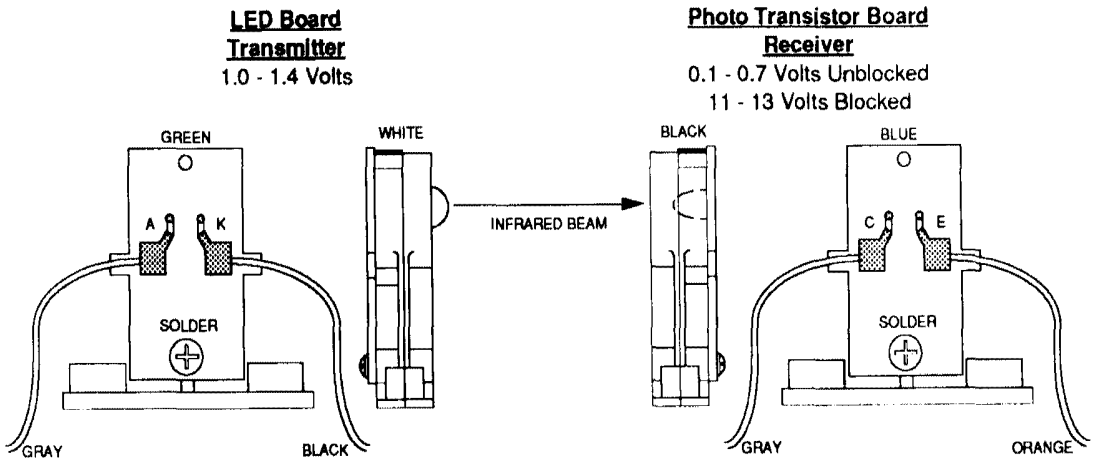
The real time clock is not running. Go to U.4 of the Utilities Menu and set the time and date.

Factory Settings Restored.

This message indicates that the CMOS RAM (U8) no longer retains any custom Pricing or Game Adjustment settings and has reverted to factory default settings. Generally, the following CPU checks will isolate the cause of the CMOS RAM memory failure. The voltage at pin 28 and pin 26 of U8 should be +5V (game turned On) and at least +4V (game turned Off). When the voltage drops below +4V, memory reset occurs. Check the batteries and battery holder. Be sure that the batteries are good and that there is no contamination on the battery holder terminals. Turn the game OFF, and use an ohmmeter to check diodes D1 and D2 on the CPU Board. D1 should read 0 ohms when forward-biased and infinite ohms when reverse-biased. D2 should read 15 ohms when forward-biased and infinite ohms when reverse-biased. (Readings taken with an analog meter.)This message can also indicate that there is an open diode on a 50V coil and noise is entering the circuit.

Opto Theory

The opto receiver (Photo Transistor) should be approximately 0.1 - 0.7 volts when the opto beam is unblocked and approximately 11 - 13 volts when the opto beam is blocked. The opto transmitter (LED) should always be approximately 1.4 volts. ***Note:*** The transmitter (LED) is larger than the receiver (Photo Transistor); it protrudes further from its case.



CPU L.E.D.'s

The CPU has three L.E.D.s located on the upper left side of the board D19, D20, and D21. On game power-up D19 and D21 turn on for a moment then, D19 turns off and D20 starts to blink rapidly. D21 remains on. The system has detected a problem if the following happens:

CPU Board L.E.D. Error Codes

Center L.E.D. blinks one time	-	U6 ROM Failure
Center L.E.D. blinks two times	-	U8 RAM Failure
Center L.E.D. blinks three times	-	U9 Custom Chip Failure

Sound Board Beep Error Codes Upon Game Turn-On:

1 Beep	=	Sound Board O.K.
2 Beeps	=	U2 Failure
3 Beeps	=	U3 Failure
4 Beeps	=	U4 Failure
5 Beeps	=	U5 Failure
6 Beeps	=	U6 Failure
7 Beeps	=	U7 Failure
8 Beeps	=	U8 Failure
9 Beeps	=	U9 Failure

Adjustment A.2 17 is set to ON.

This is a reminder to the operator that the adjustment, "Left Launcher Broken", is set to ON. This adjustment must be set to OFF once the launcher is fixed.

Adjustment A.2 18 is set to ON.

This is a reminder to the operator that the adjustment, "Right Launcher Broken"' is set to ON. This adjustment must be set to OFF once the launcher is fixed.

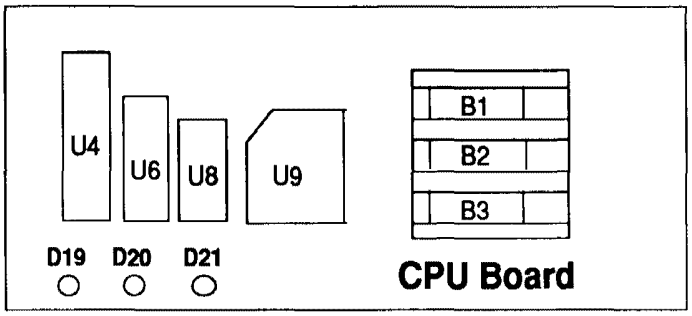
Gun Cannot Find Home -Left

The Left Gun Home switch needs attention. Either the switch is out of alignment, or there is an open connection between the switch and the 8-driver board, or Q12 on the 8-Driver Board failed, or U19 on the CPU Board failed.

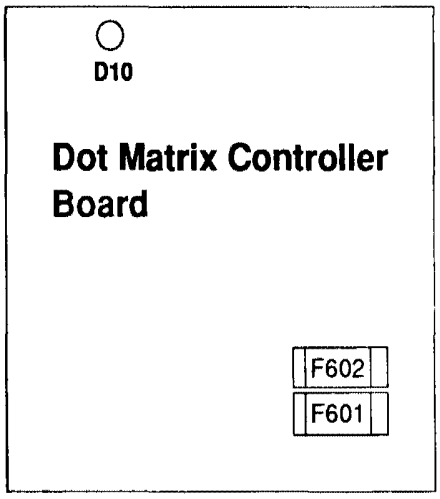
Gun Cannot Find Home -Right

The Right Gun Home switch needs attention. Either the switch is out of alignment, or there is an open connection between the switch and the 8-driver board, or Q12 on the 8-Driver Board failed, or U19 on the CPU Board failed.

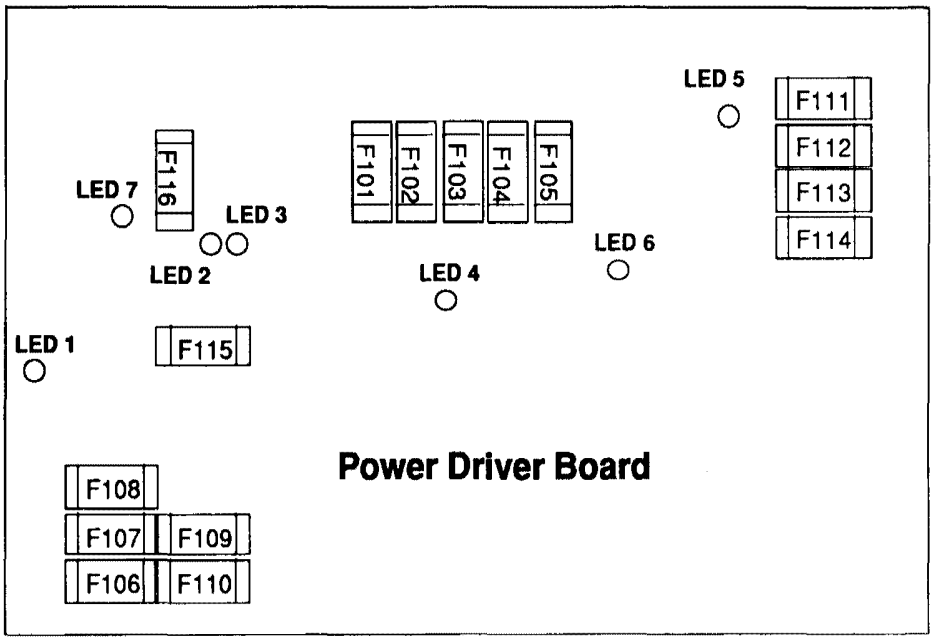
LED List



CPU Board
D19 , Blanking
D20, Diagnostic
D21, +5vdc
At game Turn-On = D19 & D21 On, D20 Off
During Normal Operation = D19 Off, D20 Flashing, D21 On

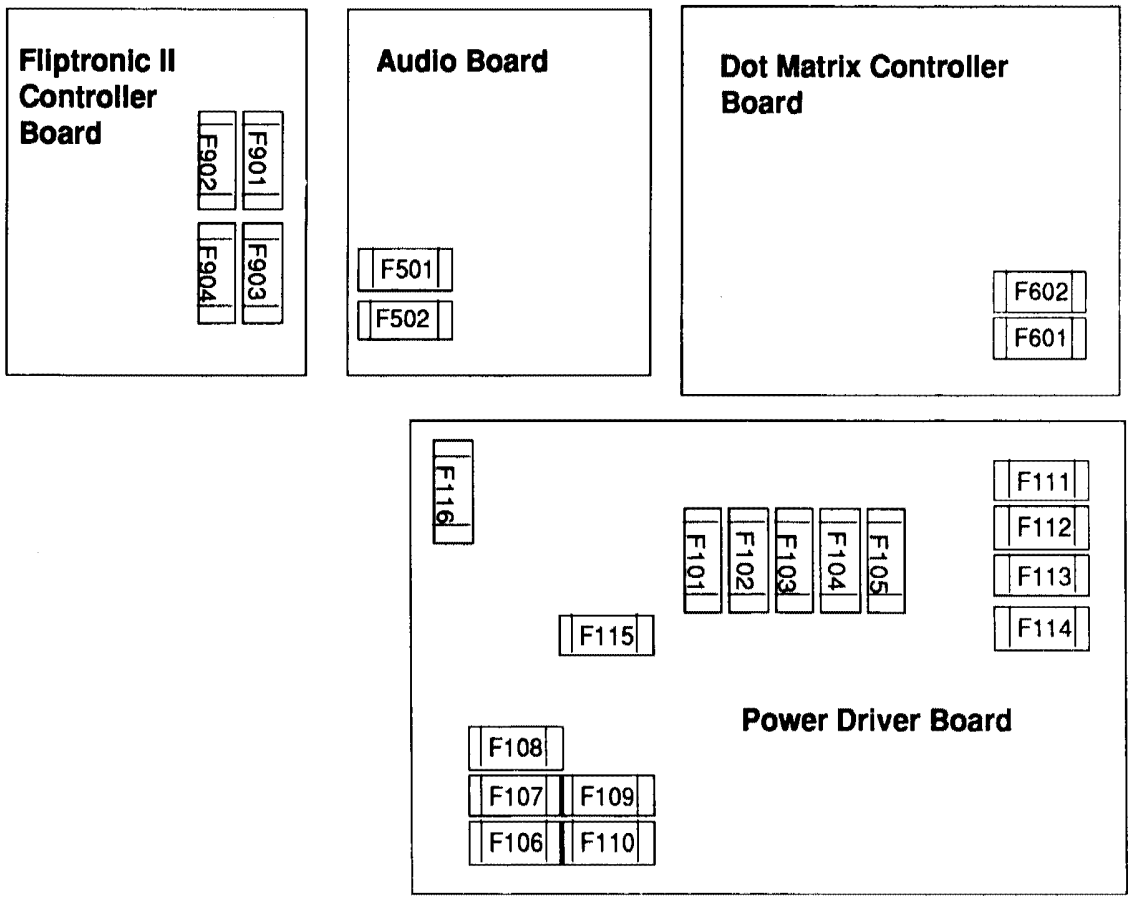


Dot Matrix Controller Board
D10, +5V Circuit, Normallly On



Power Driver Board
LED 1, +12vdc Switch Circuit, Normally On
LED 2, High/Low Line Voltage Sensor, Normally On
LED 3, High/Low Line Voltage Sensor, Normally Off
LED 4, +5vdc, Digital Circuit, Normally On
LED 5, +20vdc, Flashlamp Circuit, Normally On
LED 6, +18vdc, Lamps Circuit, Normally On
LED 7, +12vdc, Power Circuit (motors relays etc.), Normally On

Fuse List



Audio Board

F501 -25V Circuit	3A, S.B.
F502 +25V Circuit	3A, S.B.

Dot Matrix Controller Board

F601 +62V Circuit,	3/8A, F.B.
F602 -113V & -125V Circuits	3/8A, F.B.

Power Driver Board

F101 Left Flipper	3A, S.B. Not Used
F102 Right Flipper	3A, S.B. Not Used
F103 Solenoid #25-#28	3A, S.B.
F104 Solenoid #9-#16	3A, S.B.
F105 Solenoid #1-#8	3A, S.B.
F106 G.I. #5 Wht-Vio	5A, S.B.
F107 G.I. #4 Wht-Grn	5A, S.B.
F108 G.I. #3 Wht-Yel	5A, S.B.
F109 G.I. #2 Wht-Org	5A, S.B.
F110 G.I. #1 Wht-Brn	5A, S.B.
F111 Flasher Secondary	5A, S.B.
F112 Solenoid Secondary	7A, S.B.
F113 +5V Logic	5A, S.B.
F114 +18V Lamp Matrix	8A, N.B.
F115 +12V Switch Matrix	3/4A, S.B.
F116 +12V Secondary	3A, S.B.

Fliptronic II Controller Board

F901 Upper Right Flipper	3A, S.B.
F902 Upper Left Flipper	3A, S.B.
F903 Lower Right Flipper	3A, S.B.
F904 Lower Left Flipper	3A, S.B.

Line Filter

Domestic Game	8A, N.B.
Foreign Game	5A, S.B.

MAINTENANCE INFORMATION

LUBRICATION

The two main lubrication points of the Ball Release mechanism are the pivots for the arm. The mechanisms of other playfield devices are somewhat similar to the Ball Release device, and have the same lubrication requirements. A medium viscosity oil (switch target grease) is satisfactory for these devices.

Because of the functional design (arm-actuated via solenoid plunger operation), the pivot points of the Left and Right Kickers ("Slingshots") all require lubrication as a regular servicing procedure.

Lubrication to ensure proper operation also applies to the target blades of the Drop Targets. MBI Instrument Grease, also known as Drop Target Switch Lubricant, with a Williams' part number of E1165, is a recommended lubricant.

SWITCH CONTACTS

Playfield Switches
For proper game operation, switch contacts should be free of dust, dirt, contamination, and corrosion. Blade switch contacts are plated to resist corrosion. Cleaning blade switch contacts requires gentle closing of the contacts on a clean business card or piece of paper, and then pulling the paper about 2 inches, which should restore the clean contact surface. Adjust the switch contacts to a 1/16-inch gap.

Flipper Switches
This game uses the new Fliptronic II Electronic Flipper System. The End-of-Stroke switches are NORMALLY OPEN. The switch should close when the flipper is energized. All E.O.S. switches and flipper button cabinet switches are gold flashed computer grade leaf switches. Only low computer current is carried through these switches. DO NOT FILE or abrasively clean these switches! DO NOT REPLACE these switches with the old style tungsten high current type switches as intermittent operation could occur. **Note:** Unlike the old style of flipper, an E.O.S. switch failure does not harm the flipper. The game notifies the operator of the switch being mis-adjusted in the test report, but continues to play. The E.O.S. switches are a means by which the new electronic flippers feel and play with all of the subtleties of the old flippers.

CLEANING

Good game action and extended playfield life are the results of regular playfield cleaning. During each collection stop, the playfield glass should be removed and thoroughly cleaned and the playfield should be wiped off with a clean, lint-free cloth. The game balls should be cleaned and inspected for any chips, nicks, or pits. Replace any damaged balls to prevent playfield damage.

Regular, more extensive, playfield cleaning is recommended. However, avoid excessive use of water and caustic or abrasive cleaners because they tend to damage the playfield surface. Playfield wax (or any carnauba based wax), or polish may be used sparingly, to prevent a buildup on the playfield surface. Do not use cleaners containing petroleum distillates on any playfield plastics because they may dissolve the plastic material or damage the artwork.

REMOVING THE GUN ASSEMBLY

Before attempting to remove the gun (or any other) assembly, always turn off the game.

1) Open coin door and remove the front molding and the playfield glass.

2) Remove the four Phillips screws from the plastic gun cover. Lift the cover off of the kicker bracket.

3) Using a 1/4" nut driver, remove the four hex head screws from the kicker bracket. Slightly lift the kicker bracket assembly and lay it on the playfield. Be careful not to pull the cable up to far.

4) There is a piece of playfield plastic under the kicker bracket assembly. Use a 5/16" nut driver to remove the three elastic stop nuts from the plastic. Carefully, slide the playfield plastic off.

5) Lift the playfield all the way up. Follow the black tubing from the kicker bracket to the point where it branches into three plugs. Disconnect all three plugs. Lower the playfield until the support bars rest on the cabinet. Lift the kicker bracket assembly off of the playfield.

6) Raise the playfield up all the way. Use a 1/4" nut driver to remove one hex head screw from the bottom of the shaft. Slide the triangle shaped plate, and the white plastic rod attached to it, to one side. Reach around to the top of the playfield and pull the shaft out of the bushing.

7) Next, remove the bushing. Use a 11/32" nut driver to remove the four elastic stop nuts on the bottom of the bushing. At the same time, reach around to the top of the playfield and use a 1/4" nut driver to remove the four hex head screws on the top of the bushing. Slide the bushing out of its hole from the top of the playfield.

8) The motor bracket assembly has two switches. Trace their wires, under the playfield, until you come to a plug. Unplug the switches. Unplug the motor from the EMI board.

9) Use a 1/4" nut driver and remove the three hex head screws holding the motor bracket to the playfield.

   Note: On the right side motor bracket assembly, you need to remove one of the hex head screws from the playfield support bar and slide the bar to the side in order to reach one of the hex head screws on the motor bracket assembly. **Be Sure To Immediately Reattach The Support Bar To The Playfield. Do Not Lower The Playfield Unless The Support Bar Is Securely In Place.**

10) Pull the entire motor bracket assembly off of the playfield.

When Reattaching the gun assembly.....

1) Be sure to match all wire color when connecting the plugs. Be aware that the motor switch plug substitutes green-white wires for violet-white wires.

2) When reattaching the shaft to the triangle plate, be sure the square on the shaft fits into the square hole in the triangle plate.

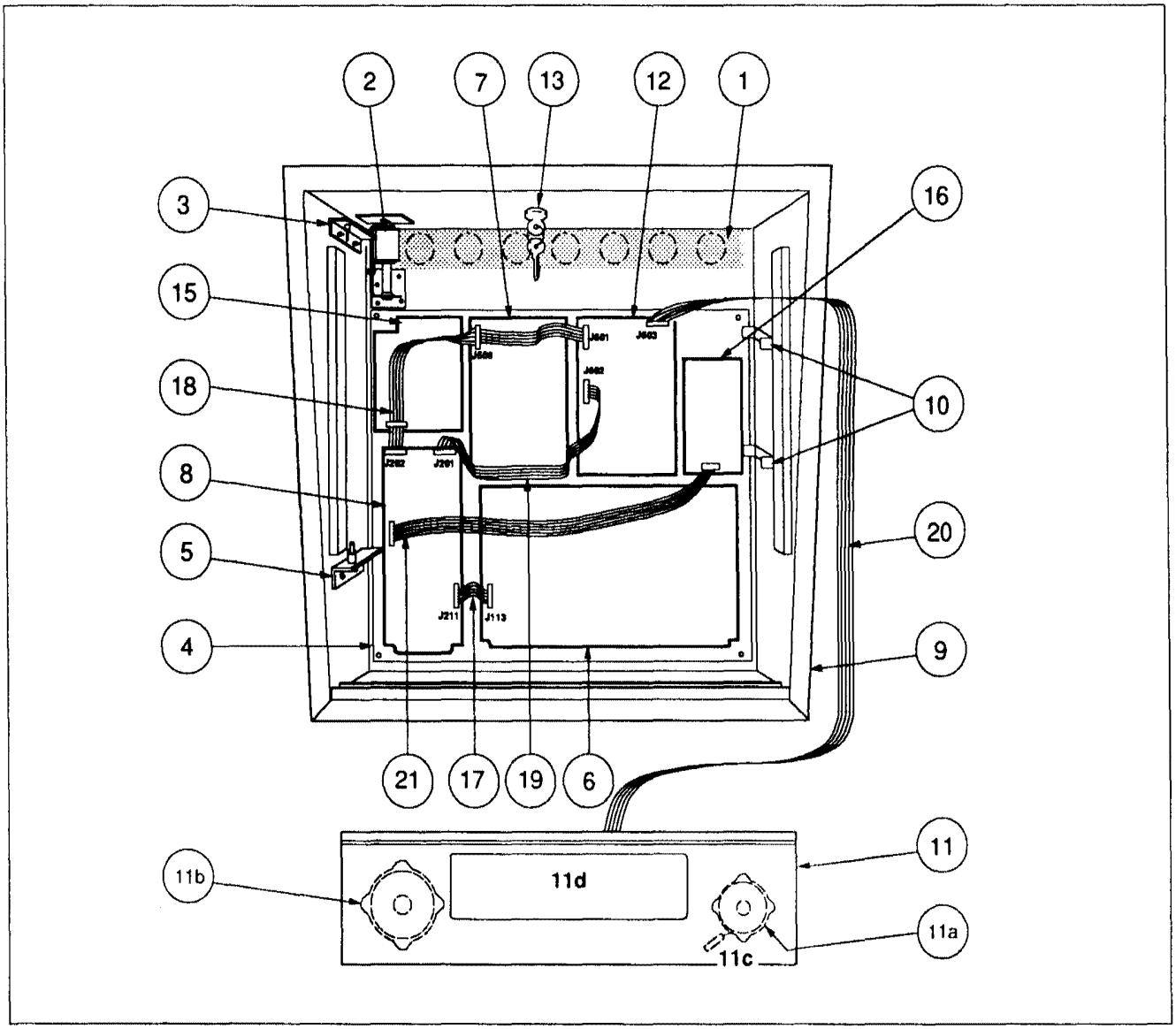
3) When the gun assembly is reattached properly, it should point toward the wire loading ramp.

NOTES

SECTION 2

Parts Information

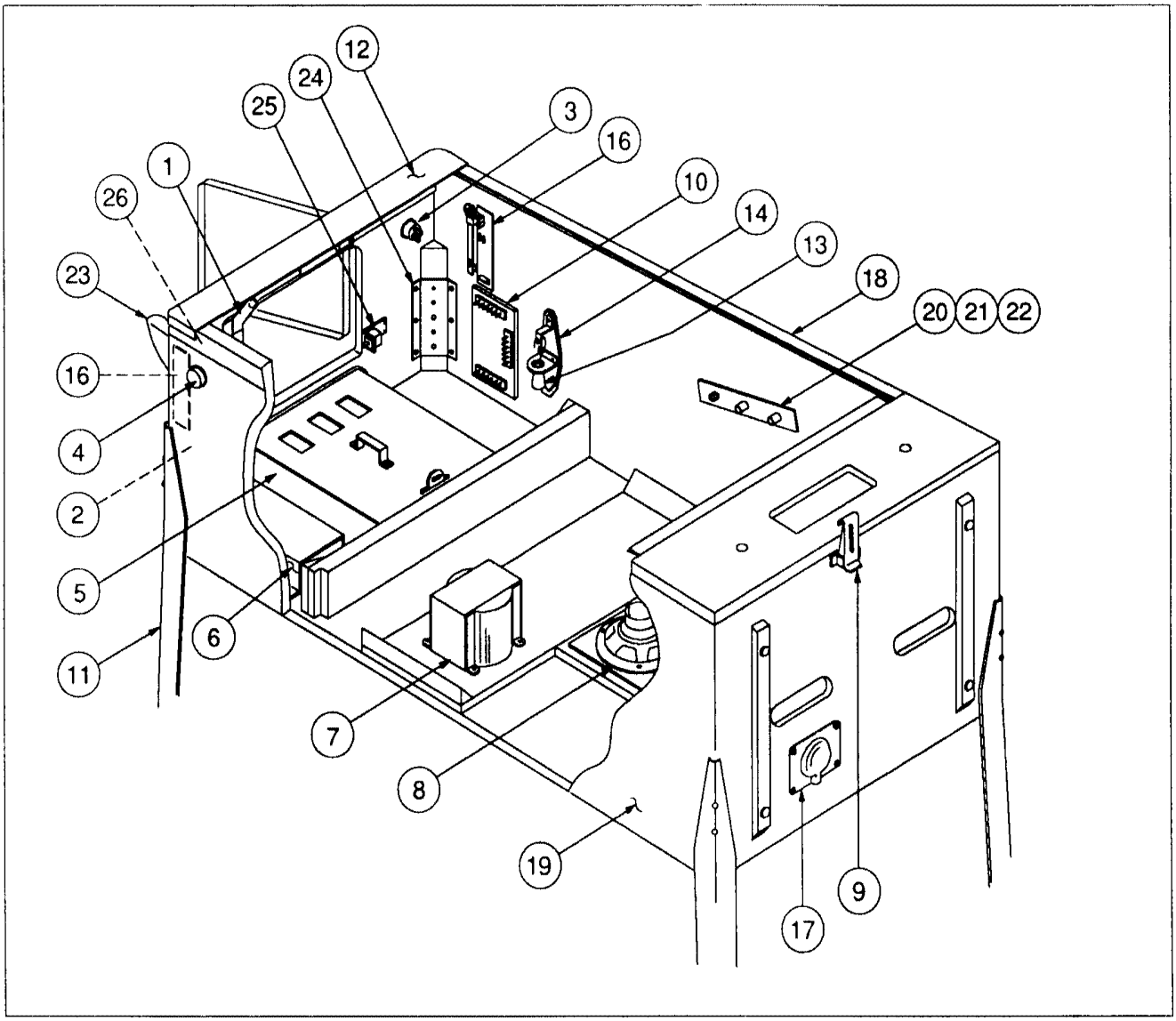
Backbox Assembly



Item	Part Number	Description
1.	01-6645	Venting Screen
2.	B-10686-1	Knocker & Bracket Assy.
3.	A-12497	Upper Insert Bd Hinge Assy.
4.	A-14092-5	Mounting Plate Assembly
5.	A-12498	Lower Insert Bd Hinge Assy.
6.	A-12697-3	Power Driver Assembly
7.	A-16917-50023	WPC Sound Board
8.	A-12742-50023	WPC CPU Board
9.	A-16123-50023	Backbox Assembly
10.	01-9047	Insert Stop Bracket
11.	A-17054	Speaker / Display Assy.
a)	5555-12924-00	Speaker, 4Ω, 15w
b)	5555-12856-00	Speaker, 5-1/4", 4Ω, 25w
c)	5045-12914-00	Cap., 10µfd., 50v, (±20%)
d)	5901-12784-00	Dot Matrix Display/Driver Bd.
12.	A-14039	Dot Matrix Contoller Board
13.	A-13379	Lock & Plate Assembly
a)	20-9637	Lock & Cam Kit
14.	50023-IN	Insert Board

Item	Part Number	Description
15.	A-15472-1	Fliptronic II Board
16.	A-16100	8-Driver PC Board
■ **Ribbon Cables:**		
17.	5795-12653-03	Ribbon Cable, 3"
18.	5795-13018-01	Ribbon Cable, 23.5"
19.	5795-10938-14	Ribbon Cable, 14"
20.	5795-13434-32	Ribbon Cable w/Ferrite, 32"
21.	5795-10938-32	Ribbon Cable, 32"
■ **Miscellaneous Parts:**		
	A-8552-50023	Tempered Backglass Assy.
	08-7456	Backbox Glass: 27" x 18-7/8"
	31-1357-50023	Screened Translight
	03-8228-2	Glass Channel Top (1)
	03-8228-3	Glass Channel Edge (2)
	03-8229-1	Glass Lift Channel (1)

Cabinet Assembly



Item	Part Number	Description
1.	A-16773	Lever Guide Assembly
2.	20-9663-17	Push Button - Green
3.	20-9663-16	Start Button - Yellow
4.	A-16883-4	Flipper Button - Red (2 Used)
5.	A-17445-1	Cashbox Assembly
6.	*	Line Filter Assembly
7.	5610-13491-00	WPC Transformer, 115/230v
8.	5555-12929-00	Speaker, 4Ω, 6", 25w
9.	20-9347	Toggle Latch
10.	A-17051-1	Coin Door Interface Bd.
11.	C-10843-2	Metal Leg Assembly
12.	A-16055	Front Molding Assembly
13.	20-6502-A	Plum Bob
14.	A-15361	Tilt Mechanism Assembly
15.	*	Cordset
16.	A-17316	Opto Flipper Assembly (2 Used)
	A-16384	Opto Flipper
17.	01-10714	Line Cord Cover

* See Application Chart (p.2-4).

Item	Part Number	Description
18.	A-12359-3	Side Molding Assy. (2 Used)
19.	11-1115	Wood Cabinet
20.	01-11408	Spacer (2 Used)
21.	02-4329-1	Pivot Nut, 7/8" (4 Used)
22.	02-4352	Pivot Bushing (2 Used)
23.	A-14747	Gun Handle Assembly
24.	01-11400	Leg Plate (4 Used)
25.	A-17175-1	Cable & Interlock Switch Assy.
26.	A-14754-1	Firing Pin Switch & Cable Assy.

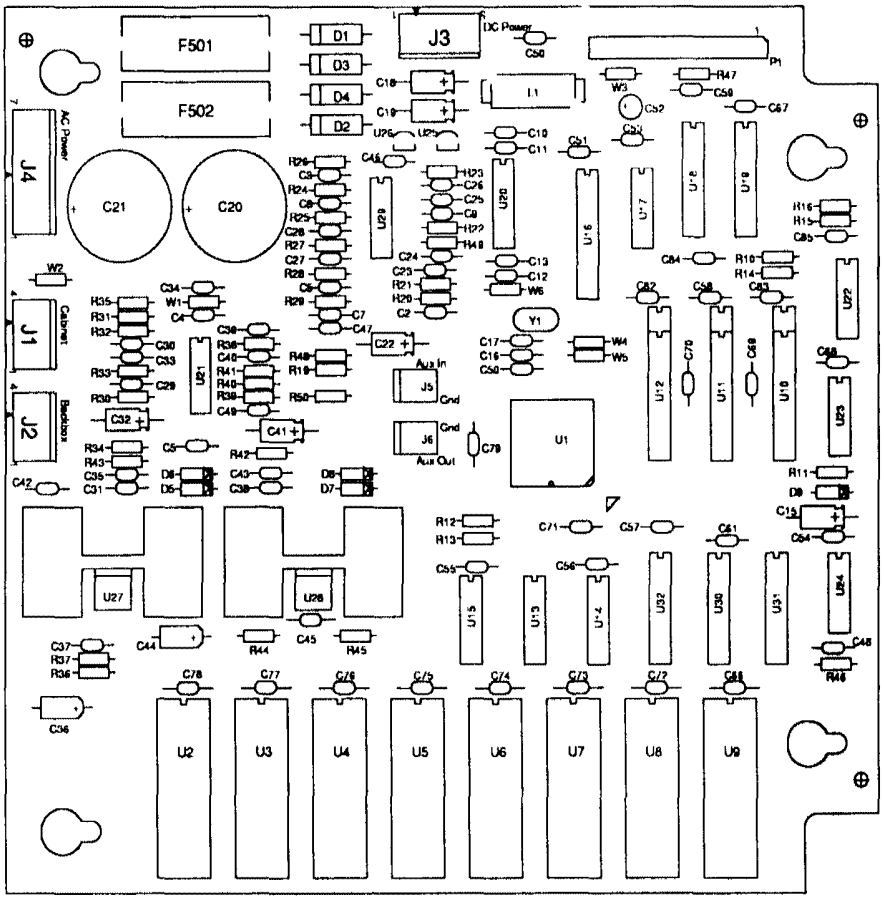
■ Miscellaneous Parts:

08-7028-1	Tempered Playfield Glass, Wide Body: 23.75" x 43"
20-6500	Steel Ball, 1-1/16" (6)
01-10797	Playfield Support Bar, 18" Long
01-5148	Clip Bracket
08-7377	Leg Adjuster, 3"
A-17195	Tilt Switch Assy. w/Cable

Line Filter/Cordset Application Chart

COUNTRY	LINE FILTER ASSY.			CORDSET								
	A-16970-120V	A-16970-230V		5850-13271-00	5850-13272-00	5850-13273-00	5850-13274-00	5850-13275-00	5850-13276-00	5850-13277-00	5850-13278-00	A-17175-2
UNITED STATES	√			√								
CANADA	√			√								
TAIWAN	√			√								
MEXICO	√			√								
CENTRAL AMERICA	√			√								
SOUTH KOREA	√			√								
PUERTO RICO	√			√								
AUSTRIA		√			√							
BELGIUM		√			√							
FINLAND		√			√							
FRANCE		√			√							
GREECE		√			√							
HOLLAND		√			√							
HUNGARY		√			√							
NETHERLANDS		√			√							
NETH. ANTILLES		√			√							
NORWAY		√			√							
POLAND		√			√							
PORTUGAL		√			√							
SPAIN		√			√							
SWEDEN		√			√							
TURKEY		√			√							
WEST GERMANY		√			√							
UNITED KINGDOM		√				√						
IRELAND		√				√						
HONG KONG		√				√						
DENMARK		√					√					
ITALY		√						√				
CHILE		√						√				
PEOPLE'S REP. OF CHINA		√						√				
SWITZERLAND		√							√			
AUSTRALIA		√								√		
NEW ZEALAND		√								√		
ARGENTINA		√								√		
JAPAN	√										√	√

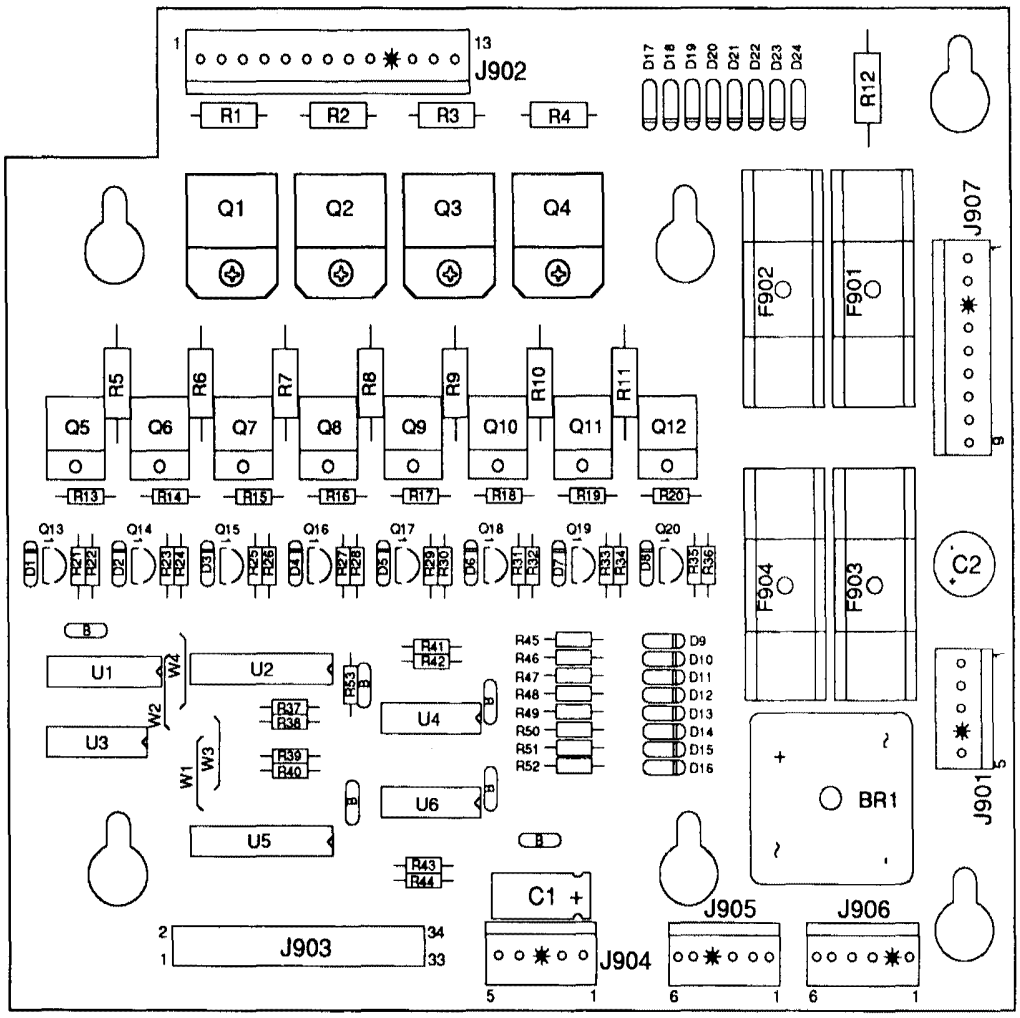
A-16917-50023 Sound Board Assembly



Part No.	Designator	Description
4004-01005-06	U27, U28	Mach. Screw, 4-40 x 3/8"
4404-01119-00	U27, U28	Nut, 4-40
5010-08772-00	R39, R41	Resistor, 15KΩ, 1/4W, 5%
5010-08774-00	R30, R34, R37, R42, R45	Resistor, 22KΩ, 1/4W, 5%
5010-08991-00	R10, R12 -R16	Resistor, 4.7KΩ, 1/4W, 5%
5010-09034-00	R47	Resistor, 10KΩ, 1/4W, 5%
5010-09035-00	R11, R19, R33, R40	Resistor, 47KΩ, 1/4W, 5%
5010-09036-00	R46	Resistor, 100Ω, 1/4W, 5%
5010-09219-00	R31, R32, R38	Resistor, 8.2KΩ, 1/4W, 5%
5010-09358-00	R50	Resistor, 1KΩ, 1/4W, 5%
5010-09534-00	W4, W6	Resistor, 0Ω (Jumper)
5010-13420-00	R36, R44	Resistor, 680Ω, 1/4w, 5%
5010-13607-00	R20-R29, R48, R49	Resistor, 6.2KΩ, 1/4w, 5%
5010-13517-00	R35, R43	Resistor, 15Ω, 1/4w, 5%
5040-09365-00	C15, C18, C19, C32, C41	Capacitor, 1 µF, 63V, Alum Axial
5040-09421-00	C52	Capacitor, 100µF, 25V, Alum Radial
5040-13417-00	C20, C21	Capacitor, 10,000µF, 35V, Alum Rad.
5041-09009-00	C36, C44	Capacitor, 22µF, 10V, Tant Axial
5041-13187-00	C22	Capacitor, 4.7µF Tant Axial
5043-08996-00	C4, C5, C10-C13, C31, C35, C38, C43,C46, C47, C50 -C79	Capacitor, 0.10µF, Cer Axial
5043-10267-00	C37, C45	Capacitor, 150pF, Cer Axial
5048-11028-00	C16, C17	Capacitor, 22pF, Cer Axial
5048-11029-00	C48	Capacitor, 100pF, Cer Axial
5048-11030-00	C49	Capacitor, 470pF, Cer Axial
5048-11033-00	C33	Capacitor, 0.022µF, 5%, Cer Axial
5048-12036-00	C34, C42	Capacitor, 0.22µF, Cer Axial
5048-13418-00	C30, C39, C40	Capacitor, .047µF, 5%, Cer Axial
5048-13608-00	C8	Capacitor, 6800 pF, 50V, Cer Axial
5048-13609-00	C7, C24, C26	Capacitor, 3900 pF, 50V, Cer Axial
5048-13610-00	C2, C3, C9, C27, C29	Capacitor, 1000 pF, 50V, Cer Axial
5048-13611-00	C6, C23, C25, C28	Capacitor, 680 pF, 50V, Cer Axial
5070-09045-00	D1 - D4	MR-501 Rectifier Diode
5070-09054-00	D5 - D9	1N4004 Signal Diode

Part No.	Designator	Description
5250-13302-00	U25	78L05 Pos 5 Volt Reg TO-92
5250-13303-00	U26	79L05 Neg 5 Volt Reg TO-92
5283-10551-00	U17	IC74F00 Fast Quad NAND Gate
5311-10946-00	U22	IC74HC74 Dual D Flip Flop
5311-10947-00	U23	IC74HC125 quad Tri-State Buffer
5311-10948-00	U15	IC74HC138 1 of 8 Decoder
5311-10954-00	U18, U19	IC74HCT374 Octal D Flip Flop
5311-12043-00	U13, U14	IC74HC174 Hex D Flip Flop
5311-12538-00	U24	IC74HC14 Hex Schmitt Inverter
5311-12287-00	U30 - U32	IC74HC541 Octal Bus Driver
5340-13304-00	U10 - U12	ICSRAM 2Kx8 35ns .300DIP
5370-12730-00	U21, U29	ICTL084 Quad op Amp
5370-13419-00	U27, U28	Audio Power Amp TDA2030AV
5371-13299-00	U20	ICDAC AD-1851 16 bit
5400-13298-00	U1	Processor ADSP-2105-KP40
5520-13301-00	Y1	Crystal 10MHz Parallel Resonant
5551-09822-00	L1	Inductor, 4.7µH, 3Amp
5700-12047-00	U16	IC socket 24 pin 0.300 DIP
5700-12088-00	U2 - U9	IC socket 32 pin 0.600 DIP
5705-12638-00	U27, U28	Heatsink 5298-B
5733-12060-01	-	Fuse Holder MT3AG(F501, F502)
5791-10862-04	J1, J2	Connector, 4-pin Header
5791-10862-05	J3	Connector, 5-pin Header
5791-10862-07	J4	Connector, 7-pin Header
5791-12516-00	P1	Connector, 34 Hen 2 x 17 Str .100
A-17002	U16	PAL Sub-Assembly
A-5343-50023-2	U2	EPROM Sub-Assembly
A-5343-50023-3	U3	EPROM Sub-Assembly
A-5343-50023-4	U4	EPROM Sub-Assembly
A-5343-50023-5	U5	EPROM Sub-Assembly
A-5343-50023-6	U6	EPROM Sub-Assembly
A-5343-50023-7	U7	EPROM Sub-Assembly
A-5343-50023-8	U8	EPROM Sub-Assembly
A-5343-50023-9	U9	EPROM Sub-Assembly
5731-10356-00	F501, F502	Fuse, 3Amp, 250V, Slow Blow

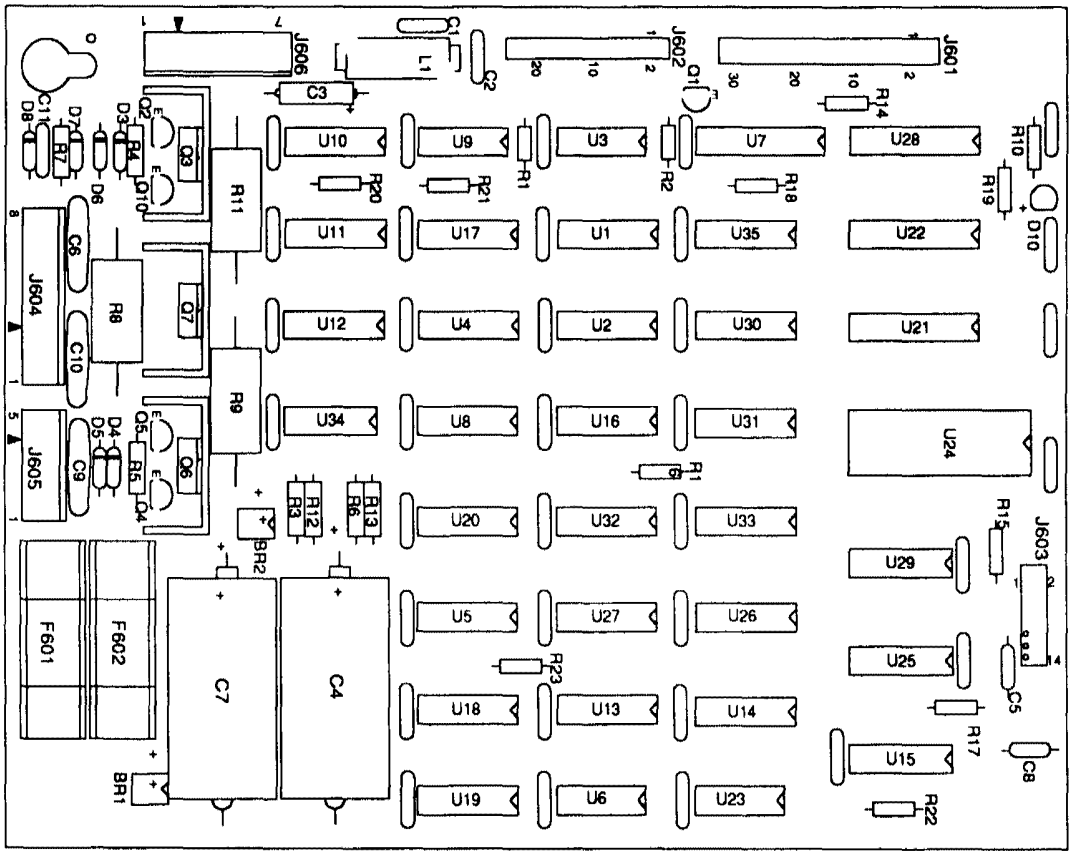
A-15472-1 Fliptronic II Board



Part Number	Designator	Description
01-10572	Q1-Q4	Heatsink
20-9684	Q5-Q12	Fastener Snap
4006-01003-08	Q1-Q4	Mach. Screw, 6-32
4406-01128-00	Q1-Q4	Nut 6-32 KEPS
5010-09034-00	R37 - R44, R53	Resistor, 10KΩ, 1/4w, 5%
5010-09358-00	R22, R24, R26, R28, R30, R32, R34, R36, R45 - R52	Resistor, 1KΩ, 1/4w, 5%
5010-09361-00	R1 - R4	Resistor, 220Ω, 1/2w, 5%
5010-09416-00	R21, R23, R25, R27, R29, R31, R33, R35	Resistor, 470Ω, 1/4w, 5%
5010-09534-00	W3, W4	Resistor, 0Ω
5010-10171-00	R13 - R20	Resistor, 56Ω, 1/4w, 5%
5011-12956-00	R5 - R12	Resistor, 2.7KΩ, 1w, 5%
5040-08986-00	C1	Capacitor, 100M, 10v
5040-09537-00	C2	Capacitor, 100µF, 100v
5043-08980-00	B	Capacitor, .01µF, 50v

Part Number	Designator	Description
5070-09054-00	D1 - D24	Diode1N4004
5162-12635-00	Q5-Q12	Transistor TIP102 NPN
5190-09016-005	Q13 - Q20	Transistor 2N4403 PNP
191-12179-00	Q1-Q4	Transistor TIP36C PNP
5315-12009-00	U2	IC 74HCT374
5315-12031-00	U5	IC 74HCT244
5315-12812-00	U1	IC 74HCT138
5315-12951-00	U3	IC 74HCT00
5370-12272-00	U4, U6	IC LM339 QUAD COMP
5791-10862-09	J907	Connector, 9-pin Header Sq. Pin
5791-10862-05	J901, J904	Connector, 5-pin Header Sq. Pin
5791-10862-13	J902	Connector, 13-pin Header Sq. Pin
5791-13830-06	J905, J906	Connector, Str Sq. Pin Header .100
5791-12516-00	J903	34 HEN 2x17 STR
5100-09690-00	BR1	Bridge Rectifier
5731-10356-00	F901 - F904	Fuse S-B, 3A., 250v
5733-12060-01	-	Fuse Holder (F901-F904)

A-14039 Dot Matrix Controller Assembly

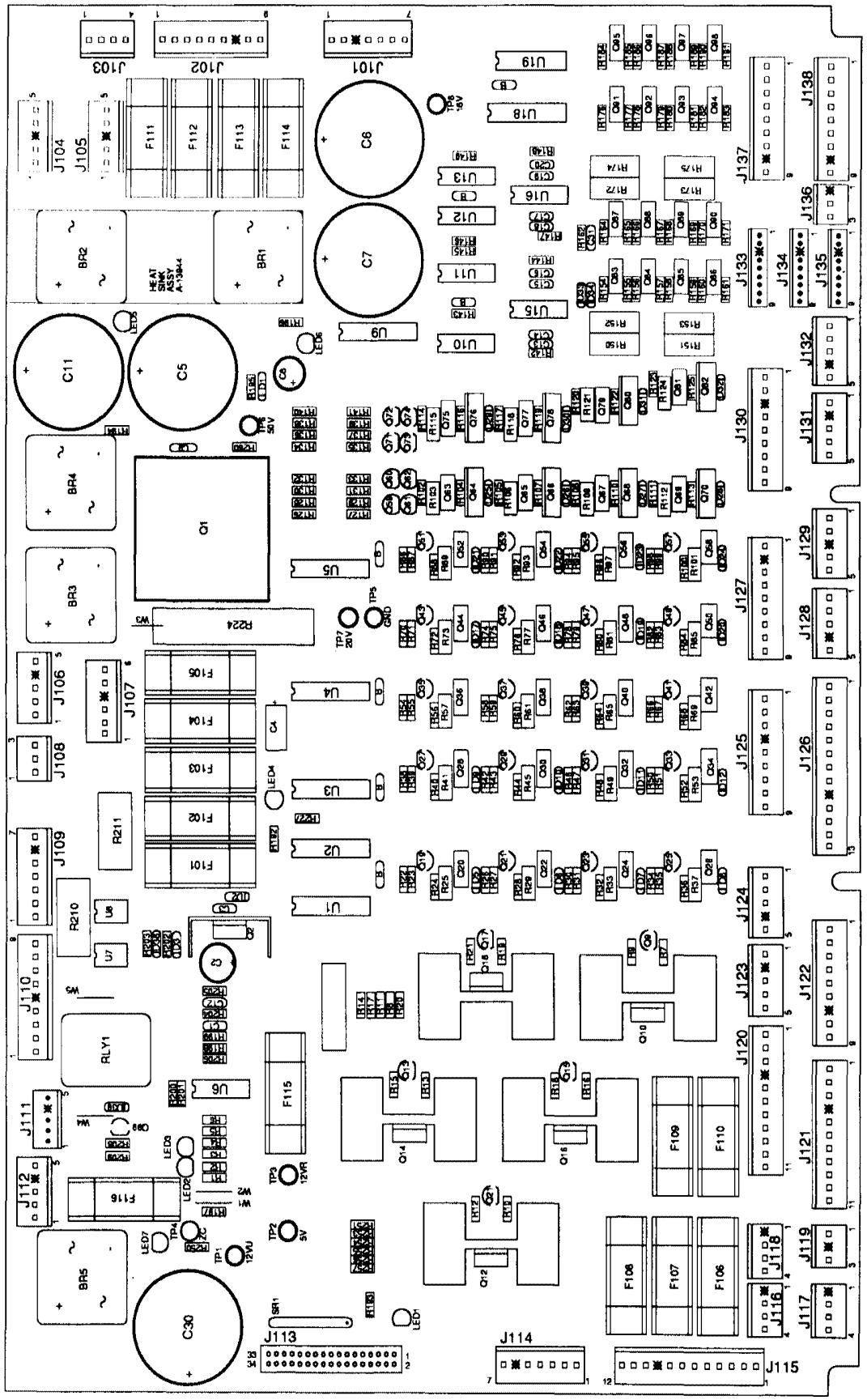


Part Number	Ckt Designator	Description
5010-08991-00	R1	Resistor, 4.7KΩ, 1/4w, 5%
5010-09224-00	R10	Resistor, 270Ω, 1/4w, 5%
5010-12832-00	R3, R6, R12, R13	Resistor, 47KΩ, 1/2w, 5%
5010-12841-00	R4, R5	Resistor, 120Ω, 1/2w, 5%
5012-12830-00	R9	Resistor, 1.8KΩ, 5w, 5%
5012-12842-00	R11	Resistor, 120Ω, 5w, 5%
5012-12843-00	R8	Resistor, 4.7K, 5w, 5%
5010-10171-00	R7	Resistor, 56Ω, 1/4w, 5%
5040-08986-00	C3	Capacitor, 100µfd., 10v, (±20%)
5040-12324-00	C4, C7	Capacitor, 150µfd., 160v, (±50%)
5043-08980-00	BYPASS	Capacitor, .01µfd., 50v, (+80, -20%)
5043-09072-00	C6, C9, C10	Capacitor, .1µfd., 500v, (+80, -20%)
5043-09845-00	C1, C2, C11	Capacitor, 1KP, 50v, (±20%)
5043-09492-00	C5, C8	Capacitor, 100P, 50v, (±10%)
5070-09054-00	D7	Diode, 1N4004, 1.0A.
5075-12824-00	D6, D8	Zener, 1N4742A, 12v
5075-12823-00	D4, D5	Zener, 1N4758A, 56v
5075-12826-00	D3	Zener, 1N4759A, 62v
5100-12833-00	BR1, BR2	Bridge, 400v, 1A.
5160-10269-00	Q1	Transistor, 2N3904 NPN
5164-09056-00	Q2, Q10	Transistor, MPSD02, NPN
5164-12154-00	Q3, Q7	Transistor, MJE15030 NPN
5194-09055-00	Q4, Q5	Transistor, MPSD52 PNP
5194-12155-00	Q6	Transistor, MJE15031 PNP
5281-09738-00	U16, U25 - U27	IC, 74LS157
5281-10033-00	U3	IC, 74LS30
5281-10043-00	U31 - U33, U35	IC, 74LS175
5311-10946-00	U4, U5, U17, U18, U20	IC, 74HC74
5311-10947-00	U9	IC, 74HC125
5311-10951-00	U10, U11	IC, 74HC161
5311-10977-00	U6	IC, 74HC04
5311-12817-00	U29	IC, 74HC165
5311-12819-00	U21	IC, 74HC688
5311-12820-00	U23	IC, 74HC27
5311-12822-00	U13 - U15	IC, 74HC193
5315-12009-00	U22	IC, 74HCT374
5315-12812-00	U1, U2, U30	IC, 74HCT138
5281-09308-00	U28	IC, 74HCT245
5315-12815-00	U8, U34	IC, 74HCT08
5315-12816-00	U19	IC, 74HCT32
5315-12821-00	U7	IC, 74HCT240
5340-12278-00	U24	S/RAM 2064 150NS
5551-09822-00	L1	IND 4.7µH, 3.0A.
5671-13732-00	D10	Display LED Red
5705-09199-00	Q3, Q6, Q7	Heatsink 6030B
5731-12328-00	F601, F602	Fuse, 3/8A.,SB, 250v
5733-12060-00		Fuse Holder (F601, F602)
5791-10850-00	J602	Connector, 26-pin STR Sq.
5791-10862-05	J605	Connector, 5-pin Header Sq.
5791-10862-07	J606	Connector, 7-pin Header Sq.
5791-10862-08	J604	Connector, 8-pin Header Sq.
5791-12516-00	J601	34 Hen 17x2 STR
5791-12827-00	J603	14 Hen 7x2 STR
5010-09036-00	R14-R23	Resistor, 100Ω, 1/4w, 5%
4006-01003-06	Q3, Q6, Q7	Mach. Screw, 6-32 x 3/8
4406-01128-00	Q3, Q6, Q7	Nut, 6-32 KEPS

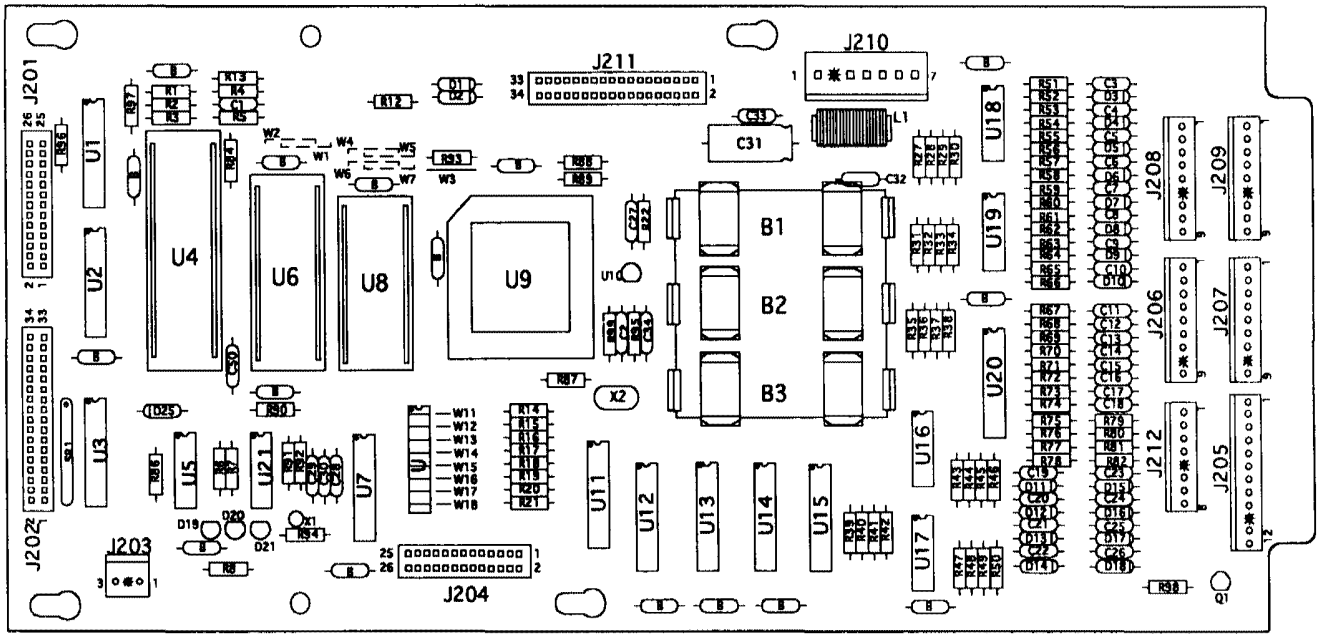
A-12697-3 WPC Power Driver Assembly

Item	Part Number	Ckt Designator	Description
1	Not Used		
2	4006-01005-06	Q1, Q2	Mach. Screw, 6-32 x 3/8
3	4406-01128-00	Q1, Q2	Nut, 6-32 KEPS
4	4004-01005-06	Q10, Q12, Q14, Q16, Q18	Mach. Screw, 4-40 x 3/8
5	4404-01119-00	Q10, Q12, Q14, Q16, Q18	Nut, 4-40 SNUT
6	5010-08981-00	R260	Resistor, 10KΩ, 1/2w, 5%
7	5010-08991-00	R9, R12, R15, R18, R21, R23, R27, R31, R35, R39, R43, R47, R51, R55, R59, R63, R67, R71, R75, R79, R83, R87, R91, R95, R99, R126, R128, R130, R132, R134, R136, R138, R140, R227	Resistor, 4.7KΩ, 14w, 5%
8	5010-08992-00	R8, R11, R14, R17, R20, R177, R179, R181, R183, R185, R187, R189, R191	Resistor, 560Ω, 1/4w, 5%
9	5010-08993-00	R25, R29, R33, R37, R41, R45, R49, R53, R57, R61, R65, R69, R73, R77, R81, R85, R89, R93, R97, R101, R103, R106, R109, R112, R115, R118, R121, R124	Resistor, 68Ω, 1/4w, 5%
10	5010-08997-00	R24, R28, R32, R36, R40, R44, R48, R52, R56, R60, R64, R68, R72, R76, R80, R84, R88, R92, R96, R100, R102, R105, R108, R111, R114, R117, R120, R123, R195	Resistor, 2.7KΩ, 1/4w, 5%
11	5010-08998-00	R155, R157, R159, R161, R165, R167, R169, R171	Resistor, 2.2KΩ, 1/4w, 5%
12	5010-09034-00	R3, R4, R6, R142-R149, R197, R198	Resistor, 10KΩ, 1/4w, 5%
13	5010-09085-00	R194, R196, R251, R253-R257	Resistor, 1.5KΩ, 1/4w, 5%
14	5010-09086-00	R252	Resistor, 6.8KΩ, 1/4w, 5%
15	5010-09224-00	R1, R2, R192, R201, R205, R208	Ressistor, 270Ω, 1/4w, 5%
16	5010-09314-00	R176, R178, R180, R182 R184, R186, R188, R190	Resistor, 1.2KΩ, 1/4w, 5%
17	5010-09324-00	R206	Resistor, 27KΩ, 1/4w, 5%
18	5010-09358-00	R154, R156, R158, R160, R164, R166, R168, R170, R162, R193, R199, R200 R250	Resistor, 1KΩ, 1/4w, 5%
19	5010-09361-00	R104, R107, R110, R113 R116, R119, R122, R125	Resistor, 220Ω, 1/4w, 5%
20	5010-09416-00	R22, R26, R30, R34, R38, R42, R46, R50, R54, R58, R62, R66, R70, R74, R78, R82, R86, R90, R94, R98, R127, R129, R131, R133, R135, R137, R139, R141	Resistor, 470Ω, 1/4w, 5%
21	5010-09534-00	W1, W2	Resistor, 0Ω
22	5010-11079-00	R7, R10, R13, R16, R19	Resistor, 51Ω, 1/4w, 5%
23	5010-12427-00	R150-R153, R172-R175	Resistor, .22Ω, 1w, 5%
24	5012-12632-00	R224	Resistor, .12Ω, 10w, 5%
25	Not Used		
26	5019-10143-00	SR1	SIP, 9R, 10 pin, 470Ω, 5%
27	5040-08986-00	C4	Capacitor, 100µfd, 10v (±20%)
28	5040-09421-00	C2	Capacitor, 100µfd, 25v (+50, -10%)
29	5040-09537-00	C8	Capacitor, 100µfd, 100v (±20%)
30	5040-12313-00	C5, C6, C7, C11, C30	Capacitor, 15,000µfd, 25v (±20%)
31	5043-08980-00	B-BYPASS	Capacitor, .01µfd, 50v (+80, -20%)
32	5043-08998-00	C13-C20, C31	Capacitor, .1µfd, 50v (+20%)
33	5043-09845-00	C1, C12	Capacitor, 1,000pfd, 50v (±20%)
34	5048-10994-00	C3	Capacitor, .33µfd, 50v (±20%) Ax.
35	5070-08919-00	D33, D34	Diode, 1N4148, 150MA.
36	5070-09054-00	D1-D3, D5-D12, D17-D32, D38	Diode, 1N4004, 1.0A.
37	5100-09690-00	BR1-BR5	Bridge Rectifier, 35A., 200v
38	5131-12725-00	Q10, Q12, Q14, Q16, Q18	Triac, BT138E
39	5162-12422-00	U19	IC, ULN 2803
40	5162-12635-00	Q20, Q22, Q24, Q26, Q28 Q30, Q32, Q34, Q36, Q38, Q40, Q42, Q44, Q46, Q48, Q50, Q52, Q54, Q56, Q58, Q63, Q65, Q67, Q69, Q75, Q77, Q79, Q81, Q83 - Q90	Transistor, TIP 102
41	5194-09055-00	Q9, Q11, Q13, Q15, Q17, Q19, Q21, Q23, Q25, Q27, Q29, Q31, Q33, Q35, Q37, Q39, Q41, Q43, Q45, Q47, Q49, Q51, Q53, Q55, Q57, Q59-Q62, Q71-Q74	Transistor, 2N5401 PNP
42	5191-12179-00	Q64, Q66, Q68, Q70, Q76 Q78, Q80, Q82	Transistor, TIP36C PNP
43	5192-12428-00	Q91-Q98	Transistor, TIP 107
44	5250-12634-00	Q1	Reg LM 323 5v
45	5281-09486-00	U1-U5, U18	IC, 74LS374 8 Dual D Flipflop
46	5281-09487-00	U10-U13	IC, 74LS74 Dual D flipflop
47	5281-10182-00	U9	IC, 74LS240, L/Drvr
48	5370-12272-00	U6, U15, U16	IC, LM339 Quad. Comp
49	5460-12423-00	Q2	IC, LM 7812
50	Not Used		
51	5671-13732-00	LED1 - LED7	Display LED Red
52	Not Used		
53	5701-09652-00	Q1	Thermal Pad TO-3
54	5705-09199-00	Q2	Heatsink, #6030B
55	Not Used		
56	5705-12637-00	Q1	Heatsink 5054
57	5705-12638-00	Q10, Q12, Q14, Q16, Q18	Heatsink 5298B
58	5733-12060-01		Fuse Holder, F101-F116
59	Not Used		
60	5791-10862-03	J108, J119, J136	Connector, 3-pin Header STR Sq.
61	5791-10862-04	J103, J116-J118	Connector, 4-pin Header STR Sq.
62	5791-10862-05	J112, J104-J106, J123, J124, J128, J129, J131, J132	Connector, 5-pin Header STR Sq.
63	5791-10862-06	J107	Connector, 6-pin Header STR Sq.
64	5791-10862-07	J101, J109, J114	Connector, 7-pin Header STR Sq.
65	5791-10862-09	J102, J122, J125, J127, J130, J137, J138	Connector, 9-pin Header STR Sq.
66	5791-10862-11	J120, J121	Connector, 11-pin Header STR Sq.
67	5791-10862-12	J115	Connector, 12-pin Header STR Sq.
68	5791-10862-13	J126	Connector, 13-pin Header STR Sq.
69	5791-13830-05	J111	Connector, 5-pin Header STR Sq.
70	5791-13830-09	J133-J135	Connector, 9-pin Header STR Sq.
71	5791-12516-00	J113	34 HEN 2x17 STR
72	5824-09248-00	TP1-TP8	Test Point #1502-1
73	5041-09163-00	C9	Capacitor, 2.2µfd TANT
74-100	Not Used		
101	Not Used		
102	5730-09071-00	F114	Fuse, 8A, 32v
103	Not Used		
104	5731-09432-00	F112	Fuse, S-B, 7A., 250v
105	5731-09651-00	F106 - F111, F113	Fuse, S-B, 5A., 250v
106	Not Used		
107	5731-10356-00	F101 - F105, F116	Fuse, S-B, 3A., 250v
108	5730-09797-00	F115	Fuse, S-B, 3/4A., 250v
109	5705-12698-00		Heatsink #62365
110	4010-01006-00		Mach. Screw, 10-32 x 5/8

A-12697-1 WPC Power Driver Assembly



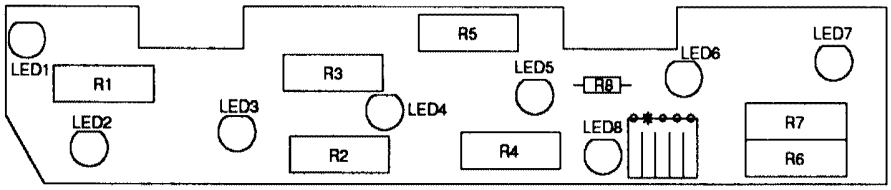
A-12742-50023 WPC CPU Board Assembly



Part Number	Designator	Description
5010-09034-00	R14-R22, R27-R42, R86, R90, R94, R98	Resistor, 10KΩ, 1/4w, 5%
5010-09085-00	R1, R2, R4, R96, R97	Resistor, 1.5KΩ, 1/4w, 5%
5010-09314-00	R52, R54, R56, R58, R60, R62, R64, R66, R75-R82	Resistor, 1.2KΩ, 1/4w, 5%
5010-09358-00	R3, R43-R51, R53, R55, R57, R59, R61, R63, R65, R67-R74, R84	Resistor, 1KΩ, 1/4w, 5%
5010-09416-00	R5-R8, R12, R13, R87-R89	Resistor, 470Ω, 1/4w, 5%
5010-09534-00	W1, W3, W4, W7	Resistor, 0Ω
5010-10258-00	R95, R99	Resistor, .01µfdΩ, 1/4w, 5%
5010-10989-00	R92	Resistor, 470KΩ, 1/4w, 5%
5010-12104-00	R91	Resistor, 22µfd, 1/4w, 5%
5019-09362-00	SIP 1	SIP, 9R, 10-pin, 4.7KΩ, 5%
5040-08986-00	C31	Capacitor, 100µfd, 10v (±20%)
5043-08980-00	B	Capacitor, .01µfd, 50v, (+80, -20%)
5043-09030-00	C27	Capacitor, 0.047µfd, 50v (±20%)
5043-09065-00	C3 - C26	Capacitor, 470pfd, 50v (±20%)
5043-09491-00	C2, C29, C30, C34	Capacitor, 22pfd, 1KV, (±10%)
5043-09492-00	C28	Capacitor, 100pfd, 50v, (±10%)
5043-09845-00	C32, C33	Capacitor, 1KP, 50v, (±20%)
5070-08919-00	D2 - D18	Diode, 1N4148, 150MA
5070-09266-00	D1, D25	Diode, 1N5817, 1.0A.
5160-10269-00	Q1	Transistor, 2N3904, NPN
5162-12422-00	U20	IC, ULN, 2803A
5281-09308-00	U3	IC, 74LS245, Octal Bus Trncv
5281-09486-00	U14	IC, 74LS374, 8D F/F

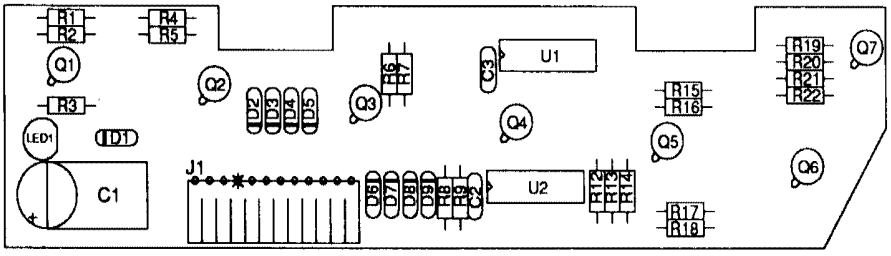
Part Number	Designator	Description
5281-09851-00	U5	IC, 74LS14, SMT/TRG
5281-09867-00	U1, U2, U7	IC, Octal Buffer, 74LS244
5281-10182-00	U11, U12, U13, U15	IC, 74LS240 Driver
5284-12651-00	U21	IC, 4584
5340-13062-00	U8	IC/RAM 32K x 8
5370-12272-00	U16 - U19	IC, LM339, Quad. Comp
5370-12687-00	U10	MC, 34064 Reset Chip
5520-10438-00	X2	Crystal, 8.0MHz.
5520-12084-00	X1	Crystal 32.768 KHz
5551-09822-00	L1	ILN, 4.7 UH 3A
5671-13732-00	D19 - D21	DSPL LED RED
5700-08985-00	U4	Socket, IC 40P, .6"
5700-12088-00	U6	Socket, IC 32P, .6"
5700-12424-00	U9	Socket, 84 Pin PLCC
5791-10850-00	J201, J204	Connector, 26-pin Header Str Sq.
5791-10862-07	J210	Connector, 7-pin Header Str Sq.
5791-13830-08	J212	Connector, 8-pin Header Str Sq.
5791-13830-09	J206 - J209	Connector, 9-pin Header Sq. pin
5791-13830-12	J205	Connector, 12-pin Header Sq. pin
5791-12516-00	J202, J211	34 Hen 2x17 STR
A-15814	B1 - B3	Battery Holder "AA"
5048-11033-00	C50	Capacitor, 0.022µf, 10v
A-5343-50023-1	U6	Game PROM Assembly
5410-12426-00	U9	WPC-89 ASIC
5400-10320-00	U4	IC MPU 68B09E
5880-09022-00	B1 - B3	Battery, Alkaline, 1.5v ("AA")
5645-09025-00	W11 - W18	Switch Dip 8 Pos

A-16927
7 Ball Trough LED PCB Assembly



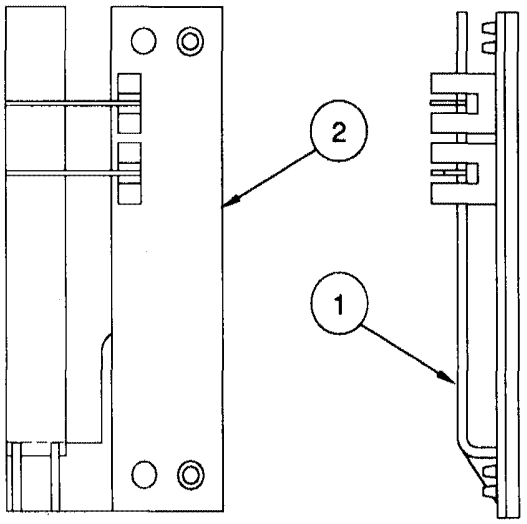
Part Number	Designator	Description
5791-13830-05	J1	Connector, 5-pin Header
5671-12731-00	LED1 - LED7	Diode-Infra Red
5010-12928-00	R1 -R7	Resistor, 270Ω, 2W, 5%
5671-13732-00	LED8	Display LED Red
5010-09314-00	R8	Resistor, 1.2KΩ, 1/4W, 5%

A-16926
7 Ball Trough Photo Transistor Assy.



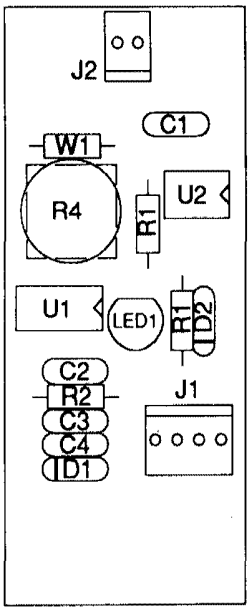
Part Number	Designator	Description
5163-12732-00	Q1 - Q7	Photo Transistor
5791-13830-12	J1	Connector, 12-pin Header
5010-09999-00	R1, R2, R4-R7, R10, R11, R15, R16, R19-R22	Resistor, 2KΩ, 1/4W, 5%
5010-10631-00	R3	Resistor, 1.2KΩ, 1/4W, 5%
5010-09162-00	R18, R8, R13	Resistor, 100KΩ, 1/4W, 5%
5010-08774-00	R9, R17	Resistor, 22KΩ, 1/4W, 5%
5010-09034-00	R12	Resistor, 10KΩ, 1/4W, 5%
5070-09054-00	D1 - D9	Diode 1N4004, 1.0A
5370-12272-00	U1, U2	ICLM339 Quad
5671-13732-00	LED1	Display LED Red
5043-08980-00	C2, C3	Capacitor, 0.01µF, 50V
5040-12298-00	C1	Capacitor, 100µFd, 40V (±50%)

A-17316
Flipper Opto PCB Assembly



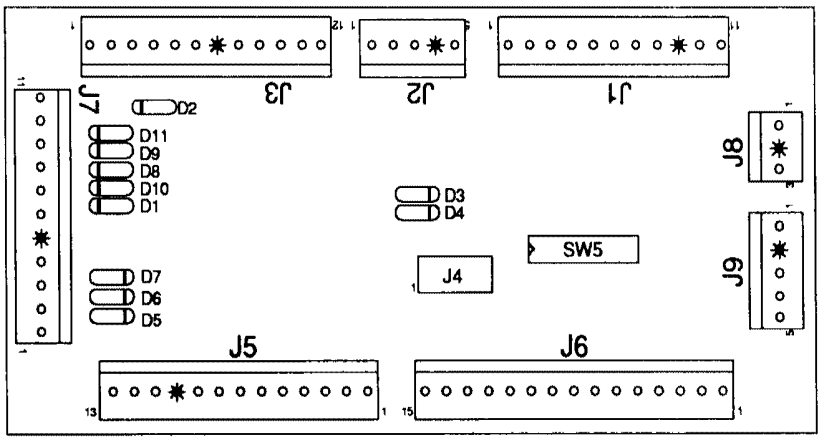
Item	Part Number	Description
1.	03-9001	Interrupter Flip-Opto
2.	A-16384	Flipper Opto Switch Assembly
	5010-08930-00	Resistor, 470Ω, 1/2w, 5%
	5490-12451-00	Opto Inter Lg. 10mA.
	5791-12462-07	Connector, 7-pin Header

A-16922
Prox Sensor II PCB Assembly



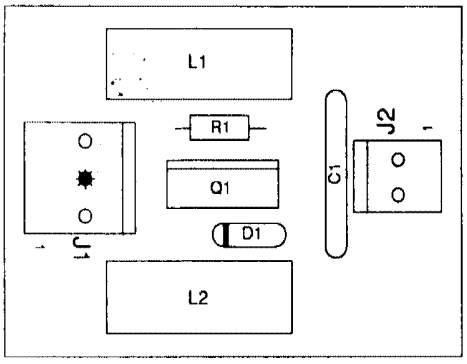
Part Number	Designator	Description
5370-13452-00	U1	I.C. TDA 0161
5490-13507-00	U2	I.C. Opto 4N35
5671-13732-00	LED1	LED RED
5791-13830-04	J1	Connector, 4-pin Header
5791-13830-02	J2	Connector, 2-pin Header
5014-10260-00	R4	Pot 2K .15w, 20%
5070-08919-00	D1, D2	Diode 1N4148
5048-13658-00	C1, C2	Capacitor, 3300pF, 100v (±5%)
5041-09031-00	C4	Capacitor, 1µfd, 25v Axial
5013-13661-00	R1	Resistor, 9.09kΩ, 1/4w, 1%
5010-10983-00	R2	Resistor, 1.8kΩ, 1/4w, 5%

A-17051-1
Coin Door Interface PCB Assembly



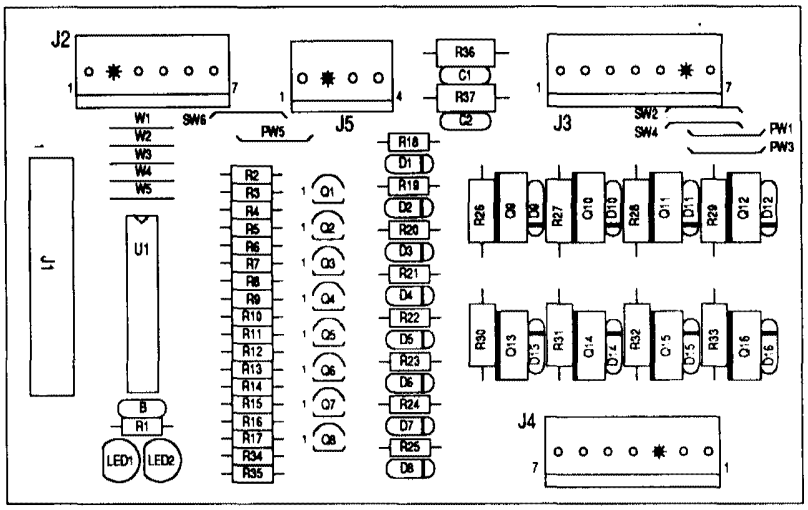
Part Number	Designator	Description
5791-10862-03	J8	Connector, 3-pin Header Str Sq. pin .156
5791-10862-05	J2, J9	Connector, 5-pin Header Str Sq. pin .156
5791-10862-11	J1, J7	Connector, 11-pin Header Str Sq. pin .156
5791-10862-12	J3	Connector, 12-pin Header Str Sq. pin .156
5791-10862-13	J5	Connector, 13-pin Header Str Sq. pin .156
5791-10862-15	J6	Connector, 15-pin Header Str Sq. pin .156
5645-09025-00	SW5	Sw DIP 8 Pos
5070-09054-00	D1 - D11	Diode, 1N4004, 1.0A.
5791-11000-10	J4	Connector, 10-pin Header Str Sq. pin .156

A-15542
Motor EMI PCB Assembly



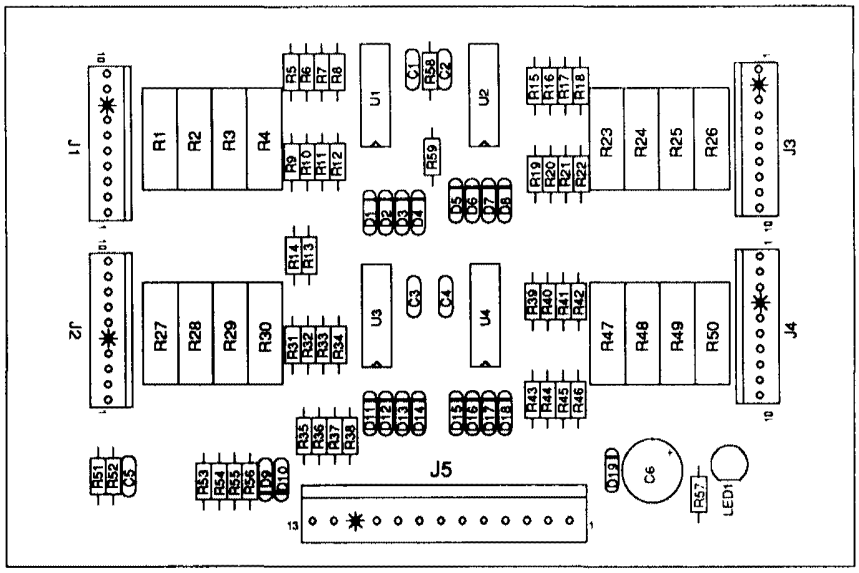
Part Number	Designator	Description
5551-09822-00	L1, L2	Ind. 4.7MH3AMP
5791-12273-03	J1	Connector, 3-pin Header Sq.
5791-12273-02	J2	Connector, 2-pin Header Sq.
5070-09054-00	D1	Diode 1N4004, 1.0A.

A-16100
8-Driver PCB Assembly



Part Number	Designator	Description
5317-13400-00	U1	IC74ALS576 O/F-F
5190-09016-00	Q1 - Q8	Trans. 2N4403 PNP
5162-12635-00	Q9 -Q16	Trans. TIP 102NPN
5070-09054-00	D1- D16	Diode, 1N4004, 1.0A.
5010-08991-00	R1, R2, R4, R6, R8, R10, R12, R14, R16	Resistor, 4.7KΩ, 1/4w, 5%
5010-09416-00	R3, R5, R7, R9, R11, R13, R15, R17	Resistor, 470Ω, 1/4w, 5%
5043-08980-00	B	Capacitor, .01μF, 50v(+80, -20%)
5010-10171-00	R18 - R25	Resistor, 56Ω, 1/4w, 5%
5011-12956-00	R26 - R33	Resistor, 2.7KΩ, 1/4w, 5%
5010-09314-00	R35	Resistor, 1.2KΩ, 1/4w, 5%
5010-09224-00	R34	Resistor, 270Ω, 1/4w, 5%
5671-09019-00	LED1, LED2	Disp. Red LED
5010-08930-00	R37	Resistor, 470Ω, 1/2w, 5%
5043-09065-00	C2	Capacitor, 470PF, 50v(±20%)
5010-09534-00	W4, SW2, SW4, SW6	Resistor, 0Ω (Jumper)
5791-10850-00	J1	Connector, 26-pin Header Str Sq.100
5791-10862-06	J2	Connector, 6-pin Header Str Sq.100
5791-10862-07	J3, J4	Connector, 7-pin Header Str Sq.100
5791-10862-04	J5	Connector, 4-pin Header Str Sq.100

A-16998
16-Opto PCB Assembly



Part Number	Designator	Description
5043-08996-00	C1-C5	Capacitor, 0.1µF, 50v (±20%) Axial
5040-13102-00	C6	Capacitor, 470µF, 35v (±20%)
5791-13830-10	J1-J4	Connector, 10-pin Header Str Sq. Lck .100
5791-10862-13	J5	Connector, 13-pin Header Str Sq. Lck .156
5671-13732-00	LED1	Display LED Red
5010-12928-00	R1-R4, R23-R30, R47-R50	Resistor, 270Ω, 2w, 5%
5010-09999-00	R5-R12, R15-R22, R31-R46	Resistor, 2KΩ, 1/4w, 5%
5010-08774-00	R13, R14, R51	Resistor, 22KΩ, 1/4w, 5%
5010-09162-00	R52, R54, R56, R58, R59	Resistor, 100KΩ, 1/4w, 5%
5010-09034-00	R53, R55	Resistor, 10KΩ, 1/4w, 5%
5010-10631-00	R57	Resistor, 1.2KΩ, 1/2w, 5%
5370-12272-00	U1-U5	IC LM339 Quad Comp
5070-09054-00	D1-D19	Diode 1N4004, 1.0A.

A-15849-R-2 & A-15849-L-2 Flipper Assembly

Item	Part Number	Description
1.	B-13104-R	Flipper Base Assy., Right
	B-13104-L	***Flipper Base Assy., Left***
2.	SW-1A-194	Switch Assembly
3.	4701-00002-00	Lockwasher, #6 Split
4.	4105-01019-10	Sh. Metal Screw, #5 x 5/8 P-RH-A
5.	4008-01079-05	Mach. Screw, 8-32 x 5/16 H-SOC
6.	4701-00003-00	Lockwasher, #8 Split
7.	01-9375	Switch Mounting Bracket
8.	20-6516	Speednut, Tinnerman
9.	4010-01066-06	Cap Screw, 10-32 x 3/8, SH
10.	4701-00004-00	Lockwasher, #10 Split
11.	A-12390	Flipper Stop Assembly
12.	FL-11629	Flipper Coil (Blue)
a)	03-7066-5	Coil Tubing
13.	01-7695	Solenoid Bracket
14.	4006-01017-04	Mach. Screw, 6-32 x 1/4 P-RH-S
15.	10-364	Spring
16.	A-15848-R	Crank Link Assembly, Right
	A-15848-L	***Crank Link Assembly, Left***
a)	A-17050-R	Flipper Crank Assembly, Right
	A-17050-L	***Flipper Crank Assembly, Left***
b)	A-15847	Flipper Link Assembly
c)	02-4676	Link Spacer Bushing
d)	4010-01086-14	Cap Screw, 10-32 x 7/8 SH
e)	4700-00023-00	Flatwasher, 5/8 x 13/64 x 16ga.
f)	4701-00004-00	Lockwasher #10 Split
g)	4410-01132-00	Nut, 10-32 ESN
17.	23-6577	Bumper Plug, 5/8"
18.	03-7568	Flipper Bushing
19.	4006-01005-06	Mach. Screw, 6-32 x 3/8 P-PH
20.	4406-01117-00	Nut, 6-32 Hex

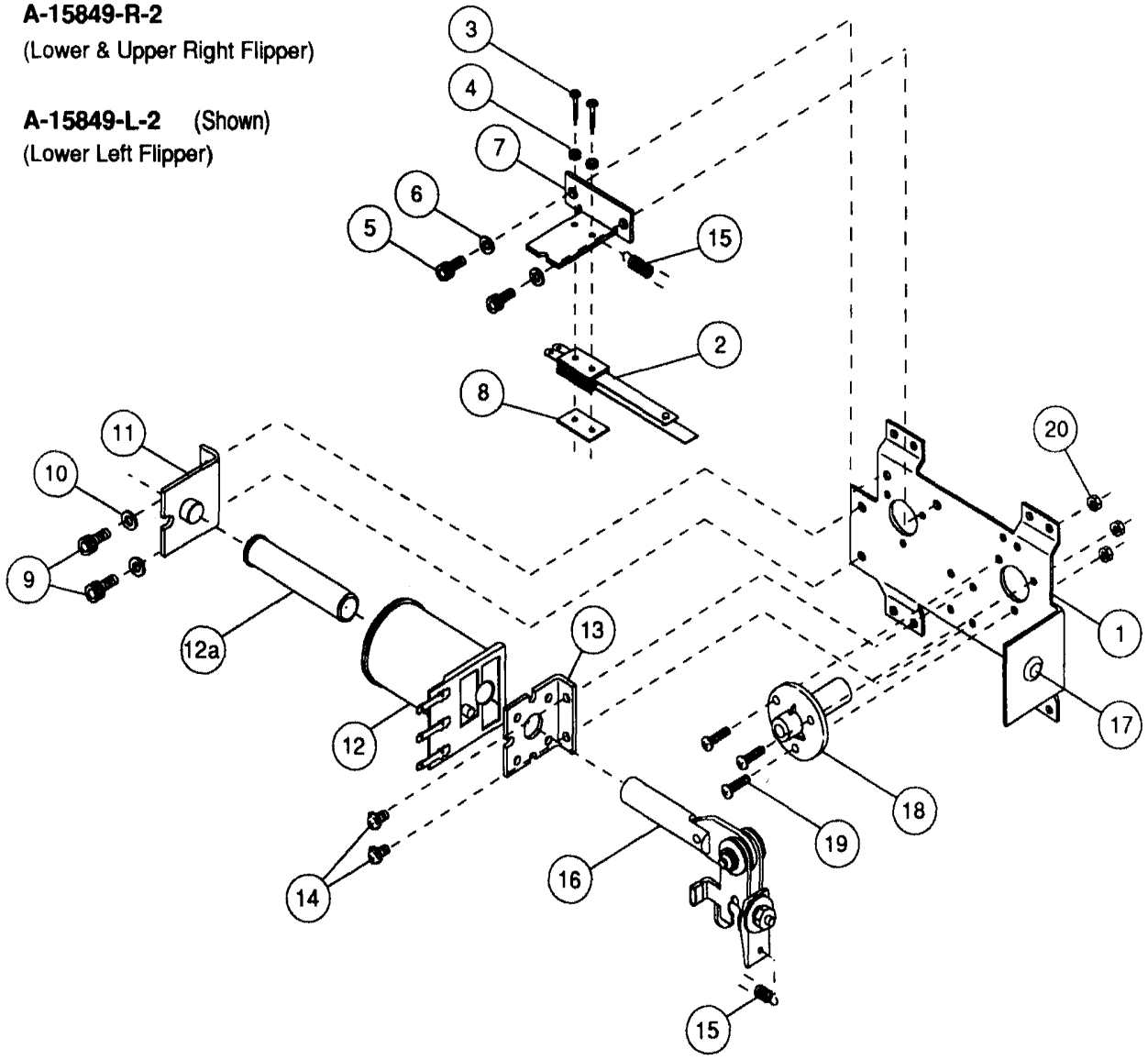
■ **Associated Parts for Left & Right Flippers:**

21.	23-6695	Flipper Rubber Ring, 1-1/2" (3 Used)
22.	20-9250-5	Flipper & Shaft-White (3 Used)

Flipper Assembly

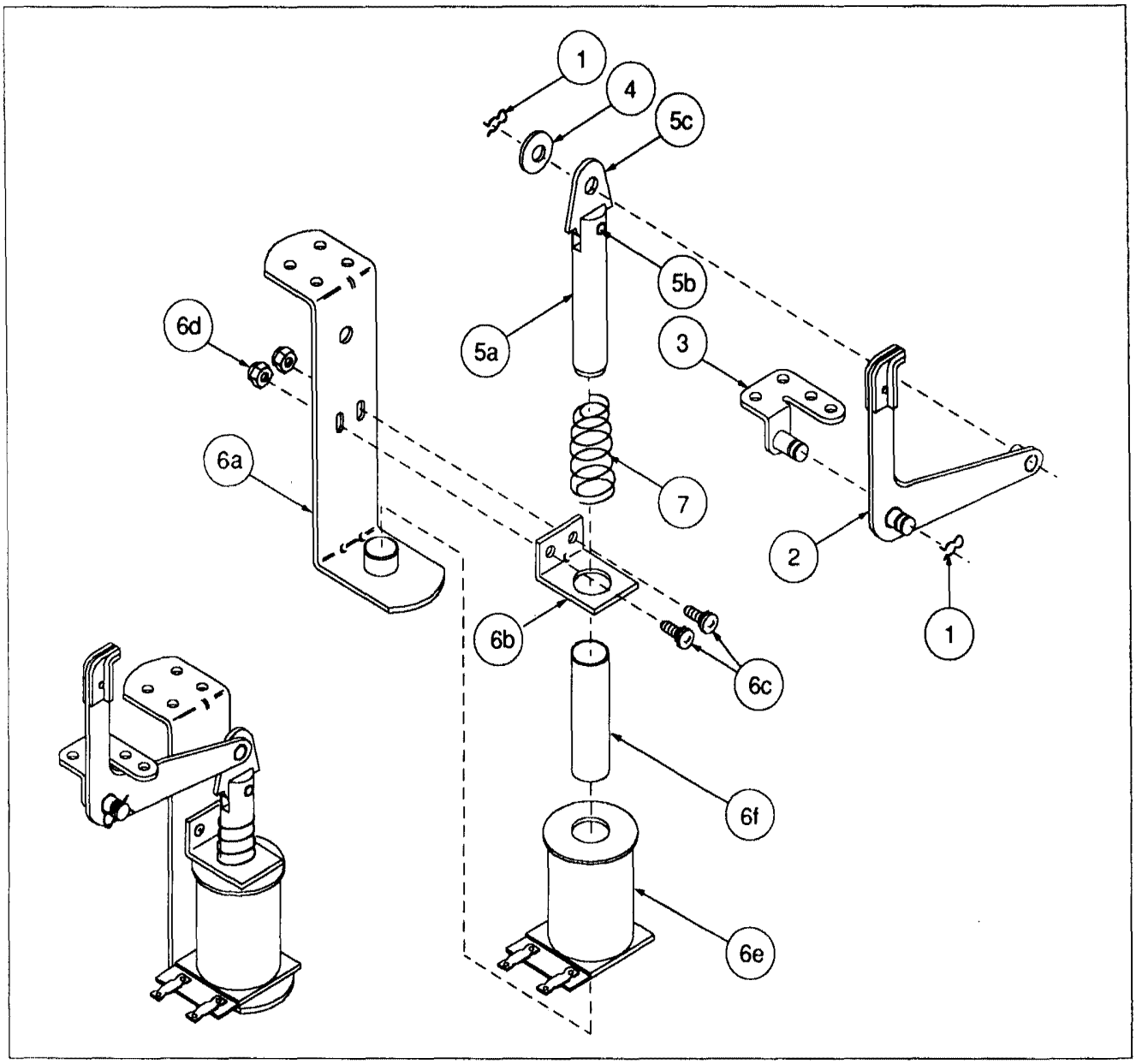
A-15849-R-2
(Lower & Upper Right Flipper)

A-15849-L-2 (Shown)
(Lower Left Flipper)



- *Flipper Notes:*
  1. *Each Flipper Assembly is mounted beneath the playfield, in conjuction with the Plastic Flipper & Shaft, and Flipper Rubber on the upper side of the playfield.*
  2. *With the flipper, in the non-activated position, the E.O.S. Switch contacts must have a gap of .062 (±.015) inch. When flipper is activated switch must close.*
  3. *Any adjustment of the E.O.S. Switch must be made at a minimum distance of 0.25 inch from the switch body.*
  4. *Longer blade of E.O.S. Switch must be straight. Gap adjustment is done by adjusting shorter blade.*
  5. *All moving elements of the assembly must operate freely without any evidence of binding.*
  6. *Apply Loctite™ 245 when reatacking screws to the Flipper Stop Assembly, the Solenoid Bracket, and the Flipper Bushing.*

B-12665 Kicker Arm (Slingshot) Assembly

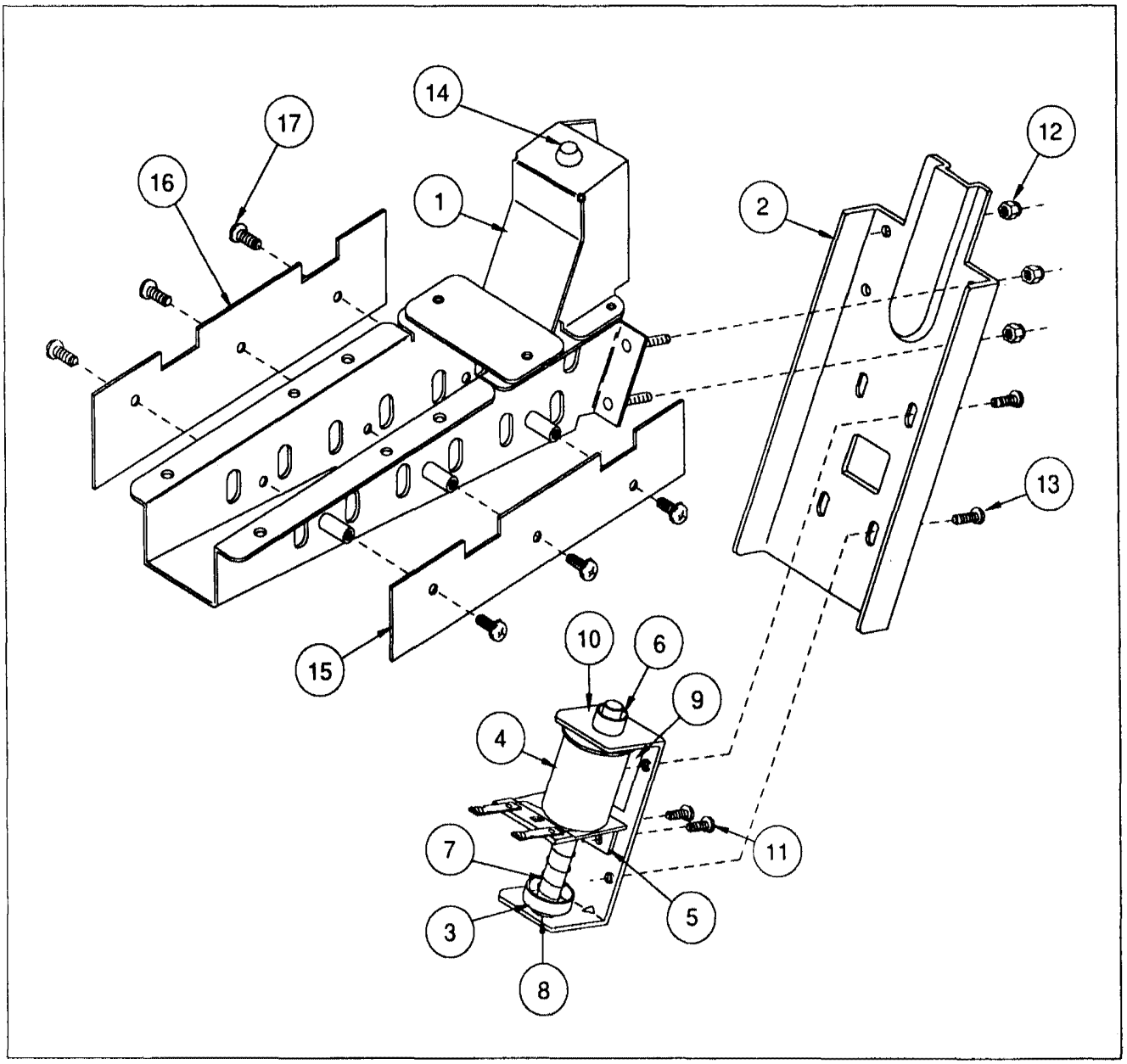


Associated Parts for **Right & Left Kickers:**

Item	Part Number	Description
1.	12-6227	Hairpin Clip
2.	A-12664	Kicker Crank Assembly
3.	A-5653	Mounting Bracket Assembly
4.	4700-00030-00	Flatwasher, 17/64 x 1/2 x 15ga.
5.	A-5103	Coil Plunger Assembly
a)	02-2364	Coil Plunger
b)	03-8085	Armature Link
c)	20-8716-5	Roll Pin, 1/8 x 7/16"

Item	Part Number	Description
6.	**B-9362-R-3**	**Coil & Bracket Assy., Right**
	B-9362-L-2	**Coil & Bracket Assy., Left**
a)	B-7572-1	Bracket & Stop Assembly
b)	01-8-508-S	Coil Retaining Bracket
c)	4006-01017-06	Mach. Screw, 6-32 x 3/8
d)	4406-01119-00	Nut, 6-32 ESN
e)	AE-26-1200	Coil Assembly
f)	03-7066	Coil Tubing
7.	10-128	Spring

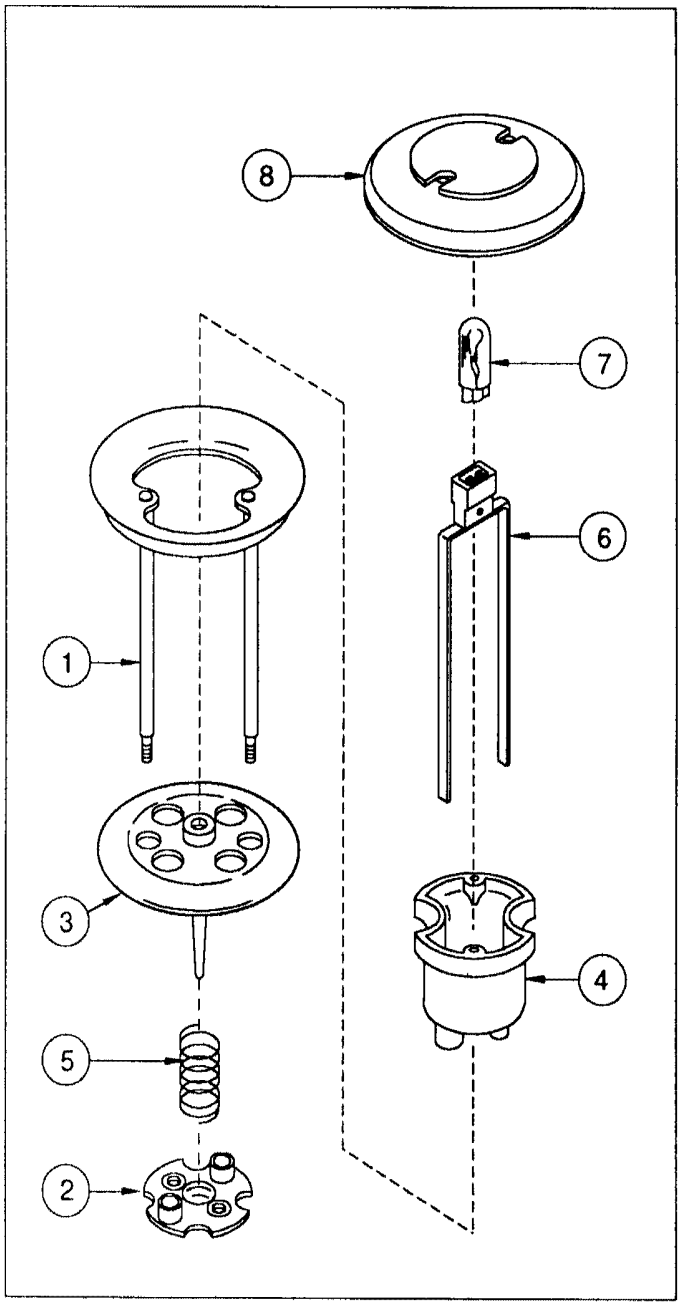
A-16765 Outhole Ball Trough Assembly



Item	Part Number	Description
1.	A-16809	Ball Trough Welded Assy.
2.	01-11587	Ball Trough Front
3.	A-6306-2	Bell Armature Asssembly
4.	AE-26-1500	Coil Assembly
5.	01-8-508-T	Solenoid Bracket
6.	03-7067-5	Coil Tubing
7.	10-135	Insulator
8.	23-6420	Rubber Grommet
9.	03-8523	Insulator

Item	Part Number	Description
10.	01-11586	Coil Mtg. Bracket (Bell)
11.	4008-01017-05	Mach. Screw, 8-32x5/16 P-RH SEMS
12.	4408-01119-00	Nut 8-32 ESN
13.	4008-01017-06	Mach. Screw, 8-32x3/8 P-RH SEMS
14.	23-6702	Bumper Plug
15.	A-16529	7 IR LED PCB Assembly
16.	A-16530	7 IR LED PCB Assembly
17.	4006-01017-06	Mach. screw, 6-32x3/8 P-RH SEMS

B-9414-3
Jet Bumper Assembly

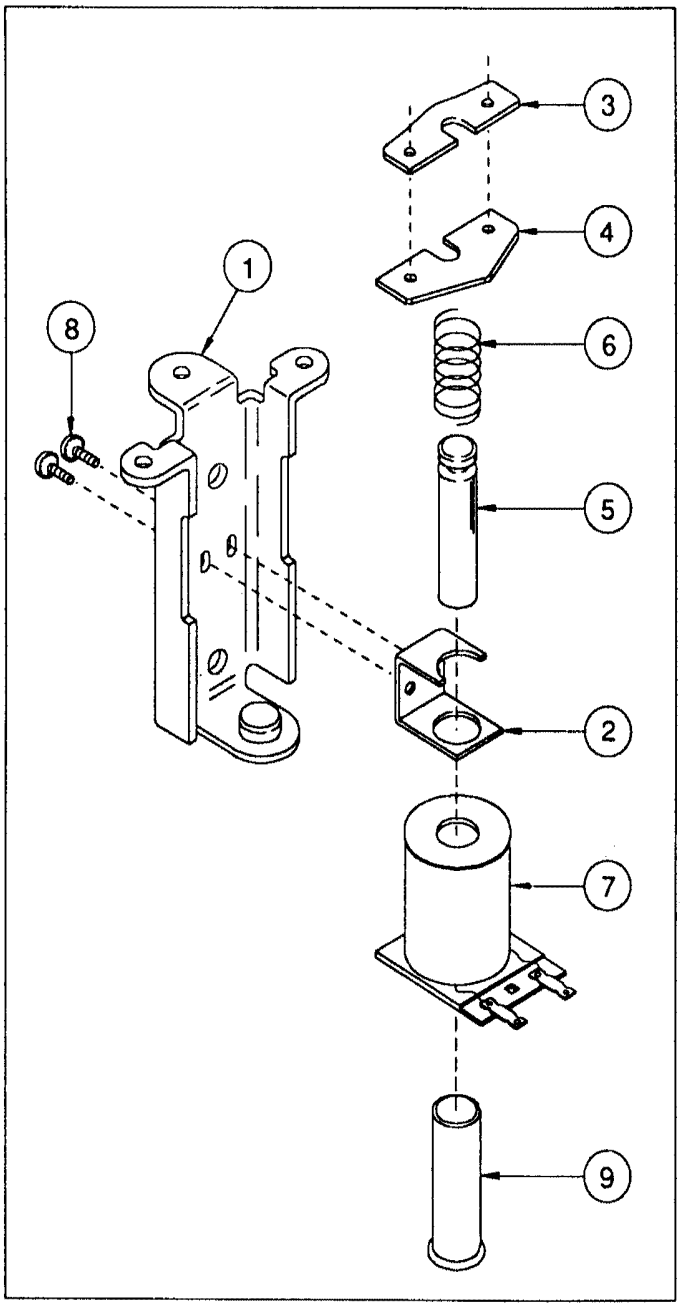


Item	Part Number	Description
1.	A-4754	Bumper Ring Assembly
2.	03-6009-A5	Bumper Base, White
3.	03-6035-4	Bumper Wafer, Red
4.	03-7443-5	Bumper Body, White
5.	10-7	Spring
6.	24-8776	Socket - Wedge Base
7.	24-8768	Bulb #555 (6.3V., 0.25A.)

Associated Parts:

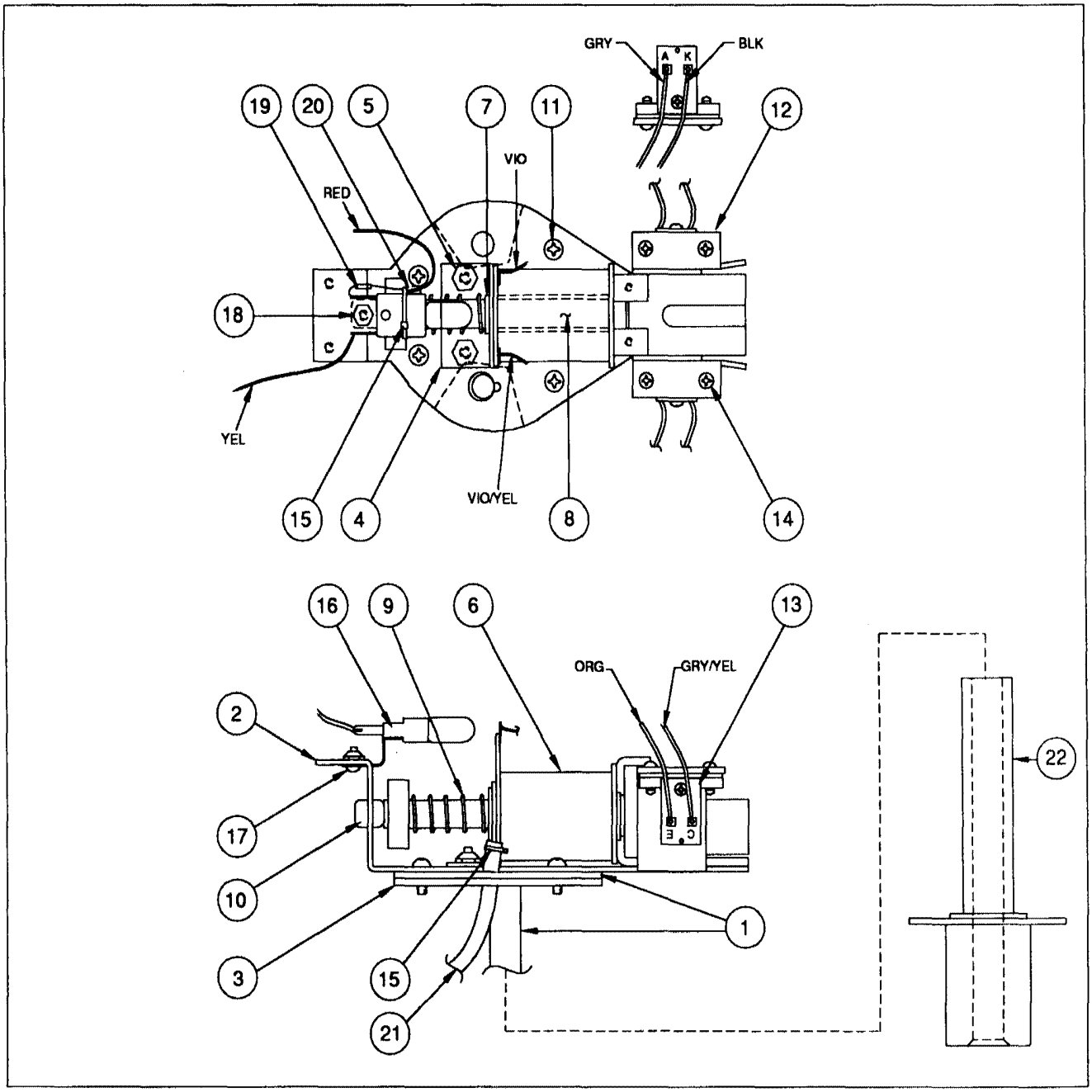
8.	03-8254-9	Jet Bumper Cap (Tr. Red)

A-9415-2
Jet Bumper Coil Assembly



Item	Part Number	Description
1.	B-7417	Bracket & 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.	AE-26-1200	Coil Assembly
8.	4006-01017-04	Mach. Screw, 6-32 x 1/4"
9.	03-7066	Coil Tubing

A-17081-L & A-17081-R Gun Assembly



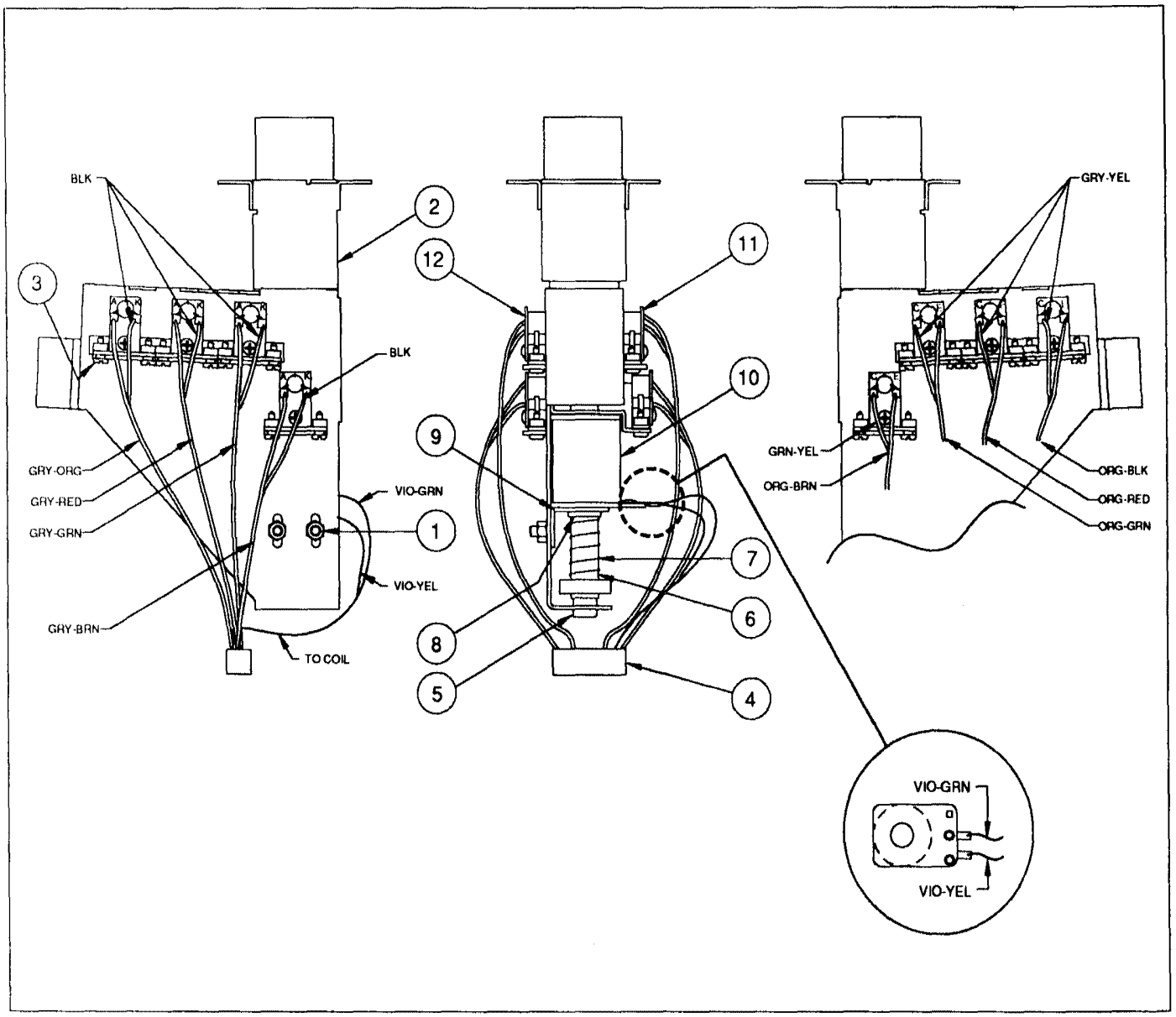
Item	Part Number	Decription
1.	A-17080	Gun Shaft Assembly
2.	A-17083	Gun Kicker Bracket Assy.
3.	01-11798	Plate, Nut
4.	01-11800	Bracket, Coil
5.	4408-01119-00	Nut, 8-32 ESN
6.	AE-23-800	Coil Sub-Assembly
7.	03-7067	Tubing, Coil
8.	A-13270	Bell Armature Assembly
9.	10-135	Solenoid Spring
10.	23-6420	Rubber Grommet
11.	4008-01003-06	Mach. Screw, 8-32 x 3/8 PPH-S
12.	A-16908	Opto LED Assembly, RTV
13.	A-16909	Opto Photo Trans. Assy., RTV
14.	4106-01004-06	Sh. Metal Screw, #6 x 3/8 PPH

Item	Part Number	Decription
15.	03-7520-2	Tie Wrap, Nylon
16.	A-12887	Socket & #555 Bulb Assembly
17.	4006-01003-05	Mach. Screw, 6-32 x 5/16 PPH-S
18.	4406-01119-00	Nut, 6-32 ESN
19.	5070-09054-00	Diode 1N4004, 1.0A.
20.	RM-21-03	Tubing #10
21.	H-17067	Top Gun Cable

■ Associated Parts:

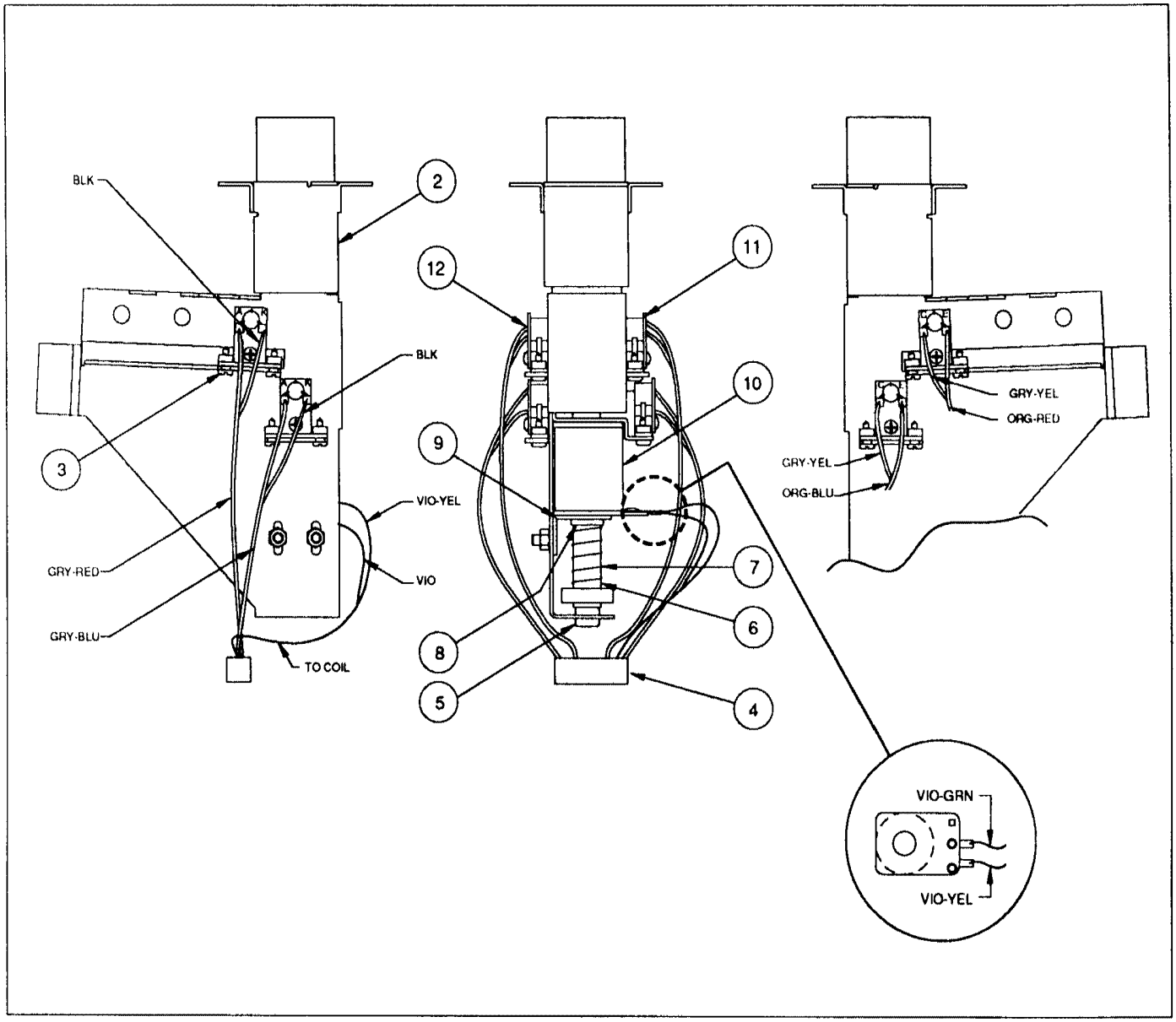
22.	A-17084	Bushing Assembly
23.	A-17220-L	U-Gun Motor Bracket Assy., Left
	A-17220-R	U-Gun Motor Bracket Assy., Right

A-17049 Ball Popper Assembly



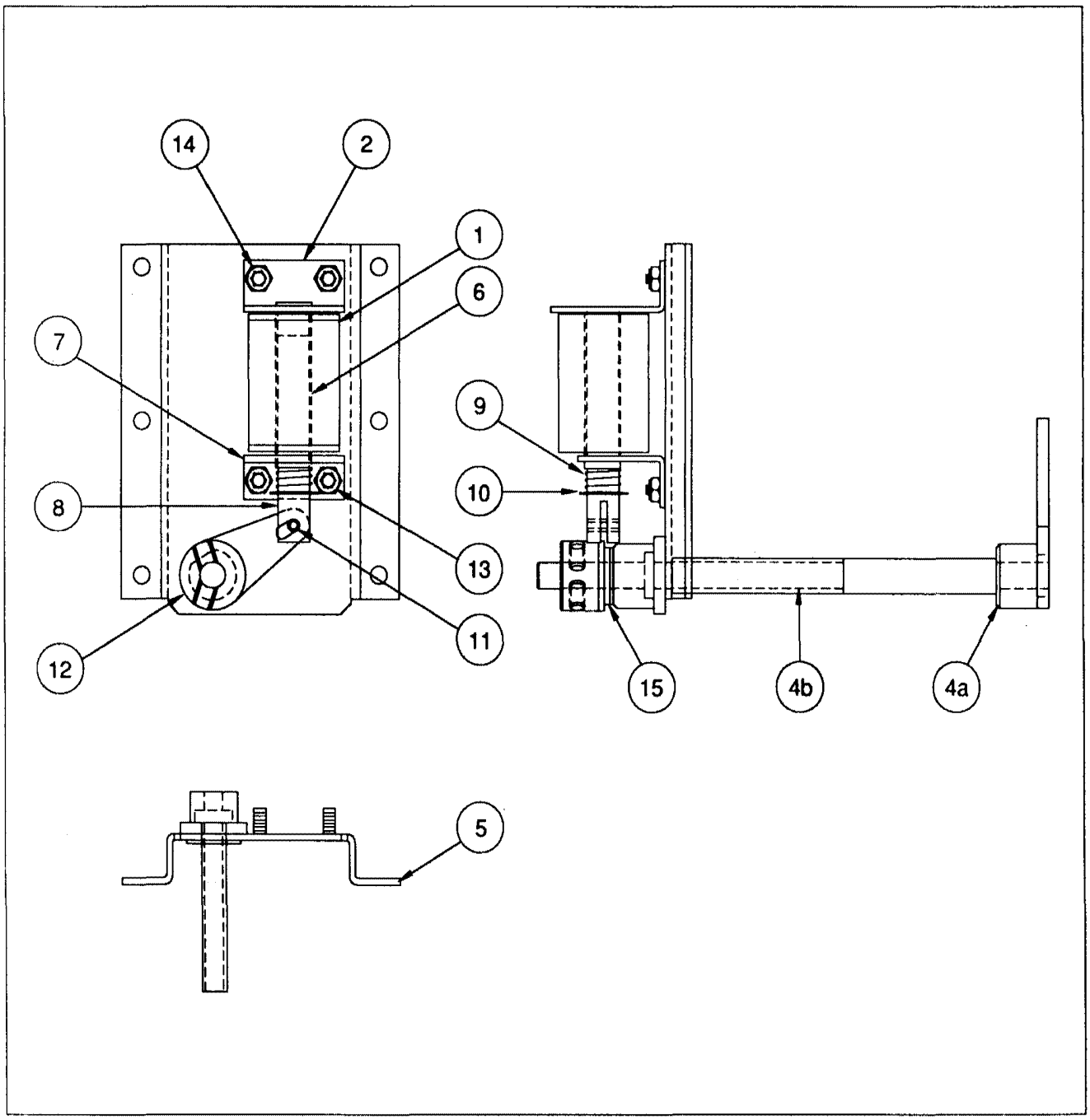
Item	Part Number	Decription
1.	4408-01119-00	Nut, 8-32 ESN
2.	A-17048	Ball Popper, Welded Assembly
3.	4106-01013-06	Sh. Metal Screw, #6 x 3/8 P-PH-ST
4.	H-17066-1	Cable Assembly
5.	23-6420	Rubber Grommet
6.	A-13270	Armature Assembly
7.	10-135	Solenoid Spring
8.	03-7067	Tubing Coil
9.	A-16858	Coil Bracket
10.	AE-23-800	Coil Assembly
11.	A-16908	L.E.D. Assembly
12.	A-16909	Photo Transistor Assembly

A-17049-1 Ball Popper Assembly



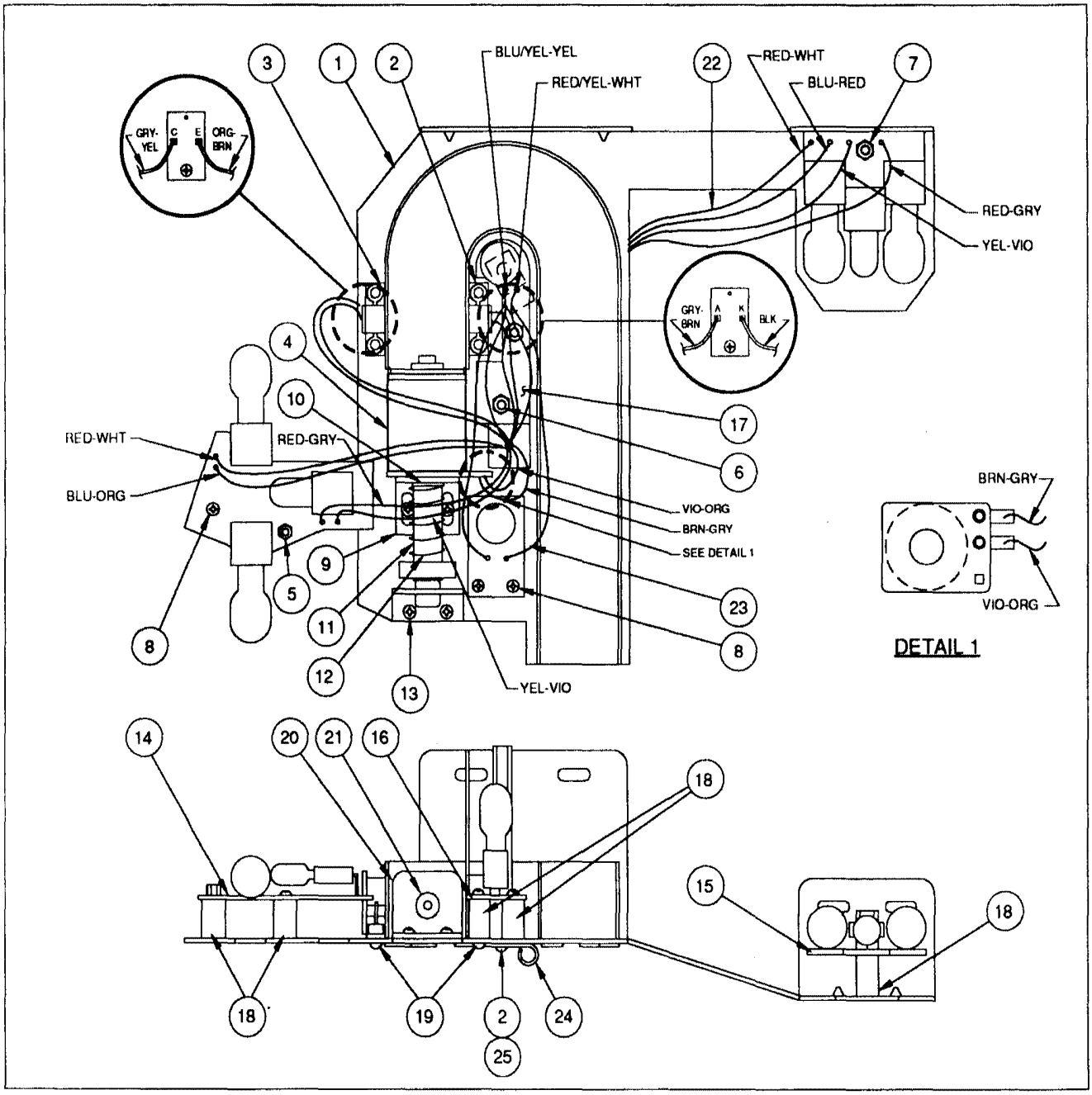
Item	Part Number	Decription
1.	4408-01119-00	Nut, 8-32 ESN
2.	A-17048	Ball Popper, Welded Assembly
3.	4106-01013-06	Sh. Metal Screw, #6 x 3/8 P-PH-ST
4.	H-17065	Cable Assembly
5.	23-6420	Rubber Grommet
6.	A-13270	Armature Assembly
7.	10-135	Solenoid Spring
8.	03-7067	Tubing Coil
9.	A-16858	Coil Bracket
10.	AE-23-800	Coil Assembly
11.	A-16908	L.E.D. Assembly
12.	A-16909	Photo Transistor Assembly

A-16763 Divertor Assembly



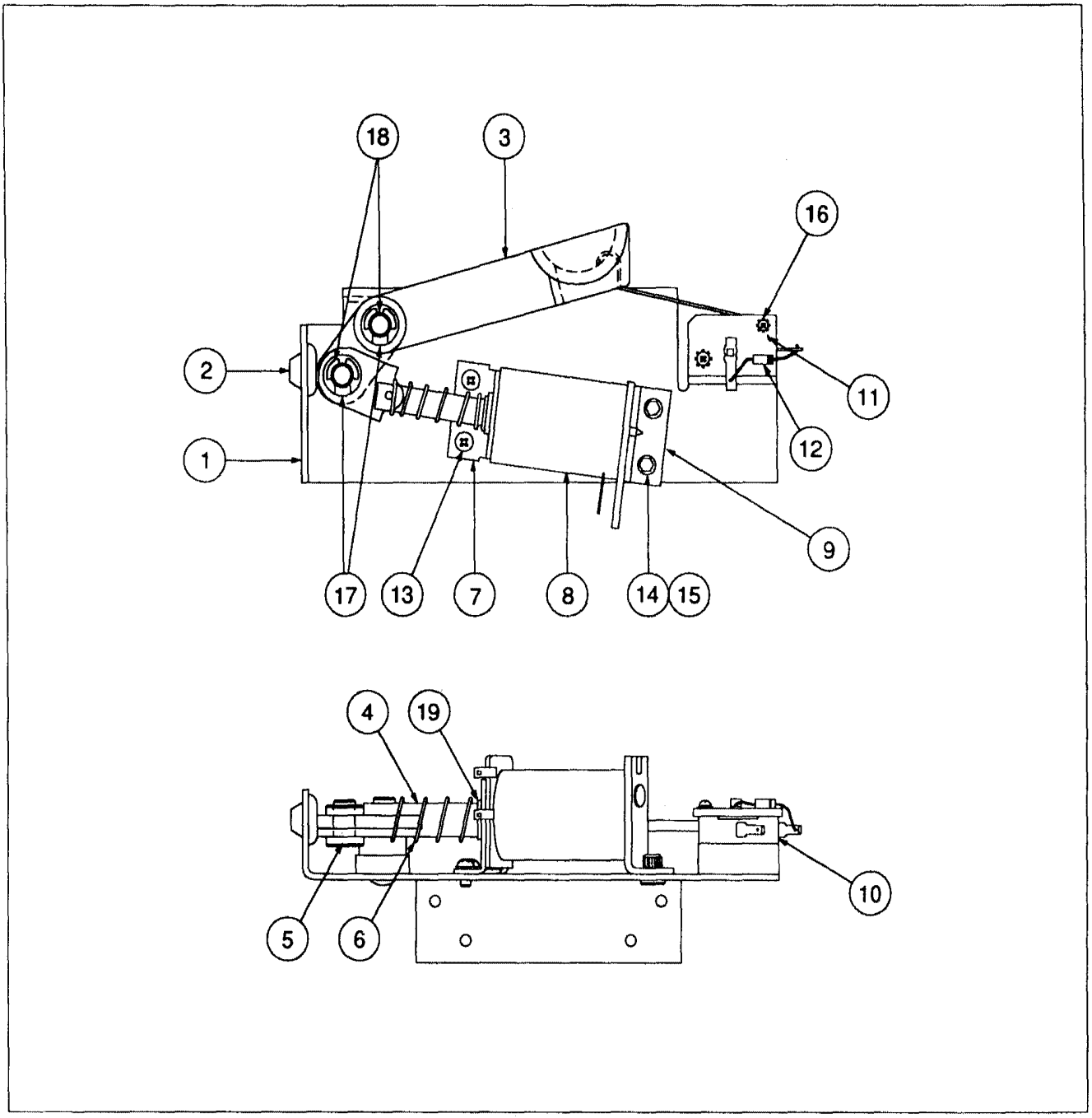
Item	Part Number	Decription	Item	Part Number	Decription
1.	AE-25-1000	Coil Assembly	8.	02-4831	Shaft, Divertor Actuator
2.	A-15605	Coil Stop Bracket Assembly	9.	10-395	Spring
3.	A-16566	Divertor Actuator Shaft Assy.	10.	20-8712-43	"E" Ring, 7/16"
4.	A-17630	Divertor Shaft Staked Assy.	11.	20-8716-5	Roll Pin, 1/8 x 7/16"
a)	01-12215	Divertor	12.	4323-01158-06	Set Screw, 1/4-28 x 3/8"
b)	02-4930	Divertor Shaft (Rear)	13.	4406-01119-00	Nut, 6-32, ESNA
5.	A-16767	Divertor Base, Bushing, Stud Assy.	14.	4408-01119-01	Nut, 8-32, ESNA/NTM
6.	03-7066	Tubing Coil	15.	4700-00104-00	Flatwasher, 23/64 x 1/2 x 16ga.
7.	01-10225	Coil Mounting Bracket			

A-17219 Borg Bracket Assembly



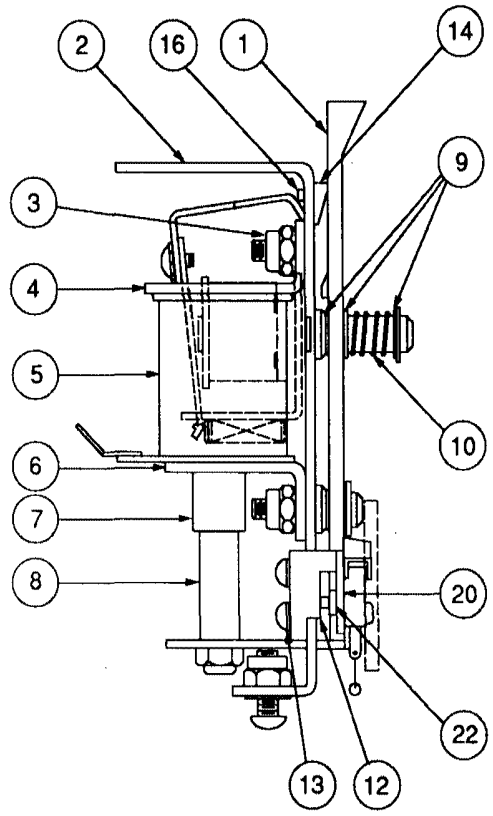
Item	Part Number	Decription	Item	Part Number	Decription
1.	A-17290	Borg Platform - Welded Assy.	14.	A-17158	3-Lamp & Flashlamp PCB
2.	A-16908	LED Assembly	15.	A-17157	3-Lamp & Flashlamp PCB
3.	A-16909	Photo Trans. Assembly	16.	A-17159	Single Flash Lamp PCB
4.	AL-23-800	Coil Assembly	17.	A-17160	2-Lamp & Flashlamp PCB
5.	02-4883-01	Hex Stand-off	18.	03-8022-1	Spacer,
6.	02-4883-03	Hex Stand-off	19.	4106-01013-06	Sh. Metal Screw, #6 x 3/8"
7.	02-4883-02	Hex Stand-off	20.	01-11982	Grommet Bracket
8.	4006-01005-14	Mach. Screw, 6-32 x 7/8" SEMS	21.	23-6420	Rubber Grommet
9.	01-11981	Solenoid Bracket	22.	H-17240	Borg Ship Cable
10.	03-7067	Tubig Coil	23.	17-1116-6	Jumper Wire (Yellow, 6" Long)
11.	A-13270	Armature Assembly	24.	03-7655-4	Wire Harness Clip
12.	10-135	Solenoid Spring	25.	4006-01027-06	Mach. Screw, 6-32 X 3/8" P-RWH
13.	4006-01003-05	Mach. Screw, 6-32 X 5/16" P-PH			

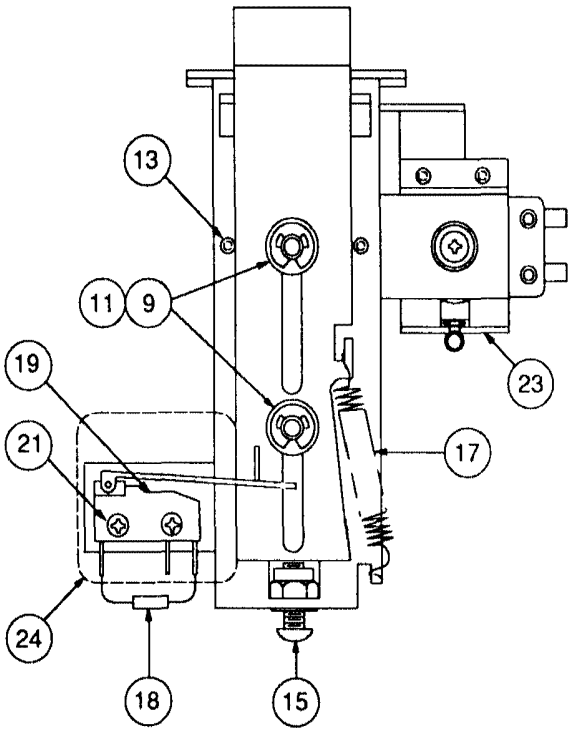
A-16757 Catapult Assembly



Item	Part Number	Decription	Item	Part Number	Decription
1.	A-16758	Catapult Bracket Assembly	12.	5070-09054-00	Diode, 1N4004, 1.0A.
2.	23-6577	Plug Bumper	13.	4008-01017-04	Mach. Screw, 8-32 x 1/4"P-RH-S
3.	03-8089	Catapult Arm	14.	4010-01066-06	Cap Screw, 10-32 x 3/8 SH
4.	A-12293	Catapult Plunger Assembly	15.	4701-0004-00	Lockwasher #10 Split
5.	02-4301	Catapult Arm Pin	16.	4004-01003-12	Mach. Screw, 4-40 x 3/4 P-RH-S
6.	10-135	Spring	17.	4700-00104-00	Flatwasher, 5/16 x 1/2 x 16ga.
7.	01-8413	Bracket, Coil Mounting	18.	20-8712-31	Retaining Ring
8.	AE-23-800	Coil Assembly	19.	03-7066	Coil Tubing
9.	A-16886	Stop Bracket Assembly	20.	23-6622	Foam Tape, Double Side
10.	5647-12133-12	Switch, Miniature	21.	03-7655-4	Cable Clamp
11.	A-7438-1	Terminal Strip Assembly	22.	4700-00005-00	Flatwasher, 9/64 x 7/16 x 21ga.

A-14615 1-Bank Drop Target Assembly

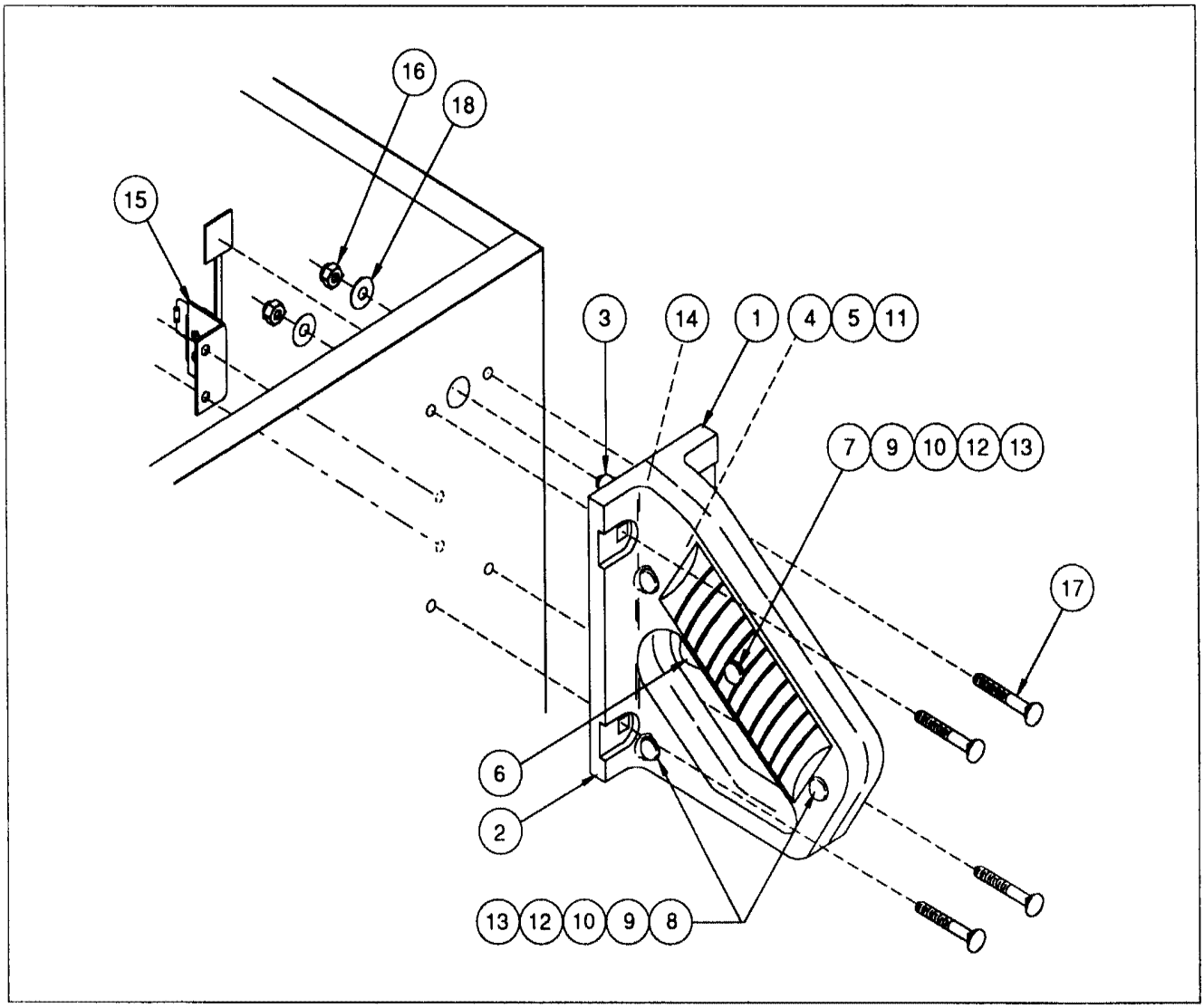




Item	Part Number	Description
1.	03-8750	Target - Flush
2.	A-14617	Bracket & Post Assy.
3.	4408-0119-00	Nut 8-32 ESNA
4.	A-11397	Stop Bracket Assembly
5.	AE-26-1200	Coil Assembly
6.	01-8413	Coil Mounting Bracket
7.	03-7066-4	Tubing
8.	A-11388-2	Plate & Reset Assembly
9.	4700-00072-00	Flatwasher, 17/64 x 1/2"
10.	10-392	Spring
11.	20-8712-25	"E"-Ring, 1/4" Shaft
12.	01-10183	Switch Bracket
13.	4006-01003-03	Mach. Screw, 6-32 x 3/16"
14.	03-8034	Single Stop Target

Item	Part Number	Description
15.	4010-01025-14	Mach. Screw, 10-32 x 7/8 P-RH
16.	07-6688-17N	Rivet, 5/32 x 7/32"
17.	10-433	Spring Extension
18.	5070-09054-00	Diode 1N4001
19.	5647-12693-31	Switch
20.	01-8600	Switch Insulator
21.	4002-01105-10	Mach. Screw, 2-56 x 5/8"
22.	01-8240	Nut Plate
23.	A-14908	Target Knock Down Assembly
a)	01-8647-L	Actuator
b)	A-14913	Frame & Eyelet Assembly
c)	SM1-26-600	Coil Assembly
24.	03-8630	Guide, Actuator

A-14747 Gun Handle Assembly

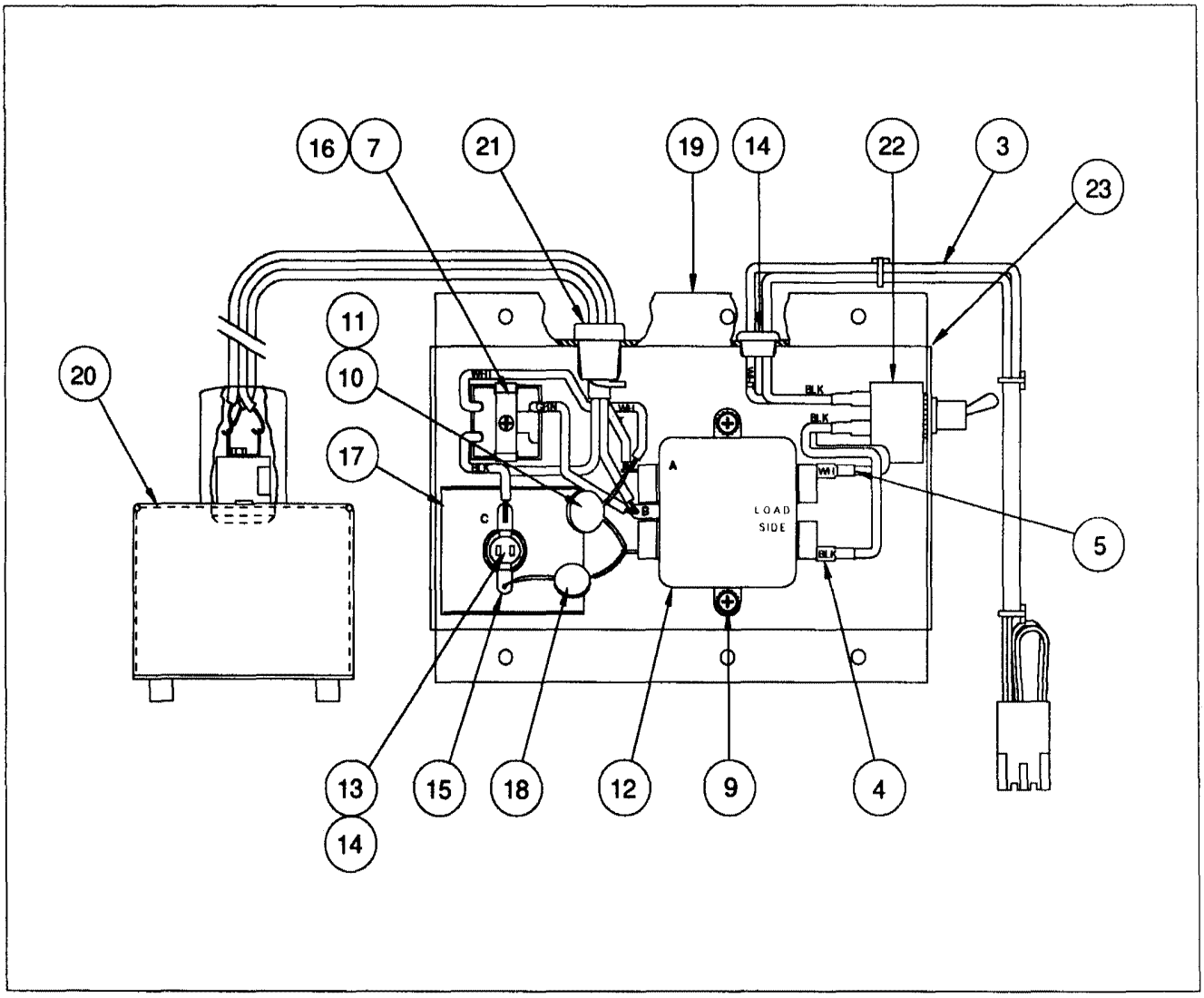


Item	Part Number	Description
1.	21-6688-L	Gun Handle, Left
2.	21-6688-R	Gun Handle Right
3.	A-14712	Bushing Firing Pin
4.	10A-304	Spring
5.	02-4558	Firing Pin Assembly
6.	A-14694	Trigger Assembly
7.	02-4546	Fastner, Button Head
8.	02-4547	Fastner, Button Head
9.	4010-01097-06B	Mach. Screw, 10-32 x 3/8 BH
10.	4700-00129-00B	Flatwasher, 13/64 x 15/32 x 22ga.
11.	02-4588	Tubing (Spring Stop)
12.	4702-00014-00B	Lockwasher, 1/4 Internal
13.	4702-00013-00B	Lockwasher #10 Internal
14.	4006-01003-06	Mach. Screw, 6-32 x 3/8 P-PH

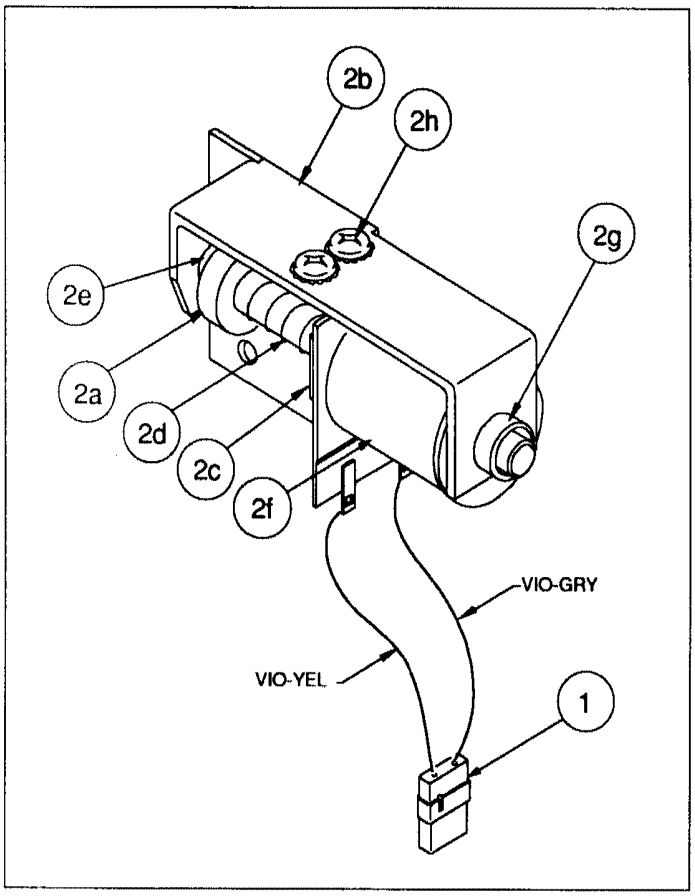
■ **Associated Parts:**

Item	Part Number	Description
15.	A-14754-1	Mini-Micro Switch & Bracket Assy.
16.	4410-01119-00	Nut 10-24 ESN (4 Used)
17.	4310-01123-24B	Bolt 10-24 x 1-1/2 C.B. (4 Used)
18.	4700-00023-00	FW 13/64 x 5/8 x 16ga. (4 Used)

A-16970-120V
A-16970-230V
Line Filter Assembly

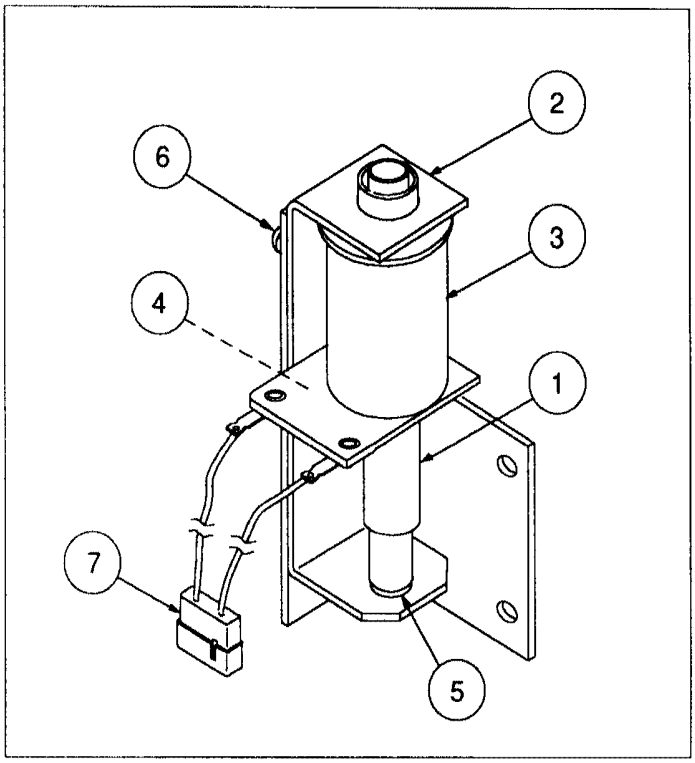


Item	Part Number	Decription	Item	Part Number	Decription
1.	H-13870	Black Jumper Cable	13.	5730-09252-00	Fuse 8A 250V
2.	H-13871	Orange Jumper Cable	14.	5731-09651-00	Fuse SB 5A 250V
3.	H-14790	A.C. Cable	15.	5733-12869-00	Fuse Holder Panel Mount
4.	H-14792-1	A.C. Cable, Black	16.	5851-09184-00	SER Outlet Snap-In
5.	H-14792-2	A.C. Cable, White	17.	01-10623	Insulator, Thermistor
6.	RM-21-06	#18 Vinyl Fgls	18.	5016-12978-00	Thermistor 8A 2.5R25
7.	03-8928	Tube Plug 1" Sq.	19.	A-14810-1	Chassis Assembly
8.	03-8591	Bushing-Strain Relief	20.	A-15473-1	IEC Power Input Assembly
9.	4008-01017-08	Mach, Screw, 8-32 x 1/2" P-R	21.	03-8712	Bushing-Strain Relief
10.	5017-09044-00	Varistor Metox 10A	22.	5640-13250-00	Toggle Switch, DPST
11.	5017-09063-00	Varistor 275V 15J	23.	A-16969	Switch Mounting Plate Assy.
12.	5102-10310-00	Line Filter 5VK	24.	4406-01128-00	Nut #6-32 KEPS



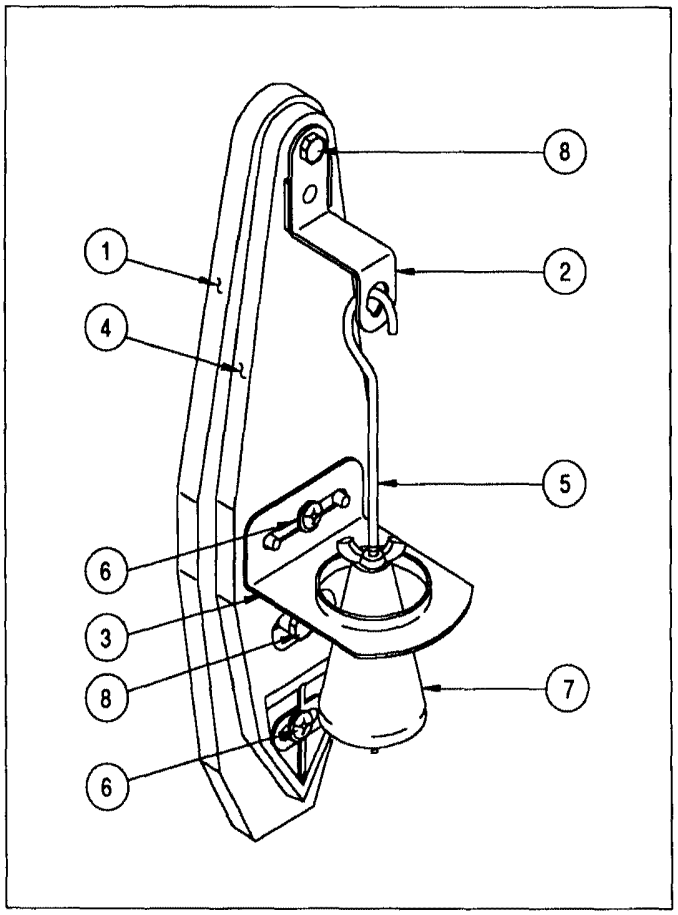
A-17234
Bottom Arch Kicker Assembly

Item	Part Number	Description
1.	**H-17237**	**Cable Assembly**
2.	**B-11873**	**Coil Sub-Assembly**
a)	A-6306-2	Bell Armature Assembly
b)	B-7409-2	Mtg. Kicker Bracket Assembly
c)	01-8-508-T	Solenoid Bracket
d)	10-135	Solenoid Spring
e)	23-6420	Rubber Grommet
f)	AE-23-800	Coil Assembly
g)	03-7067-5	Coil Tubing
h)	4008-01017-05	Mach. Screw, #8-32 x 5/16"P-RH



B-10686-1
Knocker Assembly

Item	Part Number	Description
1.	A-5387	Coil Plunger Assembly
2.	01-11273	Mtg. Bracket Assembly
3.	AE-23-800	Coil Sub-Assembly
4.	01-8-508-T	Coil Retaining Bracket
5.	23-6420	Rubber Grommet
6.	4008-01017-04	Mach. Screw, 8/32 x 1/4"P-RH
7.	H-11835	Knocker Cable
8.	03-7067-5	Coil Tubing



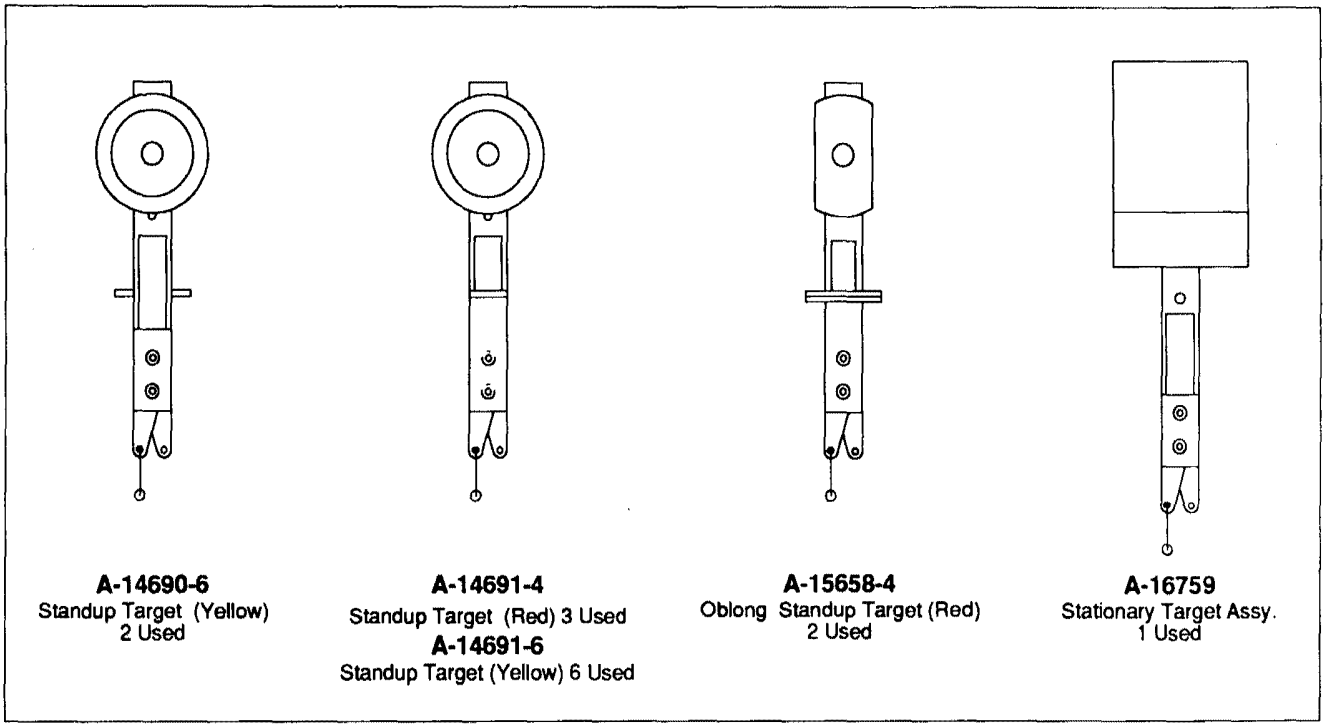
A-15361
Tilt Mechanism Assembly

Item	Part Number	Description
1.	A-15360	Mount Plate, Tilt Mech.
2.	01-3444	Bracket, Tilt Upper
3.	01-3445	Bracket, Tilt Lower
4.	03-8668	Pendulum, Tilt Mech.
5.	12-6231	Wire, Plum Bob
6.	4006-01113-06	MS, 6-32 x 3/8 PL-HEX-WHD

Associated Parts

7.	20-6502-A	Plum Bob
8.	4406-01120-00	Wing Nut (2)

Target Assemblies



A-14690-6
Standup Target (Yellow)
2 Used

A-14691-4
Standup Target (Red) 3 Used
A-14691-6
Standup Target (Yellow) 6 Used

A-15658-4
Oblong Standup Target (Red)
2 Used

A-16759
Stationary Target Assy.
1 Used

A-17078 U-Trough Assembly

Item	Part Number	Decription
1.	A-15605	Drop Tgt. Stop Bracket Assy.
2.	A-16566	Divertor Actuator Shaft Assy.
3.	A-17124	Divertor Plate
4.	A-17079	Trough Liner
5.	A-17268	Divertor Assembly
6.	A-17631	Divertor Shaft Staked Assembly
7.	01-10225	Coil Mounting Bracket
8.	01-11809	Thrust Cap
9.	01-11810	Thrust Cap
10.	02-4831	Shaft Divertor Actuator
11.	02-4898	Strike Pin
12.	03-8960	Plastic Trough
13.	03-9008	Trough Cover
14.	03-9009	Trough Cover
15.	01-11856	Trough Cover Bracket
16.	01-11908	Hanger Bracket
17.	01-11909	Hanger Bracket
18.	01-11910	Hanger Bracket
19.	01-11911	Hanger Bracket
20.	01-11912	Hanger Bracket
21.	H-17010-1	Big Trough Cable

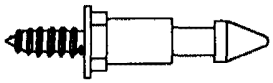
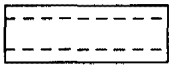
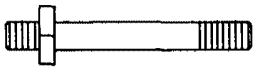
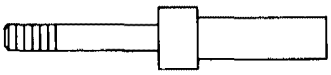
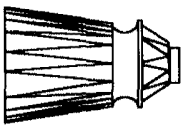
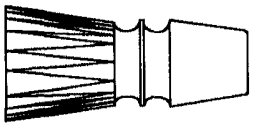
A-17220-L U-Gun Motor Bracket Assy.

Item	Part Number	Decription
1.	01-11799-L	Gun Motor Bracket, Left
2.	A-17562	Motor & Crank Assembly
3.	03-8620	Actuator, Bookcase
4.	4108-01031-14	Sh. Metal Screw, #8 x 7/8 P-TH
5.	4700-00023-00	Flatwasher, 13/64 x 5/8 x 16ga.
6.	5647-12693-08	Mini-Micro Switch
7.	5647-12693-58	Mini-Micro Switch
8.	4002-01105-07	Mach. Screw, 2-56 x 7/16 P-PH-S
9.	01-8240	Plate Nut #2-56
10.	5070-09054-00	Diode 1N4004, 1.0A.
11.	H-17068-1	Gun Cable
12.	A-17645-L	Drive Plate Assembly, Left

A-17220-R U-Gun Motor Bracket Assy.

Item	Part Number	Decription
1.	01-11799-R	Gun Motor Bracket, Right
2.	A-17562	Motor & Crank Assembly
3.	03-8620	Actuator, Bookcase
4.	4108-01031-14	Sh. Metal Screw, #8 x 7/8 P-TH
5.	4700-00070-00	Flatwasher, 3/16 x 5/8 x 16ga.
6.	5647-12693-08	Mini-Micro Switch
7.	5647-12693-58	Mini-Micro Switch
8.	4002-01105-07	Mach. Screw, 2-56 x 7/16 P-PH-S
9.	01-8240	Plate Nut #2-56
10.	5070-09054-00	Diode 1N4004, 1.0A.
11.	H-17068-1	Gun Cable
12.	A-17645-R	Drive Plate Assembly, Right

Metal & Plastic Posts

	Part Number	Description
	02-3905	Bumper Post #8 WS (1)
	02-4020	Support Post (2)
	02-4424-1	Post 6-32/8-32 2-1/32" (8)
	02-4659-1	Post #10 (16)
	02-4934	Ramp Post (1)
	03-8319-13 03-8319-9	Star Post #8 Star Post #8
	03-8130-13	Double Star Bumper Post, Clear (1)

STAR TREK Unique Parts List

Part Number	Description
A-12742-50023	WPC CPU Assembly
A-13204-50023	Bottom Arch Assembly
A-13769-50023	Playfield & Insert Assembly
A-16123-50023	Backbox Assembly
A-16387	Ball Popper Hsg. Welded Assy.
A-16421	Ball Popper Outer Hsg. Welded Assy.
A-16622	Ball Guide Assembly
A-16623	Ball Guide Assembly
A-16624	Ball Guide Assembly
A-16626	Upper Housing Assembly
A-16756	U-Plastic Ramp Assembly
A-16757	Catapult Assembly
A-16759	Standup Target Assembly
A-16763	Divertor Assembly
A-16773	Lever Guide Assembly
A-16811	U-Plastic Ramp Assembly
A-16852	Ball Guide Assembly
A-16853	Ball Guide Assembly
A-16854	Ball Guide Assembly
A-16865	Ball Guide Assembly
A-16917-50023	Sound Board Assembly
A-16920-1	6-Lamp Board & Spacer Assy.
A-16922-1	Prox Sensor II Assy. w/Spacer
A-16959	Switch Gate Assembly
A-17012-1	6-Lamp Board & Spacer Assy.
A-17013-1	5-Lamp Board & Spacer Assy.
A-17014-1	3-Lamp Board & Spacer Assy.
A-17015	U-Plastic Ramp Assembly
A-17022	Spin Target Assembly
A-17023	Wireform & Target Assembly
A-17049	Ball Popper Assembly
A-17049-1	Ball Popper Assembly
A-17054	Speaker/Display Panel Assy.
A-16054	Ind. & Eddy Sensor Cable Assy.
A-17078	U-Trough Assembly
A-17081-L	Gun Assembly - Left
A-17081-R	Gun Assembly - Right
A-17082-L	Driver Plate Assembly - Left
A-17082-R	Driver Plate Assembly - Right
A-17084	Bushing Assembly
A-17195	Tilt Switch Assy. w/Cable
A-17219	Borg Bracket Assembly
A-17220-L	U-Gun Motor Brkt. - Left
A-17220-R	U-Gun Motor Brkt. - Right
A-17221-1	Coin Door Interface & Spacer Assy.
A-17223	16-Opto Board & Brkt. Assembly
A-17234	Bottom Arch Kicker Assembly
A-17313-1	Flipper Return Frame Assy., Right
A-17313-2	Flipper Return Frame Assy., Left
A-17330	2-Lamp Board & Brkt. Assembly
A-17343	G.I. Cable & Socket Assembly
A-17356-1	26-Lamp Board & Spacer Assy.
A-17416	Standup Switch & Bracket Assy.
A-17418	Kicker Switch Assembly
A-17445-1	6-Ball Cashbox Assembly - Multiple
A-17483	Klingon Ship Assembly
A-17484	Romulan Ship Assembly
A-17489-1	50023-Playfield Plastic Assy.
A-17489-2	50023-Playfield Plastic Assy.
A-17489-3	50023-Playfield Plastic Assy.
A-17489-4	50023-Playfield Plastic Assy.
A-17489-5	50023-Playfield Plastic Assy.
A-17489-6	50023-Playfield Plastic Assy.
A-17509	U-Ball Guide & Opto Assembly
A-17510	U-Load Rp./Popper Hsg. Assy. - R.
A-17511	U-Load Rp./Popper Hsg. Assy. - L.
A-17512	U-Ball Guide & Opto Assembly
A-17615	Divertor Actuator Shaft Assy.
A-17628	Bracket - Support
A-17630	Divertor Shaft Staked Assy.
A-17631	Divertor Shaft Staked Assy.
A-17632	Plfd. Lamp Sub Cable Assy.
A-17652	Ball Guide
A-17657	Wood Back Panel Assembly
A-8552-50023	Backglass Assembly
C-10843-2	Metal Leg Assembly
01-11410	Ball Guide
01-11412	Ball Guide
01-11658	Ball Guide
01-11679	Bracket - Support
01-11700	Ball Guide - Bottom Arch Right
01-11701	Ball Guide - Bottom Arch Left
01-12215	Divertor
01-12227	Ball Deflector
02-4930	Divertor Shaft Rear
02-4931	Divertor Shaft (Pivot)
03-8985	Sensor retention Clip
03-9026	Gun Cover
12-7097	Wire Ramp, Left
12-7098	Wire Ramp, Right
12-7119	Wire Ramp Catapult
12-7162	Wire Ramp
12-7163	Wire Ramp
20-9663-16	Start Push Button w/Sw, Yellow
20-9663-17	Push Button w/Sw, Green
31-1808	Matrix Label Insert
36-50023	Playfield Hard Coat

STAR TREK Cable List

Part Number	Description
H-11835	Knocker Cable
H-13870	Black Jumper Cable
H-14584	Dot Matrix Display Cable
H-14790	A. C. Cable
H-14792-1	A.C. Jumper Cable
H-14792-2	A.C. Jumper Cable
H-15049	Trigger Cable
H-15476	Logic Power Cable
H-15736	Secondary Cable
H-16505	Extended Driver
H-16599	Coin Door Cable
H-16810	50 Volt Cable
H-16884	Speaker Panel Cable
H-17005-1	Cabinet Cable
H-17006	Insert Cable
H-17007-2	Plfd. Lamp Cable
H-17008-2	Plfd Solenoid Cable
H-17009	Plfd. Switch Cable
H-17010-1	Trough Cable
H-17011	Cabinet Switch-Lamp Cable
H-17019	Dixi-Mars Interface Cable

Part Number	Description
H-17063	Eddy Sensor Cable
H-17065	Ball Popper Cable
H-17066-1	Locker Cable
H-17067	Top Gun Cable
H-17068-1	Button Gun Cable
H-17193	Ramp Cable
H-17194	Left Ramp Cable
H-17196	Cabinet Tilt Cable
H-17197	Rt. Ramp Cable
H-17198	Spinner Cable
H-17216-1	Plfd. Opto Cable
H-17217	Plum Bob Mech. Cable
H-17237	Kickback Cable
H-17240	Borg Ship Cable
H-17282	Advance Sign Cable
H-17300	Opto LED Cable
H-17301	Opto Photo Transistor Cable
H-17342	Top Side G.I. Cable
H-17534	Plfd. Lamp Sub Cable
H-17573	G.I. Cable, Green

UPPER PLAYFIELD PARTS LOCATONS

Item	Part Number	Description
1	A-15849-R-2	Upper Right Flipper Assy.
1a)	20-9250-5	Flipper Paddle & Shaft
2	A-16757	Catapult Assembly
3	A-17313-1	Flipper Return Frame
4	A-17081-R	Right Gun Assembly
4a)	A-17220-R	Gun Motor Bracket w/Motor
4b)	A-17084	Bushing
5	12-7098	Right Wire Ramp
6	A-14691-6	Yellow Standup Target
7	12-7161	Right Loading Wire Ramp
8	A-17049-1	Ball Popper Complete
8a)	A-16510	Ball Popper Outer Housing
9	A-15849-R-2	Upper Right Flipper Assy.
10	12-7162	Catapult Wire Ramp
11	A-15658-4	Red Oblong Standup Target
12	12-7163	Crossover Wire Ramp
13	B-9414-3	Jet Bumper Assembly
13a)	B-12030-2	Jet Bumper Leaf Switch
13b)	A-9415-2	Jet Bumper Coil Assembly
13c)	03-8254-9	Jet Bumper Cap
14	A-17015	Plastic Ramp
14a)	01-11591	Ramp Flap
15	A-16626	Upper Housing Assembly
16	A-17485	Shuttle Craft Assembly
17	A-17219	Borg Bracket Assembly
17a)	A-17290	Borg Plateform Welded Assy.
17b)	03-8996	Borg Ship
18	A-14615	1-Bank Drop Target
19	A-16759	Black Standup Target
20	A-16763	Divertor Assembly
20a)	01-12215	Divertor
20b)	A-17630	Shaft
21	A-17484	Romulan Ship
22	A-17330	2-lamp PCB
23	A-14690-6	Yellow Standup Target
24	03-8994	Klingon Ship
24a)	12-7150	Klingon Ship Support Wire
25	A-16959	Switch Gate Assembly
26	A-16811	Plastic Ramp
26a)	01-11635	Flap
26b)	A-17272	2-lamp PCB
27	A-16756	Plastic Ramp
27a)	01-11819	Flap
28	A-17022	Spin Target
29	A-17049	Ball Popper Complete
29a)	A-16387	Ball Popper Outer Housing
30	A-17049-1	Ball Popper Complete
30a)	A-16421	Ball Popper Outer Housing
31	A-14691-4	Red Standup Targets
32	A-14691-6	Yellow Standup Targets
33	12-7097	Left Wire Ramp
34	12-7160	Left Loading Wire Ramp
35	A-17081-L	Left Gun Assembly
35a)	A-17220-L	Gun Motor Bracket w/ Motor
35b)	A-17084	Bushing

Item	Part Number	Description
36	A-17313-2	Flipper Return Frame Assembly
37	A-17234	Bottom Arch Kickback
38	A-15849-L-2	Left Flipper Assembly
39	B-9362-L-2	Left Kicker Coil & Bracket
39a)	B-12665	Nylon Kicker
40	B-9362-R-2	Right Kicker Coil & Bracket Assy
40a)	B-12665	Nylon Kicker
41	A-16959	Switch Gate Assembly

Parts Under Bottom Arch

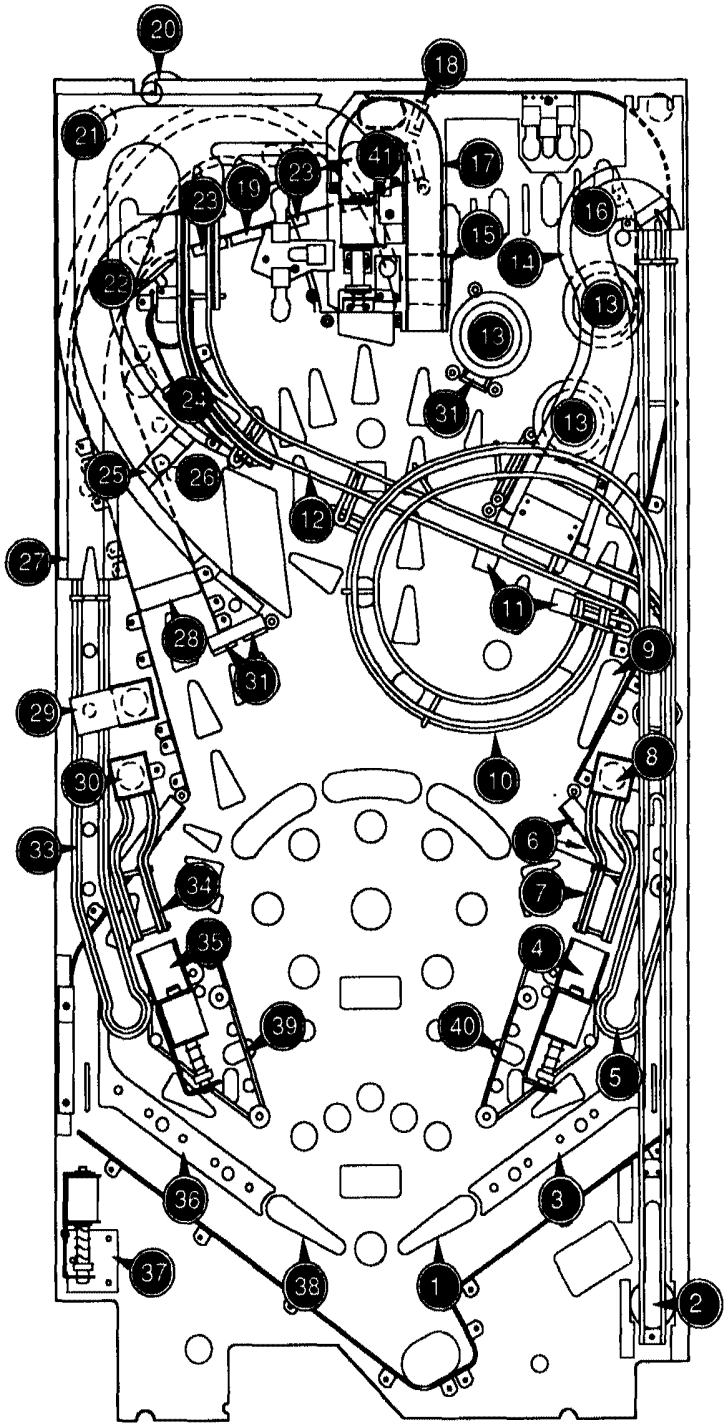
Part Number	Description
31-1008-50023	Screened Bottom Arch
12-7122	Wire Fence
20-9041	Tinnerman Speednut
20-9601	#8-32 Nut Retainer

Not Shown

Part Number	Description
A-16765	Ball Trough Assembly Complete
03-8962-1	*Full Playfield Mylar
16-50023-1	Instruction Card
20-6500	Steel Ball

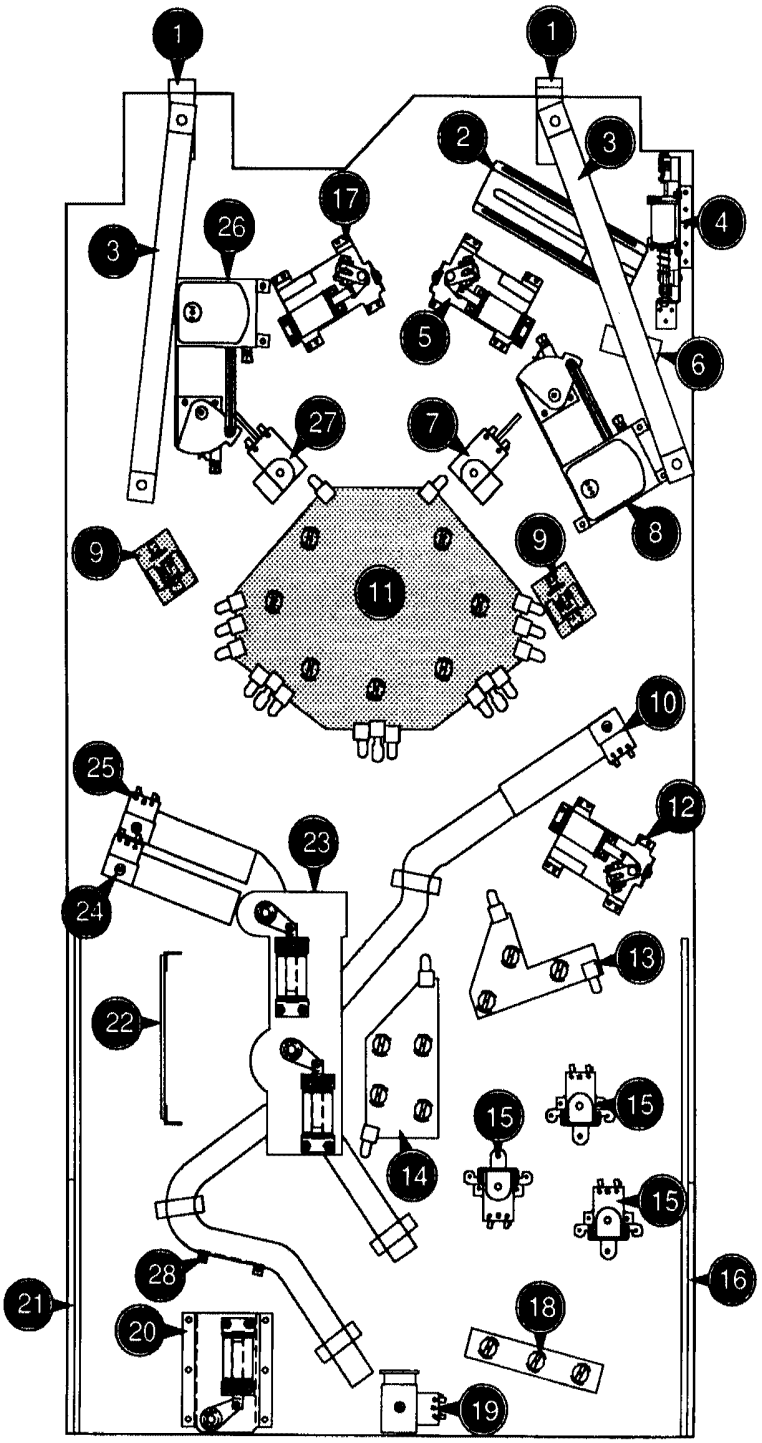
***The *STAR TREK* hardcoat playfield does not require a full mylar. However Mylars can be purchased through your local Williams Distributor.**

UPPER PLAYFIELD PARTS LOCATONS



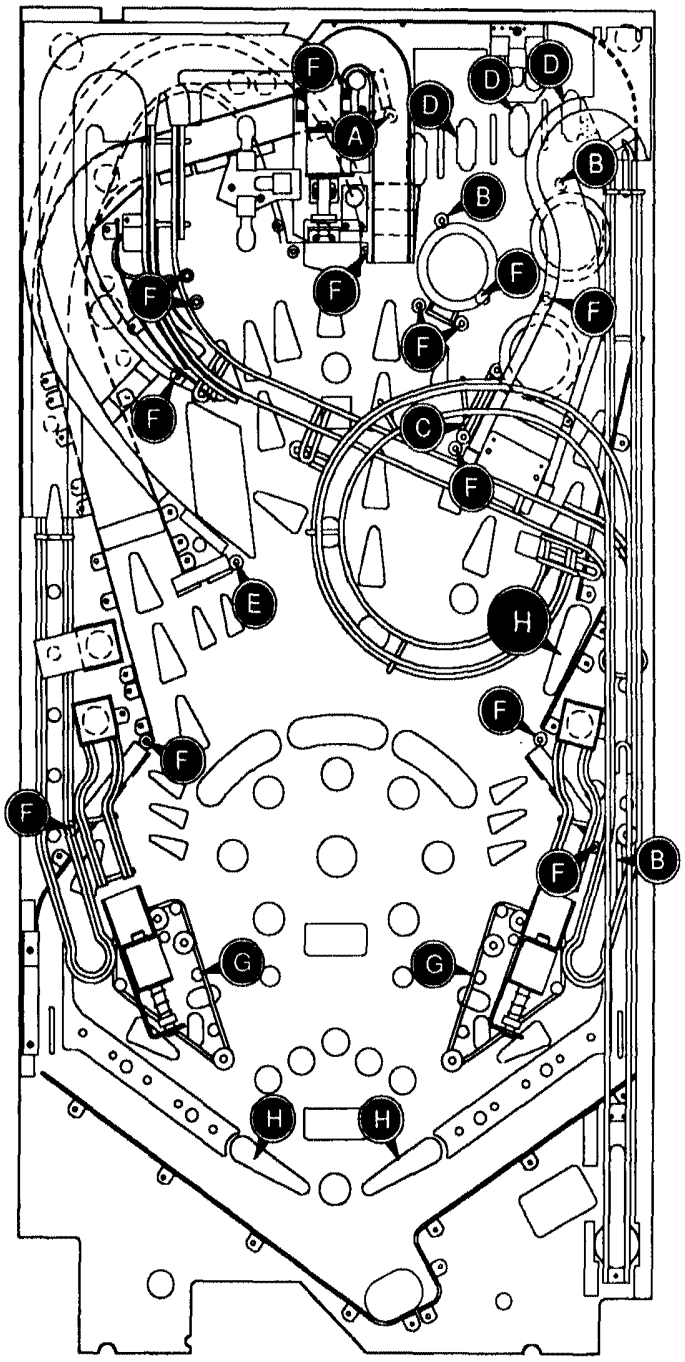
LOWER PLAYFIELD PARTS LOCATIONS

Item	Part Number	Description
1.	01-9211	Plfd. Hanger Bracket (2 Used)
2.	A-16765	Outhole Ball Trough Assembly
3.	A-17558	Leg Support (2 Used)
4.	A-16757	Catapult Assembly
5.	A-15849-R-2	Flipper Assembly, Lwr. Right
6.	A-16922	Prox Sensor II Assembly
7.	B-12665	Kicker Arm (Slingshot) Assy., Right
	B-9362-R-3	Coil & Bracket Assembly
	10-128	Spring
8.	A-17220-R	U-Gun Motor Bracket, Right
9.	A-15542	Motor EMI (2 Used)
10.	A-17049-1	Ball Popper Assembly
11.	A-17356	26-Lamp Board Assembly
12.	A-15849-R-2	Flipper Assembly, Upper Right
13.	A-17013	5-Lamp Board Assembly
14.	A-17012	6-Lamp Board Assembly
15.	A-9415-2	Jet Bumper Coil Assembly
16.	A-16637-2	Plfd. Slide Mechanism, Right
17.	A-15849-L-2	Flipper Assembly, Lwr. Left
18.	A-17014	3-Lamp Board Assembly
19.	A-14615	1-Bank Drop Target Assy.
20.	A-16763	Divertor Assembly
21.	A-16637-1	Plfd. Slide Mechanism, Left
22.	A-16998	16-Opto Board Assembly
23.	A-17078	U-Trough Assembly
24.	A-17049	Ball Popper Assembly
25.	A-17049-1	Ball Popper Assembly
26.	A-17220-L	U-Gun Motor Bracket, Left
27.	B-12665	Kicker Arm (Slingshot) Assy., Left
	B-9362-L-2	Coil & Bracket Assembly
	10-128	Spring
28.	01-11860	Shield Bracket



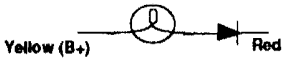
RUBBER PARTS LOCATONS

Item	Part No.	Qty	Description
A	23-6694-5	1	Black Rubber Ring 3/4"
B	23-6694-6	3	Black Rubber RIng 1"
C	23-6694-7	2	Black Rubber Ring 1-1/4"
D	23-6641	5	Black Rubber Ring
E	23-6552	1	Yellow Rubber Bumper Sleeve
F	23-6556	15	Black Rubber Bumper Sleeve
G	23-6694-13	2	Black Rubber Ring 4"
H	23-6695	3	Black Flipper Rubber Rings



LAMP MATRIX

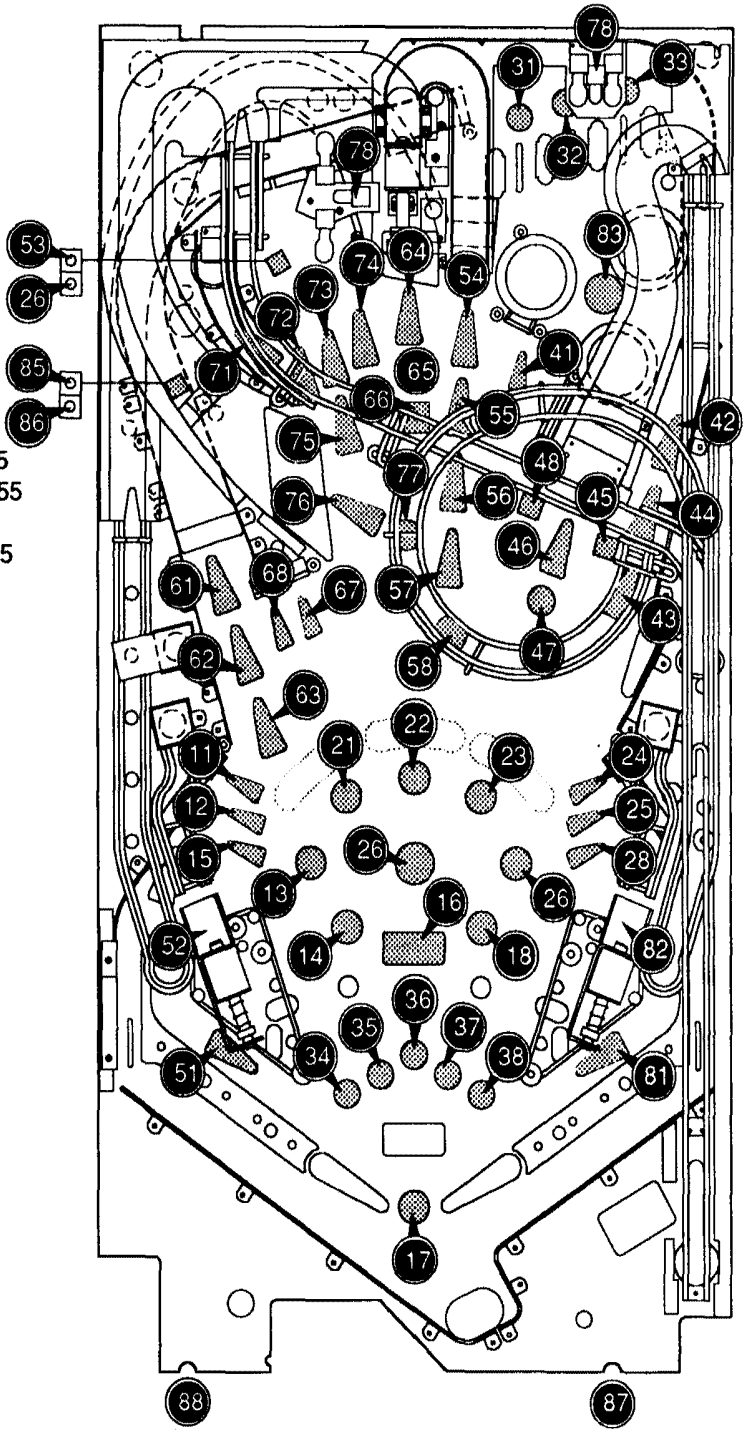
LAMPS



Column / Row	1 Yellow-Brown J137-1 Q98	2 Yellow-Red J137-2 Q97	3 Yellow-Orange J137-3 Q96	4 Yellow-Black J137-4 Q95	5 Yellow-Green J137-5 Q94	6 Yellow-Blue J137-6 Q93	7 Yellow-Violet J137-7 Q92	8 Yellow-Gray J137-9 Q91
Red-Brown J133-1 Q90 1	Left Bank Top 11	Ship Mode 3 21	Top Lane Left 31	Q 41	Left Return Lane 51	Generic 3 61	Generic 2 71	Right Return Lanes 81
Red-Black J133-2 Q89 2	Left Bank Middle 12	Ship Mode 4 22	Top Lane Center 32	Generic 1 42	Left Launcher 52	Increase Warp 62	Top 3 -bank Left 72	Right Launcher 82
Red-Orange J133-4 Q88 3	Ship Mode 1 13	Ship Mode 5 23	Top Lane Right 33	Right Lock 43	Advance in Rank 53	Spinner 63	Top 3-bank Center 73	Million Jets 83
Red-Yellow J133-5 Q87 4	Ship Mode 2 14	Right Bank Top 24	Bonus 2X 34	Holodeck 44	Generic 6 54	Generic 7 64	Top 3-bank Right 74	Kickback 84
Red-Green J133-6 Q86 5	Left Bank Bottom 15	Right Bank Middle 25	Bonus 4X 35	Right 2x Shuttle 45	Super 55	Left Millions 65	Left Lock 75	Borg Lock 85
Red-Blue J133-7 Q85 6	Final Frontier 16	Command Decision 26	Multipliers Held 36	Generic 4 46	Jackpot 56	Jackpot X 66	Generic 5 76	Borg Jackpot 86
Red-Violet J133-8 Q84 7	Shoot Again 17	Ship Mode 6 27	Bonus 8X 37	Right Millions 47	Extra Ball 57	Rift 67	Worm Hole 77	Buy-in 87
Red-Gray J133-9 Q83 8	Ship Mode 7 18	Right Bank Bottom 28	Bonus 10X 38	Left 2X Shuttle 48	Start Mission 58	Time 68	Borg Ship 78	Start Button 88

LAMPS LOCATIONS

Item	Bulb No.	Lamp Assy No.	Description
11	24-8768	A-17356	Left Bank Top #555
12	24-8768	A-17356	Left Bank Middle #555
13	24-8768	A-17356	Ship Mode 1 #555
14	24-8768	A-17356	Ship Mode 2 #555
15	24-8768	A-17356	Left Bank Bottom #555
16	24-8768	A-17356	Final Frontier #555
17	24-6549	A-11754	Shoot Again #44
18	24-8768	A-17356	Ship Mode 7 #555
21	24-8768	A-17356	Ship Mode 3 #555
22	24-8768	A-17356	Ship Mode 4 #555
23	24-8768	A-17356	Ship Mode 5 #555
24	24-8768	A-17356	Right Bank Top #555
25	24-8768	A-17356	Right Bank Middle #555
26	24-8768	A-17356	Command Decision #555
27	24-8768	A-17356	Ship Mode 6 #555
28	24-8768	A-17356	Right Bank Bottom #555
31	24-8768	A-17014	Top Lane Left #555
32	24-8768	A-17014	Top Lane Center #555
33	24-8768	A-17014	Top Lane Right #555
34	24-8768	A-16920	Bonus 2X #555
35	24-8768	A-16920	Bonus 4X #555
36	24-8768	A-16920	Multipliers Held #555
37	24-8768	A-16920	Bonus 8X #555
38	24-8768	A-16920	Bonus 10X #555
41	24-6549	A-11905	Q #44
42	24-6549	A-11905	Generic 1 #44
43	24-6549	A-11754	Right Lock #44
44	24-8768	A-17013	Holodeck #555
45	24-8768	A-17013	Right 2X Shuttle #555
46	24-8768	A-17013	Generic 4 #555
47	24-8768	A-17013	Right Millions #555
48	24-8768	A-17013	Left 2X Shuttle #555
51	24-6549	A-11754	Left Return Lane #44
52	24-8768	A-12887	Left Launcher #555
53	24-8768	A-17330	Advance in Rank #555
54	24-8768	A-17012	Generic 6 #555
55	24-8768	A-17012	Super #555
56	24-8768	A-17012	Jackpot #555
57	24-6549	A-11905	Extra Ball #44
58	24-6549	A-11905	Start Mission #44
61	24-6549	A-11905	Generic 3 #44
62	24-6549	A-11905	Increase Warp #44
63	24-6549	A-11905	Spinner #44
64	24-8768	A-17012	Generic 7 #555
65	24-8768	A-17012	Left Millions #555
66	24-8768	A-17012	Jackpot X #555
67	24-6549	A-11905	Rift #44
68	24-6549	A-11905	Time #44
71	24-6549	A-11905	Generic 2 #44
72	24-6549	A-11905	Top 3-bank Left #44
73	24-6549	A-11905	Top 3-bank Center #44
74	24-6549	A-11905	Top 3-bank Right #44
75	24-6549	A-11905	Left Lock #44
76	24-6549	A-11905	Generic 5 #44
77	24-6549	A-11905	Worm Hole #44
78	24-8768	A-17158	Borg Ship #555



Item	Bulb No.	Lamp Assy No.	Description
81	24-6549	A-11754	Right Return Lane#44
82	24-8768	A-12887	Right Launcher #555
83	24-6549	A-11754	Millions Jets #44
84	24-6549	A-11905	Kickback #44
85	24-8768	A-17272	Borg Lock #555
86	24-8768	A-11905	Borg Jackpot #555
87		20-9663-17	Buy-in
88		20-9663-16	Start Button

SWITCH MATRIX

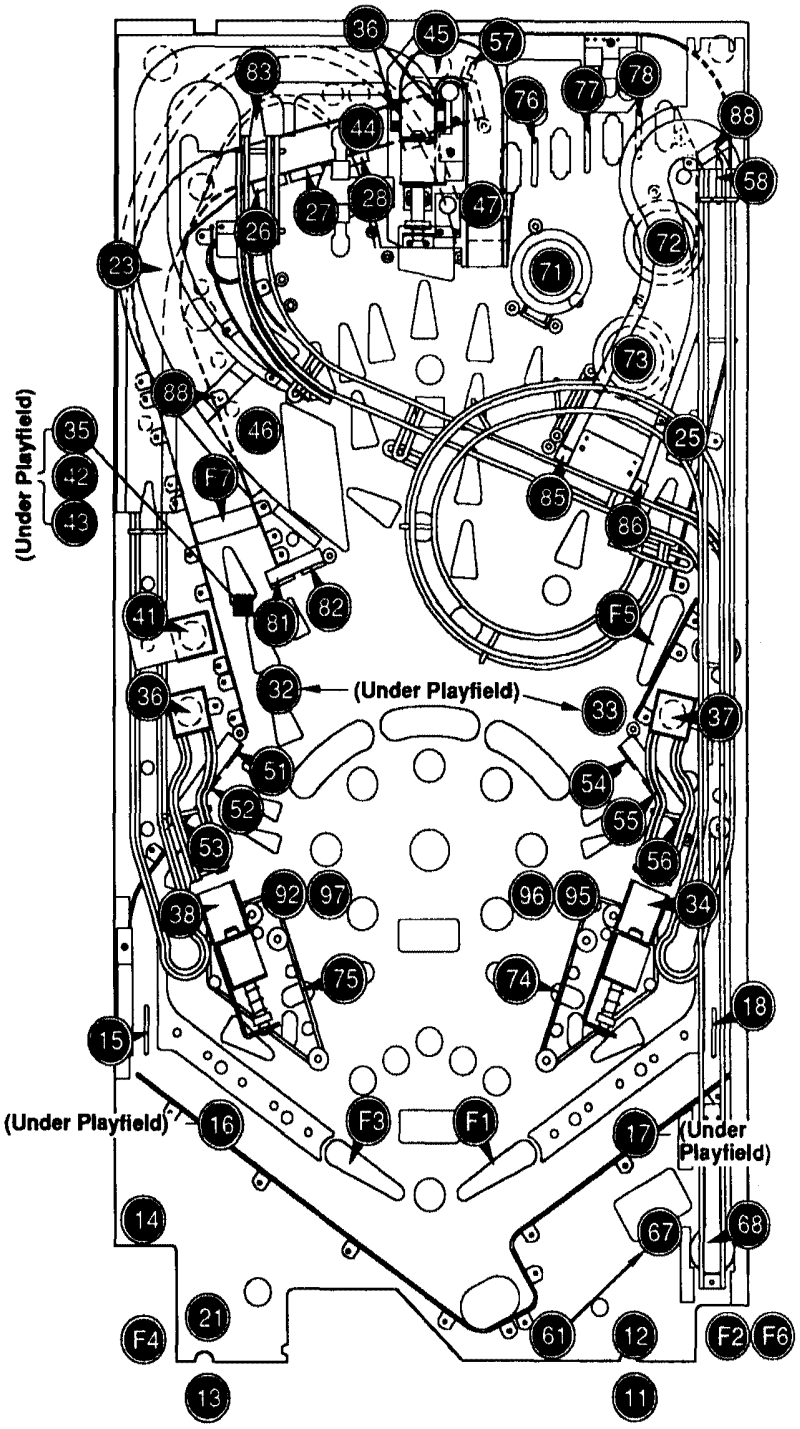
Green ——o——\——o——◄—— White

Dedicated Grounded Switches	Row \ Column	1 Green-Brown J207-1 U20-18	2 Green-Red J207-2 U20-17	3 Green-Orange J207-3 U20-16	4 Green-Yellow J207-4 U20-15	5 Green-Black J207-5 U20-14	6 Green-Blue J207-6 U20-13	7 Green-Violet J207-7 U20-12	8 Green-Gray J207-9 U20-11	9 Violet-White Q11 J5-1	Flipper Grounded Switches
Orange-Brown J205-1 Left Coin Chute D1	1 White-Brown J209-1 U18-11	Buy-in Button 11	Slam Tilt 21	Borg Lock 31	Under L. Lock Sw. 1 41	L. Bank Top 51	Trough L.R 1 61	Left Jet 71	Time 81	Not Used 91	Black-Green J906-1 Lower Right E.O.S. F1
Orange-Red J205-2 Center Coin Chute D2	2 White-Red J209-2 U18-9	Right Fire Button 12	Coin Door Closed 22	Under L. Gun Sw. 2 32	Under L. Lock Sw. 3 42	L. Bank Middle 52	Trough L.R 2 62	Right Jet 72	Rift 82	Left Gun Mark 92	Blue-Violet J905-1 Lower Right Opto F2
Orange-Black J205-3 Right Coin Chute D3	3 White-Orange J209-3 U18-5	Start Button 13	Made Middle Ramp 23	Under R. Gun Sw. 2 33	Under L. Lock Sw. 4 43	L. Bank Bottom 53	Trough L.R 3 63	Bottom Jet 73	Made Left Ramp 83	Not Used 93	Black-Blue J906-3 Lower Left E.O.S. F3
Orange-Yellow J205-4 4th Coin Chute D4	4 White-Yellow J209-4 U18-7	Plumb Bob Tilt 14	Always Closed 24	Right Gun Shooter 34	Left Outer Loop 44	R. Bank Top 54	Trough L.R 4 64	Right Sling 74	Q 84	Not Used 94	Blue-Gray J905-2 Lower Left Opto F4
Orange-Green J205-6 Normal Function / Service Credits / Test Function / Escape D5	5 White-Green J209-5 U19-11	Left Outlane 15	Enter Right Ramp 25	Under L. Lock Sw. 2 35	Under Top Hole 45	R. Bank Middle 55	Trough L.R 5 65	Left Sling 75	Left 2X Shuttle 85	Right Gun Home 95	Black-Violet J906-4 Upper Right E.O.S. F5
Orange-Blue J205-7 Normal Function / Volume Down / Test Function / Down D6	6 White-Blue J209-7 U19-9	Left Return Lane 16	Left 45° Target 26	Under L. Gun Sw. 1 36	Under Left Hole 46	R. Bank Bottom 56	Trough L.R 6 66	Top Lane Left 76	Right 2X Shuttle 86	Right Gun Mark 96	Black-Yellow J905-3 Upper Right Opto F6
Orange-Violet J205-8 Normal Function / Volume Up / Test Function / Up D7	7 White-Violet J209-8 U19-5	Right Return Lane 17	Center 45° Target 27	Under R. Gun Sw. 1 37	Under Borg Hole 47	Top Drop Target 57	Trough Up 67	Top Lane Center 77	Made Right Ramp 87	Left Gun Home 97	Black-Gray J906-5 Spinner* F7
Orange-Gray J205-9 Normal Function / Begin Test / Test Function / Enter D8	8 White-Gray J209-9 U19-7	Right Outlane 18	Right 45° Target 28	Left Gun Shooter 38	Borg Entry 48	Right Outer Loop 58	Shooter 68	Top Lane Right 78	Enter Left Ramp 88	Not Used 98	Black-Blue J905-5 Not Used F8

***Note:** Used as switches other than flipper switches in this game. ▒▒ = Opto Switch

SWITCH LOCATIONS

Item	Switch No.	Where Used
F1	SW-1A-194	Lwr Rt. Flipper EOS
F2	A-17316	Lwr Rt. Flipper Cab.
F3	SW-1A-194	Lwr Lt. Flipper EOS
F4	A-17316	Lwr Lt. Flipper Cab.
F5	SW-1A-194	Upper Right Flipper EOS
F6	A-17316	Upper Right Flipper Cab.
F7	5647-12693-11	Spinner
F8		Not Used
11	20-9663-17	Buy-in
12	5647-12693-03	Right Fire Button
13	20-9663-16	Start Button
14	20-6502-A	Plumb Bob Tilt
15	A-12688	Left Outlane
16	A-17064	Left Return Lane
17	A-17064	Right Return Lane
18	A-12688	Right Outlane
21	A-17238	Slam Tilt
22	5643-09268-00	Coin Door Closed
23	5647-12693-21	Made Middle Ramp
24	5643-09112-00	Always Closed
25	5647-12693-11	Enter Right Ramp
26	A-14690-6	Left 45° Target
27	A-16759	Center 45° Target
28	A-14690-6	Right 45° Target
31	A-16908 (LED) A-16909 (Transistor)	Borg Lock
32	A-16908 (LED) A-16909 (Transistor)	Under Left Gun Sw. 2
33	A-16908 (LED) A-16909 (Transistor)	Under Right Gun Sw. 2
34	A-16908 (LED) A-16909 (Transistor)	Right Gun Shooter
35	A-16908 (LED) A-16909 (Transistor)	Under Left Lock Sw. 2
36	A-16908 (LED) A-16909 (Transistor)	Under Left Gun Sw. 1
37	A-16908 (LED) A-16909 (Transistor)	Under Right Gun Sw. 1
38	A-16908 (LED) A-16909 (Transistor)	Left Gun Shooter
41	A-16908 (LED) A-16909 (Transistor)	Under Left Lock Sw. 1
42	A-16908 (LED) A-16909 (Transistor)	Under Left Lock Sw. 3
43	A-16908 (LED) A-16909 (Transistor)	Under Left Lock Sw. 4
44	A-16908 (LED) A-16909 (Transistor)	Left Outer Loop
45	A-16908 (LED) A-16909 (Transistor)	Under Top Hole
46	A-16908 (LED) A-16909 (Transistor)	Under Left Hole
47	A-16908 (LED) A-16909 (Transistor)	Under Borg Hole
48	A-16908 (LED) A-16909 (Transistor)	Borg Entry
51	A-14691-6	Left Bank Top
52	A-14691-6	Left Bank Middle
53	A-14691-6	Left Bank Bottom
54	A-14691-6	Right Bank Top
55	A-14691-6	Right Bank Middle
56	A-14691-6	Right Bank Bottom
57	5647-12693-31	Top Drop Target
58	A-12688-1	Right Outer Loop
61	A-16927 (LED) A-16926 (Transistor)	Trough L.R. 1
62	A-16927 (LED) A-16926 (Transistor)	Trough L.R. 2
63	A-16927 (LED) A-16926 (Transistor)	Trough L.R. 3
64	A-16927 (LED) A-16926 (Transistor)	Trough L.R. 4
65	A-16927 (LED) A-16926 (Transistor)	Trough L.R. 5
66	A-16927 (LED) A-16926 (Transistor)	Trough L.R. 6
67	A-16927 (LED) A-16926 (Transistor)	Trough Up
68	5467-12133-12	Shooter
71	A-12030-2	Left Jet
72	A-12030-2	Right Jet
73	A-12030-2	Bottom Jet
74	A-17418	Right Sling
75	A-17418	Left Sling
76	A-12688-1	Top Lane Left
77	A-12688-1	Top Lane Center
78	A-12688-1	Top Lane Right
81	A-14691-4	Time



Item	Switch No.	Where Used
82	A-14691-4	Rift
83	5647-12693-21	Made Left Ramp
84	A-14691-4	Q
85	A-15658-4	Left 2X Shuttle
86	A-15658-4	Right 2X Shuttle
87	5647-12693-11	Made Right Ramp
88	5647-12693-11	Enter Left Ramp
91		Not Used
92	5647-12693-58	Left Gun Mark
93		Not Used
94		Not Used
95	5647-12693-08	Right Gun Home
96	5647-12693-58	Right Gun Mark
97	5647-12693-08	Left Gun Home
98		Not Used

† Not Shown
* The Score slingshot switches have diodes across them.

SOLENOID / FLASHER TABLE

Sol. No.	Function	Solenoid Type	Voltage Connections			Drive xister	Drive Connections			Drive Wire Color	Solenoid Part Number Flashlamp Type	
			Playfield	Backbox	Cabinet		Playfield	Backbox	Cabinet		Playfield	Backbox
01	Left Gun Kicker	High Power	J107-3			Q82	J130-1			Vio-Brn	AE-23-800	
02	Right Gun Kicker	High Power	J107-3			Q80	J130-2			Vio-Red	AE-23-800	
03	Left Gun Popper	High Power	J107-3			Q78	J130-4			Vio-Org	AE-23-800	
04	Right Gun Popper	High Power	J107-3			Q76	J130-5			Vio-Yel	AE-23-800	
05	Left Popper	High Power	J107-3			Q64	J130-6			Vio-Grn	AE-23-800	
06	Plunger	High Power	J107-3			Q66	J130-7			Vio-Blu	AE-23-800	
07	Knocker	High Power		J107-3		Q68		J130-8		Vio-Blk		AE-23-800
08	Kickback	High Power	J107-3			Q70	J130-9			Vio-Gry	AE-23-800	
09	Left Slingshot	Low Power	J107-2			Q58	J127-1			Brn-Blk	AE-26-1200	
10	Right Slingshot	Low Power	J107-2			Q56	J127-3			Brn-Red	AE-26-1200	
11	Trough	Low Power	J107-2			Q54	J127-4			Brn-Org	AE-26-1500	
12	Left Jet Bumper	Low Power	J107-2			Q52	J127-5			Brn-Yel	AE-26-1200	
13	Right Jet Bumper	Low Power	J107-2			Q50	J127-6			Brn-Grn	AE-26-1200	
14	Bottom Jet Bumper	Low Power	J107-2			Q48	J127-7			Brn-Blu	AE-26-1200	
15	Top Divertor	Low Power	J107-2			Q46	J127-8			Brn-Vio	AE-25-1000	
16	Borg Kicker	Low Power	J107-2			Q44	J127-9			Brn-Gry	AL-23-800	
17	Left Gun Motor	Low Power	J118-2			Q42	J126-1			Blk-Brn	A-17562	
18	Right Gun Motor	Low Power	J118-2			Q40	J126-2			Blk-Red	A-17562	
19	Not Used					Q38				Blk-Org		
20	Jets Flasher	Flasher	J107-6			Q36	J126-4			Blk-Yel	#89 (1)	
21	Right Popper Flasher	Flasher	J107-6	J106-5		Q28	J126-5	J125-6		Blu-Grn	#89 (1)	#906 (1)
22	Middle Ramp Flasher	Flasher	J107-6			Q30	J126-6			Blu-Blk	#89 (2)	
23	Shields Flasher	Flasher	J107-6	J106-5		Q34	J126-7	J125-8		Blu-Vio	#906 (3)	#906 (1)
24	Autofire Flasher	Flasher	J107-6			Q32	J126-8			Blu-Gry	#906 (1)	
25	Exit Un. Gnd. Flasher	Gen. Purpose	J107-6	J106-5		Q26	J122-1	J124-1		Blu-Brn	#89 (1)	#906 (1)
26	Right Borg Flasher	Gen. Purpose	J107-6	J106-5		Q24	J122-2	J124-2		Blu-Red	#906 (2)	#906 (1)
27	Left Borg Flasher	Gen. Purpose	J107-6	J106-5		Q22	J122-3	J124-3		Blu-Org	#906 (2)	#906 (1)
28	Center Borg Flasher	Gen. Purpose	J107-6	J106-5		Q20	J122-4	J124-5		Blu-Yel	#906 (2)	#906 (1)
29-36	*See Flipper Circuits*											
37*	Under Divertor Top	Low Power	J107-1			Q16	J4-2			Brn-Wht	AE-25-1000	
38*	Under Divertor Bot.	Low Power	J107-1			Q15	J4-4			Blk-Wht	AE-25-1000	
39*	Top Drop Up	Low Power	J107-1			Q14	J4-5			Org-Wht	AE-26-1200	
40*	Top Drop Down	Low Power	J107-1			Q13	J4-6			Yel-Wht	SM1-26-600	
41*	Romulan Flashers	Low Power	J107-6	J106-5		Q9	J3-2	J3-2		Grn-Wht	#906 (1)	#906 (1)
42*	Right Ramp Flashers	Low Power	J107-6	J106-5		Q10	J3-3	J3-3		Blu-Wht	#89 (1)	#906 (1)

***Note: Controlled from the 8-Driver Board, not the Power Driver Board**

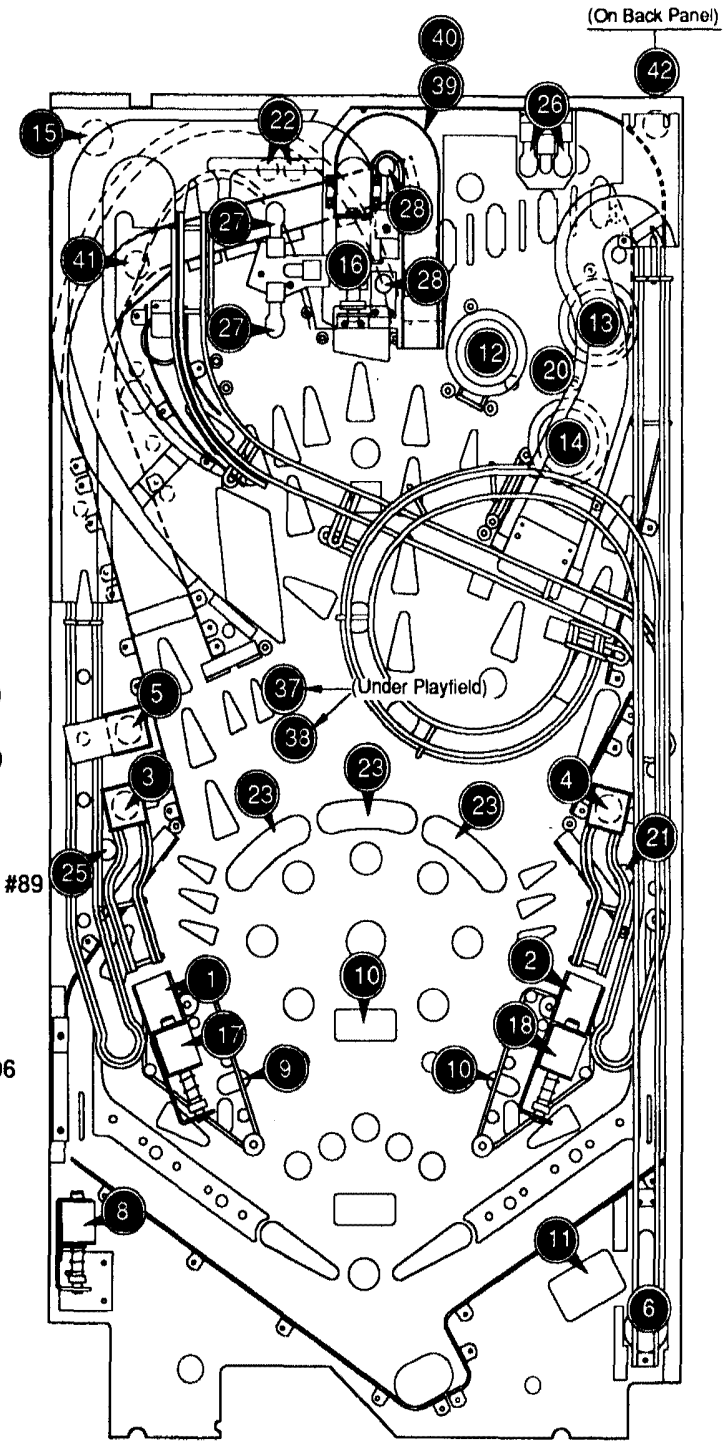
	General Illumination											
01	Shields G.I.	G.I.	J121-1			Q18	J121-7			Wht-Brn	#44	
02	Insert G.I.	G.I.		J120-2		Q10		J120-8		Wht-Org		#555
03	Insert G.I	G.I.		J120-3		Q14		J120-9		Wht-Yel		#555
04	Playfield G.I.	G.I.	J121-5			Q16	J121-10			Wht-Grn	#44	
05	Return Lane/Coin	G.I.	J121-6		J119-3	Q12	J121-11		J119-1	Wht-Vio	#44	

	Flipper Circuits		Voltage Connections Playfield	Drive Transistors Power	Drive Transistors Hold	Drive Connections Playfield	Drive Wire Colors Power	Drive Wire Colors Hold	Coil Part Number	Coil Colors
(29)	Lower Right Flipper	Lwr. Rt. Power	J907-7 (Blu-Yel)	Q4		J902-13	Blu-Vio		FL-11629	Blue
(30)		Lwr. Rt. Hold	J907-7 (Blu-Yel)		Q11	J902-11		Org-Grn		
(31)	Lower Left Flipper	Lwr. Lt. Power	J907-9 (Gry-Yel)	Q3		J902-9	Blu-Gry		FL-11629	Blue
(32)		Lwr. Lt. Hold	J907-9 (Gry-Yel)		Q9	J902-7		Org-Blu		
(33)	Upper Right Flipper	Up Rt. Power	J907-1 (Blu-Yel)	Q2		J902-6	Blk-Yel		FL-11629	Blue
(34)		Up Rt. Hold	J907-1 (Blu-Yel)		Q7	J902-4		Org-Vio		
35	Not Used	Up Lt. Power	J907-4 (Gry-Yel)	Q1		J902-3	Blk-Blu		Not Used	Not Used
36	Not Used	Up Lt. Hold	J907-4 (Gry-Yel)		Q5	J902-1		Org-Gry		

J4-1 = Tieback Diode
J1XX-X = Power Driver Board, JX-X = 8-driver Board, J9XX-X = Fliptronic II Board

SOLENOID / FLASHER LOCATION

Item	Coil/Flasher No.	Assy No.	Description
01	AE-23-800	A-17081-L	Left Gun Kicker
02	AE-23-800	A-17081-R	Right Gun Kicker
03	AE-23-800	A-17049-1	Left Gun Popper
04	AE-23-800	A-17049-1	Right Gun Popper
05	AE-23-800	A-17049	Left Popper
06	AE-23-800	A-16757	Plunger
07	AE-23-800	B-10686-1	Knocker
08	AE-23-800	A-17234	Kickback
09	AE-26-1200	B-9362-L-2	Left Slingshot
10	AE-23-1200	B-9362-R-2	Right Slingshot
11	AE-26-1500	A-16765	Trough
12	AE-26-1200	A-9415-2	Left Jet Bumper
13	AE-26-1200	A-9415-2	Right Jet Bumper
14	AE-26-1200	A-9415-2	Bottom Jet Bumper
15	AE-25-1000	A-16763	Top Divertor
16	AL-23-800	A-17219	Borg Kicker
17	A-17562	A-17220-L	Left Gun Motor
18	A-17562	A-17220-R	Right Gun Motor
19	Not Used		Not Used
20	24-8704	A-9302	Jets Flasher #89
21	24-8704	A-8798	Right Popper Flasher #89
	24-8802	-----	Backbox #906
22	24-8704	A-8798	Middle Ramp Flasher #89
23	24-8802	-----	Shield Flashers #906
	24-8802	-----	Backbox #906
24	24-8802	A-8798	Autofire Flasher #906
25	24-8704	-----	Exit Under Gnd. Flashers #89
	24-8802	-----	Backbox #906
26	24-8802	-----	Right Borg Flashers #906
	24-8802	-----	Backbox #906
27	24-8802	-----	Left Borg Flashers #906
	24-8802	-----	Backbox #906
28	24-8802	-----	Center Borg Flashers #906
	24-8802	-----	Backbox #906
29 to 36 see Flipper Circuits			
37	AE-25-1000	A-17124	Under Divertor Top
38	AE-25-1000	A-17124	Under Divertor Bottom
39	AE-26-1200	A-14615	Top Drop Up
40	SM1-26-600	A-14615	Top Drop Down
41	24-8802	C-13337	Romulan Flashers #906
	24-8802	-----	Backbox #906
42	24-8704	-----	Right Ramp Flashers #89
	24-8802	-----	Backbox #906



General Illumination

01	24-6549	-----	*Shields G.I. #44
02	24-8768	-----	*Insert G.I. #555
03	24-8768	-----	*Insert G.I. #555
04	24-6549	-----	*Playfield G.I. #44
05	24-6549	-----	*Return Lane/Coin #44

Flippers

29-30	FL-11629	A-15205-R-2	*Lower Right Flipper
31-32	FL-11629	A-15205-L-2	*Lower Left Flipper
33-34	FL-11629	A-15205-R-2	*Upper Right Flipper
35	Not Used		
36	Not Used		

* Not Shown

Notes

SECTION 3

Schematics, Wiring Diagrams, and Circuit Theory

CONNECTOR & COMPONENT IDENTIFICATION

Each plug or jack -except the Audio Board and Dot Matrix Display/Driver Board - receives a number that identifies the circuit board and position on that board that it connects to. J-designations refer to the male part of a connector. P-designations refer to the female part of a connector. For example, J101 designates jack 1 of board 1 (a Power Driver Board Board jack); P206 designates plug 6 of board 2 (a CPU Board plug). Identifying the specific pin number of a connector involves a hyphen, which separates the pin number from the plug or jack designation. For example, J101-3 refers to pin 3 of jack 1 on board 1.

Other game components may also have similar numbers to clarify their locations or related circuits. For example, F501 refers to a fuse located on the Audio Board.

Prefix numbers for the WPC circuit boards are listed below.

1- Power Driver Board
2- CPU Board
6- Dot Matrix Controller
9-Fliptronic II Controller Board

Audio Board and Dot Matrix Display/Driver Board do not have an identification number.

Schematics for standard WPC backbox boards are found in the WPC Schematics Manual. Playfield, cabinet and all other backbox board schematics are found in this section.

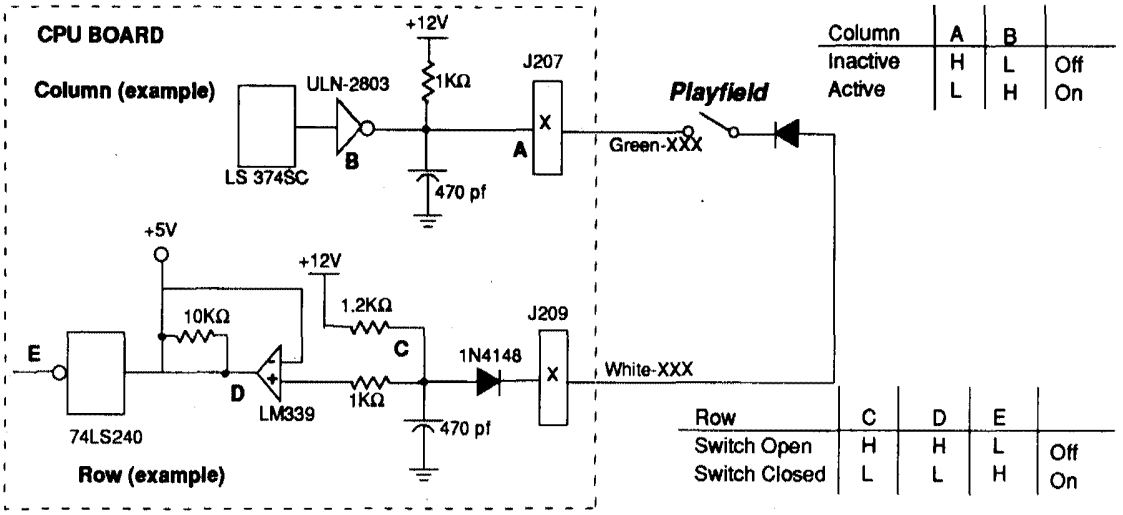
SWITCHES

Green — White

Dedicated Grounded Switches	Column / Row	1 Green-Brown J207-1 U20-18	2 Green-Red J207-2 U20-17	3 Green-Orange J207-3 U20-16	4 Green-Yellow J207-4 U20-15	5 Green-Black J207-5 U20-14	6 Green-Blue J207-6 U20-13	7 Green-Violet J207-7 U20-12	8 Green-Gray J207-9 U20-11	9 Violet-White Q11 J5-1	Flipper Grounded Switches
Orange-Brown J205-1 Left Coin Chute D1	1 White-Brown J209-1 U18-11	Buy-in Button 11	Slam Tilt 21	Borg Lock 31	Under L. Lock Sw. 1 41	L. Bank Top 51	Trough L.R. 1 61	Left Jet 71	Time 81	Not Used 91	Black-Green J906-1 Lower Right E.O.S. F1
Orange-Red J205-2 Center Coin Chute D2	2 White-Red J209-2 U18-9	Right Fire Button 12	Coin Door Closed 22	Under L. Gun Sw. 2 32	Under L. Lock Sw. 3 42	L. Bank Middle 52	Trough L.R. 2 62	Right Jet 72	Rift 82	Left Gun Mark 92	Blue-Violet J905-1 Lower Right Opto F2
Orange-Black J205-3 Right Coin Chute D3	3 White-Orange J209-3 U18-5	Start Button 13	Made Middle Ramp 23	Under R. Gun Sw. 2 33	Under L. Lock Sw. 4 43	L. Bank Bottom 53	Trough L.R. 3 63	Bottom Jet 73	Made Left Ramp 83	Not Used 93	Black-Blue J906-3 Lower Left E.O.S. F3
Orange-Yellow J205-4 4th Coin Chute D4	4 White-Yellow J209-4 U18-7	Plumb Bob Tilt 14	Always Closed 24	Right Gun Shooter 34	Left Outer Loop 44	R. Bank Top 54	Trough L.R. 4 64	Right Sling 74	Q 84	Not Used 94	Blue-Gray J905-2 Lower Left Opto F4
Orange-Green J205-6 Normal Function: Service Credits; Test Function: Escape D5	5 White-Green J209-5 U19-11	Left Outlane 15	Enter Right Ramp 25	Under L. Lock Sw. 2 35	Under Top Hole 45	R. Bank Middle 55	Trough L.R. 5 65	Left Sling 75	Left 2X Shuttle 85	Right Gun Home 95	Black-Violet J906-4 Upper Right E.O.S. F5
Orange-Blue J205-7 Normal Function: Volume Down; Test Function: Down D6	6 White-Blue J209-7 U19-9	Left Return Lane 16	Left 45° Target 26	Under L. Gun Sw. 1 36	Under Left Hole 46	R. Bank Bottom 56	Trough L.R. 6 66	Top Lane Left 76	Right 2X Shuttle 86	Right Gun Mark 96	Black-Yellow J905-3 Upper Right Opto F6
Orange-Violet J205-8 Normal Function: Volume Up; Test Function: Up D7	7 White-Violet J209-8 U19-5	Right Return Lane 17	Center 45° Target 27	Under R. Gun Sw. 1 37	Under Borg Hole 47	Top Drop Target 57	Trough Up 67	Top Lane Center 77	Made Right Ramp 87	Left Gun Home 97	Black-Gray J906-5 Spinner* F7
Orange-Gray J205-9 Normal Function: Begin Test; Test Function: Enter D8	8 White-Gray J209-9 U19-7	Right Outlane 18	Right 45° Target 28	Left Gun Shooter 38	Borg Entry 48	Right Outer Loop 58	Shooter 68	Top Lane Right 78	Enter Left Ramp 88	Not Used 98	Black-Blue J905-5 Not Used F8

***Note:** Used as switches other than flipper switches in this game. = Opto Switch

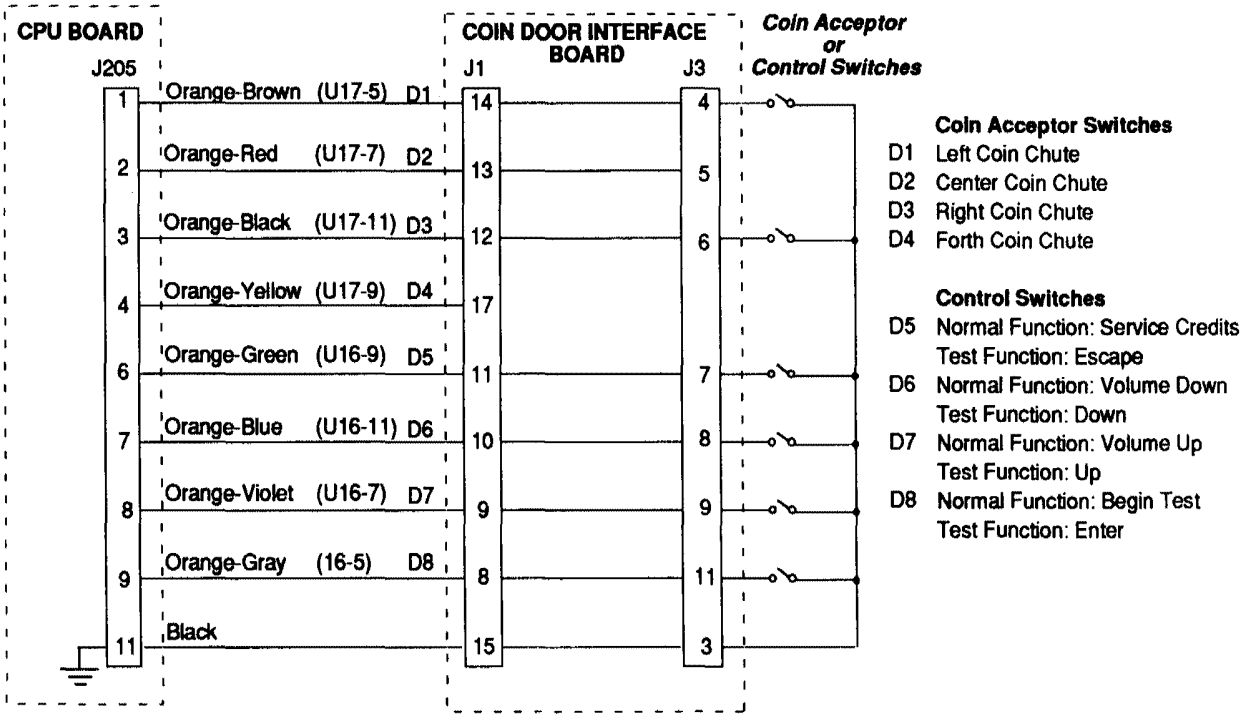
Switch Matrix Circuit



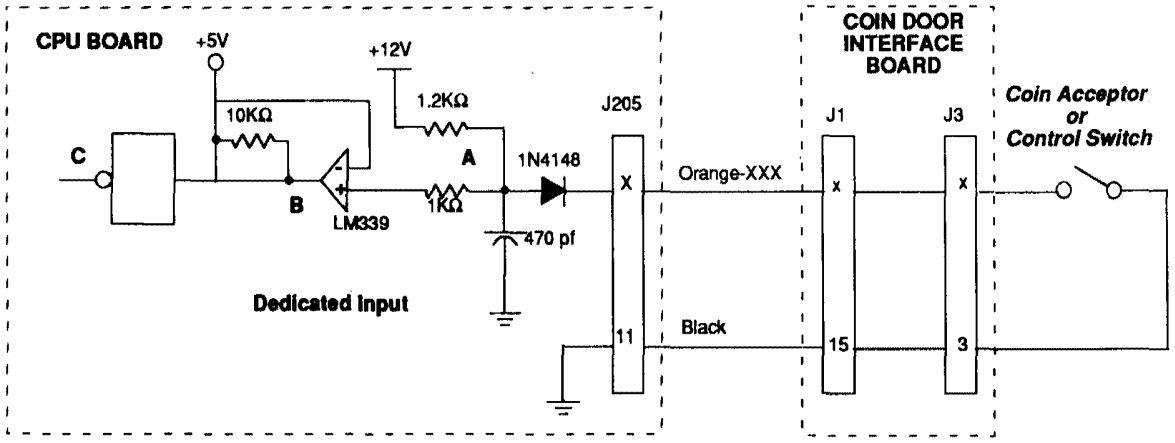
The microprocessor is constantly strobing the column side of the switch. When point "A" on the column circuit toggles low the column side is active.

When a switch closes the row side of the circuit activates. The "+" input to the LM339 drops below +5V therefore its output is low. Corresponding row and column switches must be low at the same time, for the switch to be considered closed by the microprocessor. When the switch opens, the "+" input to the LM339 is above +5V, its output is high and the row is inactive.

Dedicated Switches



Dedicated Switch Circuit

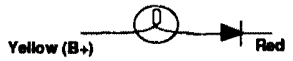


Switch	A	B	C	
Open	H	H	L	Off
Closed	L	L	H	On

The dedicated switches operate similar to switches in the matrix except that instead of a column circuit there is a direct tie to ground. Therefore, the column side is constantly active (low).

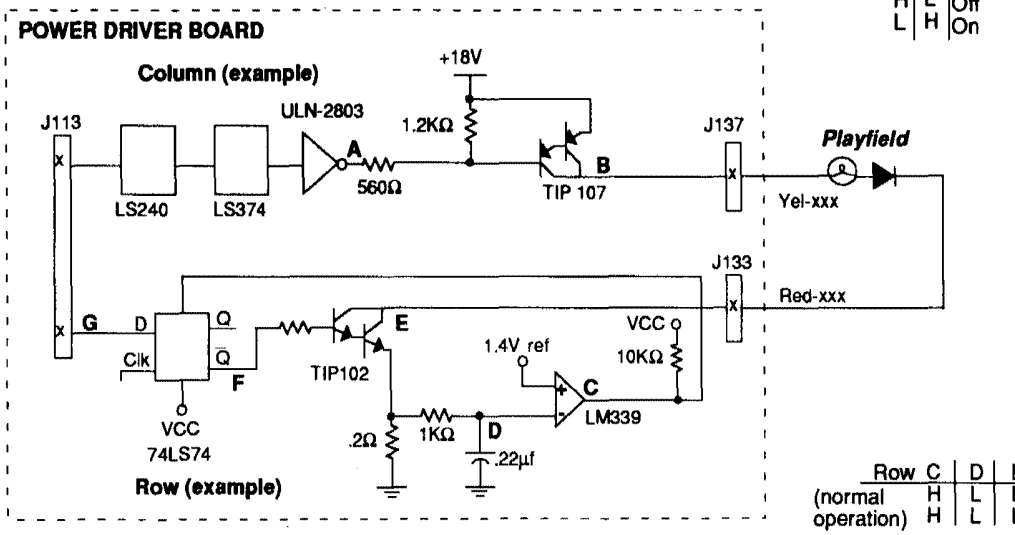
When a switch closes the row side (dedicated input) of the circuit activates. The "+" input to the LM339 drops below +5V therefore its output is low. Since the row circuit (dedicated input) is tied directly to ground through the switch, the switch is considered closed by the microprocessor. When the switch opens, the "+" input to the LM339 is above +5V, its output is high and the row is inactive.

LAMPS



Column / Row	1 Yellow-Brown J137-1 Q98	2 Yellow-Red J137-2 Q97	3 Yellow-Orange J137-3 Q96	4 Yellow-Black J137-4 Q95	5 Yellow-Green J137-5 Q94	6 Yellow-Blue J137-6 Q93	7 Yellow-Violet J137-7 Q92	8 Yellow-Gray J137-9 Q91
Red-Brown J133-1 1 Q90	Left Bank Top 11	Ship Mode 3 21	Top Lane Left 31	Q 41	Left Return Lane 51	Generic 3 61	Generic 2 71	Right Return Lanes 81
Red-Black J133-2 2 Q89	Left Bank Middle 12	Ship Mode 4 22	Top Lane Center 32	Generic 1 42	Left Launcher 52	Increase Warp 62	Top 3-bank Left 72	Right Launcher 82
Red-Orange J133-4 3 Q88	Ship Mode 1 13	Ship Mode 5 23	Top Lane Right 33	Right Lock 43	Advance in Rank 53	Spinner 63	Top 3-bank Center 73	Million Jets 83
Red-Yellow J133-5 4 Q87	Ship Mode 2 14	Right Bank Top 24	Bonus 2X 34	Holodeck 44	Generic 6 54	Generic 7 64	Top 3-bank Right 74	Kickback 84
Red-Green J133-6 5 Q86	Left Bank Bottom 15	Right Bank Middle 25	Bonus 4X 35	Right 2x Shuttle 45	Super 55	Left Millions 65	Left Lock 75	Borg Lock 85
Red-Blue J133-7 6 Q85	Final Frontier 16	Command Decision 26	Multipliers Held 36	Generic 4 46	Jackpot 56	Jackpot X 66	Generic 5 76	Borg Jackpot 86
Red-Violet J133-8 7 Q84	Shoot Again 17	Ship Mode 6 27	Bonus 8X 37	Right Millions 47	Extra Ball 57	Rift 67	Worm Hole 77	Buy-in 87
Red-Gray J133-9 8 Q83	Ship Mode 7 18	Right Bank Bottom 28	Bonus 10X 38	Left 2X Shuttle 48	Start Mission 58	Time 68	Borg Ship 78	Start Button 88

Lamp Matrix Circuit



Column	A	B	
	H	L	Off
	L	H	On

Row	C	D	E	F	G	
(normal	H	L	H	L	H	Off
operation)	H	L	L	H	L	On

The processor sends a signal to the column circuit causing the output of the UNL-2803 to toggle. When point "A" drops low, the TIP107 transistor conducts and point "B" changes to a high state. At the same time the processor drives the input of the 74LS74 low, causing a high at output "F". A high state at the base of TIP102 causes the transistor to conduct bringing the row circuit to ground and turning the lamp On.

The processor changes the input of the 74LS74 to a high state to turn the lamp Off.

In overcurrent conditions the lamp is shut Off through the comparator. If the voltage at the negative input of the LM339 rises above 1.4V the output changes to a low, which is fed back to the 74LS74 and shuts the row circuit Off.

SOLENOID / FLASHER TABLE

Sol. No.	Function	Solenoid Type	Voltage Connections			Drive xister	Drive Connections			Drive Wire Color	Solenoid Part Number Flashlamp Type	
			Playfield	Backbox	Cabinet		Playfield	Backbox	Cabinet		Playfield	Backbox
01	Left Gun Kicker	High Power	J107-3			Q82	J130-1			Vio-Brn	AE-23-800	
02	Right Gun Kicker	High Power	J107-3			Q80	J130-2			Vio-Red	AE-23-800	
03	Left Gun Popper	High Power	J107-3			Q78	J130-4			Vio-Org	AE-23-800	
04	Right Gun Popper	High Power	J107-3			Q76	J130-5			Vio-Yel	AE-23-800	
05	Left Popper	High Power	J107-3			Q64	J130-6			Vio-Grn	AE-23-800	
06	Plunger	High Power	J107-3			Q66	J130-7			Vio-Blu	AE-23-800	
07	Knocker	High Power		J107-3		Q68		J130-8		Vio-Blk		AE-23-800
08	Kickback	High Power	J107-3			Q70	J130-9			Vio-Gry	AE-23-800	
09	Left Slingshot	Low Power	J107-2			Q58	J127-1			Brn-Blk	AE-26-1200	
10	Right Slingshot	Low Power	J107-2			Q56	J127-3			Brn-Red	AE-26-1200	
11	Trough	Low Power	J107-2			Q54	J127-4			Brn-Org	AE-26-1500	
12	Left Jet Bumper	Low Power	J107-2			Q52	J127-5			Brn-Yel	AE-26-1200	
13	Right Jet Bumper	Low Power	J107-2			Q50	J127-6			Brn-Grn	AE-26-1200	
14	Bottom Jet Bumper	Low Power	J107-2			Q48	J127-7			Brn-Blu	AE-26-1200	
15	Top Divertor	Low Power	J107-2			Q46	J127-8			Brn-Vio	AE-25-1000	
16	Borg Kicker	Low Power	J107-2			Q44	J127-9			Brn-Gry	AL-23-800	
17	Left Gun Motor	Low Power	J118-2			Q42	J126-1			Blk-Brn	A-17562	
18	Right Gun Motor	Low Power	J118-2			Q40	J126-2			Blk-Red	A-17562	
19	Not Used					Q38				Blk-Org		
20	Jets Flasher	Flasher	J107-6			Q36	J126-4			Blk-Yel	#89 (1)	
21	Right Popper Flasher	Flasher	J107-6	J106-5		Q28	J126-5	J125-6		Blu-Grn	#89 (1)	#906 (1)
22	Middle Ramp Flasher	Flasher	J107-6			Q30	J126-6			Blu-Blk	#89 (2)	
23	Shields Flasher	Flasher	J107-6	J106-5		Q34	J126-7	J125-8		Blu-Vio	#906 (3)	#906 (1)
24	Autofire Flasher	Flasher	J107-6			Q32	J126-8			Blu-Gry	#906 (1)	
25	Exit Un. Gnd. Flasher	Gen. Purpose	J107-6	J106-5		Q26	J122-1	J124-1		Blu-Brn	#89 (1)	#906 (1)
26	Right Borg Flasher	Gen. Purpose	J107-6	J106-5		Q24	J122-2	J124-2		Blu-Red	#906 (2)	#906 (1)
27	Left Borg Flasher	Gen. Purpose	J107-6	J106-5		Q22	J122-3	J124-3		Blu-Org	#906 (2)	#906 (1)
28	Center Borg Flasher	Gen. Purpose	J107-6	J106-5		Q20	J122-4	J124-5		Blu-Yel	#906 (2)	#906 (1)
29-36	*See Flipper Circuits*											
37*	Under Divertor Top	Low Power	J107-1			Q16	J4-2			Brn-Wht	AE-25-1000	
38*	Under Divertor Bot.	Low Power	J107-1			Q15	J4-4			Blk-Wht	AE-25-1000	
39*	Top Drop Up	Low Power	J107-1			Q14	J4-5			Org-Wht	AE-26-1200	
40*	Top Drop Down	Low Power	J107-1			Q13	J4-6			Yel-Wht	SM1-26-600	
41*	Romulan Flashers	Low Power	J107-6	J106-5		Q9	J3-2	J3-2		Grn-Wht	#906 (1)	#906 (1)
42*	Right Ramp Flashers	Low Power	J107-6	J106-5		Q10	J3-3	J3-3		Blu-Wht	#89 (1)	#906 (1)

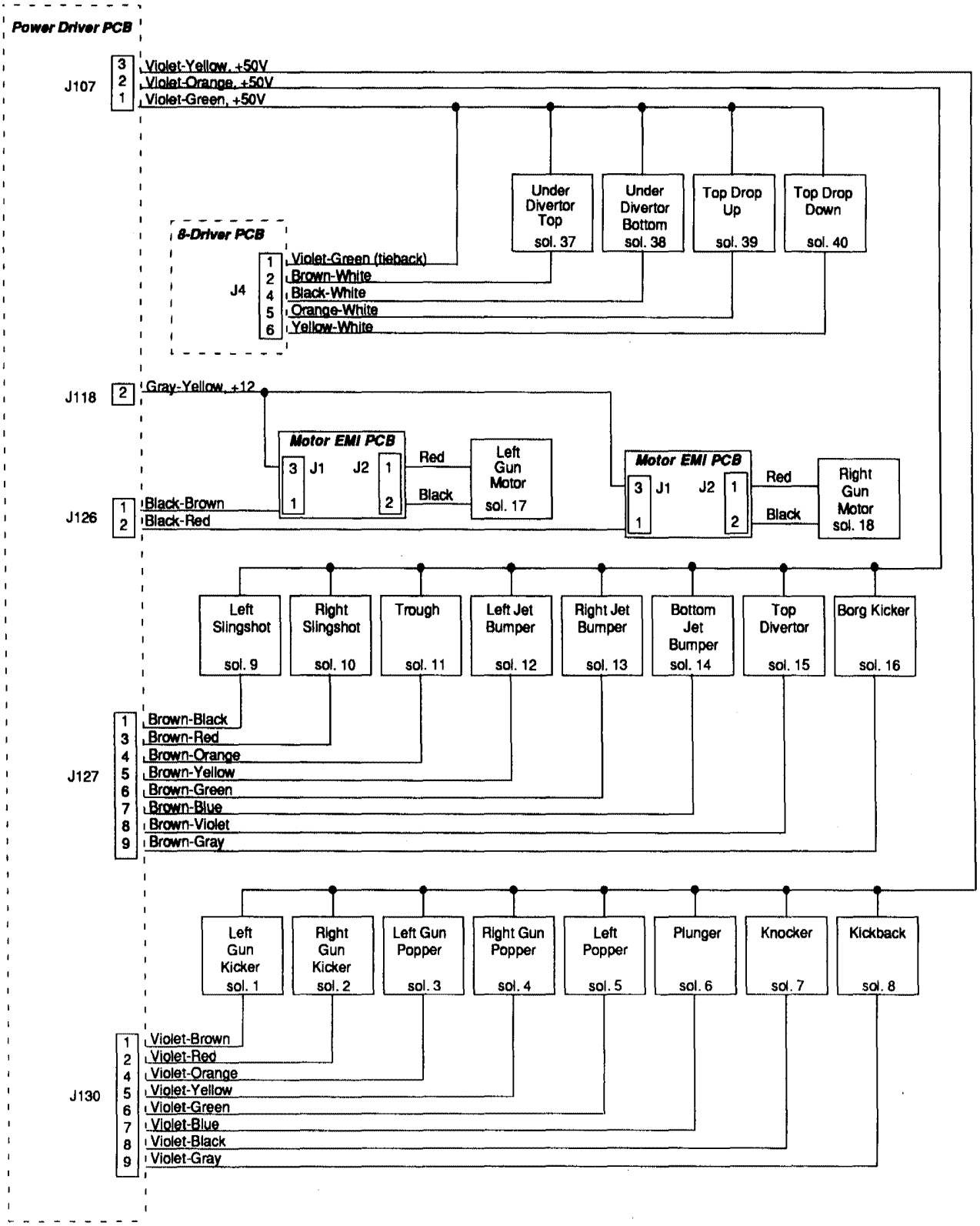
*Note: **Controlled from the 8-Driver Board, not the Power Driver Board**

	General Illumination											
01	Shields G.I.	G.I.	J121-1			Q18	J121-7			Wht-Brn	#44	
02	Insert G.I.	G.I.		J120-2		Q10		J120-8		Wht-Org		#555
03	Insert G.I	G.I.		J120-3		Q14		J120-9		Wht-Yel		#555
04	Playfield G.I.	G.I.	J121-5			Q16	J121-10			Wht-Grn	#44	
05	Return Lane/Coin	G.I.	J121-6		J119-3	Q12	J121-11		J119-1	Wht-Vio	#44	

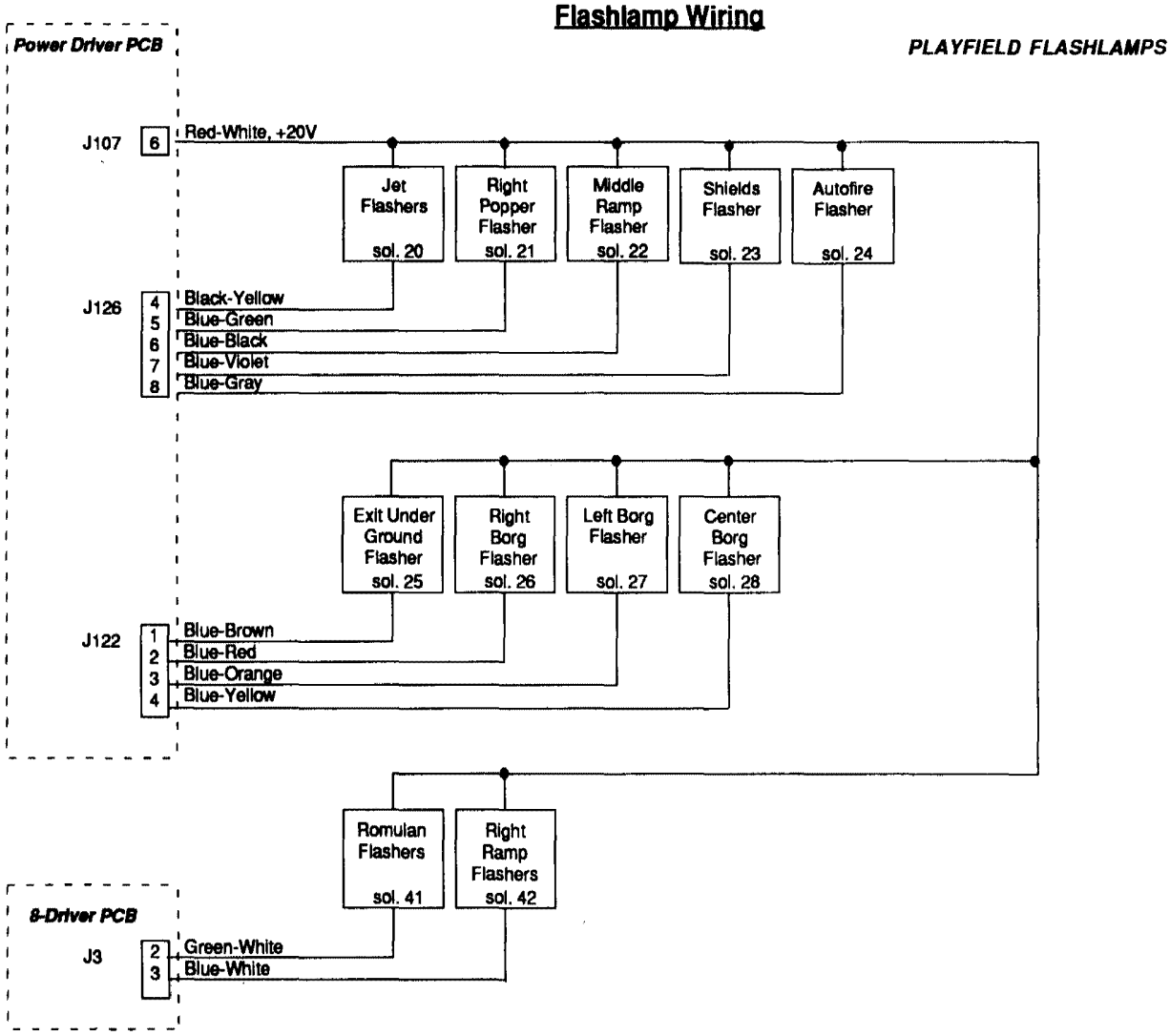
	Flipper Circuits		Voltage Connections Playfield	Drive Transistors Power	Drive Transistors Hold	Drive Connections Playfield	Drive Wire Colors Power	Drive Wire Colors Hold	Coil Part Number	Coil Colors
(29)	Lower Right Flipper	Lwr. Rt. Power	J907-7 (Blu-Yel)	Q4		J902-13	Blu-Vio		FL-11629	Blue
(30)		Lwr. Rt. Hold	J907-7 (Blu-Yel)		Q11	J902-11		Org-Grn		
(31)	Lower Left Flipper	Lwr. Lt. Power	J907-9 (Gry-Yel)	Q3		J902-9	Blu-Gry		FL-11629	Blue
(32)		Lwr. Lt. Hold	J907-9 (Gry-Yel)		Q9	J902-7		Org-Blu		
(33)	Upper Right Flipper	Up Rt. Power	J907-1 (Blu-Yel)	Q2		J902-6	Blk-Yel		FL-11629	Blue
(34)		Up Rt. Hold	J907-1 (Blu-Yel)		Q7	J902-4		Org-Vio		
35	Not Used	Up Lt. Power	J907-4 (Gry-Yel)	Q1		J902-3	Blk-Blu		Not Used	Not Used
36	Not Used	Up Lt. Hold	J907-4 (Gry-Yel)		Q5	J902-1		Org-Gry		

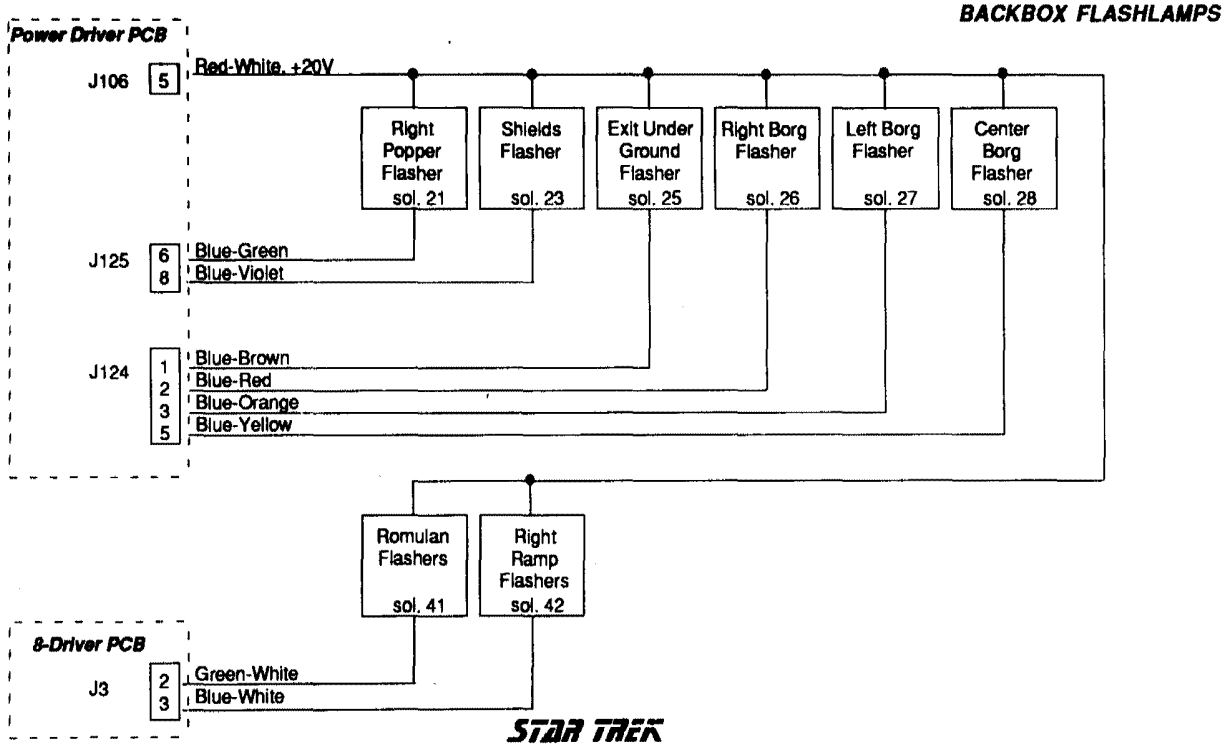
J4-1 = Tieback Diode
J1XX-X = Power Driver Board, JX-X = 8-driver Board, J9XX-X = Fliptronic II Board

Solenoid Wiring

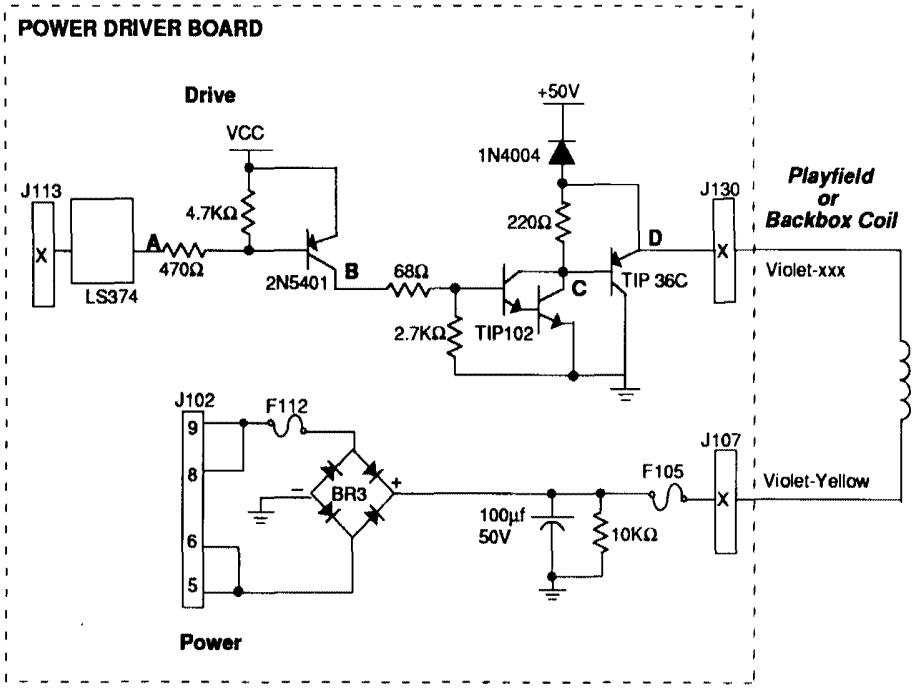


Flashlamp Wiring



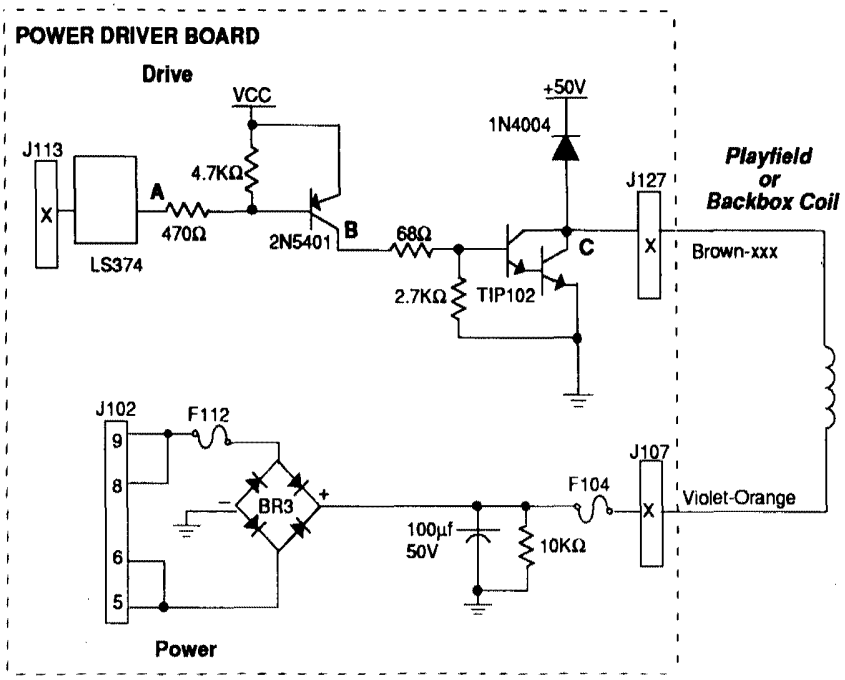


High Power Solenoid Circuit



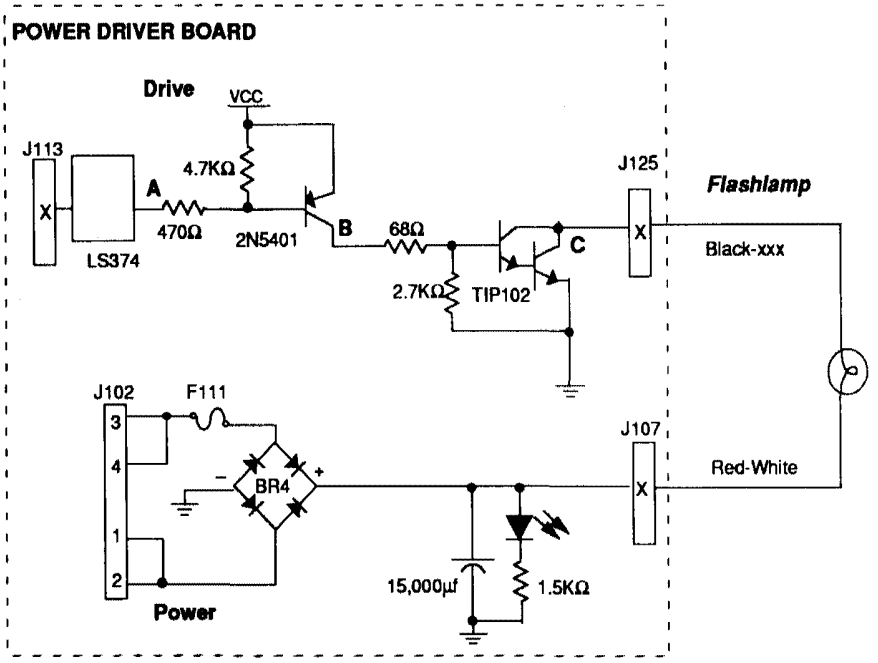
The microprocessor toggles the output of the 74LS374. When point "A" drops low, point "B" the collector of the 2N5401 transistor is high. A high at point "B" causes point "C" the collector of the TIP102 transistor, and point "D" the emitter of the TIP36 transistor to drop low. When point "D" is low the coil is grounded through the transistor and the coil turns On. The coil shuts Off when point "A" toggles high.

Low Power Solenoid Circuit



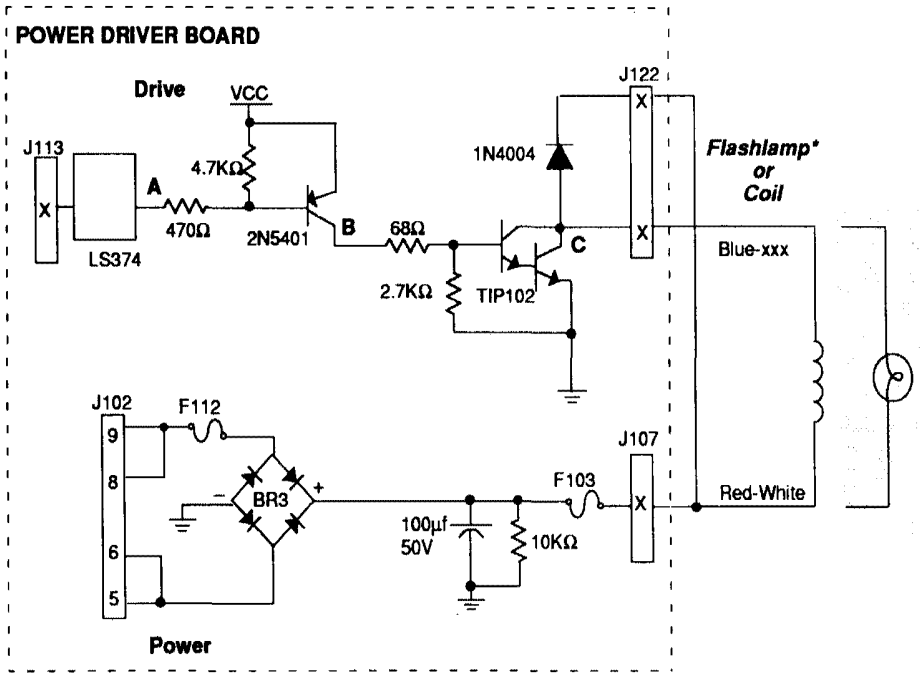
The microprocessor toggles the output of the 74LS374. When point "A" is low, point "B" the collector of the 2N5401 transistor is driven high. A high at point "B" turns On the TIP102 transistor and causes point "C" to drop low. When point "C" is low the coil is grounded through the transistor and the coil turns On. The coil shuts Off when point "A" toggles high.

Flashlamp Circuit



The microprocessor toggles the output of the 74LS374. When point "A" is low, point "B" the collector of the 2N5401 transistor is high. Once point "B" is high, point "C" the collector of the TIP102 transistor is low. When Point "C" is low the flashlamp is grounded through the transistor and the flashlamp turns On. When point "A" toggles high the circuit shuts Off.

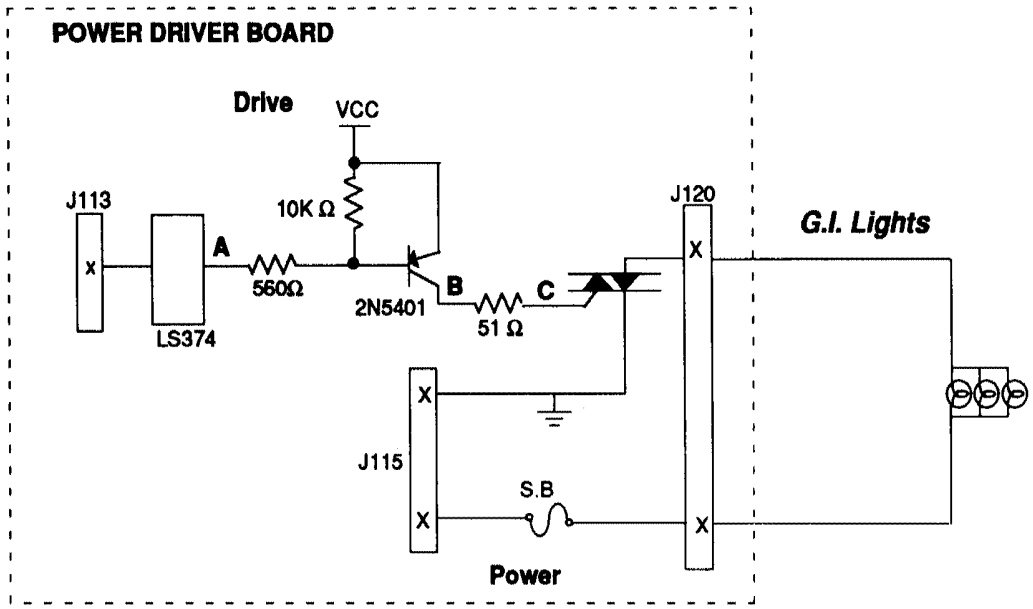
Special (General Purpose) Solenoid Circuit



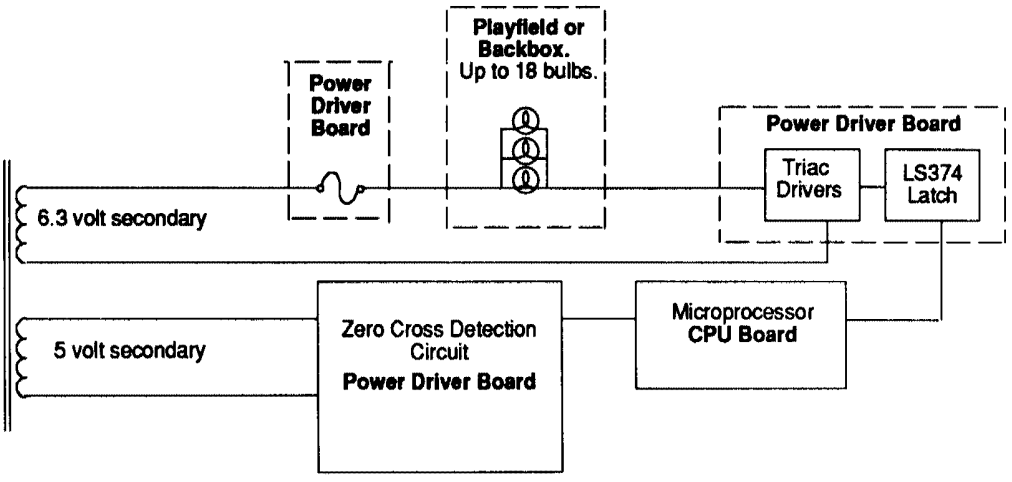
The microprocessor toggles the output of the 74LS374. When point "A" drops low, point "B" is high. A high at point "B" causes a low at point "C". When point "C" is low the coil/flashlamp is grounded through the transistor and the coil/flashlamp turns On. When point "A" toggles high the coil/flashlamp turns Off.

* Tieback Diode is not used for flashlamp circuit.

General Illumination Circuit

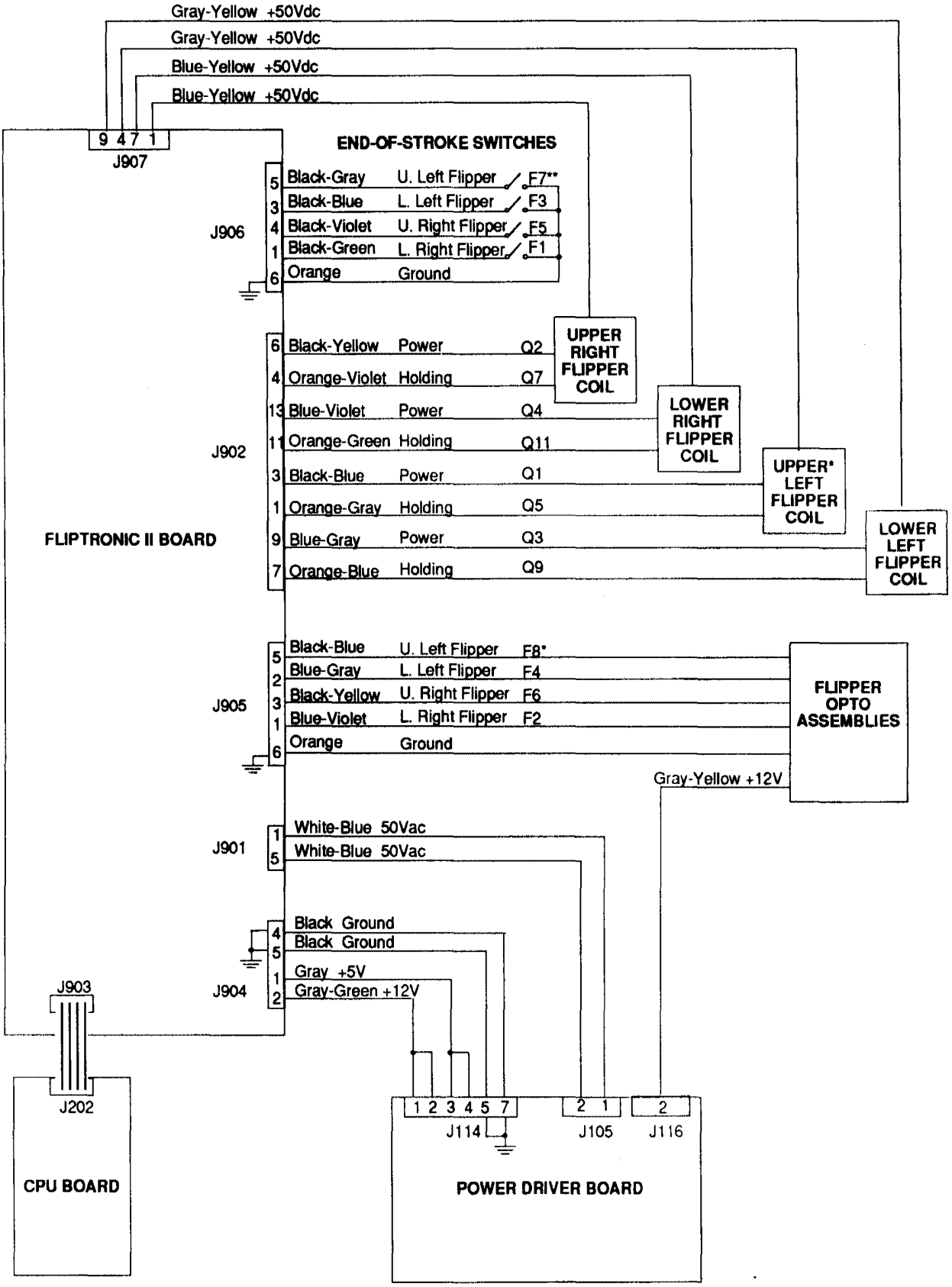


Block Diagram of General Illumination Circuit



When point "A" toggles low, then points "B" and "C" are high. This turns On the triac and the desired General Illumination string lights.

Flipper Circuit Diagram

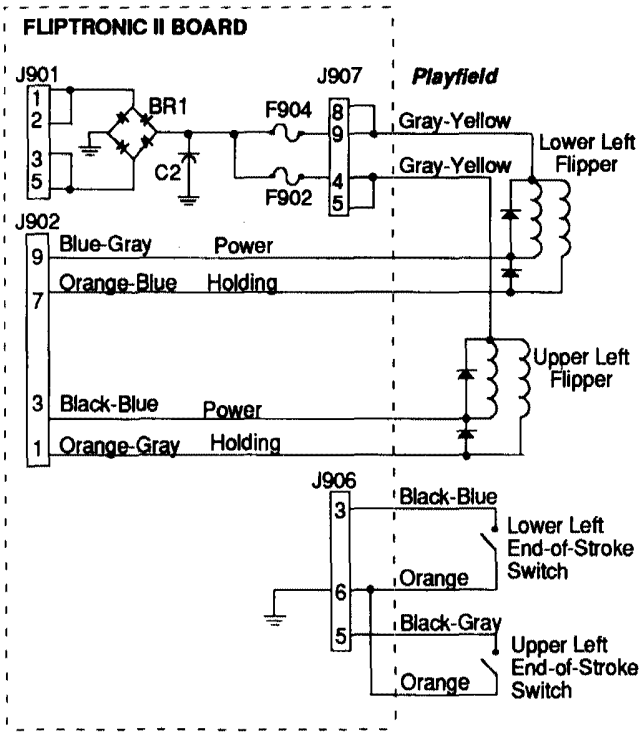


**Not used on this game.*

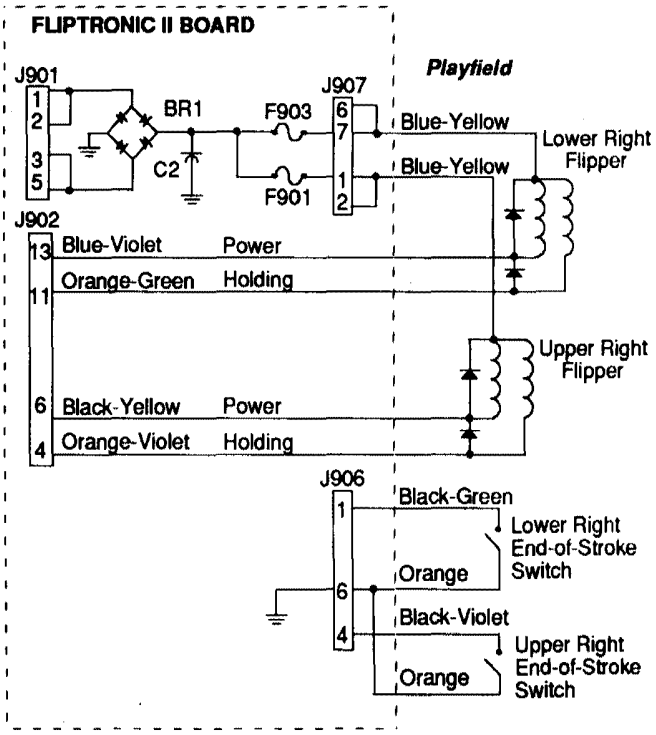
*** Used as the Spinner switch on this game.*

Flipper Coil Circuits

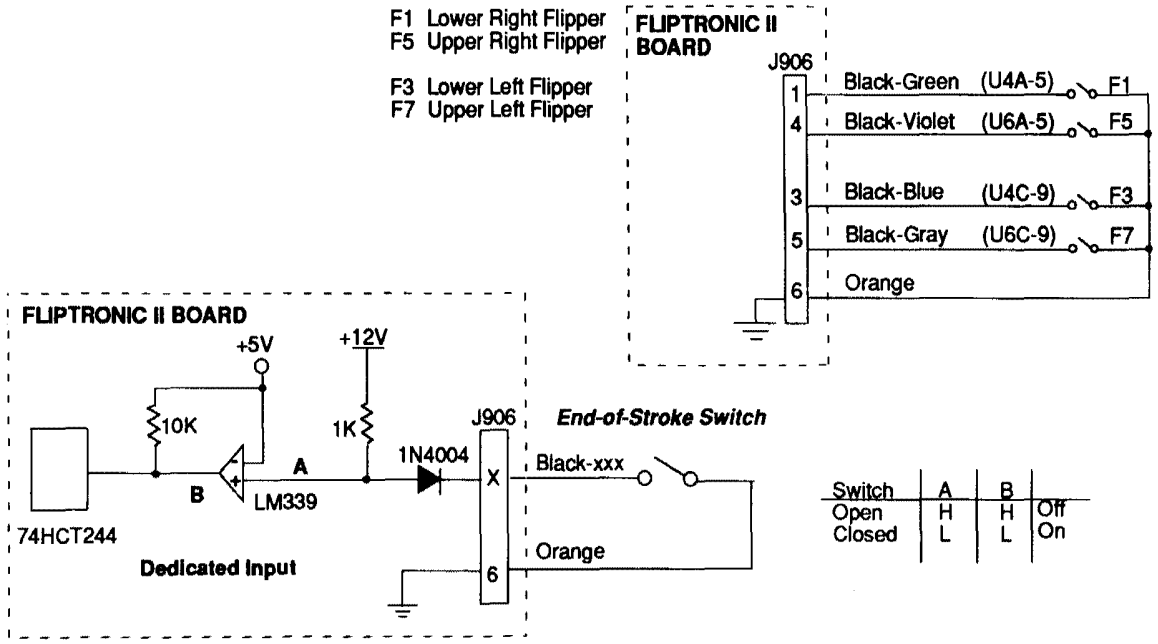
Left Flipper Circuit



Right Flipper Circuit



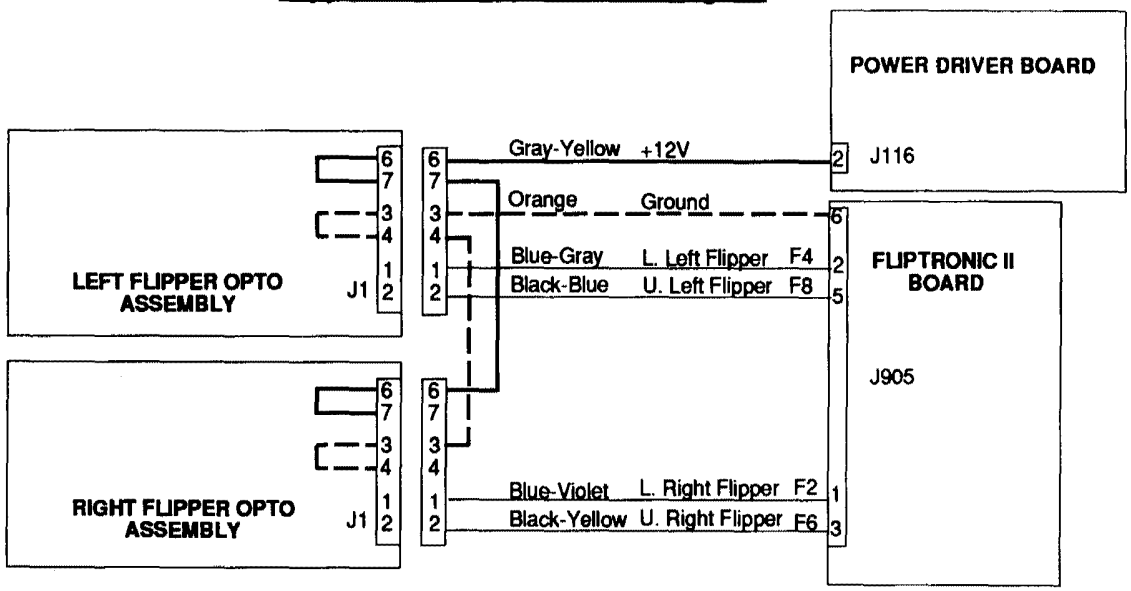
Flipper End-of-Stroke Switches



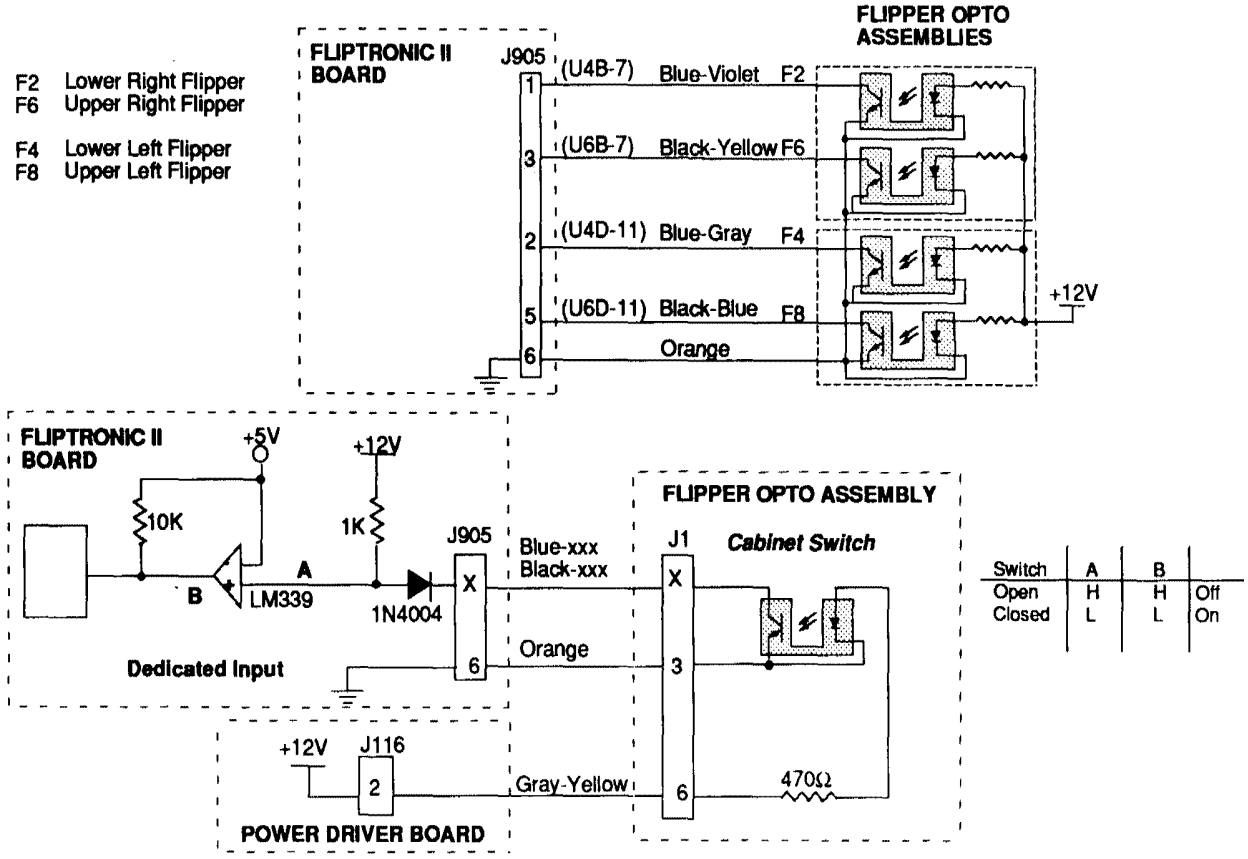
The flipper switch circuits operate similar to the dedicated switch circuit. The circuits are active low and tied to ground through the switch.

When a switch closes the row side (dedicated input) of the circuit activates. The "+" input to the LM339 drops below +5V therefore its output is low. Since the row (dedicated input) circuit is tied directly to ground through the switch, the switch is considered closed by the microprocessor. When the switch opens, the "+" input to the LM339 is above +5V, its output is high and the row (dedicated input) is inactive.

Flipper Cabinet Switch Circuit Diagram



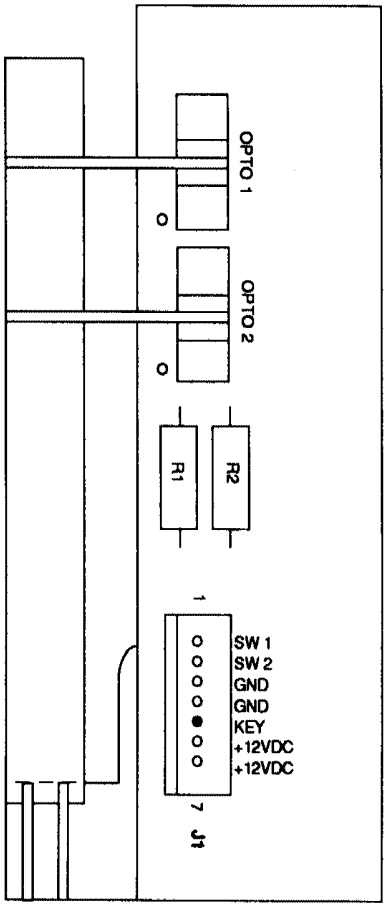
Flipper Cabinet Switches

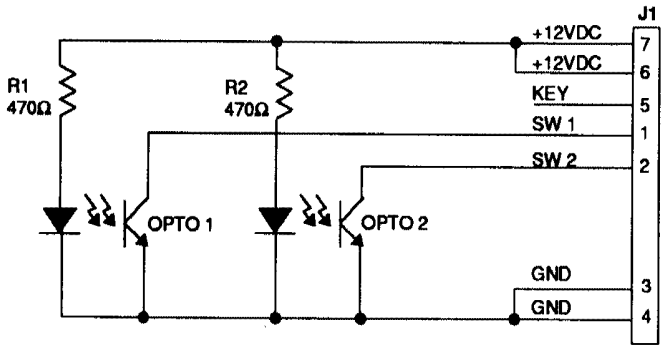


The flipper switch circuits operate similar to the dedicated switch circuit. The circuits are active low and tied to ground through the switch.

When a switch closes the row side (dedicated input) of the circuit activates. The "+" input to the LM339 drops below +5V therefore its output is low. Since the row (dedicated input) circuit is tied directly to ground through the switch, the switch is considered closed by the microprocessor. When the switch opens, the "+" input to the LM339 is above +5V, its output is high and the row (dedicated input) is inactive.

A-17316
Flipper Opto PCB Assembly





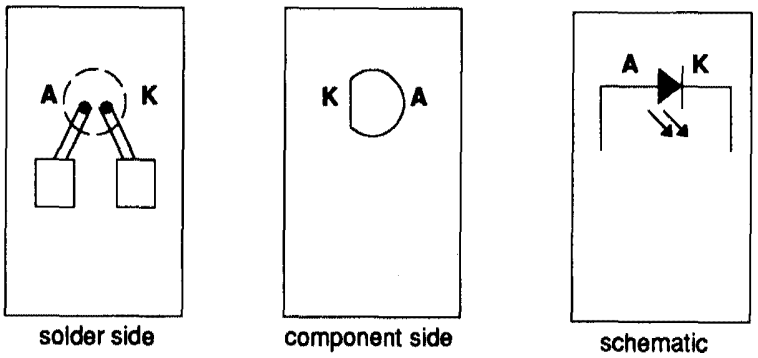
Left Side Flipper Cabinet Opto Switch Board

J1-1 Blue-Gray from Fliptronic II Board J905-2
J1-2 Black-Blue from Fliptronic II Board J905-5
J1-3 N/C
J1-4 Orange from Fliptronic II Board J905-6
J1-5 N/C
J1-6 Gray-Yellow from Fliptronic II Board J904-2
J1-7 Gray-Yellow from Fliptronic II Board J904-2

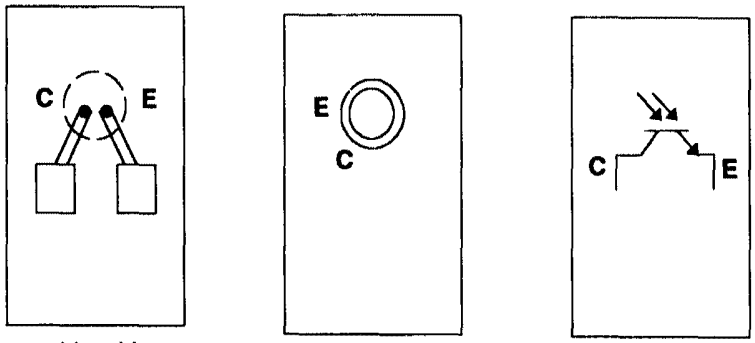
Right Side Flipper Cabinet Opto Switch Board

J1-1 Blue-Violet from Fliptronic II Board J905-1
J1-2 Black-Yellow from Fliptronic II Board J905-3
J1-3 Orange from Fliptronic II Board J905-6
J1-4 Orange from Left Flipper Opto Assembly J1-4
J1-5 N/C
J1-6 Gray-Yellow from Left Flipper Opto Assembly J1-6
J1-7 N/C

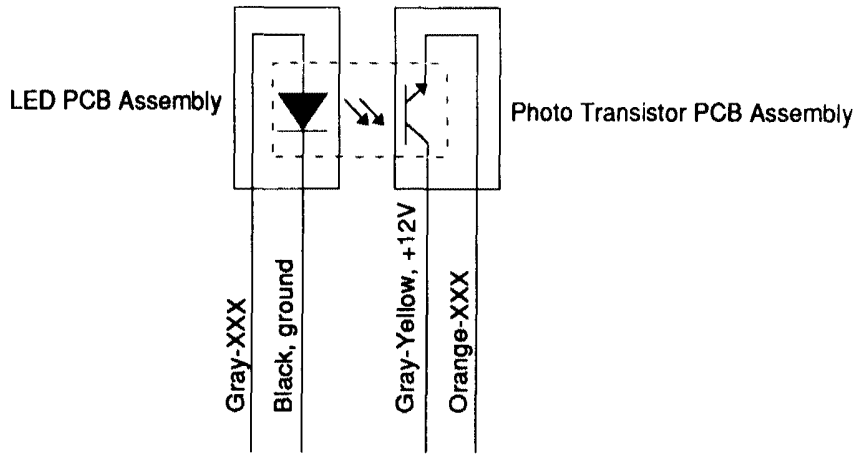
A-16908
LED PCB Assembly
(green board)



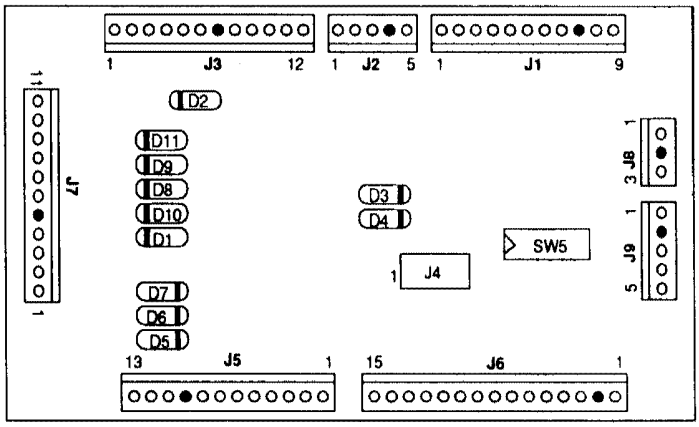
A-16909
Photo Transistor PCB Assembly
(blue board)



Typical Circuit



A-17051-1
Coin Door Interface PCB Assembly



J1-1 Orange-Gray, dedicated row 8 from CPU J205-9
J1-2 Orange-Violet, dedicated row 7 from CPU J205-8
J1-3 Orange-Blue, dedicated row 6 from CPU J205-7
J1-4 Orange-Green, dedicated row 5 from CPU J205-6
J1-5 Orange-Yellow, dedicated row 4 from CPU J205-4
J1-6 Orange-Black, dedicated row 3 from CPU J205-3
J1-7 Orange-Red, dedicated row 2 from CPU J205-2
J1-8 Orange-Brown, dedicated row 1 from CPU J205-1
J1-9 N/C
J1-10 Black, ground from CPU J205-10
J1-11 Orange-White, sw. enable from J205-12

J2-1 Black, ground from Power Driver Brd J116-3
J2-2 Gray-Yellow, +12vac from Power Driver Brd J116-2
J2-3 White-Violet, G.I. 6.8vac from Power Driver Brd J119-1
J2-4 N/C
J2-5 Violet, G.I. from Power Driver Brd J119-3

J3-1 Green-Brown, sw. col. 1 from CPU J207-1
J3-2 Green-Red, sw. col. 2 from CPU J207-2
J3-3 White-Brown, sw. row 1 from J209-1
J3-4 White-Red, sw. row 2 from CPU J209-2
J3-5 White-Orange, sw. row 3 from CPU J290-3
J3-6 White-Yellow, sw. row 4 from CPU J209-4
J3-7 N/C
J3-8 Yellow-Gray, lamp col. 8 from Power Driver Brd J137-9
J3-9 Red-Blue, lamp row 6 from Power Driver Brd J133-7
J3-10 Red-Violet, lamp row 7 from Power Driver Brd J133-8
J3-11 Red-Gray, lamp row 8 from Power Driver Brd J133-9
J3-12 N/C

J4- not used

J5-1 Violet, G.I. return to coin door
J5-2 White-Violet, G.I. 6.8vac to coin door
J5-3 Black, ground to coin door
J5-4 Orange-Brown, dedicated sw. row 1 to coin door
J5-5 Orange-Red, dedicated sw. row 2 to coin door
J5-6 Orange-Black, dedicated sw. row 3 to coin door
J5-7 Orange-Green, dedicated sw. row 5 to coin door
J5-8 Orange-Blue, dedicated sw. row 6 to coin door
J5-9 Orange-Violet, dedicated sw. row 7 to coin door
J5-10 N/C
J5-11 Orange-Gray, dedicated sw. row 8 to coin door
J5-12 Green-Red, sw col. 2 to coin door Slam tilt
J5-13 White-Brown, sw. row 1 to coin door Slam tilt

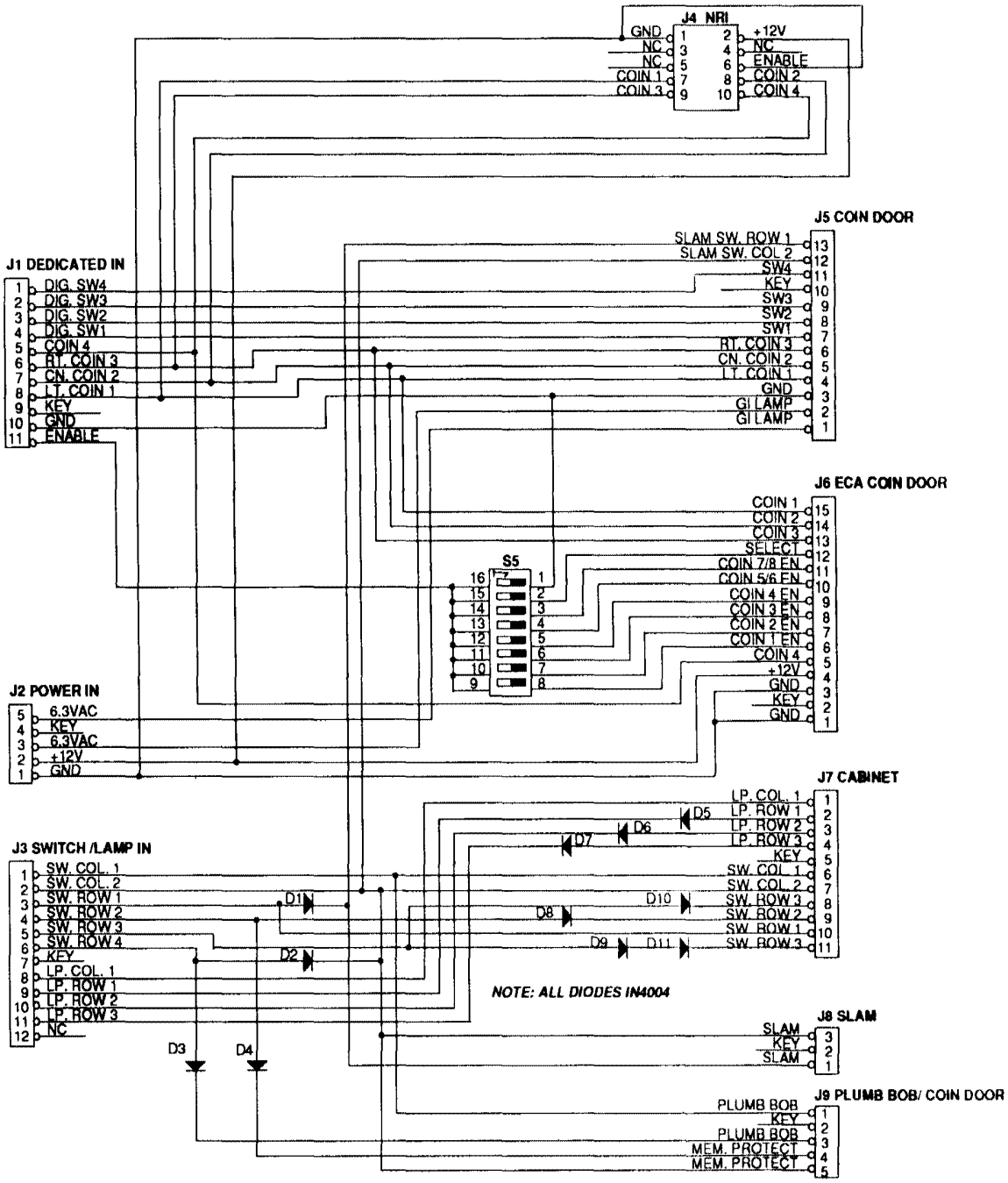
J6- not used

J7-1 Yellow-Gray, lamp col. 8 to cabinet
J7-2 N/C
J7-3 Red-Violet, lamp row 7 to cabinet
J7-4 Red-Gray, lamp row 8 to cabinet
J7-5 N/C
J7-6 Green-Brown, sw. col. 1 to cabinet
J7-7 N/C
J7-8 White-Orange, sw. row 3 to cabinet
J7-9 White-Red, sw. row 2 to cabinet
J7-10 White-Brown, sw. row 1 to cabinet
J7-11 N/C

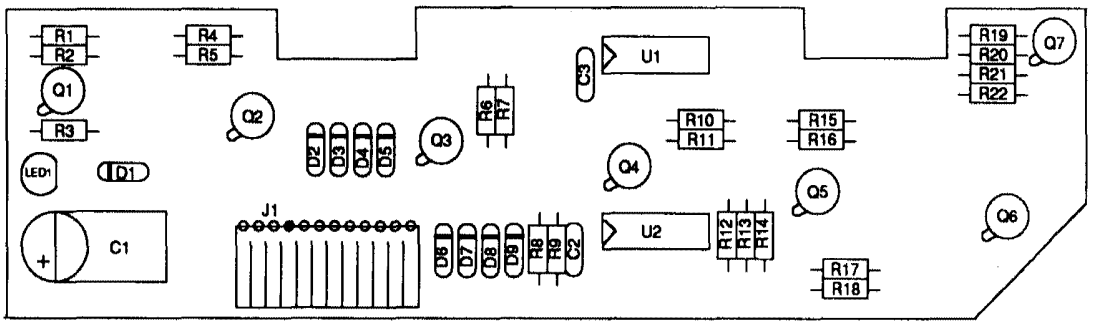
J8-1 White, sw. row to cabinet Slam tilt
J8-2 N/C
J8-3 Green, sw. col to cabinet Slam tilt

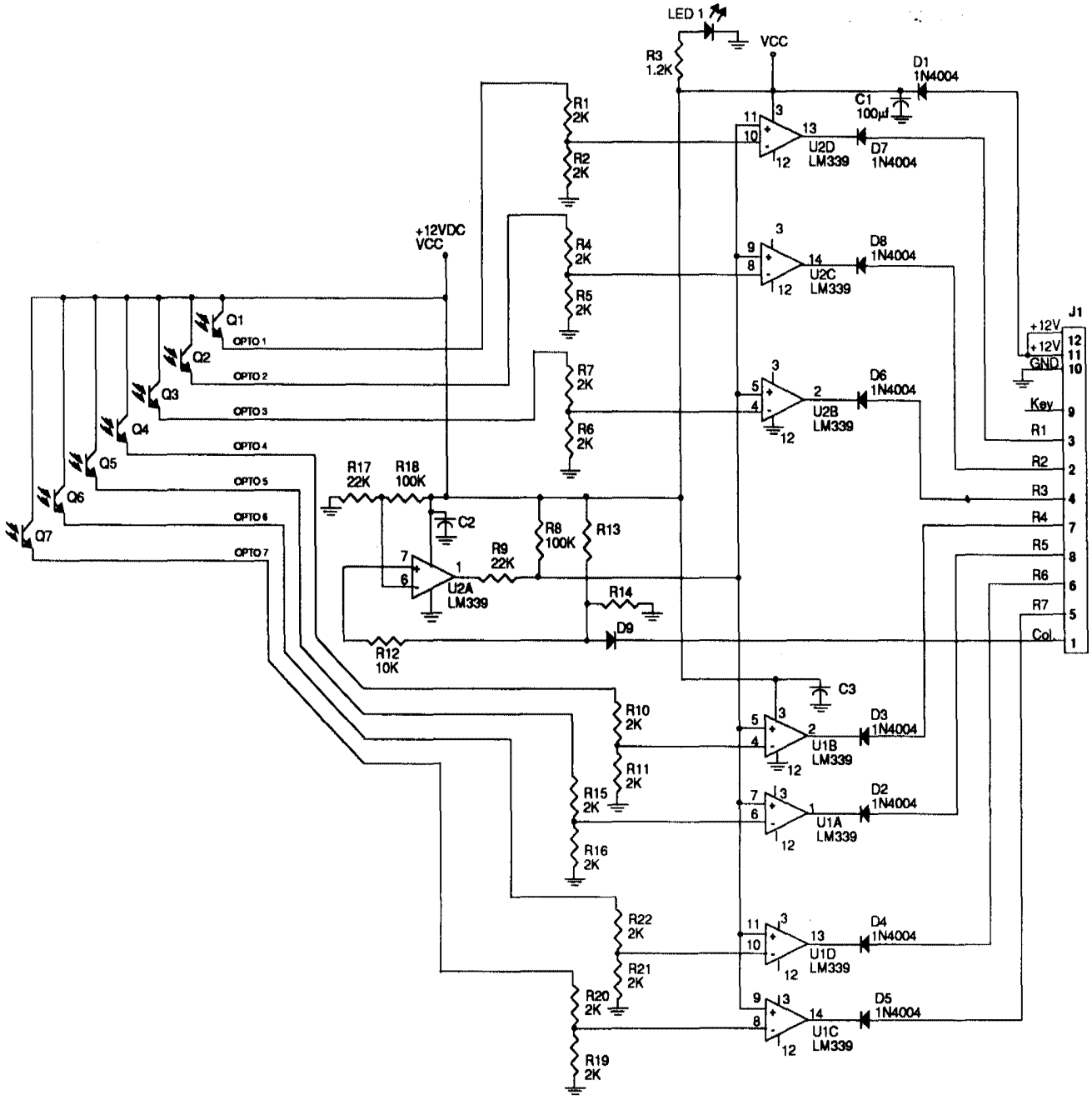
J9-1 White-Yellow, sw. row 4 to Plumb Bob tilt
J9-2 N/C
J9-3 Green-Brown, sw. col. 1 to Plumb Bob tilt
J9-4 White-Red, sw. row 2 to interlock switch
J9-5 Green-Red, sw. col. 2 to interlock switch

A-17051-1
Coin Door Interface PCB Schematic

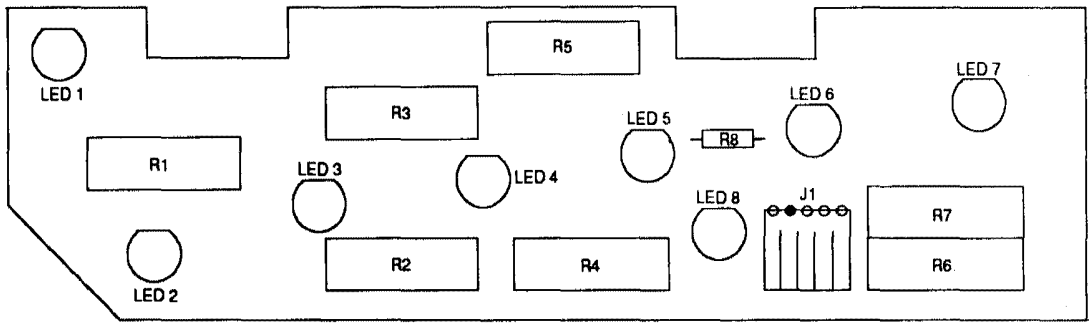


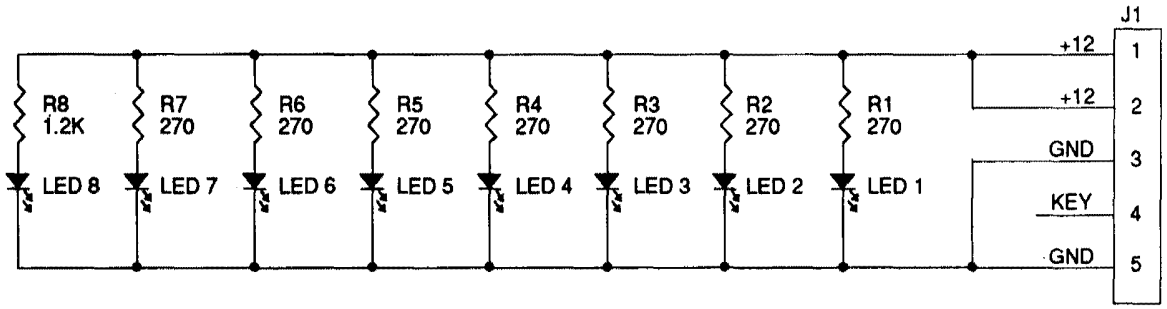
A-16926
7 Ball Trough Photo Transistor PCB Assembly





A-16927
7 Ball Trough LED PCB Assembly

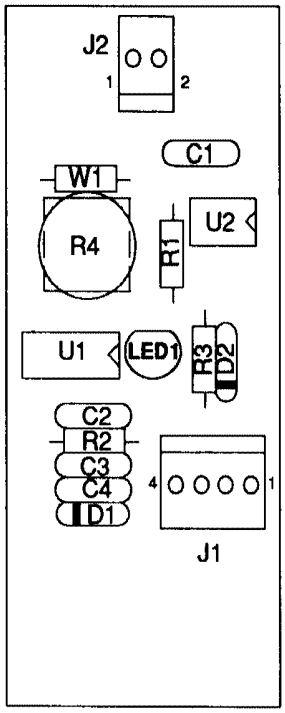


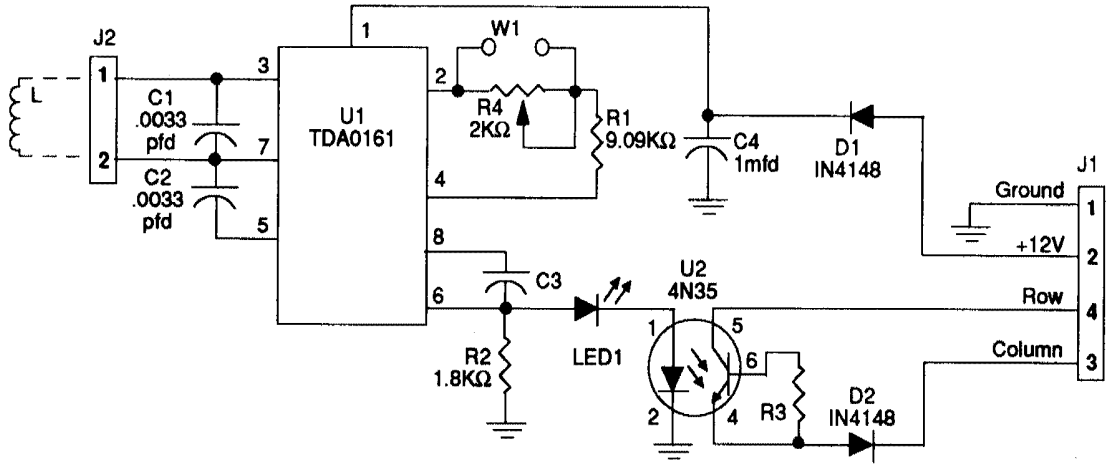


7 Ball Trough LED PCB Assembly
Connector Wiring
J1-1 Gray-Yellow, +12V from Power Driver Board J118-2
J1-2 N/C
J1-3 N/C
J1-4 Key
J1-5 Black, ground from Power Driver Board J118-3

7 Ball Trough Photo Transistor PCB Assembly
Connector Wiring
J1-1 Green-Blue, sw. col. 6 from CPU Board J207-6
J1-2 White-Red, sw. row 2 from CPU Board J209-2
J1-3 White-Brown, sw. row 1 from CPU Board J209-1
J1-4 White-Orange, sw. row 3 from CPU Board J209-3
J1-5 White-Violet, sw. row 7 from CPU Board J209-8
J1-6 White-Blue, sw. row 6 from CPU Board J209-7
J1-7 White-Yellow, sw. row 4 from CPU Board J209-4
J1-8 White-Green, sw. row 5 from CPU Board J209-5
J1-9 Key
J1-10 Black, ground from Power Driver Board J118-3
J1-11 N/C
J1-12 Gray-Yellow, +12V from Power Driver Board J118-2

A-16922
Proximity Sensor II PCB Assembly





Left Proximity Sensor II

J1-1 Black, ground from Power Driver Board J118-3
J1-2 Gray-Yellow, +12V from Power Driver Board J118-2
J1-3 Green-Brown, sw. col. 1 from CPU J207-1
J1-4 White-Blue, sw. row 6 from CPU J209-7

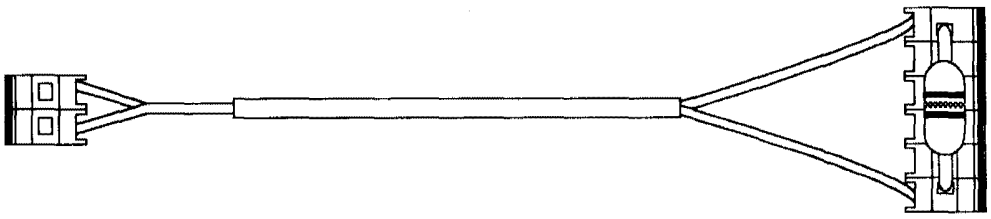
J2-1 Red, to left Eddy Sensor
J2-2 Black, to left Eddy Sensor

Right Proximity Sensor II

J1-1 Black, ground from J118-3
J1-2 Gray-Yellow, +12V from Power Driver Board J118-2
J1-3 Green-Brown, sw. col. 1 from CPU J207-1
J1-4 White-Violet, sw. row 7 from CPU J209-8

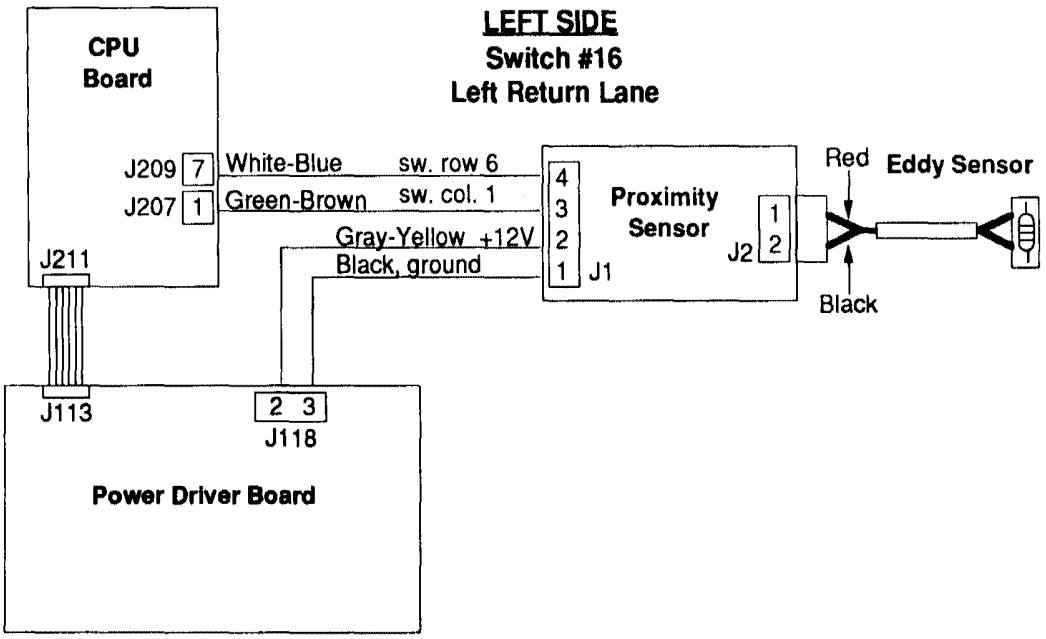
J2-1 Red, to right Eddy Sensor
J2-2 Black, to right Eddy Sensor

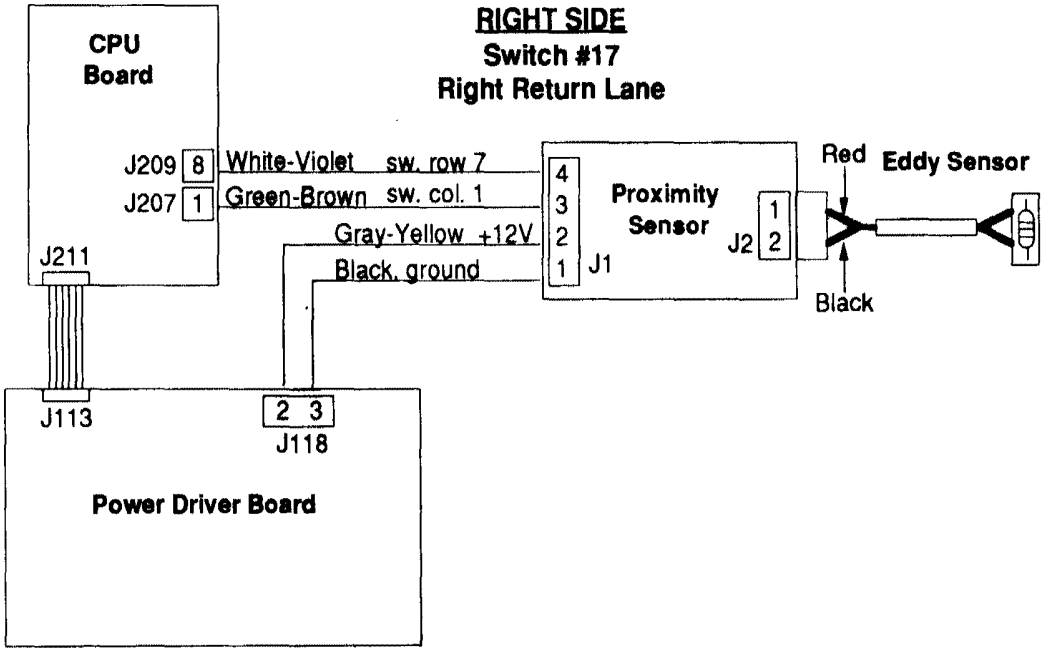
A-17064
Eddy Sensor Assembly



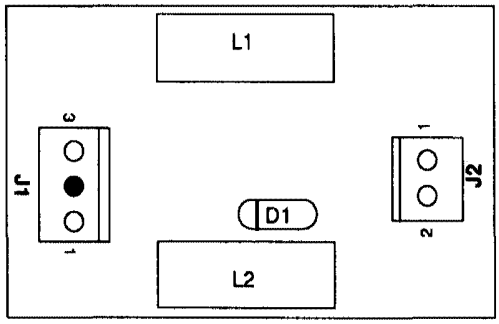
Left Eddy Sensor
Red wire from left Proximity Sensor II J2-1
Black wire from left Proximity Sensor II J2-2

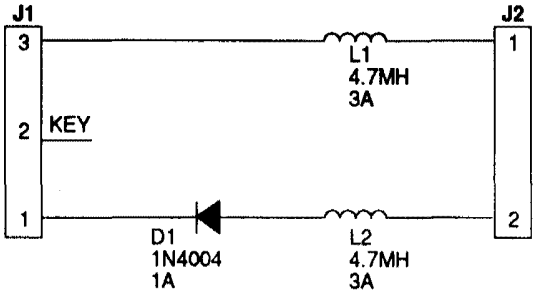
Right Eddy Sensor
Red wire from right Proximity Sensor II J2-1
Black wire from right Proximity Sensor II J2-2





A-15542
Motor EMI PCB Assembly
(for left and right gun assemblies)





Left EMI Board

J1-1 Black-Brown, ground from Power Driver Board J126-1
J1-2 N/C
J1-3 Gray-Yellow, +12V from Power Driver Board J118-2

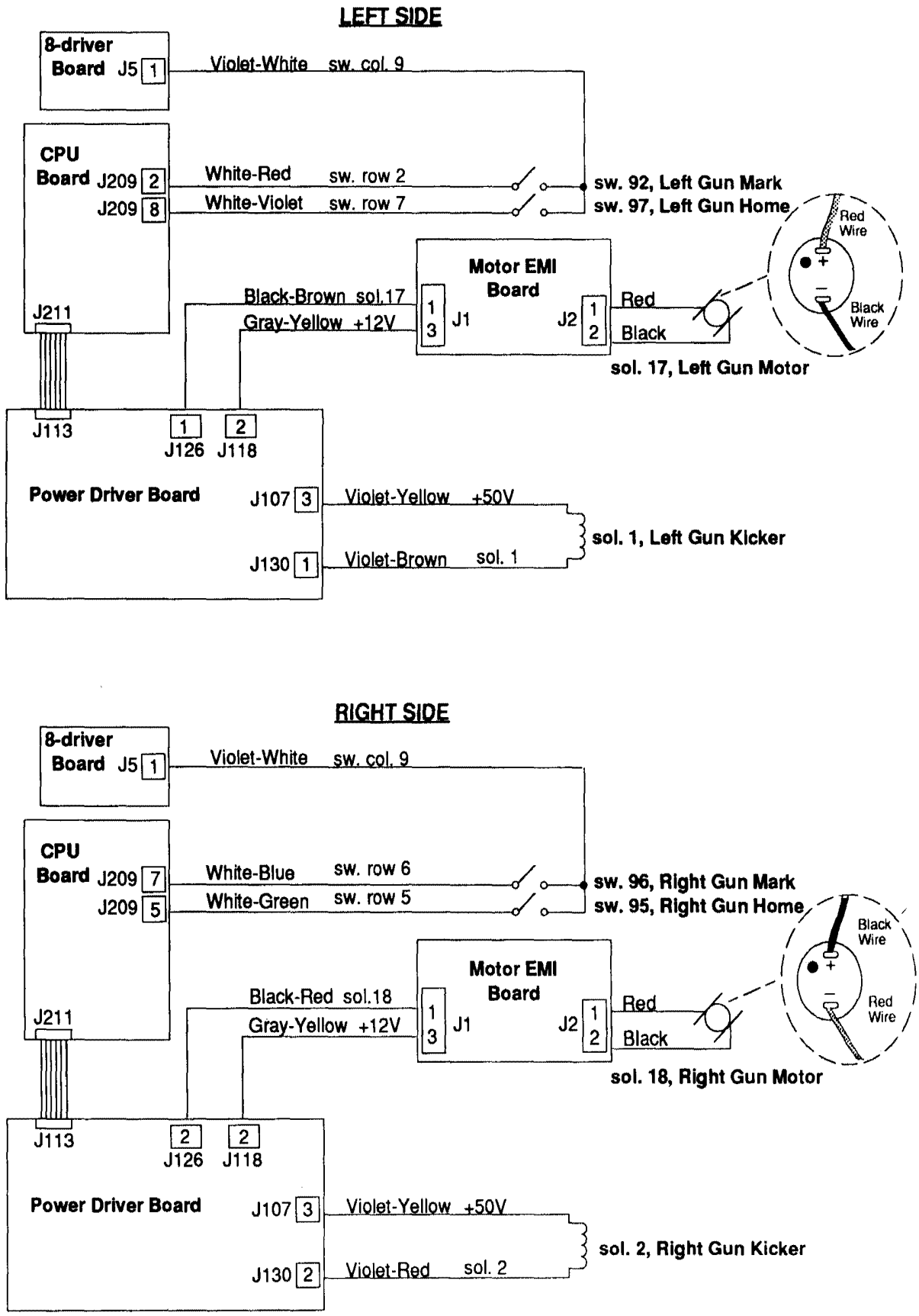
J2-1 Red, to left gun motor
J2-2 Black, to left gun motor

Right EMI Board

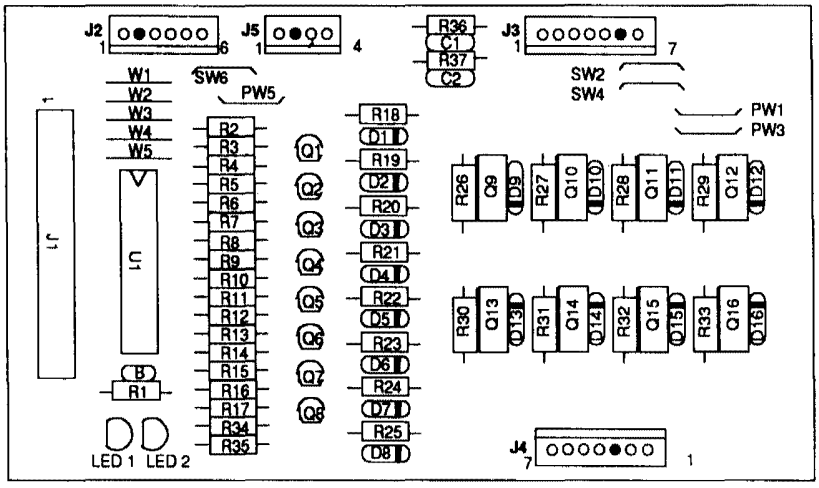
J1-1 Black-Red, ground from Power Driver Board J126-2
J1-2 N/C
J1-3 Gray-Yellow, +12V from Power Driver Board J118-2

J2-1 Red, to right gun motor
J2-2 Black, to right gun motor

Gun Circuit Diagram



A-16100
8-Driver PCB Assembly



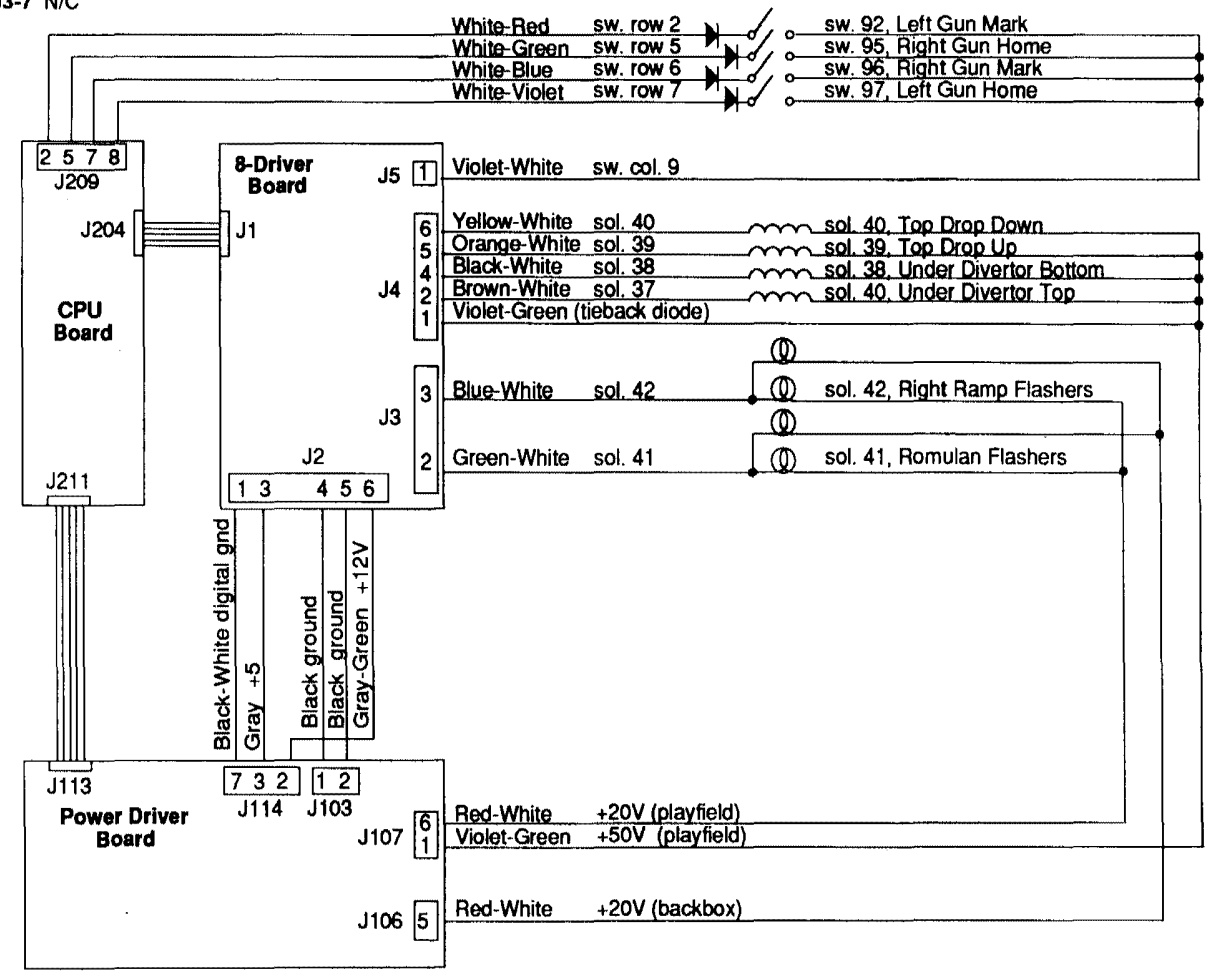
J1-1 Ribbon cable, data, from CPU Board J204

J2-1 Black-White, digital ground, from Power Driver Board J114-7
J2-2 Key
J2-3 Gray, +5V, from Power Driver Board J114-3
J2-4 Black, ground, from Power Driver Board J103-1
J2-5 Black, ground, from Power Driver Board J103-2
J2-6 Gray-Green, +12V, from Power Driver Board J114-2

J3-1 N/C
J3-2 Green-White, sol. 41 drive (Romulan Flasher), to plfd & bb
J3-3 Blue-White, sol. 42 drive (Right Ramp Flasher), to plfd & bb
J3-4 N/C
J3-5 N/C
J3-6 Key
J3-7 N/C

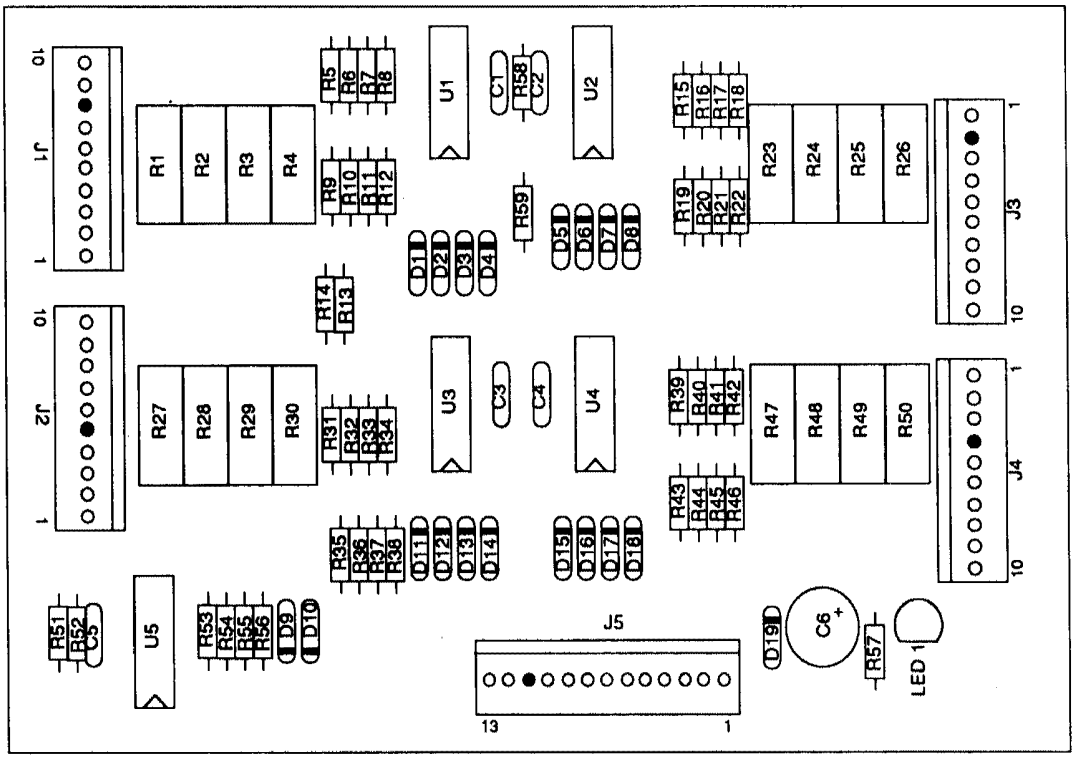
J4-1 Violet-Green, sol. 39 tieback diode
J4-2 Brown-White, sol. 37 drive (Under Divertor Top), to plfd
J4-3 N/C
J4-4 Black-White, sol. 38 drive (Under Divertor Bottom), to plfd
J4-5 Orange-White, sol. 39 drive (Top Drop Up), to plfd
J4-6 Yellow-White, sol. 40 drive (Top Drop Down), to plfd
J4-7 N/C

J5-1 Violet-White, switch column 9, to plfd
J5-2 Key
J5-3 N/C
J5-4 N/C



A-16100
8-Driver PCB Schematic

A-16998
16-Opto PCB Assembly



J1-1 Gray-White, to sw. 48 (Borg Entry)
J1-2 Gray-Violet, to sw. 47 (Under Borg Hole)
J1-3 Gray-Blue, to sw. 46 (Under Left Hole)
J1-4 Gray-Green, to sw. 45 (Under Top Hole)
J1-5 Gray-Black, to sw. 44 (Left Outer Loop)
J1-6 Gray-Orange, to sw. 43 (Under Left Lock Sw. 4)
J1-7 Gray-Red, to sw. 42 (Under Left Lock Sw. 3)
J1-8 N/C
J1-9 Gray-Brown, to sw. 41 (Under Left Lock Sw. 1)
J1-10 Black, ground to LED Assemblies

J2-1 Gray-Yellow, +12V to Photo Transistor Assemblies
J2-2 Orange-Gray, to sw. 48 (Borg Entry)
J2-3 Orange-Violet, to sw. 47 (Under Borg Hole)
J2-4 Orange-Blue, to sw. 46 (Under Left Hole)
J2-5 N/C
J2-6 Orange-Green, to sw. 45 (Under Top Hole)
J2-7 Orange-Yellow, to sw. 44 (Left Outer Loop)
J2-8 Orange-Black, to sw. 43 (Under Left Lock Sw. 4)
J2-9 Orange-Red, to sw. 42 (Under Left Lock Sw. 3)
J2-10 Orange-Brown, to sw. 41 (Under Left Lock Sw. 1)

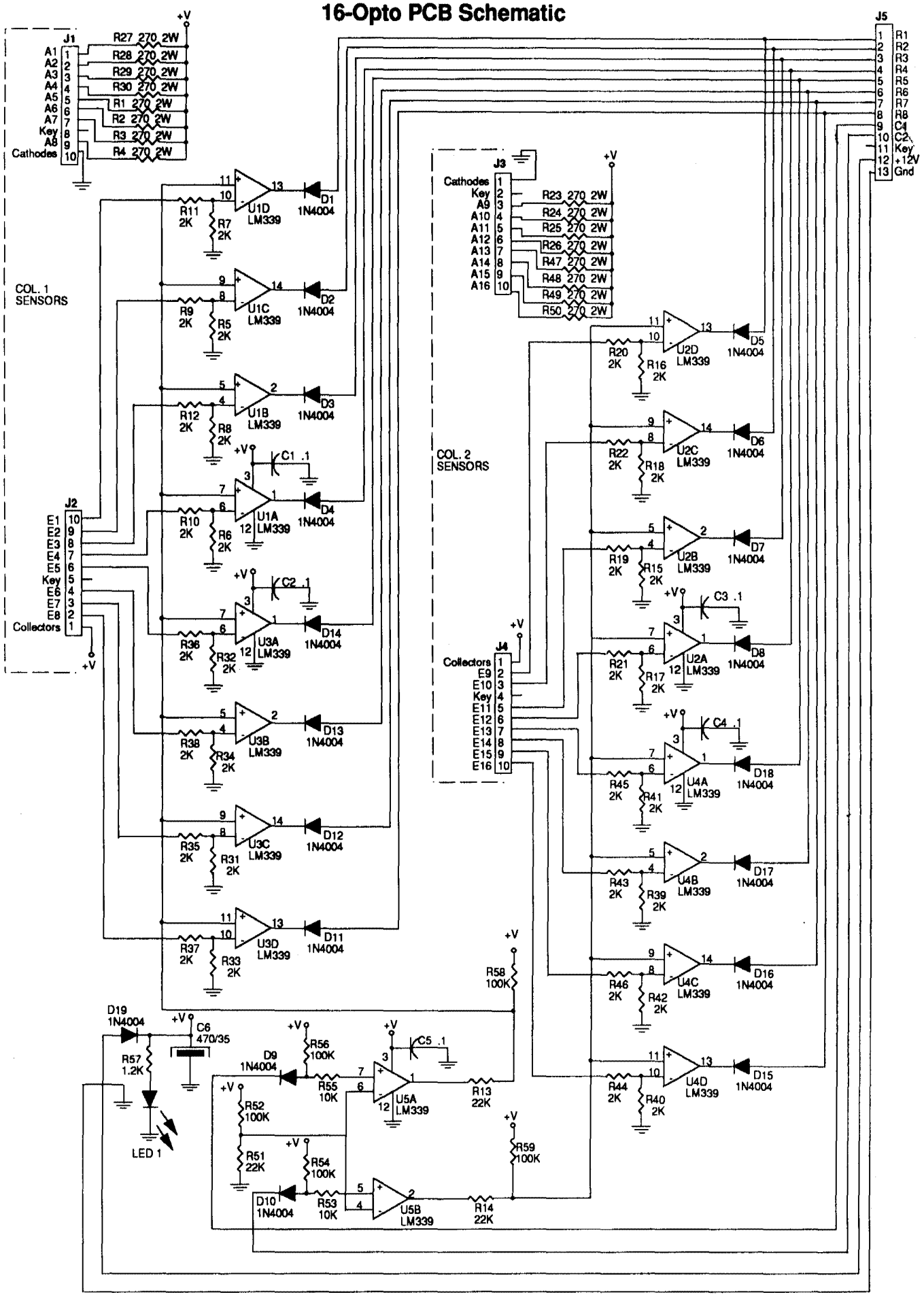
J3-1 Black, ground to LED Assemblies
J3-2 N/C
J3-3 Gray-Brown, to sw. 31 (Borg Lock)
J3-4 Gray-Red, to sw. 32 (Under Left Gun Sw. 2)
J3-5 Gray-Orange, to sw. 33 (Under Right Gun Sw. 2)
J3-6 Gray-Black, to sw. 34 (Right Gun Shooter)
J3-7 Gray-Green, to sw. 35 (Under Left Lock Sw. 2)
J3-8 Gray-Blue, to sw. 36 (Under Left Gun Sw. 1)
J3-9 Gray-Violet, to sw. 37 (Under Right Gun Sw. 1)
J3-10 Gray-White, to sw. 38 (Left Gun Shooter)

J4-1 Gray-Yellow, +12V to Photo Transistor Assemblies
J4-2 Orange-Brown, to sw. 31 (Borg Lock)
J4-3 Orange-Red, to sw. 32 (Under Left Gun Sw.2)
J4-4 N/C
J4-5 Orange-Black, to sw. 33 (Under Right Gun Sw. 2)
J4-6 Orange-Yellow, to sw. 34 (Right Gun Shooter)
J4-7 Orange-Green, to sw. 35 (Under Left Lock Sw. 2)
J4-8 Orange-Blue, to sw. 36 (Under Left Gun Sw, 1)
J4-9 Orange-Violet, to sw. 37 (Under Right Gun Sw. 1)
J4-10 Orange-White, to sw. 38 (Left Gun Shooter)

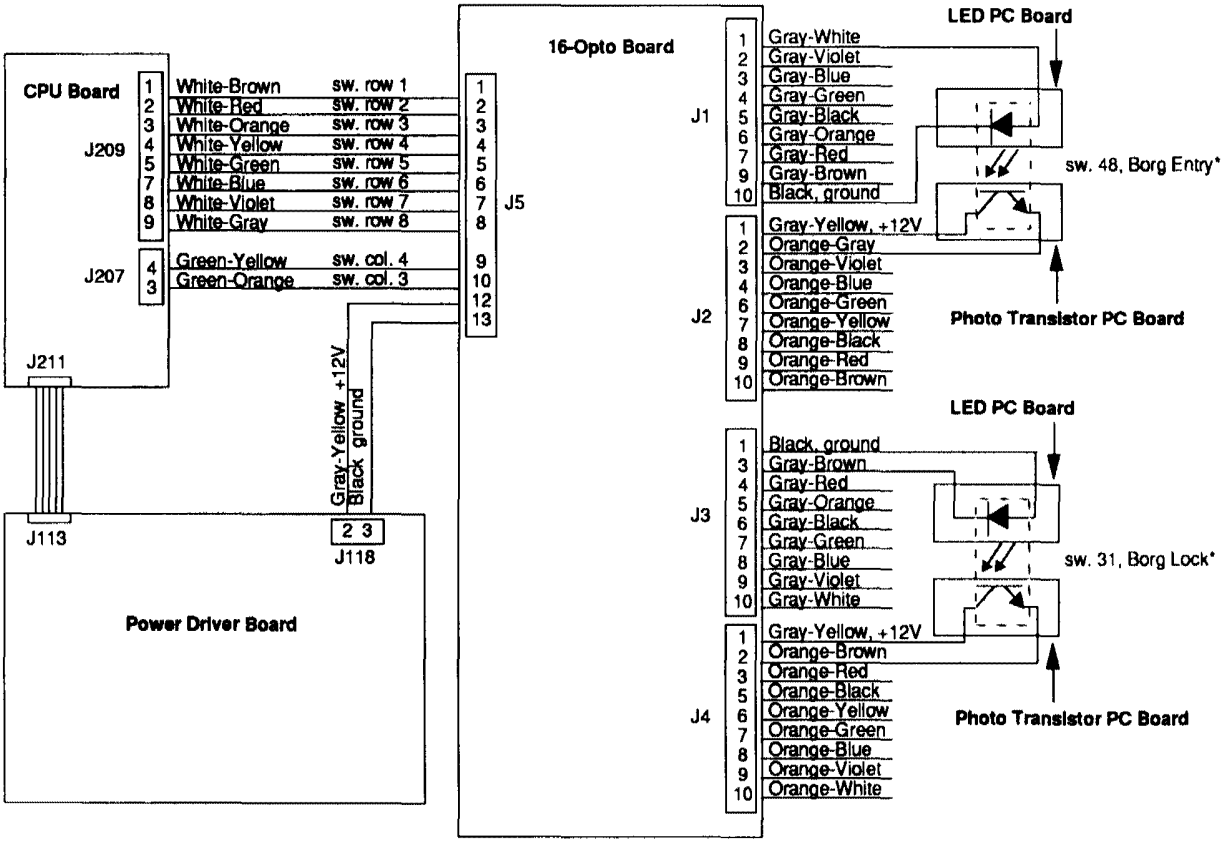
J5-1 White-Brown, sw. row 1 from CPU J209-1
J5-2 White-Red, sw. row 2 from CPU J209-2
J5-3 White-Orange, sw. row 3 from CPU J209-3
J5-4 White-Yellow, sw. row 4 from CPU J209-4
J5-5 White-Green, sw. row 5 from CPU J209-5
J5-6 White-Blue, sw. row 6 from CPU J209-7
J5-7 White-Violet, sw. row 7 from CPU J209-8
J5-8 White-Gray, sw. row 8 from CPU J209-9
J5-9 Green-Yellow, sw. col. 4 from CPU J207-4
J5-10 Green-Orange, sw. col. 3 from CPU J207-3
J5-11 N/C
J5-12 Gray-Yellow, +12V from Power Driver Board J118-2
J5-13 Black, ground from Power Driver Board J118-3

NOTE:
Photo Transistor assemblies have blue boards.
LED assemblies have green boards.

A-16998
16-Opto PCB Schematic



16-Opto PCB Assembly Switch Circuits

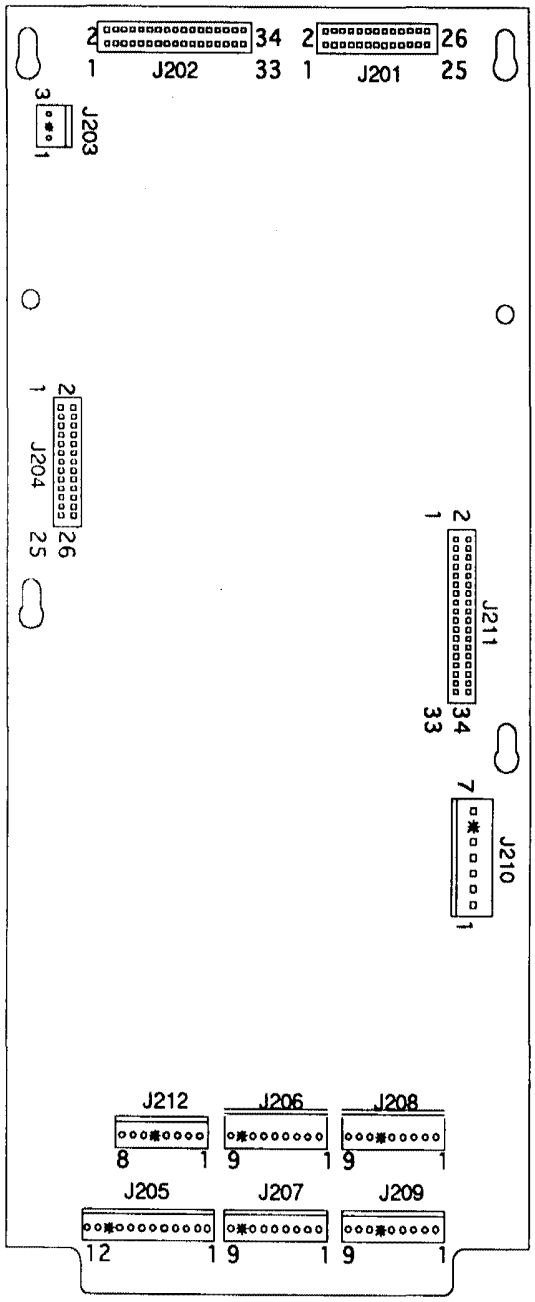


***Sample of typical circuits. Repeated for each of the 16 switches.**

NOTE:
Photo Transistor assemblies have blue boards.
LED assemblies have green boards.

Switches	Photo Transistor PCB Assembly Wire Colors		LED PCB Assembly Wire Colors	
	From J4		From J3	
#31, Borg Lock	Orange-Brown (emitter)	Gray-Yellow (collector, +12V)	Gray-Brown (anode)	Black (cathode, ground)
#32, Under Left Gun Sw. 2	Orange-Red (emitter)	Gray-Yellow (collector, +12V)	Gray-Red (anode)	Black (cathode, ground)
#33, Under Right Gun Sw. 2	Orange-Black (emitter)	Gray-Yellow (collector, +12V)	Gray-Orange (anode)	Black (cathode, ground)
#34, Right Gun Shooter	Orange-Yellow (emitter)	Gray-Yellow (collector, +12V)	Gray-Black (anode)	Black (cathode, ground)
#35, Under Left Lock Sw. 2	Orange-Green (emitter)	Gray-Yellow (collector, +12V)	Gray-Green (anode)	Black (cathode, ground)
#36, Under Left Gun Sw. 1	Orange-Blue (emitter)	Gray-Yellow (collector, +12V)	Gray-Blue (anode)	Black (cathode, ground)
#37, Under Right Gun Sw. 1	Orange-Violet (emitter)	Gray-Yellow (collector, +12V)	Gray-Violet (anode)	Black (cathode, ground)
#38, Left Gun Shooter	Orange-White (emitter)	Gray-Yellow (collector, +12V)	Gray-White (anode)	Black (cathode, ground)
	From J2		From J1	
#41, Under Left Lock Sw. 1	Orange-Brown (emitter)	Gray-Yellow (collector, +12V)	Gray-Brown (anode)	Black (cathode, ground)
#42, Under Left Lock Sw. 3	Orange-Red (emitter)	Gray-Yellow (collector, +12V)	Gray-Red (anode)	Black (cathode, ground)
#43, Under Left Lock Sw. 4	Orange-Black (emitter)	Gray-Yellow (collector, +12V)	Gray-Orange (anode)	Black (cathode, ground)
#44, Left Outer Loop	Orange-Yellow (emitter)	Gray-Yellow (collector, +12V)	Gray-Black (anode)	Black (cathode, ground)
#45, Under Top Hole	Orange-Green (emitter)	Gray-Yellow (collector, +12V)	Gray-Green (anode)	Black (cathode, ground)
#46, Under Left Hole	Orange-Blue (emitter)	Gray-Yellow (collector, +12V)	Gray-Blue (anode)	Black (cathode, ground)
#47, Under Borg Hole	Orange-Violet (emitter)	Gray-Yellow (collector, +12V)	Gray-Violet (anode)	Black (cathode, ground)
#48, Borg Entry	Orange-Gray (emitter)	Gray-Yellow (collector, +12V)	Gray-White (anode)	Black (cathode, ground)

A-12742-50023
CPU Board



J201, **26-pin Ribbon Cable,** data, To/from J602

J202, **34-pin Ribbon Cable,** data, To/from J903; P1; J601

J203-**Not Used**

J204, **26-pin Ribbon Cable,** data To/from 8-Driver Board J1

J205 - 1 Orange-Brown, ded. sw. row 1, to Coin Door Brd J1-14
J205 - 2 Orange-Red, ded. sw. row 2, to Coin Door Brd J1-13
J205 - 3 Orange-Black, ded. sw. row 3, to Coin Door Brd J1-12
J205 - 4 Orange-Yellow, ded. sw. row 4, to Coin Door J1-17
J205 - 5 N/C
J205 - 6 Orange-Green, ded. sw. row 5, to Coin Door Brd J1-11
J205 - 7 Orange-Blue, ded. sw. row 6, to Coin Door Brd J1-10
J205 - 8 Orange-Violet, ded. sw. row 7, to Coin Door Brd J1-9
J205 - 9 Orange-Gray, ded. sw. row 8, to Coin Door Brd J1-8
J205 - 10 Black, ground, to Coin Door Brd J1-15
J205 - 11 N/C
J205 - 12 Orange-White, sw. enable, to Coin Door Brd J1-18

J206-1 N/C
J206-2 N/C
J206-3 N/C
J206-4 N/C
J206-5 N/C
J206-6 N/C
J206-7 N/C
J206-8 N/C
J206-9 N/C

J207-1 Green-Brown, sw. col. 1, to playfield switches
J207-2 Green-Red, sw. col. 2, to playfield/cabinet switches
J207-3 Green-Orange, sw. col. 3, to playfield switches
J207-4 Green-Yellow, sw. col. 4, to playfield switches
J207-5 Green-Black, sw. col. 5, to playfield switches
J207-6 Green-Blue, sw. col. 6, to playfield switches
J207-7 Green-Violet, sw. col. 7, to playfield switches
J207-8 N/C
J207-9 Green-Gray, sw. col. 8, to playfield switches

J208-1 N/C
J208-2 N/C
J208-3 N/C
J208-4 N/C
J208-5 N/C
J208-6 N/C
J208-7 N/C
J208-8 N/C
J208-9 N/C

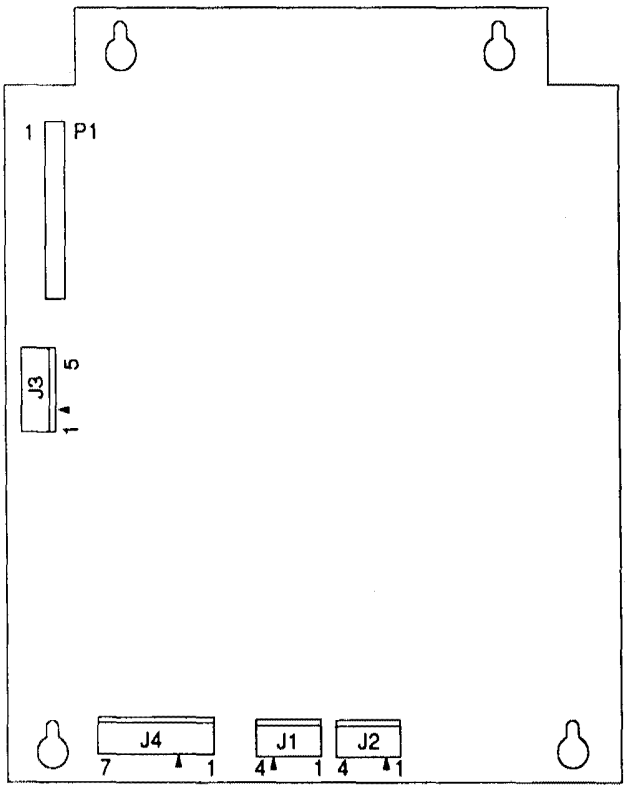
J209-1 White-Brown, sw. row 1, to playfield switches
J209-2 White-Red, sw. row 2, to playfield switches
J209-3 White-Orange, sw. row 3, to playfield switches
J209-4 White-Yellow, sw. row 4, to playfield switches
J209-5 White-Green, sw. row 5, to playfield switches
J209-6 N/C
J209-7 White-Blue, sw. row 6, to playfield switches
J209-8 White-Violet, sw. row 7, to playfield switches
J209-9 White-Gray, sw. row 8, to playfield switches

J210-1 Black, ground, from Power Driver Brd J114-5,7
J210-2 N/C
J210-3 Black, ground, from Power Driver Brd J114-5,7
J210-4 Gray, +5V, from Power Driver Brd J114-3,4
J210-5 Gray, +5V, from Power Driver Brd J114-3,4
J210-6 Gray-Green, +12V, from Power Driver Brd J114-1,2
J210-7 Gray-Green, +12V, from Power Driver Brd J114-1,2

J211, 34-pin Ribbon Cable, data, To/from J113

J212-1 Green-Brown, sw. col. 1, to Coin Door Brd J1-1
J212-2 Green-Red, sw. col. 2, to Coin Door J1-7
J212-3 N/C
J212-4 White-Brown, sw. row 1, to Coin Door Brd J1-6
J212-5 N/C
J212-6 White-Red, sw. row 2, to Coin Door Brd J1-5
J212-7 White-Orange, sw. row 3, Coin Door Brd J1-4
J212-8 White-Yellow, sw. row 4, to Coin Door Brd J1-3

A-16917-50023
Audio Board



P1, 34-pin Ribbon Cable, data, To/from J601; J903; J202

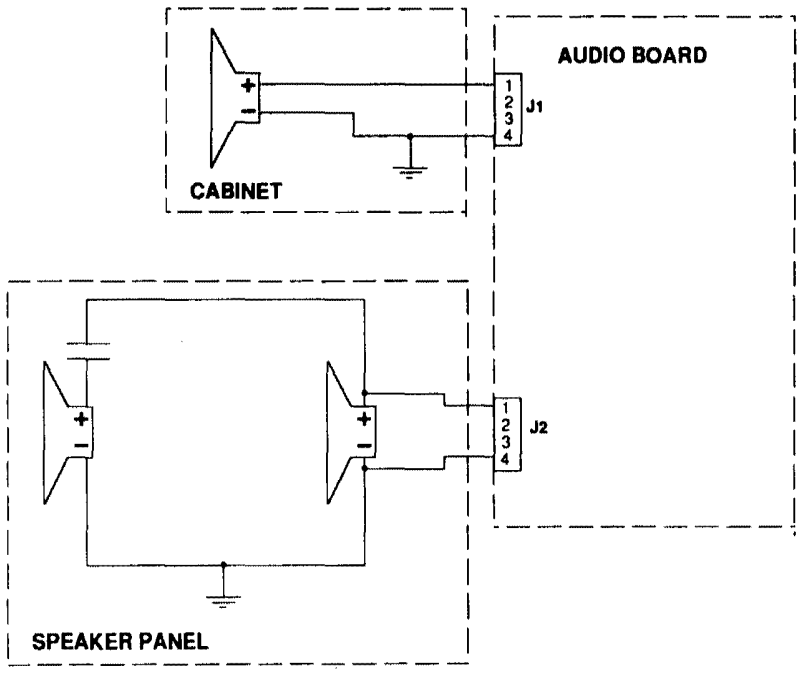
J1-1 Black-Yellow, signal to speaker
J1-2 N/C
J1-3 N/C
J1-4 Black-Yellow, signal to speaker

J2-1 Black-Yellow, signal to speaker
J2-2 N/C
J2-3 N/C
J2-4 Black-Yellow, signal to speaker

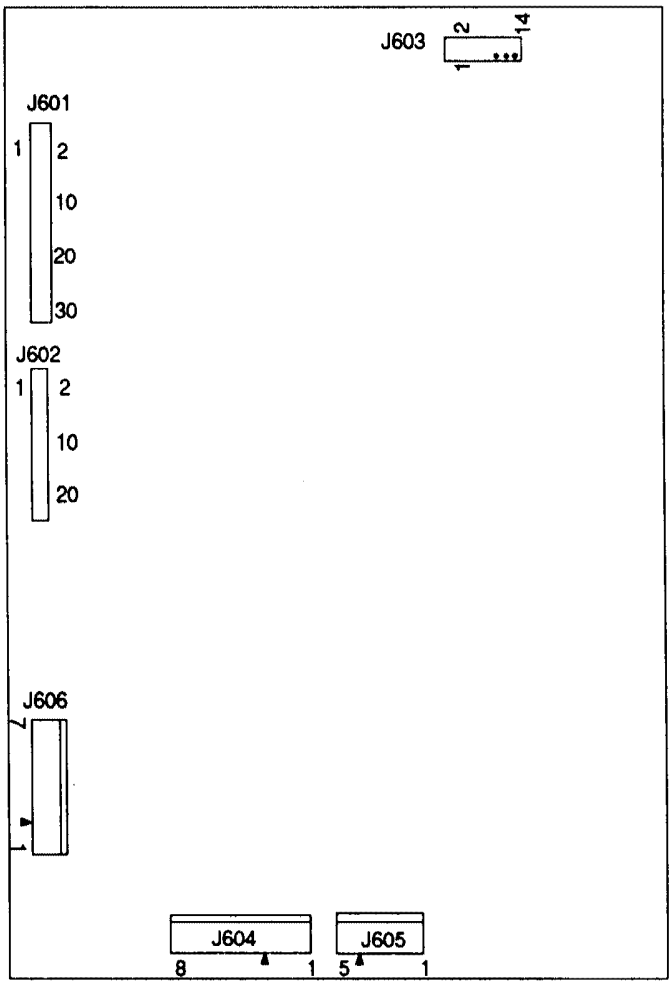
J3-1 Gray, +5V, from Power Driver Board J114-3,4
J3-2 N/C
J3-3 Gray, +5V, from Power Driver Board J114-3,4
J3-4 Black, ground, from Power Driver Board J114-5,7
J3-5 Black, ground, from Power Driver Board J114-5,7

J4-1 Gray-Green, 18VAC, from xformer secondary
J4-2 Gray-Green, 18VAC, loop from J4-1
J4-3 N/C
J4-4 Gray, 18VAC, from xformer secondary
J4-5 Gray, 18VAC, loop from J4-4
J4-6 Gray-White, 18VAC, from xformer secondary
J4-7 Gray-White, 18VAC, loop from J4-6

SPEAKER WIRING DIAGRAM



A-14039
Dot Matrix Controller Board



J601, 34-pin Ribbon Cable data, To/from J202; J903; P1

J602, 26-pin Ribbon Cable data, To/from J201

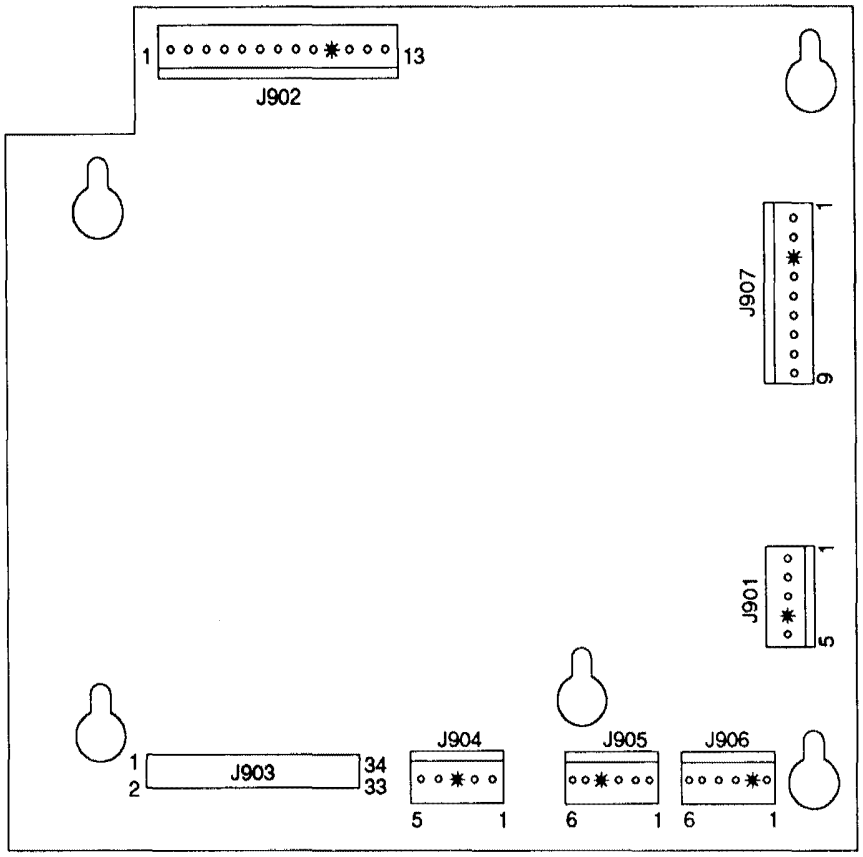
J603, 14-pin Ribbon Cable data, To/from Dot Matrix Display/Driver

J604-1 Orange, -125V, to Display/Driver pin 1
J604-2 Blue, -113V, to Display/Driver pin 2
J604-3 N/C
J604-4 Black, ground, to Display/Driver pin 4
J604-5 Black, ground, to Display/Driver pin 5
J604-6 Gray, +5V, to Display/Driver pin 6
J604-7 Gray-Yellow, +12V, to Display/Driver pin 7
J604-8 Brown, +62V, to Display/Driver pin 8

J605-1 White, 80VAC, from xformer secondary
J605-2 White, 80VAC, from xformer secondary
J605-3 Violet, 100VAC, from xformer secondary
J605-4 N/C
J605-5 Violet 100VAC, from xformer secondary

J606-1 Black, ground, loop from J606-3
J606-2 N/C
J606-3 Black, ground, from Power Driver Brd J117-3
J606-4 Gray, +5V, loop from J606-5
J606-5 Gray, +5V, from Power Driver Brd J117-4
J606-6 Gray-Yellow, +12V, loop from J606-7
J606-7 Gray-Yellow, +12V, from Power Driver Brd J117-2

A-15472-1
Fliptronic II Board



J901-1 White-Blue, 50VAC, from Power Driver Board J104-2
J901-2 White-Blue, 50VAC, loop from J901-1
J901-3 White-Blue, 50VAC, from Power Driver Board J104-1
J901-4 N/C
J901-5 White-Blue, 50VAC, loop from J901-3

J902-1 N/C
J902-2 N/C
J902-3 N/C
J902-4 Orange-Violet, holding, upper right flipper coil
J902-5 N/C
J902-6 Black-Yellow, power, upper right flipper coil
J902-7 Orange-Blue, holding, lower left flipper coil
J902-8 N/C
J902-9 Blue-Gray, power, lower left flipper coil
J902-10 N/C
J902-11 Orange-Green, holding, lower right flipper coil
J902-12 N/C
J902-13 Blue-Violet, power, lower right flipper coil

J903, 34-pin Ribbon Cable, data, To/from J202; J601; P1

J904-1 Gray, +5V, from Power Driver Board J114-3,4
J904-2 Gray-Green, +12V, from Power Driver Board J114-1,2
J904-3 N/C
J904-4 Black, ground, from Power Driver Board J114-5,7
J904-5 Black, ground, from Power Driver Board J114-5,7

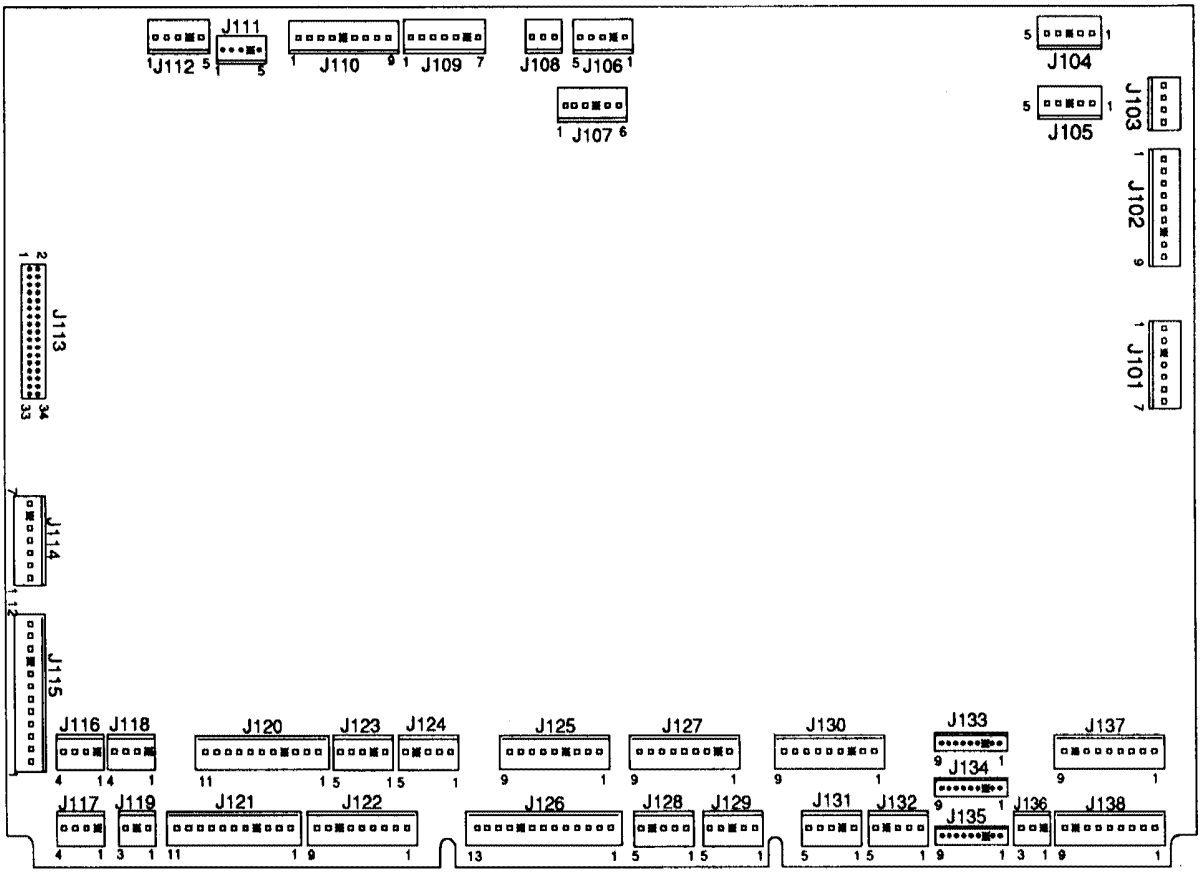
J905-1 Blue-Violet, F2, to right flipper opto switch board J1-1
J905-2 Blue-Gray, F4, to left flipper opto switch board J1-1
J905-3 Black-Yellow, F6, to right flipper opto switch board J1-2
J905-4 N/C
J905-5 Black-Blue , F8, to left flipper opto switch board J1-2
J905-6 Orange, ground, to left flipper opto switch board J1-3

J906-1 Black-Green, F1, to lower right EOS switch
J906-2 N/C
J906-3 Black-Blue, F3, to lower left EOS switch
J906-4 Black-Violet, F5, to upper right EOS switch
J906-5 Black-Gray, F7, to Spinner playfield switch
J906-6 Orange, ground, to EOS switches

J907-1 Blue-Yellow, +50V, to upper right flipper coil
J907-2 Blue-Yellow, +50, loop from J907-1
J907-3 N/C
J907-4 N/C
J907-5 N/C
J907-6 Blue-Yellow, +50V, to lower right flipper coil
J907-7 Blue-Yellow, +50V, loop from J907-6
J907-8 Gray-Yellow, +50V, to lower left flipper coil
J907-9 Gray-Yellow, +50V, loop from J907-8

NOTE: In this game, F7, which is normally used as the upper left EOS switch, is used as the Spinner playfield switch instead.

A-12697-3
Power Driver Board



J101-1 Red, 9VAC, from xformer secondary
J101-2 Red, 9VAC, from xformer secondary
J101-3 N/C
J101-4 Blue-White, 13VAC, from xformer secondary
J101-5 Blue-White, 13VAC, loop from J101-4
J101-6 Blue-White, 13VAC, from xformer secondary
J101-7 Blue-White, 13VAC, loop from J101-6

J102-1 White-Red, 16VAC, loop from J102-2
J102-2 White-Red, 16VAC, from xformer secondary
J102-3 White-Red, 16VAC, loop from J102-4
J102-4 White-Red, 16VAC, from xformer secondary
J102-5 Black-Yellow, 16VAC, loop from J102-6
J102-6 Black-Yellow, 16VAC, from xformer secondary
J102-7 N/C
J102-8 Black-Yellow, 16VAC, loop from J102-9
J102-9 Black-Yellow, 16VAC, from xformer secondary

J103-1 Black, ground, to 8-Driver Brd J2-4
J103-2 Black, ground, to 8-Driver Brd J2-5
J103-3 N/C
J103-4 N/C

J104-1 White-Blue, 50VAC, to Fliptronic II Board J901-3
J104-2 White-Blue, 50VAC, to Fliptronic II Board J901-1
J104-3 N/C
J104-4 N/C
J104-5 N/C

J105-1 N/C
J105-2 N/C
J105-3 N/C
J105-4 N/C
J105-5 N/C

J106-1 N/C
J106-2 N/C
J106-3 N/C
J106-4 N/C
J106-5 Red-White, +20V, to backbox flashlamps

J107-1 Violet-Green, +50V, to coils
J107-2 Violet-Orange, +50V, to coils
J107-3 Violet-Yellow, +50V, to coils
J107-4 N/C
J107-5 N/C
J107-6 Red-White, +20V, to playfield

J108-1 N/C
J108-2 N/C
J108-3 N/C

J109-1 N/C
J109-2 N/C
J109-3 N/C
J109-4 N/C
J109-5 N/C
J109-6 N/C
J109-7 N/C

Power Driver Board Continued...

J110-1 N/C
J110-2 N/C
J110-3 N/C
J110-4 N/C
J110-5 N/C
J110-6 N/C
J110-7 N/C
J110-8 N/C
J110-9 N/C

J111-1 N/C
J111-2 N/C
J111-3 N/C
J111-4 N/C
J111-5 N/C

J112-1 White-Green, 9.8VAC, from xformer secondary
J112-2 White-Green, 9.8VAC, loop from J112-1
J112-3 White-Green, 9.8VAC, from xformer secondary
J112-4 N/C
J112-5 White-Green, 9.8VAC, loop from J112-3

J113, 34-pin Ribbon Cable, data, To/from CPU J211

J114-1 Gray-Green, +12V, to J210-6,7; J904-2
J114-2 Gray-Green, +12V, to 8-Driver Brd. J2-6
J114-3 Gray, +5V, to 8-Driver Brd. J2-3
J114-4 Gray, +5V, to J210-4,5; J3-1,3; J904-1
J114-5 Black-White, ground, to J210-1,3; J3-4,5; J904-4,5
J114-6 N/C
J114-7 Black-White, ground, to 8-Driver Brd. J2-1

J115-1 Yellow-White, 6.8VAC, from xformer secondary
J115-2 White-Brown, 6.8VAC, from xformer secondary
J115-3 White-Brown, 6.8VAC, from xformer secondary
J115-4 White-Orange, 6.8VAC, from xformer secondary
J115-5 White-Yellow, 6.8VAC, from xformer secondary
J115-6 White-Yellow, 6.8VAC, from xformer secondary
J115-7 Orange, 6.8VAC, from xformer secondary
J115-8 Orange, 6.8VAC, from xformer secondary
J115-9 N/C
J115-10 Green, 6.8VAC, from xformer secondary
J115-11 Brown, 6.8VAC, from xformer secondary
J115-12 Brown, 6.8VAC, from xformer secondary

J116-1 N/C
J116-2 Gray-Yellow, +12V, to Coin Door J2-4
J116-3 Black, ground, to Coin Door J2-5
J116-4 N/C

J117-1 N/C
J117-2 Gray-Yellow, +12V, to Dot Matrix Controller J606-7
J117-3 Black, ground, to Dot Matrix Controller J606-3
J117-4 Gray, +5V, to Dot Matrix Controller J606-5

J118-1 N/C
J118-2 Gray-Yellow, +12V, to playfield boards
J118-3 Black, ground, to playfield boards
J118-4 N/C

J119-1 White-Violet, 6.8VAC, G.I. to Coin Door Brd J2-2
J119-2 N/C
J119-3 Violet, return, G.I. to Coin Door Brd J2-1

J120-1 N/C
J120-2 Orange, return, G.I. to backbox
J120-3 Yellow, return, G.I. to backbox
J120-4 N/C
J120-5 N/C
J120-6 N/C
J120-7 N/C
J120-8 White-Orange, 6.8VAC, G.I. to backbox
J120-9 White-Yellow, 6.8VAC, G.I. to backbox
J120-10 N/C
J120-11 N/C

J121-1 Brown, return, G.I. to playfield
J121-2 N/C
J121-3 N/C
J121-4 N/C
J121-5 Green, return, G.I. to playfield
J121-6 Violet, return, G.I. to playfield
J121-7 White-Brown, 6.8VAC, G.I. to playfield
J121-8 N/C
J121-9 N/C
J121-10 White-Green, 6.8VAC, G.I. to playfield
J121-11 White-Violet, 6.8VAC, G.I. to playfield

J122-1 Blue-Brown, sol. 25 drive, to playfield flashlamp
J122-2 Blue-Red, sol. 26 drive, to playfield flashlamp
J122-3 Blue-Orange, sol. 27 drive, to playfield flashlamp
J122-4 Blue-Yellow, sol. 28 drive, to playfield flashlamp
J122-5 N/C
J122-6 N/C
J122-7 N/C
J122-8 N/C
J122-9 N/C

J123-1 N/C
J123-2 N/C
J123-3 N/C
J123-4 N/C
J123-5 N/C

J124-1 Blue-Brown, sol. 25 drive, to backbox flashlamp
J124-2 Blue-Red, sol. 26 drive, to backbox flashlamp
J124-3 Blue-Orange, sol. 27 drive, to backbox flashlamp
J124-4 N/C
J124-5 Blue-Yellow, sol. 28 drive, to backbox flashlamp

J125-1 N/C
J125-2 N/C
J125-3 N/C
J125-4 N/C
J125-5 N/C
J125-6 Blue-Green, sol. 21 drive, to backbox flashlamp
J125-7 N/C
J125-8 Blue-Violet, sol. 23 drive, to backbox flashlamp
J125-9 N/C

Power Driver Board Continued...

J126-1 Black-Brown, sol 17 drive, to left EMI Board. J1-1
J126-2 Black-Red, sol. 18 drive, to right EMI Board J1-1
J126-3 Black-Orange, sol. 19 drive, to playfield flashlamps
J126-4 Black-Yellow, sol. 20 drive, to playfield flashlamps
J126-5 Blue-Green, sol. 21 drive, to playfield flashlamps
J126-6 Blue-Black, sol. 22 drive, to playfield flashlamps
J126-7 Blue-Violet, sol. 23 drive, to playfield flashlamps
J126-8 Blue-Gray, sol. 24 drive, to playfield flashlamps
J126-9 N/C
J126-10 N/C
J126-11 N/C
J126-12 N/C
J126-13 N/C

J127-1 Brown-Black, sol. 9 drive, to playfield coil
J127-2 N/C
J127-3 Brown-Red, sol. 10 drive, to playfield coil
J127-4 Brown-Orange, sol. 11 drive, to playfield coil
J127-5 Brown-Yellow, sol. 12 drive, to playfield coil
J127-6 Brown-Green, sol. 13 drive, to playfield coil
J127-7 Brown-Blue, sol. 14 drive, to playfield coil
J127-8 Brown-Violet, sol. 15 drive, to playfield coil
J127-9 Brown-Gray, sol.16 drive, to playfield coil

J128-1 N/C
J128-2 N/C
J128-3 N/C
J128-4 N/C
J128-5 N/C

J129-1 N/C
J129-2 N/C
J129-3 N/C
J129-4 N/C
J129-5 N/C

J130-1 Violet-Brown, sol. 1 drive, to playfield coil
J130-2 Violet-Red, sol. 2 drive, to playfield coil
J130-3 N/C
J130-4 Violet-Orange, sol. 3 drive, to playfield coil
J130-5 Violet-Yellow, sol.4 drive, to playfield coil
J130-6 Violet-Green, sol. 5 drive, to playfield coil
J130-7 Violet-Blue, sol. 6 drive, to playfield coil
J130-8 Violet-Black, sol.7 drive, to playfield coil
J130-9 Violet-Gray, sol. 8 drive, to playfield coil

J131-1 N/C
J131-2 N/C
J131-3 N/C
J131-4 N/C
J131-5 N/C

J132-1 N/C
J132-2 N/C
J132-3 N/C
J132-4 N/C
J132-5 N/C

J133-1 N/C
J133-2 N/C
J133-3 N/C
J133-4 N/C
J133-5 N/C
J133-6 N/C
J133-7 Red-Blue, lamp row 6, not used
J133-8 Red-Violet, lamp row 7, to cabinet
J133-9 Red-Gray, lamp row 8, to cabinet

J134-1 N/C
J134-2 N/C
J134-3 N/C
J134-4 N/C
J134-5 N/C
J134-6 N/C
J134-7 N/C
J134-8 N/C
J134-9 N/C

J135-1 Red-Brown, lamp row 1, to playfield lamps
J135-2 Red-Black, lamp row 2, to playfield lamps
J135-3 N/C
J135-4 Red-Orange, lamp row 3, to playfield lamps
J135-5 Red-Yellow, lamp row 4, to playfield lamps
J135-6 Red-Green, lamp row 5, to playfield lamps
J135-7 Red-Blue, lamp row 6, to playfield lamps
J135-8 Red-Violet, lamp row 7, to playfield lamps
J135-9 Red-Gray, lamp row 8, to playfield lamps

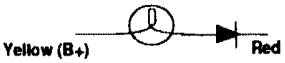
J136-1 N/C
J136-2 N/C
J136-3 Yellow-Gray, lamp column 8, to cabinet

J137-1 N/C
J137-2 N/C
J137-3 N/C
J137-4 N/C
J137-5 N/C
J137-6 N/C
J137-7 N/C
J137-8 N/C
J137-9 N/C

J138-1 Yellow-Brown, lamp column 1, to playfield lamps
J138-2 Yellow-Red, lamp column 2, to playfield lamps
J138-3 Yellow-Orange, lamp column 3, to playfield lamps
J138-4 Yellow-Black, lamp column 4, to playfield lamps
J138-5 Yellow-Green, lamp column 5, to playfield lamps
J138-6 Yellow-Blue, lamp column 6, to playfield lamps
J138-7 Yellow-Violet, lamp column 7, to playfield lamps
J138-8 N/C
J138-9 Yellow-Gray, lamp column 8, to playfield lamps

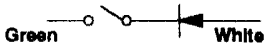
NOTES

LAMPS



Row \ Column	1 Yellow-Brown J137-1 Q98	2 Yellow-Red J137-2 Q97	3 Yellow-Orange J137-3 Q96	4 Yellow-Black J137-4 Q95	5 Yellow-Green J137-5 Q94	6 Yellow-Blue J137-6 Q93	7 Yellow-Violet J137-7 Q92	8 Yellow-Gray J137-9 Q91
1 Red-Brown J133-1 Q90	Left Bank Top 11	Ship Mode 3 21	Top Lane Left 31	Q 41	Left Return Lane 51	Generic 3 61	Generic 2 71	Right Return Lanes 81
2 Red-Black J133-2 Q89	Left Bank Middle 12	Ship Mode 4 22	Top Lane Center 32	Generic 1 42	Left Launcher 52	Increase Warp 62	Top 3-bank Left 72	Right Launcher 82
3 Red-Orange J133-4 Q88	Ship Mode 1 13	Ship Mode 5 23	Top Lane Right 33	Right Lock 43	Advance in Rank 53	Spinner 63	Top 3-bank Center 73	Million Jets 83
4 Red-Yellow J133-5 Q87	Ship Mode 2 14	Right Bank Top 24	Bonus 2X 34	Holodeck 44	Generic 6 54	Generic 7 64	Top 3-bank Right 74	Kickback 84
5 Red-Green J133-6 Q86	Left Bank Bottom 15	Right Bank Middle 25	Bonus 4X 35	Right 2x Shuttle 45	Super 55	Left Millions 65	Left Lock 75	Borg Lock 85
6 Red-Blue J133-7 Q85	Final Frontier 16	Command Decision 26	Multipliers Held 36	Generic 4 46	Jackpot 56	Jackpot X 66	Generic 5 76	Borg Jackpot 86
7 Red-Violet J133-8 Q84	Shoot Again 17	Ship Mode 6 27	Bonus 8X 37	Right Millions 47	Extra Ball 57	Rift 67	Worm Hole 77	Buy-in 87
8 Red-Gray J133-9 ~~Q83~~	Ship Mode 7 18	Right Bank Bottom 28	Bonus 10X 38	Left 2X Shuttle 48	Start Mission 58	Time 68	Borg Ship 78	Start Button 88

SWITCHES



Dedicated Grounded Switches	Row \ Column	1 Green-Brown J207-1 U20-18	2 Green-Red J207-2 U20-17	3 Green-Orange J207-3 U20-16	4 Green-Yellow J207-4 U20-15	5 Green-Black J207-5 U20-14	6 Green-Blue J207-6 U20-13	7 Green-Violet J207-7 U20-12	8 Green-Gray J207-9 U20-11	9 Violet-White Q11 J5-1	Flipper Grounded Switches
Orange-Brown J205-1 Left Coin Chute D1	1 White-Brown J209-1 U18-11	Buy-in Button 11	Slam Tilt 21	Borg Lock 31	Under L. Lock Sw. 1 41	L. Bank Top 51	Trough L.R. 1 61	Left Jet 71	Time 81	Not Used 91	Black-Green J906-1 Lower Right E.O.S. F1
Orange-Red J205-2 Center Coin Chute D2	2 White-Red J209-2 U18-9	Right Fire Button 12	Coin Door Closed 22	Under L. Gun Sw. 2 32	Under L. Lock Sw. 3 42	L. Bank Middle 52	Trough L.R. 2 62	Right Jet 72	Rift 82	Left Gun Mark 92	Blue-Violet J905-1 Lower Right Opto F2
Orange-Black J205-3 Right Coin Chute D3	3 White-Orange J209-3 U18-5	Start Button 13	Made Middle Ramp 23	Under R. Gun Sw. 2 33	Under L. Lock Sw. 4 43	L. Bank Bottom 53	Trough L.R. 3 63	Bottom Jet 73	Made Left Ramp 83	Not Used 93	Black-Blue J906-3 Lower Left E.O.S. F3
Orange-Yellow J205-4 4th Coin Chute D4	4 White-Yellow J209-4 U18-7	Plumb Bob Tilt 14	Always Closed 24	Right Gun Shooter 34	Left Outer Loop 44	R. Bank Top 54	Trough L.R. 4 64	Right Sling 74	Q 84	Not Used 94	Blue-Gray J905-2 Lower Left Opto F4
Orange-Green J205-6 Normal Function Service Credits | Test Function Escape D5	5 White-Green J209-5 U19-11	Left Outlane 15	Enter Right Ramp 25	Under L. Lock Sw. 2 35	Under Top Hole 45	R. Bank Middle 55	Trough L.R. 5 65	Left Sling 75	Left 2X Shuttle 85	Right Gun Home 95	Black-Violet J906-4 Upper Right E.O.S. F5
Orange-Blue J205-7 Normal Function Volume Down | Test Function Down D6	6 White-Blue J209-7 U19-9	Left Return Lane 16	Left 45° Target 26	Under L. Gun Sw. 1 36	Under Left Hole 46	R. Bank Bottom 56	Trough L.R. 6 66	Top Lane Left 76	Right 2X Shuttle 86	Right Gun Mark 96	Black-Yellow J905-3 Upper Right Opto F6
Orange-Violet J205-8 Normal Function Volume Up | Test Function Up D7	7 White-Violet J209-8 U19-5	Right Return Lane 17	Center 45° Target 27	Under R. Gun Sw. 1 37	Under Borg Hole 47	Top Drop Target 57	Trough Up 67	Top Lane Center 77	Made Right Ramp 87	Left Gun Home 97	Black-Gray J906-5 Spinner* F7
Orange-Gray J205-9 Normal Function Begin Test | Test Function Enter D8	8 White-Gray J209-9 U19-7	Right Outlane 18	Right 45° Target 28	Left Gun Shooter 38	Borg Entry 48	Right Outer Loop 58	Shooter 68	Top Lane Right 78	Enter Left Ramp 88	Not Used 98	Black-Blue J905-5 Not Used F8

Note: Used as switches other than flipper switches in this game. ▨ = Opto Switch

WARNINGS & NOTICES

WARNING

FOR SAFETY AND RELIABILITY, substitute parts and equipment modifications are not recommended. Use of Non-WILLIAMS parts or modifications of game circuitry, may adversely affect game play, or may cause injuries.

SUBSTITUTE PART OR EQUIPMENT MODIFICATIONS may void FCC Type Acceptance.

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WARNING

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generated, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Interference Notice

CABLE HARNESS PLACEMENTS and ground strap routing on this game have been designed to keep RF radiation and conduction within levels accepted by the FCC Rules.

TO MAINTAIN THESE LEVELS, reposition harnesses and reconnect ground straps to their original placements, if they become disconnected during maintenance.

FCC STICKER. Check the back of your game to verify that an FCC-certification sticker was attached to your game at the factory. All games that leave the WILLIAMS plant have been tested and found to comply with FCC Rules. Because the sticker is proof of this fact, legal repercussions to the owner and distributor may result, if the sticker is missing. If you receive a game, manufactured after December 1982, that has no FCC sticker, call WILLIAMS for advice or write us a note on your Game Registration Card. Be sure that the card bears your game's serial number.

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Television Series Theme Music
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⚠ CAUTION **Transport this game ONLY with hinged backbox DOWN!**

FOR SERVICE... CALL your authorized WILLIAMS Distributor.