

Bally

NOVEMBER 1995

16-50041A-101

PRELIMINARY

ATTACK FROM MARS™

Operations Manual Includes:

Operations & Adjustments • Testing & Problem Diagnosis • Parts Information •
Reference Diagrams & Schematics

Midway Manufacturing Company, 3401 North California Avenue, Chicago, Illinois 60618

DIP SWITCH SETTINGS AND JUMPERS

EPROM Jumper Settings for U6	W1	W2
1MEG, 2MEG, 4 MEG EPROM	In	Out

Dip Switch Chart

Country	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
America	Off	Off	On	On	On	On	On	On
Euopean	Off	Off	On	On	On	Off	On	On
French	Off	Off	On	On	On	On	Off	Off
German	Off	Off	On	On	On	On	On	Off
Spain	Off	Off	On	On	Off	On	On	On

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	AUTO PLUNGER	High Power	J133-2			Q72	J116-1			Vio-Brn	AE-23-800	
02	TROUGH EJECT	High Power	J133-2			Q68	J116-2			Vio-Red	AE-26-1500	
03	LEFT POPPER	High Power	J133-2			Q71	J116-4			Vio-Org	AE-26-800	
04	RIGHT POPPER	High Power	J133-2			Q67	J116-5			Vio-Yel	AE-25-1000	
05	LEFT ALIEN LOW	High Power	J133-2			Q70	J116-6			Vio-Grm	AE-26-1500	
06	LEFT ALIEN HIGH	High Power	J133-2			Q66	J116-7			Vio-Blu	AE-26-1500	
07	KNOCKER	High Power		J133-2		Q69		J116-8		Vio-Blk		AE-23-800
08	RIGHT ALIEN HIGH	High Power	J133-2			Q65	J116-9			Vio-Gry	AE-26-1500	
09	LEFT SLINGSHOT	Low Power	J133-3			Q44	J113-1			Bm-Blk	AE-26-1200	
10	RIGHT SLINGSHOT	Low Power	J133-3			Q48	J113-3			Bm-Red	AE-26-1200	
11	LEFT JET	Low Power	J133-3			Q43	J113-4			Bm-Org	AE-26-1200	
12	BOTTOM JET	Low Power	J133-3			Q47	J113-5			Bm-Yel	AE-26-1200	
13	RIGHT JET	Low Power	J133-3			Q42	J113-6			Bm-Grm	AE-26-1200	
14	RIGHT ALIEN LOW	Low Power	J133-3			Q46	J113-7			Bm-Blu	AE-26-1500	
15	SAUCER SHAKE	Low Power	J133-3			Q41	J113-8			Bm-Vio	AE-26-1500	
16	DROP TARGET	Low Power	J133-3			Q45	J113-9			Bm-Gry	AE-26-1200	
17	RIGHT RAMP HIGH (2)	Flasher	J133-6	J134-5		Q28	J111-1	J112-1		Blk-Brn	#906	#906
18	RIGHT RAMP LOW (2)	Flasher	J133-6	J134-5		Q32	J111-2	J112-2		Blk-Red	#906	#906
19	RIGHT SIDE HIGH (2)	Flasher	J133-6	J134-5		Q27	J111-3	J112-3		Blk-Org	#906	#906
20	RIGHT SIDE LOW	Flasher	J133-6			Q31	J111-4			Blk-Yel	#89	
21	CENTER ARROW	Flasher	J133-6			Q26	J111-5			Blu-Grm	#906	
22	JETS	Flasher	J133-6			Q30	J111-6			Blu-Blk	#89	
23	SAUCER DOME	Flasher	J133-6			Q25	J111-7			Blu-Vio	#906	
24	MOTOR BANK	Flasher	J140-2			Q29	J111-8			Blu-Gry	14-8023	
25	LEFT RAMP LEFT (2)	Gen. Purpose	J133-6	J134-5		Q16	J109-1	J107-1		Blu-Brn	#906	#906
26	LEFT RAMP RIGHT (2)	Gen. Purpose	J133-6	J134-5		Q15	J109-2	J107-3		Blu-Red	#906	#906
27	LEFT SIDE HIGH (2)	Gen. Purpose	J133-6	J134-5		Q14	J109-3	J107-4		Blu-Org	#906	#906
28	LEFT SIDE LOW	Gen. Purpose	J133-6			Q13	J109-4			Blu-Yel	#89	
33	RIGHT GATE	High Power	J119-6,7			Q84	J120-6			Yel-Vio	A-14406	
34	LEFT GATE	Low Power	J119-6,7			Q86	J120-4			Org-Vio	A-14406	
35	DIVERTER POWER	High Power	J119-8,9			Q81	J120-3			Yel-Gry	A-20099	
36	DIVERTER HOLD	Low Power	J119-8,9			Q83	J120-1			Org-Gry	A-20099	
37	L.E.D. CLOCK	Flasher	J140-2				J110-1			Bm-Wht	A-20670	
38	L.E.D. DATA	Flasher	J140-2				J110-3			Vio-Wht	A-20670	
39	STROBE LIGHT	Flasher	J140-2				J110-4			Org-Wht	A-20718	
General Illumination												
01	BOTTOM PLAYFIELD	G.I.	J106-1	J106-1		Q5	J106-7	J106-7		Wht-Brn	#44	#555
02	MIDDLE PLAYFIELD	G.I.	J106-2			Q4	J106-8			Wht-Org	#44, #555	
03	TOP PLAYFIELD	G.I.	J106-3			Q3	J106-9			Wht-Yel	#44, #555	
Flipper Circuits												
			Voltage Connections		Drive Transistors	Drive Connectors		Drive Wire Colors		Coil Part No.	Coil Color	
			Playfield	Hold		Playfield	Hold	Power	Hold			
29		Lwr. Rt. Power	J119-1 (Red-Gm)	Q90		J120-13	Yel-Grm					
30	Lower Right Flipper	Lwr. Rt. Hold	J119-1 (Red-Gm)	Q92		J120-11	Org-Grm			FL-11629	BLUE	
31		Lwr. Lt. Power	J119-4 (Red-Blu)	Q87		J120-9	Yel-Blu					
32	Lower Left Flipper	Lwr. Lt. Hold	J119-4 (Red-Blu)	Q89		J120-7	Org-Blu			FL-11629	BLUE	
33		Upr. Rt. Power	J119-6 (Red-Vio)	Q84		J120-6	Yel-Vio			SEE	ABOVE	
34	Upper Right Flipper	Upr. Rt. Hold	J119-6 (Red-Vio)	Q86		J120-4	Org-Vio			SEE	ABOVE	
35		Upr. Lt. Power	J119-8 (Red-Gry)	Q81		J120-3	Yel-Gry			SEE	ABOVE	
36	Upper Left Flipper	Upr. Lt. Hold	J119-8 (Red-Gry)	Q83		J120-1	Org-Gry			SEE	ABOVE	

J1xx=Power Driver Board; 24-6549=#44 bulb; 24-8704=#89 bulb; 24-8768=#555 bulb; 24-8802=#906 bulb

EPILEPSY WARNING

A very small portion of the population has a condition which may cause them to experience epileptic seizures or have momentary loss of consciousness when viewing certain kinds of flashing lights or patterns that are commonly present in our daily environment. These persons may experience seizures while watching some kinds of television pictures, playing certain video games or witnessing certain flashing light patterns. People who have not had any previous seizures may nonetheless have an undetected epileptic condition.

If you or anyone in your family has experienced symptoms linked to an epileptic condition (e.g. seizure or loss of awareness), immediately consult your physician before using this game.

We recommend that parents observe their children while they play this game. If you or your child experience any of the following symptoms: dizziness, altered vision, eye or muscle twitching, involuntary movements, loss of awareness, disorientation, or convulsions, DISCONTINUE USE IMMEDIATELY and consult your physician.

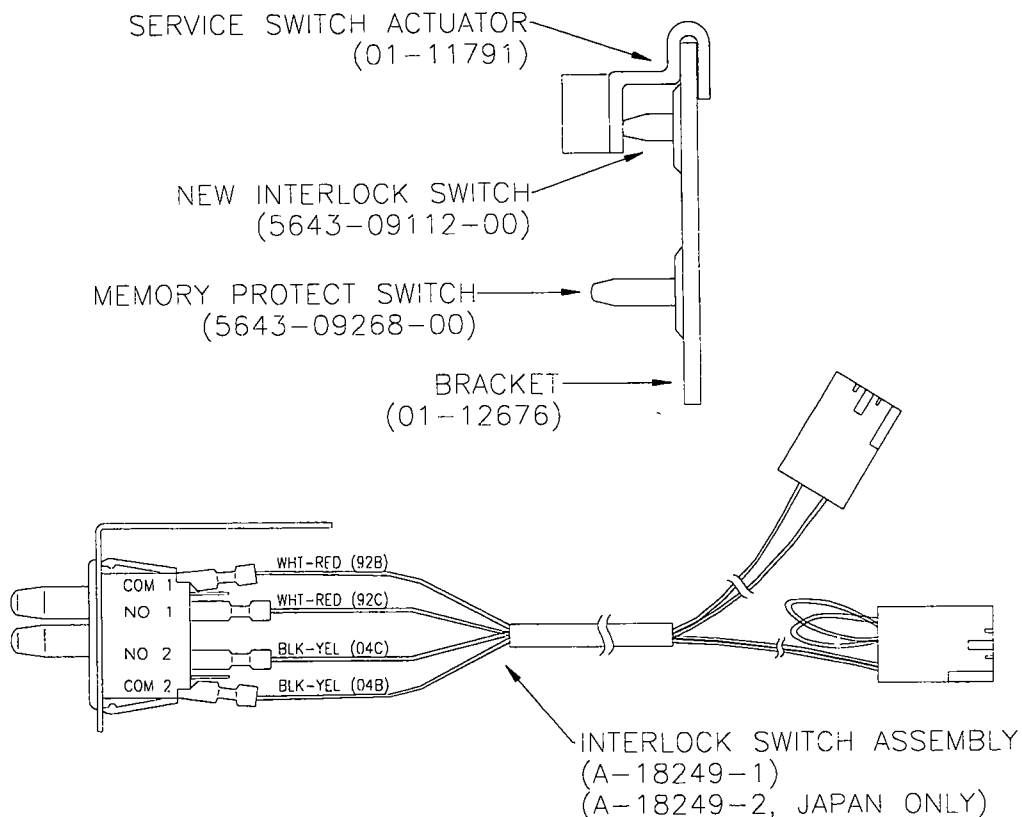
IMPORTANT NOTICE

PLEASE READ

This pinball game is equipped with a SAFETY FEATURE to prevent shocks from the solenoid circuit when the coin door is open. A new interlock switch assembly (part no. A-18249-1), 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 open, the 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 open, 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.



ATTENTION

This game uses a new Security CPU Board that is not downward compatible to the CPU boards used in previous games. The new board has an added security chip that can be interchanged between other Attack from Mars games and software revision levels. The CPU board itself is interchangeable with later model games, but must be equipped with the correct security chip and software for that specific game.

The games' electronic ID number is shown in the display during power-up. The number displayed is the same nine digit number printed on the security chip label. The first three digits are the project number without a country specific code. An example of the power-up display is shown below, the electronic ID number is bolded.

TESTING		
50041	EPROM D.0 A	
541	100020	65349

ATTACK FROM MARS™

Information current at time of release.

Fill out and mail in game registration card. Be sure to include the game serial number.
For your records, write the game serial number in the manual.

Midway Manufacturing Company 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.

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Bally's
ATTACK FROM MARS™

Game Rules

ATTACK FROM MARS™

GAME RULES

SUPER SKILL SHOT: Hold left flipper button WHILE launching ball. Make any flashing arrow shot to collect.

ATTACK WAVE: Complete center 3-bank to start an Attack Wave. Save cities by shooting center shot to destroy the saucer. Save all 5 cities to Attack & Conquer Mars!

EXTRA BALL: Complete Attack Waves OR bottom lanes to light Extra Ball. Shoot right eject to collect.

MULTI-BALL™: Center loop lights lock. Lock 3 balls in center loop to start 3-ball multi-ball. Shoot ramps and loops to collect jackpots. Collect all 5 jackpots to light moving Super Jackpot.

MARTIAN ATTACK: Complete M-A-R-T-I-A-N targets to light Martian Attack at right eject. Shoot right eject to start. Hit all 4 Martians in the time allowed to start Martian Attack 2-ball Multi-ball.

TOTAL ANNIHILATION: Complete Capture, Big-O-Beam, Tractor Beam or Atomic Blaster to start HURRY UP. Center shot awards HURRY-UP. Complete all 4 shots to start Total Annihilation 4-ball Multi-ball. Shoot ramps and loops while in Multi-ball to collect big points.

COMBOS: Make consecutive ramp and loop shots while red arrows are lit for Combos.

SUPER JETS: Get the number of jet hits needed (see display) to start Super Jets for big points.

RULE THE UNIVERSE: Collect Super jackpot, Super Jets, Martian Attack Multi-ball, Total Annihilation, Conquer Mars and 5-way combo to light Rule the Universe. Shoot right eject to start. Collect displayed points while in Multi-ball to Rule the Universe.

SECTION ONE

GAME OPERATION AND TEST INFORMATION

(System WPC) ROM Summary

IC	TYPE	BOARD	LOCATION	PART NUMBER
Game 1	27c040	CPU	G11	A-5343-50041-1R (For All Countries Except France & Belgium)
Game 1	27c040	CPU	G11	A-5343-50041-1F (France)
Game 1	27c040	CPU	G11	A-5343-50041-1B (Belgium)
Security Chip	PIC16C57	CPU	G10	A-5400-50041-1
Music/Speech	27c040	Audio	SU2	A-5343-50041-S2
Music/Speech	27c040	Audio	SU3	A-5343-50041-S3
Music/Speech	27c040	Audio	SU4	A-5343-50041-S4

NOTICE

Order replacement ROM's from your authorized MIDWAY MANUFACTURING CO. Distributor. Specify:
(1) Part Number (if available); (2) ROM Level (number on the label); (3) Game in which ROM is used.

PINBALL GAME ASSEMBLY INSTRUCTIONS

ATTACK FROM MARS IS A 4 BALL GAME.

Power: Domestic 120V @ 60 Hz
Foreign 230V @ 50 Hz
Japan 100V @ 50 Hz

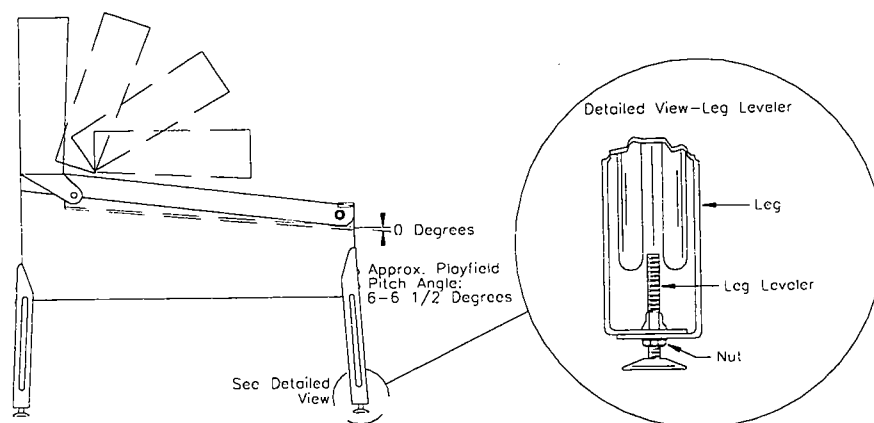
Temp: 32° F to 100° F
(0° C to 38° C)

Humidity: Not to exceed 95% relative.

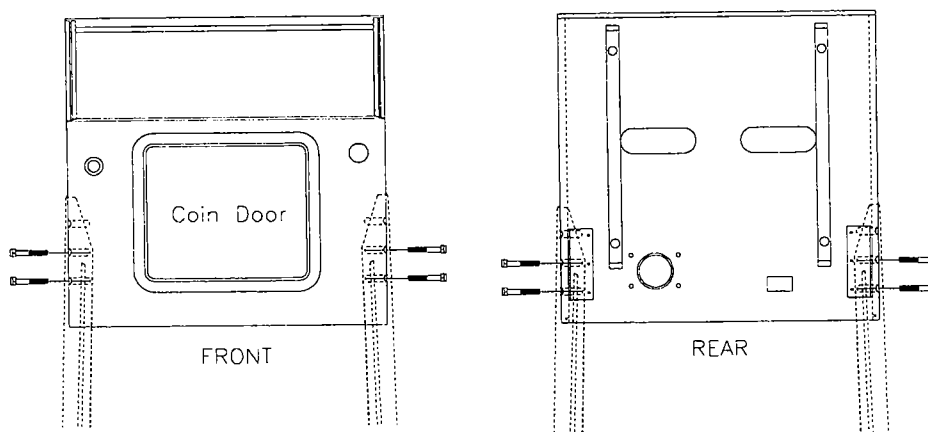
Dimensions: Width: 29" Approx.
Depth: 55" Approx.
Height: 78" Approx.

Weight: Approx. 325 Lbs. (crated)

1. Remove all cartons, parts, and miscellaneous items from the shipping container and set them aside.
2. Leg levelers and leg bolts are provided among the parts in the cash box. Install leg levelers on front and back legs (View 1). Place the cabinet on a support and attach rear legs using leg bolts (View 2).
3. Attach the front legs using leg bolts (View 2).



VIEW 1



VIEW 2

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

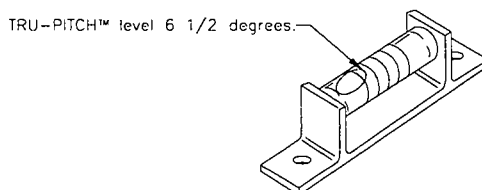


CAUTION

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 protrude approximately 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, to release the front molding. Lift the front molding off the playfield cover glass, return the latch lever to 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, storing it carefully to avoid breakage.
8. Place a level or an inclinometer on the playfield surface. Adjust the leg levelers for proper playfield level (side-to-side). NOTE: These measurements must 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.
9. The TRU-PITCH™ level is located on the right shooter rail. This allows the playfield pitch angle to be accurately adjusted WITHOUT REMOVING THE GLASS. The first line (closest to the front of the game) on the level is approximately 6 degrees. Every line thereafter is approximately another 1/2 degree of pitch. The recommended pitch is 6 1/2 degrees. The nose of the bubble should be between the first and second line on the level (see diagram below).



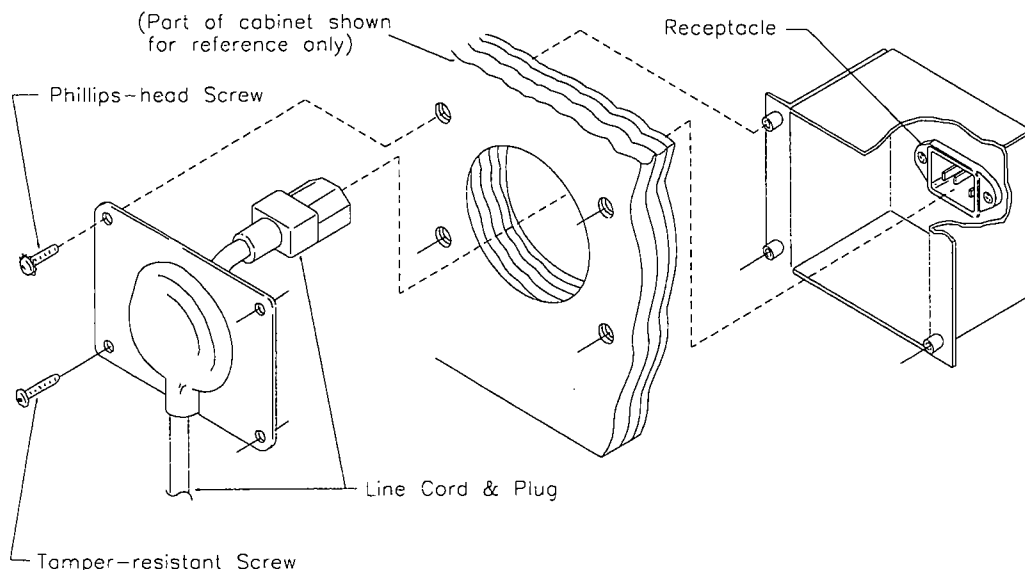
CAUTION

Playfield pitch angle adjustments can affect the operation of the plumb bob tilt, inside the cabinet. 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 screw at the bottom of the unit. Move the pointer, one groove at a time to the left or right, depending on the degree desired. Hold pointer in place and tighten screw.

10. Move the game into the desired location; recheck the level and pitch angle of the playfield.
11. Verify that the **required number** of balls are installed in the game. This game uses 4 balls.
- 12 Install playfield mylars if desired.

NOTE: This playfield has a special hardcoat surface and does not require a full protective mylar. However, mylars can be purchased through your local Bally Distributor. Specify part number 03-9486-1 for full playfield mylar.

13. Clean and reinstall the playfield cover glass, reversing the procedure of step 7.
14. To attach line cord, remove envelope stapled to the inside cabinet (near cashbox). Remove the four Phillips-head screws that mount the line cord cover plate to the rear cabinet. Match the prongs on the plug with the holes in the receptacle and push line cord securely into place. Make sure cord aligns with the indentation of plate (indentation should point toward bottom of cabinet). Remount line cord cover plate. If desired, tamper resistant screws are provided in an envelope marked "Security Screws" (located in cashbox) to remount cover plate.



15. **IMPORTANT:** Fill out and return the registration card.

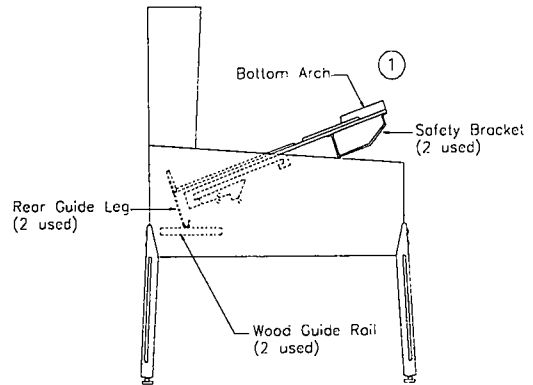
RAISING THE PLAYFIELD

CAUTION

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

To Raise Playfield:

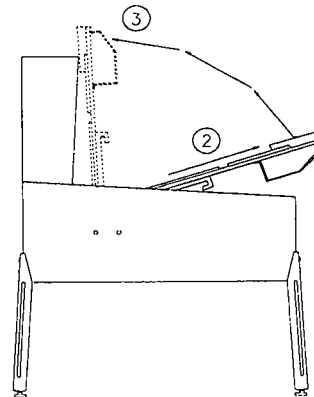
1. Grasp bottom arch and carefully lift up playfield only high enough to clear safety brackets. Rear guide legs should not hit wood guide rails or be used to slide out playfield.



2. Pull the playfield out toward you until it stops (rest position) and raise it approximately 3".

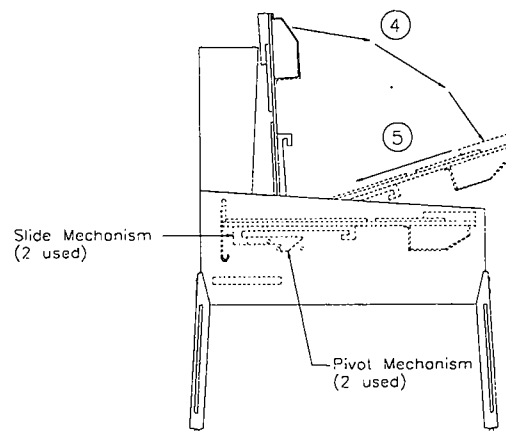
Be sure playfield is in locked position and does not slide back into the cabinet. If it does, repeat Step 2 before proceeding to Step 3.

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 Playfield:

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



GAME CONTROL LOCATIONS

Cabinet Switches

The On-Off switch is located on the bottom of the cabinet near the right front leg.

The Start Button is the push-button 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 Switches

The operator controls all game adjustments, obtains bookkeeping information, and diagnoses problems, using only four push-button switches mounted on the inside of the coin door. The Coin Door Switches 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 Switches from Normal Function to Test Function.

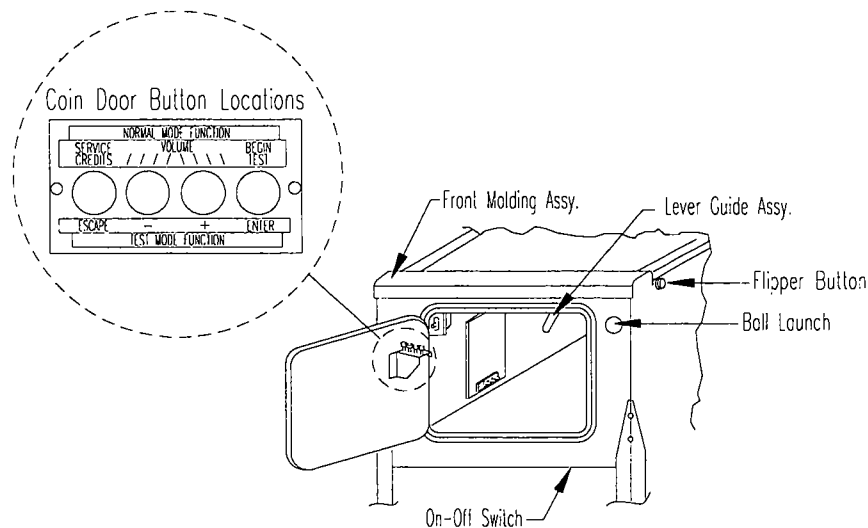
Test Function

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.



****To reset High Score, hold down the Begin Test/Enter switch for 5 seconds while in the Attract Mode.***

GAME OPERATION

CAUTION

After assembly and installation at the 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 will show in the display 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 period of time, the Start-Up Tests may contain messages concerning game problems. See 'Error Messages' for more detailed information regarding messages.

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, revision level of the system software and date the game software was revised.

Example: ATTACK FROM MARS
50041 Rev. D.01R

Sound Rev. 0.1
Sy. 3.49 01/01/89

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 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 display shows a series of messages informing the player of the 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 Start button 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 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 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. Game Over will show in the display. Afterward, the high scores flash on the display. 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 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 Earnings 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 Game Time Histograms
P.7 Time-Stamps
P.8 All Data

T. Test Menu

T.1 Switch Edges
T.2 Switch Levels
T.3 Single Switches
T.4 Solenoid Test
T.5 Flasher Test
T.6 General Illumination
T.7 Sound & Music Test
T.8 Single Lamps
T.9 All Lamps
T.10 Lamp & Flasher Test
T.11 Display Test
T.12 Flipper Test
T.13 Ordered Lamp Test
T.14 Lamp Row-Col Test
T.15 Dip Switch Test
T.16 Loop Test
T.17 Saucer LED Test
T.18 Drop Target Test
T.19 Motor Bank Test
T.20 Empty 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; Example A.1, A.2, A.3, A.4.

Press Down

Decreases Sequence; Example A.4, A.3, A.2, A.1.

Use Up and 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-Stamp

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

B.2 Earning Audits*

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

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

** "Total Plays" only counts completed games. A game is considered complete when the final ball begins. Audit information from incomplete games is ignored, therefore test and servicing operations do not affect the Audits.

† This Audit is not resettable.

B.4 Feature Audits

B.4	01	Total number of ball saves.	00
B.4	02	Total number of Multi-ball starts.	00
B.4	03	Total number of Attack Wave starts.	00
B.4	04	Total number of Attack Wave completion's.	00
B.4	05	Total number of locks lit.	00
B.4	06	Total number of balls locked.	00
B.4	07	Total number of main Multi-ball starts.	00
B.4	08	Total number of main Multi-ball Jackpot awards.	00
B.4	09	Total number of main Multi-ball Super Jackpot awards.	00
B.4	10	Total number of 1st Attack Wave starts.	00
B.4	11	Total number of 1st Attack Wave completion's.	00
B.4	12	Total number of 2nd Attack Wave starts.	00
B.4	13	Total number of 2nd Attack Wave completion's.	00
B.4	14	Total number of 3rd Attack Wave starts.	00
B.4	15	Total number of 3rd Attack Wave completion's.	00
B.4	16	Total number of 4th Attack Wave starts.	00
B.4	17	Total number of 4th Attack Wave completion's.	00
B.4	18	Total number of 5th Attack Wave starts.	00
B.4	19	Total number of 5th Attack Wave completion's.	00
B.4	20	Total number of "Attack Mars" Wave starts.	00
B.4	21	Total number of "Attack Mars" Wave completion's.	00
B.4	22	Total number of left loop shots.	00
B.4	23	Total number of left ramp shots.	00
B.4	24	Total number of right ramp shots.	00
B.4	25	Total number of right loop shots.	00
B.4	26	Total number of Hurry Up awards.	00
B.4	27	Total number of Total Annihilation starts.	00
B.4	28	Total number of Total Annihilation awards.	00
B.4	29	Total number of Total Annihilation Jackpot awards.	00
B.4	30	Total number of Martian target completion's.	00
B.4	31	Total number of Martian Attack starts.	00
B.4	32	Total number of Martians killed during Martian Attack.	00
B.4	33	Total number of Martian Multi-ball starts.	00
B.4	34	Total number of Martians killed during Martian Multi-ball	00
B.4	35	Total number of combos awards.	00
B.4	36	Total number of 5-way combos awards.	00
B.4	37	Total number of Super Jet starts.	00
B.4	38	Total number of Rule The Universe starts.	00
B.4	39	Total number of Rule The Universe wins.	00
B.4	40	Total number of Skill Shots collected.	00
B.4	41	Total number of Super Skill Shots collected.	00
B.4	42	Total number of bonus multiplier awards.	00
B.4	43	Total number of Stroke of Lucks lit.	00
B.4	44	Total number of Stroke of Lucks awarded.	00
B.4	45	Total number of Stroke of Luck 25 millions.	00
B.4	46	Total number of Stroke of Luck 50 millions.	00
B.4	47	Total number of Stroke of Luck bonus multipliers.	00
B.4	48	Total number of Stroke of Luck hold bonus multipliers.	00
B.4	49	Total number of Stroke of Luck light locks.	00
B.4	50	Total number of Stroke of Luck lock awards.	00
B.4	51	Total number of Stroke of Luck start Multi-balls.	00

B.4 Feature Audits (Continued)

B.4	52	Total number of Stroke of Luck Martian Attacks lit.	00
B.4	53	Total number of Stroke of Luck Attack Wave starts.	00
B.4	54	Total number of Stroke of Luck Extra Balls lit.	00
B.4	55	Total number of Stroke of Luck strobe Multi-ball starts.	00
B.4	56	Total number of games that used buy-in.	00
B.4	57	Total number of times 1 ball bought.	00
B.4	58	Total number of times 2 balls bought.	00
B.4	59	Total number of times 3 balls bought.	00
B.4	60	Total number of times 4 or more balls bought.	00

B.5 Histograms

B.5	01	0 - 199 Million Scores	00%
B.5	02	200 - 399 Million Scores	00%
B.5	03	400 - 599 Million Scores	00%
B.5	04	600 - 799 Million Scores	00%
B.5	05	800 - 999 Million Scores	00%
B.5	06	1 - 1.49 Billion Scores	00%
B.5	07	1.5 - 1.99 Billion Scores	00%
B.5	08	2 - 2.99 Billion Scores	00%
B.5	09	3 - 3.99 Billion Scores	00%
B.5	10	4 - 4.99 Billion Scores	00%
B.5	11	5 - 6.99 Billion Scores	00%
B.5	12	7 - 8.99 Billion Scores	00%
B.5	13	Over 9 Billion	00%
B.5	14	Game Time 0.0 - 1.0 Mins	00%
B.5	15	Game Time 1.0 - 1.5 Mins	00%
B.5	16	Game Time 1.5 - 2.0 Mins	00%
B.5	17	Game Time 2.0 - 2.5 Mins	00%
B.5	18	Game Time 2.5 - 3.0 Mins	00%
B.5	19	Game Time 3.0 - 3.5 Mins	00%
B.5	20	Game Time 3.5 - 4.0 Mins	00%
B.5	21	Game Time 4 - 5 Mins	00%
B.5	22	Game Time 5 - 6 Mins	00%
B.5	23	Game Time 6 - 8 Mins	00%
B.5	24	Game Time 8 - 10 Mins	00%
B.5	25	Game Time 10 - 15 Mins	00%
B.5	26	Game Time Over 15 Mins	00%

B.6 Time-Stamps

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

B.6	01	Current Time
B.6	02	Totals Cleared
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-Stamped
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 message "Waiting for Printer" appears in the displays.

Note: Set 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
T.2	Switch Levels
T.3	Single Switch
T.4	Solenoid Test
T.5	Flasher Test
T.6	General Illumination
T.7	Sound & Music Test
T.8	Single Lamps
T.9	All Lamps
T.10	Lamp & Flasher Tests
T.11	Display Test
T.12	Flipper Test
T.13	Ordered Lamps Test
T.14	Lamp Row-Col Test
T.15	Dip Switch Test
T.16	Loop Test
T.17	Saucer LED Test
T.18	Drop Target Test
T.19	Motor Bank Test
T.20	Empty 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, and 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, and 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 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 Press each switch one at a time. The name and number of the switch is shown in the display. If a switch other than the one pressed, or no switch at all is indicated, the system has detected a problem with the switch circuit.

T.2 Switch Levels 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 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 advance 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 advance 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. Either press the Escape button to return to the Test Menu, or the Enter button to advance to the next mode.

T.5 Flasher Test

This tests the flashlamp part of the solenoid circuit exclusively. This, like the Solenoid Test has three test 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 than 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 will show in the display and the corresponding bulb(s) flash. Press the Up or Down button to cycle through all of the flashlamp circuits one at a time. The same circuit 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 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 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 and the corresponding bulb(s) flash. Either press the Escape button to return to the Test Menu, or the Enter button to advance to the next mode.

T.6 General Illumination This test checks all of the General Illumination circuits. There are two modes of operation: Stop and Run. **Note: G.I strings 4 and 5 do not dim and brighten.**

- 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 will show in the display while the corresponding lamps light. 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 displays 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 allows you to check 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. Pressing the Up or Down button during this portion of the Sound and Music test advances to a particular sound/tune without having to wait for the program to play all the sounds available in the test. A sound/tune should be heard for each name and number that appears in the display. Any other results indicate 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. No sound/tune 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 indicate 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 indicate 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 lights 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 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 than 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, coil 01 shows in the display and the corresponding flipper activates. Press the Up or Down button to cycle through the flipper coils, one at a time. The same flipper coil 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 advance to the next mode.
- Stop - The Stop Mode halts the Flipper Coil Test. Press Enter during the Repeat mode and the Flipper Coil Test stops. No flipper coil should be activated while the test is stopped. Either press the Escape button to return to the Test Menu, or the Enter button to advance 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. Either press the Escape button to return to the Test Menu, or the Enter button to advance to the next mode.

T.13 Ordered 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 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 Lamp Row-Col Test

This test allows individual rows and columns in the lamp matrix to be operated. This is useful for trouble-shooting wiring and driver problems.

Press the UP or DOWN buttons to cycle through the different rows and columns.

T.15 Dip Switch Test

This test is used to show the positions of the dip switches on the CPU board (U27).

T.16 Loop Test

This test is used to exercise the four (4) loop switches and the two (2) control gates.

While in this test, roll a ball around either the left or the right loop. As the ball passes over the loop switches, the state of the switches and the control gates are updated in the display. When the ball has traveled completely around the loop (either from left to right, or from right to left), the display will indicate any problems found with the switches and/or the control gates.

During this test, the diagnostic test buttons on the coin door act as follows:

- | | |
|---------|---|
| Escape: | This button returns to the previous menu. |
| Enter: | This button clears any errors shown on the display. |

T.17 Saucer L.E.D. Test This test is used to exercise the L.E.D.s in the saucer. The test has two modes: Automatic and Manual.

In automatic mode, a single L.E.D. will light up in the saucer. The lit L.E.D. will then move automatically around the saucer in a clockwise manner. The position of the lit L.E.D. is shown in the display.

In manual mode, a single L.E.D. will light up in the saucer. The up (+) button moves the lit L.E.D. around the saucer in a clockwise manner. The down (-) button moves the lit L.E.D. around the saucer in a counterclockwise manner. Holding down the up (+) button or the down (-) button moves the lit L.E.D. RAPIDLY around the saucer. The position of the lit L.E.D. is shown in the display.

The lit L.E.D. is always shown in the display for both test operation modes. Should there not be a lit L.E.D. on the saucer for the position of the L.E.D. indicated in the display, then the test has detected a problem with the L.E.D.

During this test, the diagnostic test buttons on the coin door act as follows:

Escape:	This button returns to the previous menu.
Down:	In Manual Mode, this button rotates the lit L.E.D. around the saucer in a counterclockwise manner.
Up:	In Manual Mode, this button rotates the lit L.E.D. around the saucer in a clockwise manner.
Enter:	This button toggles the state of the test from Automatic Mode to Manual Mode, or from Manual Mode to Automatic Mode.

T.18 Drop Target Test This test allows the drop target to be activated while the state of the drop target switch is shown in the display.

There is only one coil for the drop target; this coil raises the target. The test has no way of getting the drop target to its "down" position; this must be done manually.

When the test detects that the drop target is down (by checking to see if the drop target switch is closed), the drop target coil will be activated to reset the drop target to its "up" position. The coil will only be activated if the coin door is closed.

Any errors accumulated by this test are shown in the display.

During this test, the diagnostic test buttons on the coin door act as follows:

Escape:	This button returns to the previous menu.
Enter:	This button toggles the state of the test from Running to Stopped, or from Stopped to Running.

T.19 Motor Bank Test This test allows the motor bank to be activated while the state of the motor bank switches are shown in the display.

This test will continually run the motor bank up and down (with small pauses when a motor bank switch edge is detected) while the test is running. Errors are accumulated, and shown in the display.

If the test accumulates enough errors for the motor bank, the test will stop itself and show the errors in the display.

During this test, the diagnostic test buttons on the coin door act as follows:

Escape:	This button returns to the previous menu.
Enter:	This button toggles the state of the test from Running to Stopped, or from Stopped to Running.

T.20 Empty Balls Test This test kicks out all balls loaded in troughs, lockups, poppers, and kickouts until no balls remain in those locations.

Note: As the trough kicks out balls, they will stack up in the shooter groove, which may require manual clearing in order to allow further balls to be kicked out.

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 settings is retained and the new settings 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 writing a Custom Message. Press the Enter button to begin entry of the custom message. Use the Up or Down button 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 you make a mistake, 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 your 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 you press Enter, 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 the operator to install 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 button 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 groups.

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.

Game Difficulty Setting Table for U.S./Canadian/French Games

Adj. No.	Adjustment Description	Extra Easy U.9 01	Easy U.9 02	Medium U.9 03	Hard U.0 04	Extra Hard U.9 05
A.2 03	Ball Saves	02	01	01	01	00
A.2 04	Ball Save Time	06	06	05	04	04
A.2 05	Extra Ball Percent	35%	30%	25%	20%	15%
A.2 06	Lane Extra Ball	6	8	10	12	14
A.2 09	Attack Wave Start Difficulty	EASY	EASY	HARD	HARD	HARD
A.2 10	Attack Wave Difficulty	EX. EASY	EASY	MEDIUM	HARD	EX. HARD
A.2 11	First Hard Lock	03	02	02	02	01
A.2 12	Super Jackpot Timer	14	12	10	08	06
A.2 13	Martian Target Memory	YES	YES	YES	YES	NO
A.2 14	Martian Attack Timer	40	35	30	25	20

Game Difficulty Setting Table for German/European Games

Adj. No.	Adjustment Description	Extra Easy U.9 01	Easy U.9 02	Medium U.9 03	Hard U.0 04	Extra Hard U.9 05
A.2 03	Ball Saves	02	01	01	01	00
A.2 04	Ball Save Time	06	06	05	04	04
A.2 05	Extra Ball Percent	35%	30%	25%	20%	15%
A.2 06	Lane Extra Ball	6	8	10	12	14
A.2 09	Attack Wave Start Difficulty	EASY	EASY	HARD	HARD	HARD
A.2 10	Attack Wave Difficulty	EX. EASY	EASY	MEDIUM	HARD	EX. HARD
A.2 11	First Hard Lock	03	02	02	02	01
A.2 12	Super Jackpot Timer	14	12	10	08	06
A.2 13	Martian Target Memory	YES	YES	YES	YES	NO
A.2 14	Martian Attack Timer	40	35	30	25	20

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 the 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 Game Adjustments Table

Adjustment Number	Adjustment Description	Install 3-Ball U.9 07 (factory)	Install 5 Ball U.9 06
A.1 01	Balls Per Game	03	05
A.1 07	Replay Start	4,500,000,000	6,000,000,000
A.2 06	Lane Extra Ball	10	14
A.2 07	Attack Wave Extra Ball	02	03
A.2 10	Attack Wave Difficulty	MEDIUM	HARD
A.2 11	First Hard Lock	02	01

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:

<u>Adjustment</u>	<u>Name</u>	<u>New Setting</u>
A.1 13	Replay Boost	Off
A.1 14	Replay Award	Extra Ball
A.1 15	Special Award	Extra 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 08	High Score 3 Credits	00
A.4 07	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:

<u>Adjustment</u>	<u>Name</u>	<u>New Setting</u>
A.1 14	Replay Award	Ticket
A.1 15	Special Award	Ticket
A.1 16	Match Award	Ticket
A.1 17	Extra Ball Ticket	Yes
A.1 31	Ticket Expansion Board	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:

<u>Adjustment</u>	<u>Name</u>	<u>New Setting</u>
A.1 04	Max. Extra 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 Not Used

U.9 12 Serial Capture This sets up the printer adjustments for 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 thru 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 50,000,000.

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. The Preset Game Adjustments Table for French Games lists the adjustments and settings that comprise the individual groups.

* The French DIP Switch Settings are:

<u>SW4</u>	<u>SW5</u>	<u>SW6</u>	<u>SW7</u>	<u>SW8</u>
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 will help in find intermittent problems. The tests that Auto Burn-in cycle through are: the Display Test, Sound and Music Test, All Lamps Test, Solenoid Test, Flashers Test, General Illumination Test, and the Flipper Coil Test. All of the tests are run concurrently. The time spent on the current 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 choice. If a mistake is made, press Escape while "Saving Adjustment Value" is in the display. The original settings 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: 1-10

A.1 02 Tilt Warnings

The number of total actuation's of the plumb bob mechanism that can occur before the game is "tilted".

Range: 1-10

A.1 03 Maximum Extra Balls

The number of extra balls that a player may accumulate.

Range: 1-10

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 Balls 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 and 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: 5-50%

A.1 07 Replay Start*

The replay start value when Auto % Replay is used. The range of this setting is 100,000,000 to 700,000,000.

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 value. When three or four replay levels are chosen, their values are automatically adjusted to three or four times the starting replay level.

*For Auto % Replay.

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 canceled when credits equal 0, the player inserts another coin, or Begin Test is pressed.

ON	-	Score is boosted between 1,000,000 and 75,000,000 points.
OFF	-	Replay score is not boosted.

A.1 14 Replay Award

For 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 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 30 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.

A.1 18 Maximum Ticket/Player

The amount of Tickets each player can earn.
Range 00 - 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 matching of these two digits 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, German, French or Spanish.

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 date and time in status report, or Attract Mode.
- NO - Do Not show date and time in status report or 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 General Illumination for spiral effects and Attract Mode.
- NO - Do Not dim General Illumination.

A.1 26 Tournament Play

Equalize Multi-ball and Jackpots during multi-player games, (do not carry over to next player).

- YES - Keep Multi-ball and Jackpots equal.
- NO - Do Not Keep Multi-ball 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 will substantially increase the life of the lamps.

Setting: - Off, 2-60 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: 4-7 (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 this 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 3 settings to determine how this is handled.

Never: - Do not allow a new game to 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 Buy Extra Ball

This adjustment determines whether each player may buy an Extra Ball at the end of a game.

Settings: OFF
1/2 CREDIT
1 CREDIT

Factory Setting: OFF

A.2 02 Buy Extra Ball Count

This adjustment specifies the number of Extra Balls that may be bought by each player at the end of a game.

Settings: 01 to 03
UNLIMITED

Factory Setting: 01

A.2 03 Ball Saves

This adjustment determines the number of "full" ball "saves" that each player receives in a game. A ball that is "saved" will be returned to play with no change to the ball in play number. A "full" ball save is used if a ball drains after it is launched into play within the amount of time specified in A.2 04. Once all "full" ball saves are used, balls will no longer be returned to play should they drain quickly after being put into play.

Settings: 01 to 05
OFF

Factory Setting: 1

A.2 04 Ball Save Time

This adjustment determines the number of seconds in which a ball may drain after being put into play, such that it will be returned to play without a change in the ball in play number.

Settings: 03 to 15

Factory Setting: 06

A.2 05 Extra Ball Percent

This adjustment determines the total percentage of extra balls desired (for all extra balls awarded from all features except replay score levels). The game will adjust the number of Attack Wave completion's required for an extra ball to achieve the requested level. When this adjustment is set to FIXED, no automatic percentaging will be done for the Attack Wave Extra Ball.

Settings: FIXED
15% to 40%

Factory Setting: 25%

A.2 06 Lane Extra Ball

This adjustment specifies the number of times the bottom lanes need to be completed in order to light an extra ball.

Settings: OFF
01 to 20

Factory Setting: 10

A.2 07 Attack Wave Extra Ball

This adjustment specifies the number of Attack Waves that need to be completed to light an extra ball. The game will start with this value and then modify it as necessary to achieve the percentage specified in A.2 05. To use a fixed level for the Attack Wave extra ball, set A.2 05 to FIXED, and then set this level.

Settings: 01 to 05

Factory Setting: 02

A.2 08 Starting Attack Wave

This adjustment is used to set the country in which the first Attack Wave will occur. If RANDOM is specified, the game will choose a random country.

Settings: RANDOM
FRANCE
GERMANY
ITALY
ENGLAND
U.S.A.

Factory Setting: RANDOM

A.2 09 Attack Wave Start Difficulty

This adjustment specifies the difficulty level of starting an Attack Wave. Attack Waves are started by completing the targets on the motor bank. When this adjustment is set to EASY, previously scored motor bank targets will be counted toward completing the bank to start an Attack Wave. When this adjustment is set to HARD, the three motor bank targets must be completed separately to start an Attack Wave.

Settings: EASY
HARD

Factory Setting: HARD

A.2 10 Attack Wave Difficulty

This adjustment specifies the difficulty level of completing an Attack Wave. This adjustment affects the number of times the saucer targets must be hit to qualify the center hole for destroying a saucer. The harder this setting, the more hits required to qualify the center hole for destroying a saucer.

Settings: EXTRA EASY
EASY
MEDIUM
HARD
EXTRA HARD

Factory Setting: MEDIUM

A.2 11 First Hard Lock

This adjustment specifies the difficulty level of lighting locks for multiball. An "easy" lock requires one (1) shot up the center ramp to light all three (3) locks. A "hard" lock requires one shot up the center ramp to light only one (1) lock. This adjustment number specifies the number of Multi-balls that must be played, minus one (1), in which a shot up the center ramp will result in a "hard" lock.

Settings: 01 to 03

Factory Setting: 02

A.2 12 Super Jackpot Timer

This adjustment specifies the number of seconds that the Super Jackpot remains available after Multi-ball is over.

Settings: OFF
05 to 20
Factory Setting: 10

A.2 13 Martian Target Memory

This adjustment determines whether scored Martian targets remain in memory from ball to ball.

Settings: NO or YES
Factory Setting: YES

A.2 14 Martian Attack Timer

This adjustment specifies the number of seconds in which the player must complete the Martian Attack feature.

Settings: 10 to 60
Factory Setting: 30

A.2 15 Player Tournament Mode

This adjustment allows players to simulate the tournament mode setting in the game (see A.1 26 for a description of Tournament Mode). If this adjustment is set to YES, and there are credits posted on the game, tournament mode may be enabled for the next game start by holding in both flipper buttons for approximately two (2) seconds and pressing the start button while the "Tournament Mode Ready" message is shown on the display.

Settings: YES or NO
Factory Setting: YES

A.2 16 Family Mode

This adjustment allows the game to operate in "Family Mode". Any possibly offensive or objectionable dot matrix images or sounds will not be utilized.

Settings: YES or NO
Factory Setting: NO

A.2 17 Attract Mode Music

This adjustment is used to allow the playing of music in attract mode.

Settings: YES or NO
Factory Setting: NO

A.2 18 Attract Mode Sounds

This adjustment is used to allow the playing of sound effects in attract mode.

Settings: YES or NO
Factory Setting: YES

A.2 19 Attract Mode Lights

This adjustment allows the game to use the flash lamps and the strobe light in attract mode.

Settings: YES or NO
Factory Setting: YES

A.2 20 Timed Plunger

This adjustment gives the number of seconds before automatically plunging a ball that is sitting in the shooter lane.

Settings: OFF
 30 to 90
Factory Default: OFF

A.2 21 Flipper Plunger

When this adjustment is set to YES, the right flipper will cause a ball sitting in the shooter lane to be launched onto the playfield. This adjustment is provided for use when the launch button is broken and/or intermittent. The game will automatically detect a broken launch button, but it may take several games to perform the detection. In this case, set this adjustment to YES until the launch button can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 22 Disable Diverter

This adjustment is provided for use when the diverter is broken and/or intermittent. The game will automatically detect a broken diverter, but it may take several games to perform the detection. In this case, set this adjustment to YES until the diverter can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 23 Disable Left Gate

This adjustment is provided for use when the left gate is broken and/or intermittent. The game will automatically detect a broken left gate, but it may take several games to perform the detection. In this case, set this adjustment to YES until the left gate can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 24 Disable Right Gate

This adjustment is provided for use when the right gate is broken and/or intermittent. The game will automatically detect a broken right gate, but it may take several games to perform the detection. In this case, set this adjustment to YES until the right gate can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 25 Disable Motor Bank

This adjustment is provided for use when the motor bank is broken and/or intermittent. The game will automatically detect a broken motor bank, but it may take several games to perform the detection. In this case, set this adjustment to YES until the motor bank can be repaired.

If it is necessary to set this adjustment to YES, and the motor is operable, use T.19 (Motor Bank Test) to move the Motor Bank to either its UP or its DOWN position. This will minimize possible damage to the top of the unit during game play, and allow for maximum game play software compensation.

Settings: YES or NO
Factory Setting: NO

A.2 26 Disable Drop Target

This adjustment is provided for use when the drop target is broken and/or intermittent. The game will automatically detect a broken drop target, but it may take several games to perform the detection. In this case, set this adjustment to YES until the drop target can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 27 Disable Aliens

This adjustment is provided for use when the Alien(s) are broken and/or intermittent. In this case, set this adjustment to YES until the Alien(s) can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 28 Disable Saucer

This adjustment is provided for use when the Saucer is broken and/or intermittent. In this case, set this adjustment to YES until the Saucer can be repaired.

Settings: YES or NO
Factory Setting: NO

A.2 29 Disable Strobe

This adjustment is provided for use when the strobe light is broken and/or intermittent. In this case, set this adjustment to YES until the strobe can be repaired.

Note: When this adjustment is set to YES, the Strobe Multi-ball feature will not be available.

Settings: YES or NO
Factory Setting: NO

A.3 Pricing Adjustments

A.3 01 Game Pricing (if set to custom, then 02 to 09 are available). Custom pricing is not available for U.S.A. and Canadian games.

The cost of a game is selected here, from the Standard Pricing Table or by using the Custom Pricing Editor (A.3 27).

A.3 02 thru A.3 09 Not Used

A.3 10 Coin Door Type (if set to custom, then 11 to 15, 20 and 25 are available)

This adjustment is used to preset adjustments 11 through 15, 20 and 25, based on standard coin doors (U.S.A., German, Etc.).

A.3 11 Collection Text

The coin system 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, and 4th coin chutes. Formerly, these values only affected the way in which the coins were totaled for auditing displays. In the new 10/94 pricing system, these values are added for each coin inserted and credits are awarded based on the amount of money accumulated. See Pricing Editor (A.3 27) for more information.

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. The factory default is 10.

A.3 17 Free Play

The 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 Not Used

A.3 20 Base Coin Size

This is the smallest unit of coin that may be used when creating a custom pricing mode using the Pricing Editor (A.3 27). For example, in the USA this is typically \$0.25. All pricing levels are then specified in 25 cent (or greater) increments.

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. The options are:

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 slot.

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.

A.3 25 Allow Hundredths

This is used for a custom door specifier. If set to "YES", then the values for A.3 12-15 are specified in units and hundredths (such as dollars and quarters). If set to "NO", then all values are in units (such as Francs and Lire).

A.3 26 Credit Fraction

This determines the smallest fraction used for credits. It must always be even to accommodate the extra ball buy-in option of 1/2 credit, and is typically 1/2 but may need to be a different value for modes requiring more coins per credit.

A.3 27 Pricing Editor

Custom pricing is not available for U.S.A. and Canadian games.

This function is now used to enter information for a custom pricing mode. The adjustment A.3 26 (Credit Fraction) may need to be set before entering the Custom Pricing Editor. This specifies the smallest fraction available for partial credits.

Because of the availability of an extra ball (buy-in) for 1/2 credit, this value is always even (1/2, 1/4, 1/6 etc.). The typical setting for A.3 26 is 1/2 (such that there are only full credits and half credits) but you may need to use a different value for other pricing modes.

Please note that formerly, the coin values specified by custom coin door adjustments A.3 12-15 only affected audit totals that showed collection totals. In the 10/94 pricing system, these coin values are added up for each coin received and credits are awarded based on pricing levels being reached. The pricing editor described here allows you to set these levels, however, it may be necessary for you to set A.3 10 (Coin Door Type) to "CUSTOM" and then change A.3 11-15, 20 and 25 to reflect the value of the coins being used. This is usually NOT NECESSARY, but must be done BEFORE using the custom pricing editor when it is necessary.

Begin the custom pricing function by pressing the "Enter" button while A.3 27 "PRICING EDITOR" is showing on the display.

The pricing editor will now show the data for the currently selected pricing mode. If this is the 1st use of the pricing editor then this will show the last built-in pricing that was selected. Otherwise it will be the last custom mode created by this function. (Note that A.3 01 will display "Custom" any time a non-standard pricing has been used.)

Assuming that last mode installed was 1/\$0.50 2/\$0.75 3/\$1.00 the display will appear as follows:

Custom Pricing Editor		
1)	\$0.25	1/2 cred.
2)	\$0.50	1 cred.
3)	\$0.75	2 cred.
4)	\$1.00	3 cred.

Display View

The "\$0.25" field will be flashing. You may now use the test mode buttons to perform the following functions:

Escape: Undo any changes to the current field and move to the previous field.

"-" (Down): Make the current field lower.

"+" (Up): Made the current field higher.

Enter: Save any change to the current field and move to the next field. Note that there are two columns of fields. Price levels are in the left column and credit levels are in the right column. Pressing "Enter" will move from the left column to the right column before moving to the next line.

Start: Save the current custom price mode or start over.

By using the above functions, simply enumerate each pricing level and the number of credits that should be awarded at that level. Please note that you must specify each fractional level in the sequence.

Example: 1/\$0.50 2/\$1.00 4/\$1.50 6/\$2.00

1)	\$0.25	1/2 cred.
2)	\$0.50	1 cred.
3)	\$0.75	1 1/2 cred.
4)	\$1.00	2 cred.
5)	\$1.25	2 1/2 cred.
6)	\$1.50	4 cred.
7)	\$1.75	4 1/2 cred.
8)	\$2.00	6 cred.

Also note that once the value of the coins repeat that no further specification is necessary.

Example: 1/\$0.50 2/\$1.00

 1) \$0.25 1/2 cred.

In the above example, only one line needs to be specified, indicating that 1/2 credit is awarded for each \$0.25 received.

Special Features:

There are some special features available by pressing the "-" (Down) button while in the left column. The following words will be displayed instead of a pricing level:

End
Delete
Insert
Clear
Repeat 1
Repeat 2
Repeat 3
Repeat 4
Repeat 5
Repeat 6
Repeat 7
Repeat 8
Repeat 9
Repeat 10
Repeat 11
Repeat 12
Repeat 13
Repeat 14
Repeat 15
Repeat 16
Repeat 17
Repeat 18
Repeat 19
Repeat 20

Pressing "Enter" with the above words selected will activate the following functions:

End This is the same as pressing the start button. A menu of choices will be provided (see "Start Button" below).

Delete This will delete the current level from the pricing mode.

Insert This will insert a new pricing level ABOVE the current level. The current level will be unaffected. There must be room for at least 1 coin between the current level and the previous level, and at least one fractional credit unit between the current level and the previous level.

Example: Inserting a new pricing level.

Custom Pricing Editor		
1)	\$0.50	1 cred.
2)	\$1.00	2 cred.
3)	\$1.50	4 cred.
4)	\$2.00	6 cred.

Display View

Use the "Enter" button to move to the \$1.50 field. Now press the "-" button once to create the following display:

Custom Pricing Editor		
1)	\$0.50	1 cred.
2)	\$1.00	2 cred.
3)	INSERT	4 cred.
4)	\$2.00	6 cred.

Display View

Now press the "Enter" button. The display will now show:

Custom Pricing Editor		
1)	\$0.50	1 cred.
2)	\$1.00	2 cred.
3)	\$1.25	2 1/2 cred.
4)	\$2.00	6 cred.

Display View

Note that the line "5) \$2.00 6 cred." no longer fits on the display. Whenever there are more than 4 pricing levels the display will scroll up and down as "Enter" and "Escape" are used to move from field to field. If you repeatedly press "Enter" the display will then show:

Custom Pricing Editor		
2)	\$1.00	2 cred.
3)	\$1.25	2 1/2 cred.
4)	\$1.50	4 cred.
5)	\$2.00	6 cred.

Display View

Clear This will clear out the current entries to allow a new price mode to be entered.

Repeat (1-20) This will cause all entries above the current line to be repeated the number of times specified. This is only available when there are no pricing levels below the current line.

Example: 1/\$0.50 2/\$1.00 15/\$5.00

Use the "Edit New Pricing Mode" feature described below to clear out the current levels.

Use "+" and "Enter" to specify 1/2 credit for \$0.25:

Custom Pricing Editor		
1)	\$0.25	1/2 cred.

Display View

Now, use "-" until the display shows "Repeat 20". The display will show the following:

Custom Pricing Editor		
1)	\$0.50	1 cred.
2)	REPEAT 20	

Display View

Press "Enter" and the display will show the following:

Custom Pricing Editor		
1)	\$0.25	1/2 cred.
2)	\$0.50	1 cred.
3)	\$0.75	1 1/2 cred.
4)	\$1.00	2 cred.

Display View

Actually, by repeating the 1st line 20 times the pricing mode is currently set up as follows, but only the 1st 4 lines are displayed.

Custom Pricing Editor		
1)	\$0.25	1/2 cred.
2)	\$0.50	1 cred.
3)	\$0.75	1 1/2 cred.
4)	\$1.00	2 cred.
5)	\$1.25	2 1/2 cred.
6)	\$1.50	3 cred.
7)	\$1.75	3 1/2 cred.
8)	\$2.00	4 cred.
9)	\$2.25	4 1/2 cred.
10)	\$2.50	5 cred.
11)	\$2.75	5 1/2 cred.
12)	\$3.00	6 cred.
13)	\$3.25	6 1/2 cred.
14)	\$3.50	7 cred.
15)	\$3.75	7 1/2 cred.
16)	\$4.00	8 cred.
17)	\$4.25	8 1/2 cred.
18)	\$4.50	9 cred.
19)	\$4.75	9 1/2 cred.
20)	\$5.00	10 cred.

Now, repeatedly press "Enter" to move to the right hand column of the 20th level. The display will show (with "10 cred." blinking):

Custom Pricing Editor		
17)	\$4.25	8 1/2 cred.
18)	\$4.50	9 cred.
19)	\$4.75	9 1/2 cred.
20)	\$5.00	10 cred.

Display View

Now, press "+" repeatedly until the right hand column of line 20) reads "15 cred."

Start Button: Once the pricing mode has been specified, exit the custom pricing editor by pressing the "Start" button. This will bring up a menu with (some or all of) the following choices:

Choose an Option:
Return to Editor
Clear Pricing
Ignore Changes
Save Changes

Display View

Use the "+" and "-" button to select your choice and press the "Enter" button to activate. The selections cause the following actions:

Return to Editor: This option will allow you to continue to edit the pricing information.

Clear Pricing: This option will clear out all pricing levels and bring you back to the pricing editor to create a pricing mode from scratch.

Ignore Changes: This option will discard the work done in the pricing editor and leave the previously installed pricing mode in the game.

Save Changes: Press "Enter" to save your custom edited pricing mode and install it as the pricing for the game. Note that this choice will not be displayed if there is not at least one pricing level specified in the pricing editor, or if no changes have been made.

Exit Pricing Editor: This option will appear if no changes have been made. It will exit the Pricing Editor leaving the pricing as is.

Pricing Table

Country	Coin Chutes				Games/Coins	Display	Pricing Adjustments A3 02 03 04 05 06 07 08 09
	Left	Center	Right	4th Chute			
USA	25¢	\$1.00*	25¢	\$1.00	1/50¢, 2/75¢, 3/\$1 ²	50¢, 75¢, \$1.00	
	25¢	\$1.00*	25¢	\$1.00	1/75¢, 2/\$1.50, 3/\$2.00 ²	1/75, 3/2.00	
	25	\$1.00	25¢	\$1.00	1/3X25¢ ²	USA1 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/\$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 ^{1,2}	USA 5/\$2.00	
	25	\$1.00	25¢	\$1.00	1/3X25¢, 2/\$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 ²	1/1, 6/5	
Canada	25¢	-	\$1.00*	-	1/50¢, 2/75¢, 3/\$1 ²	CAN. 50-75-1	
	25	-	\$1.00	-	1/50¢, 2/\$1 ²	CAN. 2/\$1.00	
	25	-	\$1.00	-	1/50¢, 3/\$1.00 ²	CAN. 3/\$1.00	
	25	-	\$1.00	-	1/2x25¢, 2/4x25¢, 3/\$1.00 ²	3/\$1.00 Coin	
	25	-	\$1.00	-	1/2x25¢, 2/\$1.00, 3/\$1.50, 6/\$2.00 ²	CAN. 6/\$2.00	
	25	-	\$1.00	-	1/2x25¢, 2/\$1.00, 3/\$1.50, 5/\$2.00 ^{1,2}	CAN. 5/\$2.00	
	25	-	\$1.00	-	1/2x25¢, 2/\$1.00, 4/\$1.50, 6/\$2.00 ²	6/\$2 4/1.50	
	25	-	\$1.00	-	1/3X25¢, 2/\$1.50, 4/\$2.00 ²	1/75, 4/2.00	
	25¢	-	\$1.00*	-	1/75¢, 2/\$1.50, 3/\$2.00 ²	1/75, 3/2.00	
	25	-	\$1.00	-	1/3X25¢ ²	CAN. 1/\$0.75	
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, 5/5Fr	SWISS 2	
Belgium	5Fr	20Fr	50Fr	-	1/4x5Fr, 1/20Fr, 3/50Fr ²	BELGIUM	
Germany	1DM	2DM	5DM	-	1/2DM, 2/3DM, 3/4DM, 4/5DM ^{1,2}	GER. 4/5DM	
					1/2DM, 2/3DM, 3/4DM, 5/5DM ^{1,2}	GER. 1/2DM	
					1/1DM, 2/2DM, 5/5DM ²	GER. 1/1DM	
					1/1DM, 2/2DM, 6/5DM ²	GER. 6/5DM	
Holland	1G	-	1G	-	1/1G ²	HOLLAND	
Sweden	1Kr	5Kr	10Kr	1Kr	1/10Kr, 2/15Kr, 3/20Kr ^{1,2}	SWEDEN 1	
	1Kr	5Kr	10Kr	1Kr	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	-	1/2x500L, 2/4x500L ²	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
Japan	100¥	-	100¥	-	1/2x25P, 3/100P	CUSTOM	03 00 12 00 04 00 01 06
	100¥	-	100¥	-	1/100¥ ²	JAPAN	
Chile	Token	-	Token	-	1/1Token ²	CHILE	
Denmark	1Kr	5Kr	10Kr	20Kr	1/2x1kr, 3/5kr, 7/10kr ²	DENMARK 1	
	1Kr	5Kr	10Kr	20Kr	1/5kr, 3/10kr, 6/20kr ^{1,2}	DENMARK 2	
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 ²	NEW ZEALAND 1	
Zealand	\$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	20 Old	20 New	50F	-	1/40F, 2/60F, 4/100F 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 Ticket.

A.4 03 Champion H.S.T.D.

The "Highest" High Score is 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 is displayed.
- OFF - The "Highest" High Score is not retained.

A.4 04 Champion Credits

The operator chooses the number of credits or tickets awarded for a Grand Champion Score. Range: 00 - 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 to be awarded whenever a player exceeds the 1st, 2nd, 3rd, and 4th highest scores. Range: 00 - 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 - 99,900,000.

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 - 99,900,000.

A.4 15 Backup Buy-In H.S.T.D. 1

A.4 16 Backup Buy-In H.S.T.D. 2

A.4 17 Backup Buy-In H.S.T.D. 3

A.4 18 Backup Buy-In H.S.T.D. 4

The first through the fourth backup Buy-In High Score values. The game automatically restores these values when the High Score Reset Every value is reached.

Range: 00 to 9,500,000,000

A.4 19 Alien Champion

This adjustment is used to set the number of Aliens that must be destroyed in a game to become the new Alien Champion.

Range: 5 to 50

Factory Setting: 30

A.4 20 Alien Champion Credits

This adjustment specifies the number of credits to award for a new Alien Champion.

Range: 00 to 03

Factory Setting: 00

A.5 Printer Adjustments (optional board required)

A.5 01 Column Width

The column width to be printed. Range: 22 - 80.

A.5 02 Lines Per Page

The amount of lines per page. Range: 20 - 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 does not pause.

A.5 04 Printer Type

Select the type of printer. Choices: Parallel, Serial, ADP., Mini-Drucker, or NSM.

A.5 05 Serial Baud Rate

The baud rate used for Serial or ADP communications (bit rate). Choices: 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 printer is not ready.
Ignore - D.T.R. signal is ignored.

A.5 07 Auto Printout

With the optional printer board installed, this adjustment allows the initiation of printouts whenever the game detects a printer connected to the game. Parallel printers are detected automatically by plugging them in and putting them on-line. Serial printers (or computers) are detected by sending a carriage return (ASCII 0x0D) or XON (ASCII 0x11).

This adjustment has the following settings:

OFF	Disable automatic printouts
MAIN AUDS	Main Audit table (B.1)
EARNINGS	Earning Audits (B.2)
STD. AUDITS	Standard Audits (B.3)
FEATURES	Feature Audits (B.4)
HISTOGRAMS	Histograms (B.5)
TIMESTAMPS	Time Stamps (B.6)
ALL DATA	All of the above data

The table specified above will automatically be printed when a printer (or computer) is detected.

If the printer is detected during game over or test mode, the printout will take place right away.

If the printer is connected while a game is being played, it will take up to 10 seconds to be detected, after which the printout will occur. The game will resume after the printout is complete.

Automatic printout will only take place if the coin door is open.

After an automatic printout has been generated, a second automatic printout will not be possible until a new game has started, or test mode begins.

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 apx. 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).

Check Fuses F115 and F116 and Opto 12V Supply

This message will be displayed if the game senses that all optical switches are not functioning. This usually occurs when there is no 12V supply to the playfield optics.

The problem is likely to be a blown fuse (F109), or at connectors J138, J139, J140 or J141 on the power driver board.

Opto Trough Bad Check Connectors, Wires and 12V Supply.

This message will be displayed if all of the optics in the playfield ball trough are not functioning. This is usually caused by a problem with a ball trough connector supplying 12V and ground for the optical circuits.

Pinball Missing.

This game normally uses five 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.

G10 Error

The security chip is incorrect or faulty. If this occurs, replace the security chip.

G11 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 set. 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 voltages 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 circuit and noise is entering the circuit.

CPU and Audio Visual Board Error Codes

The CPU has three LED's, 201, 202, and 203. At game turn-on, LED 201 and LED 202 are on, LED 203 is off. During normal operation LED 201 is off, LED 202 is on, and LED 203 is flashing. If the system detects an error the following happens:

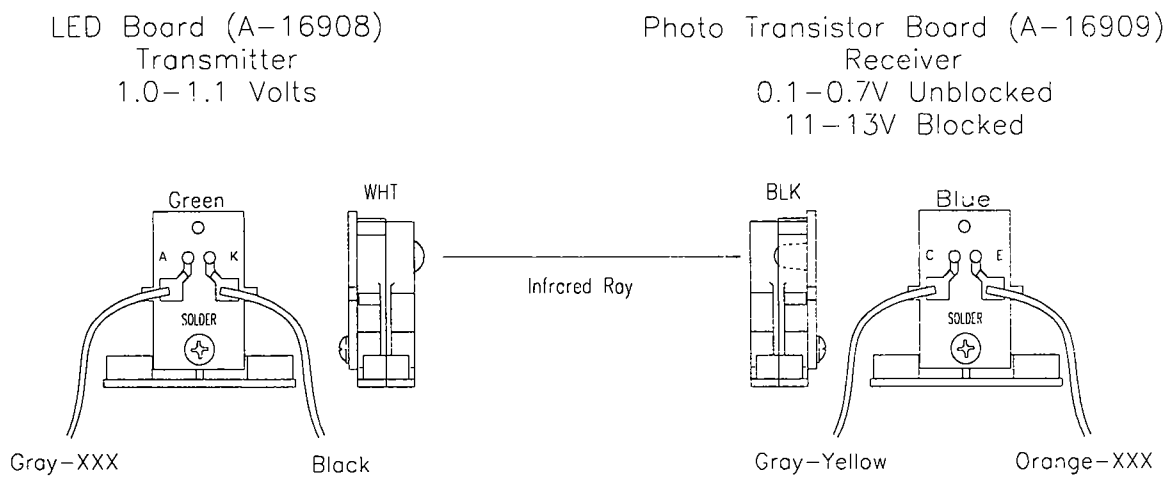
CPU BOARD	Center LED blinks once	= G11 ROM Failure
LED ERROR CODES	Center LED blinks twice	= U8 RAM Failure
	Center LED blinks three times	= G10 Security Chip Failure

Upon game turn-on you will hear one of the following.

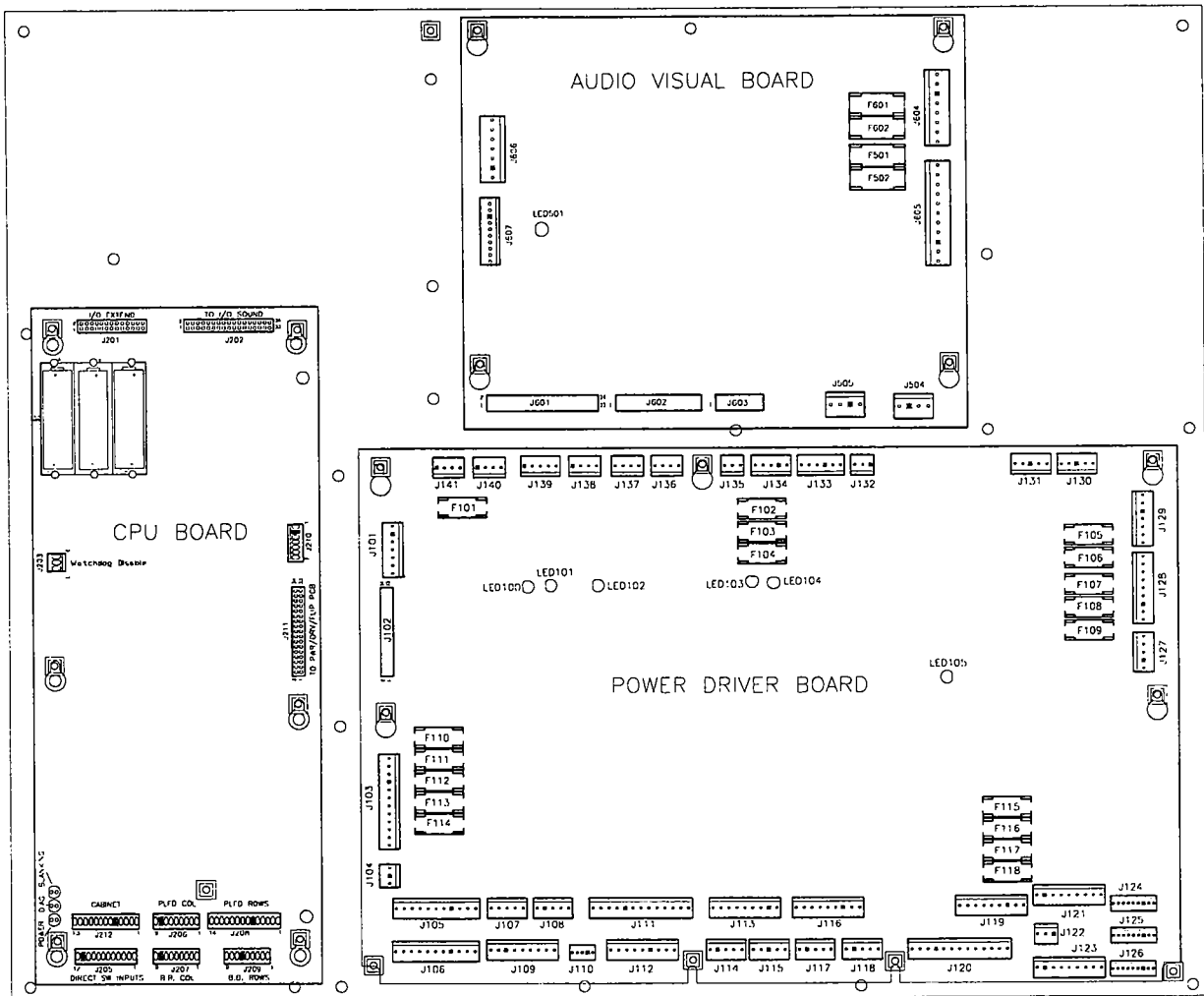
AUDIO VISUAL BOARD	1 Beep	= Audio Visual Board is O.K.
BEEP ERROR CODES	2 Beeps	= S2 Failure
	3 Beeps	= S3 Failure
	4 Beeps	= S4 Failure
	5 Beeps	= S5 Failure
	6 Beeps	= S6 Failure
	7 Beeps	= S7 Failure
	10 Beeps	= Audio Static RAM Failure

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.



LED LIST



CPU BOARD

- LED 201 Blanking
- LED 202 Power
- LED 203 Diagnostics

At game turn-on, LED 201 and LED 202 are on, LED 203 is off.
During normal operation LED 201 is off, LED 202 is on, and LED 203 is flashing.

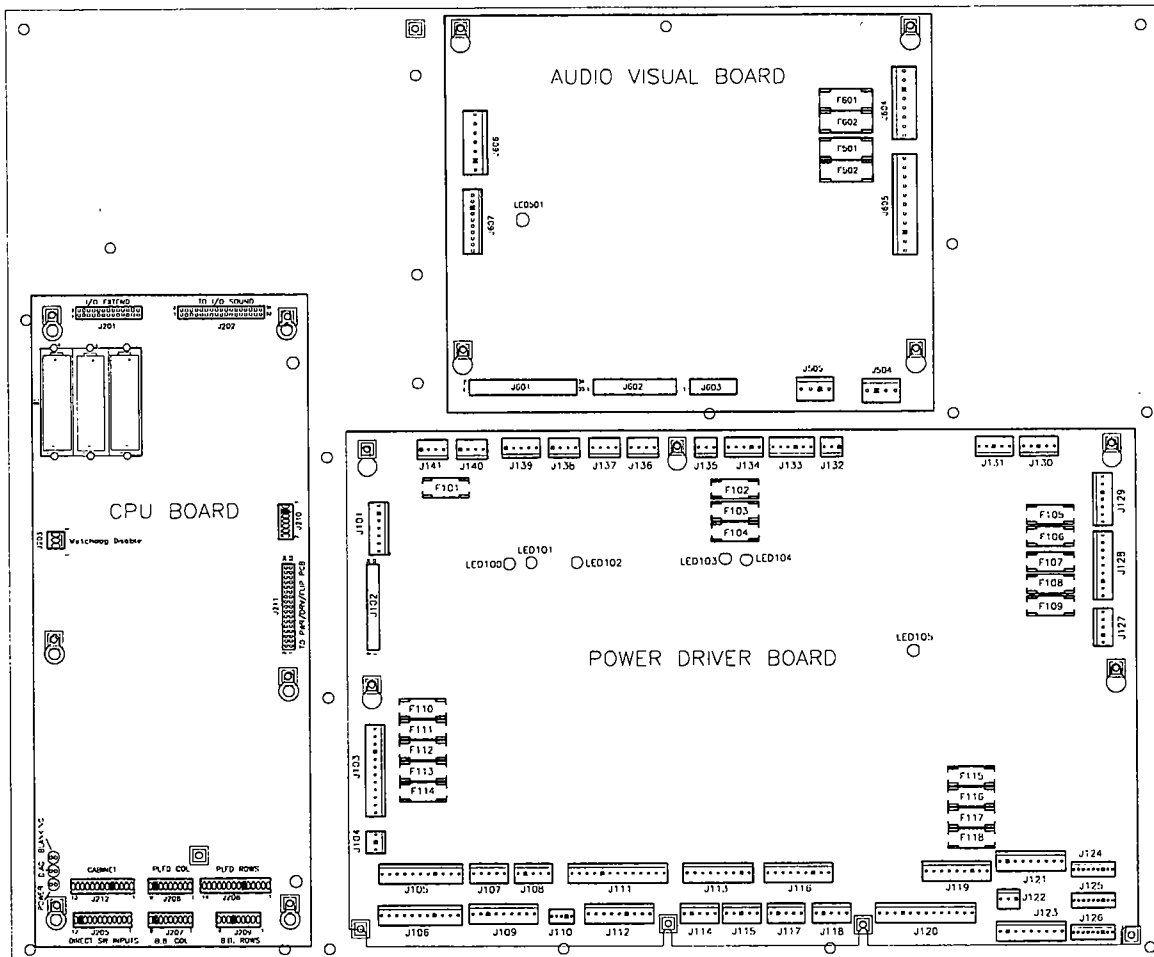
AUDIO VISUAL BOARD

- LED 501 +5VDC, Normally Flashing at a slower rate than LED 203.

POWER DRIVER BOARD

- LED 100 +12VDC Regulated, Normally On
- LED 101 +5VDC Digital, Normally On
- LED 102 +18VDC Lamps, Normally On
- LED 103 +12VDC Unregulated, Normally On
- LED 104 +20VDC Flashlamps, Normally On
- LED 105 +50VDC Coils, Normally On

FUSE LIST



AUDIO VIDEO BOARD

F501	-25V	T2.5A, 250V
F502	+25V	T2.5A, 250V
F601	+62V	T0.25A, 250V
F602	-113V & -125V	T0.25A, 250V

CPU BOARD

There are no fuses on the CPU board.

POWER DRIVER BOARD

F101	Regulated 12V	T0.63A, 250v	F110	G.I. #5 White-Violet	T4.0A, 250V
F102	Solenoids #9 to #16	T4.0A, 250V	F111	G.I. #4 White-Green	T4.0A, 250V
F103	Solenoids #1-#8	T4.0A, 250V	F112	G.I. #3 White-Yellow	T4.0A, 250V
F104	Solenoids #25 to #28	T4.0A, 250V	F113	G.I. #2 White-Orange	T4.0A, 250V
F105	+5V Logic	T4.0A, 250V	F114	G.I. #1 White-Brown	T4.0A, 250V
F106	+18V Lamp Matrix	T5.0A, 250V	F115	+50V Flippers	T2.5A, 250V
F107	Flasher Secondary	T4.0A, 250V	F116	+50V Flippers	T2.5A, 250V
F108	Solenoid Secondary	T6.3A, 250V	F117	+50V Flippers	T2.5A, 250V
F109	Unregulated 12V	T4.0A, 250V	F118	+50V Flippers	T2.5A, 250V

LINE FILTER

Foreign	T4.0A, 250V
Domestic	T5.0A, 250V

MAINTENANCE INFORMATION

LUBRICATION

The two main lubrication points of the Ball Eject mechanism* are the pivots for the arm. The mechanisms of other playfield devices are somewhat similar and have the same lubrication requirements. A medium viscosity oil (switch target grease) is satisfactory for these devices. Also, regularly lubricate the slide-mechanism rails and the leg levers.

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 Drop Targets. MBI Instrument Grease, also known as Drop Target Switch Lubricant, (Bally part number of EI 165), 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 and should close when the flipper is energized. All end-of-stroke 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 NO REPLACE these switches with the old style tungsten high current type switches, as intermittent operation could occur. Please note that unlike the old style of flipper, an end-of-stroke switch failure will not harm the flipper. The game will notify the operator of a switch being misadjusted in the test report, but will continue to play. The end-of-stroke 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.

*May not be used on all games.

SECTION TWO

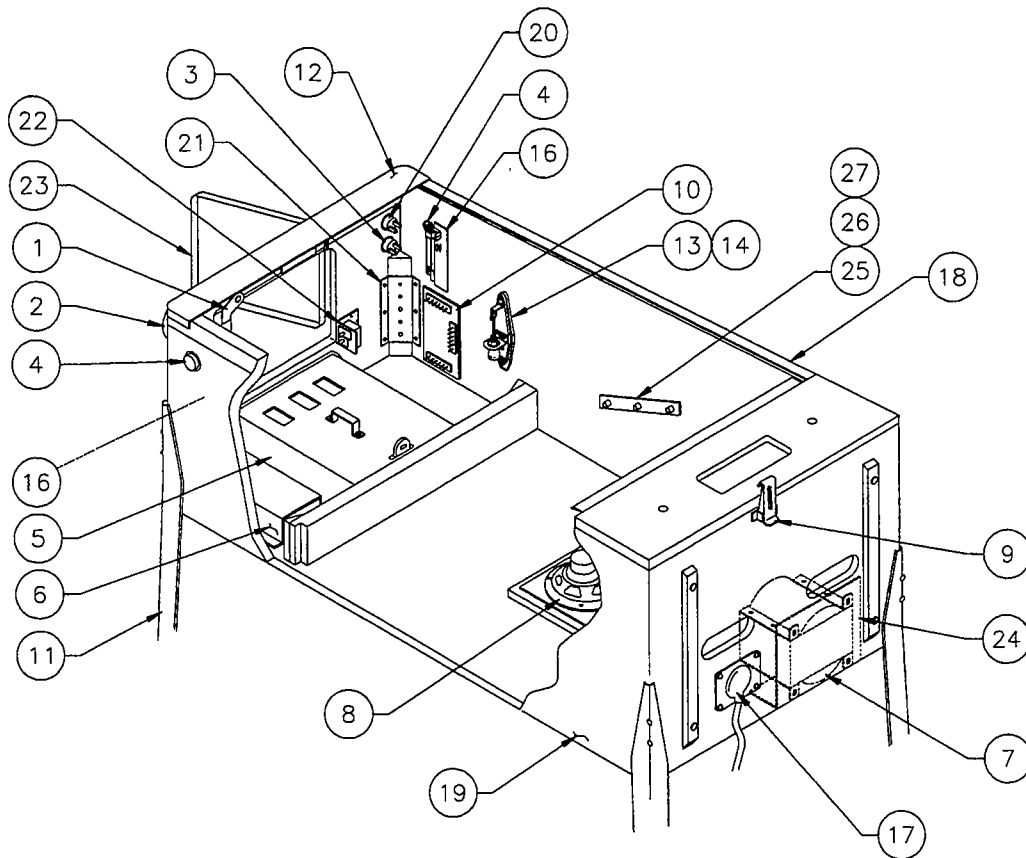
GAME PARTS INFORMATION

50041-BB

Backbox Assembly

			Ribbon Cables		
Item	Part Number	Description	Item	Part Number	Designator
1	01-6645	Venting Screen	10	5795-12653-03	Ribbon Cable, 34-pin, 3"
2	B-10686-1	Knocker Assembly	11	5795-12653-12	Ribbon Cable, 34-pin, 12"
3	A14092-7	WPC '95 Mounting Plate Assy.	12	5795-12838-25	Ribbon Cable, 14-pin, 25"
4	A-20028	WPC '95 Power Driver PCB	13	5795-10938-15	Ribbon Cable, 26-pin, 15"
5	A-20516-50041	WPC '95 Audio Visual PCB	Miscellaneous Parts		
6	A-20119-50041	WPC '95 CPU PCB			
7	04-10276-50041	Backbox, Wood			
8	A-20245	Speaker/Display Assembly			
a)	555-12924-00	Speaker Tweeter, 15w, 4Ω	08-7456	Backbox Glass: 27 x 18-7/8"	
b)	5555-12856-00	Speaker, 5-1/4", 25w, 4Ω	20-9718	Wing Screw, 3/8-16 x 2"	
c)	5045-12914-00	Capacitor, 10μfd., 50v (±20%)	31-1357-50041	Screened Translight	
d)	5901-12784-00	Dot Matrix Display/Driver Board	Backbox Cables		
9	A-13379	Lock & Plate Assembly			
10	50041-IN	Insert Assembly			
			H-20479	Dot Matrix Display Power Cable	
			H-20477	Logic Power Cable	
			H-20478	Secondary Cable	
			H-20723	Insert Cable	

50041-CAB Cabinet Assembly



Miscellaneous Parts (Not Shown)

Item	Part Number	Description	Part Number	Description
1	A-16773-1	Lever Guide Assembly	A-17195	Tilt Switch Assy. w/Cable
2	20-9663-B-4	Push Button w/Light (Red)	A-19562.1	Stay Arm Assembly
3	20-9663-21	Push Button w/Sw., <i>Extra Ball</i> (Blue)	01-12352	Clip Bracket
4	A-16883-4	Flipper Button, Red (2)	01-9011-L	Backbox Mtg. Bracket, Left
5	A-20729-1	4-Ball Cashbox Assembly	01-9011-R	Backbox Mtg. Bracket, Right
6	A-17540-1	Univ. Power Interface Assy.	01-6389-1	Cashbox Lock Bracket
7	5610-14515-00	WPC Transformer	08-7028-T	Playfield Glass
8	5555-12929-00	Speaker, 4Ω, 6", 25w	08-7377	Leg Leveler Adjuster, 3"
9	20-9347	Toggle Latch	20-6500	Steel Ball, 1-1/16" (4)
10	A-20580	Coin Door Interface Board		
11	A-19514	Leg Assembly, Chrome (4)		
12	D-12615	Front Molding Assembly		
13	20-6502-A	Plum Bob		
14	04-10346	Tilt Mechanism Assembly		
15	*	Cordset		
16	A-17316	Opto Flipper Assembly (2)		
17	01-10714	Line Cord Cover		
18	A-12359-3	Side Molding Assembly (2)		
19	11-1310	Wood Cabinet		
20	20-9663-2	Push Button w/Sw., <i>Start</i> (Green)		
21	01-11400	Leg Plate (4)		
22	A-18249-1	Cable & Interlock Switch Assy.		
23	09-61000-1	Coin Door-USA		
24	01-13936	Drip Plate		
25	01-11408	Plate Spacer (2)		
26	02-4329-1	Pivot Nut, 7/8" (4)		
27	02-4352	Pivot Bushing (2)		

Cabinet Cables

A-20201	Cable & Jumper Assy., Coin Door
H-17217.1	Plumb/Bob Mech. Protect Cable
H-17837-2	Voltage Program Jumper Cable
H-20599-1	Cabinet Cable
H-19601-1	Power Extension Cable
H-20727.1	Cabinet Switch/Lamp Cable

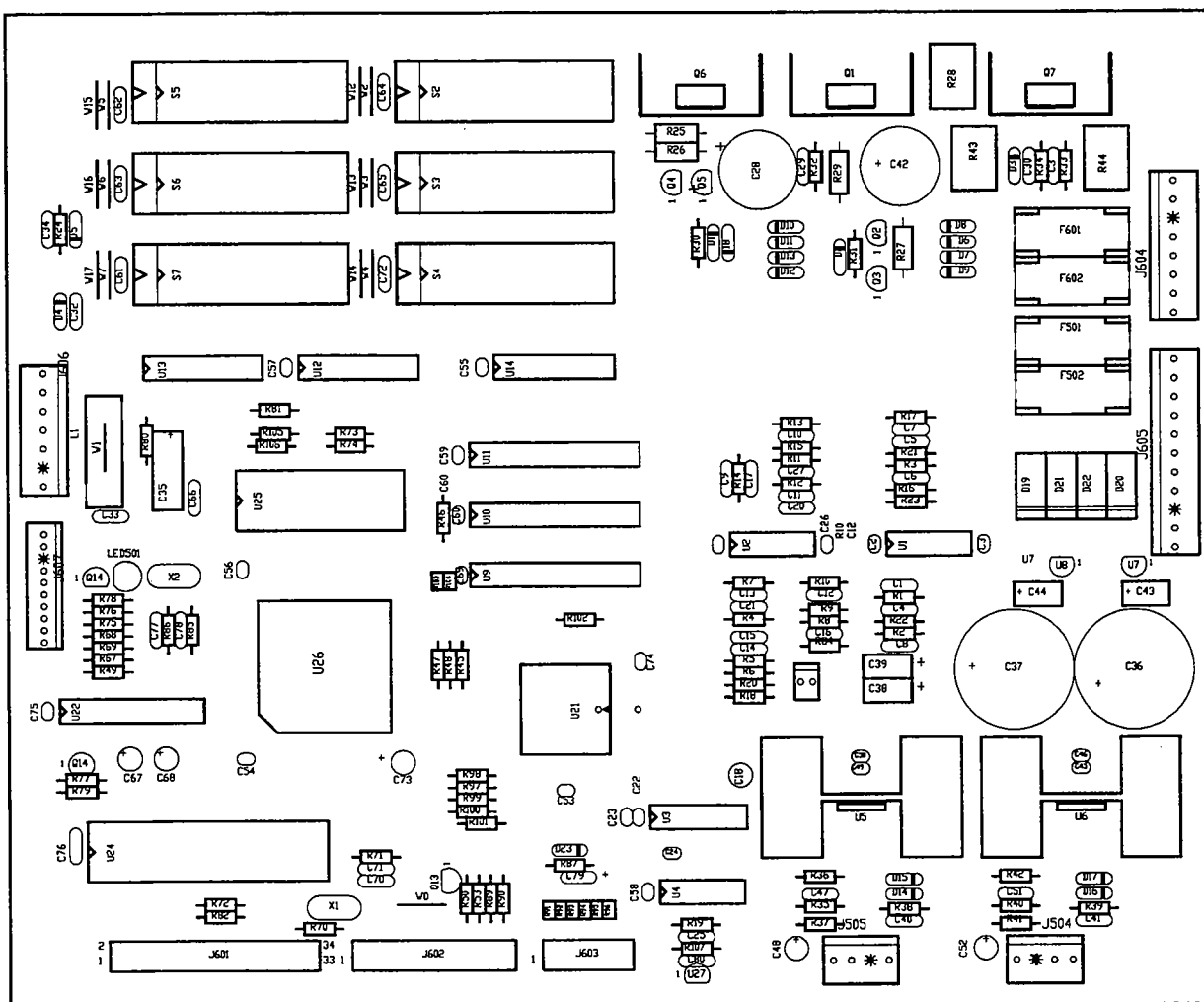
A-20516-50041

WPC '95 Audio Visual PCB Assembly

Part Number	Designator	Description	Part Number	Designator	Description
4004-01005-06	-	Mach. Screw, 4-40 x 3/8"	5048-11033-00	C1	Cap., .022m, 50v, 10% Ax.
4404-01119-00	-	Nut 4-40 ESN	5048-12036-00	C40, C41	Cap., .22m, 50v, Axial
5010-08774-00	R2, R17, R22, R23, R35, R36, R40, R42, R87	Resistor, 22K Ω , 1/4w, 5%	5048-13172-00	C78	Cap., 47pf, 50v, 20% Ax.
5010-08991-00	R20, R46-R48, R50, R72, R76, R77, R107	Resistor, 4.7K Ω , 1/4w, 5%	5048-13418-00	C4 - C6	Cap., .047m, 50v, 5% Ax.
5010-09034-00	R21	Resistor, 10K Ω , 1/4w, 5%	5048-13609-00	C9, C12, C15	Cap., 3900pf, 50v, 5% Ax.
5010-09036-00	R19	Resistor, 100 Ω , 1/4w, 5%	5048-13610-00	C8, C10, C11, C13, C14	Cap., 1000pf, 50v, 5% Ax.
5010-09134-00	R32-R34	Resistor, 150K Ω , 1/4w, 5%	5048-13611-00	C16, C17, C20, C21	Cap., 680pf, 50v, 5% Ax.
5010-09219-00	R1, R3	Resistor, 8.2K Ω , 1/4w, 5%	5048-14563-00	C29-C31	Cap., .01 μ f, 200v, 10% Axial
5010-09416-00	R73, R74, R80-R82, R88, R105, R106	Resistor, 470 Ω , 1/4w, 5%	5070-09045-00	D19-D22	Diode MR501, 3.0A
5010-09807-00	R30, R31, R67-R69, R102	Resistor, 120 Ω , 1/4w, 5%	5070-09054-00	D4, D6-D17, D23	Diode 1N4004, 1.0A
5010-10171-00	R24	Resistor, 56 Ω , 1/4w, 5%	5075-12823-00	D1, D18	Zener, 1N4758A 56v, 1w
5010-10258-00	R86	Resistor, 1M Ω , 1/4w, 5%	5075-12824-00	D3, D5	Zener, 1N4742A 12v, 1w
5010-10983-00	R53, R75, R79, R84, R85, R89, R90	Resistor, 1.8K Ω , 1/4w, 5%	5075-12826-00	D2	Zener, 1N4759, 62v, 1w
5010-12832-00	R25, R26, R27, R29	Resistor, 47K Ω , 1/4w, 5%	5160-08938-00	Q13-Q15	Transistor, 2N4401 NPN
5010-13215-00	R78, R97-R101	Resistor, 200K Ω , 1/4w, 5%	5164-09056-00	Q2, Q3	Transistor, MPSD02 NPN
5010-13372-00	R91-R96, R103, R104	Resistor, 220 Ω , 1/8w, 5%	5164-12154-00	Q1, Q7	Transistor, MJE15030 NPN
5010-13420-00	R37, R41	Resistor, 680 Ω , 1/4w, 5%	5194-09055-00	Q4, Q5	Transistor, MP5D52 PNP
5010-13517-00	R38, R39	Resistor, 15 Ω , 1/4w, 5%	5194-12155-00	Q6	Transistor, MJE15031 PNP
5010-13607-00	R4, R5, R7-R15	Resistor, 6.19K Ω , 1/8w, 1%	5250-13302-00	U7	Reg. 78L05T 5v
5012-14558-00	R44	Resistor, 1.8K Ω , 5w vertical	5250-13303-00	U8	Reg. 79L05T 5v
5012-14559-00	R43	Resistor, 4.7K Ω , 5w vertical	5311-12538-00	U4	IC 74HC14 Hex. S-T
5012-14560-00	R28	Resistor, 120 Ω , 5w vertical	5315-13081-00	U12-U14	IC Octal Buffer HCT541
5013-13661-00	R16	Resistor, 9.09K Ω , 1/4w, 1%	5340-12278-00	U25	S/Ram 2064 150NS
5013-14456-00	R6, R18	Resistor, 3.32K Ω , 1/4w, 1%	5370-12687-00	U27	IC MC 340640Reset Chp
5040-14569-00	C35	Cap., 100mf, 25v, Axial	5349-14351-00	U9-U11	SRAM 8Kx8-35ms, 28pdip
5040-09365-00	C38, C39, C43, C44	Cap., 1m, 63v(+50,-10%)Ax.	5370-12730-00	U1, U2	IC Op Amp TL084
5040-12750-00	C48, C52, C73	Cap., 22m, 35v Radial	5370-13419-00	U5, U6	IC TDA 2030AV 18w, Audio Amp
5040-13098-00	C18, C67, C68	Cap., 4.7 μ , 35v ($\pm$ 20%)	5371-13299-00	U3	IC Ad-1851 16bit mono
5040-13417-00	C36, C37	Cap., 10000 μ f, 35v Radial	5520-14561-00	X2	Crystal 20mHz, parallel 20pf
5040-14564-00	C28, C42	Cap., 150 μ f, 160v, 20%Rad.	5671-14516-00	LED 501	Led-Display Red T 1-3/4
5043-08996-00	C2, C3, C19, C22-C24, C26, C32, C34, C45, C46, C49, C50, C53-C66, C69, C72, C74-C76, C79, C80	Cap., 0.1 μ f, 50v ($\pm$ 20%) Ax.	5700-08985-00	U24	Socket IC 40-pin .6
5043-10267-00	C47, C51	Cap., 150pf, 100v Cer. Ax.	5700-12047-00	U22	Socket IC 24.3P
5048-10992-00	C27	Cap., .0047m, 50v, 10% Ax.	5700-12088-00	S2-S7	Socket Dip 32.6P"
5048-11028-00	C77	Cap., 22p, 50v, Axial	5705-12638-00	-	Heatsink 5298B
5048-11029-00	C25	Cap., 100p, 50v, 5% Axial	5705-14562-00	-	Heatsink 10-220 wave sol 287
5048-11030-00	C7	Cap., 470p, 50v, Axial	5733-14528-00	-	Fuse Holder 5x20mm 10A.
			5791-10850-00	J602	Connector, 26-pin Header Str.
			5791-10862-04	J504, J505	Connector, 4-pin Header Str.
			5791-10862-07	J606	Connector, 7-pin Header Str.
			5791-10862-08	J604	Connector, 8-pin Header Str.
			5791-10862-11	J605	Connector, 11-pin Header Str.
			5791-12516-00	J601	Connector, 34 hdr 2 x 17 .100
			5791-12827-00	J603	Connector, 14 Hen 7x2 Str.
			5791-13830-10	J607	Connector, 10-pin Str. Sq.
			5010-09534-00	W0, W1-W7, R49	Resistor, 0 Ω , 0w

A-20516-50041

WPC '95 Audio Visual PCB Assembly



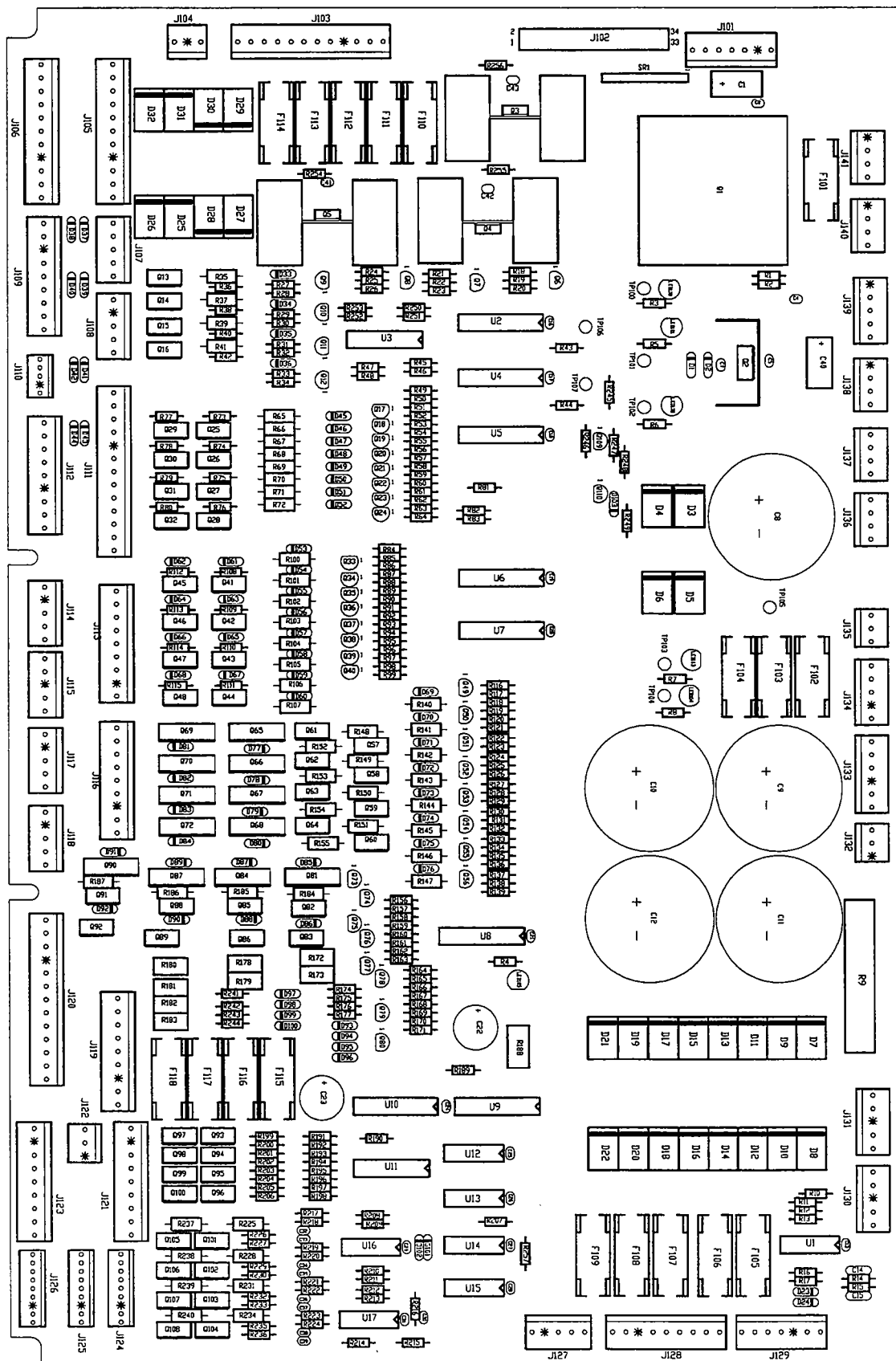
A-20028

WPC '95 Power Driver PCB Assembly

Part Number	Designator	Description	Part Number	Designator	Description
5040-14569-00	C1, C40	Capacitor, 100µF, 25v, Ax.	5013-14534-00	R2	Resistor, 243Ω, 1/4w, 1%
5043-08996-00	C2, C4, C5, C7, C13, C16, C17, C18, C19, C20, C21, C24-C39, C41-C43	Capacitor, 0.1m, 50v (±20%) Ax.	5010-09999-00	R3, R4, R6-R8, R43, R44, R81-R83, R190	Resistor, 2KΩ, 1/4w, 5%
5040-13417-00	C8 - C12	Capacitor, 10000µf, 35v Radial	5010-09224-00	R5, R14 - R17	Resistor, 270Ω, 1/4w, 5%
5048-11031-00	C14, C15	Capacitor, .001m, 50v, 10% Ax.	5012-12632-00	R9	Resistor, 12Ω, 10w, 5%
5040-09537-00	C22, C23	Capacitor, 100µ, 100v (±20%) Radial	5010-09324-00	R10	Resistor, 27KΩ, 1/4w, 5%
5070-09054-00	D1, D2, D23, D24, D33 - D100, D103	Diode 1N4004	5010-09358-00	R11, R157, R159, R161, R163, R165, R167, R169, R171, R216-R224, R247	Resistor, 1KΩ, 1/4w, 5%
5070-14526-00	D3-D22, D25-D32	Diode P600G 6A 400 PIV	5010-09034-00	R12, R13, R189, R208-R215, R248	Resistor, 10KΩ, 1/4w, 5%
5070-08919-00	D101, D102	Diode, 1N4148 150mA	5010-08992-00	R18, R21, R24, R192, R194, R196, R198, R200, R202, R204, R206	Resistor, 560Ω, 1/4w, 5%
5731-14531-00	F101	Fuse 5 x 20mm TO 63A., 250V	5010-08991-00	R19, R22, R25, R28, R30, R32, R34, R50, R52, R54, R56, R58, R60, R62, R64, R84, R86, R88, R90, R92, R94, R96, R98, R116, R119, R122, R125, R128, R131, R134, R137, R246	Resistor, 4.7KΩ, 1/4w, 5%
5731-14532-00	F115-F118	Fuse 5 x 20mm T2 50A., 250V			
5731-14530-00	F102-F105, F107, F109-F114	Fuse 5 x 20mm T 4A, 250V			
5731-14046-00	F106	Fuse S-B, 5A, 5x20mm			
5731-14529-00	F108	Fuse 5 x 20mm T 6.3A, 250V	5010-11079-00	R20, R23, R26, R254-R256	Resistor, 51Ω, 1/4w, 5%
5733-14528-00	F101-F118	Fuse Holder 5 x 20mm 10A	5010-09416-00	R27, R29, R31, R33, R45-R49, R51, R53, R55, R57, R59, R61, R63, R85, R87, R89, R91, R93, R95, R97, R99, R117, R120, R123, R126, R129, R132, R135, R138, R156, R158, R160, R162, R164, R166, R168, R170, R245, R250-R253, R257	Resistor, 470Ω, 1/4w, 5%
5705-14724-00	Q1	Heat Sink TO-3 5.1DEG/W			
5701-09652-00	Q1	Thermal Pad TO-3			
4406-01128-00	Q1	Nut 6-32 KEPS			
4006-01005-06	Q1	Mach. Screw, 6-32 x 3/8"			
5705-14562-00	Q2	Heat Sink 10-220 Wave Sol 287			
4004-01005-06	Q2-Q5	Mach. Screw, 4-40 x 3/8"			
4404-01119-00	Q2-Q5	Nut 4-40 ESN			
5705-12638-00	Q3-Q5	Heat Sink 5298B			
5791-10862-07	J101, J129	Connector, 7-pin Header Str.			
5791-12516-00	J102	Connector, 34 Hdr 2x17			
5791-10862-12	J103	Connector, 12-pin Header Str.			
5791-10862-03	J104, J122, J132, J135	Connector, 3-pin Header Str.			
5791-10862-11	J105, J106	Connector, 11-pin Header Str.			
5791-10862-05	J107, J108, J114, J115, J117, J118, J127, J130, J131, J134, J139	Connector, 5-pin Header Str.	5010-08993-00	R35, R37, R39, R41, R65-R72, R100-R107, R140-R147	Resistor, 68Ω, 1/4w, 5%
5791-10862-09	J109, J112, J113, J116, J119, J121, J123, J128	Connector, 9-pin Header Str.	5010-08997-00	R36, R38, R40, R42, R73-R80, R108, R109, R110-R115, R118, R121, R124, R127, R130, R133, R136, R139	Resistor, 2.7kΩ, 1/4w, 5%
5791-10862-13	J111, J120	Connector, 13-pin Header Str.			
5791-13830-09	J124-J126	Connector, 9-pin Header Str.	5010-09361-00	R148-R155, R184-R187	Resistor, 220Ω, 1/4w, 5%
5791-10862-06	J133	Connector, 6-pin Header Str.	5011-12956-00	R172, R173, R178-R183	Resistor, 2.7KΩ, 1/4w, 5%
5791-10862-04	J136-J138, J140, J141	Connector, 4-pin Header Str.	5010-10171-00	R174-R177, R241-R244	Resistor, 56Ω, 1/4w, 5%
5671-14516-00	LED100-LED105	LED Dspl Red T-1	5010-14711-00	R188	Resistor, 10KΩ, 1/4w, 5%
5250-14527-00	Q1	Regulator Voltage LM317K	5010-09314-00	R191, R193, R195, R197, R199, R201, R203, R205	Resistor, 1.2kΩ, 1/4w, 5%
5460-12423-00	Q2	I.C. LM7812			
5131-12725-00	Q3-Q5	Triac BT138E	5010-09086-00	R207	Resistor, 6.8kΩ, 1/4w, 5%
5194-09055-00	Q6-Q12, Q17-Q24, Q33-Q40, Q49-Q56, Q109	Transistor, MPSD52 PNP	5010-12427-00	R225, R228, R231, R234, R237-R240	Resistor, .22kΩ, 1/4w, 5%
5162-12635-00	Q13-Q16, Q25-Q32, Q41-Q48, Q57-Q64, Q82, Q83, Q85, Q86, Q88, Q89, Q91, Q92, Q101-Q108	Transistor, TIP102	5010-08998-00	R226, R227, R229, R230, R232, R233, R235, R236	Resistor, 2.2kΩ, 1/4w, 5%
5191-12179-00	Q65-Q72, Q81, Q84, Q87, Q90	Transistor, TIP36C	5010-09040-00	R249	Resistor, 33Ω, 1/4w, 5%
5190-09016-00	Q73 - Q80	Transistor, 2N4403 PNP	5019-10143-00	SRI	SIP RES 470 x 9R
5192-12428-00	Q93 - Q100	Transistor, TIP107	5824-09248-00	TP100-TP107	Test Point #1502-1
5160-10269-00	Q110	Transistor, 2N3904	5370-12272-00	U1, U16, U17	I.C. LM339 Quad Comp
5013-14535-00	R1	Resistor, 750Ω, 1/4w, 1%	5281-09486-00	U2, U4-U8, U10	I.C. 74LS374 8d/f/f
			5162-12422-00	U3, U11	Trans uln 2803 Oc-drl
			5281-10182-00	U9	I.C. 74LS240 l/drvr
			5281-09487-00	U12 - U15	I.C. 74LS74 Dual d f/f
			5791-13830-05	J110	Connector, 5-pin Header

A-20028

WPC '95 Power Driver PCB Assembly

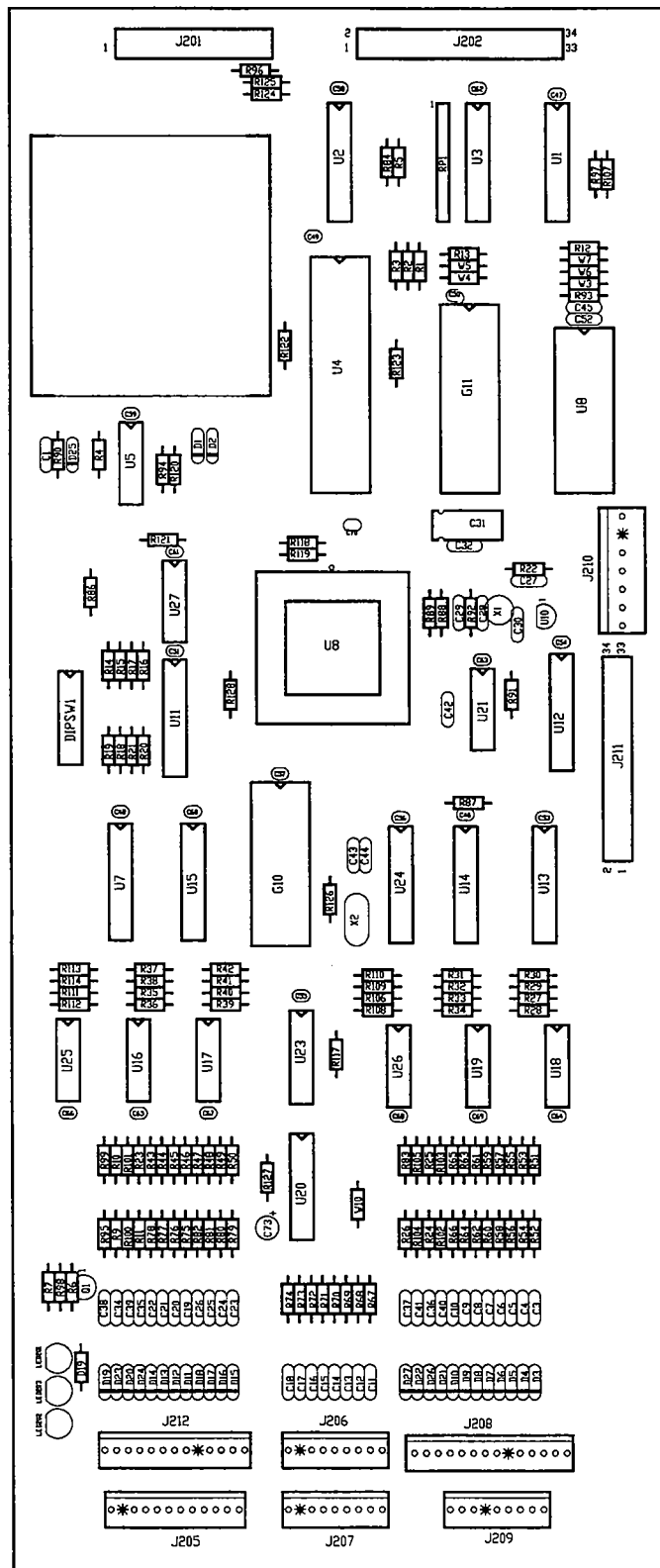


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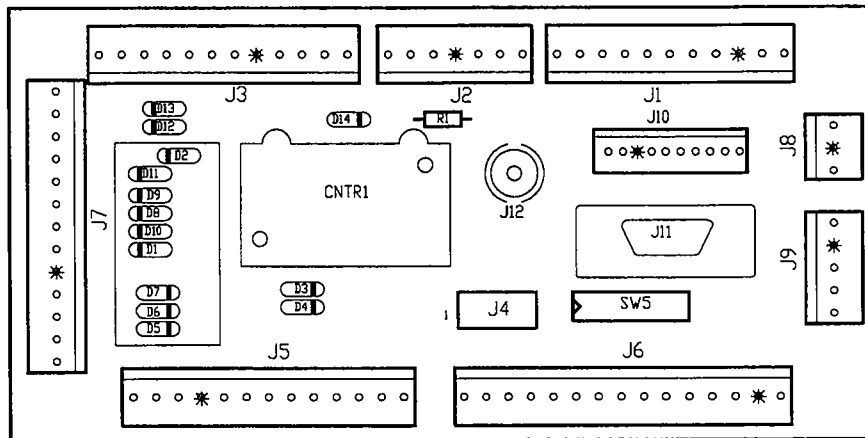
WPC '95 CPU PCB Assembly

Part Number	Designator	Description
A-15814	B1	Battery Holder
5048-11033-00	C1, C42	Cap., .022μ. 50v, 10% Ax.
5048-11030-00	C3-C26, C34-C41	Cap., 470p, 50v Axial
5043-09030-00	C27	Cap., .047m, 50v (±20%) Ax.
5048-13375-00	C28	Cap., 100p, 50v, 10% Axial
5048-11028-00	C29, C30, C43, C44	Cap., 22p, 50v Axial
5040-14569-00	C31	Cap., 100μ, 25v, Axial
5048-11031-00	C32	Cap., .001μ, 50v, Axial
5043-08996-00	C45 - C70	Cap., 0.1μ, 50v (±20%) Ax.
5040-13098-00	C73	Cap., 4.7μF, 35v (±20%)
5645-09025-00	DIPSW1	Switch Dip 8-Position
5070-09266-00	D1, D25	Diode 1N5817 1.0A.
5070-08919-00	D2 - D24, D26, D27	Diode 1N4148 150mA.
5700-10176-00	G10	Socket Dip 28.6
5700-12088-00	G11	Socket Dip 32.6p"
5700-08985-00	U4	IC Socket 40-pin
5700-12424-00	U9	Socket 84-pin
5700-10389-00	U20	IC Socket 18-pin 3"
5791-10850-00	J201	Connector, 26-pin Header
5791-12516-00	J202, J211	Connector, 34-pin Hdr. 2x17
5791-13830-12	J205	Connector, 12-pin Header Str.
5791-13830-09	J206, J207, J209	Connector, 9-pin Header
5791-13830-14	J208	Connector, 14-pin Header
5791-10862-07	J210	Connector, 7-pin Header
5791-13830-13	J212	Connector, 13-pin Header
5671-14516-00	LED201 - LED203	LED Dspl. Red T-1-3/4
5160-10269-00	Q1	Transistor, 2N3904 NPN
5019-09669-00	RP1	SIP 4.7K, 9R, 10 (5%)
5010-09358-00	R1-R4, R9-R11, R23-R26, R43-R84, R93, R95-R97, R99-R114, R117	Resistor, 1kΩ, 1/4W, 5%
5010-09416-00	R5-R8, R12, R13, R87-R89	Resistor, 470Ω, 1/4w, 5%
5010-09034-00	R14-R22, R27-R42, R86, R90, R94, R98	Resistor, 10KΩ, 1/4w, 5%
5010-12104-00	R91	Resistor, 22M, 1/4w, 5%
5010-10989-00	R92	Resistor, 470KΩ, 1/4w, 5%
5010-09187-00	R118 - R123, R128	Resistor, 150Ω, 1/4w, 5%
5010-09434-00	R124, R125	Resistor, 22Ω, 1/4w, 5%
5010-09040-00	R127	Resistor, 33Ω, 1/4w, 5%
5010-09534-00	W3, W4, W7, R124, R125	Resistor, 0Ω
5010-10258-00	R126	Resistor, 1M, 5% 1/4w
5281-09867-00	U1, U2, U7	I.C. 74HCT244
5281-09851-00	U5	I.C. 74LS14 SMT/TRG
5281-09308-00	U3	IC 74LS245 Trnc
5340-13062-00	U9	IC RAM 32k x 8 Static
5370-12687-00	U10	I.C. MC 34064 Reset Chp.
5281-10182-00	U11-U13, U15	I.C. 74LS240 Vdrv
5311-14068-00	U14, U24	I.C. 74HC574 Octal d-latch
5370-12272-00	U16-U19, U25, U26	I.C. LM339 Quad Comp.
5284-12651-00	U21	I.C. 4584 Hex Schmitt
5311-14554-00	U23	I.C. 74HC237 3 to 8 non inv
5281-09743-00	U27	I.C. 74LS08 Quad.
5520-12084-00	X1	Crystal 32.768KHz
5520-14761-00	X2	Xtal-8M Anti Res Parallel Cut
A-5400-50041-1	G10	PIC16C57 Assembly
5880-09022-00	B1	Battery 1.5v AA Alkaline
5400-10320-00	U4	I.C. MPU68B09E
5410-12426-00	U9	I.C. WPC-89 ASIC
5162-12422-00	U20	Trans uln 2803 Oc-Drl
A-5343-50041-1A	G11	Game ROM Assembly

A-20119-50041 WPC '95 CPU PCB Assembly

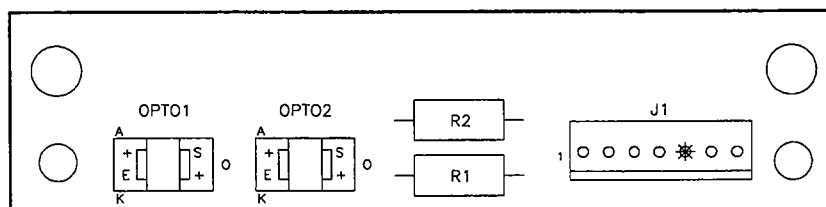


A-20580 Coin Interface PCB Assembly



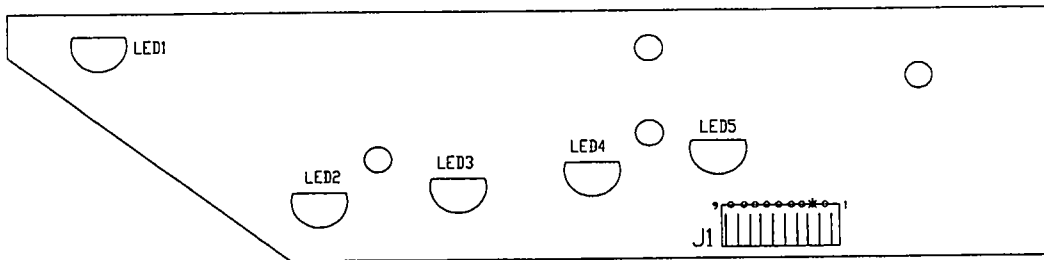
Part Number	Designator	Description
5070-09054-00	D1-D14	Diode 1N4004 1.0A.
5791-10862-11	J1	Connector, 11-pin Header Str. Sq.
5791-10862-07	J2	Connector, 7-pin Header Str. Sq.
5791-10862-12	J3	Connector, 12-pin Header Str. Sq.
5791-11000-10	J4	Connector, 10-pin Header Str. Sq.
5791-10862-13	J5, J7	Connector, 13-pin Header Str. Sq.
5791-10862-15	J6	Connector, 15-pin Header Str. Sq.
5791-10862-03	J8	Connector, 3-pin Header Str. Sq.
5791-10862-05	J9	Connector, 5-pin Header Str. Sq.
5791-12462-10	J10	Connector, 10-pin Header Str. Sq.
5010-09040-00	R1	Resistor, 33, 1/4w, 5%
5645-09025-00	SW5	Switch DIP 8 Pos.

A-17316 Flipper Opto PCB Assembly



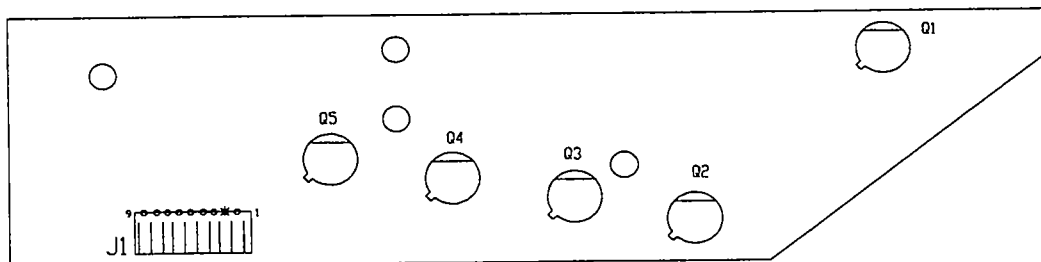
Part Number	Designator	Description
A-20207	-	Flipper Opto Switch PCB
5010-09061-00	R1, R2	Resistor, 680Ω, 1/2w, 5%
5490-14575-00	OPTO1, OPTO2	IC Opto Integ Schmitt 10mA.
5791-13830-07	J1	Connector, 7-pin Header Solid Sq.
03-9001	-	Interrupter Flip-Opto

A-18617-1 Trough IRED LED PCB Assembly



Part Number	Designator	Description
5671-12731-00	LED1 - LED5	Infra Red Diode
5791-12622-09	J1	Connector, 9-pin Header Sq.

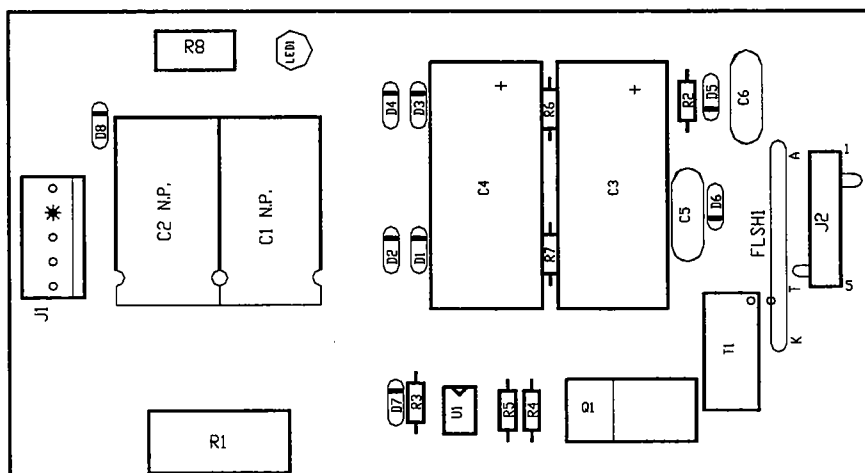
A-18618-1 Trough IRED Transistor PCB Assembly



Part Number	Designator	Description
5163-14114-00	Q1 - Q5	Infra Red Photo Transistor
5791-12622-09	J1	Connector, 9-pin Header Sq.

A-20669

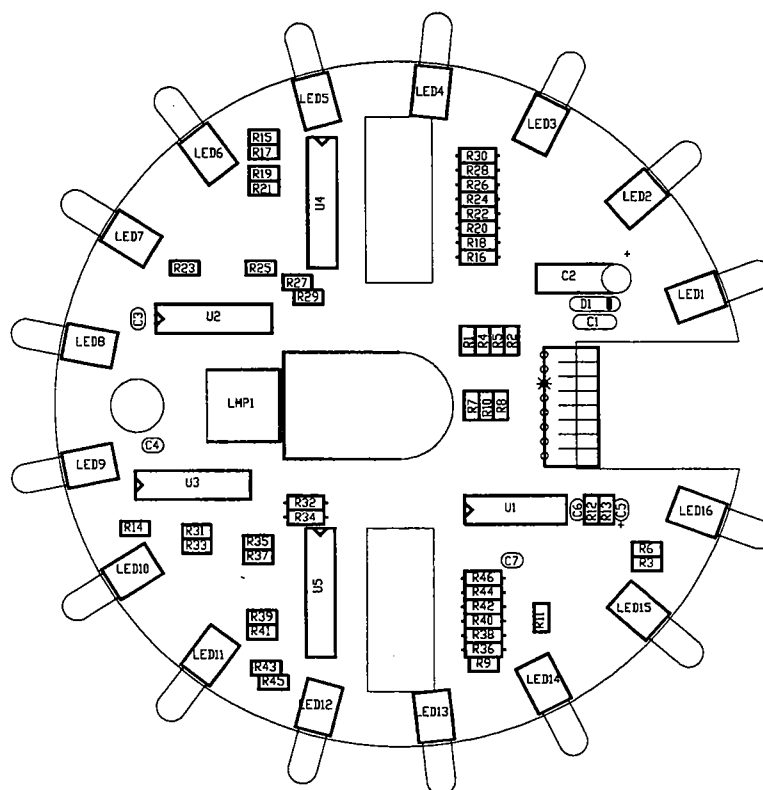
Strobe Lamp PCB Assembly



Part Number	Designator	Description
5045-13523-00	C1, C2	Capacitor, 100fd, 100v, 10Ax.
5040-09794-00	C3, C4	Capacitor, 100M, 250v Axial
5045-10728-00	C5, C6	Capacitor, .22fd, 250v ($\pm 10\%$)
5070-09054-00	D1-D8	Diode 1N4004 1.0A.
5791-10862-05	J1	Connector, 5-pin Header Str Sq.
5791-14779-00	J2	Connector 5-pin Header Vert Mini Fit
5671-14516-00	LED1	LED Display Red
5131-13524-00	Q1	Triac C106d 4A, 400v
5012-13560-00	R1	Resistor, 120 Ω , 5w, 5%
5010-08772-00	R2, R4	Resistor, 15K Ω , 1/4w, 5%
5010-09358-00	R3, R5	Resistor, 1K Ω , 5%, 1/4w
5010-09162-00	R6, R7	Resistor, 100K Ω , 5%, 1/4w
5010-14711-00	R8	Resistor, 10K Ω , 5%, 1/4w
5551-13525-00	T1	Ind. Trigger Coil
5490-13526-00	U1	IC Opto Isolator Moc 3011

A-20670

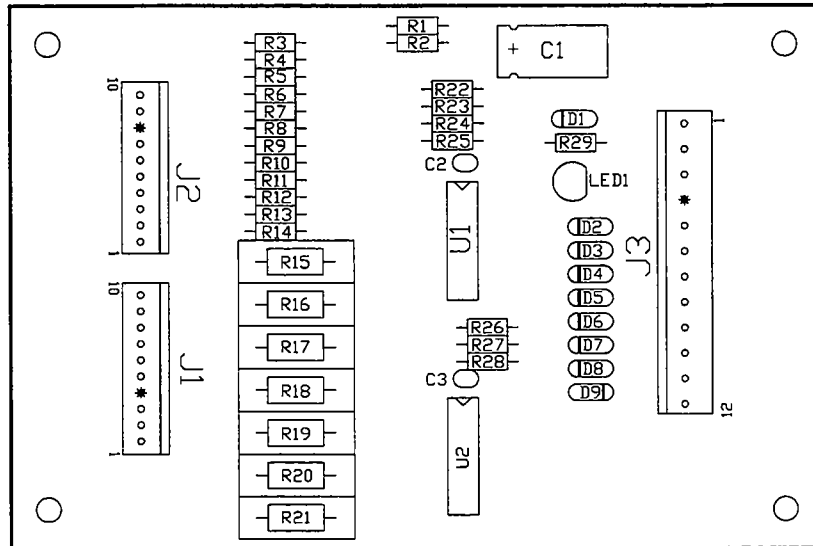
16-LED PCB Chase Assembly



Part Number	Designator	Description
5043-08996-00	C1, C3, C4, C6, C7	Capacitor, 0.1μfd, 50v (±20%) Axial
5040-09343-00	C2	Capacitor, 10μfd, 20v (±20%) Axial
5048-10994-00	C5	Capacitor, .33μfd, 50v (±20%) Axial
5070-09054-00	D1	Diode 1N4004 1.0A
5791-12622-08	J1	Connector, 8-pin Header R/A Lck
24-8802	J2	Flash Lamp Wedge Base
5671-13732-01	LED1 - LED16	LED Display Red
24-8857	LP1	Flash Lamp Socket
5010-13594-00	R1, R2, R4, R5, R7, R8, R10	Resistor, 1KΩ, 1/8w, 5% Film
5010-13593-00	R3, R6, R9, R12-R14	Resistor, 10KΩ, 1/8w, 5% Film
5010-13843-00	R11	Resistor, 22KΩ, 1/8w, 5% Film
5010-13367-00	R15, R17, R19, R21, R23, R25, R27, R29, R31, R33, R35, R37, R39, R41, R43, R45	Resistor, 2.2KΩ, 1/8w, 5% Film
5010-09416-00	R16, R18, R20, R22, R24, R26, R28, R30, R32, R34, R36, R38, R40, R42, R44, R46	Resistor, 470Ω, 1/8w, 5% Film
5370-12272-00	U1	IC LM339 Quad Comp
5310-14760-00	U2, U3	IC 4094 Parallel Out Shif
5162-12422-00	U4, U5	Trans ULN 2803 Oc-Drl
03-9473	LED1 - LED16	Spacer T1&3/4 Rt Angle LED

A-15576

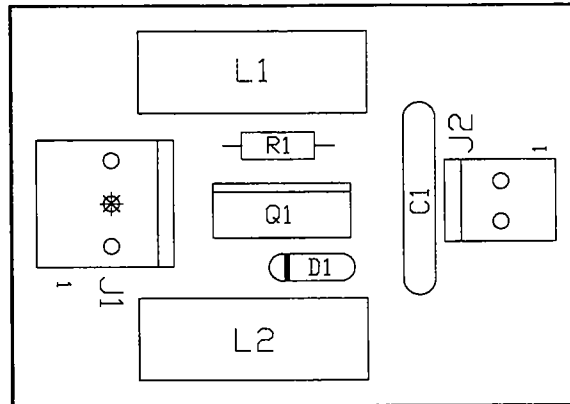
7-Switch Opto PCB Assembly



Part Number	Designator	Description
5040-12298-00	C1	Capacitor, 100 μ Fd, 40v ($\pm$ 50%)
5043-08980-00	C2, C3	Capacitor, 0.01 μ , 50v
5671-13732-00	LED1	Display LED Red
5370-12272-00	U1, U2	ICLM339 Quad
5070-09054-00	D1 - D9	Diode 1N4004 1.0A.
5010-12928-00	R15 - R21	Resistor, 270 Ω , 2w, 5%
5010-09999-00	R1 - R14	Resistor, 2K Ω , 1/4w, 5%
5010-10631-00	R29	Resistor, 1.2K Ω , 1/4w, 5%
5010-09162-00	R23, R25, R26	Resistor, 100K Ω , 1/4w, 5%
5010-08774-00	R22, R24	Resistor, 22K Ω , 1/4w, 5%
5010-09034-00	R28	Resistor, 10K Ω , 1/4w, 5%
5791-10862-12	J3	Connector, 12-pin Header Sq.
5791-13830-10	J1, J2	Connector, 10-pin Header Sq.

A-15340

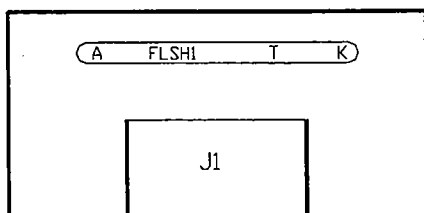
Motor EMI w/Brake PCB Assembly



Part Number	Designator	Description
5551-09822-00	L1, L2	Inductor, 4.7MH3AMP
5791-12273-03	J1	Connector, 3-pin Header Str Sq.
5791-12273-02	J2	Connector, 2-pin Header Str Sq.
5070-09054-00	D1	Diode, 1N4004 1.0A.
5010-08998-00	R1	Resistor, 2.2K Ω , 1/4w, 5%
5162-12635-00	Q1	Transistor TIP 102

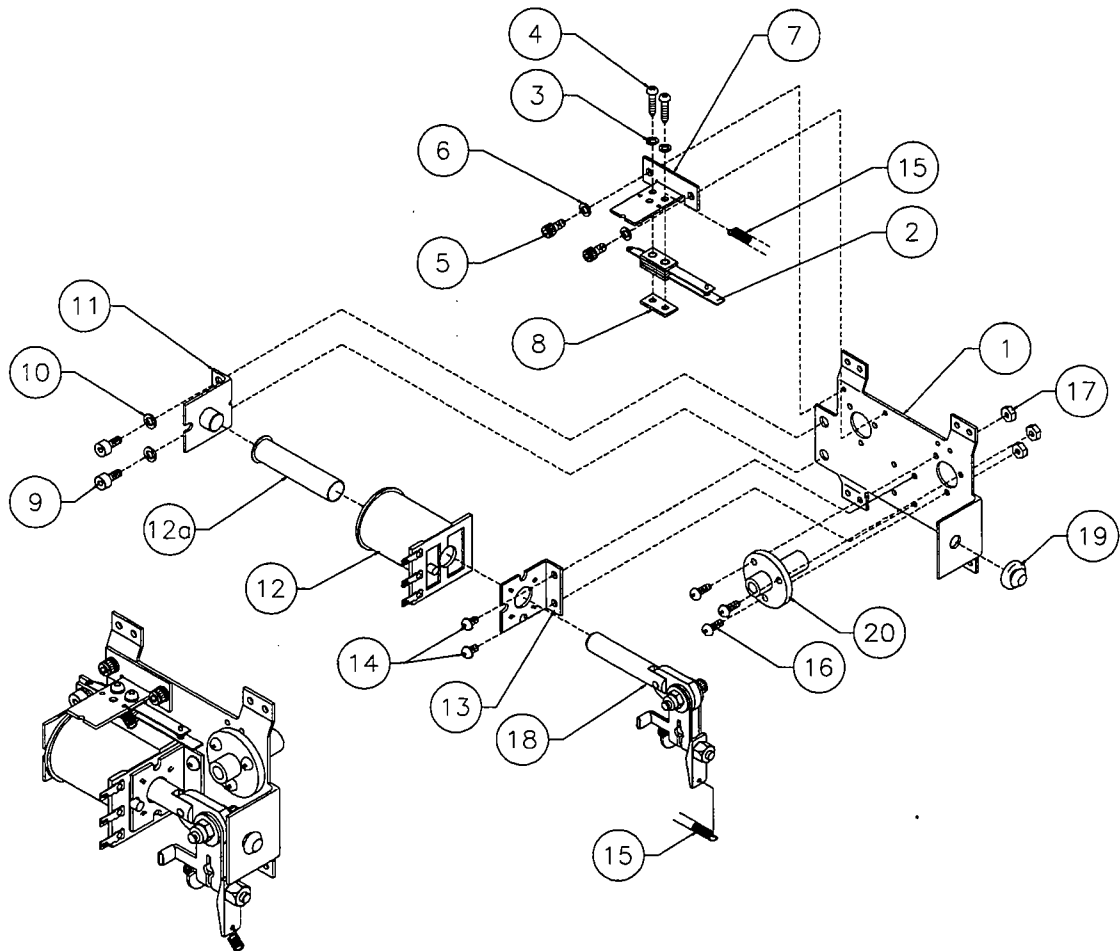
A-20718

Strobe Tube PCB Assembly



Part Number	Designator	Description
5791-14774-00	J1	Connector, 5-pin Header Mini Fit
03-9495		Xenon Tube Spacer
24-8835	FLSH1	Xenon Flash Tube

A-15849-L-2 Flipper Assembly

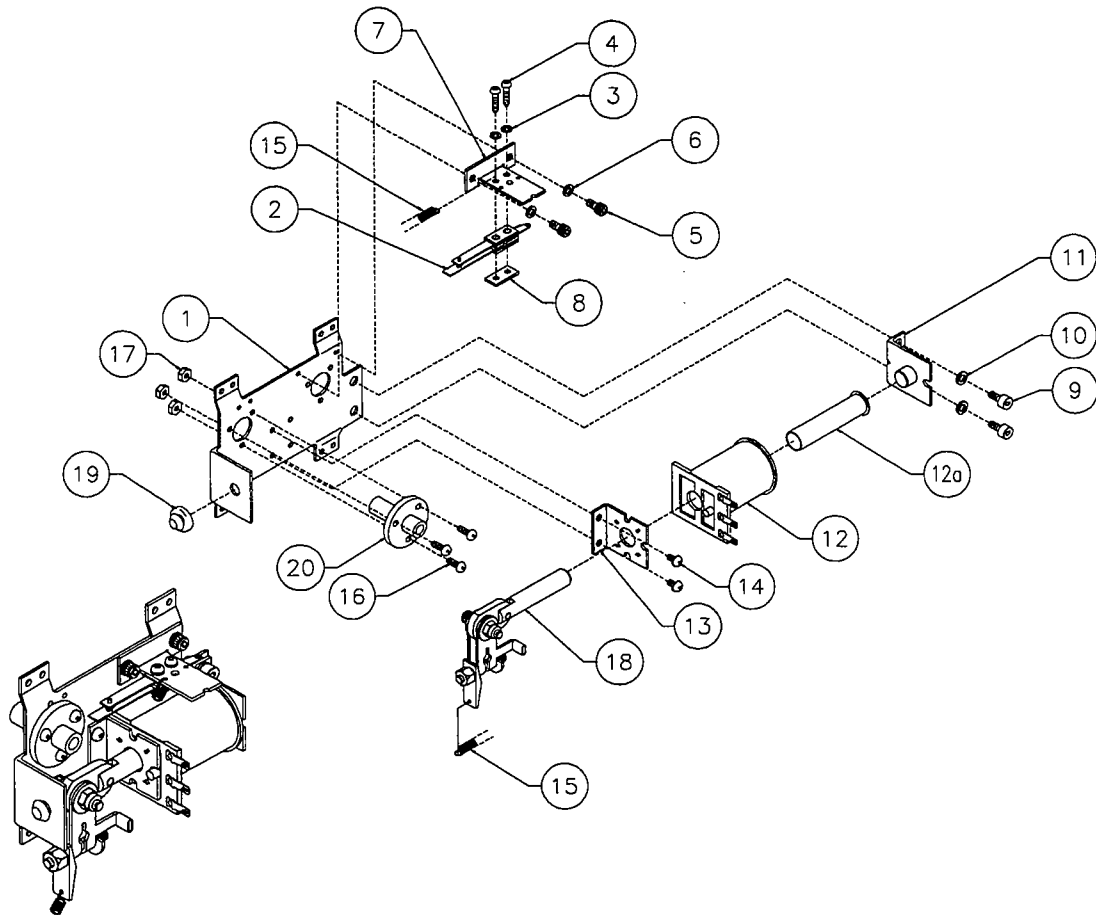


Item	Part Number	Description	Item	Part Number	Description
1	B-13104-L	Flipper Base Assembly, Left	18	A-15848-L	Crank Link Assembly, Left
2	SW-1A-194	Switch Assembly	a)	A-17050-L	Flipper Crank Assembly, Left
3	4701-00002-00	Lockwasher #6 Split	b)	A-15847	Flipper Link Assembly
4	4105-01019-10	Sh. Metal Screw, #5 x 5/8"	c)	02-4676	Link Spacer Bushing
5	4008-01079-05	Mach. Screw, 8-32 x 5/16"	d)	4010-01086-14	Cap Screw, 10-32 x 7/8"
6	4701-00003-00	Lockwasher #8 Split	e)	4700-00023-00	Flat Washer, 5/8 x 13/64 x 16ga.
7	01-9375	Switch Mounting Bracket	f)	4701-00004-00	Lockwasher #10 Split
8	20-6516	Speednut, Tinnerman	g)	4410-01132-00	Nut 10-32 ESN
9	4010-01066-06	Cap Screw, 10-32 x 3/8"	19	23-6577	Bumper Plug, 5/8"
10	4701-00004-00	Lockwasher #10 Split	20	03-7568	Flipper Bushing
11	A-12360	Flipper Stop Assembly			
12	FL-11629	Flipper Coil, Blue			
a)	03-7066-5	Coil Tubing			
13	01-7695-1	Solenoid Bracket			
14	4006-01017-04	Mach. Screw, 6-32 x 1/4"			
15	10-364	Spring			
16	4006-01005-06	Mach. Screw, 6-32 x 3/8"			
17	4406-01117-00	Nut 6-32 Hex.			

Associated Parts: (Not Shown)

21	23-6695	Flipper Rubber Ring, Black
22	20-10110-5	Flipper Bat w/Shaft

A-15849-R-2 Flipper Assembly

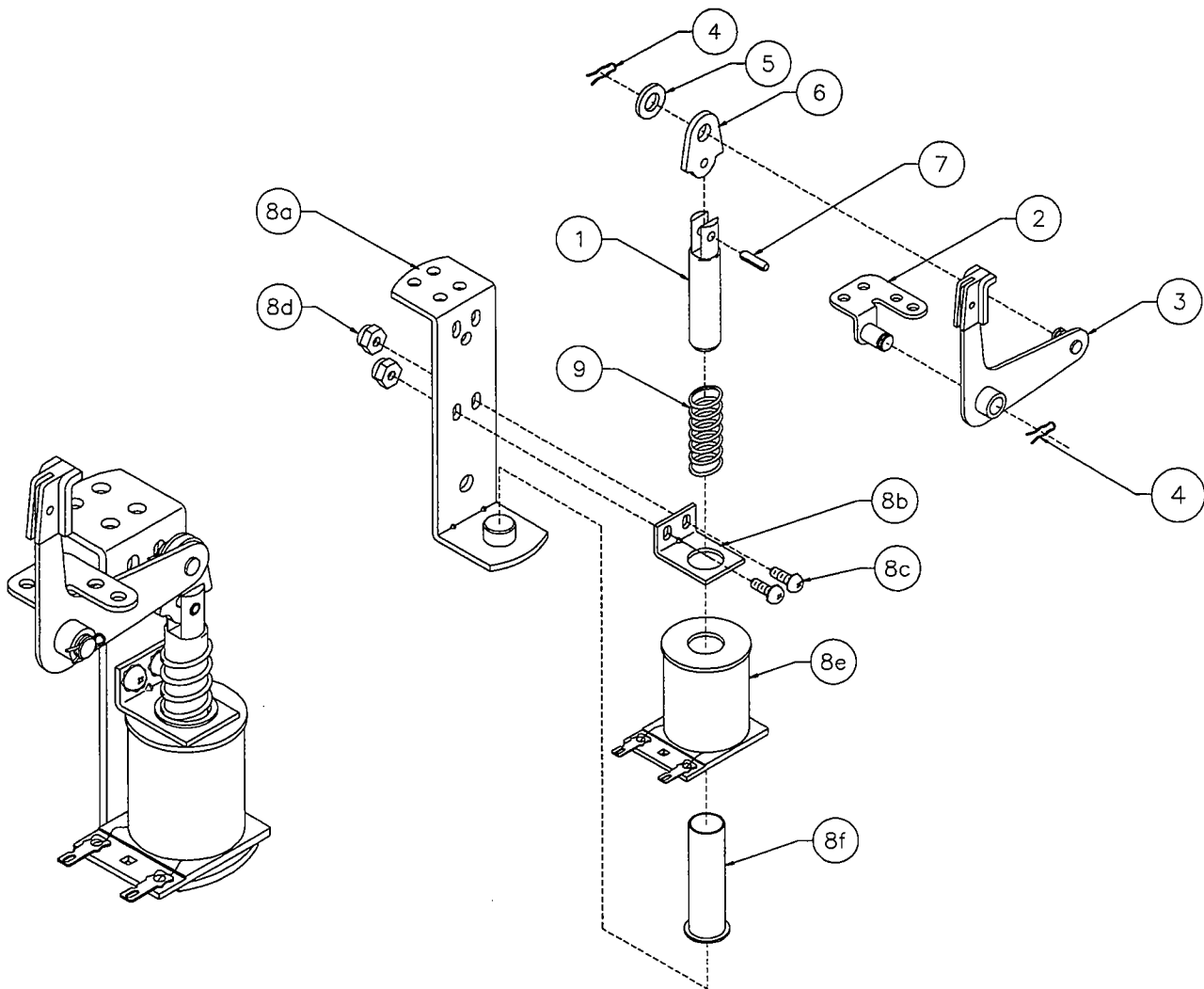


Item	Part Number	Description	Item	Part Number	Description
1	B-13104-R	Flipper Base Assembly, Right	18	A-15848-R	Crank Link Assembly, Right
2	SW-1A-194	Switch Assembly	a)	A-17050-R	Flipper Crank Assembly, Right
3	4701-00002-00	Lockwasher #6 Split	b)	A-15847	Flipper Link Assembly
4	4105-01019-10	Sh. Metal Screw, #5 x 5/8"	c)	02-4676	Link Spacer Bushing
5	4008-01079-05	Mach. Screw, 8-32 x 5/16"	d)	4010-01086-14	Cap Screw, 10-32 x 7/8"
6	4701-00003-00	Lockwasher #8 Split	e)	4700-00023-00	Flat Washer, 5/8 x 13/64 x 16ga.
7	01-9375	Switch Mounting Bracket	f)	4701-00004-00	Lockwasher #10 Split
8	20-6516	Speednut, Tinnerman	g)	4410-01132-00	Nut 10-32 ESN
9	4010-01066-06	Cap Screw, 10-32 x 3/8"	19	23-6577	Bumper Plug, 5/8"
10	4701-00004-00	Lockwasher #10 Split	20	03-7568	Flipper Bushing
11	A-12360	Flipper Stop Assembly	Associated Parts: (Not Shown)		
12	FL-11629	Flipper Coil, Blue			
a)	03-7066-5	Coil Tubing	21	23-6695	Flipper Rubber Ring
13	01-7695	Solenoid Bracket	22	20-10110-5	Flipper w/Shaft
14	4006-01017-04	Mach. Screw, 6-32 x 1/4"			
15	10-364	Spring			
16	4006-01005-06	Mach. Screw, 6-32 x 3/8"			
17	4406-01117-00	Nut 6-32 Hex.			

Flipper Notes...

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

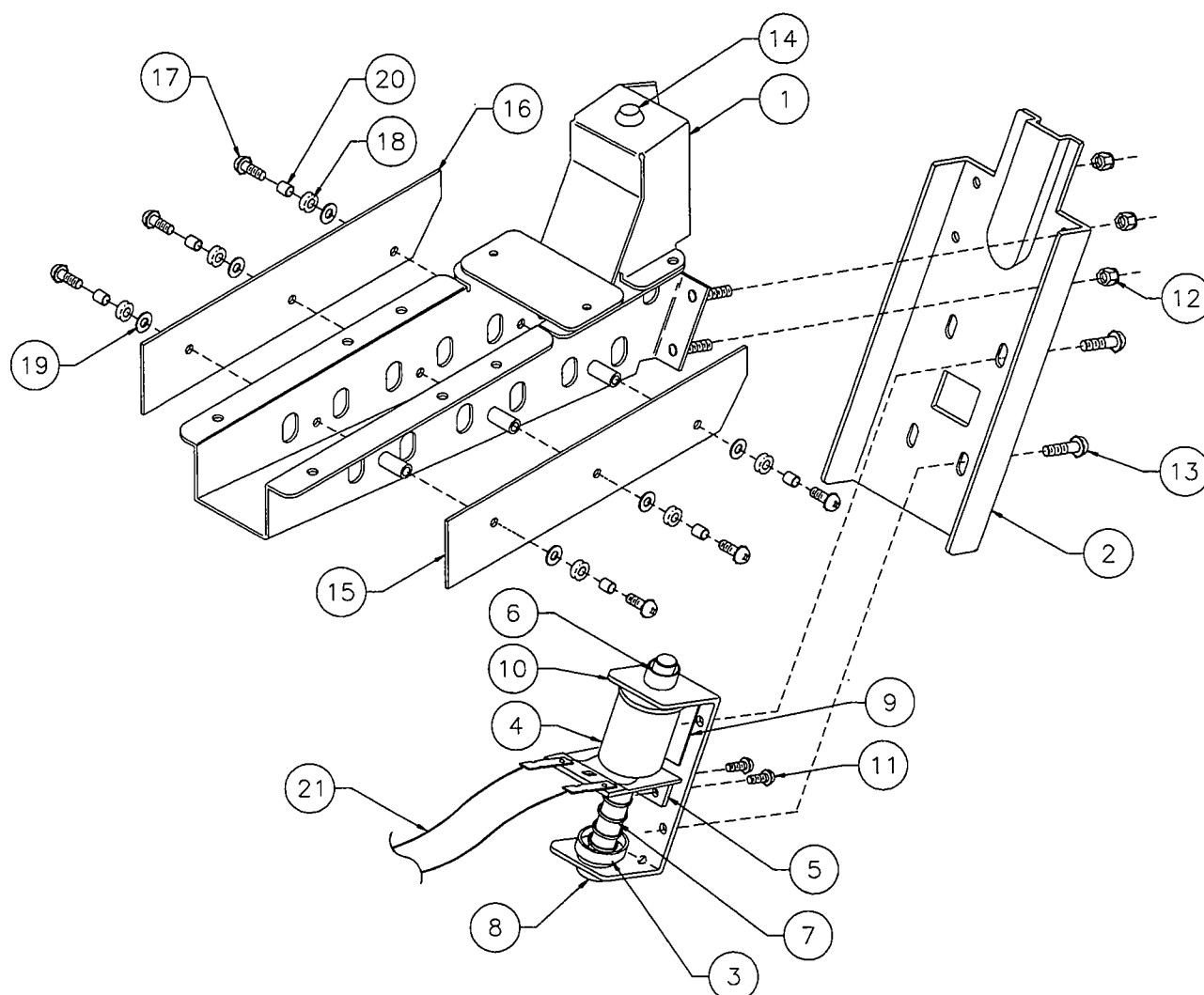
A-17811 Kicker Arm (Slingshot) Assembly



Associated Parts for Right & Left Kickers:

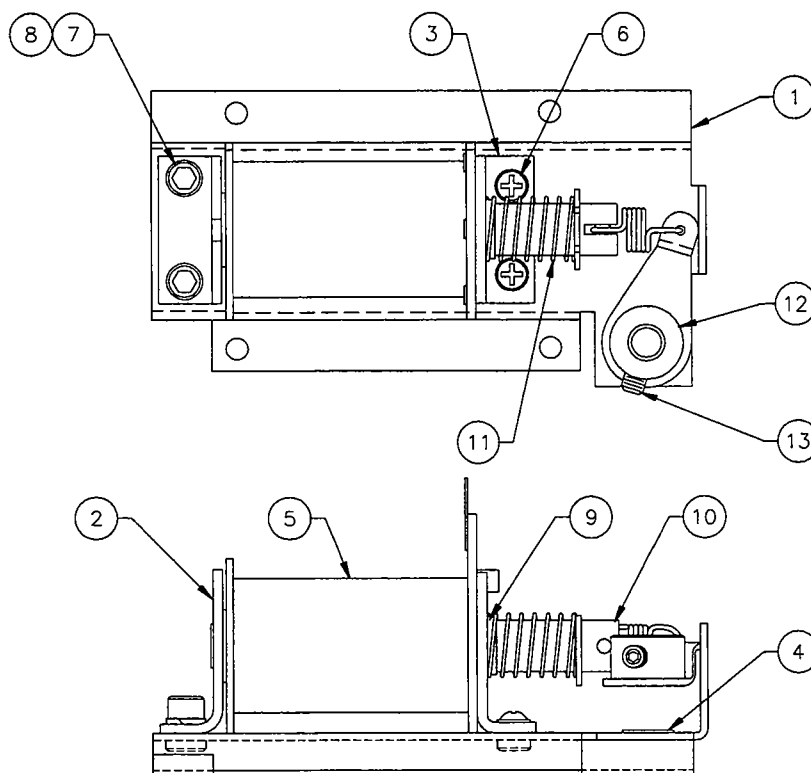
Item	Part Number	Description	Item	Part Number	Description
1	02-2364	Coil Plunger	8	B-9362-L-2	Coil & Bracket Assembly, Left
2	A-17810	Mounting Bracket Assembly		B-9362-R-3	Coil & Bracket Assembly, Right
3	A-12664	Kicker Crank Assembly	a)	A-17808	Bracket & Stop Assembly
4	12-6227	Hairpin Clip	b)	01-8-508-S	Coil Retaining Bracket
5	4700-00030-00	FW, 17/64 x 1/2 x 15ga.	c)	4006-01017-06	Mach. Screw, 6-32 x 3/8"
6	03-8085	Armature Link	d)	4406-01119-00	Nut, 6-32 ESN
7	20-8716-5	Roll Pin, 1/8 x 7/16"	e)	AE-26-1200	Coil Assembly
			f)	03-7066	Coil Tubing
			9	10-128	Spring

A-19963-1 Ball Trough Assembly Complete



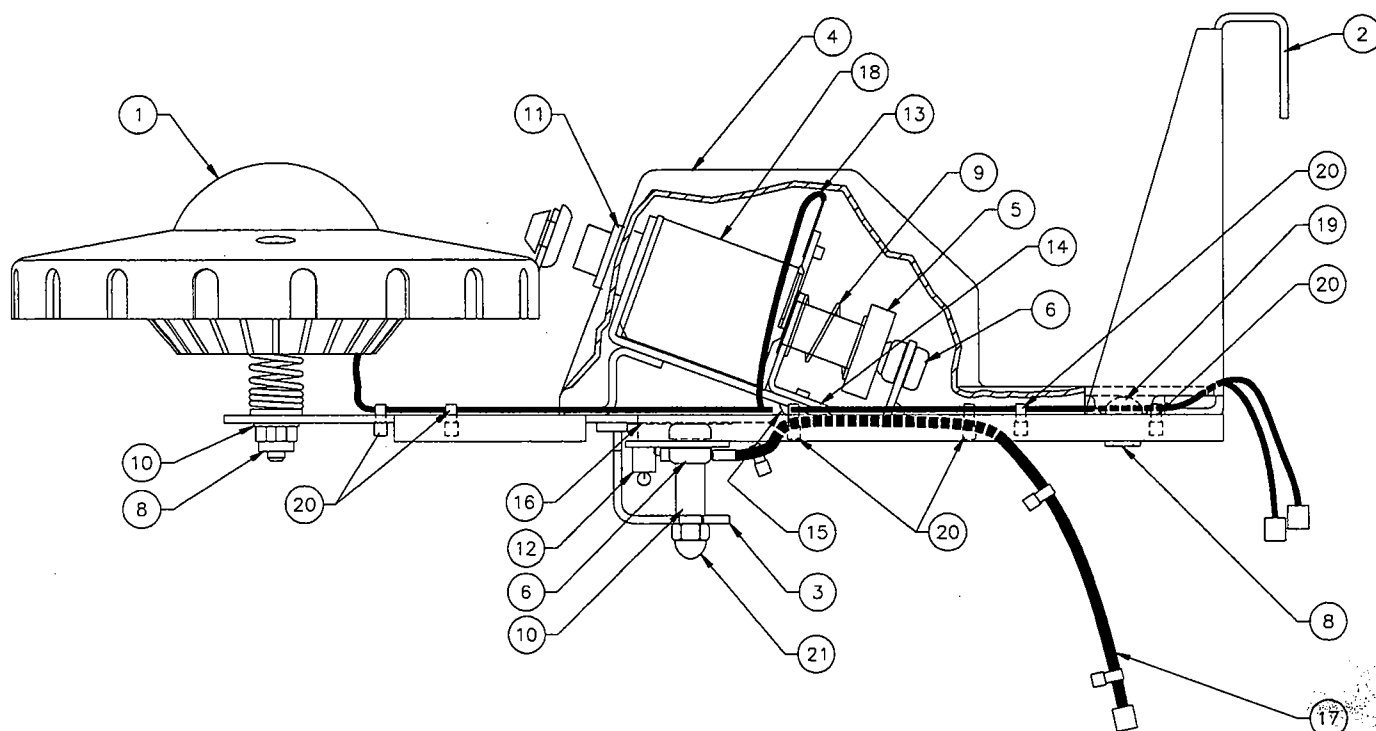
Item	Part Number	Description	Item	Part Number	Description
1	A-16809-2	Ball Trough Welded Assy.	12	4408-01119-00	Nut 8-32 ESN
2	01-11587	Ball Trough Front	13	4008-01017-06	Mach. Screw, 8-32 x 3/8"
3	A-6306-2	Bell Armature Assembly	14	23-6702	Bumper Plug
4	AE-26-1500	Coil Assembly	15	A-18617-1	Trough IRED LED PCB Assembly
5	01-8-508-T	Solenoid Assembly	16	A-18618-1	Trough IRED Transistor PCB Assy.
6	03-7067-5	Coil Tubing	17	4006-01003-10	Mach. Screw, 6-32 x 5/8" SEMS
7	10-135	Spring	18	23-6626	Rubber Grommet
8	23-6420	Rubber Grommet	19	4700-00004-00	Flat Washer, 9/64 x 7/16 x 21ga.
9	03-8523	Insulator	20	02-4975	Bushing
10	01-1158	Coil Mounting Bracket	21	H-19523	Mini Solenoid Cable
11	4008-01017-05	Mach. Screw, 8-32 x 5/16"			

A-17241 Ramp Diverter Assembly



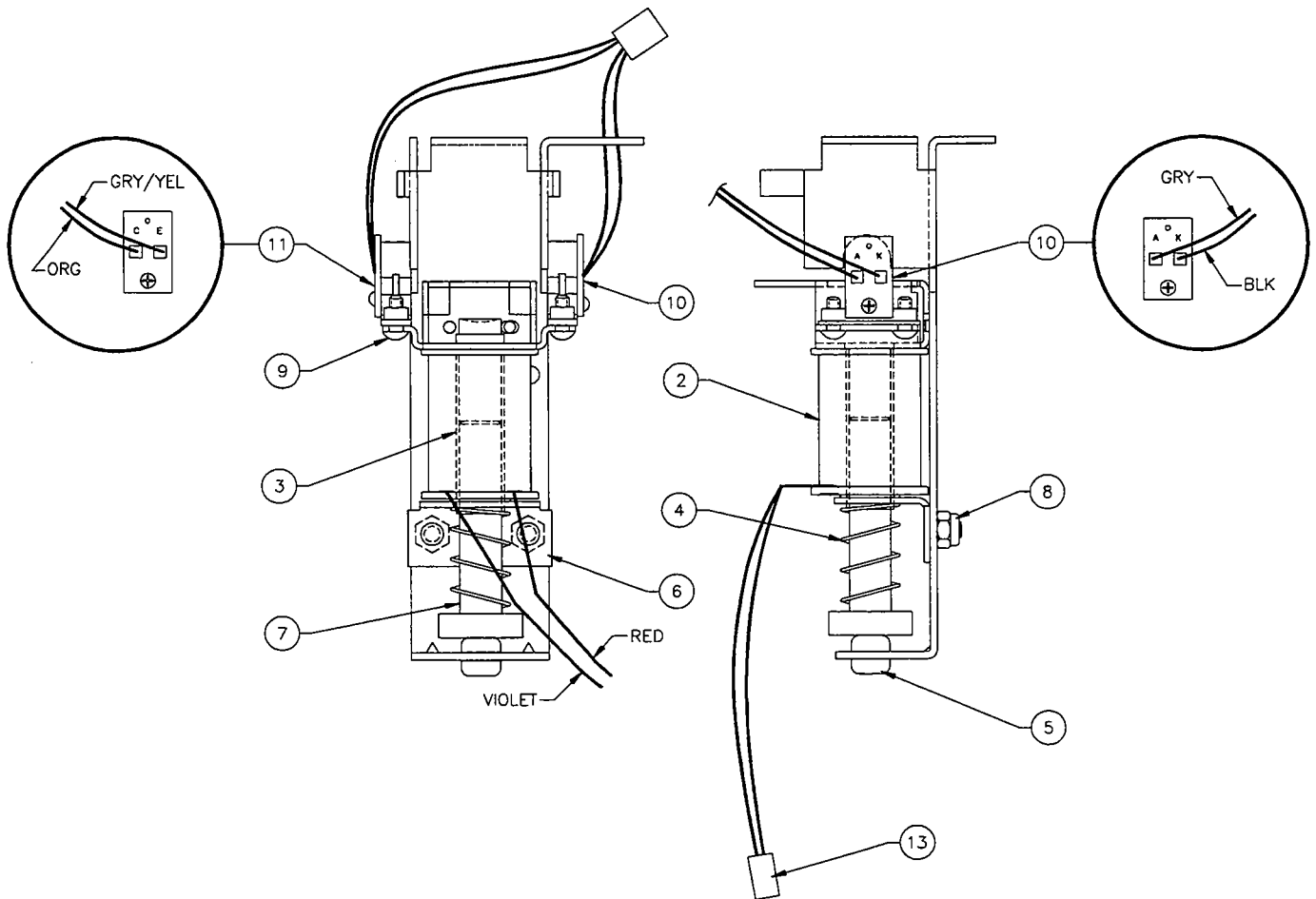
Item	Part Number	Description
1	01-11957	Ramp Diverter Mounting Bracket
2	A-12390	Flipper Stop Bracket Assembly
3	01-7695-0	Solenoid Bracket
4	20-8790	Nyliner Bearing
5	A-20099	Coil Assembly
6	4006-01017-04	Mach. Screw, 6-32 x 1/4"
7	4010-01066-06	Mach. Screw, 10-32 x 3/8"
8	4701-00004-00	Lockwasher #10 Split
9	03-7066-5	Coil Tubing
10	A-16636	Diverter Plunger Assembly
11	10-303	Master Spring
12	A-14185	Drive Arm Assembly
13	4010-01169-04	Set Screw, 10-32 x 1/4"

A-20608 Saucer Assembly



Item	Part Number	Description	Item	Part Number	Description
1	A-20713	Saucer Assembly	11	03-7067-3	Coil Tubing
2	04-10315	Saucer Support Weldment	12	A-20718	Xenon Flash Tube Assembly
3	03-9478	Strobe Light Cover	13	H-19523	Coil Cable
4	03-9470	Saucer Coil Cover	14	01-8-508-T	Coil Retainer Bracket
5	04-10361	Saucer Armature	15	4008-01003-04	Mach. Screw, 8-32 x 1/4"
6	23-6420	Rubber Grommet	16	01-14220	Strobe Light Insulator
7	03-9454	Tie Wrap	17	5797-14773-00	Strobe Cable
8	4408-01119-00	Nut 8-32 ESNA	18	AE-26-1500	Coil Assembly
9	10-135	Armature Spring	19	4008-01017-05	Mach. Screw, 8-32
10	4700-00009-00	FW, 11/64 x 7/16 x 22ga.			

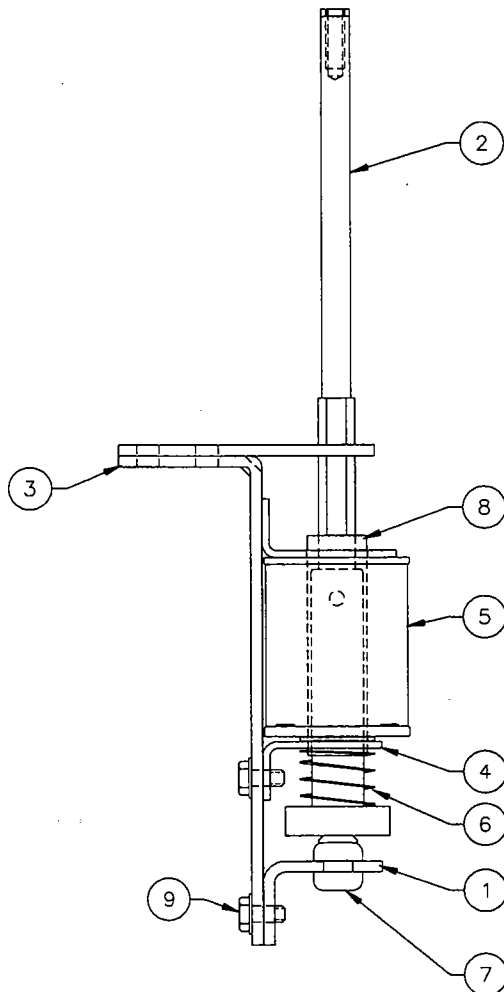
A-20633 Left Popper Assembly



Item	Part Number	Description
1	04-10312	Weldment Left Popper
2	AE-23-800	Coil Assembly
3	03-7067	Coil Tubing
4	10-135	Solenoid Spring
5	23-6420	Rubber Grommet
6	04-10086.1	Mounting Bracket
7	A-17767	Bell Armature Assembly
8	4408-01119-00	Nut, 8-32 ESN
9	4106-01013-06	Sh. Metal Screw, #6 x 3/8"
10	A-16908	LED Assembly, RTV
11	A-16909	Photo Transistor Assy., RTV
12	H-17609-5	Cable - Gen. Opto
13	H-19523	Cable - Mini Solenoid

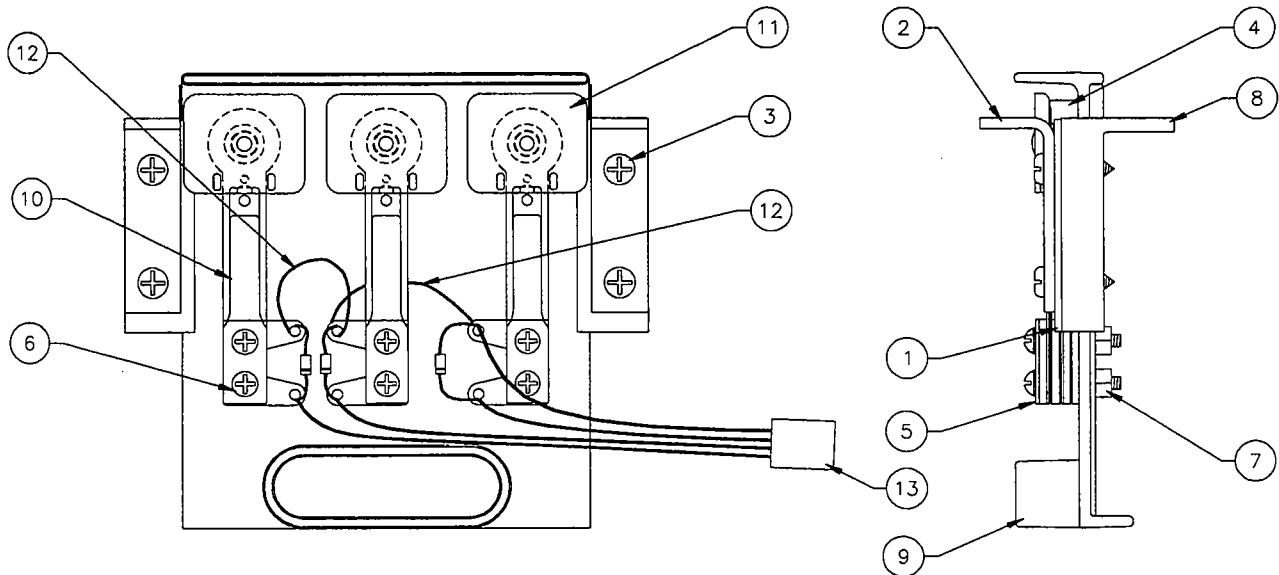
A-20579-1 & A-20579-2 Alien Mechanism Assembly

*(A-20579-1 & A-20579-2 are identical in assembly
with exception to the orientation of the coil assembly)*



Item	Part Number	Description
1	01-14172	Coil Stop Bracket
2	04-10360	Armature Assembly
3	04-10311	Alien Weldment Bracket
4	01-8-508-	Coil Retainer Bracket
5	AE-26-1500	Coil Assembly
6	10-135	Spring - Plunger
7	23-6420	Rubber Grommet
8	03-7067	Coil Tubing
9	4008-01113-04	Mach. Screw, 8-32 x 1/4"

A-20683 3-Bank Moving Target Assembly



Item	Part Number	Description
1	03-8020	Retainer Carrier
2	01-8494	Support Bracket
3	4106-01001-10	Sh. Metal Screw, #6 x 5/8"
4	23-6534-9	Edge Protector
5	01-3670-1	Switch Plate - Flat
6	4004-01003-12	Mach. Screw, 4-40 x 3/4"
7	4404-01119-00	Nut 4-40 ESNA
8	03-8235	Target Guide
9	03-8236	Carrier Target
10	SW-1A-201-4	Switch Target Assy., Sq. Red
11	SW-1A-200-4	Switch Target Assy. Sq. Red (2)
12	17-1116-3	Cut Wire 3"
13	H-20737	Cable, 3-Bank Target Inline

Notes

Notes

SECTION THREE

GAME WIRING AND SCHEMATICS

CONNECTOR & COMPONENT IDENTIFICATION

Each plug or jack receives a number that identifies the circuit board and the position on that board that it connects to. J-designations refer to a male connector. P-designations refer to a female connector. For example, J101 designates jack 1 of board 1 (a Power Driver 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 is a fuse on the Audio Video board.

Prefix numbers for WPC circuit boards are listed below.

J1XX - Power Driver board jacks; F1XX - Power Driver board fuses.

J2XX - CPU Board (There are no fuses on the CPU board.)

J5XX and J6XX - Audio Video board (AV board) jacks; F5XX and F6XX - Audio Video board fuses.

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.

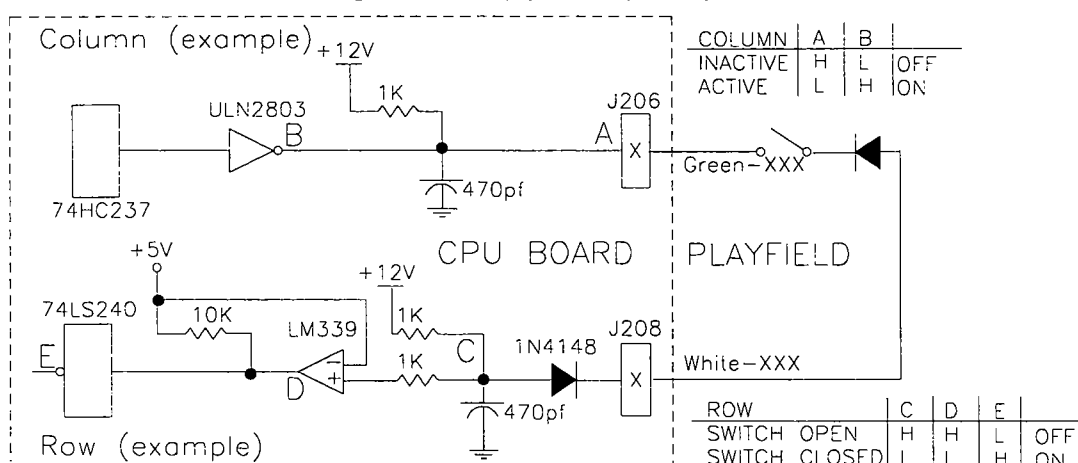
SWITCH MATRIX

Dedicated Grounded Switches			White →  Green								Flipper Grounded Switches
	Column	Row	1 Green-Brown J206-1 U20-18	2 Green-Red J206-2 U20-17	3 Green-Orange J206-3 U20-16	4 Green-Yellow J206-4 U20-15	5 Green-Black J206-5 U20-14	6 Green-Blue J206-6 U20-13	7 Green-Violet J206-7 U20-12	8 Green-Gray J206-9 U20-11	
Orange-Brown J205-1 U17-5 Left Coin Chute D1	1 White-Brown J208-1 U18-11	1	LAUNCH BUTTON 11	SLAM TILT 21	TROUGH EJECT 31	MARTIAN TARGET 41	LEFT SLINGSHOT 51	LEFT RAMP ENTER 61	RIGHT LOOP HIGH 71	NOT USED 81	Black-Green J208-13 Lower Right Flipper EOS F1
Orange-Red J205-2 U17-7 Center Coin Chute D2	2 White-Red J208-2 U18-9	2	NOT USED 12	COIN DOOR CLOSED 22	TROUGH BALL 1 32	MARTIAN TARGET 42	RIGHT SLINGSHOT 52	CENTER RAMP ENTER 62	RIGHT LOOP LOW 72	NOT USED 82	Blue-Violet J212-12 Lower Right Flipper Opto F2
Orange-Black J205-3 U17-11 Right Coin Chute D3	3 White-Orange J208-3 U18-5	3	START BUTTON 13	NOT USED 23	TROUGH BALL 2 33	MARTIAN TARGET 43	LEFT JET 53	RIGHT RAMP ENTER 63	LEFT LOOP HIGH 73	NOT USED 83	Black-Blue J208-12 Lower Left Flipper EOS F3
Orange-Yellow J205-4 U17-9 4th Coin Chute D4	4 White-Yellow J208-4 U18-7	4	PLUMB BOB TILT 14	ALWAYS CLOSED 24	TROUGH BALL 3 34	MARTIAN TARGET 44	BOTTOM JET 54	LEFT RAMP EXIT 64	LEFT LOOP LOW 74	NOT USED 84	Blue-Gray J212-11 Lower Left Flipper Opto F4
Orange-Green J205-6 U16-9 Normal Function Ser Credits Test Function Esc D5	5 White-Green J208-5 U19-11	5	NOT USED 15	NOT USED 25	TROUGH BALL 4 35	LEFT MOTOR BANK 45	RIGHT JET 55	RIGHT RAMP EXIT 65	LEFT SAUCER TARGET 75	NOT USED 85	Black-Violet J208-11 Upper Right Flipper EOS F5 (NOT USED)
Orange-Blue J205-7 U16-11 Normal Function Vol Down Test Function Down D6	6 White-Blue J208-7 U19-9	6	LEFT OUTLANE 16	LEFT RETURN 26	LEFT POPPER 36	CENTER MOTOR BANK 46	MARTIAN TARGET 56	MOTOR BANK DOWN 66	RIGHT SAUCER TARGET 76	NOT USED 86	Black-Yellow J212-10 Upper Right Flipper Opto F6
Orange-Violet J205-8 U16-7 Normal Function Vol Up Test Function Up D7	7 White-Violet J208-8 U19-5	7	RIGHT RETURN 17	RIGHT OUTLANE 27	RIGHT POPPER 37	RIGHT MOTOR BANK 47	MARTIAN TARGET 57	MOTOR BANK UP 67	DROP TARGET 77	NOT USED 87	Black-Gray J208-10 Upper Left Flipper EOS F7 (NOT USED)
Orange-Gray J205-9 U16-5 Normal Function Begin Test Test Function Enter D8	8 White-Gray J208-9 U19-7	8	SHOOTER LANE 18	EDDY SENSOR 28	LEFT TOP LANE 38	RIGHT TOP LANE 48	MARTIAN TARGET 58	NOT USED 68	CENTER TROUGH 78	NOT USED 88	Black-Blue J212-9 Upper Left Flipper Opto F8

J2XX = CPU Board;

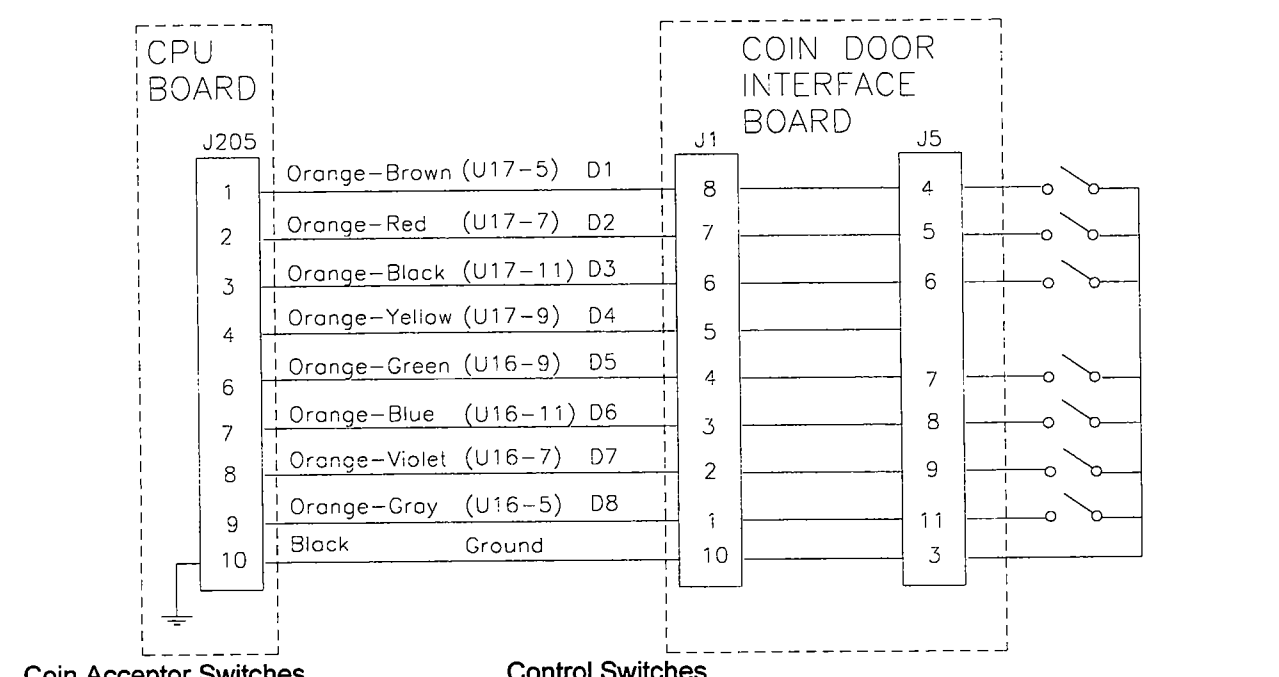
☐ = Opto, Typically Closed

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.

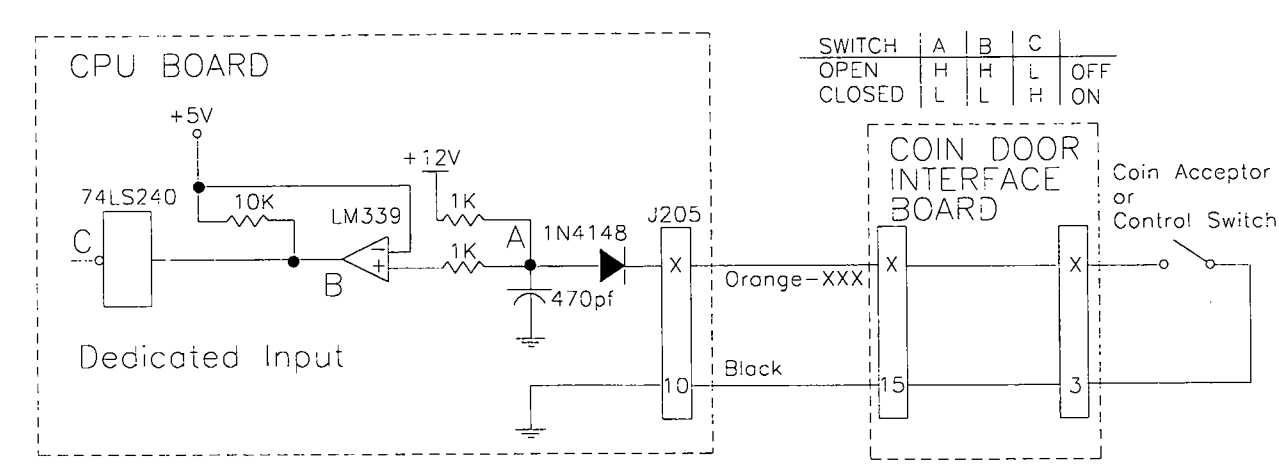
DEDICATED SWITCHES



Control Switches

D5 - Normal Function, Service Credits; Test Function, Escape
D6 - Normal Function, Volume Down; Test Function, Down
D7 - Normal Function, Volume Up; Test Function, Up
D8 - Normal Function, Begin Test; Test Function, Enter

DEDICATED SWITCH CIRCUIT



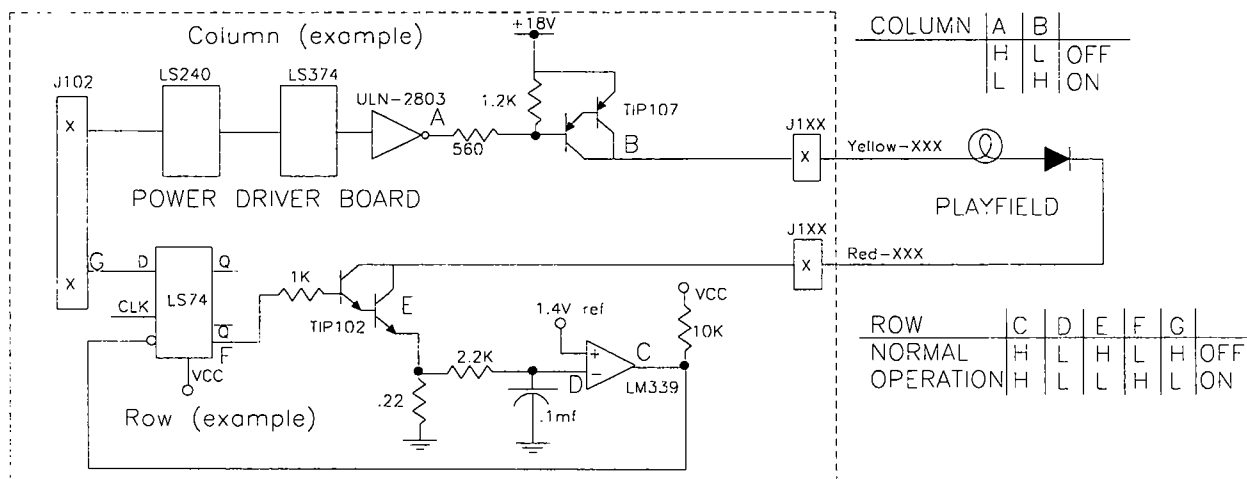
The dedicated switches operate similar in the matrix, except that instead of a column circuit there is a direct tie to ground. Therefore, the column side is constantly active (low). When a switch closes, the row side (dedicated input) of the circuit activates. The “+” input to the LM339 drops below +5V, therefore the 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.

LAMP MATRIX

Column Row	1 Yellow-Brown J121-1 Q96	2 Yellow-Red J121-2 Q100	3 Yellow-Orange J121-3 Q95	4 Yellow-Black J121-4 Q99	5 Yellow-Green J121-5 Q94	6 Yellow-Blue J121-6 Q98	7 Yellow-Violet J121-7 Q93	8 Yellow-Gray J121-9 Q97
1 Red-Brown J125-1 Q104	SUPER JETS 11	BIG-O-BEAM 1 21	TRACTOR BEAM 1 31	RIGHT LOOP ARROW 41	ATTACK MARS 51	MARTIA"N" TARGET 61	CAPTURE 1 71	SHOOT AGAIN 81
2 Red-Black J125-2 Q108	SUPER JACKPOT 12	BIG-O-BEAM 2 22	TRACTOR BEAM 2 32	CENTER RAMP ARROW 42	D.C. U.S.A. 52	MARTI"A"N TARGET 62	CAPTURE 2 72	LEFT OUTLANE 82
3 Red-Orange J125-4 Q103	MARTIAN ATTACK MULTIBALL 13	BIG-O-BEAM 3 23	TRACTOR BEAM 3 33	LEFT TOP LANE 43	LONDON ENGLAND 53	ATOMIC BLASTER 1 63	CAPTURE 3 73	LEFT RETURN 83
4 Red-Yellow J125-5 Q107	ANNIHILATION 14	LEFT RAMP JACKPOT 24	RIGHT RAMP JACKPOT 34	RIGHT TOP LANE 44	LIGHT LOCK 54	ATOMIC BLASTER 2 64	LEFT LOOP JACKPOT 74	RIGHT RETURN 84
5 Red-Green J125-6 Q102	RETURN TO BATTLE 15	LEFT RAMP ARROW 25	RIGHT RAMP ARROW 35	LEFT MOTOR BANK 45	LOCK 1 55	ATOMIC BLASTER 3 65	LEFT LOOP ARROW 75	RIGHT OUTLANE 85
6 Red-Blue J125-7 Q106	CONQUER MARS 16	LOCK 2 26	MARTIAN ATTACK 36	CENTER MOTOR BANK 46	PISA ITALY 56	RIGHT LOOP JACKPOT 66	"M"ARTIAN TARGET 76	LAUNCH BUTTON 86
7 Red-Violet J125-8 Q101	5-WAY COMBO 17	LOCK 3 27	RULE UNIVERSE 37	RIGHT MOTOR BANK 47	BERLIN GERMANY 57	EXTRA BALL 67	M"A"RTIAN TARGET 77	NOT USED 87
8 Red-Gray J125-9 Q105	DROP TARGET 18	CENTER RAMP JACKPOT 28	STROKE OF LUCK 38	MAR"T"IAN TARGET 48	PARIS FRANCE 58	MART"I"AN TARGET 68	MA"R"TIAN TARGET 78	START BUTTON 88

J1XX = Power Driver Board

LAMP MATRIX CIRCUIT



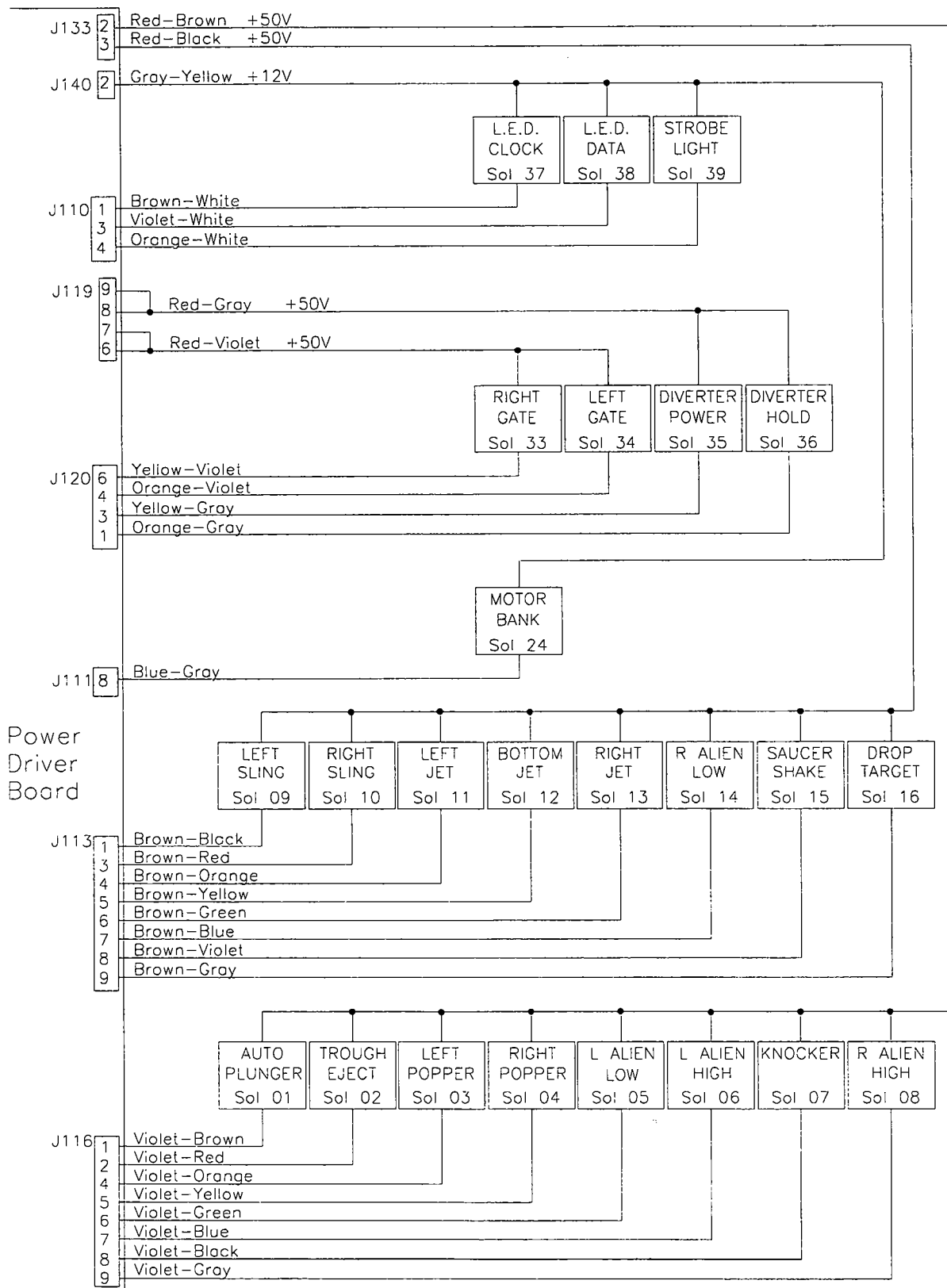
The microprocessor sends a signal to the column circuit causing the output of the UNL-2803 to toggle. When point "A" drops low, the TIP107 transistor conducts and point "B" changes to a high state. At the same time, the microprocessor drives the input of the 74LS74 low, causing a high at output "F".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

SOLENOID/FLASHER TABLE

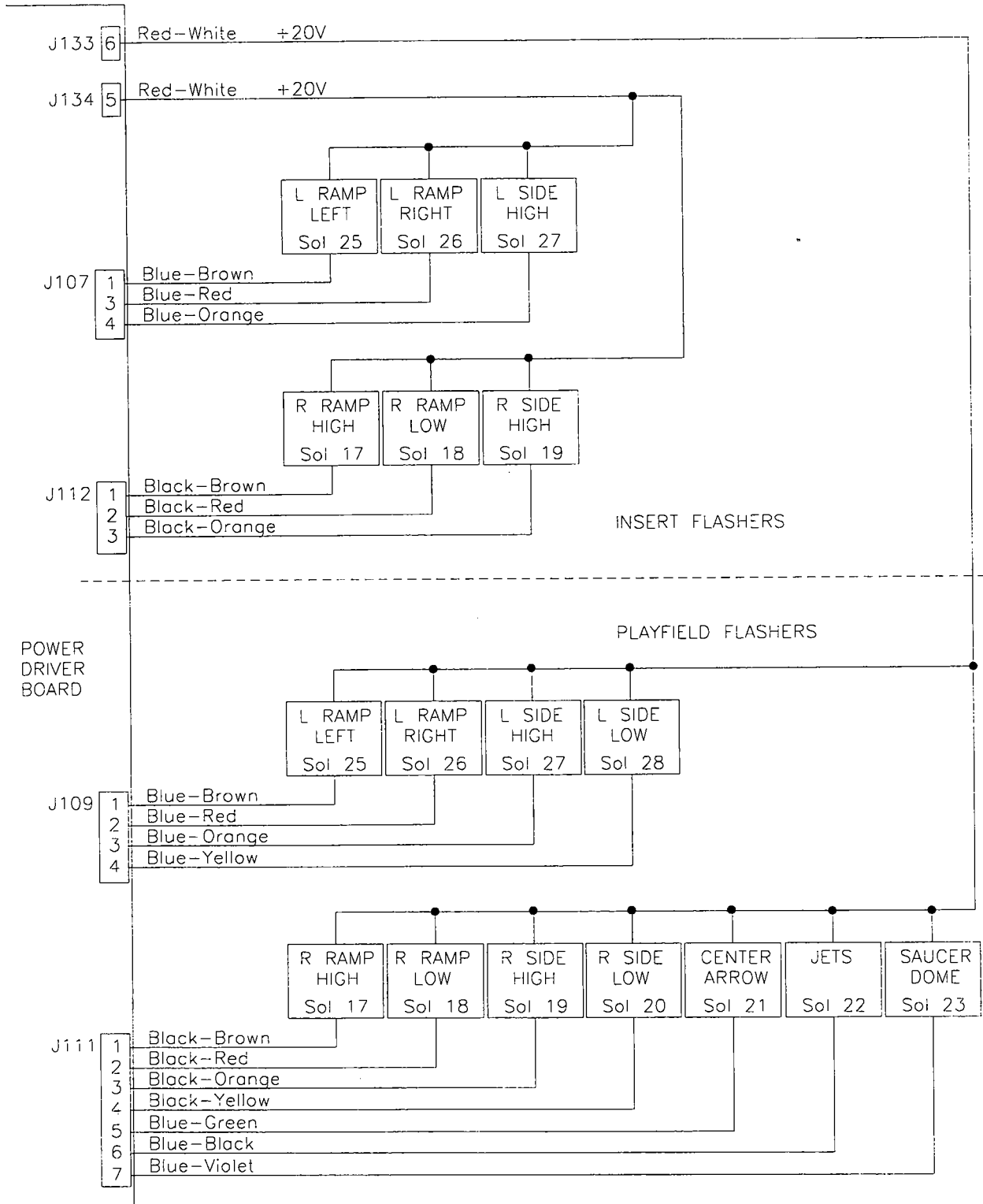
Sol. No.	Function	Solenoid Type	Voltage Connections			Drive Xister	Drive Connections			Drive Wire Color	Solenoid Part number	
			Playfield	Backbox	Cabinet		Playfield	Backbox	Cabinet		Flashlamp Type	Backbox
01	AUTO PLUNGER	High Power	J133-2			Q72	J116-1			Vio-Brn	AE-23-800	
02	TROUGH EJECT	High Power	J133-2			Q68	J116-2			Vio-Red	AE-26-1500	
03	LEFT POPPER	High Power	J133-2			Q71	J116-4			Vio-Org	AE-26-800	
04	RIGHT POPPER	High Power	J133-2			Q67	J116-5			Vio-Yel	AE-25-1000	
05	LEFT ALIEN LOW	High Power	J133-2			Q70	J116-6			Vio-Grn	AE-26-1500	
06	LEFT ALIEN HIGH	High Power	J133-2			Q66	J116-7			Vio-Blu	AE-26-1500	
07	KNOCKER	High Power		J133-2		Q69		J116-8		Vio-Blk		AE-23-800
08	RIGHT ALIEN HIGH	High Power	J133-2			Q65	J116-9			Vio-Gry	AE-26-1500	
09	LEFT SLINGSHOT	Low Power	J133-3			Q44	J113-1			Brn-Blk	AE-26-1200	
10	RIGHT SLINGSHOT	Low Power	J133-3			Q48	J113-3			Brn-Red	AE-26-1200	
11	LEFT JET	Low Power	J133-3			Q43	J113-4			Brn-Org	AE-26-1200	
12	BOTTOM JET	Low Power	J133-3			Q47	J113-5			Brn-Yel	AE-26-1200	
13	RIGHT JET	Low Power	J133-3			Q42	J113-6			Brn-Grn	AE-26-1200	
14	RIGHT ALIEN LOW	Low Power	J133-3			Q46	J113-7			Brn-Blu	AE-26-1500	
15	SAUCER SHAKE	Low Power	J133-3			Q41	J113-8			Brn-Vio	AE-26-1500	
16	DROP TARGET	Low Power	J133-3			Q45	J113-9			Brn-Gry	AE-26-1200	
17	RIGHT RAMP HIGH (2)	Flasher	J133-6	J134-5		Q28	J111-1	J112-1		Blk-Brn	#906	#906
18	RIGHT RAMP LOW (2)	Flasher	J133-6	J134-5		Q32	J111-2	J112-2		Blk-Red	#906	#906
19	RIGHT SIDE HIGH (2)	Flasher	J133-6	J134-5		Q27	J111-3	J112-3		Blk-Org	#906	#906
20	RIGHT SIDE LOW	Flasher	J133-6			Q31	J111-4			Blk-Yel	#89	
21	CENTER ARROW	Flasher	J133-6			Q26	J111-5			Blu-Grn	#906	
22	JETS	Flasher	J133-6			Q30	J111-6			Blu-Blk	#89	
23	SAUCER DOME	Flasher	J133-6			Q25	J111-7			Blu-Vio	#906	
24	MOTOR BANK	Flasher	J140-2			Q29	J111-8			Blu-Gry	14-8023	
25	LEFT RAMP LEFT (2)	Gen. Purpose	J133-6	J134-5		Q16	J109-1	J107-1		Blu-Brn	#906	#906
26	LEFT RAMP RIGHT (2)	Gen. Purpose	J133-6	J134-5		Q15	J109-2	J107-3		Blu-Red	#906	#906
27	LEFT SIDE HIGH (2)	Gen. Purpose	J133-6	J134-5		Q14	J109-3	J107-4		Blu-Org	#906	#906
28	LEFT SIDE LOW	Gen. Purpose	J133-6			Q13	J109-4			Blu-Yel	#89	
33	RIGHT GATE	High Power	J119-6,7			Q84	J120-6			Yel-Vio	A-14406	
34	LEFT GATE	Low Power	J119-6,7			Q86	J120-4			Org-Vio	A-14406	
35	DIVERTER POWER	High Power	J119-8,9			Q81	J120-3			Yel-Gry	A-20099	
36	DIVERTER HOLD	Low Power	J119-8,9			Q83	J120-1			Org-Gry	A-20099	
37	L.E.D. CLOCK	Flasher	J140-2				J110-1			Brn-Wht	A-20670	
38	L.E.D. DATA	Flasher	J140-2				J110-3			Vio-Wht	A-20670	
39	STROBE LIGHT	Flasher	J140-2				J110-4			Org-Wht	A-20718	
General Illumination												
01	BOTTOM PLAYFIELD	G.I.	J106-1	J106-1		Q5	J106-7	J106-7		Wht-Brn	#44	#555
02	MIDDLE PLAYFIELD	G.I.	J106-2			Q4	J106-8			Wht-Org	#44, #555	
03	TOP PLAYFIELD	G.I.	J106-3			Q3	J106-9			Wht-Yel	#44, #555	
Flipper Circuits												
			Voltage Connections		Drive Transistors	Power	Hold	Drive Connectors		Drive Wire Colors	Power	Hold
			Playfield	Power				Playfield	Power			
29		Lwr. Rt. Power	J119-1 (Red-Grn)		Q90			J120-13		Yel-Grn		
30	Lower Right Flipper	Lwr. Rt. Hold	J119-1 (Red-Grn)		Q92			J120-11		Org-Grn		
31		Lwr. Lt. Power	J119-4 (Red-Blu)		Q87			J120-9		Yel-Blu		
32	Lower Left Flipper	Lwr. Lt. Hold	J119-4 (Red-Blu)		Q89			J120-7		Org-Blu		
33		Upr. Rt. Power	J119-6 (Red-Vio)		Q84			J120-6		Yel-Vio		
34	Upper Right Flipper	Upr. Rt. Hold	J119-6 (Red-Vio)		Q86			J120-4		Org-Vio		
35		Upr. Lt. Power	J119-8 (Red-Gry)		Q81			J120-3		Yel-Gry		
36	Upper Left Flipper	Upr. Lt. Hold	J119-8 (Red-Gry)		Q83			J120-1		Org-Gry		

J1xx=Power Driver Board; 24-6549=#44 bulb; 24-8704=#89 bulb; 24-8768=#555 bulb; 24-8802=#906 bulb

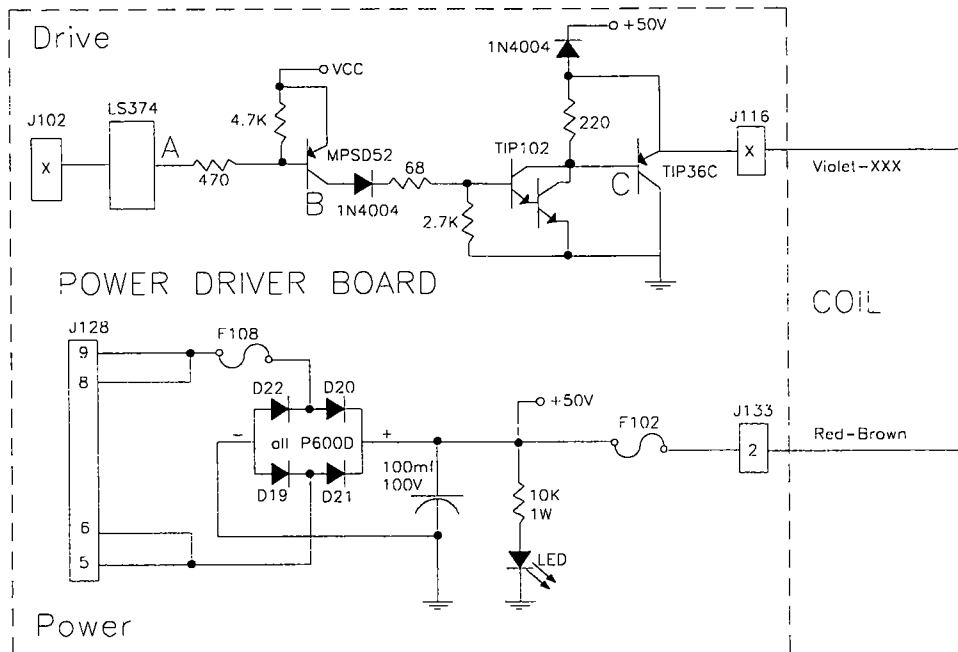
SOLENOID WIRING



FLASHER WIRING

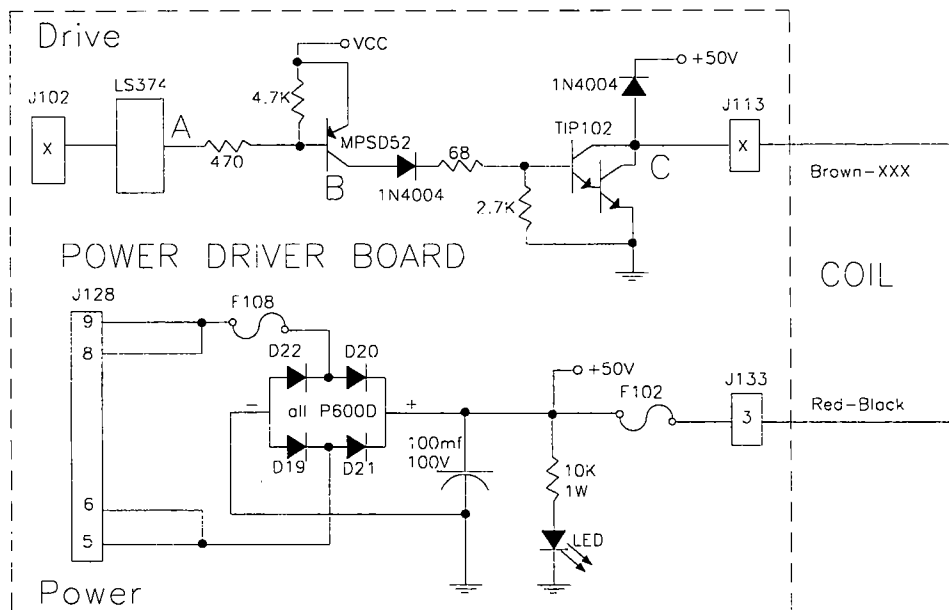


HIGH POWER SOLENOID CIRCUIT



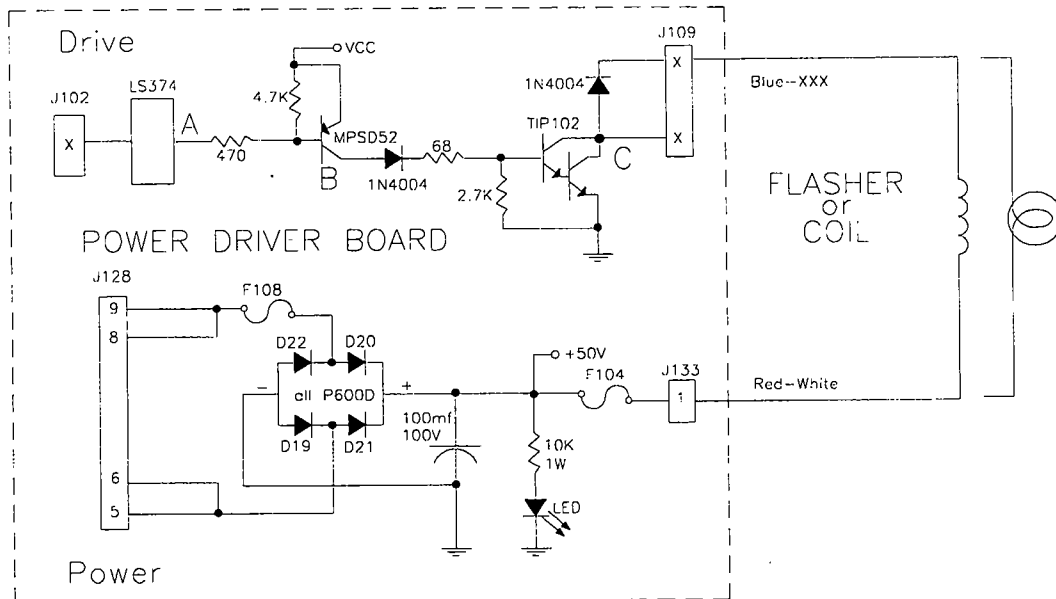
The microprocessor toggles the output of the 74LS374. When point "A" is low, point "B", the collector of the 2N5401 transistor, is high. A high at point "B" causes point "C", the collector of the TIP102 transistor and point "D", the emitter of the TIP36C transistor, to drop low. When point "D" is low, the coil is grounded through the transistor and 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 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 turns on. The coil shuts off when point "A" toggles high.

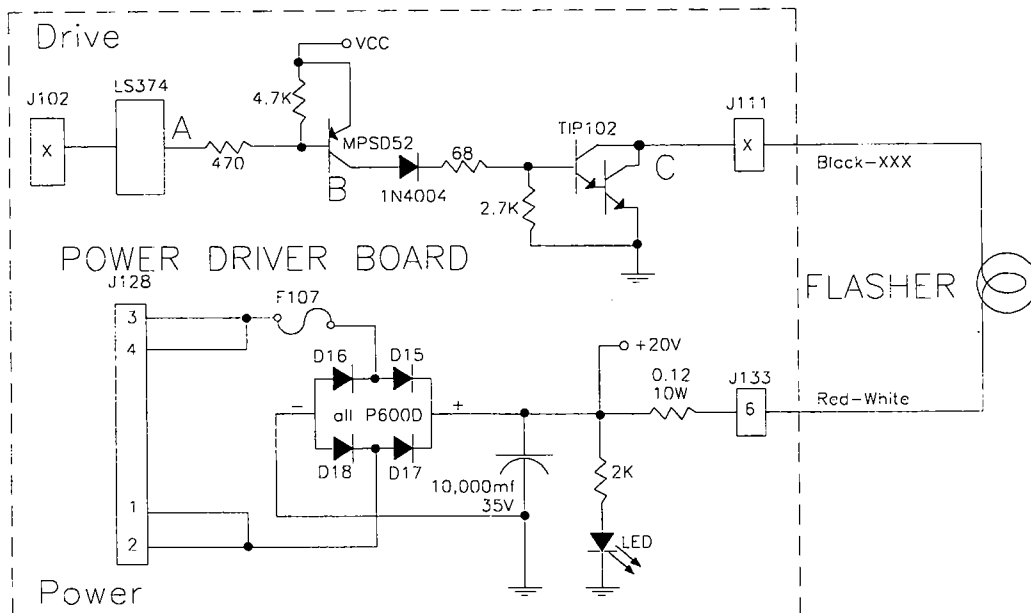
SPECIAL (GENERAL PURPOSE) SOLENOID CIRCUIT



The microprocessor toggles the output of the 74LS374. When point "A" is low, point "B" the collector of the 2N5401 transistor, 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 turns on. When point "A" toggles high the coil/flashlamp turns off.

* Tieback diode is not used for flashlamp circuit.

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 turns on. When point "A" toggles high, the current shuts off.

GENERAL ILLUMINATION CIRCUIT

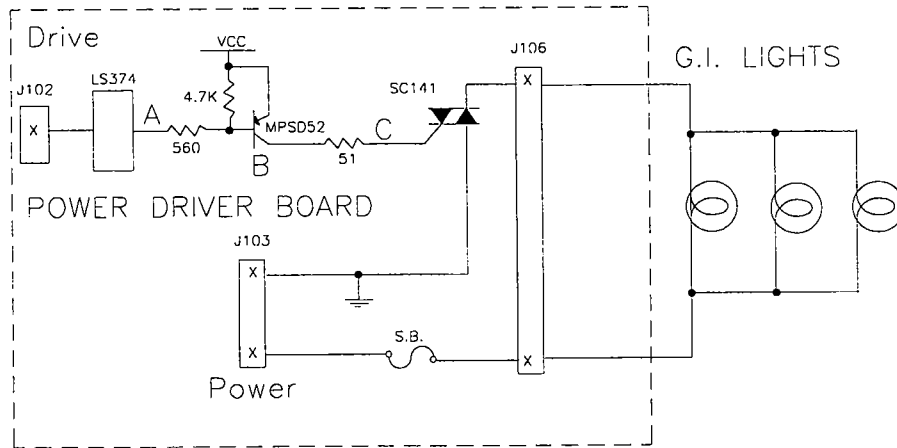


Figure #1

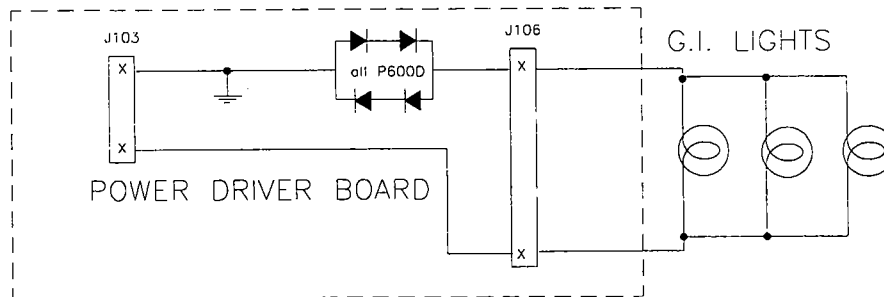
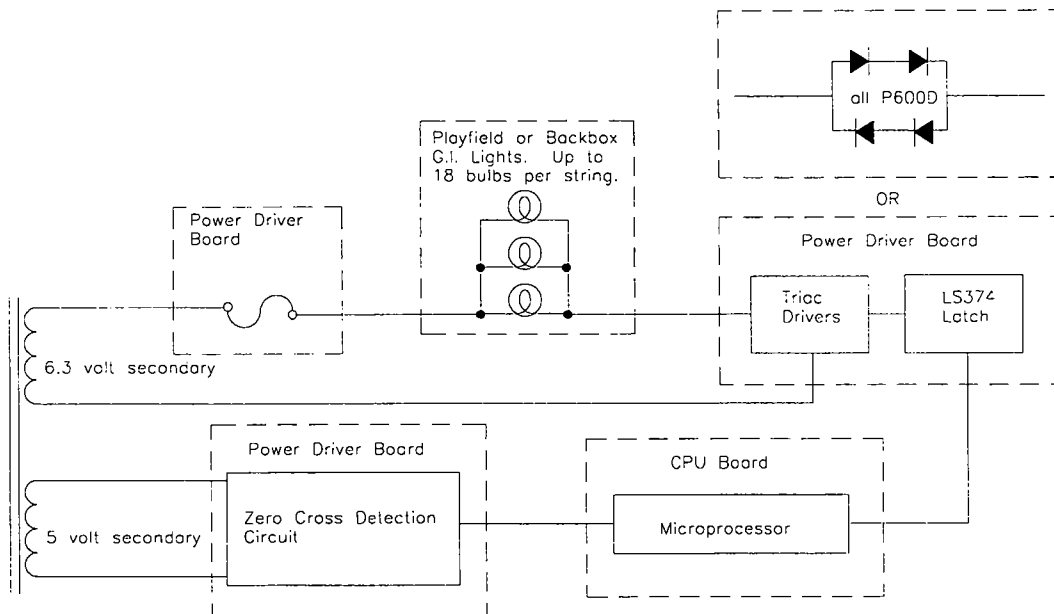


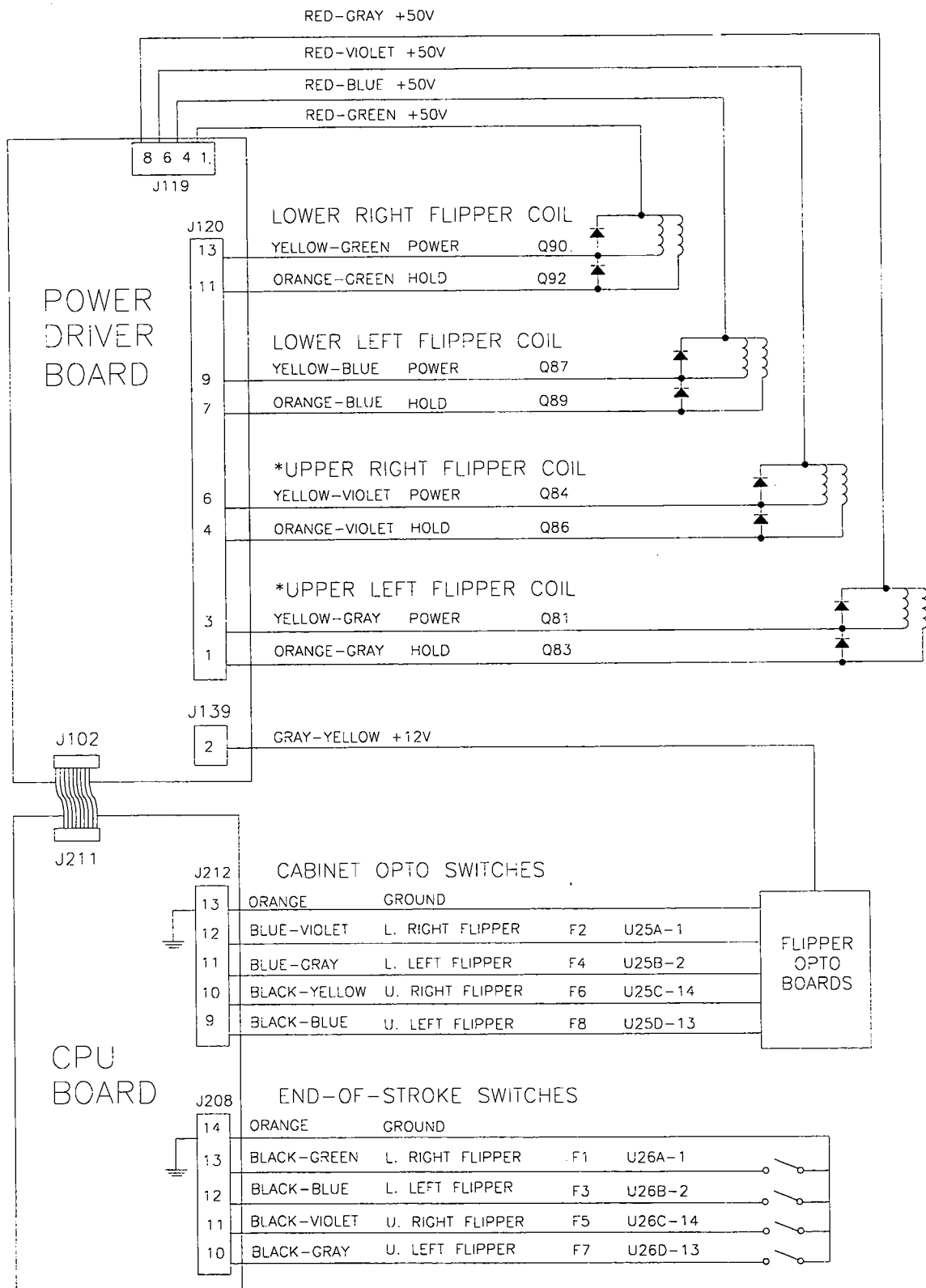
Figure #2

There are five general illumination strings; three like figure #1 and two like figure #2. When point "A" toggles low, points "B" and "C" are high. This turns on the triac and the desired general illumination string of lights.

BLOCK DIAGRAM OF GENERAL ILLUMINATION CIRCUIT



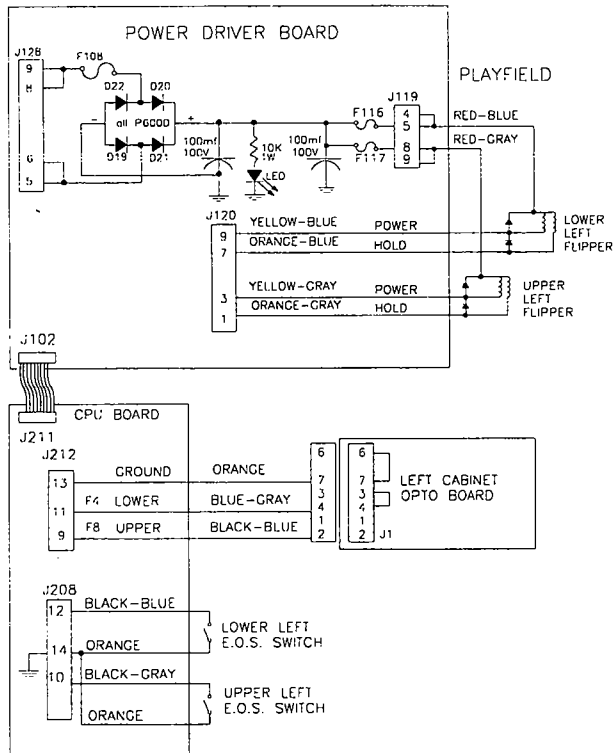
FLIPPER CIRCUIT DIAGRAM



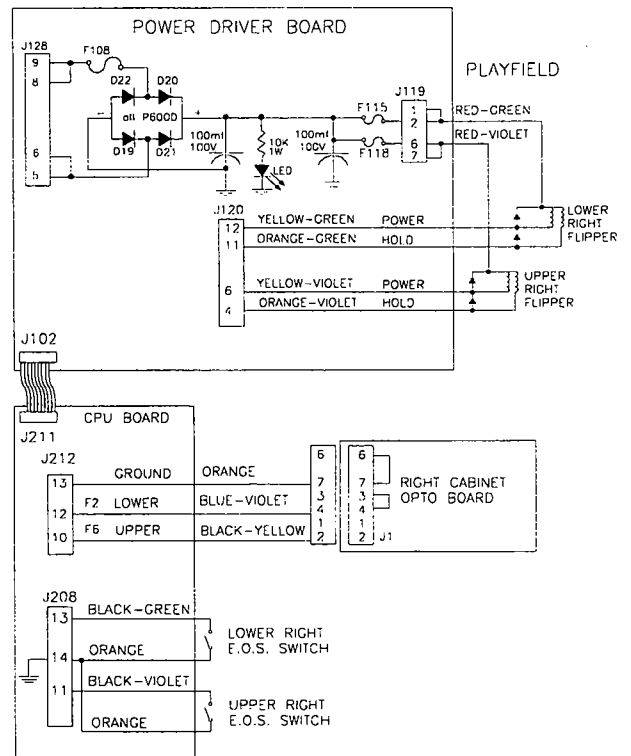
***NOTE: May be used as circuits other than flipper circuits.**

FLIPPER COIL CIRCUITS

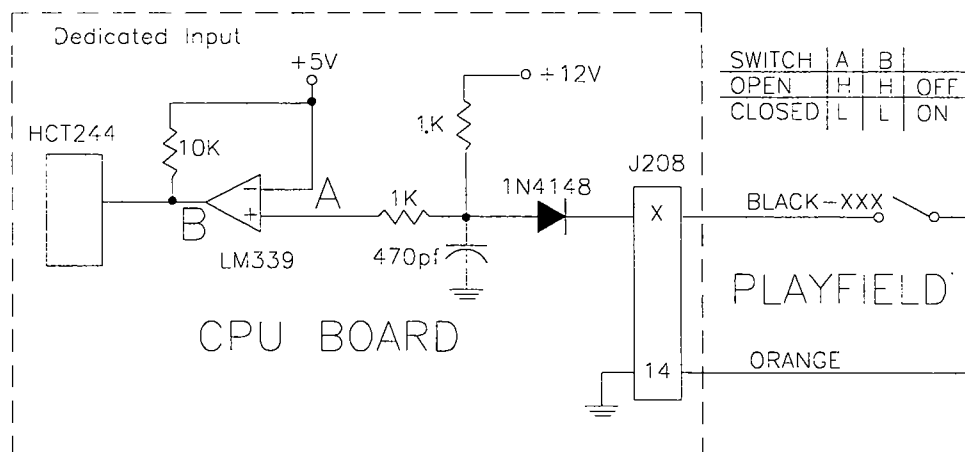
LEFT FLIPPER CIRCUIT



RIGHT FLIPPER CIRCUIT

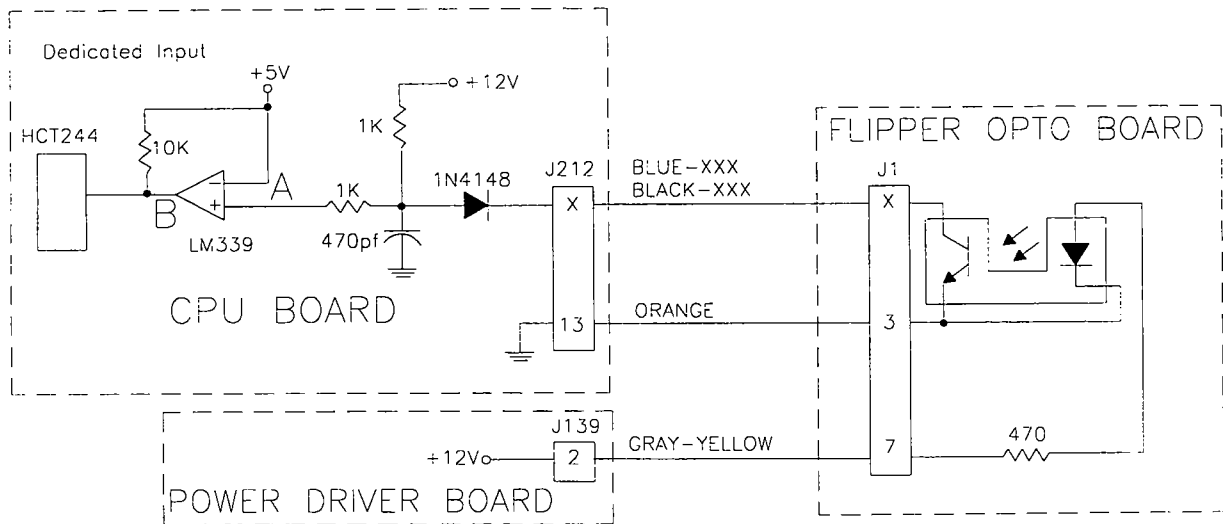
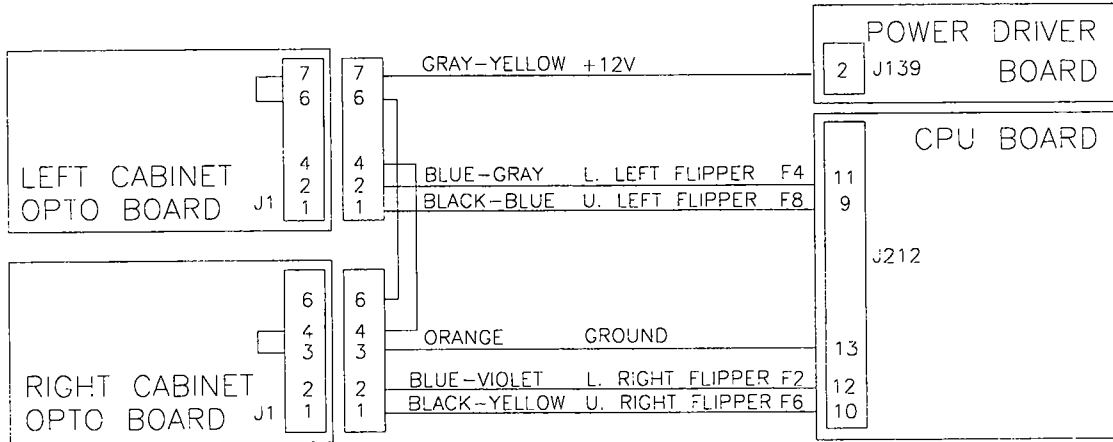


FLIPPER END-OF-STROKE SWITCH CIRCUIT



The flipper E.O.S. 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 of 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 CIRCUITS



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

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.

LED P.C.B. Assembly (transmitter) **A-16908**

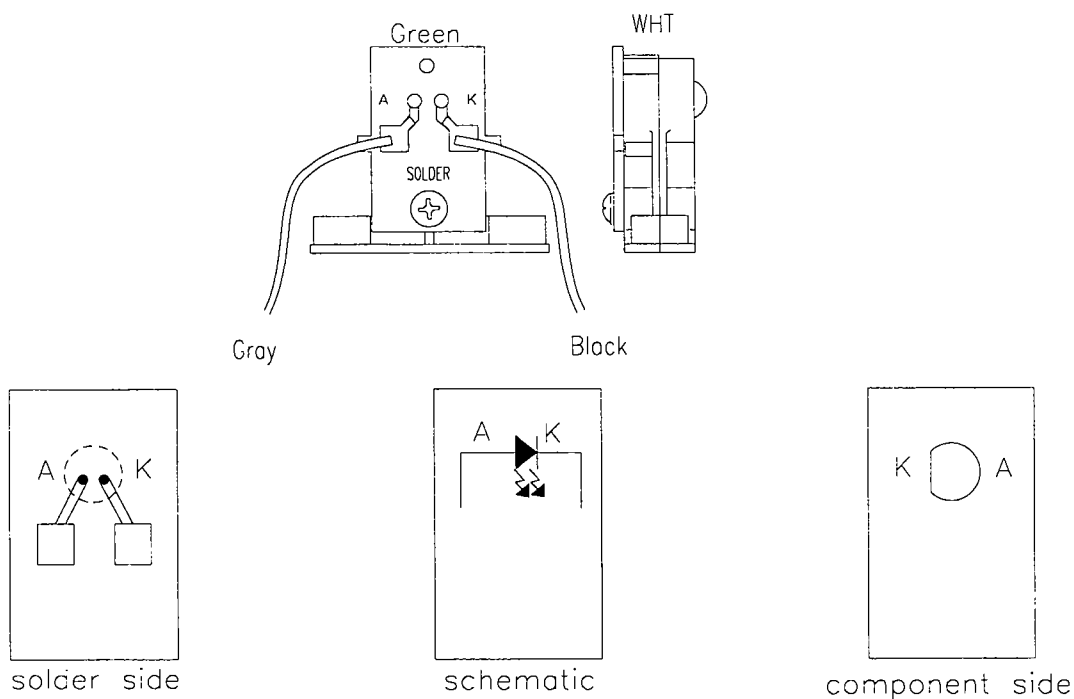
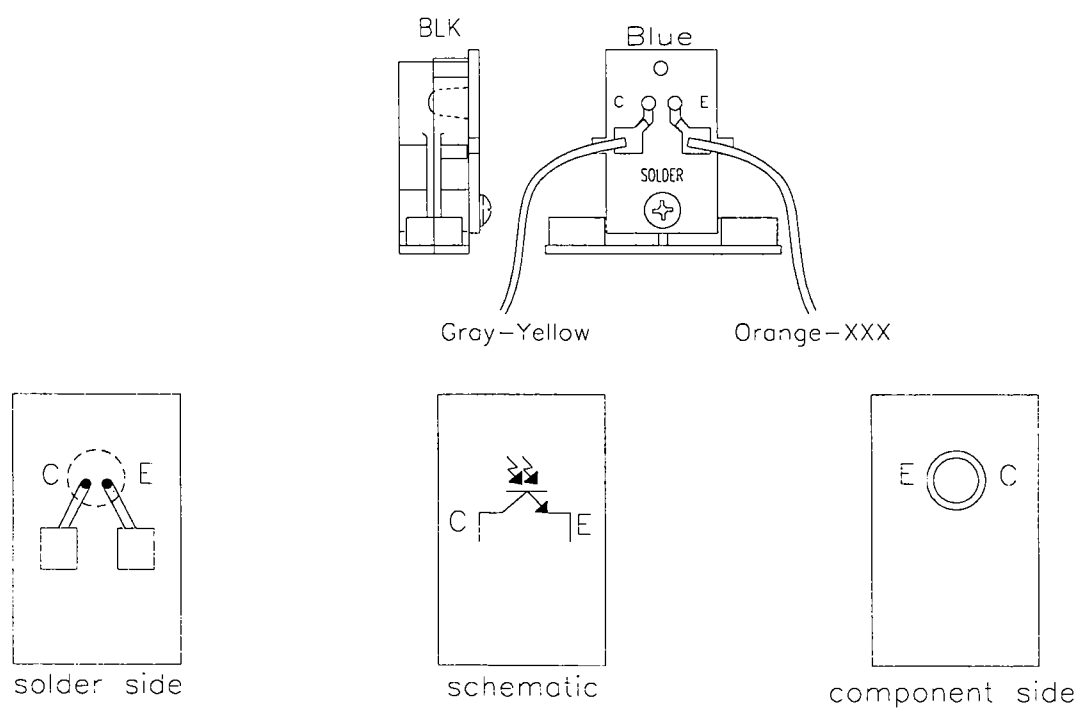
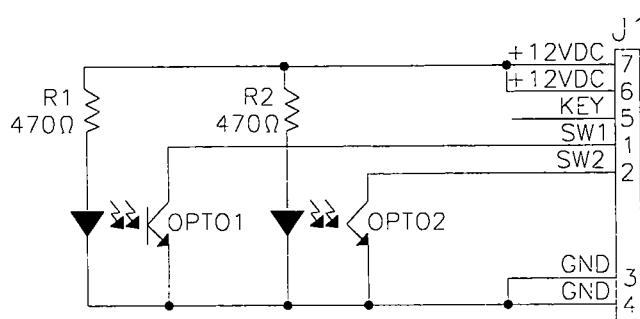
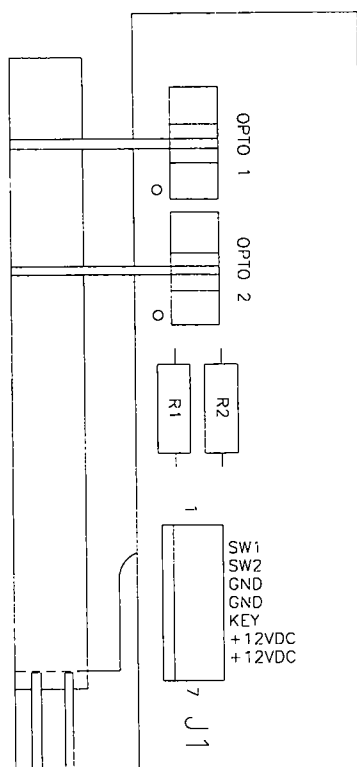


Photo Transistor P.C.B. Assembly (receiver) **A-16909**



Flipper Opto P.C.B. Assembly A-17316



Left Side Flipper Cabinet Opto Switch Board

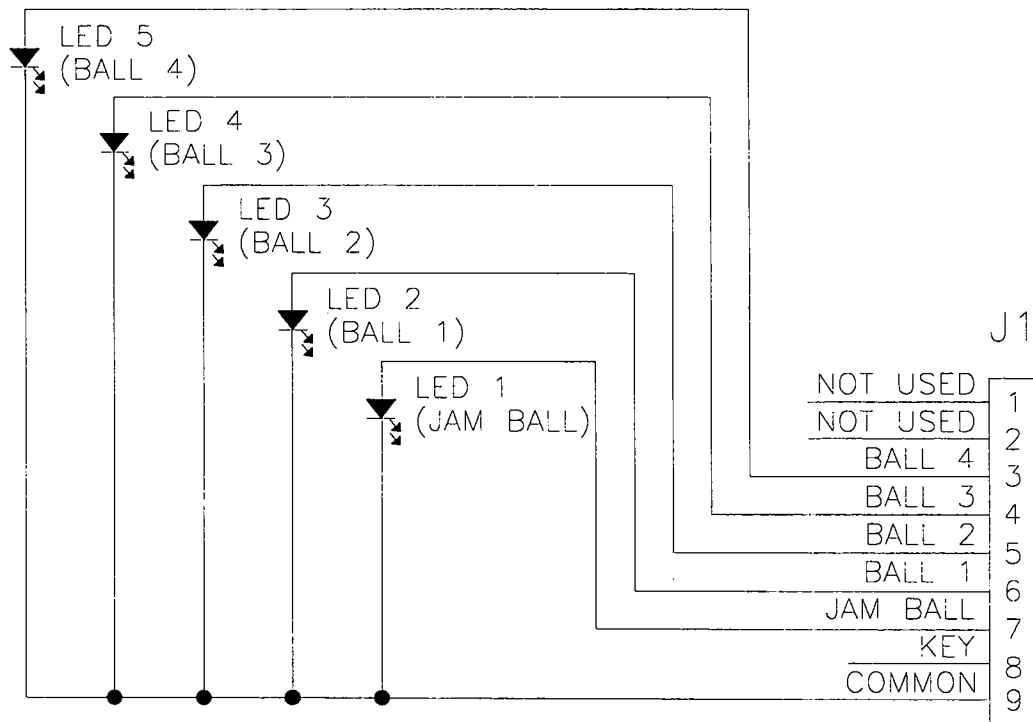
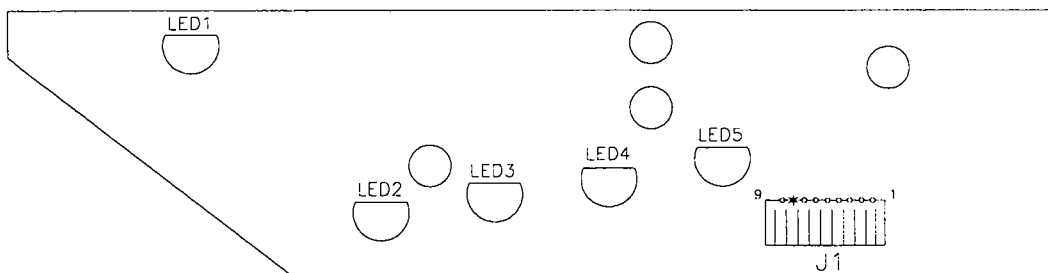
J1-1 Black-Blue from CPU Bd. J212-9
 J1-2 Blue-Gray from CPU Bd. J212-11
 J1-3 Not Used
 J1-4 Orange to/from Right Flipper Opto Bd. J1-4
 J1-5 Key
 J1-6 Gray-Yellow to/from Right Flipper Opto Bd. J1-6
 J1-7 Gray-Yellow from Power Driver Bd. J139-2

Right Side Flipper Cabinet Opto Switch Board

J1-1 Black-Yellow from CPU Bd. J212-10
 J1-2 Blue-Violet from CPU Bd. J212-12
 J1-3 Orange from CPU Bd. J212-13
 J1-4 Orange to/from Left Flipper Opto Bd. J1-4
 J1-5 Key
 J1-6 Gray-Yellow to/from Left Flipper Opto J1-6
 J1-7 Not Used

TROUGH IRED LED P.C.B. ASSEMBLY A-18617-1

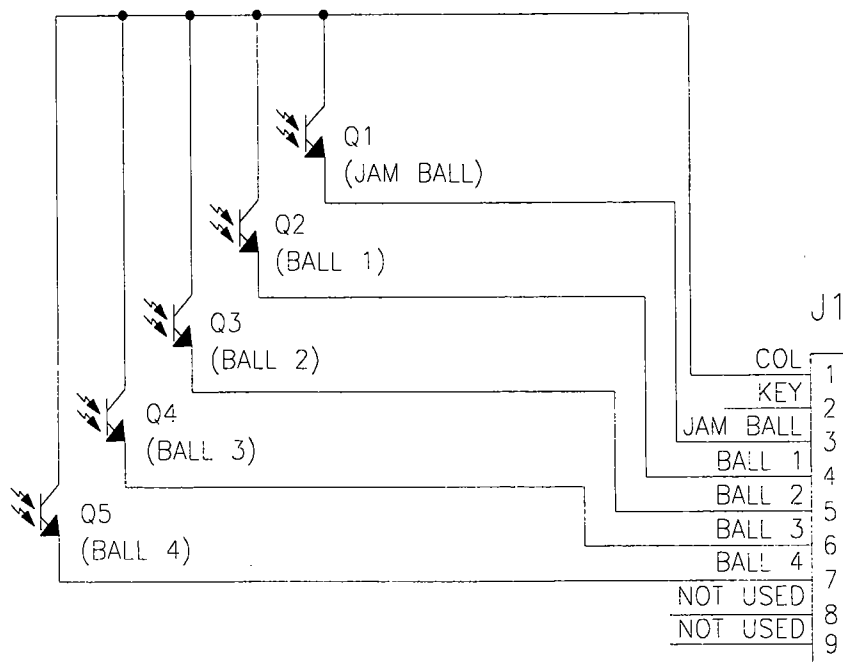
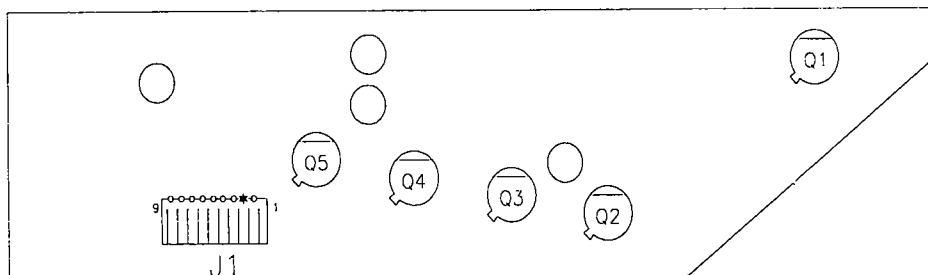
J1-1 Not Used
 J1-2 Not Used
 J1-3 Gray-Green, from SW-7 Opto P.C.B. J1-3
 J1-4 Gray-Black, from SW-7 Opto P.C.B. J1-5
 J1-5 Gray-Orange, from SW-7 Opto P.C.B. J1-6
 J1-6 Gray-Red, from SW-7 Opto P.C.B. J1-7
 J1-7 Gray-Brown, from SW-7 Opto P.C.B. J1-8
 J1-8 Key
 J1-9 Black, from SW-7 Opto P.C.B. J1-10



Trough 7 IRED Circuit

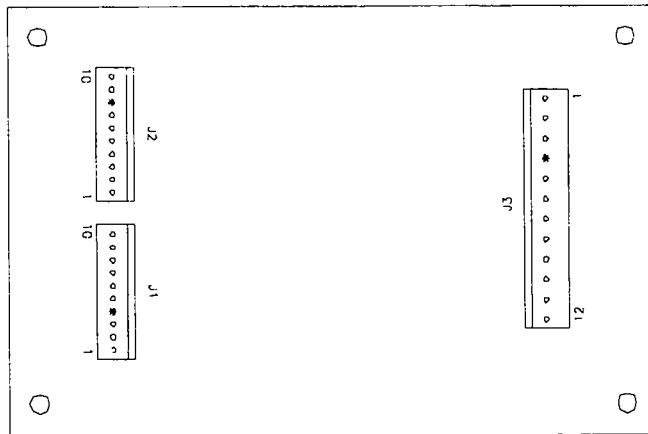
TROUGH IRED TRANSISTOR P.C.B. ASSEMBLY A-18618-1

J1-1 Gray-Yellow, from SW-7 Opto P.C.B. J2-10
 J1-2 Key
 J1-3 Orange-Brown, from SW-7 Opto P.C.B. J2-7
 J1-4 Orange-Red, from SW-7 Opto P.C.B. J2-6
 J1-5 Orange-Black, from SW-7 Opto P.C.B. J2-5
 J1-6 Orange-Yellow, from SW-7 Opto P.C.B. J2-4
 J1-7 Orange-Green, from SW-7 Opto P.C.B. J2-3
 J1-8 Not Used
 J1-9 Not Used



Trough 7 IR TSTR Circuit

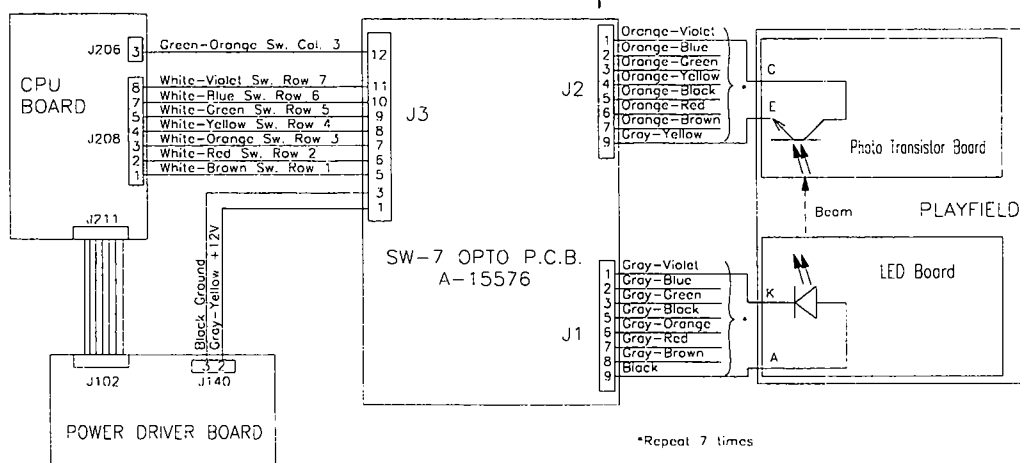
SW-7 Opto Board A-15576



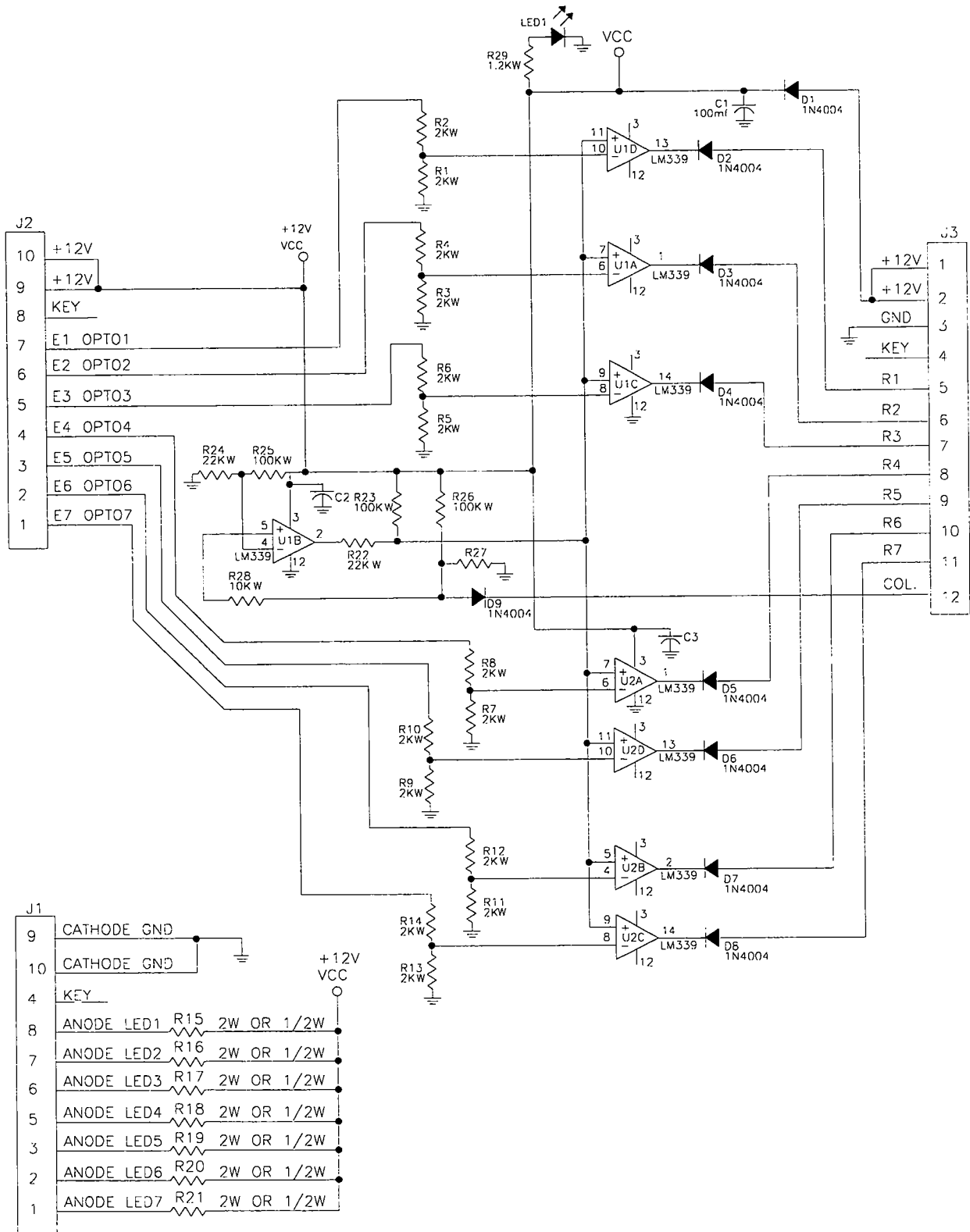
J1-1 Gray-Violet to Sw #37
 J1-2 Gray-Blue to Sw #36
 J1-3 Gray-Green to A-18617-1 (LED) J1-3 Sw #35
 J1-4 Key
 J1-5 Gray-Black to A-18617-1 (LED) J1-4 Sw #34
 J1-6 Gray-Orange to A-18617-1 (LED) J1-5 Sw #33
 J1-7 Gray-Red to A-18617-1 (LED) J1-6 Sw #32
 J1-8 Gray-Brown to A-18617-1 (LED) J1-7 Sw #31
 J1-9 Black Ground to Sw #36 & #35
 J1-10 Black Ground to A-18617-1 J1-9

J2-1 Orange-Violet to Sw #37
 J2-2 Orange-Blue Sw #36
 J2-3 Orange-Green to A-18618-1 (Photo) J1-7 Sw #35
 J2-4 Orange-Yellow to A-18618-1 (Photo) J1-6 Sw #34
 J2-5 Orange-Black to A-18618-1 (Photo) J1-5 Sw #33
 J2-6 Orange-Red to A-18618-1 (Photo) J1-4 Sw #32
 J2-7 Orange-Brown to A-18618-1 (Photo) J1-3 Sw #31
 J2-8 Key
 J2-9 Gray-Yellow +12VDC to Sw #36 & #35
 J2-10 Gray-Yellow +12VDC to A-18618 (Photo) J1-1

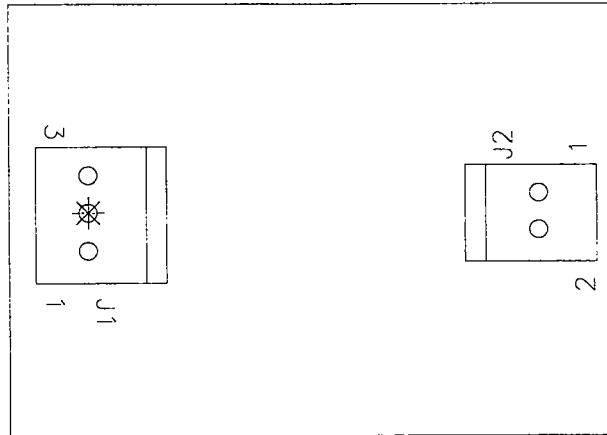
J3-1 Gray-Yellow +12VDC from J140-2
 J3-2 Not Used
 J3-3 Black Ground from J140-3
 J3-4 Key
 J3-5 White-Brown from J208-1
 J3-6 White-Red from J208-2
 J3-7 White-Orange from J208-3
 J3-8 White-Yellow from J208-4
 J3-9 White-Green from J208-5
 J3-10 White-Blue from J208-7
 J3-11 White-Violet from J208-8
 J3-12 Green-Orange from J206-3



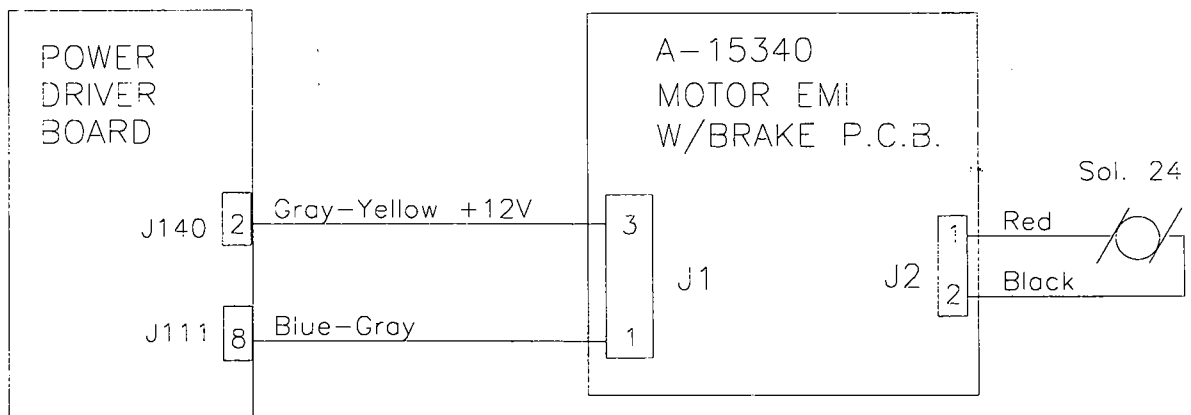
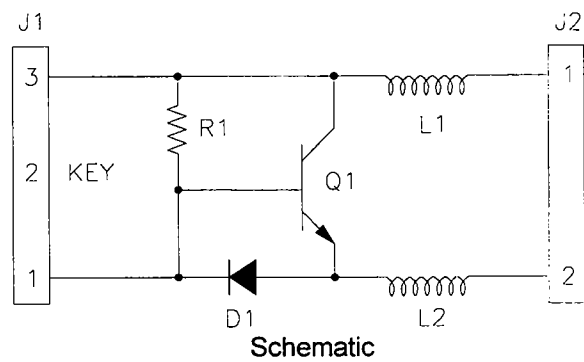
SW-7 Opto Board A-15576



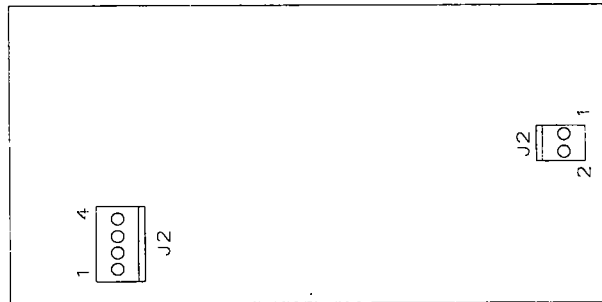
Motor EMI w/Brake P.C.B. Assembly A-15340



- J1-1 Blue-Gray from J111-8
- J1-2 Key
- J1-3 Gray-Yellow +12V from J140-2
- J2-1 Red to Sol 24 Motor Bank
- J2-2 Black to Sol 24 Motor Bank

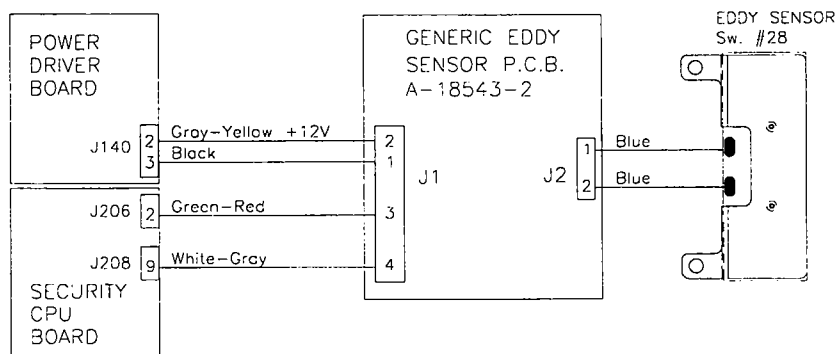


Generic Eddy Sensor P.C.B. Assembly A-18543-2

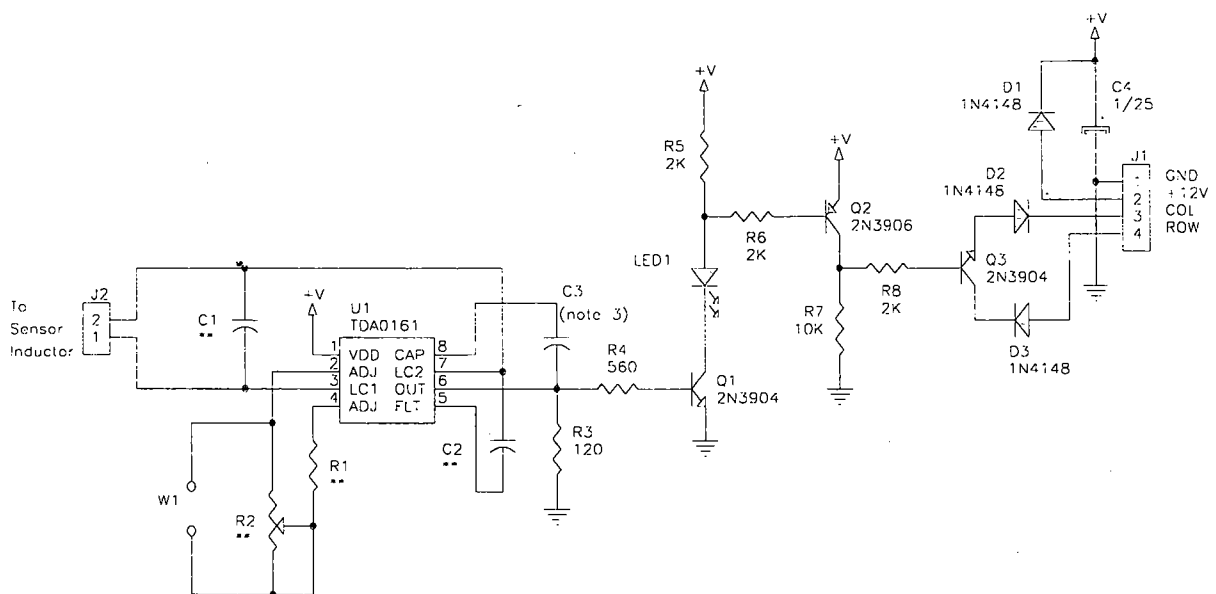


J1-1 Black Ground from J140-3
 J1-2 Gray-Yellow +12V from J140-2
 J1-3 Green-Red from J206-2
 J1-4 White-Gray from J208-9

J1-1 Blue to Eddy Sensor Sw. #28
 J1-2 Blue to Eddy Sensor Sw. #28

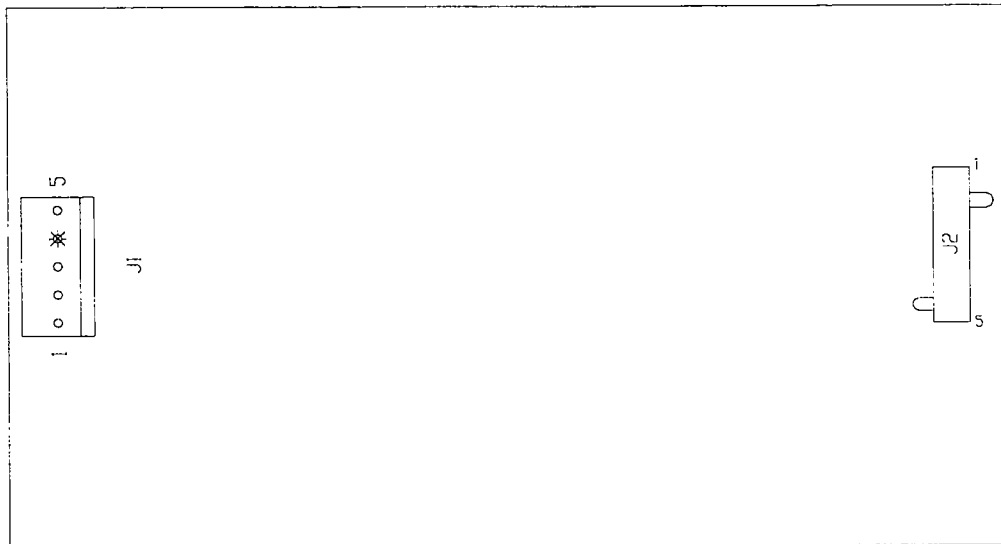


Circuit



Schematic

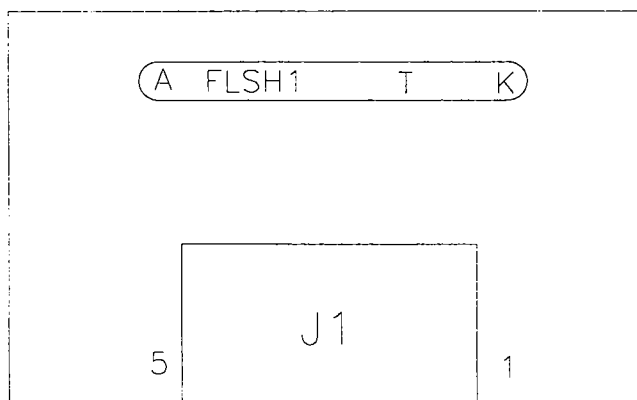
Strobe Lamp P.C.B. Assembly A-20669



J1-1 Gray-Yellow +12V from J140-2
 J1-2 Orange-White from J110-4
 J1-3 White-Blue from J130-1
 J1-4 Key
 J1-5 White-Blue from J130-2

J2-1 White to Strobe Tube P.C.B. J1-1
 J2-2 Key
 J2-3 White to Strobe Tube P.C.B. J1-3
 J2-4 Not Used
 J2-5 White to Strobe Tube P.C.B. J1-5

Strobe Tube P.C.B. Assembly A-20718



J1-1 White from Strobe Lamp P.C.B. J2-1
 J1-2 Key
 J1-3 White from Strobe Lamp P.C.B. J2-3
 J1-4 Not Used
 J1-5 White from Strobe Lamp P.C.B. J2-5

J134-1 Not Used
J134-2 Not Used
J134-3 Not Used
J134-4 Key
J134-5 Red-White, +20VDC to Insert Flashlamps

J135 Not Used

J136 Not Used

J137 Not Used

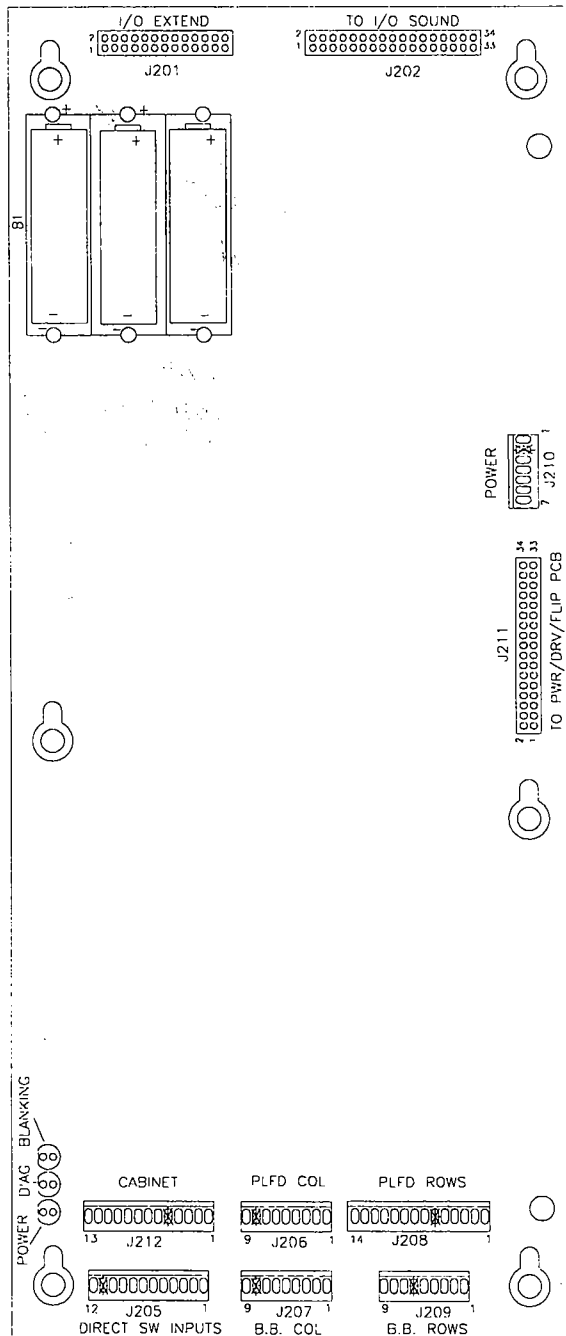
J138 Not Used

J139 -1 Key
J139 -2 Gray-Yellow +12V to Cabinet
J139 -3 Black Ground to Cabinet
J139 -4 Not Used
J139-5 Black-White to Coin Door Bd. J2-7

J140-1 Key
J140-2 Gray-Yellow, +12V to Playfield
J140-3 Black, Ground to Playfield
J140-4 Not Used

J141-1 Key
J141-2 Gray-Yellow, +12V to Coin Door Board J2-2
J141-3 Black, Ground to Coin Door Board J2-1
J141-4 Not Used

Security CPU Board Assembly A-20119-50041



J201 26-Pin Ribbon Cable, Data to/from J602

J202 34-Pin Ribbon Cable, Data to/from J601

J203 Not Used

J204 Not Used

J205-1 Orange-Brown, Ded. Sw. Row 1, to Coin Door Bd. J1-8
 J205-2 Orange-Red, Ded. Sw. Row 2, to Coin Door Bd. J1-7
 J205-3 Orange-Black, Ded. Sw. Row 3, to Coin Door Bd. J1-6
 J205-4 Orange-Yellow, Ded. Sw. Row 4, to Coin Door Bd. J1-5
 J205-5 Not Used
 J205-6 Orange-Green, Ded. Sw. Row 5, to Coin Door Bd. J1-4
 J205-7 Orange-Blue, Ded. Sw. Row 6, to Coin Door Bd. J1-3
 J205-8 Orange-Violet, Ded. Sw. Row 7, to Coin Door Bd. J1-2
 J205-9 Orange-Gray, Ded. Sw. Row 8, to Coin Door Bd. J1-1
 J205-10 Black, Ground, to Coin Door Bd. J1-10
 J205-11 Key
 J205-12 Orange-White, Sw. Enable, to Coin Door Bd. J1-11

J206-1 Green-Brown, Sw. Col. 1, to Playfield Sw.
 J206-2 Green-Red, Sw. Col. 2, to Playfield Sw.
 J206-3 Green-Orange, Sw. Col. 3, to Playfield Sw.
 J206-4 Green-Yellow, Sw. Col. 4, to Playfield Sw.
 J206-5 Green-Black, Sw. Col. 5, to Playfield Sw.
 J206-6 Green-Blue, Sw. Col. 6, to Playfield Sw.
 J206-7 Not Used
 J206-8 Key
 J206-9 Not Used

J207 Not Used

J208-1 White-Brown, Sw. Row 1, to Playfield Sw.
 J208-2 White-Red, Sw. Row 2, to Playfield Sw.
 J208-3 White-Orange, Sw. Row 3, to Playfield Sw.
 J208-4 White-Yellow, Sw. Row 4, to Playfield Sw.
 J208-5 White-Green, Sw. Row 5, to Playfield Sw.
 J208-6 Key
 J208-7 White-Blue, Sw. Row 6, to Playfield Sw.
 J208-8 White-Violet, Sw. Row 7, to Playfield Sw.
 J208-9 White-Gray, Sw. Row 8, to Playfield Sw.
 J208-10 Not Used
 J208-11 Not Used
 J208-12 Black-Blue, F3, to Lower Left E.O.S. Sw.
 J208-13 Black-Green, F1, to Lower Right E.O.S. Sw.
 J208-14 Orange, Ground to E.O.S. Sw.

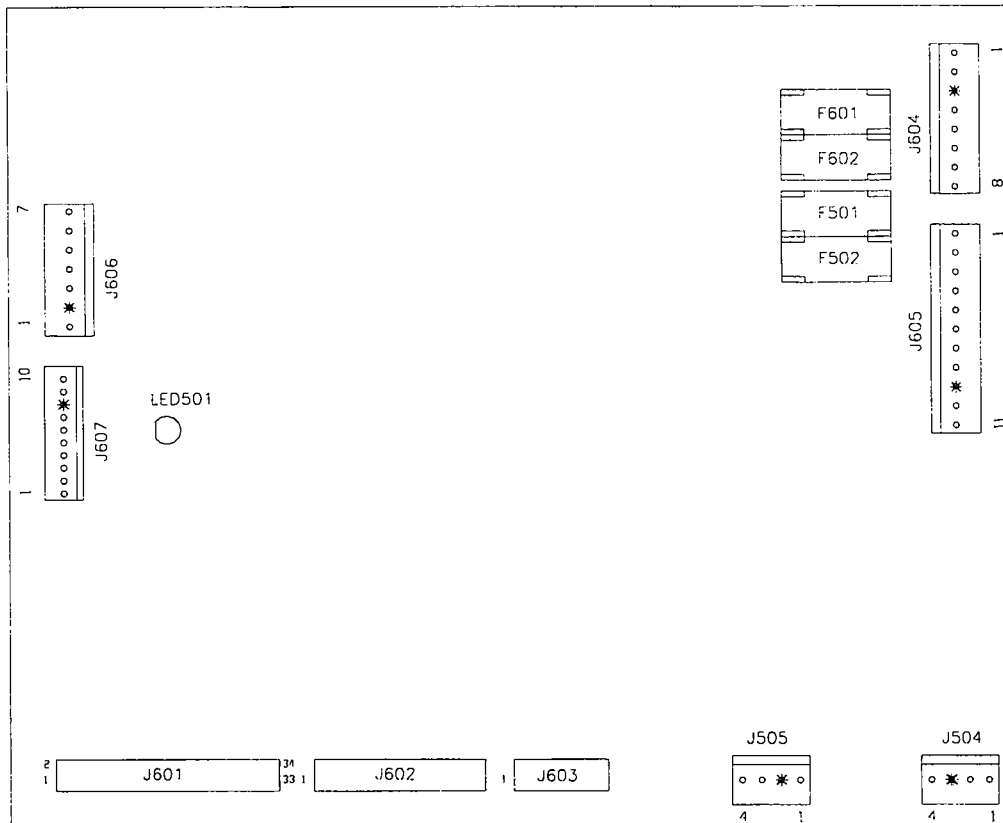
J209 Not Used

J210-1 Black, Ground, to/from J101-7, J606-1
 J210-2 Key
 J210-3 Black, Ground, to/from J101-5, J606-3
 J210-4 Gray, +5V, to/from J101-4, J606-4
 J210-5 Gray, +5V, to/from J101-3, J606-5
 J210-6 Gray-Green, +12V, to/from J101-2, J606-6
 J210-7 Gray-Green, +12V, to/from J101-1, J606-7

J211 34-Pin Ribbon Cable, Data to/from J102

J212-1 Green-Brown, Sw. Col. 1, to Coin Door Board J3-1
 J212-2 Green-Red, Sw. Col. 2, to Coin Door Board J3-2
 J212-3 Not Used
 J212-4 White-Brown, Sw. Row 1, to Coin Door Board J3-3
 J212-5 Key
 J212-6 White-Red, Sw. Row 2, to Coin Door Board J3-4
 J212-7 White-Orange, Sw. Row 3, to Coin Door Board J3-5
 J212-8 White-Yellow, Sw. Row 4, to Coin Door Board J3-6
 J212-9 Black-Blue, F8, to Left Flipper Opto Board J1-1
 J212-10 Black-Yellow, F6, to Right Flipper Opto Board J1-1
 J212-11 Blue-Gray, F4, to Left Flipper Opto Board J1-2
 J212-12 Blue-Violet, F2, to Right Flipper Opto Board J1-2
 J212-13 Orange, Ground to Right Flipper Opto Board J1-3

Audio Visual Board Assembly A-20516-50041



J601 34-Pin Ribbon Cable, Data to CPU J202

J602 26-Pin Ribbon Cable, Data to CPU J201

J603 14-Pin Ribbon Cable, Data to/from Dot Matrix Display Driver

J604-1 Orange, -125V to Display Driver Pin 8

J604-2 Blue, -113V to Display Driver Pin 7

J604-3 Key

J604-4 Black, Ground to Display Driver Pin 5

J604-5 Black, Ground to Display Driver Pin 4

J604-6 Gray, +5V to Display Driver Pin 3

J604-7 Gray-Yellow, +12 to Display Driver Pin 2

J604-8 Brown, +62 to Display Driver Pin 1

J605-1 White, 80VAC from Transformer Secondary

J605-2 White, 80VAC from Transformer Secondary

J605-3 Violet, 100VAC from Transformer Secondary

J605-4 Violet, 100VAC from Transformer Secondary

J605-5 Gray-White, 18VAC from Transformer Secondary

J605-6 Gray-White, Loop End from J605-5

J605-7 Gray, 18VAC from Transformer Secondary

J605-8 Gray, Loop End from J605-7

J605-9 Not Used

J605-10 Gray-Green, 18VAC from Transformer Secondary

J605-11 Gray-Green, 18VAC Loop End from J605-10

J606-1 Black, Ground to/from J101-7, J210-1

J606-2 Key

J606-3 Black, Ground to/from J101-5, J210-3

J606-4 Gray, +5V to/from J101-4, J210-4

J606-5 Gray, +5V to/from J101-3, J210-5

J606-6 Gray-Green, +12V to/from J101-2, J210-6

J606-7 Gray-Green, +12V to/from J101-1, J210-7

J607 Not Used

J504-1 Black-Yellow, Signal to Cabinet Speaker

J504-2 Key

J504-3 Not Used

J504-4 Black, Signal to Cabinet Speaker

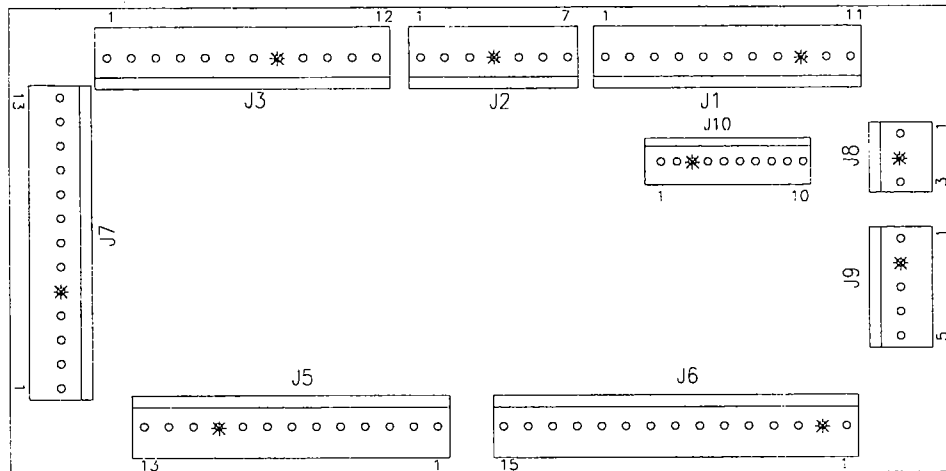
J505-1 Black-Yellow, Signal to Backbox Speaker

J505-2 Not Used

J505-3 Key

J505-4 Black, Signal to Backbox Speaker

Coin Door Interface Board A-20580



J1-1 Orange-Gray, Ded. Sw. Row 8 Form CPU J205-9
 J1-2 Orange-Violet, Ded. Sw. Row 7 from CPU J205-8
 J1-3 Orange-Blue, Ded. Sw. Row 6 from CPU J205-7
 J1-4 Orange-Green, Ded. Sw. Row 5 from CPU J205-6
 J1-5 Orange-Yellow, Ded. Sw. Row 4 from CPU J205-4
 J1-6 Orange-Black, Ded. Sw. Row 3 from CPU J205-3
 J1-7 Orange-Red, Ded. Sw. Row 2 from CPU J205-2
 J1-8 Orange-Brown, Ded. Sw. Row 1 from CPU J205-1
 J1-9 Key
 J1-10 Black, Ground from CPU J205-10
 J1-11 Orange-White, Sw. Enable from CPU J205-12

J2-1 Black, Ground from Power Driver Board J141-3
 J2-2 Gray-Yellow, +12VAC For Power Driver Bd. J141-2
 J2-3 White-Violet, G.I. 6.8VAC from Power Driver J104-1
 J2-4 Key
 J2-5 Violet, G.I. from Power Driver Bd. J104-3
 J2-6 Not Used
 J2-7 Black-White from J139-5

J3-1 Green-Brown, Sw. Col. 1 from CPU J212-1
 J3-2 Green-Red, Sw. Col. 2 from CPU J212-2
 J3-3 White-Brown, Sw. Row 1 from CPU J212-4
 J3-4 White-Red, Sw. Row 2 from CPU J212-6
 J3-5 White-Orange, Sw. Row 3 from CPU J212-7
 J3-6 White-Yellow, Sw. Row 4 from CPU J212-8
 J3-7 Key
 J3-8 Yellow-Gray, Lamp Col. 8 from Power Driver J122-3
 J3-9 Red-Blue, Lamp Row 6 from Power Driver J126-7
 J3-10 Red-Violet, Lamp Row 7 from Power Driver J126-8
 J3-11 Red-Gray, Lamp Row 8 from Power Driver J126-9

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, Ded. Sw. Row 1 to Coin Door
 J5-5 Orange-Red, Ded. Sw. Row 2 to Coin Door
 J5-6 Not Used
 J5-7 Orange-Green, Ded. Sw. Row 5 to Coin Door
 J5-8 Orange-Blue, Ded. Sw. Row 6 to Coin Door
 J5-9 Orange-Violet, Ded. Sw. Row 7 to Coin Door
 J5-10 Key
 J5-11 Orange-Gray, Ded. 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

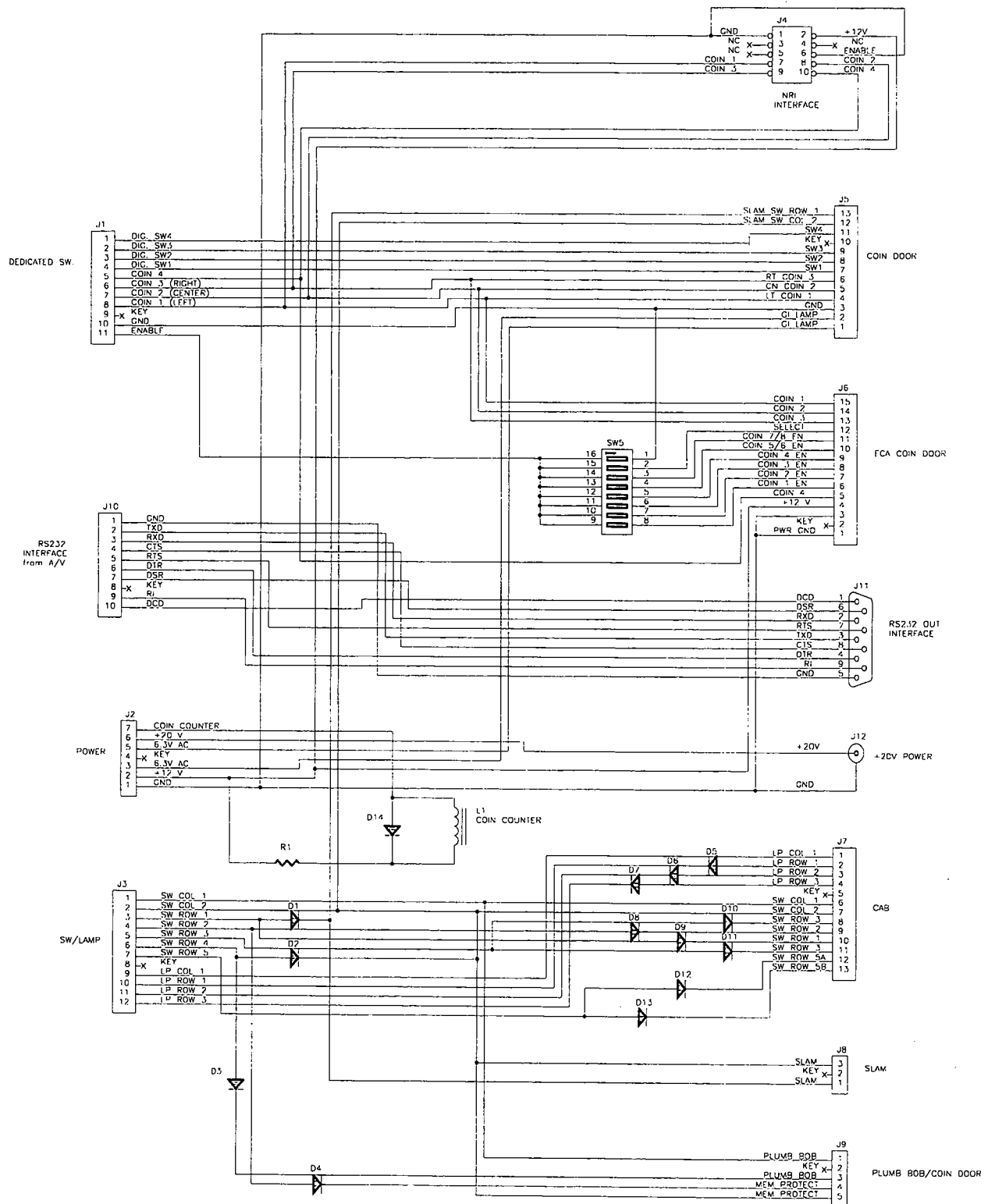
J6 Not Used

J7-1 Yellow-Gray, Lamp Col. 8 to Cabinet
 J7-2 Red-Blue, Lamp Row 6 to Cabinet
 J7-3 Red-Violet, Lamp Row 7 to Cabinet
 J7-4 Red-Gray, Lamp Row 8 to Cabinet
 J7-5 Key
 J7-6 Green-Brown, Sw. Col. 1 to Cabinet
 J7-7 Green-Red, Sw. Col. 2 to Cabinet
 J7-8 White-Orange, Sw. Row 3 to Cabinet
 J7-9 Not Used
 J7-10 White-Brown, Sw. Row 1 to Cabinet
 J7-11 White-Orange, Sw. Row 3 to Cabinet

J8-1 White, Sw. Row to Cabinet Slam Tilt
 J8-2 Key
 J8-3 Green, Sw. Col. to Cabinet Slam Tilt

J9-1 White-Yellow, Sw. Row 4 to Plumb Bob Tilt
 J9-2 Key
 J9-3 Green-Brown, Sw. Col. 1 to Plumb Bob Tilt
 J9-4 White-Red, Sw. Row 2 to Interlock Sw.
 J9-5 Green-Red, Sw. Col. 2 to Interlock Sw.

Coin Door Interface Board Schematic A-20580



Notes

Handwriting practice lines consisting of 20 horizontal dotted lines.