Williams ELECTRONICS, INC.

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Game No. 502
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COSMIC GUNFIGHT

INSTRUCTION BOOKLET

This booklet provides game operation, bookkeeping, game adjustment, diagnostic, and self-test procedures for COSMIC GUNFIGHT. For installation and special maintenance information refer to the blue-covered game manual.

SPECIAL CONSIDERATIONS WHEN REPLACING CIRCUIT BOARDS

CPU Board

1. Revision level 7 CPU Boards (batteries located on lower left corner at board) of later boards must be used.
2. Must be equipped with blue-labeled Flipper ROMs and blue-labeled Game ROMs.
3. Jumpers W3, W10, W11, W14, W17, W19, W20, and W22 must be connected. Jumpers W4, W9, W12, W15, W16, W18, W21, and W23 must be removed. With the exception of W25, (Factory Setting Jumper) all other jumpers are not changed.

Driver Board

Must be equipped with zero-ohm resistors or wire jumpers (W9-W16) in place of switch matrix drive series resistors R204-R211.

Sound Board

Must be jumpered for ROM operation and be equipped with Sound ROM 12. (Jumpers W2, W5, W7, W9, W10, W12, and W15 connected; W3, W4, W6, W8, W11, and W13 removed).

Power Supply Board

1. Model D 8345 board required (equipped with relay).
2. Fuse F4 (10A SB) for flipper solenoids must be installed.

Display Boards

Model C 8363 Master Display and 7-digit Slave Displays required.

Game Operation

Game Over Mode - Turn game ON; player 1 score shows 00; all player scores alternate the high score to date, Game Over lamp lights. All playfield lamps cycle in attract mode.

Credit Posting - Insert coins; sound produced, number of credits displayed. If maximum credits* exceeded by coin or high score to date, credits posted correctly and coin lockout de-energizes until remaining credits are below maximum. No credits may be won and coins are rejected while the coin lockout is de-energized.

Game Start - Two balls must be resting on ball ramp or ball shooter switches (maximum of one ball in ball shooter trough) before game will start. Push credit button, startup tune played, ball served, credit display reduced by 1, player 1 score flashes 00 until first scoring switch is made, ball in play display shows 1. Pushing credit button before ball 2 allows additional players.

*Indicates adjustable features.

Multi-Ball, Multi Lane Change and ***Lane Change*** are trademarks of Williams Electronics, Inc.

Bonus - The Bonus can be advanced from 1 to 63,000: One advance for the X, Y, 1, 2, and 3 rollovers and three advances for the right lane, flipper return lanes, and for completing a drop target 3-bank. Making a flipper return lane lights the right lane to advance the Bonus Multiplier (2X, 3X, 4X, 5X). The Advance Bonus X lamp goes out when collected or (adjustable) after 10 seconds.

1-2-3 Lanes - Spotting lane lamps lights top eject hole lock arrow, and scores and advances top lane bonus (10,000-150,000). Spotting lamps a second time lights bottom eject hole lock arrow. Operating right flipper (***Multi Lane Change***™ feature #1) rotates lane lamps.

X-Y Lanes - Spotting lane lamps advances top eject hole value (10,000, 20,000, 30,000, 50,000, 100,000). Operating left flipper (***Multi Lane Change*** feature #2) rotates lane lamps.

A-B-C Targets - Making a target lights letter lamp with associated arrow lit. Lighting all nine lamps qualifies the player for COSMIC BALL. Operating both flippers at the same time rotates A-B-C arrows (***Multi Lane Change*** feature #3). Lighting all nine lamps the second time lights lower eject hole for a possible extra ball.

Drop Targets - Completing a drop target 3-bank adds 3 seconds to COSMIC BALL time (see COSMIC BALL Play). Completing a bank in sequence lights associated bank sequence lamp. Lighting all three sequence lamps lights lower eject hole for a possible extra ball.

Right Lane - Making right lane rollover scores and advances lit value (20,000, 30,000, 40,000, 50,000, 60,000, 2X Scoring).

Multi-Ball™ **Play** - Spotting 1-2-3 lane lamps spots an eject hole lock lamp. Locking both balls initiates 2-ball, Multi-Ball play. The COSMIC BALL timer is advanced while two balls are in play (see COSMIC BALL play). During ***Multi-Ball*** play each drop target scores 5,000 and, when associated 20,000 Each lamp is lit, scores 20,000.

Cosmic Ball Play - COSMIC BALL play is a timed interval after the last regular ball where both balls may be brought into play. This is an adjustable feature (see function 32 chart below). Lighting the three drop target In Sequence lamps during COSMIC BALL play scores a special.

SETTING	DESCRIPTION
00	COSMIC BALL time may be earned throughout game. (See Drop Targets and ***Multi-Ball*** play above.)
01	COSMIC BALL time may be earned after qualifying. (See A-B-C Targets, Drop Targets and ***Multi-Ball*** play above.)
02	No COSMIC BALL time may be earned.
03	No COSMIC BALL.

Lamps on Memory

(1) 1-2-3 rollovers
(2) X & Y rollovers
(3) A-B-C matrix & arrow
(4) Lane 1-2-3 completion (10K-20K-40K-80K)
(5) Upper eject hole scores
(6) Upper & lower lock-when-lit
(7) Bonus Multiplier*
(8) Right side lane Bonus value*
(9) Drop target in sequence
(10) Advance Bonus X*

Tilt - Ball in play tilted on first closure of ball roll tilt and third* closure of plumb bob and playfield tilts. Slam tilt returns game to Game Over mode.

End of Game - Match Digits* appear in ball in play display, credit* awarded for match. Exceeding high score to date awards three* credits. Match, High Score to Date, and Game Over sounds made as appropriate. A new game cannot be started with more than one ball in the ball shooter trough; excess balls must be returned to playfield and drain to rest on ball ramp switches.

*Indicates adjustable features.

BOOKKEEPING AND GAME EVALUATION

(Functions 01-17)

1. Set AUTO-UP/MANUAL-DOWN switch to AUTO-UP and depress ADVANCE pushbutton. Test 04 is indicated in the credits display, Function 00 in Match display, and Game Identification in Player 1 display.
2. Operate the ADVANCE pushbutton to display Functions 01 thru 04 on the Match display (See Table 1) and record the corresponding totals (number of coins and total paid credits) from the Player 1 display. (To review a total that has been advanced past, set switch to MANUAL-DOWN and operate the ADVANCE pushbutton).
3. Operate the ADVANCE pushbutton to display Functions 05, 06, and 07 in the Match display and record the corresponding free credit totals from the Player 1 display.
4. Operate the ADVANCE pushbutton to display Function 08 in the Match display. Total credits is indicated in the Player 1 display, total free credits in the Player 2 display, and percentage of free credits in the Player 4 display.
5. Operate the ADVANCE pushbutton to display Function 09 thru 12 in the Match display and record the corresponding totals from the Player 1 display.
6. Operate the ADVANCE pushbutton to display Functions 13 thru 17 in the Match display and record the corresponding totals from the Player 2 display.
7. With switch set to MANUAL-DOWN operate ADVANCE to display Function 50 in the Match Display. From Function 50 you can return to game over or zero audit totals and return to game over. Perform step 8.a. or 8.b. as desired.
8. a. To return to game over, set the switch to AUTO-UP and depress ADVANCE.
   b. **To zero audit totals** and return to game over set switch to AUTO-UP, operate the credit button to display 35 in the Player 1 display, and depress ADVANCE.

Table 1. Audit Totals

FUNCTION	DESCRIPTION		
	PLAYER 1	PLAYER 2	PLAYER 4
00	Game Identification (2502 1)	—	—
01	Coins, Left chute	—	—
	(closest to coin door hinge)	—	—
02	Coin, center chute	—	—
03	Coin, right chute	—	—
04	Total Paid Credits	—	—
05	Special Credits	—	—
06	Replay Score Credits	—	—
07	Match Credits	—	—
08	Total Credits	Free Credits	% Free Credits
09	Total Extra Balls	—	—
10	Ball Time in Minutes	—	—
11	Total Balls Played	—	—
12	Current High Score	—	—
	to Date		
13	Backup High Score	High Score to Date	—
	to Date	Credits Awarded	
14	Replay 1 Score	Times exceeded	—
15	Replay 2 Score	Times exceeded	—
16	Replay 3 Score	Times exceeded	—
17	Replay 4 Score	Times exceeded	—

GAME ADJUSTMENT PROCEDURE

(Functions 13-41)

Coin door must be open to change settings.

1. Set AUTO-UP/MANUAL-DOWN switch to AUTO-UP and depress the ADVANCE pushbutton. Test 04 is indicated in the Credits display, Function 00 in Match display, and game identification in Player 1 display.
2. **To raise** Function number in Match display, operate ADVANCE pushbutton with switch set to AUTO-UP. **To lower** Function number, operate ADVANCE with switch set to MANUAL-DOWN.
3. With desired Function indicated in Match display, **raise** value in player 1 display by operating credit button with switch set to AUTO-UP; **lower** value by operating credit button with switch set to MANUAL-DOWN. Value left in Player 1 display is the new setting. For values see Table 2, and for pricing Table 3.
4. Repeat steps 2 and 3 until all required adjustments have been made.
5. Operate ADVANCE until Function 50 is indicated in Match display. From Function 50 you can return to game over or **restore factory settings**. Perform step 6 or 7 as desired.
6. To return to game over, depress ADVANCE with switch set to AUTO-UP.
7. To restore factory settings **and** zero audit totals:
   a. Operate Credit button with switch set to AUTO-UP until 45 is indicated in Player 1 Display.
   b. Depress ADVANCE. The game returns to Test 04, Function 00.
   c. Set switch to MANUAL-DOWN and depress ADVANCE to indicate Function 50.
   d. Set switch to AUTO-UP and depress ADVANCE.

RESETTING HIGH SCORE TO DATE

1. Using game adjustment procedure, set Function 13 to the desired reset value.
2. Depress HIGH SCORE RESET pushbutton.

FACTORY AUDIT TOTALS

(Functions 42-49)

The factory audit functions are not assigned.

Table 2. Game Adjustments

FUNCTION	DESCRIPTION	NOTES	*FACTORY SETTING
13	Backup High Score to Date [HSTD Credits Awarded]	1	2,500,000
14	Replay 1 Score [Times exceeded]	2,5	1,000,000
15	Replay 2 Score [Times exceeded]	2,5	2,000,000
16	Replay 3 Score [Times exceeded]	2,5	0
17	Replay 4 Score [Times exceeded]	2,5	0
18	Maximum Credits	3	30
19	Standard and Custom Pricing Control	4	01/02
20	Left Coin Slot Multiplier	4	01/09
21	Center Coin Slot Multiplier	4	04/45
22	Right Coin Slot Multiplier	4	01/18
23	Coin Units Required for Credit	4	01/05
24	Coin Units Bonus Point	4	00/45
25	Minimum Coin Units	4	00
26	Match: 00 = Match ON; 01 = Match OFF	-	00
27	Special: 00 = Awards Credit; 01 = No Special; 02 = Awards Points	-	01
28	Replay Scores: 00 = Awards Credit; 01 = Awards Extra Ball	5	00
29	Maximum Plumb Bob Tilts	-	03
30	Number of Balls (03 or 05)	-	03
31	Initial COSMIC BALL Time (00 to 99 seconds)	6	30
32	COSMIC BALL Control: 00 = COSMIC BALL Time may be earned throughout game; 01 = COSMIC BALL Time may be earned after qualifying; 02 = No COSMIC BALL Time may be earned; 03 = No COSMIC BALL	6	00
33	Bonus Multiplier Memory: 00 = No Memory; 01 = Memory	-	00
34	Right Lane Lamps 00 = 20,000 Lit Initially, Lamps on Memory; 01 = Not Lit Initially, Lamps on Memory; 02 = 20,000 Lit Initially, No Lamp Memory; 03 = Not Lit Initially, No Lamp Memory	-	00
35	Top Eject Hole: 00 = 10,000 Lit Initially; 01 = Not Lit Initially	-	00
36	Advance Bonus X Lamp: 00 = Stays on until collected	-	
	01 = Turns off after 10 seconds or when collected	-	00
37	A-B-C Lamps: 00 = Three Lit Initially; 01 = Not Lit Initially	-	00
38	Not Used	7	00
39	Background Sound (Attract Mode Sound 00 = Both; 01 = Attract Mode Only; 02 = Background Only; 03 = Neither	-	00
40	High Score Credits	1	03
41	Maximum Extra Balls at one time (00 = No Extra Ball)	-	04

* Second Factory Setting value is with jumper W25 on CPU Board connected.

[ ] Description in brackets shown in Player 2 Display.

1. Function 13 may be set to any multiple of 100,000 points. Setting Function 40 to zero with Function 13 set to any score but zero permits the High Score to Date feature to operate but no credits are awarded.
2. Functions 14-17 (Replay Scores) may be set to any multiple of 100,000 points. Setting a function to zero disables the replay score point.
3. Setting Maximum Credits (Function 18) to zero places the game in a **free play mode**.
4. With Function 19 set to 00, Functions 20-25 must be set manually. Refer to Table 2 for eight standard pricing schemes (selected by values of 01-08 for Function 19) and custom pricing values. For straight quarter play, set Function 19 to 00, Function 23 to 01 and Function 24 to 00. All other pricing functions should remain at their factory settings.
5. No Extra Balls are awarded at replay levels during Cosmic Ball play.
6. Lighting all A-B-C lamps qualifies the player for Cosmic Ball Play. With 00 or 01 setting, use instruction card 502-2 A; with 02 setting use 502-2 B; with 03 setting use 502-3.
7. Function 38 should be kept at the 00 Factory Setting.

Table 3. Standard and Custom Price Settings

COIN DOOR MECHANISM	CREDITS	FUNCTION						
		19	20	21	22	23	24	25
Twin-Quarter	1/25¢, 3/50¢, 7/$1	00	03	12	03	02	12	00
Quarter, Dollar, Quarter	1/25¢, 3/50¢, 7/$1 coin only	00	03	14	03	02	00	00
	1/25¢, 7/$1 coin only	00	01	07	01	01	00	00
	1/25¢, 3/50¢, 6/$1	00	01	04	01	01	02	00
	1/25¢, 6/$1 coin only	00	01	06	01	01	00	00
	1/25¢, 5/$1	00	01	04	01	01	04	00
	2/50¢, 5/$1	00	01	04	01	01	04	02
	1/25¢, 5/$1 coin only	00	01	05	01	01	00	00
	•1/25¢, 4/$1	**01**	**01**	**04**	**01**	**01**	**00**	**00**
	2/50¢, 4/$1	00	01	04	01	01	00	02
	•1/50¢, 2/75¢, 3/4 x 25¢ 4/$1 or 5 x 25¢	**05**	**03**	**15**	**03**	**04**	**15**	**00**
	1/50¢, 3/$1, 4/$1.25	00	03	12	03	04	15	00
	1/50¢, 3/$1, 7/$2	00	12	48	12	14	96	18
	•1/50¢, 3/$1, 6/$2	**03**	**01**	**04**	**01**	**02**	**04**	**00**
	1/50¢	00	01	04	01	02	00	00
1DM, 5DM, 2DM	**•1/1DM, 3/2DM, 10/5DM**	**02**	**09**	**45**	**18**	**05**	**45**	**00**
	2/1DM, 5/2DM, 14/5DM	00	13	65	26	05	65	00
20-Cent, 50-Cent	1/20¢, 3/50¢	00	06	00	15	05	00	00
1 Franc, 10 Franc, 5 Franc	**•1/2F, 3/5F only, 8/10F only**	**04**	**01**	**16**	**06**	**02**	**00**	**00**
25 Cent,	**•1/25¢, 4/1G**	**06**	**01**	**00**	**04**	**01**	**00**	**00**
1 Guilder,	1/25¢, 5/1G	00	01	00	04	01	04	00
Twin 100 Yen	2/100Y	00	02	00	02	01	00	00
1 Franc or	1/1F, 3/2F	00	01	01	01	01	02	00
Twin-1 Franc	1/1F	00	01	01	01	01	00	00
5 Franc,	**•1/5F, 2/10F**	**07**	**01**	**00**	**02**	**01**	**00**	**00**
10 Franc	**•1/10F**	**08**	**01**	**00**	**02**	**02**	**00**	**00**
Twin-2 Franc	**•1/2F**	**03**	**01**	**04**	**01**	**01**	**00**	**00**
10, 20 Franc	**•1/10F, 2/20F**	**07**	**01**	**00**	**02**	**01**	**00**	**00**
Twin-1 Sucre	1/3S, 2/5S	00	02	00	02	05	00	00

•Indicates standard price settings by adjusting **only** Function 19. For other price settings, set Function 19 to 00 and set Functions 20 through 25 to the values indicated in the chart.

DIAGNOSTIC PROCEDURES

Display Digits Test

1. Set AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN and depress ADVANCE. Displays should indicate all 0's.
2. Set the switch to AUTO-UP. Displays should sequence from all 0's thru all 9's. Comma segments should come on when odd digits are displayed.
3. To stop cycling, set switch to MANUAL-DOWN. Operate ADVANCE pushbutton to step through the tests one number at a time. Set switch to AUTO-UP to resume cycling.

Sound Test

1. From Display Digits Test depress ADVANCE with the switch set to AUTO-UP. Test 00 should be indicated in the Credits display and the Match display should sequence from 00 thru 06. Different sounds should be produced for 00, 01, 02, 03, and 04.
2. To continuously pulse a single sound, set the toggle switch to MANUAL-DOWN. Operate ADVANCE pushbutton to sequence through sounds one at a time. Set toggle switch to AUTO-UP to resume sequencing.

Lamp Test

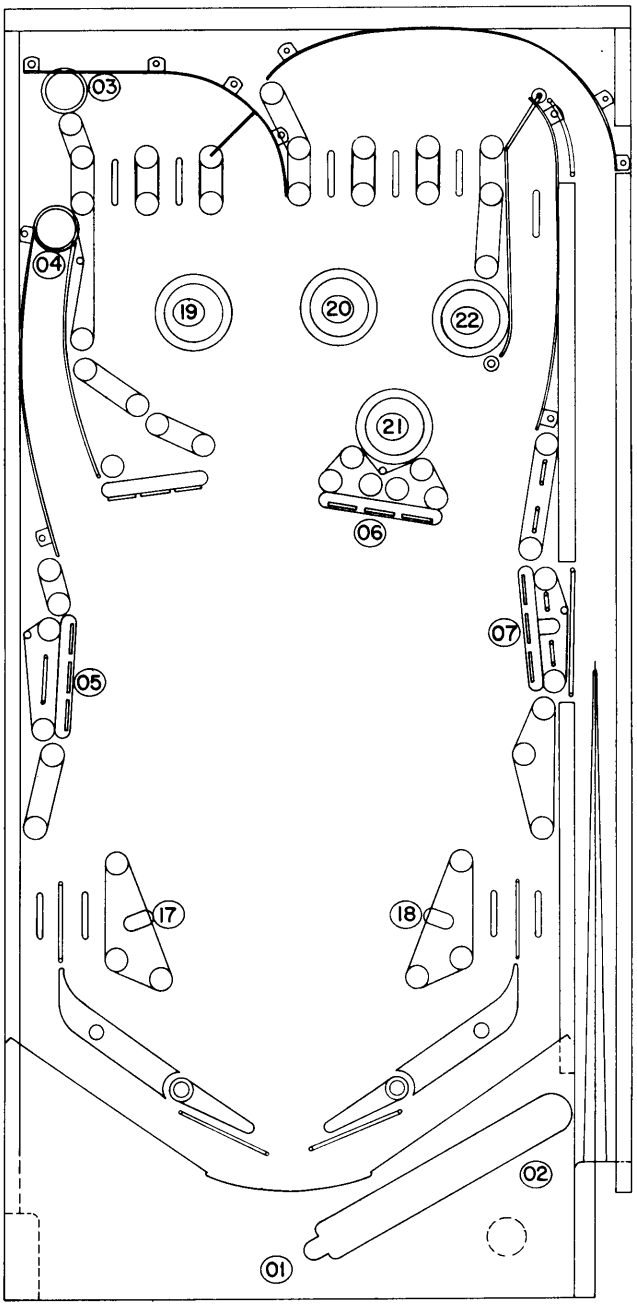
From Sound Test depress ADVANCE with the switch set to AUTO-UP. Test 01 should be indicated in the Credits display and all multiplexed lamps should flash.

ROW \ COLUMN	1 YEL-BRN 2J5-8	2 YEL-RED 2J5-9	3 YEL-ORN 2J5-6	4 YEL-BLK 2J5-7	5 YEL-GRN 2J5-3	6 YEL-BLU 2J5-5	7 YEL-VIO 2J5-1	8 YEL-GRY 2J5-2
1 RED-BRN 2J7-1	SAME PLAYER SHOOTS AGAIN 1	X LANE-TOP LEFT 9	40K (RIGHT LANE) 17	TOP EJECT HOLE LOCK ARROW 25	ARROW (A) 33	B-RIGHT 41	IN SEQUENCE (LEFT 3-BANK) 49	4+ BONUS (4,000) 57
2 RED-BLK 2J7-2	BALL IN PLAY 2	Y LANE-TOP LEFT 10	50K (RIGHT LANE) 18	BOTTOM EJECT HOLE LOCK ARROW 26	ARROW (B) 34	C-LEFT 42	IN SEQUENCE (CENTER 3-BANK) 50	8+ BONUS (8,000) 58
3 RED-ORN 2J7-3	TILT 3	LANE 1-TOP RIGHT 11	60K (RIGHT LANE) 19	BOTTOM EJECT HOLE EXTRA BALL ARROW 27	ARROW (C) 35	C-CENTER 43	IN SEQUENCE (RIGHT 3-BANK) 51	16+ BONUS (16,000) 59
4 RED-YEL 2J7-4	GAME OVER 4	LANE 2-TOP RIGHT 12	2X SCORING (RIGHT LANE) 20	TOP EJECT HOLE (10,000) 28	A-LEFT 36	C-RIGHT 44	20,000 EACH (LEFT 3-BANK) 52	32+ BONUS (32,000) 60
5 RED-GRN 2J7-5	MATCH 5	LANE 3-TOP RIGHT 13	1-2-3 LANES 10K 21	TOP EJECT HOLE (20,000) 29	A-CENTER 37	COSMIC BALL PLAYER 1 45	20,000 EACH (CENTER 3-BANK) 53	2X BONUS MULTIPLIER 61
6 RED-BLU 2J7-6	HIGH SCORE TO DATE 6	ADV X (RIGHT LANE) 14	1-2-3 LANES 20K 22	TOP EJECT HOLE (30,000) 30	A-RIGHT 38	COSMIC BALL PLAYER 2 46	20,000 EACH (RIGHT 3-BANK) 54	3X BONUS MULTIPLIER 62
7 RED-VIO 2J7-9	ALL SCORES 2X (RIGHT LANE) 7	20K (RIGHT LANE) 15	1-2-3 LANES 40K 23	TOP EJECT HOLE (50,000) 31	B-LEFT 39	COSMIC BALL PLAYER 3 47	1 BONUS (1,000) 55	4X BONUS MULTIPLIER 63
8 RED-GRY 2J7-8	COSMIC BALL TIMER 8	30K (RIGHT LANE) 16	1-2-3 LANES 80K 24	TOP EJECT HOLE (100,000) 32	B-CENTER 40	COSMIC BALL PLAYER 4 48	2+ BONUS (2,000) 56	5X BONUS MULTIPLIER 64

Figure 1. Lamp Matrix

Solenoid Test

1. From Lamp Test depress ADVANCE with the switch set to AUTO-UP. Test 02 should be indicated in the Credits display. The Match display sequences from 01 thru 25. Corresponding solenoids 01 thru 24 are pulsed. Flipper relay is de-energized with subtest 25.
2. To continuously pulse a single solenoid set switch to MANUAL-DOWN. Operate ADVANCE pushbutton sequence through the solenoids one at a time. Set switch to AUTO-UP to resume sequencing.



Sol. No.	Function
01	Outhole
02	Ball Ramp Thrower
03	Top Eject Hole
04	Bottom Eject Hole
05	Left 3-Bank Drop Target Reset
06	Center 3-Bank Drop Target Reset
07	Right 3-Bank Drop Target Reset
08	Not Used
09	Not Used
10	Not Used
11	General Illumination Relay
12	Not Used
13	Not Used
14	Not Used
15	Bell
16	Coin Lockout Relay
17	Left Kicker
18	Right Kicker
19	Left Jet Bumper
20	Center Jet Bumper
21	Bottom Jet Bumper
22	Right Jet Bumper

Figure 2. Playfield Solenoid Locations and Solenoid Chart

Table 4. Solenoid Connections

SOL. NO.	FUNCTION	WIRE COLOR	CONNECTIONS	DRIVER TRANS.	SOLENOID PART NO.
01	Outhole	GRY-BRN	2P11-4, 8P3-1	Q15	SA-23-850-DC
02	Ball Ramp Thrower	GRY-RED	2P11-5, 8P3-2	Q17	SG1-23-850-DC
03	Top Eject Hole	GRY-ORN	2P11-7, 8P3-3	Q19	SG1-23-850-DC
04	Bottom Eject Hole	GRY-YEL	2P11-8, 8P3-4	Q21	SG1-23-850-DC
05	Left 3-Bank Drop Target Reset	GRY-GRN	2P11-9, 8P3-5	Q23	SA3-23-850-DC
06	Center 3-Bank Drop Target Reset	GRY-BLU	2P11-3, 8P3-6	Q25	SA3-23-850-DC
07	Right 3-Bank Drop Target Reset	GRY-VIO	2P11-2, 8P3-7	Q27	SA3-23-850-DC
08	Not Used	GRY-BLK	2P11-1, 8P3-8	Q29	—
09	Not Used	BRN-BLK	2P9-9, 8P3-9	Q31	—
10	Not Used	BRN-RED	2P9-7, 8P3-10	Q33	—
11	General Illumination Relay	BRN-ORN	2P9-1, 8P3-11	Q35	5580-09555
12	Not Used	BRN-YEL	2P9-2, 8P3-12	Q37	—
13	Not Used	BRN-GRN	2P9-3, 8P3-13	Q39	—
14	Not Used	BRN-BLU	2P9-4, 8P3-14	Q41	—
15	Bell	BRN-VIO	2P9-5, 7P1-17	Q43	—
16	Coin Lockout Relay	BRN-GRY	2P9-6, 7P1-18, 7P2-4	Q45	SM-29-1000-DC
*17	Left Kicker	BLU-BRN	2P12-7, 8P3-17	Q2	SG1-23-850-DC
*18	Right Kicker	BLU-RED	2P12-4, 8P3-18	Q4	SG1-23-850-DC
*19	Left Jet Bumper	BLU-ORN	2P12-3, 8P3-19	Q6	SG-23-850-DC
*20	Center Jet Bumper	BLU-YEL	2P12-6, 8P3-20	Q8	SG-23-850-DC
*21	Bottom Jet Bumper	BLU-GRN	2P12-8, 8P3-21	Q10	SG-23-850-DC
*22	Right Jet Bumper	BLU-BLK	2P12-9, 8P3-22	Q12	SG-23-850-DC
	Right Flipper	BLU-VIO	2P12-1, 7P1-7	—	SFL-19-400/ 30-750-DC
	Left Flipper	BLU-GRY	2P12-2, 7P1-9	—	SFL-19-400/ 30-750-DC

***NOTES:**

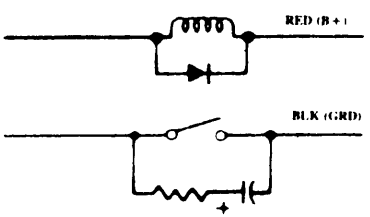
1. Special switch connections for solenoids 17 through 22 are as follows:

   19—ORN-BRN—2P13-5, 8P3-24
   20—ORN-RED—2P13-3, 8P3-25
   21—ORN-BLK—2P13-2, 8P3-26
   20—ORN-YEL—2P13-4, 8P3-27
   21—ORN-GRY—2P13-8, 8P3-28
   22—ORN-BLU—2P13-9, 8P3-29

2. Flipper button connections are as follows:

   Right—ORN-VIO—2P12-1, 7P1-7
   Left—ORN-GRY—2P12-2, 7P1-9

3. Typical wiring for solenoids and special switches follows.

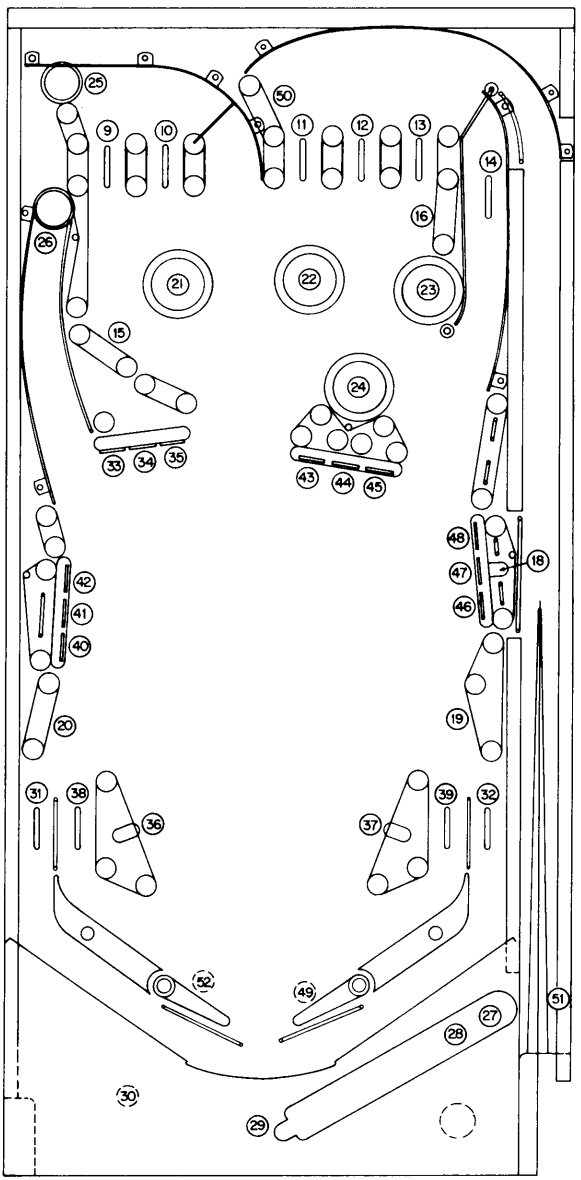


Switch Test

1. From Solenoid Test depress ADVANCE with the switch set to AUTO-UP. Test 03 should be indicated in the Credits display and any stuck switches in the Master display. As stuck switch(es) is displayed a sound is produced. The display continuously cycles through the stuck switches and as they are opened, the number is removed from the sequence. When all switches are open, the Match display is blank and the sounds stop.
2. If all switches in a row are displayed, first verify that all are open and then check for a short to ground on the row wire.
3. Operate switches; a sound is produced and switch number is momentarily indicated in the ball in play display. If two switches in a row are indicated with one switch closed, check for a short between the column wires; for multiple indication check column wire for short to ground. If two switches in a column are indicated with one switch closed, check for short between row wires.

4. If proper indications are obtained in Test 03 but matrix problem is suspected in game play, disconnect lamp connectors 2P5 and 2P7. Recheck in game play. Perform CPU Self-Test if problem remains. If problem is cleared, check for short between lamp matrix and jet bumper mounting brackets.

5. Shorted diodes can cause "rectangle" switch matrix problems. For example, consult the switch matrix chart and visualize a situation where the drop target switch 42 is down and one ball is in the lower eject hole (switch #26). If the second ball makes the left 3-bank center drop target switch 41, a shorted diode at switch 42 would cause top eject hole switch 25 to be indicated. This would falsely initiate ***Multi-Ball*** play. Note that the faulty switch is "diagonally" opposite from the invalidly-indicated switch.



Switch No.	Function (Score)
01	Plumb Bob Tilt
02	Ball Roll Tilt
03	Credit Button
04	Right Coin Chute
05	Center Coin Chute
06	Left Coin Chute
07	Slam Tilt
08	High Score Reset
09	X Rollover (1,000)
10	Y Rollover (1,000)
11	Lane 1 Rollover (1,000)
12	Lane 2 Rollover (1,000)
13	Lane 3 Rollover (1,000)
*14	Top Right Side Lane Rollover (Lit Value/Value Advance)
15	Top Left Standup (10)
16	Top Right Standup (10)
17	Not Used
18	Right 3-Bank Standup (10)
19	Lower Right Standup (10)
20	Lower Left Standup (10)
21	Left Jet Bumper (100)
22	Center Jet Bumper (100)
23	Right Jet Bumper (100)
24	Bottom Jet Bumper (1,000)
25	Top Eject Hole (Lit Value)
26	Lower Eject Hole (5K)
27	Right Ball Ramp Switch
28	Left Ball Ramp Switch
29	Outhole
30	Playfield Tilt
31	Outer Left Drain Lane Rollover (5K)
32	Outer Right Drain Lane Rollover (5K)
**33	A-B-C Left Standup Target (500)
**34	A-B-C Center Standup Target (500)
**35	A-B-C Right Standup Target (500)
36	Left Kicker (10)
37	Right Kicker (10)
38	Left Flipper Lane Rollover (1K)
39	Right Flipper Lane Rollover (1K)
‡40	Left 3-Bank Bottom Drop Target (1K)
‡41	Left 3-Bank Center Drop Target (1K)
‡42	Left 3-Bank Top Drop Target (1K)
‡43	Center 3-Bank Left Drop Target (1K)
‡44	Center 3-Bank Center Drop Target (1K)
‡45	Center 3-Bank Right Drop Target (1K)
‡46	Right 3-Bank Bottom Drop Target (1K)
‡47	Right 3-Bank Center Drop Target (1K)
‡48	Right 3-Bank Top Drop Target (1K)
49	Right Flipper ***Lane Change***™ Switch (1-2-3)
50	Top Center Standup (10)
51	Ball Shooter Rollover
52	Left Flipper ***Lane Change*** Switch (X-Y)

* At top of values "ALL SCORES 2X" arrow is lit, and values start over at 20K

** Matrix Arrow Lit or Not

‡ If in sequence + 50K; 5K or 20K each during ***Multi-Ball*** play.

Figure 3. Playfield Switch Locations and Switch Chart

ROW \ COLUMN	1 GRN-BRN 2J2-9	2 GRN-RED 2J2-8	3 GRN-ORN 2J2-7	4 GRN-YEL 2J2-6	5 GRN-BLK 2J2-5	6 GRN-BLU 2J2-3	7 GRN-VIO 2J2-2	8 GRN-GRY 2J2-1
1 WHT-BRN 2J3-9	PLUMB BOB TILT 1	X ROLLOVER 9	NOT USED 17	TOP EJECT HOLE 25	A-B-C LEFT STANDUP TARGET 33	LEFT 3-BANK CENTER DROP TARGET 41	RIGHT FLIPPER *LANE CHANGE*™ SWITCH (1-2-3) 49	NOT USED 57
2 WHT-RED 2J3-8	BALL ROLL TILT 2	Y ROLLOVER 10	RIGHT 3-BANK STANDUP 18	LOWER EJECT HOLE 26	A-B-C CENTER STANDUP TARGET 34	LEFT 3-BANK TOP DROP TARGET 42	TOP CENTER STANDUP 50	NOT USED 58
3 WHT-ORN 2J3-7	CREDIT BUTTON 3	LANE 1 ROLLOVER 11	LOWER RIGHT STANDUP 19	RIGHT BALL RAMP SWITCH 27	A-B-C RIGHT STANDUP TARGET 35	CENTER 3-BANK LEFT DROP TARGET 43	BALL SHOOTER ROLLOVER 51	NOT USED 59
4 WHT-YEL 2J3-6	RIGHT COIN CHUTE 4	LANE 2 ROLLOVER 12	LOWER LEFT STANDUP 20	LEFT BALL RAMP SWITCH 28	LEFT KICKER 36	CENTER 3-BANK CENTER DROP TARGET 44	LEFT FLIPPER *LANE CHANGE* SWITCH (X-Y) 52	NOT USED 60
5 WHT-GRN 2J3-5	CENTER COIN CHUTE 5	LANE 3 ROLLOVER 13	LEFT JET BUMPER 21	OUTHOLE 29	RIGHT KICKER 37	CENTER 3-BANK RIGHT DROP TARGET 45	NOT USED 53	NOT USED 61
6 WHT-BLU 2J3-4	LEFT COIN CHUTE 6	TOP RIGHT SIDE LANE ROLLOVER 14	CENTER JET BUMPER 22	PLAYFIELD TILT 30	LEFT FLIPPER LANE ROLLOVER 38	RIGHT 3-BANK BOTTOM DROP TARGET 46	NOT USED 54	NOT USED 62
7 WHT-VIO 2J3-3	SLAM TILT 7	TOP LEFT STANDUP 15	RIGHT JET BUMPER 23	OUTER LEFT DRAIN LANE ROLLOVER 31	RIGHT FLIPPER LANE ROLLOVER 39	RIGHT 3-BANK CENTER DROP TARGET 47	NOT USED 55	NOT USED 63
8 WHT-GRY 2J3-1	HIGH SCORE RESET 8	TOP RIGHT STANDUP 16	BOTTOM JET BUMPER 24	OUTER RIGHT DRAIN LANE ROLLOVER 32	LEFT 3-BANK BOTTOM DROP TARGET 40	RIGHT 3-BANK TOP DROP TARGET 48	NOT USED 56	NOT USED 64

Figure 4. Switch Matrix

INITIATING AUTO-CYCLE MODE

1. Set AUTO-UP/MANUAL-DOWN switch to AUTO-UP and depress ADVANCE pushbutton. Test 04 is indicated in Credit display and Function 00 in Match Display.
2. Set switch to MANUAL-DOWN and depress ADVANCE to indicate Function 50 in the Match Display.
3. Set switch to AUTO-UP and operate Credit button to indicate 15 in Player 1 Display.
4. Depress ADVANCE pushbutton to start Auto-Cycle mode. Each cycle of this mode sequences thru the Display Digits Test, Sound Test (00), Lamp Test (01), and Solenoid test (02).
5. To terminate the test and return to game over, turn the game OFF and back ON.

CPU BOARD SELF-TEST

Depress the DIAGNOSTIC pushbutton on the left side of the CPU Board. The following indications are provided. With 0 indication the game returns to the game over mode.

0 - Test Passed
1 - IC13 RAM Faulty
2 - IC16 RAM Faulty
3 - IC17 ROM 2 Faulty
4 - IC17 ROM 2 Faulty
5 - IC20 ROM 1 Faulty
6 - IC14 Game ROM 1 Faulty
7 - IC26 Game ROM 0 Faulty
8 - IC19 CMOS RAM or Memory Protect Circuit Faulty
9 - Coin-door closed, Memory Protect Circuit Faulty, or IC19 CMOS RAM Faulty.

Note that "0" remaining after power turn-on indicates CPU Board lockup.

SOUND BOARD SELF-TEST

Depress DIAGNOSTIC pushbutton on the top of the Sound Board. Several electronic sounds should be produced. This sequence of sounds is repeated until the game is turned OFF and back ON.

"Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference."