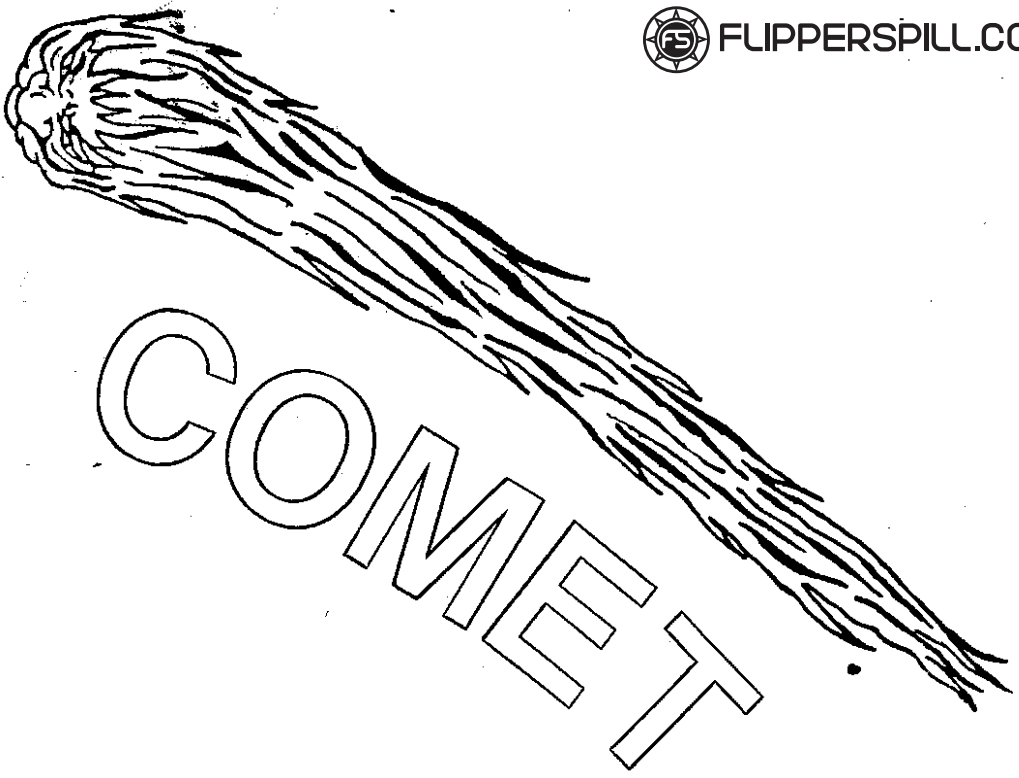


INSTRUCTION MANUAL

including procedures for...

- operation
- bookkeeping
- adjustment
- diagnostics

Williams®
ELECTRONICS GAMES, INC.

System-9 ROM Summary

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

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

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

System-9 Solenoid Table

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

Using only one High Score...

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

How To Make Game Adjustments

GAME-ADJUSTMENT PROCEDURE, FUNCTIONS 13-41

Coin door must be open to change settings

ADJUSTMENT PROCEDURE SUMMARIZED...

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

ADJUSTMENT PROCEDURE IN DETAIL...

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

Continued on page 8

Game-Adjustment Table

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

FUNCTION	DESCRIPTION	FACTORY SETTING*
34	Game Adjustment #4: Background/Attract Mode Sound	00

Setting	Background Sound	Attract Mode Sound	Spot Ducks/Rabbits Double Target
00	On	On	On
01	Off	On	On
02	On	Off	On
03	Off	Off	On
04	On	On	Off
05	Off	On	Off
06	On	Off	Off
07	Off	Off	Off
1x	Knocker used in some fireworks		
2x	Knocker used in more fireworks		
3x	Knocker used in more fireworks		
4x	Knocker used in more fireworks		
5x	Knocker used in more fireworks		

(x = 0, 1, 2, 3,...7 from above for desired sounds)

35	Game Adjustment #5: Time to make "Roller-Coaster" bonus May be any setting between the limits of 10 and 20 seconds	15
36	Game Adjustment #6: Memory for "Cycle-Jump" Extra Ball shot	01

Setting	Memory State	*Operating Mode*: To light Cycle-Jump Extra Ball lamps requires hitting all ducks and all rabbits *2 times per*:
00	Off	Game.
01	On	Game.
02	Off	Ball.
03	On	Ball.

37	Game Adjustment #7: Memory on "Corkscrew" Extra Ball shot 00: No Memory 01: Memory On	01
38	Game Adjustment #8: Memory for the three Special lamps	01

Setting	Memory State	*Operating Mode*: To light Special lamps requires hitting all ducks and all rabbits 3 *times per*:
00	Off	Game.
01	On	Game.
02	Off	Ball.
03	On	Ball.

39	Game Adjustment #9: "Cycle-Jump" memory & score lamps	00

Setting	Lamps start when...	Bonus Advance (Bottom, Middle, Top Ring)
00: Liberal	turn begins	3, 5, 10
01: Conservative	turn begins	2, 3, 5
02: Liberal	1st ball is in play	3, 5, 10
03: Conservative	1st ball is in play	2, 3, 5
04: Liberal	playfield switch is made	3, 5, 10
05+: Conservative	playfield switch is made	2, 3, 5

40	Maximum high-score credits 00: Displays high scores without credit payouts	04/03
41	Maximum Extra-Balls at any time	04
49	Not Used	
50	Special Function 15: Auto-Cycle Mode 35: Zero bookkeeping totals 45: Restore factory settings & zero bookkeeping totals	

NOTES

1. The second factory-setting value is with jumper W5 on the CPU Board removed.

2. Functions 14 through 17 (replay levels) may be set to any multiple of 100,000 points. Setting function 40 to zero with function 13 set to *any score but zero* permits the high-score feature to operate but no credits are awarded.

3. Setting functions 14 through 17 (replay levels) to zero disables the replay-score point.

4. High scores are displayed or suppressed by adjusting function 12. Use AUTO-UP and press ADVANCE repeatedly until the number of high scores you wish to show (0, 1, 2, or all 4) appears on the displays. Now return to **Game-Over Mode.**

Introducing Game Diagnostics

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

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

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

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

Diagnostic Procedures

DISPLAY TEST

1. Use MANUAL-DOWN and press ADVANCE. Displays should indicate all 0s.

2. Use AUTO-UP. Displays should sequence from all 0s through all 9s. Comma segments should come on when the odd digits are displayed.

3. To stop cycling, use MANUAL-DOWN. Press ADVANCE to step through the tests one number at a time. Use AUTO-UP to resume cycling.

SOUND TEST

1. *(From Display Test)* Use AUTO-UP and press ADVANCE. Test 00 should be indicated in the Credits display and the Match display should sequence from 00 through 06. A different sound should be produced for each number.

2. To continuously pulse a single sound, use MANUAL-DOWN. Press ADVANCE to step through sounds one at a time. Use AUTO-UP to resume sequencing.

3. Press the SOUND DIAGNOSTIC-SWITCH. Now listen for the following words. Missing or damaged words indicate the failure of a particular ROM as shown below. For part-ordering information, see the **ROM Summary** at the beginning of this manual.

ROM/Sounds Table

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

LAMP TEST

1. Refer to your game's ***Lamp-Matrix Table*** for lamp numbers and wiring. CPU-Board connections at jacks 1J6 (rows) and 1J7 (columns) are also shown there.

2. *(From Sound Test)* Use AUTO-UP and press ADVANCE. Test 01 should be indicated in the Credits display and all feature-lamps should flash.

SOLENOID TEST

1. Refer to your ***Solenoid Table*** for solenoid numbers and wiring. CPU-Board connections at jacks 1J11 and 1J12 are also shown there.

2. *(From Lamp Test)* Use AUTO-UP and press ADVANCE. Test 02 should be indicated in the Credits display. The Ball-In-Play display sequences from 01 through 25. Corresponding solenoids are pulsed. The flipper relay is de-energized with sub-test 25.

3. Special solenoids (jet bumpers, kickers, etc.) *are not pulsed during the Solenoid Test.* Instead, you must check these solenoids manually. Press on their trigger switches or pull their switch-trigger lines low.

4. To continuously pulse a single solenoid, use MANUAL-DOWN. Press ADVANCE to step through controlled solenoids one at a time. Use AUTO-UP to resume sequencing.

System-9 Solenoid Table

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

***NOTES**

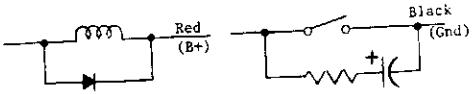
1. Special-switch connections for solenoids 17 through 21 are as follows:
   17—ORN-BRN—1J18-5, 8P3-24
   18—ORN-RED—1J18-3, 8P3-25
   19—ORN-BLK—1J18-2, 8P3-26
   20—ORN-YEL—1J18-4, 8P3-27
   21—ORN-GRN—1J18-8, 8P3-28

2. **FLIPPER COILS.** This game requires 50-volt flipper coils. For proper operation, the replacement part listed MUST be used.

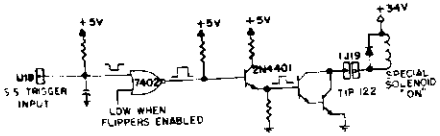
3. Flipper-button connections:
   Right—ORN-VIO—1J19-1, 7P1-7
   Left—ORN-GRY—1J19-2, 7P1-9
   Not Used—BLK-BLU—1J19-2, 7P1-30

4. On German games, the solenoid-12 wiring is used for the token-dispenser solenoid.

5. Typical circuits for solenoids and special switches follow.

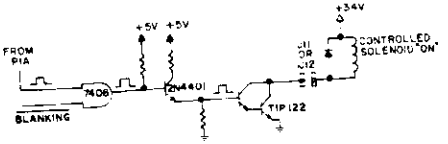


SPECIAL-SOLENOID LOGIC FOR "ON" STATE



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

CONTROLLED-SOLENOID LOGIC FOR "ON" STATE



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

System 9 Lamp-Matrix Table

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

System 9 Switch-Matrix Table

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

SWITCH TEST

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

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

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

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

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

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

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

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

AUTO-CYCLE MODE

1. The **Auto-Cycle Mode** permits you to check intermittent problems in the playfield, backbox, cabinet, and CPU Board.

2. Set function 50 of Test 04 (**Bookkeeping Mode**) to 15.

3. Press ADVANCE to start the **Auto-Cycle Mode**. This mode repeatedly sequences through the Display Test, Sound Test (00), Lamp Test (01), and Solenoid Test (02).

4. This sequence is repeated, until the game is turned off and on.

SYSTEM-9 MEMORY-CHIP TEST

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

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

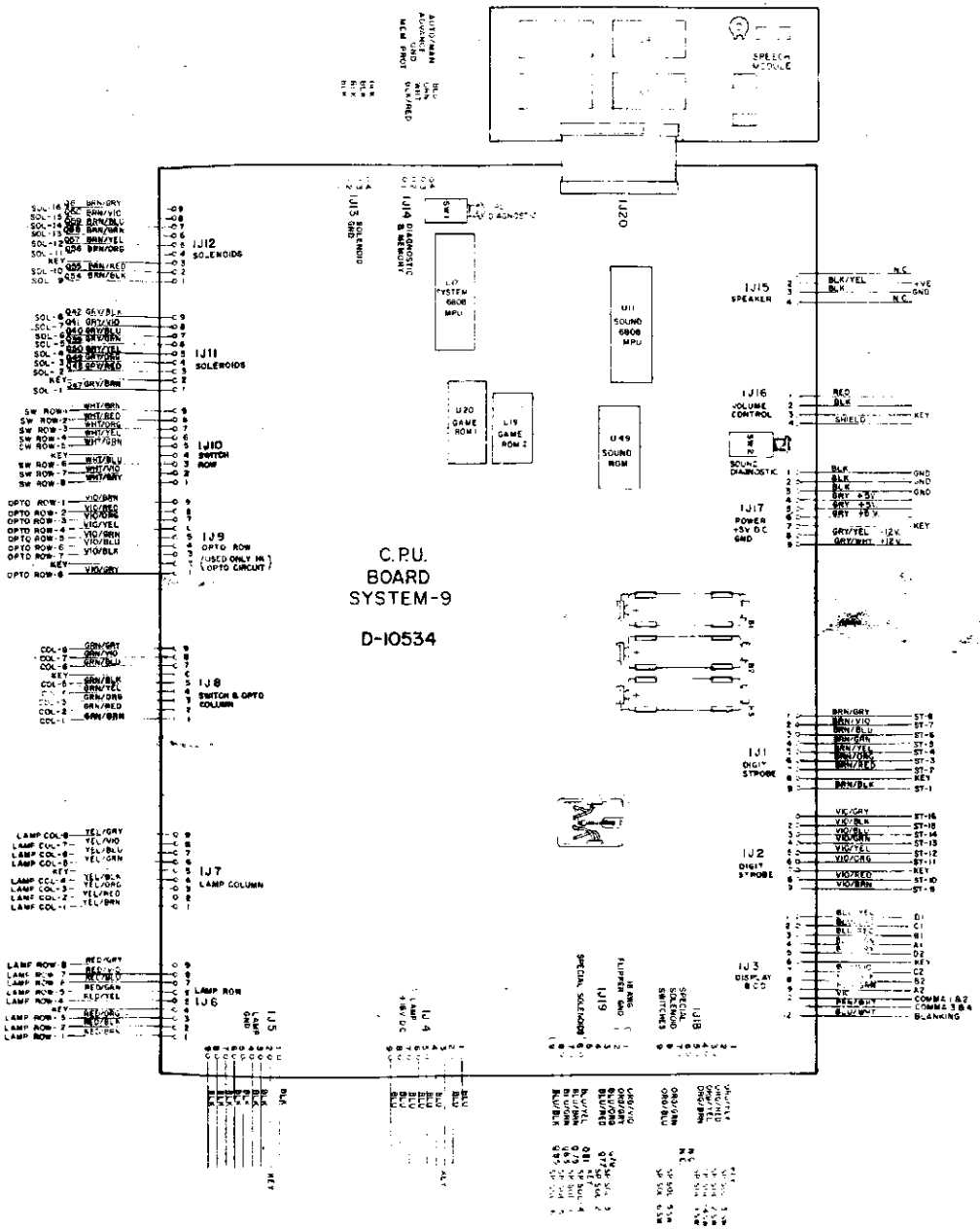
IF YOUR GAME IS LOCKED UP, you may have a bad power supply. The 5-volt logic supply is the first one you should check. Then, check the 12-volt supply, which is used to reset your microprocessor. Test for both DC and AC. *Here's why...*

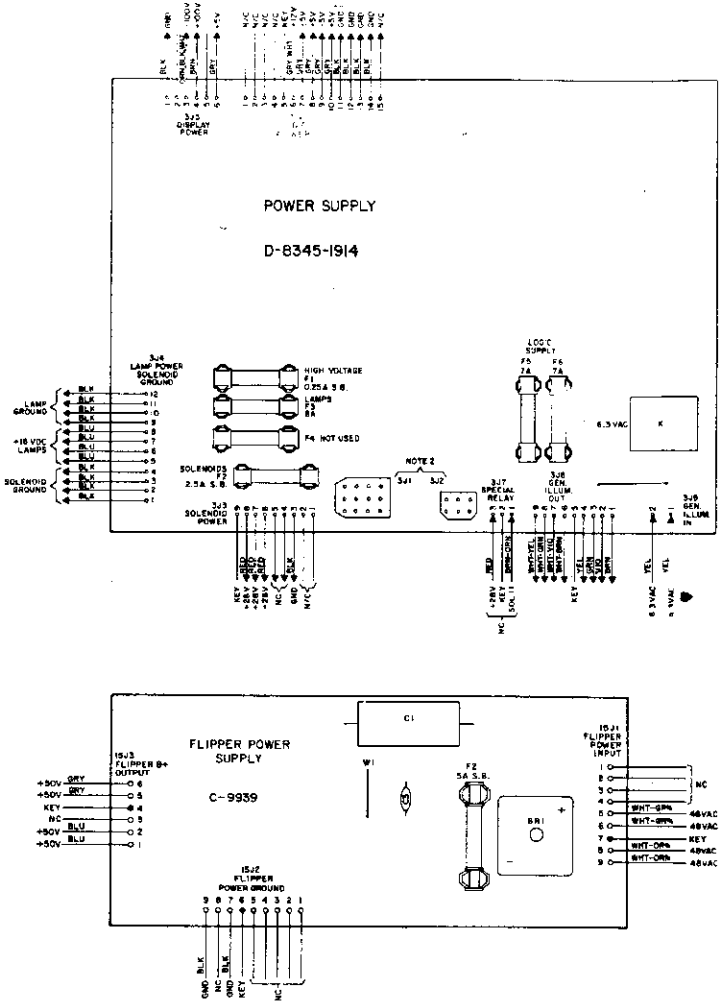
NORMAL RIPPLE FIGURES. You may find a few millivolts of AC at the regulated-DC power outputs. Depending on their rated output, unregulated DC supplies can produce over 100 millivolts of AC. Power supplies with leaky electrolytics produce substantially more ripple than this.

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

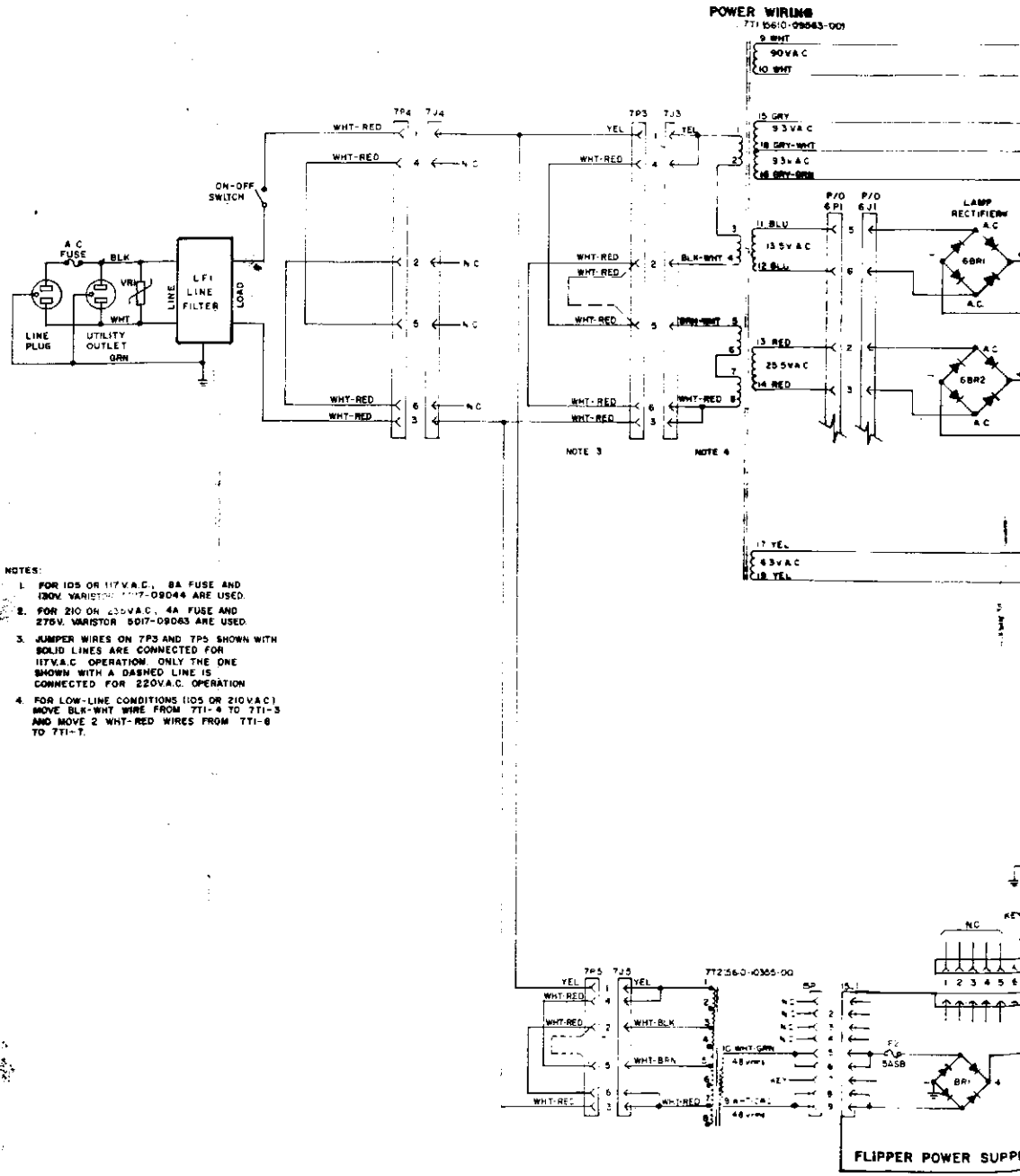
SAFETY FIRST! Before removing capacitors, *discharge them* by shunting them with a 10K, 1W resistor.

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


C.P.U.
BOARD
SYSTEM-9
D-10534
SPEECH MODULE
U20
U10 SYSTEM 6808 MPU
U11 SOUND 6808 MPU
U20 GAME ROM 1
U19 GAME ROM 2
U49 SOUND ROM
SW1
DIAGNOSTIC
MEM PROT
J1 SOLENOID
J2 DIGIT STROBE
J3 DISPLAY & LED
J4 LAMP +50V DC
J5 LAMP COL DRIVE
J6 LAMP ROW
J7 LAMP COLUMN
J8 SWITCH & OPTO COLUMN
J9 OPTO ROW (USED ONLY IN OPTO CIRCUIT)
J10 SWITCH ROW
J11 SOLENOIDS
J12 SOLENOIDS
J13 SOLENOID GND
J14 DIAGNOSTIC & MEMORY
J15 SPEAKER
J16 VOLUME CONTROL
J17 POWER +5V DC GND
J18 SPECIAL SOLENOID SWITCHES
J19 SPECIAL SOLENOID
FLIPPER GND
SOUND DIAGNOSTIC

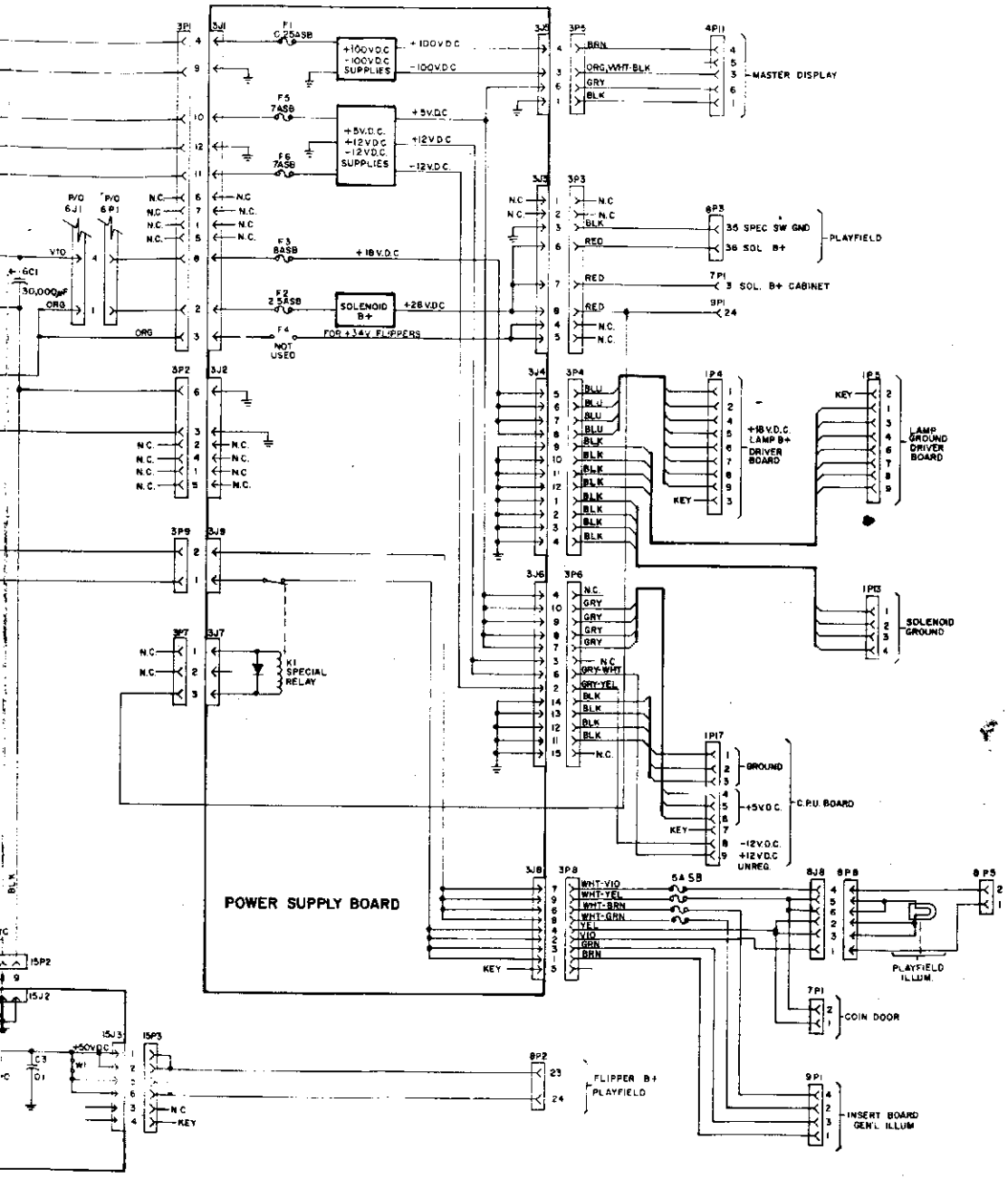


Backbox PC Boards Wiring Diagrams



NOTES:

1. FOR 105 OR 117 V.A.C., 8A FUSE AND 130V. VARISTOR [illegible]-09044 ARE USED.
2. FOR 210 OR 235 V.A.C., 4A FUSE AND 275V. VARISTOR 5017-09063 ARE USED.
3. JUMPER WIRES ON 7P3 AND 7P5 SHOWN WITH SOLID LINES ARE CONNECTED FOR 117 V.A.C. OPERATION. ONLY THE ONE SHOWN WITH A DASHED LINE IS CONNECTED FOR 220 V.A.C. OPERATION.
4. FOR LOW-LINE CONDITIONS (105 OR 210 V.A.C.) MOVE BLK-WHT WIRE FROM 7TI-4 TO 7TI-3 AND MOVE 2 WHT-RED WIRES FROM 7TI-6 TO 7TI-7.



Power Wiring Diagram