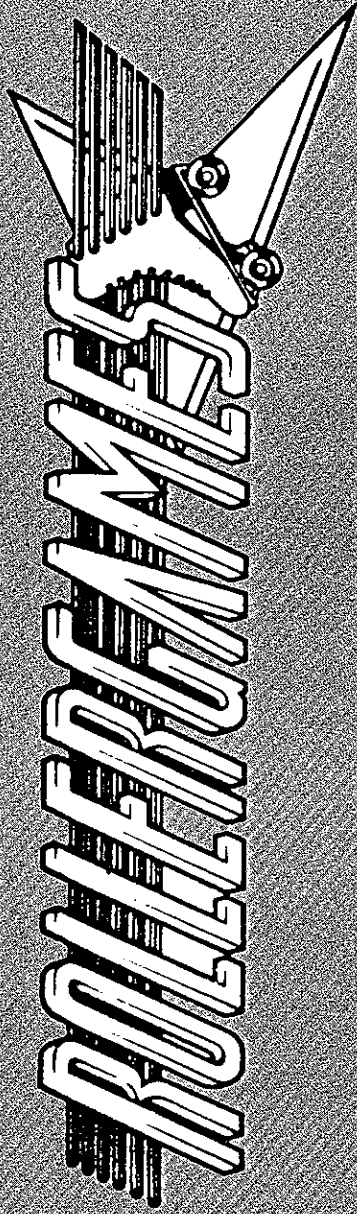


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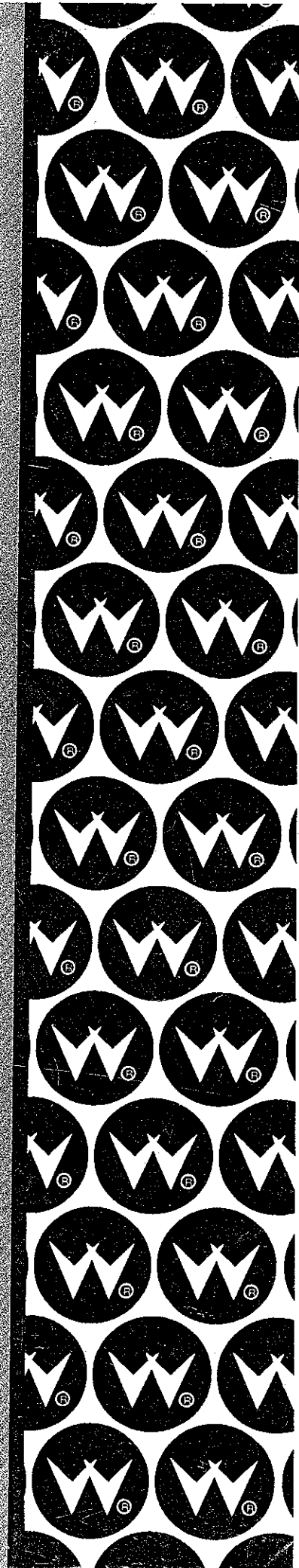


OPERATIONS MANUAL

including:

- Game Operation & Adjustments
- Game Testing & Problem Diagnosis
- Parts Information
- Reference Diagrams & Schematics

16-576-101
March 1990



RollerGames ROM and Jumper Table

Game	CPU / Rev.	P/N - U15 Game μP	P/N - U27 G. ROM 1	P/N - U26 G. ROM 2	Jumpers	Audio Bd	P/N - U4 A. ROM 1	P/N - U19 A. ROM 2	P/N - U20 A. ROM 3
ROLLERGAMES	System 11C	5400-09150-00	A-5343-576-2	A-5343-576-1	W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19	System 11C	A-5343-576-3	A-5343-576-4	A-5343-576-5

RollerGames Solenoid Table

Sol. No.	Function	Solenoid Type	Wire Color	Connections		Driver Tmstr	Solenoid Part Number Flashlamp Type	
				CPU Bd	Playfield/ Cabinet		g= B/glass; p=PI/field	
01A ³	Outhole Kicker	Switched	Vio-Brn }	1P11-1	5J1-9: 5J4-9 (A)	Q33	AE-23-800	
01C ³	Flash 1	Switched	Blk-Brn }	(Gry-Brn)	5J5-9 (C)	Q33	#89/906 flashlamps	4p
02A ³	Shooter Lane Feeder	Switched	Vio-Red }	1P11-3	5J1-7: 5J4-8 (A)	Q25	AE-23-800	
02C ³	Flash 2	Switched	Blk-Red }	(Gry-Red)	5J5-8 (C)	Q25	#89/906 flashlamps	2p,1g
03A ³	Not Used	Switched	Vio-Orn }	1P11-4	5J1-6: 5J4-7 (A)	Q32		
03C ³	Flash 3	Switched	Blk-Orn }	(Gry-Orn)	5J5-7(C)	Q32	#89/906 flashlamps	1p,2g
04A ³	Ball Popper	Switched	Vio-Yel }	1P11-5	5J1-5: 5J4-6 (A)	Q24	AE-24-900	
04C ³	Flash 4	Switched	Blk-Yel }	(Gry-Yel)	5J5-5 (C)	Q24	#89/906 flashlamps	1p,2g
05A ³	Not Used	Switched	Vio-Grn }	1P11-6	5J1-4: 5J4-5 (A)	Q31		
05C ³	Flash 5	Switched	Blk-Grn }	(Gry-Grn)	5J5-4 (C)	Q31	#89/906 flashlamps	2p,2g
06A ³	3-Bank Drop Target Reset	Switched	Vio-Blu }	1P11-7	5J1-3: 5J4-4 (A)	Q23	AE-26-1200	
06C ³	Flash 6	Switched	Blk-Blu }	(Gry-Blu)	5J5-3 (C)	Q23	#89/906 flashlamps	1p,2g
07A ³	Knocker (in Backbox)	Switched	Vio-Blk }	1P11-8	5J1-2: 5J4-2 (A)	Q30	AE-23-800	
07C ³	Flash 7	Switched	Blk-Vio }	(Gry-Vio)	5J5-2 (C)	Q30	#89/906 flashlamps	1p,2g
08A ³	Lock Diverter	Switched	Vio-Gry }	1P11-9	5J1-1: 5J4-1 (A)	Q22	AE-24-900	
08C ³	Flash 8	Switched	Blk-Gry }	(Gry-Blk)	5J5-1 (C)	Q22	#89 flashlamps	3p
09	Flash 9	Controlled	Brn-Blk	1P12-1	5J2-9: 5J6-9: 2J4-3	Q17	#89/906 flashlamps	1p,2g
10	Insert Bd Genl Illum Relay	Controlled	Brn-Red	1P12-2	5J2-8: 5J6-8: 2J4-5	Q9	5580-09555-01	4a
11	Playfield Genl Illum Relay	Controlled	Brn-Orn	1P12-4	5J2-6: 5J6-7: 2J4-6	Q16	5580-12145-00	4b
12	A/C Select Relay	Controlled	Brn-Yel	1P12-5	5J2-5	Q8	5580-09555-01	5
13	Upper Kickback	Controlled	Brn-Grn	1P12-6	5J2-4: 5J6-5	Q15	AE-23-800	
14	Lock Kickback	Controlled	Brn-Blu	1P12-7	5J2-3: 5J6-3	Q7	AE-23-800	
15	Left Kicker ("sling")	Controlled	Brn-Vio	1P12-8	5J2-2: 5J6-2	Q14	AE-23-800	
16	Right Kicker ("sling")	Controlled	Brn-Gry	1P12-9	5J2-1: 5J6-1	Q6	AE-23-800	
17	Left Jet Bumper	Special #1	Blu-Brn	1P19-7	5J3-7: 5J7-7	Q75	AE-23-800	
18	Ramp Diverter	Special #2	Blu-Red	1P19-4	5J3-6: 5J7-6	Q71	AE-23-800	
19	Right Jet Bumper	Special #3	Blu-Orn	1P19-3	5J3-3: 5J7-3	Q73	AE-23-800	
20	Outlane Kickback	Special #4	Blu-Yel	1P19-6	5J3-4: 5J7-5	Q69	AE-23-800	
21	Lower Jet Bumper	Special #5	Blu-Grn	1P19-8	5J3-2: 5J7-2	Q77	AE-23-800	
22	Deep Freeze Magnet	Special #6	Blu-Blk	1P19-9	5J3-1: 5J7-1	Q79	B-13522	
-	Right Flipper	-	Orn-Vio	1P19-1	2J5-5: 2J10-7	-		
-	Lower Right Flipper	-	[Blu-Vio] ²		[2J10-1: 2J8-15]		FL11630/50VDC	
-	Upper Right Flipper	-	[Blu-Yel] ²		[2J10-3: 2J8-13]		FL11630/50VDC	
-	Left Flipper	-	Orn-Gry	1P19-2	2J5-4: 2J10-8			
-	Lower Left Flipper	-	[Blu-Gry] ²		[2J10-2: 2J8-14]		FL11630/50VDC	

Notes: 1. Wire colors, except flipper Orn-Vio and Orn-Gry, are ground connections (to coil terminal with unbanded end of diode). Flipper Orn-Vio and Orn-Gry wires connect from CPU Board to flipper switch. 2. Flipper connections shown in braces are from flipper switch to flipper coil. 3. "A" circuits are pulsed, when Sol. 12 is de-energized; "C" circuits are pulsed, with Sol. 12 energized. Wire colors in brackets are those from respective A and C terminals corresponding to the J1-terminal connection listed for the Aux Power Driver Bd, which controls the device pulsing by Sol. 12. 4. Relay is mounted on Relay Bd, (4a) pn C-11998-1; (4b) C-11902-1. 5. Relay is mounted on Aux Power Driver Bd, D-12247 in the backbox. 6. Transistor designations refer to the Sound Overlay Solenoid Board parts.

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Section 1

Game Operation & Test Information

- **ROLLERGAMES (System 11C) ROM Summary**
- **Pinball Game Assembly Instructions**
- **Game Play**
- **Game Status Displays**
- **Game Adjustment Procedure**
- **Game Pricing**
- **Test/Diagnostic Procedures**

ROLLERGAMES (System 11C) ROM Summary

IC	DESCRIPTION	TYPE	IDENTIFIER	BOARD	PART NUMBER
Game ROM 1	32K x 8 ROM	27256	U27	CPU	A-5343-576-2
Game ROM 2	32K x 8 ROM	27256	U26	CPU	A-5343-576-1
Music/Speech ROM 1	64K x 8 ROM	27512	U4	Audio	A-5343-576-3
Music/Speech ROM 2	64K x 8 ROM	27512	U19	Audio	A-5343-576-4
Music/Speech ROM 3	64K x 8 ROM	27512	U20A	Audio	A-5343-576-5

NOTICE

To order a replacement ROM from your authorized WILLIAMS ELECTRONICS GAMES distributor, specify: (1) part number (if available); (2) ROM label color; (3) ROM level (number) on the label; (4) which game the ROM is used in.

CONNECTOR & COMPONENT IDENTIFICATION

WILLIAMS ELECTRONICS GAMES uses a special technique to identify connectors and other game components. Each plug or jack receives a prefix number (which identifies the circuit board), a letter, and a number. J-designations refer to the male part of a connector. P-designations refer to the female part of a connector. For example, 1J1 designates jack 1 of board 1 (a CPU Board jack); 3P6 designates plug 6 of board 3 (a Power Supply 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, 1J1-3 refers to pin 3 of jack 1 on board 1.

Other game components may also have similar prefixes preceding their designator to clarify their locations or related circuit.

Prefix numbers for the System 11C circuit boards and other major assemblies are listed below. A prefix number may precede a component designator to identify its associated unit (e.g., Backbox fuse 6F1).

1 - CPU	6 - Backbox
2 - Master Interconnect	7 - Cabinet
3 - Backbox Power Supply	8 - Playfield
4 - Alphanumeric Display	9 - Insert Board
5 - Aux Power Driver	10 - Audio

ROLLERGAMES CIRCUIT BOARDS

System 11C Circuit Boards for **ROLLERGAMES** are in the backbox. They are accessible by unlocking the Backbox lock, removing the Backbox glass, unlatching the Insert Board, and swinging it open.

The Master Display Board is mounted on the interior side of the Speaker/Display Panel, below the Backbox glass in the Backbox. To access the Master Display Board, unlock the Backbox, remove the Backbox glass, lift the Speaker/Display Panel, and lay it on the game cabinet.

Lamp circuit boards are mounted on the Playfield and on the Speaker/Display Panel.

CPU BOARD. The System 11C CPU Board (p/n D-11883-576) must be equipped with the ROMs specified in the **ROLLERGAMES** (System 11C) ROM Summary. CPU Board jumpers W1, W2, W4, W5, W7, W11, W14, and W16 must be connected.

AUDIO BOARD. The Audio Board is p/n D-11581-576, including ROMs and microprocessor.

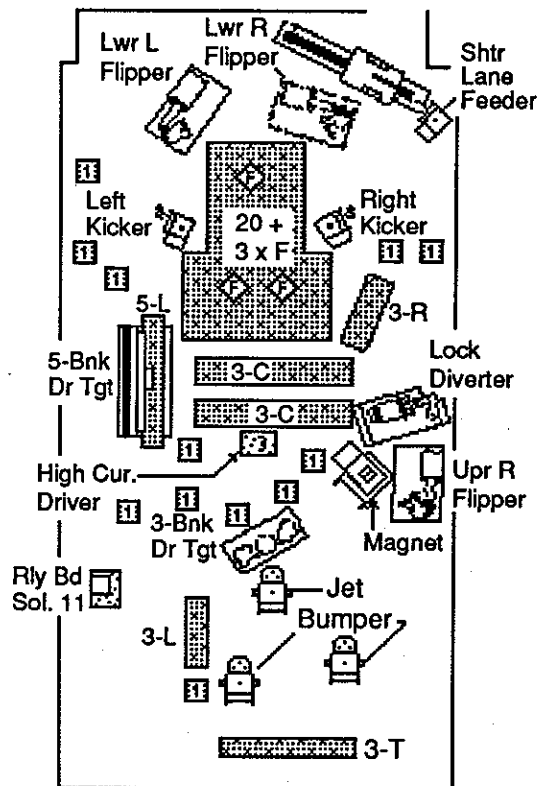
POWER SUPPLY BOARD. The Power Supply Board is p/n D-12246.

AUX POWER DRIVER BOARD. The Aux Power Driver Board is D-12247-576.

MASTER INTERCONNECT BOARD. The Master Interconnect Board is D-12313-576.




DISPLAY BOARD. The Alphanumeric Display Unit Board is p/n D-12232-1.

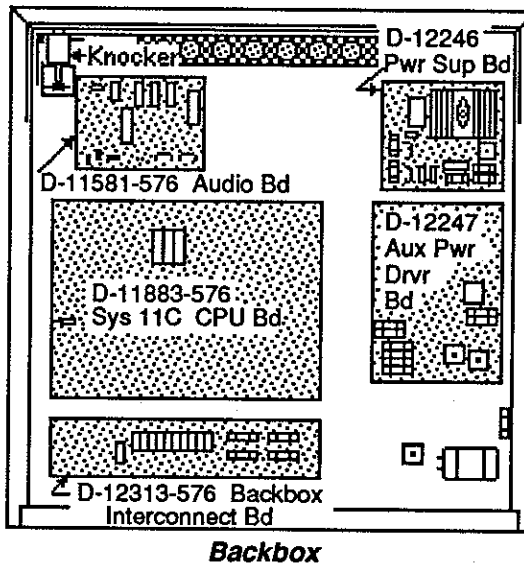
Figure 1 shows the locations of these circuit boards, as well as other devices especially located to make **ROLLERGAMES** a great game.



Under side of Playfield, Viewed in Raised Position

LOCATIONS

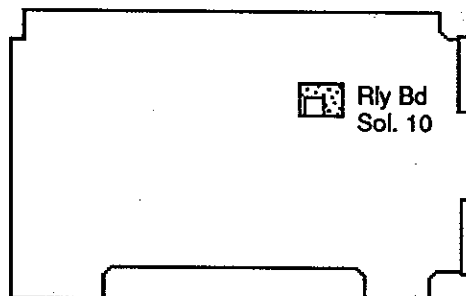
-  Circuit Boards
-  Lamp Boards
-  Major Mechanisms



Backbox



Display/Speaker Panel, Rear View



Insert Board, Inner Side View

Figure 1. Locations Diagram - Game Circuit Boards and Major Mechanisms

ROLLERGAMES GAME CONTROL LOCATIONS

Figure 2 shows the locations of the following switches, except for the last one (CPU Diagnostic switch, which is shown in the Backbox portion of Figure 1, along the left edge of the CPU Board).

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

The Volume Control is on the left inner wall of the cabinet on the tilt mechanisms board. It is accessible by opening the coin box door.

The Credit switch (also called the START button) is a pushbutton to the left of the coin door on the cabinet exterior.

GAME ADJUSTMENT/DIAGNOSTIC SWITCHES. **ROLLERGAMES** allows the operator to control all game adjustments, obtain bookkeeping information, and diagnose problems, using only three switches mounted on the inside of the coin door, along with the Credit button beside the coin door.

ADVANCE, AUTO-UP/MANUAL-DOWN, and HIGH-SCORE RESET are the switches located on the inside of the coin door. Refer to the text discussing Game Status Displays and the Test/Diagnostic Procedures for details concerning button operation.

The Memory Protect switch is on the inside frame of the coin door. This interlock switch must be open to clear bookkeeping totals and to make game adjustments. It automatically opens, when the coin door opens.

Figure 1 shows the location of the CPU Board switch (left edge of CPU Board, Backbox View).

The CPU Diagnostic switch (SW 2) is the switch mounted on the left edge of the CPU Board near a large, socketed microprocessor chip. This switch initiates the Memory Chip Test explained in the Test/Diagnostic Procedures.

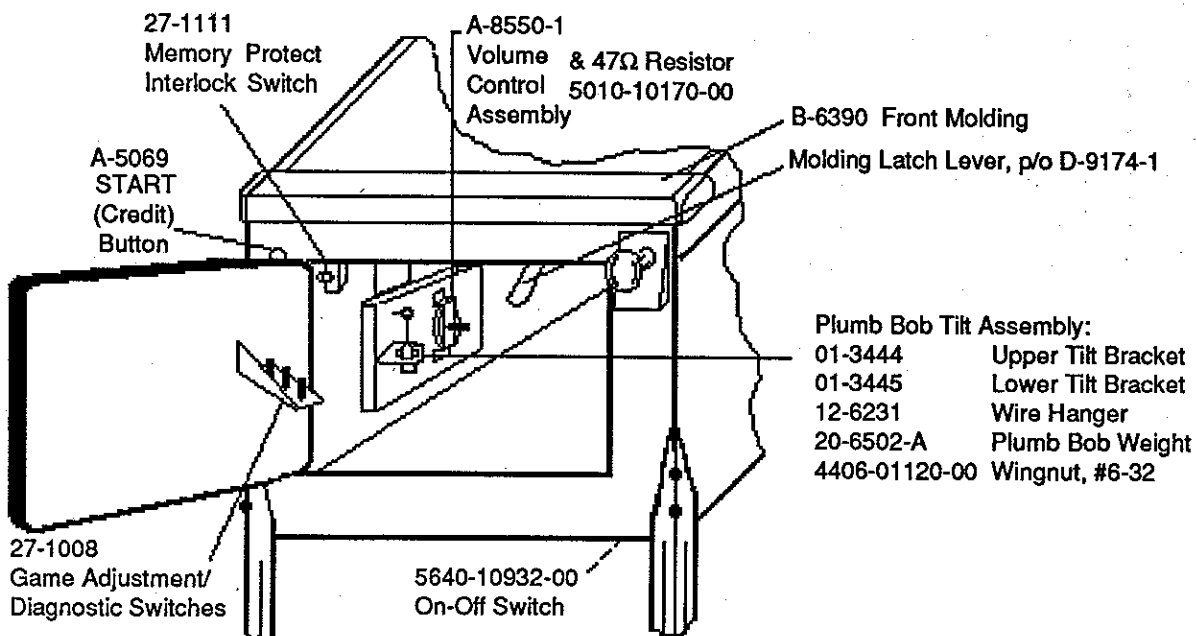


Figure 2. Pinball Game Controls Locations

PINBALL GAME ASSEMBLY INSTRUCTIONS

1. Open the shipping container; remove all cartons, parts, and other items, and set them aside.
2. Place the cabinet on a support and attach rear legs (after installing the leg levellers), using leg bolts. Leg levellers and leg bolts are provided among the parts in the cash box.
3. Attach the front legs (after installing leg levellers), using leg bolts. See Figure 3 for details.

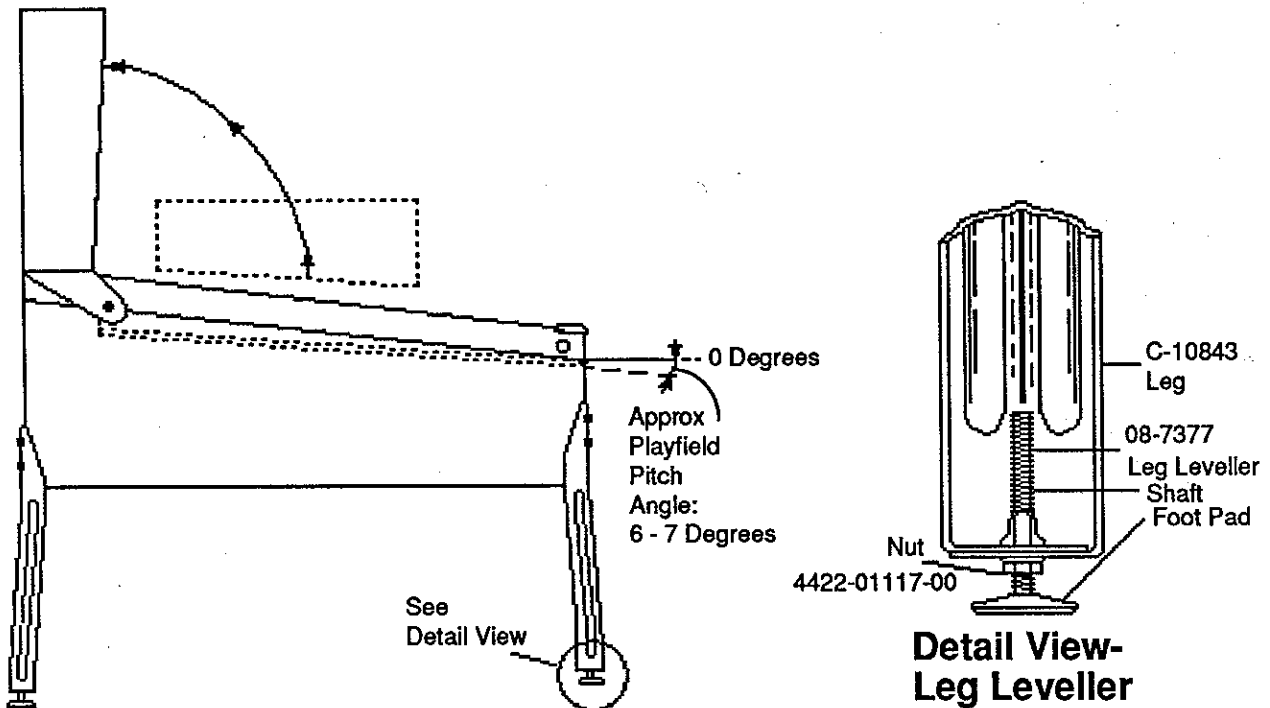


Figure 3. Pinball Assembly, Playfield Pitch Angle, and Leg Leveller Details.

4. Reach into the cabinet and backbox and ensure that the interconnecting cables are free to move (not kinked or pinched). Be careful to avoid damaging wires at any stage of the assembly process.
5. Raise the hinged backbox upright and stabilize it into position. Unlock the backbox, and remove the backbox glass, storing it carefully to avoid scratches. Remove the shipping block holding the Insert Board. Unlatch the Insert Board and open it; lift the Speaker/Display Panel and lay it on the playfield glass. 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. Remount the Speaker/Display Panel; close the Insert Board and latch it in position. Reinstall the backbox glass, and lock the backbox.

WARNING

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

PINBALL GAME ASSEMBLY INSTRUCTIONS (Continued)

7. Unlock and open the coin door. Locate the Molding Latch Lever (shown in Figure 2), and move the 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 toward the right, and close the coin door. Carefully slide the glass downward, until it clears the grooves of the Left and Right Side Moldings. Lift the glass up and away from the game, storing it carefully to avoid breakage.
8. Place a level or an inclinometer on the playfield surface. Adjust the leg levellers for proper playfield level (side-to-side) and playfield pitch angle (incline) of approximately 6-7 degrees. NOTE: It is recommended that these measurements be made ON the playfield, not the cabinet nor the playfield cover glass. Tighten the nut on each leg leveller shaft to maintain this setting, as shown in Figure 3.

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.

9. Move the game into the desired location; recheck the level and pitch angle of the playfield.
10. Verify that the *required number* of balls are installed in the game. (**ROLLERGAMES**: 3 balls.)
11. Clean and reinstall the playfield cover glass, reversing the procedure of step 7. Prepare the game for player operation.

GAME OPERATION

WARNING

After assembly and installation at its site location, this game must be plugged into a properly grounded outlet to prevent shock hazard, and to assure proper game operation. DO NOT use a 'cheater' plug to defeat the ground pin on the line cord. DO NOT cut off the ground pin.

POWERING UP. Perform the following 'power up' routine upon completion of the assembly and installation procedure, as well as at the beginning of each period of game operation. Initially, it will confirm that the game is in proper operating condition; later, it will aid the operator via its messages (refer to later text entitled "Problem Analysis Messages").

Procedure. With the coin door closed, plug the game in, and switch it ON, using the On-Off switch. In normal operation, the player 1 score display initially shows 00. Then, the game goes into the Attract Mode (playfield and backbox lamps flashing, sounds being heard, etc., if the operator does not change the Factory Setting).

Open the coin door and press the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN. Press the ADVANCE button to begin the game test routine. Return to AUTO-UP and perform the entire test routine to verify that the game is operating satisfactorily. Successful completion of the tests shows that the game is ready to begin earning your investment return.

GAME OPERATION (Continued)

After the game has been on location for a period of time, the test routine may be preceded by messages concerning game problems. The text entitled 'Problem Analysis Messages' at the end of the Text/Diagnostic Procedures contains more details concerning messages displayed at each game turn-on.

ATTRACT MODE*. Playfield and backbox lamps blink. The player score displays exhibit a series of messages informing the player concerning:

- A. Recent highest scores*;
- B. A "custom message"
("I WANT MY ROCK ... AND ... ROLLER GAMES")*;
- C. The score to achieve to obtain a Replay award*;

These (or similar) displays reappear occasionally, accompanied by sounds and music, until a player initiates game play by inserting a coin or, when credits are available, pressing the START button.

CREDIT POSTING. Insert coin(s). A sound is heard for each coin, and the player score displays show 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 player score display decreases by one. The upper Player Score Display flashes 00 (until the first playfield switch is actuated), and the lower Player Score Display shows ball 1, except for 4-player games where the ball # shows in the individual player's display. Additional players may enter the game by pressing the START button once for each player, before the end of play on the first ball.

TILT. Actuating the Slam Tilt switch on the coin door inside the cabinet ends the current game; **ROLLER-GAMES** then proceeds to the Game Over Mode. With the third closure* of the plumb bob tilt switch, the player loses the remaining play of that ball, but can complete the game.

END OF 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 Match display. Credit* may be awarded, when the last two digits of any player's score display (1 through 4) match the random digits of the Match display. Match, high score, and game over sounds are made, as appropriate.

GAME OVER MODE. The GAME OVER display shows in the player score displays. Then, the high scores flash on the appropriate player score displays. The game proceeds to the Attract Mode.

* - operator-adjustable feature

ROLLERGAMES GAME STATUS DISPLAYS

ROLLERGAMES provides the game owner/operator with a display of information concerning the game's bookkeeping and game play feature adjustments. Basically, three classes of information now become available in this status display mode: Id (Identification); Au (Audit); Ad (Adjustment). Each of the underscored two-letter abbreviations for these classes appears in the Player Score Displays, while the system microprocessor for the **ROLLERGAMES** game is displaying the items within each class.

Identification Information—Id

With the game turned on, the coin door open, and the AUTO-UP/MANUAL-DOWN switch in the AUTO-UP position, the operator can press the ADVANCE switch once, briefly. Player displays immediately change from the Attract Mode to the Game Status Display or Identification (Id) Mode. This is evident by the following display, shown in columnar form. The column headings refer to the two backbox displays.

Upper Player Score Display	Lower Player Score Display
ROLLERGAMES	Id 00 576 L-x*

* x - indicates ROM revision level; e.g., 1 is initial issue; 2, 3, etc. for later revisions.

The game is named in the upper Player Score display. The game's identification number, the ROM revision level, and the Id Mode stage (Id 00) shows in the Lower Player Score display.

Pressing ADVANCE once more causes the Id 01 display to appear. This display describes the installed software more fully; that is, country; development stage; date of revision.

Pressing ADVANCE once more causes the Id 02 display to appear. This display describes which of the "Install" options is currently in effect. For example, if the YES option of the INSTALL FACTORY Adjustment Item (Ad 70) was last selected, *FACTORY SETTING* appears on the player score displays. Changing the setting of any other game adjustment item, after selecting the YES option for Ad 70 causes the display to change to *FACTORY ALTERED*. Similarly, if the operator selects the YES option for INSTALL HARD (Ad 65), the display indicates *HARD SETTING*. Changing a game adjustment item later then causes the display to show *HARD ALTERED*.

Audit Information—Au

While the AUTO-UP switch remains in the Up position, the operator can press the ADVANCE switch once, briefly, to begin the backbox displays of Audit (sometimes called "bookkeeping") Information. Fifty-four audit entries are now available. Calculation of the various factors is no longer necessary because the System 11C game program now performs all the mathematical factor computations. This information is intended to aid the owner/operator in evaluating how the game is performing in each location, by providing knowledge about which game features are receiving the most play. With this information, the owner/operator can determine whether adjusting the game features to other settings will contribute to increased game earnings.

The operator can press the ADVANCE button once to view each Audit Information display item. To proceed more rapidly through this information, the operator only has to press and hold the ADVANCE button. If a desired item is passed, the operator can use the MANUAL-DOWN switch position with the ADVANCE button to back up to the desired item.

The **ROLLERGAMES** Audit Table lists the 54 Audit Items of the **ROLLERGAMES** Game Status Displays. Presentation of these Audit Items again utilizes the player score displays: The Audit Item entry appears in the lower Player Score Display accompanied by the Item's data, while the upper display shows the Item description. A few example entries are shown in the table. Detection of erroneous data affecting any of the counters used in these audit items causes the message, ERROR, to be displayed during display of any audit item associated with that particular counter. (The program does not analyze the cause of the error; it merely alerts the operator of the error's existence by the message.)

ROLLERGAMES GAME STATUS DISPLAYS (Continued)

RollerGames Audit Table

Audit Item (Lower)	Descriptive Phrase (Upper Display)	Audit Item ¹ Value (Lower Display)
AU01	LEFT COINS [chute next to coin door hinge]	432
02	CENTER COINS	0
03	RIGHT COINS	398
04	PAID CREDITS	830
05	TOTAL PLAYS	
06	TOTAL FREE (Total Free Plays)	
07	PERCENT FREE (% Free Plays)	
08	REPLAY AWARDS	
09	PERCENT REPLAY (% Replay Awards)	
10	SPECIAL AWARDS	
11	PERCENT SPECIAL (% Special Awards)	
12	MATCH AWARDS	
13	HSTD (High Score to Date) CREDITS	
14	PERCENT HSTD (% HSTD Credits)	
15	EXTRA BALLS	
16	PERCENT EX. BALL (% Extra Balls)	
17	AV. BALL TIME (Average Time in Seconds)	
18	MINUTES OF PLAY (Minutes of Play)	
19	BALLS PLAYED	
20	REPLAY1 AWARDS	
21	REPLAY2 AWARDS	
22	REPLAY3 AWARDS	
23	REPLAY4 AWARDS	
24	1 PLAYER GAMES	
25	2 PLAYER GAMES	
26	3 PLAYER GAMES	
27	4 PLAYER GAMES	
28	BURN IN CYCLES	
29	LEFT DRAINS (# of drains via Left Outlane)	
30	LEFT KICKBACKS (# of Left Outlane Kickbacks)	
31	RIGHT DRAINS (# of drains via Right Outlane)	
32	TOTAL RAMP SHOTS (# of all Ramp Shots)	
33	DEEP FREEZE PLAY (# of 'Deep Freeze' plays)	
34	SKATE COMPLETE (# of completions of SKATE Drop Target)	
35	TOP DROPS COMP. (# of completions of Top Drop Targets)	
36	ALL TEAMS COMP. (# of completions of 'ALL TEAMS' play)	
37	MULTIBALLS (# of Multi-Ball™ plays)	
38	JACKPOTS. (# of 'JACKPOT' awards)	
39	H.S.RESET COUNTER	
40	0.0-0.4 MIL. SCORE (# of games <500K)	
41	0.5-0.9 MIL. SCORE (# of games ≥500K, <1M)	
42	1.0-1.9 MIL. SCORE (# of games ≥1M, <2.0M)	
43	2.0-2.9 MIL. SCORE (# of games ≥2.0M, <3.0M)	
44	3.0-3.9 MIL. SCORE (# of games ≥3.0M, <4.0M)	
45	4.0-5.9 MIL. SCORE (# of games ≥4.0M, <6.0M)	
46	6.0-7.9 MIL. SCORE (# of games ≥6.0M, <8.0M)	
47	8.0-99.9 MIL. SCORE (# of games ≥8.0M, <100M)	
48	1ST REPLAY IS XXXXXXXX	
49	AV. MIN. GAME TIME (Average Game in Minutes)	
50	SUDDEN DEATH (# of 'Sudden Death' plays)	
51	SUDDN. DEATH RMPS. (# of 'Sudden Death' Ramp shots)	
52	SUDDN. DEATH COMP. (# of 'Sudden Death' Ramp shots)	
53	ROLLER MOTION. (# of times for "Roller Motion")	
54	-NOT USED -	

NOTE: 1. The numbers shown in this column for Items 1 through 4 are examples. Entries for all items depend on the amount of play; thus, they will vary from location to location.

ROLLERGAMES GAME STATUS DISPLAYS (Continued)

Adjustment Information—Ad

At end of the Audit Information presentation, with the AUTO-UP switch in the Up position, the operator can press the ADVANCE button to proceed to the Adjustment Information portion of the **ROLLERGAMES** Game Status Displays, as shown in the Player Score Displays. A list of the Game Adjustments appears in the **ROLLERGAMES** Game Adjustment Table.

The operator can press the ADVANCE button once to view each Adjustment Information display item. To proceed more rapidly through this information, the operator only has to press and hold the ADVANCE button. If a desired item is passed, the operator can use the MANUAL-DOWN switch position with the ADVANCE button to back up to the desired item.

The **ROLLERGAMES** Game Adjustment Table lists the 70 items of the Adjustment Information portion of the **ROLLERGAMES** Game Status Displays. Presentation of the displays is similar to that for the Audit Information (that is, the upper display shows a descriptive phrase; the light type below the column headings names the respective backbox displays where the information appears, etc.).

The **ROLLERGAMES** Game-specific Adjustments Table lists those game-specific Adjustment Items for which settings vary between the major models of pinball products. The Game Adjustment Table, along with the Game-specific Adjustments Table, provides the Factory Settings for the three major models of pinball products (defined by country/language designation).

NOTE

In these tables, each Adjustment Item's Factory Setting for each of the three major models of pinball products is that shown in the 'Domestic' (US/Can.) column, unless a superseding entry appears in the French or West German columns of these tables. A superseding entry takes precedence over the 'Domestic' entry for the only the particular model indicated.

RollerGames Game-specific Adjustments Table

Adjustment Item (Lower)	Descriptive Phrase (Upper Display)	Factory Setting (Lower)		
		Domestic (US/Can.)	French	W Ger/ European
Ad 31	Kickback Setting	Medium		
32	Ex Ball Percent	30 %	25 %	30 %
33	Pwr Play Ex Ball	7 Ramps		7 Ramps
35	Pwr Play Special	13 Ramps		15 Ramps
36	Top Drop Timer	Off		20 sec
38	Save Locks	Variable	Yes	Variable
41	Spinner Timer	10 sec		9 sec
42	Roller Motion Free	1		0
48	Williams Restart	Willi		Will

ROLLERGAMES GAME STATUS DISPLAYS (Continued)

RollerGames Game Adjustment Table

Adjustment Item (Lower)	Descriptive Phrase (Upper Display)	Factory Setting (Lower) 6		
		Domestic (US/Can.)	French	W Ger/ European
Ad 01	AUTO REPLAY ¹ or FIXED REPLAY ¹	10 (%)		
02	REPLAY START (or REPLAY LEVEL 1) ¹	SCORES		
03	REPLAY LEVELS (or REPLAY LEVEL 2) ¹	6,000,000	6,500,000	7,000,000
04	(REPLAY LEVEL 3) ¹	01 (or OFF)		02
05	(REPLAY LEVEL 4) ¹	(see text)		
06	REPLAY AWARD	(see text)		
07	SPECIAL AWARD	Credit		
08	MATCH FEATURE	Credit		
09	BALLS / GAME	8 %	8%	7%
10	TILT WARNING	03		
11	MAXIMUM EX. BALL	03	01	
12	MAXIMUM CREDITS	04		
13	HIGHEST SCORES	10	20	30
14	BACKUP HI. SCR.1	On		
15	BACKUP HI. SCR. 2	9,000,000	9,500,000	9,500,000
16	BACKUP HI. SCR. 3	8,500,000	9,000,000	9,000,000
17	BACKUP HI. SCR. 4	8,000,000	8,500,000	8,500,000
18	HI. SCR.1 CREDITS	7,500,000	8,000,000	8,000,000
19	HI. SCR.2 CREDITS	01	03	03
20	HI. SCR.3 CREDITS	01	01	00
21	HI. SCR.4 CREDITS	01	01	00
22	H. S. RESET EVERY	01	01	00
23	FREE PLAY	3,000		750
24	U.S.A. 2 COINAGE (4 COINS 3 PLAYS) ^{2,3,4}	NO		
25	LEFT UNITS	USA 2	French 1	German 2
26	CENTER UNITS	03	02	06
27	RIGHT UNITS	12	10	12
28	UNITS/ CREDIT	03	20	30
29	UNITS/ BONUS	04	05	05
30	MINIMUM UNITS	00	20	00
31 - 58	Game-specific Play / Coinage Adjustments (detailed in text, the Game-specific Adjustments Setting Table and the Difficulty Setting Comparison Table)			00
59	5 INSTALL ADDABALL	NO		
60	5 INSTALL 5-BALL	NO		
61	5 INSTALL NOVELTY	NO		
62	5 INSTALL EX. EASY	NO		
63	5 INSTALL EASY	NO		
64	5 INSTALL MEDIUM	NO		
65	5 INSTALL HARD	NO		
66	5 INSTALL EX. HARD	NO		
67	AUTO BURN-IN	NO		
68	INSTALL FACTORY	NO		
69	CLEAR AUDITS	NO		
70	CLEAR COINS	NO		

NOTES:

- Automatic Replay percentage value range is adjustable from 5 to 25%, via the Credit Button. Item 02 permits changing the factory setting value for Replay Start Level (valid for next 50 games played). Item 03 permits setting up to four replay levels, with values as detailed in text describing Item 03. For Fixed Replay Scores, set Auto Replay value to 1 less than 5(%) via the Credit Button. Go to items 02, 03, 04, and 05; install their replay level scores. Turn off any replay level by setting 00 as its value.
- Phrase in parentheses is Factory Setting. Phrase appears in player displays. Press Credit Button to change setting of the game pricing of Item 24.
- To change country OR coinage setting, press Credit button to obtain 24 Standard Settings, followed by a Custom Setting. The Custom Setting activates Items 25 through 30. When a Standard Setting is used, items 25 through 30 are set automatically, and cannot be changed.
- Refer to Pricing Table and text describing these items.
- Special Preset Adjustment, whose effects are noted in the Game Adjustment text.
- Entries in Factory Setting columns for French and W. German games show only differences from entries in first (US / Can.) column.

ROLLERGAMES GAME STATUS DISPLAYS (Continued)

One of the following **ROLLERGAMES** Game Difficulty Setting Tables shows the five game 'difficulty' Adjustment Items (ranging from Ad 62 - Extra Easy through Ad 66 - Extra Hard) for the major models of pinball products (defined by country-language designations). Installing any one of these 'difficulty' Adjustments causes the values shown for each of the included game play Adjustment Items to be installed as a group, changing the level of play from one difficulty level to another. The owner/operator can use the information provided by the Audit Table items to determine whether the 'difficulty level' for this game in this location needs to change to obtain a higher level of earnings from the game or to provide a greater challenge to the location's players.

Once the 'difficulty level' is changed, a careful review of the Audit Items will reveal whether the change has achieved this higher-earnings goal. Sometimes, one (or more) of the Adjustment Items needs further change to keep the number of plays high, while still keeping the earnings level high. "Fine-tuning" of the game's Adjustment Items is a key feature of Williams Electronic Games products.

RollerGames

Game Difficulty Setting Table for US / Canadian / French Games

Adj #	Adj Description	Extra Easy Ad 62	Easy Ad 63	Medium Ad (Factory) 64	Hard Ad 65	Extra Hard Ad 66
31	Kickback Setting	Easy	Easy	Medium	Medium	Medium
32	Extra Ball Percent	40 %	35 %	30 %	25 %	20 %
33	Pwr. Play Ex. Ball	5 Ramps	6 Ramps	7 Ramps	8 Ramps	10 Ramps
34	Special Percent	5 %	5 %	5 %	5 %	5 %
35	Pwr. Play Special	12 Ramps	12 Ramps	13 Ramps	14 Ramps	15 Ramps
36	Top Drop Timer	Off	Off	Off	18 sec	13 sec
37	Deep Freeze	Easy	Easy	Easy	Medium	Hard
38	Save Locks	Yes	Yes	Variable	Variable	No
39	Jetway Teams	Easy	Easy	Easy	Easy	Medium
40	Suddn. Death Time	Slow	Slow	Medium	Fast	Ex. Fast
41	Spinner Timer	15 sec	12 sec	10 sec	8 sec	7 sec
42	Rolr. Motion Free	2	1	1	0	0
43	WILLIAMS Memory	Always	Always	Always	Always	Always
44	Cycle Locks	On	On	On	On	On
45	Contest Mode	No	No	No	No	No
46	Magnet Speech	Normal	Normal	Normal	Normal	Normal
47	Speech Usage	Normal	Normal	Normal	Normal	Normal
48	WILLIAMS Restart	Willia	Willi	Willi	Wil	W

ROLLERGAMES GAME STATUS DISPLAYS (Continued)

NOTE

The 'difficulty' Factory Setting for French games is the equivalent of Ad 64 Medium, with 3 balls/game. German/European games also use the equivalent of Ad 64 Medium, with 3 balls/game.

RollerGames

Game Difficulty Setting Table for German / European Games

Adj #	Adj Description	Extra Easy Ad 62	Easy Ad 63	Medium Ad 64 (Factory)	Hard Ad 65	Extra Hard Ad 66
31	Kickback Setting	Easy	Easy	Medium	Medium	Medium
32	Extra Ball Percent	35 %	30 %	30 %	25 %	20 %
33	Pwr. Play Ex. Ball	6 Ramps	7 Ramps	8 Ramps	9 Ramps	11 Ramps
34	Special Percent	5 %	5 %	5 %	5 %	5 %
35	Pwr. Play Special	14 Ramps	14 Ramps	15 Ramps	16 Ramps	16 Ramps
36	Top Drop Timer	Off	Off	20 sec	18 sec	16 sec
37	Deep Freeze	Easy	Easy	Easy	Medium	Hard
38	Save Locks	Yes	Yes	Variable	Variable	No
39	Jetway Teams	Easy	Easy	Easy	Medium	Medium
40	Suddn. Death Time	Slow	Medium	Fast	Fast	Fast
41	Spinner Timer	14 sec	11 sec	9 sec	7 sec	7 sec
42	Rolr. Motion Free	1	1	0	0	0
43	WILLIAMS Memory	Always	Always	Always	Always	Always
44	Cycle Locks	On	On	On	On	On
45	Contest Mode	No	No	No	No	No
46	Magnet Speech	Normal	Normal	Normal	Normal	Normal
47	Speech Usage	Normal	Normal	Normal	Normal	Normal
48	WILLIAMS Restart	Willi	Will	Wil	Wil	W

GAME ADJUSTMENT PROCEDURE

Adjustment Items 01 through 70

The coin door must be open to access the Game Adjustment/Diagnostic switches. All readings and setting changes require operation of these coin door switches. Some setting changes utilize the START button; some also use the flipper button(s). Additional text describing the game adjustment items follows this procedure; the value of the Factory Setting for each Game Adjustment item is in the preceding **ROLLERGAMES Game Adjustment Table**.

1. Use AUTO-UP and press ADVANCE. The Id 00 display initially appears. Press ADVANCE until the Player 3 display indicates Ad 01. If the factory setting has not changed, the upper Player Score display indicates AUTO REPLAY, and the lower display shows 10%, indicating a 10% replay percentage. (The game program adjusts itself automatically, as discussed in the following text concerning the 'details' about Adjustment Item 01.)
2. To reach a higher item number (in the lower display), use AUTO-UP and press ADVANCE. To return to a previous item number, use MANUAL-DOWN and press ADVANCE.

GAME ADJUSTMENT PROCEDURE (Continued)

- 3: With the desired Game Adjustment Item number showing in the lower display, increase the setting value (or select another option) shown in the lower display by using AUTO-UP and pressing the START button. Repeat this step for each item, until all changes to the factory settings for the Game Adjustment Items have been made. The preceding Game Adjustment Table consolidates the Factory Settings into one grouping.

(The same procedure can be used for Audit Items. To zero **Au 01 - 04** (concerning the coin chutes and the total coins), the operator can proceed to item 68, Clear Coins, and press the START button to obtain the YES option. The operator then presses the ADVANCE button and notes the "DONE" display, which verifies that the entry values for items 01 through 04 of the Audit Items are now reset to zero.)

For example, the operator may desire to change the degree of game play difficulty from the Factory Setting (equivalent to the Install Medium [Ad 64] difficulty, along with a number of other automatically installed settings, as shown in the right column of the Game Adjustment Table) to another difficulty more suitable for the players at a particular game site. Four other 'automatic' play difficulty settings (Ad 62 - Ad 66) are available, each of which, if selected, installs all the adjustments listed for that difficulty in the Game Adjustment Setting Comparison Table, which precedes the 'details' text.

4. To proceed rapidly through the entire adjustments series, press and hold ADVANCE, until Ad 70 shows in the lower display. From item 70, you can: (A) return to the Game-Over Mode; or (B) restore factory settings and zero audit (bookkeeping) totals. Perform either of the following, as desired:

A. To reach Game-Over Mode, use AUTO-UP and press ADVANCE once. **ROLLERGAMES** now goes to the Game-Over Mode.

B. To restore the Factory Settings for Game Adjustment Items (as listed in the Game Adjustments Table), zero all audit (bookkeeping) totals, and return to Game-Over Mode, use AUTO-UP or MANUAL-DOWN to display Ad 70 in the lower display. Press the START button to display the YES option in the lower display. Using AUTO-UP, press ADVANCE once. **ROLLERGAMES** now zeroes ALL Audit Item totals and changes ALL Game Adjustment Items back to those originally selected as Factory Settings. It then shows the operator a message ("FACTORY SETTING") that this has occurred. (A problem in the Memory Protection circuit or closing the coin door will cause the message "ADJUST FAILURE" to appear.) Press ADVANCE once more to return to the Game-Over Mode.

GAME ADJUSTMENT PROCEDURE (Continued)

Details of Adjustment Items 01 through 70

01 Auto Replay (or Fixed Replay)

Of the two options, AUTO REPLAY is the percentage of replays automatically awarded per game. The game program aids a pinball's initial installation by causing a comparison of the value of the Replay Level to the value of all players' scores every 50 games. At each comparison, the program increases (or decreases) the Replay Level by an amount necessary to achieve the replay percentage specified either via the factory setting or later operator selection. Use the START button to change the percentage within the range of 5 to 25 (%), with the value increasing using AUTO-UP (or decreasing using MANUAL-DOWN). The next START button change below 5%, selects the FIXED REPLAY option.

For AUTO REPLAY, Ad 02 provides the Starting Replay Level (the upper display shows REPLAY START). Ad 03 provides the number of replay levels (01, 02, 03, or 04). **ROLLERGAMES** then proceeds to Ad 06 automatically.

For FIXED REPLAY, Ad 02 is the first replay level (REPLAY LEVEL 1). Ad 03, 04, and 05 are the other replay levels.

02 Starting Replay Level (or Replay Level 1)

For AUTO REPLAY (refer to Ad 01), the initial Factory Setting is listed in the Game Adjustment Table. The range of settings is 2,000,000 through 19,600,000 (by increments of 200,000 with AUTO-UP or decrements of 200,000 with MANUAL-DOWN).

For FIXED REPLAY, the operator can enter the value to be used for the first fixed replay score level via the START button. The range of settings is: OFF; 200,000 through 19,800,000 (by increments of 200,000 with AUTO-UP, or decrements of 200,000 with MANUAL-DOWN).

03 Replay Levels (or Replay Level 2)

For AUTO REPLAY (refer to Ad 01), this is the number of replay levels in a game. The option range is one, two, three, or four replay level(s). When the operator chooses two replay levels, **ROLLERGAMES** automatically adjusts the second replay level to be twice the value selected for Ad 02, the starting replay level. Choosing three or four replay levels automatically adjusts their replay levels to three times or four times the Ad 02 value.

For FIXED REPLAY, the technique of value entry and the range of settings are identical to those of Ad 02.

04 (Replay Level 3)

For AUTO REPLAY, this Adjustment Item is not applicable. **ROLLERGAMES** automatically bypasses this adjustment.

For FIXED REPLAY, the technique of value entry and the range of settings are identical to those of Ad 02.

05 (Replay Level 4)

For AUTO REPLAY, this Adjustment Item is not applicable. **ROLLERGAMES** automatically bypasses this adjustment.

For FIXED REPLAY, the technique of value entry and the range of settings are identical to those of Ad 02.

GAME ADJUSTMENT PROCEDURE (Continued)

06 Replay Award

For either AUTO REPLAY or FIXED REPLAY (Ad 01), the operator can select the form of the award automatically provided when the player exceeds any Replay Level (Automatic or Fixed). The choices are:

- Credit - Reaching each replay level obtains a credit (free game).
- Ball - Reaching each replay level obtains an extra ball.
- Audit - Reaching each replay level obtains nothing to the player; it does increase the entry value of the Audit Item(s) maintaining a tally of these awards (Au 08, and Au 20 through 23, as applicable).

07 Special Award

The operator can select the form of the award automatically provided when the player scores a Special. The choices are:

- Credit - Scoring each Special, when lit, obtains a credit (free game).
- Ball - Scoring each Special, when lit, obtains an extra ball.
- Score - Scoring each Special, when lit, obtains a score advance of 100,000 points to the player.

08 Match Award

The operator can select (via the START button) the desired percentage for the Match action occurring at the completion of each game. The choices are:

- 1%-50% - 1% is 'hard'; 50% is 'extremely easy'. During Match action, the game selects a random two-digit number at end of game and compares each player's score for an identical two digits in the rightmost two positions. A matching of the two digits results in the award of a credit.
- Off - The MATCH display does not operate at completion of the game; no award is given.

09 Balls / Game

The operator can define a "game" by specifying the number of balls to be played. The range of this setting is 1 through 9.

10 Tilt Warning

The operator can specify the number of total actuations of the plumb bob mechanism that can occur before the game is "tilted". The range of this setting is 1 through 5.

11 Maximum Extra Ball

The operator can choose (via the START button) the number of Extra Balls to be awarded to a player. The range of this setting is:

- 00 - NO extra ball play; displays a message, NO EX. BALL.
- 1 -9 Extra Balls - 1 through 9 Extra Balls per ball.

12 Maximum Credits

The operator can specify the maximum number of credits the game can accumulate, either through game play awards or coin purchases. The range of settings is 5 through 10. Reaching the specified setting prevents the award of any credits.

13 Highest Scores

The operator can specify (via the START button) whether the game is to maintain a record of the four highest scores achieved to date. The choices are:

- Off - NO high scores are recorded.
- On - The four highest scores are stored in memory for use by Game Adjustment 22.

GAME ADJUSTMENT PROCEDURE (Continued)

- 14 Backup High Score 1**
The operator can set the Backup High Score value in the upper display (for Player 1), using the START button. The game automatically restores this value, when the operator presses, and holds, the HIGH SCORE RESET switch, or when an automatic High Score Reset event (Ad 22) occurs.
- 15 Backup High Score 2**
This adjustment is similar to Ad 14, except that this applies to the Player 2 Score display. The adjustment technique is identical to Ad 14. It is also restored as described for Ad 14.
- 16 Backup High Score 3**
This adjustment is similar to Ad 14, except that this applies to the Player 3 Score display. The adjustment technique is identical to Ad 14. It is also restored as described for Ad 14.
- 17 Backup High Score 4**
This adjustment is similar to Ad 14, except that this applies to the Player 4 Score display. The adjustment technique is identical to Ad 14. It is also restored as described for Ad 14.
- 18 Credits for Highest Score 1**
The operator can select the number of credits to be awarded, by using the START button, whenever a player exceeds the previous Highest Score. The range of this setting is 00 through 10.
- 19 Credits for Highest Score 2**
This adjustment is similar to Ad 18, except that this applies to the player's exceeding the second highest score. The START button adjustment technique is the same as for Ad 18. The range of this setting is 00 through 03.
- 20 Credits for Highest Score 3**
This adjustment is similar to Ad 18, except that this applies to the player's exceeding the third highest score. The START button adjustment technique is the same as for Ad 18. The range of this setting is 00 through 03.
- 21 Credits for Highest Score 4**
This adjustment is similar to Ad 18, except that this applies to the player's exceeding the fourth highest score. The START button adjustment technique is the same as for Ad 18. The range of this setting is 00 through 03.
- 22 Automatic High Score Reset**
The operator can specify (via the START button) that the game will provide an automatic reset of the displayed "Highest Scores", and the number of games to be played before the reset occurs. (Audit item 39 displays the games remaining before the reset.) The values provided upon reset are those selected by the operator in Ad 14 through 17, the Backup High Scores. The range of this setting is Off (to disable this adjustment), and 250 to 24,750 games (in increments of 250).
- 23 Free Play**
The operator can select (via the START button) whether a player can operate the game without a coin (free play) or with a coin. The choices are:
- No - A coin is necessary for game play.
 - Yes - Game play is free; no coin is required.

GAME ADJUSTMENT PROCEDURE (Continued)

24 Coinage Selections

The operator can specify (via the START button) any of the 23 Standard Settings for game pricing, each of which exhibits a message identifying the country and the number of coins required and the number of games that the coin requirement purchases. Choosing a Standard Setting permits the game to omit items Ad 25 through 30, which are adjustments allowing for a special custom coinage setting.

Following the last Standard Setting is a Custom Coinage Setting, which allows the operator to utilize Ad 25 through 30 in establishing a special coinage setting. A message, CUSTOM COINAGE, indicates that the operator can enter the appropriate values into the Ad 25 through 30 adjustment items.

The values for Ad 25 through 30 of each Standard Setting, as well as other possible values for the Custom Coinage Setting are shown in the Pricing Table.

25 Left Chute Coin Units

The operator can specify (via the START button) the number of coin units purchased by a coin passing through the left coin chute.

26 Center Chute Coin Units

The operator can specify (via the START button) the number of coin units purchased by a coin passing through the center coin chute.

27 Right Chute Coin Units

The operator can specify (via the START button) the number of coin units purchased by a coin passing through the right coin chute.

28 Units Required for Credit

The operator can define (via the START button) the number of coin units required to obtain 1 Credit. A coin unit counter in the game program totals the number of coin units purchased through all coin chutes prior to each game. If the total of these coin units matches, or exceeds, the Units per Credit value by a multiple (or more, coin units) of the specified Units per Credit value, the Credits display shows the proper number of Credits. The coin unit counter retains any remaining coin units, until the start of a game; then, the coin unit counter is cleared (its contents are zeroed).

29 Units Required for Bonus

The operator can specify (via the START button) that 1 additional Credit is to be indicated in the Credits display, when a certain number of coin units are accumulated.

30 Minimum Units Required for any Credits Posted

The operator can specify that NO Credits are to be posted (indicated in the Credits display), until the credits units counter reaches a particular value, by setting this value to 02 (or more). A setting of 01 allows the Credits display to show fractional coin units.

The System 11C game program defines the following 28 Adjustment items as "game-specific"; that is, they are unique for each game. The Game Designer/Engineer/Programmer team members work together to use these as controlling factors for game play. By varying the setting of these Adjustment items, it is possible to "fine-tune" a game to suit a particular location, enabling the owner/operator to reap maximum earnings, while still providing the players with sufficient challenge to keep them playing.

GAME ADJUSTMENT PROCEDURE (Continued)

31 KICKBACK SETTING

The operator can choose (via the START button) the operating conditions of the Left Outlane Kickback. The choices are:

- Easy* - The Kickback is ON at each Ball Start.
- Medium* - The Kickback is ON at Game Start, and when lit, stays in memory from ball to ball.
- Hard* - The Kickback is OFF at Game Start, but stays in memory from ball to ball.
- Ex. Hard* - The Kickback is OFF at each Ball Start.

32 EXTRA BALL PERCENTAGE

The operator can specify (via the START button) the number of Extra Balls awarded per game, as determined by the percentage setting selected. The range of this adjustment setting is 5 - 11% (Conservative) through 40 - 50% (Extremely Liberal), and Off.

33 PWR. PLAY EX. BALL

The operator can choose (via the START button) the number of Power Play Ramp shots required to light the Extra Ball lamp at the Turn-around Lane. The range of this adjustment setting is 4 Ramps (Liberal) through 30 Ramps (Conservative), and Off.

34 SPECIAL PERCENT

The operator can choose (via the START button) the percentage limit for the SPECIAL award. The range of this adjustment setting is 1 - 11% (Conservative) through 20 - 30% (Extremely Liberal), and Off.

35 PWR. PLAY SPECIAL

The operator can choose (via the START button) the number of Power Play Ramp shots required to light the SPECIAL lamps in the Left and Right Outlanes. The range of setting is 10 Ramps (Liberal) through 50 Ramps (Conservative). This adjustment can also be turned off, via a setting of Off.

36 TOP DROP TIMER

The operator can specify (via the START button) the Time Period for initially resetting the Top Drop Target Bank. This Adjustment controls how difficult it is to light the LOCK lamp. The range of this adjustment setting is 5 seconds (Conservative) through 20 seconds (Liberal), during which the downed targets remain down, until the specified Time Period elapses. This setting can also be OFF (Extremely Liberal).

37 DEEP FREEZE

The operator can choose (via the START button) the operating conditions of the Deep Freeze Magnet. The choices are:

- Easy* - The Deep Freeze Magnet is ON at each ball start.
- Medium* - The Magnet is ON at Game Start, and when lit, stays in memory from ball to ball.
- Hard* - The Magnet is OFF at Game Start, but stays in memory from ball to ball.
- Ex. Hard* - The Magnet is OFF at each Ball Start.

38 SAVE LOCKS

The operator can specify (via the START button) whether any 'Locked' balls are held at the end of play on each ball or each game. To hold 'Locked' balls over to the next ball (or game) enables obtaining Multi-Ball™ play more easily for the next player. The choices are:

- Yes* - 'Locked' balls ARE held over.
- No* - 'Locked' balls are NOT held over.
- Variable* - The game determines whether holding over 'Locked' balls is best.

GAME ADJUSTMENT PROCEDURE (Continued)

39 JETWAY TEAMS

The operator can choose (via the START button) the operating conditions for the Jetway Teams feature: Lighting all six teams lights the EXTRA BALL lamp of the Top Turnaround Lane. The choices are:

- Easy* - Any lighted Teams remain in memory from ball to ball.
- Medium* - All Teams are unlighted at each Ball Start. The award is more difficult to obtain.
- Hard* - The award is more difficult to obtain than at the Medium setting.

40 SUDDN. DEATH TIME

The operator can choose (via the START button) the rate at which the Sudden Death Timer operates during "Sudden Death". This adjustment limits the number of ramp shots via the time limit. The choices are:

- Slow* - (Liberal) The timer operates slowly, permitting more ramp shot attempts.
- Medium* - The countdown rate increases limiting the number of ramp shot attempts.
- Fast* - The rate increases above the Medium setting limiting the number of ramp shot attempts.
- Extra Fast* - (Conservative) The timer operates at its highest rate, enabling the fewest ramp shots.

41 SPINNER TIMER

The operator can choose (via the START button) the Time Period for the Spinner being lighted, spotting another Jetway Team via a successful shot. The range of settings is 05 (Conservative) - 20 (Liberal) seconds.

42 ROLR. MOTION FREE

The operator can choose (via the START button) the number of times the Ball Popper will score Roller Motion, before it must be relighted via the top Standup Targets (1-2-3). The range of settings is 0 (Conservative) - 5 (Liberal).

43 WILLIAMS MEMORY

The operator can choose (via the START button) the operating conditions for the lighted W-I-L-L-I-A-M-S lamps of the Speaker/Display Panel. The choices are:

- Always* - (Liberal) Any lighted letters remain in memory from player to player, and from game to game.
- Game* - (Conservative) Any lighted letters are turned off at Game Start, but remain in memory from player to player.
- Player* - (Very Conservative) The game retains any lighted letters for each player, with no carry-over.

44 CYCLE LOCKS

The operator can choose (via the START button) whether the Upper Kickback kicks the balls in the Left Wireform Loop Ramp at intervals during the game. The choices are:

- Yes* - Balls ARE kicked during game play.
- No* - Balls are NOT kicked.

45 CONTEST MODE

The operator can choose (via the START button) whether the game is set for contest or tournament play. Contest games are identical from game to game. This has the effect of installing certain settings for some of the Game Adjustments: a) Ad 32 and Ad 34 have the 0 setting installed (disabling all automatic percentaging); b) Ad 38 (Save Locks) has the No setting installed; c) Ad 43 has the Player setting installed. Jackpot value is fixed at 1,500,000. The choices are:

- No* - The game is set for normal play.
- Yes* - The game is set for use in a contest or tournament.

GAME ADJUSTMENT PROCEDURE (Continued)

46 MAGNET SPEECH

The operator can choose (via the START button) how the Flip - Don't Flip speech sounds occur during the game. The choices are:

Normal - The speech is heard each time the magnet is activated.

Less - The speech is heard during Multi-Ball™, and the first time the magnet is used by each player.

47 SPEECH USAGE

The operator can choose (via the START button) whether the speech "Kick Butt" occurs during game play. The choices are:

Normal - The "Kick Butt" speech occurs during the game.

Family - The speech is NOT used.

48 WILLIAMS RESTART

The operator can choose (via the START button) the number of letters in the word WILLIAMS (on the Speaker/Display Panel) that are lighted after the player fails in an attempt to score the Bonus associated with lighting the word WILLIAMS. The range of settings is *Willia* (Liberal) to *W* (Conservative).

49 CUSTOM MESSAGE

The operator can choose (via the START button) whether to display a message during the Attract Mode. (When display of a message is selected, the operator can either utilize the message provided or change the message.) Three choices are available:

- 1 - Display a message during the Attract Mode. The lower display shows this choice as ON. The 3-line message provided is:

I WANT MY ROCK ... AND ... ROLLERGAMES.

- 2 - Do NOT display a message during the Attract Mode. (Lower display shows OFF.)
- 3 - The lower display shows this choice as CHANGE. The operator can enter a special

("custom") message, as follows:

- A. Press ADVANCE once. The operator can now enter as many as three 16-character lines for display during the Attract Mode.
- B. Use the flipper button(s) to select each message character (alphabet, numbers, and special symbols are available). In case of error, enter a "back arrow" (just before "space") to correct, followed by correct character. For a period after any letter, use letters with periods (following the special symbols). The entire character set is the following:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 0 1 2 3 4 5 6 7 8 9 < > ? - / * ' ,

A . B . C . D . E . F . G . H . I . J . K . L . M . N . O . P . Q . R . S . T . U . V . W . X . Y . Z . _

- C. Move to the next character via the Credit button. The game program does not allow entirely blank lines to be displayed.

50 DISPLAY AU 01 - 04

The operator can choose (via the START button) how to display the coinage audit information, Au 01 - 04. No information is lost; it remains stored in the CPU memory. The information is now available for readout via the player score displays. Three choices are available:

Yes - Both the audit text (slot identification) and the value is displayed.

Value - Only the numerical value is displayed.

No - NO display occurs.

GAME ADJUSTMENT PROCEDURE (Continued)

51 1 COIN BUY-IN

The operator can choose (via the START button) whether the player is allowed to 'buy-in' a subsequent game for 1 coin. The number of games that may be purchased at this cost is determined by the number of players in the previous game; that is, if the previous game had three players, 3 Credits can be purchased at the rate of 1 coin per credit. The choices are:

Yes - The player has 10 seconds to 'buy-in' the next game(s) at the 1 coin per game rate.

No - The 'buy-in' feature is disabled.

52 REPLAY BOOST

The operator can choose (via the START button) whether the Replay Score is boosted (increased) during any games awarded by regular game play. This adjustment is disabled whenever a game is set to Free Play (Ad 23 - Yes). The choices are:

Yes - The Replay Score is increased by 1 Million each time a game is won; it resets to its normal setting whenever a coin is inserted.

No - The Replay Score increase is disabled.

53 - 58 Special Preset Adjustment Settings

SPECIAL PRESET ADJUSTMENTS CAUTION

Adjustments 53 through 66 are Special Preset Adjustments to enable the operator to perform the setting of multiple adjustments at once. They permit the operator to: (1) modify the game for a specific area (for example, coinage settings for a country); (2) change a group of adjustments to conform with laws of certain localities; and (3) change the degree of difficulty of game play (Ad 62 through 66). Whenever the operator chooses to use any Special Preset Adjustment, the operator can later access any or all of the individual Adjustments affected by that Special Adjustment for subsequent changes.

A similar technique is recommended in the event of error or uncertainty concerning any Special Preset Adjustment, after the operator selects it: The operator can restore the factory setting of each individual Adjustment, then select the desired Special Preset Adjustment, and then return to any of the preceding individual adjustments to determine whether use of the Special Adjustment has had the desired effect.

The Backbox displays for each Special Preset Adjustment indicate whether the operator has selected it, by identifying the Adjustment in the upper displays by name and the selection choice of NO, meaning Not Selected (this is the Factory Setting), or YES, meaning Selected, in the lower display. Operator installation of the 'selected' Preset Adjustment occurs by using the START button to choose YES and then pressing the ADVANCE switch. The displays then show the name of the Adjustment again, with DONE to show that the installation is now in effect.

Note that, when an operator installs any of the Special Preset Adjustments, Adjustment Items using the automatic adjust feature of the game program reset to the INITIAL auto adjust value listed for that Adjustment Item.

GAME ADJUSTMENT PROCEDURE (Continued)

NOTE

A game in which the CPU has ROMs installed for German (Deutsch) or French (Francais) language and play adjustments automatically has certain Adjustment Items preset. The following tables show these Preset Adjustment Items for each of the special language games.

53 through 58 For German/European Games Only: Install German 1, 2, 3, 4, 5 or 6

The operator can use these Adjustment Items to modify the game pricing selection of Standard Setting named "German 2 or German 1" in the Pricing Table to permit the style of play for the particular price shown in the **ROLLERGAMES** Preset Game Adjustments Table for German/European Games.

RollerGames
Preset Game Adjustments Table for German/European Games

Adj #	Adj Description	German Ad 1 53	German Ad 2 54	German Ad 3 55	German Ad 4 56	German Ad 5 57	German Ad 6 58
06	Replay Award	Credit	Coil	Audit	Credit	Coil	Audit
07	Special Award	Credit	Ball	Score	Credit	Ball	Score
08	Match Feature	7 %	7 %	Off	7 %	7 %	Off
14	Backup High Score 1	9.500.000	9.500.000	00	9.500.000	9.500.000	00
15	Backup High Score 2	9.000.000	8.000.000	00	9.000.000	9.000.000	00
16	Backup High Score 3	8.500.000	8.500.000	00	8.500.000	8.500.000	00
17	Backup High Score 4	8.000.000	8.000.000	00	8.000.000	8.000.000	00
18	High Score 1 Credits	01	01	00	01	01	00
19	High Score 2 Credits	00	00	00	00	00	00
20	High Score 3 Credits	00	00	00	00	00	00
21	High Score 4 Credits	00	00	00	00	00	00
24	Coinage Setting	6 spiele/5 DM	6 spiele/5 DM	6 spiele/5 DM	7 spiele/5 DM	7 spiele/5 DM	7 spiele/5 DM

GAME ADJUSTMENT PROCEDURE (Continued)

53 through 58 For French Games Only: Install French 1, 2, 3, 4, 5, or 6.

The operator can use these Adjustment Items to modify the style of play for the particular setting shown in the **ROLLERGAMES Preset Adjustments Table for French Games**.

**RollerGames
Preset Game Adjustments Table for French Games**

Adj #	Adj Description	French 1 Ad 53	French 2 Ad 54	French 3 Ad 55	French 4 Ad 56	French 5 Ad 57	French 6 Ad 58
31	Kickback Setting	Medium	Hard	Easy	Medium	Medium	Medium
32	Ex Ball Percent	25 %	20 %	33 %	25 %	25 %	25 %
60	Install 5 Ball	N/A	N/A	N/A	N/A	N/A	Yes

53 through 55 UNUSED (For USA / Canadian Games only)

56 through 58 (For USA / Canadian Games only)

The operator can use these Adjustment Items to modify the game pricing selection.

**RollerGames
Preset Game Adjustments Table for US / Canadian Games**

Adj #	Adj Description	Install 1 Coin Ad 56	Install 3/\$1.00 Ad 57	Install 2 Coins Ad 58
02	Replay Start	6,000,000	6,000,000	7,500,000
09	Balls / Game	3	3	5
14	Backup High Score 1	9,000,000	9,000,000	9,500,000
15	Backup High Score 2	8,500,000	8,500,000	9,000,000
16	Backup High Score 3	8,000,000	8,000,000	8,500,000
17	Backup High Score 4	7,500,000	7,500,000	8,000,000
24	Coinage Setting	USA 1	USA 2	USA 3

GAME ADJUSTMENT PROCEDURE (Continued)

59 Install Add-A-Ball

The operator can utilize this option to delete all Free Play awards and replace them with Extra Ball awards. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
06	Replay Award	Ball	19	Hi Scr 2 Credits	00
07	Special Award	Ball	20	Hi Scr 3 Credits	00
08	Match Feature	Off	21	Hi Scr 4 Credits	00
18	Hi Scr 1 Credits	00	34	SPECIAL Percent	Off
			35	Pwr Play SPECIAL	Off

60 Install 5 Ball

The operator can change the game to 5-ball play, including the changing of certain features to the recommended 5-ball difficulty level. NOTE: Ad 65 (Install HARD) settings are also set when the game is changed to '5-ball Play'. Other Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
02	Replay Start	7,500,000	16	B'up Hi Score 3	8,500,000
09	Balls / Game	05	17	B'up Hi Score 4	8,000,000
14	B'up Hi Score 1	9,500,000	65	Install Hard	Yes
15	B'up Hi Score 2	9,000,000			

61 Install Novelty

The operator can remove all Free Play and Extra Ball awards by selecting the Yes Option. Individual Adjustments are affected, as follows:

Ad	Name	New Setting	Ad	Name	New Setting
01	Fixed Replay	SCORES	13	Highest Scores	Off
02	Replay Level 1	Off	18	Hi Scr 1 Credits	00
03	Replay Level 2	Off	19	Hi Scr 2 Credits	00
04	Replay Level 3	Off	20	Hi Scr 3 Credits	00
05	Replay Level 4	Off	21	Hi Scr 4 Credits	00
06	Replay Award	Audit	32	Ex Ball Percent	Off
07	Special Award	Score	33	Pwr Play Ex Ball	Off
08	Match Feature	Off	34	SPECIAL Percent	Off
11	No Extra Balls	00	35	Pwr Play SPECIAL	Off

62 Install Extra Easy

The operator can change the game play difficulty adjustments to a combination that is much less difficult than the Factory Settings. The Game Difficulty Setting Table, which precedes these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Extra Easy' group.

63 Install Easy

The operator can change the game play difficulty adjustments to a combination that is somewhat less difficult than the Factory Settings. The Game Difficulty Setting Table, which precedes these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Easy' group.

64 Install Medium

The operator can change the game play difficulty adjustments to a combination that is about the same difficulty as the Factory Settings. The Game Difficulty Setting Table, which precedes these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Medium' group.

GAME ADJUSTMENT PROCEDURE (Continued)

65 Install Hard

The operator can change the game play difficulty adjustments to a combination that is somewhat more difficult than the Factory Settings. The Game Difficulty Setting Table, which precedes these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Hard' group.

66 Install Extra Hard

The operator can change the game play difficulty adjustments to a combination that is much more difficult than the Factory Settings. The Game Difficulty Setting Table, which precedes these 70 individual Adjustments descriptions, lists the Adjustments and the settings that comprise the 'Extra Hard' group.

67 Auto Burn-In

The operator can choose the YES option for this Special Preset Adjustment to perform certain automatic testing of the game, as used in the factory. It does not affect the game operation, but merely provides for a cyclic testing of most of the game's mechanisms.

68 Install Factory

The operator can request the game (via the START button) to provide the normal Factory Settings, essentially restoring the game to its 'factory condition'. The operator must select the 'YES' option for this adjustment to obtain the resetting action. The 'YES' option clears all Audits, resets all Game Adjustments to the respective Factory Settings, and provides a restart of the Auto Replay (Ad 01). After selecting the YES option, the operator must press the ADVANCE button. The game then displays the message, FACTORY SETTING.

Closing of the coin door before appearance of the FACTORY SETTING message or a problem in the Memory Protect circuit will cause the game to display ADJUST FAILURE. A loss of battery power or improper treatment of the Game Adjustments will cause the game to attempt to restore Factory Settings. The game announces the results of this reset process with the appropriate message, FACTORY SETTING or ADJUST FAILURE.

69 Clear Audits

The operator can request the clearing of the non-coinage audits (Au 05 through 55) by selecting (via the START button) the YES option, as shown in the lower display. This Adjustment zeroes the counters tallying the remaining Audit factors. Please note that this does NOT affect the Automatic Replay Percentage data nor the automatic High Score Reset counter. After the YES option is displayed, the operator must press the ADVANCE button. The game then displays DONE to show that the non-coinage audits were reset to zero.

70 Clear Coins

The operator can request the clearing of the coinage audits (Au 01 through 04) by selecting (via the START button) the YES option, as shown in the lower display. This adjustment zeroes the counters tallying the number of coins through each slot, the Paid Credits counter, and the Credits display. After the YES option is displayed, the operator must press the ADVANCE button. The game then displays DONE to show that the coinage audits were reset to zero.

RESETTING THE HIGH SCORES

The challenge of exceeding the High Score (either the factory setting or a higher score by another player) is the goal of many pinball game players. To keep a pinball game challenging requires a method of resetting the High Score value for those occasions when a skilled player registers a truly excellent score. Other players note this score and may decide not to play simply because their skill is not adequate to exceed an extremely high score.

For **ROLLERGAMES**, in fact, three methods of resetting the High Score values are available. The simplest method involves allowing Game Adjustment Item Ad 22 to reset the High Score values automatically after the specified number of plays designated by the operator. The second method requires pressing the High Score Reset switch on the inside of the coin door in the Attract Mode. This action simply erases the previous high score values and replaces them with the Backup High Score values. The third method establishes new values replacing the factory setting values or previous operator setting values; it requires performing the following steps:

1. Using AUTO-UP or MANUAL-DOWN, reach item Ad 14 (and items Ad 15, 16, and 17, if desired). The High Score value of the factory setting (or previous operator-adjusted setting) appears in the upper display. If this value is satisfactory, go to step 4 below.
2. If you wish to increase the High Score value from that displayed in the upper display, use AUTO-UP, and press the Credit button, until the desired value shows in the upper display.
3. If you wish to decrease the High Score value, use MANUAL-DOWN, and press the Credit button, until the desired value shows in the upper display.
4. Using AUTO-UP, press and hold down ADVANCE, until the lower display shows Ad 70 Press ADVANCE once, to return to Game- Over Mode.
5. Press the High Score Reset switch (on coin door), and listen for the sound signifying that the score reset action is complete. Observe player score displays to verify that the new High Score values are displayed.

GAME PRICING

PRICING MADE EASY. Game Adjustment Item Ad 24 allows the operator an easy method of setting the pricing functions. Pressing the Credit button allows the operator a choice of one of the 16 "Standard" Settings, with associated automatic pricing (the upper display shows the Country identifier, with a number for a country having more than one "Standard" Setting; the lower displays show the games per coin(s) information). In the Pricing Table, each "Standard" Setting is denoted by a Country Identifier. Automatic Pricing causes each of the other pricing items (columns 25 through 30) to change to the value shown in the table for that selected "Standard" Setting. In the table where the word "CUSTOM" appears, the owner/operator must enter the values shown (columns 25 through 30) to obtain the games per coin factor shown in the Games/Coin column of the table. To make these setting adjustments, the owner/operator must press the Credit button until the words "CUSTOM COINAGE" appear in the player score displays.

CUSTOM PRICING. Adjustment Item 24 must be set to the Custom Coinage Setting (upper display showing CUSTOM COINAGE) to enable the operator to enter desired custom pricing selections for Items 25 through 30, based on the Pricing Table. Item 25 is the left coin chute multiplier. Item 26 is the center coin chute multiplier. Item 27 is the right coin chute multiplier. Item 28 is the number of coin units equal to one Credit. (A Credit is usually equal to one game.)

The calculation of the ratio of Games : Price uses the ratio equation of $X : VC$, where:

X = Coin Chute Multiplier (Item 25, 26, or 27 in Pricing Table);

V = Value of coin;

C = Coin units equivalent to one Credit (Item 28).

For example, for 25¢ chutes at the factory setting, substituting values in the Games : Price ratio calculation gives 1 : 25 x 1, or one game for 25¢.

UNITS REQUIRED FOR BONUS CREDIT. Item 29 is the number of coin units that must pass through the coin chute(s) before an additional Credit (game) is posted (displayed). At the factory setting, the number in this item is 00. (This 00 means that NO bonus credit (free game) is awarded, although purchase of more than one game at a time occurs.)

MINIMUM COIN UNITS. Item 30 determines the number of coin units that must pass through the coin chute(s) before play may begin. The Factory Setting for this item is 00. (This 00 means that the Minimum Coin Units feature (Item 30) is disabled; a 01 setting also means that this feature is still disabled, yet the Credits message display should display fractional coin units.)

RollerGames Pricing Table

Country	Coin Chute			Games/Coin	Ad 24 Display	Pricing Functions					
	Left	Center	Right			25	26	27	28	29	30
USA and Canada	25¢	-	25¢	1/25¢, 4/\$1 ²	U.S.A. 1	01	04	01	01	00	00
				1/50¢, 2/75¢, 3/\$1 ^{1,2}	U.S.A. 2	03	12	03	04	00	00
				1/50¢, 2/\$1 ²	U.S.A. 3	01	04	01	02	00	01
				1/25¢, 3/\$1 ²	U.S.A. 4	01	00	01	02	04	01
				1/25¢, 3/50¢, 6/\$1	CUSTOM	01	04	01	01	02	00
				1/25¢, 5/\$1	CUSTOM	01	00	01	01	04	00
				1/50¢ ; Add'l game: 25¢	CUSTOM	98	00	98	99	00	00
Austria	5 Sch	10 Sch	10 Sch	1/2x5 Sch, 3/2x10 Sch ²	AUSTRIA	01	02	02	02	04	01
				2/5 Sch, 5/10 Schilling	CUSTOM	02	00	05	01	00	00
				2/5x1 Sch, 2/5 Sch, 5/10 Sch	CUSTOM	02	10	25	05	00	00
Australia	20¢	-	\$1	1/3x20¢, 2/\$1 ²	AUSTRAL.	02	00	10	05	00	00

GAME PRICING (Continued)

RollerGames Pricing Table (Continued)

Country	Coin Chute			Games/Coin	Ad 24 Display	Pricing Functions					
	Left	Center	Right			25	26	27	28	29	30
United Kingdom	10 P	50 P	1£	1/2x10 P, 3/50 P, 7/1£ ²	U.K.	03	15	30	05	30	00
	10 P	50 P	20 P	1/10 P, 5/50 P, 2/20 Pence	CUSTOM	03	15	30	05	30	00
Switzerland	1 F	2 F	5 F	1/1 F, 3/2 F, 7/5 Franc ²	SWISS	01	03	07	01	00	00
	1 F	-	2 F	1/1 F, 3/2 F	CUSTOM	03	00	06	02	00	00
Belgium	20 F	20 F	20 F	3/20 Franc ²	BELGIUM	03	03	03	01	00	00
	5 F	-	20 F	1/2x5 F, 2/20 Franc	CUSTOM	01	00	04	02	00	01
	5 F	20 F	20 F	1/2x5 F, 2/20 F, 2/20 F	CUSTOM	01	04	04	02	00	01
	5 F	5 F	20 F	1/2x5 F, 1/2x5 F, 2/20 F	CUSTOM	01	01	04	02	00	01
West Germany	1 DM	2 DM	5 DM	1/1 DM, 2/2 DM, 7/5 DMark ^{2,3}	GERMAN1	06	12	30	05	30	00
				1/1 DM, 2/2 DM, 6/5 DM ^{1,2}	GERMAN2	06	12	30	05	00	00
				1/1 DM, 3/2 DM, 9/5 DM	CUSTOM	09	18	45	05	00	00
				1/2x1 DM, 1/2 DM, 3/5 DM	CUSTOM	03	06	15	05	00	00
				2/1 DM, 5/2 DM, 14/5 DM	CUSTOM	13	26	65	05	65	00
Netherlands	1 Hfl	2.5 Hfl	2.5 Hfl	1/1 Hfl, 3/2.5 Holland Floorn ²	NETHERL	06	15	15	05	00	00
	25¢	-	1 G	1/25¢, 5/1 Guilder	CUSTOM	01	00	05	01	00	00
	1 G	-	1 G	1/1 Guilder ²	HOLLAND	01	00	01	01	00	00
Sweden	5 Kr	5 Kr	5 Kr	1/5 Krona ²	SWEDEN	01	01	01	01	00	00
	1 Kr	-	1 Kr	1/2x1 Krona	CUSTOM	01	04	01	02	00	01
France	1 F	5 F	10 F	1/3x1 F, 2/5 F, 5/10 Franc ^{1,2}	FRANCE	02	10	20	05	20	00
	1 F	5 F	10 F	1/2x1 F, 3/5 F, 7/10 Franc	CUSTOM	03	15	30	05	30	00
	5 F	10 F	10 F	1/5 F, 3/10 F, 7/2x10 Franc	CUSTOM	03	15	30	10	60	15
	5 F	10 F	10 F	2/5 F, 4/10 F, 9/2x10 Franc	CUSTOM	02	10	20	05	40	10
	5 F	10 F	10 F	2/5 F, 5/10 F, 11/2x10 Franc	CUSTOM	01	05	10	02	20	05
Italy	500 L	500L	500 L	1/500 Lire ²	ITALY	01	01	01	01	00	00
Spain	25 P	-	100P	1/25 P, 5/100 Peseta ²	SPAIN	05	00	20	04	00	00
	25 P	-	100P	1/25 P, 4/100 Peseta	CUSTOM	01	00	04	01	00	00
	25 P	-	100P	1/2x25 P, 2/100 Peseta	CUSTOM	01	00	04	02	00	00
	25 P	-	100P	1/2x25 P, 3/100 Peseta	CUSTOM	03	00	12	04	00	06
Japan	100 ¥	-	100 ¥	1/100 Yen ²	JAPAN	01	00	01	01	00	00
	-	100 ¥	-	2/100 ¥	CUSTOM	01	04	01	02	00	01
Antilles, Netherl.	25¢	-	1 G	1/25¢, 4/1 Guilder ²	ANTILLES	01	01	04	01	00	00
Chile	Token	-	Token	1/1 Token ²	CHILE	01	04	01	01	00	00
Denmark	1 Kr	5 Kr	10 Kr	1/2x1 Kr, 3/5 Kr, 7/10 Krone ²	DENMARK	03	15	30	05	30	00
Finland	1 Mka	-	5 Mka	1/2x1 Mka, 3/5 Markka ²	FINLAND	03	00	15	05	00	00
New Zealand	20¢	-	20¢	1/3x20¢ ²	N.Z.	01	00	01	03	00	01
Norway	1 Kr	-	1 Kr	1/2x1 Kr, 3/5x1 Krone ²	NORWAY	01	00	01	02	05	00
Argentina	10¢	10¢	10¢	1/1 Token ²	ARG	01	01	01	01	00	00
Greece	10D	20D	50D	1/2x10D, 1/20D, 3/50 Drachma ²	GREECE	03	06	15	05	00	00

Notes:

1. Factory Default. 2. Standard Setting - Change by pressing Credit button. 3. Other functions are also affected; see the explanations for Adjustment Items 53 through 58.

TEST/DIAGNOSTIC PROCEDURES

WILLIAMS ELECTRONICS GAMES also provides a series of diagnostic tests to aid the operator in determining game condition (that is, whether the game's features and highlights are operating satisfactorily). These tests activate virtually all the electronic and electromechanical devices comprising the game, so that the operator can readily locate a malfunctioning device or simply verify that all devices are working properly. In order, these tests deal with the music, the displays, the game sounds, the lamps, the solenoids, and the switches.

In addition to the diagnostic testing, a feature called the Auto Burn-in Mode is available. Activating this mode enables the operator to observe the game while all of the diagnostic tests, except the switch tests, occur. This can be very helpful in locating 'intermittent' problems.

Activating either the entire test series or one of the individual tests requires use of the Game Adjustment/Diagnostic switches. Open the coin door for access to these switches. To proceed to the Diagnostic Tests, the operator must simply switch the game On, set the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN, and press the ADVANCE button.

CAUTION

The System 11C game program greatly aids the operator and service personnel: At the beginning of the Test/Diagnostic Procedures (and also at game Turn-On), the player score displays now signal, with a message ("Press ADVANCE for Report") that the game program has detected a problem that affects game play. Messages for **ROLLERGAMES** include "Check Switch ##", "Pinball Missing", etc. Refer to the text on Problem Analysis Messages at the end of the Test/Diagnostic Procedures for more details concerning the messages' meaning. To proceed with the Test/ Diagnostic Procedures, use AUTO-UP, and press ADVANCE.

MUSIC TEST.

1. In the Music Test, observe that the upper displays show the message, MUSIC TEST. Switching to AUTO-UP, observe that the message now reads MUSIC OFF, and that the lower display shows 00 00. Press the Credit button to select the desired music selection: 01 through 07 (the selections repeat). Adjust the volume control for proper sound level for the game location.
2. Use the AUTO-UP position.

DISPLAY TEST.

1. To initiate the Display Test, press ADVANCE. Observe that upper display briefly shows the message, DISPLAY TEST, and that the lower display shows 01 (the Display Test identifier).
2. Use AUTO-UP. Observe that all displays begin a display cycle of all 0s through all 9s, one digit at a time. Verify that the proper comma segments light during display of the odd-numbered digits. Next, a special "all segments" character 'walks' from left to right across each player score display.
3. To halt the display cycle, use MANUAL-DOWN. Then, press ADVANCE to step through the sequential digit display, digit by digit, and the subsequent "all segments" characters display test. Use AUTO-UP to resume cycling, and to proceed to the next test.

SOUND TEST.

1. (From Display Test) To initiate the Sound Test, press ADVANCE. Observe that the upper displays show the message, SOUND TEST, and that the lower display shows 02 (the Sound Test identifier). The lower display shows a series of test steps from 00 through 07. Verify that a different sound is heard each time the number in the display changes.
2. To repeatedly pulse a single sound, use MANUAL-DOWN. Verify that one particular sound repeats. Press ADVANCE to step to the next sound, which repeats until ADVANCE is pressed again. Use AUTO-UP to resume cycling the sounds, and to proceed to the next test.

TEST/DIAGNOSTIC PROCEDURES (Continued)

LAMP TESTS.

1. All Lamps.

(From Sound Test) To initiate the first Lamps Test, press ADVANCE. Observe that the upper displays show the message, ALL LAMPS, and that the lower display shows 03 (All Lamps Test identifier) and that all feature lamps (playfield and backbox) blink on and off. (Note, however, that the General Illumination lamps remain lighted steadily.) To locate the wiring associated with a particular feature lamp, refer to the Lamp-Matrix Table. CPU Board connections at jacks 1J6 (columns) and 1J7 (rows) are also listed in the table.

2. Single Lamps.

From the All Lamps test, using AUTO-UP, press ADVANCE to initiate the Single Lamps Test. The upper displays initially show the message, SINGLE LAMPS, and the lower display shows 04. Then, the lower display shows 04 01, and the upper displays change to show "W", the name of the lamp currently blinking. Press the START button to proceed through an ascending series of designator numbers (01 through 64), with the upper displays showing the individual lamp's name. (To proceed through a descending series of lamp identifiers, use MANUAL-DOWN.) Press and hold the START button to proceed rapidly to the desired lamp.

RollerGames Lamp-Matrix Table

COLUMN ROW	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 RED- 1 BRN 1J6-1	W 1	Track 8 9	Track 13 17	S L Dr Tgt 25	Bad Attitude Team 1 33	Top Standup 3 41	W Top Dr Tgt 49	Track 1 57
Q81 RED- 2 BLK 1J6-2	I 2	Track 11 10	Track 10 18	K L Dr Tgt 26	Maniacs Team 2 34	Top Standup 2 42	A Top Dr Tgt 50	Track 2 58
Q82 RED- 3 ORN 1J6-3	L 3	Track 4 11	Track 6 19	A L Dr Tgt 27	Violators Team 3 35	Top Standup 1 43	R Top Dr Tgt 51	Track 3 59
Q83 RED- 4 YEL 1J6-5	L 4	Bonus 2X 12	Track 9 20	T L Dr Tgt 28	Rockers Team 4 36	Extra Ball 44	Jackpot (Ramp Entry) 52	Track 5 60
Q84 RED- 5 GRN 1J6-6	I 5	Track 7 13	Skate Again 21	E L Dr Tgt 29	Hot Flash Team 5 37	Special (2) (Outlanes) 45	Lock (Ramp Entry) 53	Track 14 61
Q85 RED- 6 BLU 1J6-7	A 6	Bonus 1X 14	Left Jetway 22	BR Standup A 30	T-Birds Team 6 38	J (Top Lane) 46	Million (Ramp Entry) 54	Track 15 62
Q86 RED- 7 VIO 1J6-8	M 7	Bonus 4X 15	Roller Motion (Ball Popper) 23	BR Standup B 31	Williams Bonus (Popper) 39	E (Top Lane) 47	Magnet (2) 55	Track 16 63
Q87 RED- 8 GRY 1J6-9	S 8	Track 12 16	Right Jetway 24	BR Standup C 32	Lites Jetway (Return Lanes) (2) 40	T (Top Lane) 48	Atomic Whip (Left Outlane) 56	Track 17 64

BR = Bottom right; BL = Bottom Left ○ = Multiple Lamps

TEST/DIAGNOSTIC PROCEDURES (Continued)

SOLENOID TEST.

- (From Lamp Test) Using AUTO-UP, press ADVANCE. Observe that the upper display shows the message, COIL TEST, the lower display shows 05 (Solenoid Test identifier). Next, the lower display shows a series of test steps from 01 through 27, while the upper display shows the solenoid/circuit name. During each of these steps, pulsing of the respective solenoid/circuit occurs. The test cycles repeatedly, unless halted via the MANUAL-DOWN switch. Refer to the **Solenoid Table** for solenoid numbers and wiring information. CPU Board connections at 1P11, 1P12, and 1P19 are also listed in the table. (NOTE: Solenoids 23 - 27 connect from the "Sound Overlay Solenoid" Board)

To continuously pulse a single solenoid/circuit, use MANUAL-DOWN. Press ADVANCE to sequence through the switched, controlled, and special solenoids. Use AUTO-UP to resume test cycling, and to proceed to the next test.

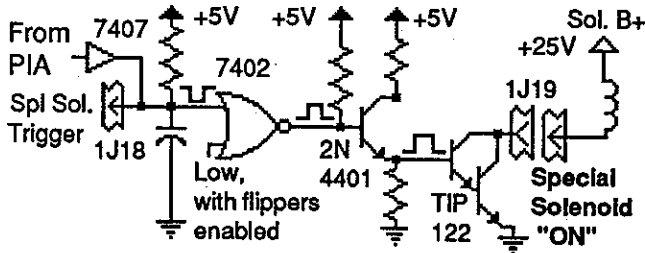
RollerGames Solenoid Table

Sol. No.	Function	Solenoid Type	Wire Color	Connections		Driver Trnstr	Solenoid Part Number Flashlamp Type	
				CPU Bd	Playfield/ Cabinet		g= B'glass; p=Pl'field	
01A ³	Outsole Kicker	Switched	Vio-Brm	1P11-1	5J1-9: 5J4-9 (A)	Q33	AE-23-800	
01C ³	Flash 1	Switched	Blk-Brm	(Gry-Brm)	5J5-9 (C)	Q33	#89/906 flashlamps 4p	
02A ³	Shooter Lane Feeder	Switched	Vio-Red	1P11-3	5J1-7: 5J4-8 (A)	Q25	AE-23-800	
02C ³	Flash 2	Switched	Blk-Red	(Gry-Red)	5J5-8 (C)	Q25	#89/906 flashlamps 2p,1g	
03A ³	Not Used	Switched	Vio-Orm	1P11-4	5J1-6: 5J4-7 (A)	Q32		
03C ³	Flash 3	Switched	Blk-Orm	(Gry-Orm)	5J5-7(C)	Q32	#89/906 flashlamps 1p,2g	
04A ³	Ball Popper	Switched	Vio-Yel	1P11-5	5J1-5: 5J4-6 (A)	Q24	AE-24-900	
04C ³	Flash 4	Switched	Blk-Yel	(Gry-Yel)	5J5-5 (C)	Q24	#89/906 flashlamps 1p,2g	
05A ³	Not Used	Switched	Vio-Grm	1P11-6	5J1-4: 5J4-5 (A)	Q31		
05C ³	Flash 5	Switched	Blk-Grm	(Gry-Grm)	5J5-4 (C)	Q31	#89/906 flashlamps 2p,2g	
06A ³	3-Bank Drop Target Reset	Switched	Vio-Blu	1P11-7	5J1-3: 5J4-4 (A)	Q23	AE-26-1200	
06C ³	Flash 6	Switched	Blk-Blu	(Gry-Blu)	5J5-3 (C)	Q23	#89/906 flashlamps 1p,2g	
07A ³	Knocker (in Backbox)	Switched	Vio-Blk	1P11-8	5J1-2: 5J4-2 (A)	Q30	AE-23-800	
07C ³	Flash 7	Switched	Blk-Vio	(Gry-Vio)	5J5-2 (C)	Q30	#89/906 flashlamps 1p,2g	
08A ³	Lock Diverter	Switched	Vio-Gry	1P11-9	5J1-1: 5J4-1 (A)	Q22	AE-24-900	
08C ³	Flash 8	Switched	Blk-Gry	(Gry-Blk)	5J5-1 (C)	Q22	#89 flashlamps 3p	
09	Flash 9	Controlled	Bm-Blk	1P12-1	5J2-9: 5J6-9: 2J4-3	Q17	#89/906 flashlamps 1p,2g	
10	Insert Bd Gen'l Illum Relay	Controlled	Bm-Red	1P12-2	5J2-8: 5J6-8: 2J4-5	Q9	5580-09555-01 ^{4a}	
11	Playfield Gen'l Illum Relay	Controlled	Bm-Orm	1P12-4	5J2-6: 5J6-7: 2J4-6	Q16	5580-12145-00 ^{4b}	
12	A/C Select Relay	Controlled	Bm-Yel	1P12-5	5J2-5	Q8	5580-09555-01 ⁵	
13	Upper Kickback	Controlled	Bm-Grm	1P12-6	5J2-4: 5J6-5	Q15	AE-23-800	
14	Lock Kickback	Controlled	Bm-Blu	1P12-7	5J2-3: 5J6-3	Q7	AE-23-800	
15	Left Kicker ("sling")	Controlled	Bm-Vio	1P12-8	5J2-2: 5J6-2	Q14	AE-23-800	
16	Right Kicker ("sling")	Controlled	Bm-Gry	1P12-9	5J2-1: 5J6-1	Q6	AE-23-800	
17	Left Jet Bumper	Special #1	Blu-Brm	1P19-7	5J3-7: 5J7-7	Q75	AE-23-800	
18	Ramp Diverter	Special #2	Blu-Red	1P19-4	5J3-6: 5J7-6	Q71	AE-23-800	
19	Right Jet Bumper	Special #3	Blu-Orm	1P19-3	5J3-3: 5J7-3	Q73	AE-23-800	
20	Outlane Kickback	Special #4	Blu-Yel	1P19-6	5J3-4: 5J7-5	Q69	AE-23-800	
21	Lower Jet Bumper	Special #5	Blu-Grm	1P19-8	5J3-2: 5J7-2	Q77	AE-23-800	
22	Deep Freeze Magnet	Special #6	Blu-Blk	1P19-9	5J3-1: 5J7-1	Q79	B-13522	
-	<u>Right Flipper</u>	-	Om-Vio	1P19-1	2J5-5: 2J10-7	-		
-	Lower Right Flipper	-	[Blu-Vio] ²		[2J10-1: 2J8-15]	-	FL11630/50VDC	
-	Upper Right Flipper	-	[Blu-Yel] ²		[2J10-3: 2J8-13]	-	FL11630/50VDC	
-	<u>Left Flipper</u>	-	Om-Gry	1P19-2	2J5-4: 2J10-8	-		
-	Lower Left Flipper	-	[Blu-Gry] ²		[2J10-2: 2J8-14]	-	FL11630/50VDC	

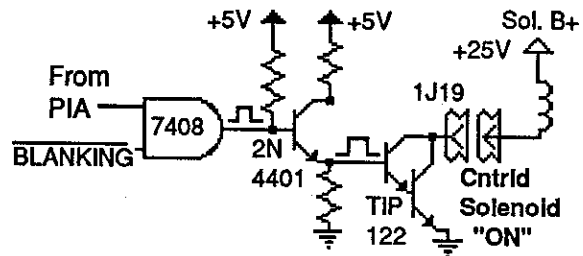
Notes: 1. Wire colors, except flipper Om-Vio and Om-Gry, are ground connections (to coil terminal with unbanded end of diode). Flipper Om-Vio and Om-Gry wires connect from CPU Board to flipper switch. 2. Flipper connections shown in braces are from flipper switch to flipper coil. 3. "A" circuits are pulsed, when Sol. 12 is de-energized; "C" circuits are pulsed, with Sol. 12 energized. Wire colors in brackets are those from respective A and C terminals corresponding to the J1-terminal connection listed for the Aux Power Driver Bd, which controls the device pulsing by Sol. 12. 4. Relay is mounted on Relay Bd, (4a) p/n C-11998-1; (4b) C-11902-1. 5. Relay is mounted on Aux Power Driver Bd, D-12247 in the backbox. 6. Transistor designations refer to the Sound Overlay Solenoid Board parts.

TEST/DIAGNOSTIC PROCEDURES (Continued)

"On" State Logic - Special Solenoid



"On" State Logic - Controlled Solenoid



"Off" State - Special Solenoid:

The Special Switch Trigger Input goes low. Meanwhile, the PIA line remains high. The remaining signals reverse their states.

"Off" State - Controlled Solenoid:

The Enable Input (from the PIA) goes low. Meanwhile, the BLANKING signal remains high. The rest of the signals reverse their states.

NOTE

As directed by the game program, the Solenoid A/C Select Relay (solenoid 12) switches the solenoid B+ power between two power busses to permit actuating two groups of solenoids at the proper times. In its de-energized state, the Relay connects the 'circuit A power' to 16 "controlled" and "switched" solenoids (identified in the table with no suffix letter or the letter A, after the solenoid number). Individual solenoid operation then depends on the game program enabling the ground path for solenoid actuation via the driver transistor associated with each solenoid circuit. For example, the game program can actuate the Outhole Kicker solenoid (sol. 01A), via the driver transistor Q33.

When the game program determines that the Solenoid A/C Select Relay (sol. 12) must be energized, the relay connects 'circuit C power' to eight group C solenoids (01C through 08C). Now, driver transistor Q33 can actuate the Flash 1 circuit (sol. 01C). Using this "multiplexing" technique, the same driver transistor can control actuation of two separate (A side and C side) solenoid circuits.

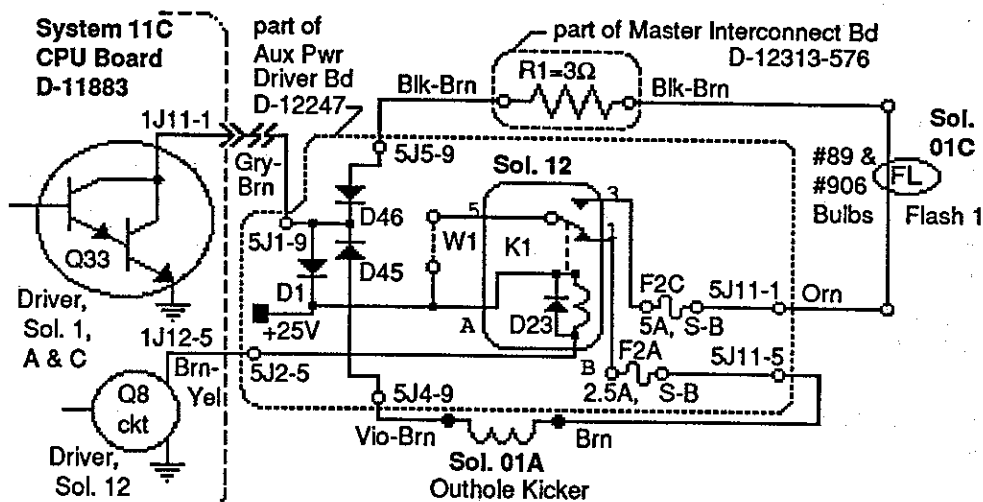


Figure 4. Typical Solenoid A/C Select Relay Circuit, showing the function of Solenoid 12, the Solenoid A/C Select Relay.

TEST/DIAGNOSTIC PROCEDURES (Continued)

SWITCH TESTS.

1. Switch Levels.

(From Solenoid Test) To initiate the Switch Levels Test, press ADVANCE. Observe that the upper display shows the message, SWITCH LEVELS, and the lower display shows 06 (Switch Levels Test identifier). Normally, the right portion of the lower display remains blank, indicating that no switch is actuated.

If, however, a switch *is* actuated (possibly stuck closed), the lower display shows that switch's number, while the upper displays indicate the switch's name. A sound also accompanies the displays. (This is another facet of the **ROLLERGAMES** game program's switch testing capability.) If more than one switch is closed, a series of displays show each actuated switch's name and number.

(In addition, either of these problems could result in the reporting of a switch problem (or problems) at game Turn-On or at the beginning of Diagnostic Tests.)

As soon as the operator opens a closed switch, its name and number are eliminated from the Switch Levels display series. For **ROLLERGAMES**, switch numbers can range from 01 through 64. Refer to the **Switch-Matrix Table** for switch numbers and wiring information. CPU Board connections at jacks 1J8 (columns) and 1J10 (rows) are also listed in the table.

RollerGames Switch-Matrix Table

COLUMN ROW	1 Q45 GRN-BRN 1J8-1	2 Q49 GRN-RED 1J8-2	3 Q44 GRN-ORN 1J8-3	4 Q48 GRN-YEL 1J8-4	5 Q43 GRN-BLK 1J8-5	6 Q47 GRN-BLU 1J8-7	7 Q42 GRN-VIO 1J8-8	8 Q46 GRN-GRY 1J8-9
1	WHT-BRN 1J10-9 Plumb Bob Tilt 1	Outhole 9		5-Bank Dr Tgt S 25	BL Kicker ("sling") 33	(Top Standup) 1 41	W Top Dr Tgt 49	Flipper Right 57
2	WHT-RED 1J10-8 C Side Power A/C Relay 2		Right Return Lane 18	5-Bank Dr Tgt K 26	BR Kicker ("sling") 34	(Top Standup) 2 42	A Top Dr Tgt 50	Flipper Left 58
3	WHT-ORN 1J10-7 Game Start 3	Ball Trough #3 (left) 11	Right Outlane 19	5-Bank Dr Tgt A 27	Left Jet Bumper 35	(Top Standup) 3 43	R Top Dr Tgt 51	
4	WHT-YEL 1J10-6 Right Coin Chute 4	Ball Trough #2 (mid) 12	Shooter Lane 20	5-Bank Dr Tgt T 28	Right Jet Bumper 36	EXTRA BALL 44	Ramp Lock Entry 52	
5	WHT-GRN 1J10-5 Center Coin Chute 5	Ball Trough #1 (right) 13	L Jetway Top 21	5-Bank Dr Tgt E 29	Lower Jet Bumper 37		Ball Lock 1 53	
6	WHT-BLU 1J10-3 Left Coin Chute 6		R Jetway Top 22	A (BR Standup) 30	Ramp Diverter 1 38	J (Top Lane) 46	Ball Lock 2 54	
7	WHT-VIO 1J10-2 Slam Tilt 7		Left Spinner 23	B (BR Standup) 31	Ramp Diverter 2 39	E (Top Lane) 47		
8	WHT-GRY 1J10-1 High Score Reset 8	Ball Popper 16	Right Spinner 24	C (BR Standup) 32	Left Outlane (Lower L Kickback) 40	T (Top Lane) 48	Left Return Lane 56	

BL = Bottom Left BR = Bottom Right

Row Problems. If a display of two (or more) switch numbers of a row occurs, although only one switch is closed, check for a short circuit between the column wires.

Multiple Switch Number Indications. Check the associated column wire for a short circuit to ground.

Column Problems. If display of two (or more) switch numbers in a column occurs (while only one switch is actuated), check for a short circuit between the row wires.

Use AUTO-UP to proceed to the next test.

TEST/DIAGNOSTIC PROCEDURES (Continued)

SWITCH TESTS (Continued).

2. Switch Edges.

From the Switch Levels Test, press ADVANCE. Observe that the upper display shows the message, SWITCH EDGES; the lower display shows 07 (Switch Edges Test identifier). The right portion of the lower display is blank, indicating that no switch is actuated.

This test permits the operator to test whether actuating a switch provides the proper signal to the System 11C switch testing program. When actuating a switch, the operator should see the switch's name and number in the displays. If no indication appears at the time the switch is actuated, the operator then knows that there is a malfunction associated with that switch.

Using this technique, the operator can test each switch appearing in the **ROLLERGAMES** switch problem reporting displays (either at game Turn-On or at the beginning of the Diagnostic Tests) to determine whether the switch can be actuated. If the switch's name and number are displayed while the operator checks its operation, the operator then knows that the reported problem with that switch is NOT currently caused by a switch malfunction. The operator can then seek other causes for the reported problem, being almost certain now that the switch did not fail. This test is also useful when the operator is adjusting the sensitivity of a particular switch's actuation mechanism.

Among the possibilities is the fact that the players have not actuated that switch because of some other problem; the operator should try to analyze what could cause the switch to be missed during game play, and remedy that problem cause. With these new tests, switch problems are, therefore, more easily isolated.

3. **Playfield or CPU Board?** To determine whether a switch problem is in the playfield or the CPU Board, remove connectors 1P8 and 1P10 from the CPU Board. Begin the Switch Test. Use a jumper wire to simulate switch actuation. For example, placing a jumper between 1J10-9 and 1J8-2 should (based on the Switch-Matrix Table) should produce an indication of switch 09 being actuated.

ENDING THE DIAGNOSTIC TESTS.

To end the Diagnostic Tests, reach the C-Side Test (08 in the lower display), use AUTO-UP and press ADVANCE. The backbox displays should show the **ROLLERGAMES** game's Identification Information (the Id00 screen). Use MANUAL-DOWN, and press ADVANCE to reach Adjustment Item 70 (INSTALL FACTORY). Use AUTO-UP, and press ADVANCE to go to the Attract Mode.

AUTO BURN-IN MODE.

The Auto Burn-in Mode permits the operator to check intermittent (or nonrecurring) problems associated with most portions of the game's circuitry. Repeatedly cycling through a group of tests can sometimes bring a problem, which occurs only randomly or occasionally, to exhibit itself more frequently, thereby aiding in the isolation of the problem. To activate the Auto Burn-in Mode:

1. While in the Game Adjustments, reach Ad 67 and change the Factory Setting of NO to YES, via the Credit button. Set the AUTO-UP/MANUAL-DOWN switch to AUTO-UP.
2. Press ADVANCE to start the Auto Burn-in Mode. This mode repeatedly sequences through the Music Test, the Display Test, the Sound Test, the All Lamps portion of the Lamp Test, and the Solenoid Test.
3. To halt the Auto Burn-in Mode, switch the game Off and then On. **ROLLERGAMES** now starts in the Attract Mode. (If a switch problem is now reported by the displays, perform the Switch Tests again to determine the nature of the problem; then, perform necessary repairs.)

TEST/DIAGNOSTIC PROCEDURES (Continued)

SYSTEM 11C MEMORY CHIP TEST.

A new feature is now included in the Memory Chip Test for System 11C. During power-up, the CPU performs a self-testing routine. When all tests are satisfactory, the game proceeds to the Attract Mode, allowing players to use the game. Whenever a portion of the testing does not produce satisfactory results, the game displays a message, before proceeding to the next portion of the testing. ONLY after all tests are satisfactory does the game allow play to begin.

In addition to the displayed message, when any part of the self-test routine fails, LED2 ('DIAGNOSTIC'), mounted on the CPU Board, can be observed to determine the probable cause of the problem. This LED blinks, or flashes, a certain number of times to identify the probable cause, as described in the **CPU LED Indicator Codes Table**. The operator can also start the self-test routine by pressing the CPU Diagnostic Switch (SW 2) on the edge of the CPU Board.

CPU LED Indicator Codes Table

Diagnostic LED		
Blinks/ Flashes	CPU Problem	Explanation
1	U25 RAM FAILURE	U25 RAM could not be used properly (NO other tests are performed; the game is locked here, until the game is turned off).
2	MEM. PROT. FAILURE	This message means that (A) the Coin Door may be shut; (B) the Memory Protect Switch may be stuck in the ON position; (C) the memory protect logic is protecting the memory; or (D) a U25 RAM failure is occurring. (See Note 1)
3	U51 PIA FAILURE	U51 has a malfunction. (See Note 2)
4	U38 PIA FAILURE	U38 has a malfunction. (See Note 2)
5	U41 PIA FAILURE	U41 has a malfunction. (See Note 2)
6	U42 PIA FAILURE	U42 has a malfunction. (See Note 2)
7	U54 PIA FAILURE	U54 has a malfunction. (See Note 2)
8	U10 PIA FAILURE	U10 has a malfunction. (See Note 2)
9	IRQ FAILURE	IRQ has a malfunction. It may be missing or too fast or too slow.
10	U27 ROM FAILURE	U27's internal checksums do not match. It may be a ROM failure, or its associated connections and connecting devices are causing it to appear to have a problem. (The following U26 test is skipped.)
11	U26 ROM FAILURE	U26's internal checksums do not match.

Notes: 1. This test assumes that the Coin Door is OPEN; it is initiated ONLY by pressing the CPU Diagnostic Switch (SW2).
 2. Alternatively, its associated connections or connecting devices are causing the IC to appear to have problems.

TEST/DIAGNOSTIC PROCEDURES (Continued)

SYSTEM 11C SOUND CIRCUITRY TESTS.

Testing of the System 11C Sound circuitry, including the Audio Board, is possible only after successful completion of the System 11C Memory Chip Test.

Audio Board Test. The game program conducts a brief check of the Audio Board (D-11581) circuitry at game Turn-on; the game program reports the test results by brief sounds, as follows: No sound = Audio Board is not operating, or a failure is affecting the sound circuitry (broken cable; dead amplifier; etc.); 1 sound = system OK; 2 sounds = RAM problem; 3 sounds = U4 problem; 4 sounds = U19 problem; 5 sounds = U20 problem.

NO SOUND DURING THIS TEST (but sound can be heard during the Diagnostic Tests).

Check the -12 V supply voltage on the Audio Board. If this -12V dc voltage is low (or AC ripple seems too high), perform the following checks:

1. The gray and gray-green transformer secondary wires for 19.4 V ac.
2. The CPU Board filter capacitor C26 for -12 V dc.
3. The filter capacitor C26 for excessive AC ripple (over 0.75V ac).

If the previous checks did not isolate the problem, turn the Volume Control for maximum output. Momentarily touch a powered-up AC soldering pencil on the center tap of the Volume Control.

CAUTION

DO NOT use a soldering iron over 40 watts. Note also that cordless soldering irons will NOT work for this test.

Hearing a low hum or a 'click' indicates that the power amplifier (U1, TDA2002), the Volume Control, and the speaker are operating satisfactorily, as is the sound circuit cabling. Not hearing a sound requires repeating the test with the Volume Control turned part way down, to determine whether the Volume Control is faulty. Also, check the cable connectors for proper mating, and that no broken wires affect this circuit.

PROBLEM ANALYSIS MESSAGES

The System 11C game program has a great capability to aid the operator and service personnel: At Game Turn-on (and also at the beginning of the Test/Diagnostic Procedures) after the game has been operating for an extended period, the player score displays now may signal with a message, "Press **ADVANCE** for Report", that the game program has detected a possible problem with the game.

To obtain details of the problem, open the coin door and press the AUTO-UP/MANUAL-DOWN switch to MANUAL-DOWN. Press the **ADVANCE** button to begin displaying the message(s). The following messages apply to your **ROLLERGAMES** game.

Adjust Failure. This message indicates a problem with the setting of Game Adjustments. For example, if the game operator changes Adjustment Item settings by selecting Yes for AD 70 (Install Factory) and then closes the coin door before the appearance of the **FACTORY SETTING** message, the game will display the **ADJUST FAILURE** message to indicate that the resetting of the Adjustment Items did not occur properly. As mentioned earlier in the Game Adjustment Procedure text (near Ad 70), other factors can also cause this message to appear.

Check Switch ##. This message indicates that at least one switch was stuck 'On' at game turn-on or has NOT been actuated during ball play (for 90 balls or ~30 games) by displaying the message "**Check Switch ##**", listing each problem switch by number. (The game program compensates the game play requirements affected by each disabled switch to allow 'nearly normal' play. This helps keep **ROLLERGAMES** earning, until the service technician can repair the problem, bringing the game back to its normal good profits!)

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

Pinball Missing. ROLLERGAMES normally uses three balls; however, it will operate with two balls. This message announces that a ball is missing or stuck somewhere. 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 (#11, #12, or #13) or the Shooter Lane switch (#20).

Coin Door Slam Switch Stuck. This message indicates that the Slam Tilt 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 and should be cleared to permit proper game operation.

MAINTENANCE INFORMATION

Regular maintenance is essential to a game's continuing contribution to the operator's earnings.

LUBRICATION

The two main lubrication points of the Left and Right Kickers ("Slingshots") mechanism are the pivots for the Kicker Arm. 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. A medium viscosity oil (20W or 30W) is very satisfactory for these devices.

Lubrication to ensure proper operation also applies to the target blades of the 3-Bank and 5-Bank Drop Targets. MBI Instrument Grease, also known as Drop Target Switch Lubricant, with a Williams' part number of 20-8886, is a recommended lubricant.

SWITCH CONTACTS

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 button switches and the End of Stroke (EOS) switch on the flipper tend to suffer from pitting caused by the high current in this circuit. Weak or "slow" flipper action is the result of this pitting. Carefully restore the surface of the flipper switch contact with a very fine contact file; finish the surface restoration with a contact burnishing tool. This should bring the flipper action back to its usual 'snappy' action. The contact surfaces of these switches should be adjusted to enable the maximum area of contact during switch closure. This allows the current flowing through these switches to be at the designed, peak value for best flipper action.

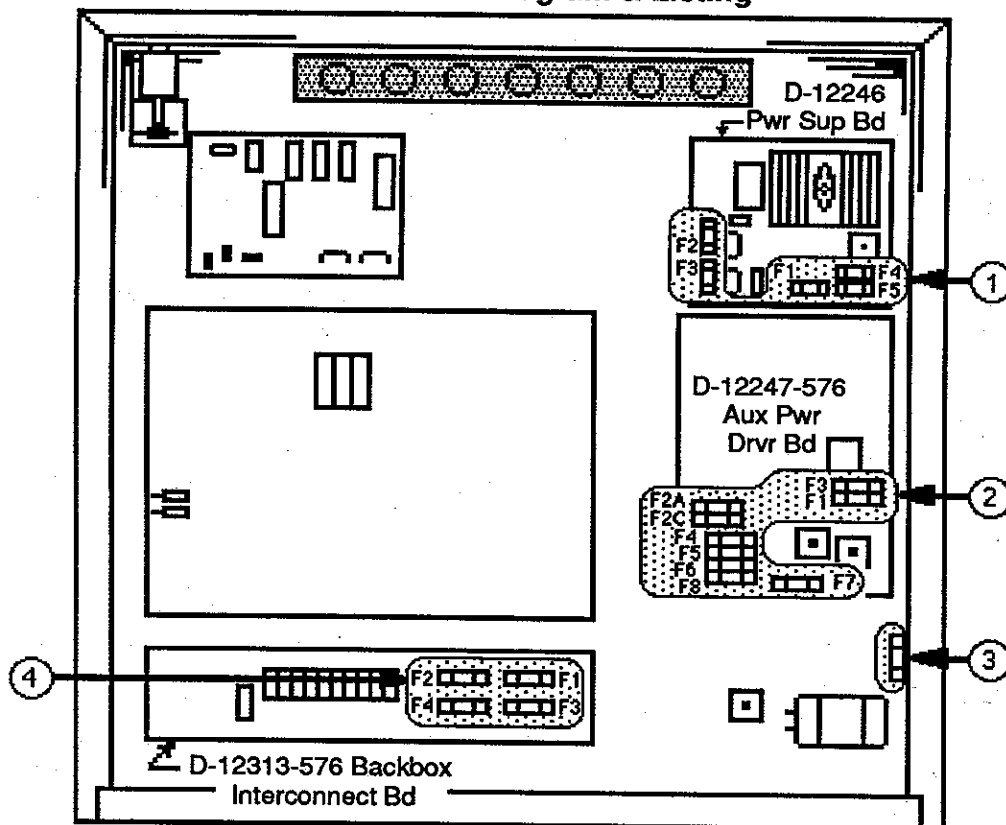
CLEANING

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. 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 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.

Fuse Listing

Fuse Locations Diagram & Listing



Item	Part Number	Description	Circuit/Location
1	5731-12328-00	Fuse, 3/8A., Slow-Blow (S-B), 250V	F1; D-12246 Power Supply Board
1	5731-12327-00	Fuse, 1/8A., S-B, 250V	F2, F3; D-12246 Power Supply Board
1	5731-09432-00	Fuse, 7A S-B, 250v	F4, F5; D-12246 Power Supply Board
2	5731-09128-00	Fuse, 2-1/2A., S-B, 250v	F2A, F3, F4; D-12247 Aux Pwr Driver Board
2	5731-09651-00	Fuse, 5A., S-B, 250v	F1, F2C; D-12247 Aux Pwr Driver Board
2	5731-08665-00	Fuse, 2A., S-B, 250v	F5, F6; D-12247 Aux Pwr Driver Board
2	5731-06314-00	Fuse, 4A., S-B, 250v	F7; D-12247 Aux Pwr Driver Board
2	5731-09432-00	Fuse, 7A., S-B, 250v	F8; D-12247 Aux Pwr Driver Board
3	5730-09071-00	Fuse, 8A., Normal-Blow (N-B), 32v	+18 Vdc Lamp Ckt/ Lwr Rt B'box fuseholder (1)
4	5731-09651-00	Fuse, 5A., S-B, 250v	F1 - F4; Gen. Illumin/B'box Interconnect Board
5	5731-09651-00	Fuse, 5A., S-B, 250v	F1; C-13088 Triac Assembly Board
-	5730-09252-00	Fuse, 8A., N-B, 125v	Input ("high voltage") Power Line/Cabinet Box*

* One 4A., S-B, 250v fuse (5731-06314-00) is provided for an overseas (220v) game installation.

Concerning the fuses listed as item 2, F1 protects the +25V dc Special Solenoid circuit connected via the Red-White wires, including the Left, Right, and Lower Jet Bumpers for ROLLER GAMES. F2A protects the "A" Solenoids connected with Brown wires, including the Outhold Kicker, Shooter Lane Feeder, and the Lock Diverter. F2C protects the "C" Solenoids connected with Orange wires, including Flash 1 through Flash 8 circuits. F3 protects the Controlled Solenoids connected with Red wires, including Flash 9, Insert Bd General Illumination Relay, Playfield General Illumination Relay, and the Left and Right Kickers. F4 protects the +50V Solenoids connected with Violet-Yellow wires, including Upper Kickback, Lock Kickback, Ramp Diverter, Outlane Kickback, and the Deep Freeze Magnet. F5 protects the Lower and Upper Right Flippers. F6 protects the Lower Left Flipper. F7 protects the input to the +50V dc rectifier, and F8 protects the input to the +25V dc rectifier on the Aux Power Driver Board.

Section 2 Game Parts Information

- **Parts Lists & Diagrams**

Locations:

Game Circuit Boards and Major Mechanisms

Power Supply Board (D-12246)

Aux Power Driver Board (D-12247-576)

Backbox Interconnect Board (D-12313-576)

Audio Board (D-111581-576)

System 11C CPU Board (D-11883-576)

Master Display Board (D-12232-1)

7-Segment Display & Lamp Boards

All Major Assemblies of ROLLERGAMES

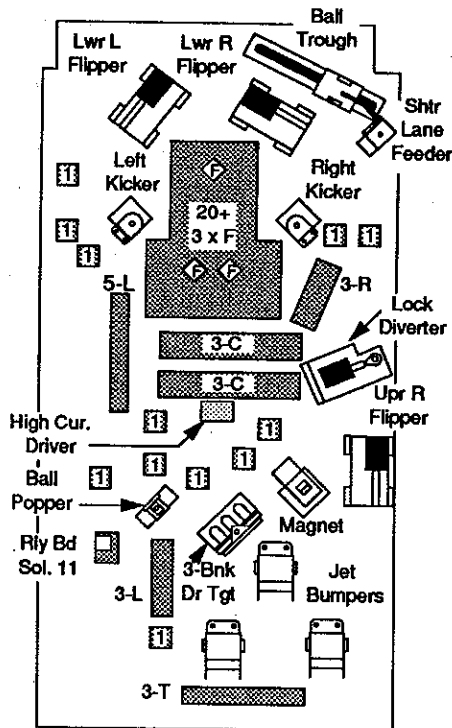
Solenoids/Flashers & Rubber Parts

Switches

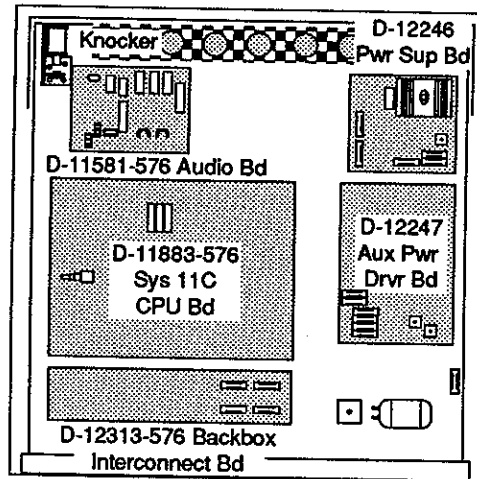
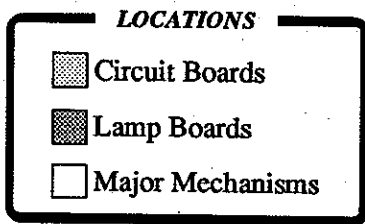
Lamps

Playfield Parts

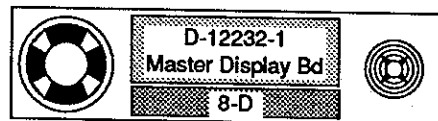
Locations Diagram - Game Circuit Boards and Major Mechanisms



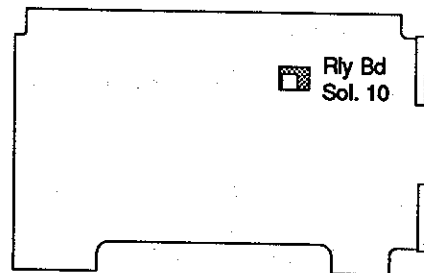
*Under Side of Playfield,
Viewed in Raised Position*



Backbox



Display/Speaker Panel, Rear View

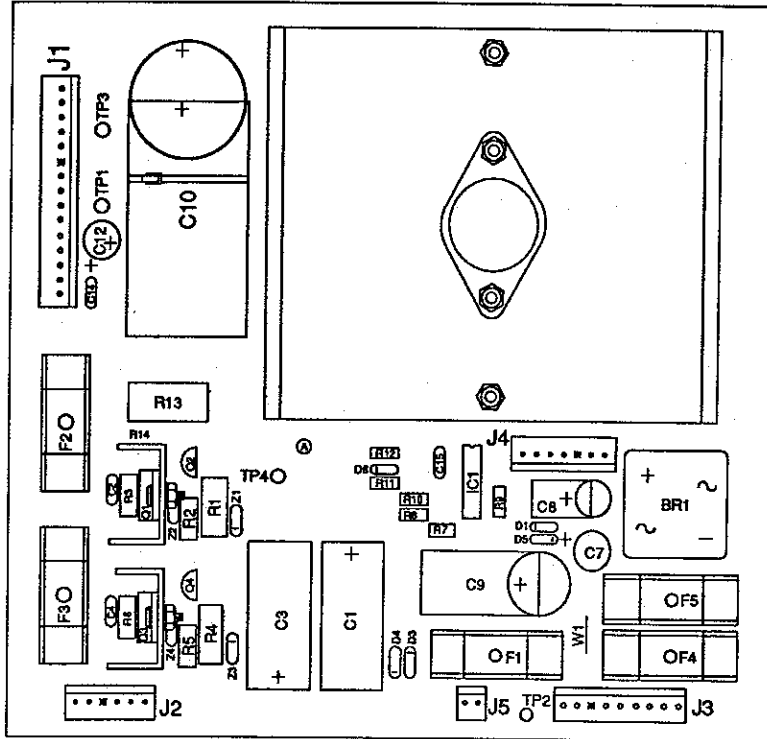


Insert Board, Inner Side View

- | | | | |
|-------------|----------------------------------|-------------|------------------------------------|
| B-8039-2 | Outhole Kicker (under Btm Arch) | C-11223-1 | 3-Bank Drop Target |
| C-11626-L-3 | Lower Left Flipper | C-13205 | 3-Bank Opto Board |
| C-11626-R-3 | Lower Right Flipper | C-11998-1 | Relay Board (Sol. 11 Gen. Illum) |
| C-9638 | Shooter Lane Feeder | B-9414-1 | Jet Bumper (3 total) |
| B-9362-L-1 | Coil & Bracket Assembly | B-9415-1 | Bumper Coil & Bracket Assembly (3) |
| B-12224 | Lamp Board ("1") | C-12709 | Lamp Board ("3-L") |
| C-13374 | Lamp Board ("20 + 3 x "F") | C-12000 | Lamp Board ("3-T") |
| C-13375 | Lamp Board ("F") | | |
| B-12665 | Left & Right Kicker Arm Assembly | B-10686-1 | Knocker Assembly |
| B-9362-R-1 | Coil & Bracket Assembly | D-11581-576 | Audio Board |
| B-9362-L-1 | Coil & Bracket Assembly | D-12246 | Power Supply Board |
| C-13361 | Lamp Board ("3-R") | D-11883-576 | System 11C CPU Board |
| C-13362 | Lamp Board ("5-L") | D-12247-576 | Aux Power Driver Board |
| C-13425 | Lamp Board ("3-C") | D-12313-576 | Backbox Interconnect Board |
| B-13496 | Lock Diverter Assembly | | |
| B-13494 | Diverter Arm & Shaft Assembly | D-13536 | Spkr/Display/Lamp Panel Assembly |
| C-13509 | High Current Driver Assembly | C-13537 | Lamp Board ("8-D") |
| B-13520 | Magnet Assembly | D-12232-1 | Master Display Board |
| C-13723 | Upper Right Flipper | C-11998-1 | Relay Board (Sol. 10 Gen. Illum) |

Power Supply

p/n D-12246



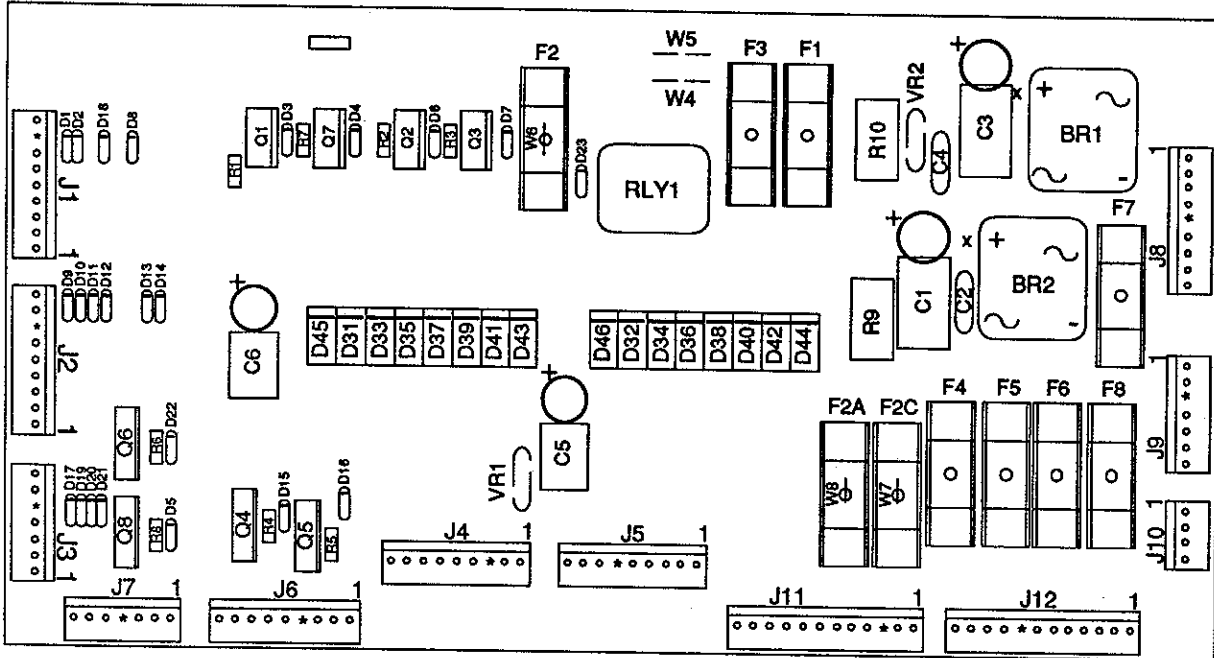
Item	Part No.	Ckt Symbol	Description	Item	Part No.	Ckt Symbol	Description
1	5765-12317-00		Power Supply PCB	26	5075-09060-00	ZR2, ZR4	Zener, 1N4764, 100v, 1w
2	5733-12060-01	F1-F5	Fuse Holder	27	5460-09424-00	IC1	IC, Volt. Reg., MC1723C5
3	5731-09432-00	F4, F5	Fuse, 7A., S-B, 250v	28	5010-09069-00	R3, R6	Resistor, 330K, 5%, 1/2w, C.F.
4	5731-12328-00	F1	Fuse, 3/8A., S-B, 250v	29	5010-10631-00	R2, R5	Resistor, 1.2K, 5%, 1/2w
5	5730-12327-00	F2, F3	Fuse 1/8 A., 250v	30	5010-09536-00	R1, R4	Resistor, 39K, 5%, 1w
6	5791-10862-15	J1	Connector, 15-pin Hdr	31	5013-09426-00	R7	Resistor, 2.15K, 1%, 1/4w, C. F.
7	5791-10862-06	J2	Connector, 6-pin Hdr	32	5013-09427-00	R8	Resistor, 4.99K, 1%, 1/4w, C. F.
8	5791-10862-09	J3	Connector, 9-pin Hdr	33	5010-09541-00	R9	Resistor, 2.7K, 2%, 1/4w, C. F.
9	5100-09690-00	BR1	Bridge Rectifier, 35A., 200V	34	5010-09085-00	R10	Resistor, 1.5K, 5%, 1/4w, C. F.
10	5164-12154-00	Q1	Transistor, MJE15030, NPN	35	5010-09428-00	R11	Resistor, 1.5K, 2%, 1/4w, C. F.
11	5194-12155-00	Q3	Transistor, MJE15031, PNP	36	5010-09508-00	R12	Resistor, 270Ω, 2%, 1/4w, C. F.
12	5194-09055-00	Q2	Transistor, MP5D52, PNP	37	5012-09429-00	R13	Resistor, 0.12Ω, 5%, 5w
13	5164-09056-00	Q4	Transistor, MP5D02, NPN	38	5040-12324-00	C1, C3	Capacitor, 150 mfd, 160v, radial
14	5162-09425-00	Q5	Transistor, 2N6057, NPN	39	5043-09072-00	C2, C4	Capacitor, 0.1 mfd, 500v, disc
15	5701-09652-00		Thermal Pad T0-3	40	5040-09421-00	C7	Capacitor, 100 mfd, 25v, radial
16	4006-01003-06		Mach. Screw, 6-32 x 3/8	41	5040-09422-00	C8	Capacitor, 47 mfd, 50v, radial
17	4006-01003-08		Mach. Screw, 6-32 x 1/2	42	5040-09420-00	C9	Capacitor, 1000 mfd, electr, 25v, axial or radial
18	20-9229		Thermal Compound		5040-08893-00		
19	4406-01117-00		Nut, 6-32 Hex.	43	5040-09419-00	C10	Capacitor, 18,000 mfd, electr, 20v, axial
20	5010-09534-00	W1	Resistor, 0Ω	44	5040-09423-00	C12	Capacitor, 330 mfd, electr, 10v, radial
21	4703-00007-00		Lockwasher, #6 Ext.	45	5043-09446-00	C14	Capacitor, 0.1 mfd, 50v, disc
22	5705-12330-00		Heatsink 4"	46	5043-09065-00	C15	Capacitor, 470 pfd
23	5705-09199-00		Heatsink 6030B	47	5824-09248-00	TP1-TP4	Terminal, #1502-1 (Test Post)
24	5070-09054-00	D1, D3-D6	Diode, 1N4004	48	03-7947		Tie Wrap, 8" Long
25	5075-09059-00	ZR1, ZR3	Zener, 1N5990, 3.9v, 1/2w				

NOTES:

- Heat sink compound must be applied between transistor and heat sink.
- Observe index mark on integrated circuit, polarity of capacitors and diodes, and position of transistors.
- The view of Q5 and its related heat sink and hardware is from the bottom of the heatsink, to clarify installation.

Auxiliary Power Driver Board

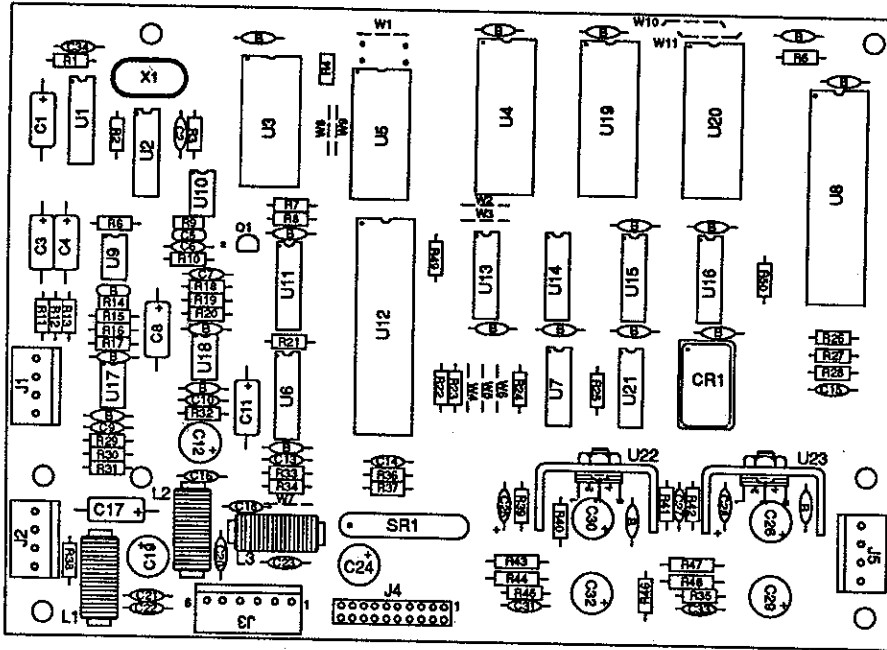
p/n D-12247-576



Part Number	Ckt Designator	Description
5763-12184-00		Bare PC Board
5040-09537-00	C1, C3	Capacitor, 100 μfd., 100v, Radial
5040-12181-00	C5, C6	Capacitor, 10 μfd., 100v, Radial
5043-09072-00	C2, C4	Capacitor, 0.1 μfd., 500v
5010-09160-00	R1 - R8	Resistor, 220Ω, 1/4w C.F., 5%
5012-12238-00	R9	Resistor, 3.3KΩ, 5w, 10%
5010-09534-00	W1, W3, W4, W6	Resistor, 0Ω
5017-12180-00	VR1, VR2	Varistor, 100v
5100-09690-00	BR1, BR2	Bridge Rectifier, 35A, 200v
5070-08785-00	D1 - D23	Diode, 1N4003
5070-09045-00	D31 - D46	Diode, MR501
5191-12179-00	Q1 - Q8	Transistor, TIP36C
5580-09555-01	K1	Relay, DPDT, 13A
5733-12060-01		Fuse Holder
5731-08665-00	F5, F6	Fuse, 2A, S-B, 250v
5731-09128-00	F2A, F3	Fuse, 2-1/2A, S-B, 250v
5731-09651-00	F1, F2C	Fuse, 5A, S-B, 250v
5731-09432-00	F4, F7, F8	Fuse, 7A, S-B, 250v
5791-10862-09	J1, J2, J4 - J6, J8	Connector, 9-pin Hdr, Sq Pin
5791-10862-07	J3, J7, J9	Connector, 7-pin Hdr, Sq Pin
5791-10862-12	J11, J12	Connector, 12-pin Hdr, Sq Pin
5791-10862-04	J10	Connector, 4-pin Hdr, Sq Pin
16-8850-292		PCB Label

Audio Board

p/n D-11581-576

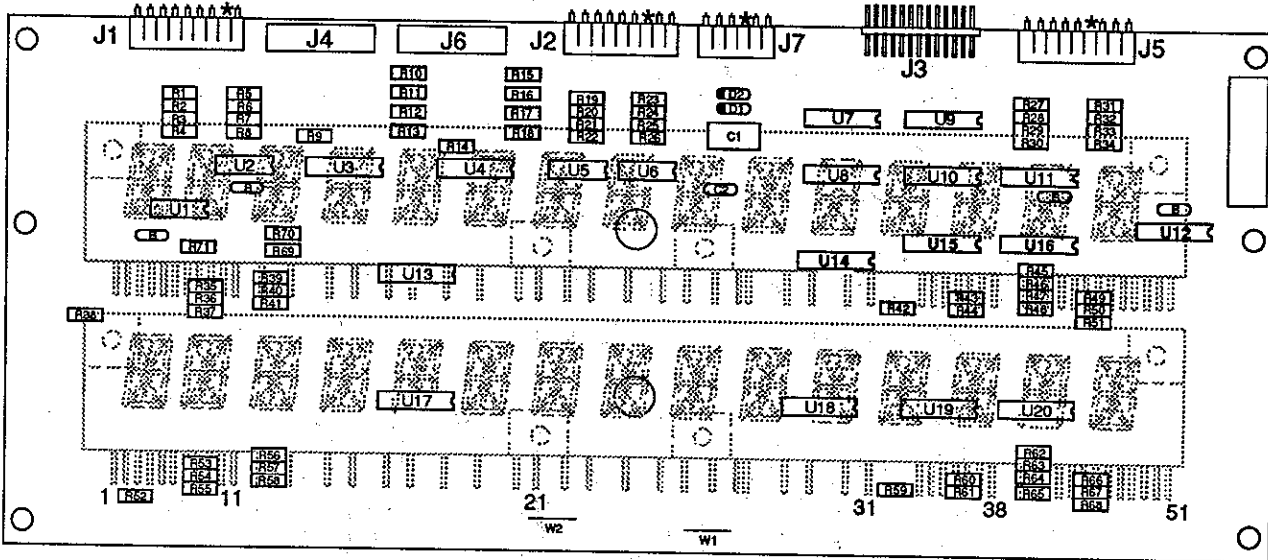


Part Number	Ckt Designator	Description	Part Number	Ckt Designator	Description
5766-12130-00		Bare PC Board	5010-09162-00	R39	Resistor, 100KΩ, 1/4w, 5%
5371-11087-00	U1	IC, D/A Conv, YM3012	5010-10258-00	R40	Resistor, 1MΩ, 1/4w, 5%
a) 5700-09006-00		Socket, IC, 16-pin (U1)	5010-09179-00	R10	Resistor, 3.3MΩ, 1/4w, 5%
5370-11086-00	U3	IC, Sound Processor, YM2151	5010-08772-00	R18	Resistor, 15KΩ, 1/4w, 5%
a) 5700-09004-00		Socket, IC, 24-pin (U3)	5010-08824-00	R32	Resistor, 43KΩ, 1/4w, 5%
5400-10320-00	U8	IC, μProcessor, MC68B09E	5010-08846-00	R31	Resistor, 220KΩ, 1/4w, 5%
a) 5700-08985-00		Socket, IC, 40-pin (U8)	5010-08991-00	R12	Resistor, 4.7KΩ, 1/4w, 5%
A-5343-576-5	U4	IC, Audio ROM 1	5010-09219-00	R38	Resistor, 8.2KΩ, 1/4w, 5%
A-5343-576-6	U19	IC, Audio ROM 2	5010-09331-00	R16	Resistor, 13KΩ, 1/4w, 5%
A-5343-576-7	U20	IC, Audio ROM 3	5010-09333-00	R29	Resistor, 180KΩ, 1/4w, 5%
a) 5700-10176-00		Socket, IC, 28-pin (U4, U19, U20)	5010-09342-00	R30	Resistor, 36KΩ, 1/4w, 5%
5371-09152-00	U11	IC, D/A Convtr, MC1408	5010-09534-00	W2, W9, W11	Resistor, 0Ω
5430-10322-00	U12	IC, PIA, MC68B21	5010-10985-00	R14, R15	Resistor, 20KΩ, 1/4w, 5%
5340-10139-00	U5	IC, RAM/S 5518-2 2Kx8	5010-10985-00	R13	Resistor, 4.9KΩ, 1/4w, 5%
5281-09487-00	U7, U16	IC, Dual D Flipflop, 74LS74	5013-09427-00	C1, C3, C4, C8, C17	Capacitor, 10μf, 20v, ±20%
5281-10043-00	U13	IC, 74LS175	5040-09343-00	C12, C19, C24	Capacitor, 100μf, 35v
5281-09235-00	U21	IC, Triple NAND, 74LS10	5040-10974-00	C26, C30	Capacitor, 470μf, 16v; +50, -10%
5370-09321-00	U9, U10, U17, U18	IC, Op Amp, MC1458	5040-09776-00	C11	Capacitor, 1μf, 63v, +50 -10%
5281-09215-00	U2	IC, Hex Inv, 74LS04	5040-09365-00	C29, C32	Capacitor, 1000μf, 16v, 20%
5281-09246-00	U14	IC, 2-4 Dec, 74LS139	5040-12006-00	C25, C28	Capacitor, 10μf, 10v, ±10%
5281-09745-00	U15	IC, Dual Mux, 74LS138	5041-09243-00	C25, C28	Capacitor, 0.01μf, 50v, +80, -20%
5370-09156-00	U22, U23	IC, Audio Amp, TDA2002	5043-08980-00	C5, B (20)*	Capacitor, 0.1μf, 50v, ±10%
a) 5705-09199-00		Heatsink, #6030B	5043-08996-00	C31, C33	Capacitor, 0.1μf, 50v, ±20%
b) 4006-01003-06		Mach. Screw, 6-32 x 3/8	5043-09065-00	C13 - C15	Capacitor, 470 pfd, 50v, ±20%
c) 4408-01117-00		Nut, 6-32 Hex.	5043-09492-00	C2, C34	Capacitor, 100 pfd, 50v, ±10%
d) 4703-00007-00		Lockwasher, #6 Ext.	5043-09844-00	C6	Capacitor, 47 pfd, 50v, ±20%
5160-10269-00	Q1	Transistor, 2N3904, NPN	5043-09845-00	C16, C18, C20 - C23, C27	Capacitor, 1000 pfd, 50v, ±20%
5060-10396-00	SP1	SIP 4.7K & 470pfd, 8R8C	5046-09346-00	C7	Capacitor, 1200pfd, 50V, ±5%
5010-09181-00	R44, R48	Resistor, 1.0Ω, 1/2w, 5%	5046-09350-00	C9	Capacitor, 180pfd, 100V, ±5%
5010-09161-00	R35, R45	Resistor, 2.2Ω, 1/4w, 5%	5048-10992-00	C10	Capacitor, 4700pfd, 50v,
5010-09361-00	R43, R46, R47	Resistor, 220Ω, 1/2w, 5%	5370-09691-00	U6	IC, 55536, CVSD
5010-09358-00	R41, R42	Resistor, 1KΩ, 1/4w, 5%	5520-09020-00	X1	Crystal, 3.58 MHz
5010-08998-00	R2, R3	Resistor, 2.2KΩ, 1/4w, 5%	5521-10931-00	CR1	Oscillator, 8 MHz
5010-08983-00	R7-R9	Resistor, 3.3KΩ, 1/4w, 5%	5551-09822-00	L1 - L3	Inductor, 4.7 μH, 3A.
5010-08991-00	R1, R4, R5, R11, R25 - R28, R33, R36, R37, R49, R50	Resistor, 4.7KΩ, 1/4w, 5%	5791-09437-00	J4	Connector, 20 pin, (Hdr), Rib. Cbl
5010-09034-00	R17, R22-R24, R34	Resistor, 10KΩ, 1/4w, 5%	5791-10882-04	J1, J2, J5	Connector, 4 pin (Hdr)
5010-09324-00	R6, R19, R20, R21	Resistor, 27KΩ, 1/4w, 5%	5791-10862-06	J3	Connector, 6 pin (Hdr)
			16-8850-290		PCB I.D. Label
			20-9229		Thermal Compound

Notes... *20 capacitors (shown on diagram with "B" symbol) provide +5VDC filtering for ICs.
 All capacitors are ceramic, 50v, axial, unless otherwise noted.
 All resistors are 5%, 1/4w, Carbon Film, unless otherwise noted.

Master Display Board

p/n D-12232-1



Part Number	Ckt Designator	Description
5760-12306-00		Bare PC Board
5670-12308-00	DSPL1, DSPL2	Display, 16-Character, A/N
5310-09882-00	U1, U2, U5, U6	I.C. 4001
5310-08975-00	U7 - U12	I.C. 4049
5680-08968-00	U13, U14, U17, U18	I.C. 6184, Anode Driver
5680-08969-00	U15, U16, U19, U20	I.C. 7180, Cathode Driver
5040-09343-00	C1	Axial Cap, 10 μ fd, 20v, \pm 20%
5043-08980-00	Bypass	Axial Cap, 0.01 μ fd, 50v, +80, -20%
5075-09135-00	D1, D2	Zener, 1N4740A, 10v, 1w
5791-10869-09	J1, J2, J5	9-pin Header, Rt. Angle
5791-10869-06	J7	6-pin Header, Rt. Angle
5791-10851-00	J3	26-pin Header, Rt. Angle
5010-08773-00	R1-R8, R19-R35, R41, R43, R45, R71	Resistor, 18K Ω , 1/4w, 5%
5010-10258-00	R38, R52	Resistor, 1M Ω , 1/4w, 5%
5010-10927-00	R36, R39, R40, R42, R47, R48, R50, R51, R54, R56, R57, R59, R64, R65, R67, R68	Resistor, 8.2K Ω , 1/2w, 5%
5010-08981-00	R37, R44, R46, R49, R55, R61, R63, R66	Resistor, 10K Ω , 1/2w, 5%
03-8088-1	Support	Support, Display
16-8850-234		PCB Label
23-6634		Cover, Display

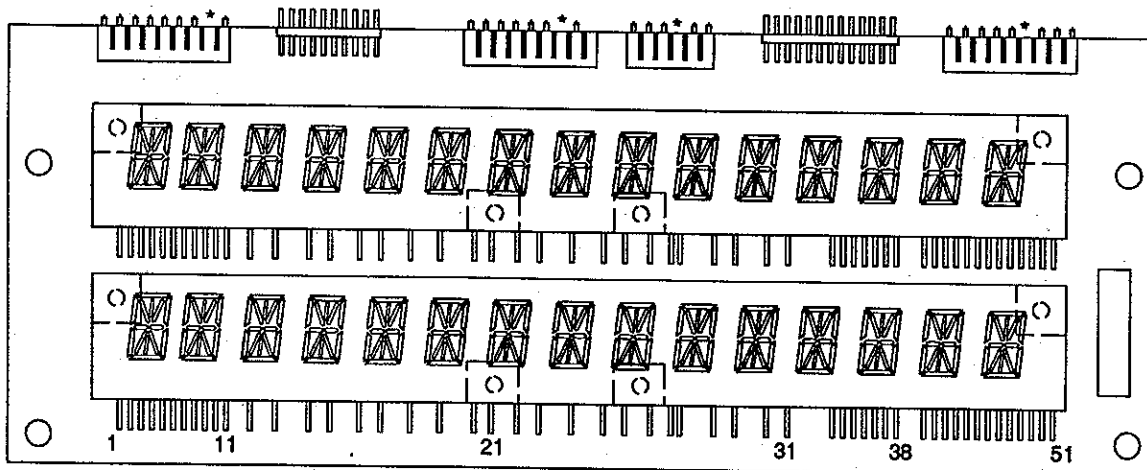
Pinout Table

used on Master Display Board, p/n D-12232-1 or -2

Board Pin #	Glass Pin #	Signal/Function	Board Pin #	Glass Pin #	Signal/Function	Board Pin #	Glass Pin #	Signal/Function	Board Pin #	Glass Pin #	Signal/Function
1	1	N/C		24	cut	31	47	Strobe 8		70	cut
2	2	Segment A	23	25	Strobe 12		48	cut	40	71	Strobe 4
3	3	Segment J		26	cut	32	49	Strobe 8		72	cut
4	4	Segment B	24	27	Strobe 12		50	cut		73	cut
5	5	Strobe 16		28	cut		51	cut		74	cut
6	6	Segment K		29	cut		52	cut	41	75	Strobe 3
7	7	Strobe 16		30	cut	33	53	Strobe 7		76	cut
8	8	Segment H	25	31	Strobe 11		54	cut	42	77	Strobe 3
9	9	Segment F		32	cut	34	55	Strobe 7		78	cut
10	10	Segment M	26	33	Strobe 11		56	cut	43	79	Strobe 2
11	11	Strobe 15		34	cut	35	57	Strobe 6	44	80	Comma
12	12	Segment C		35	cut		58	cut	45	81	Strobe 2
13	13	Strobe 15		36	cut		59	cut	46	82	Segment P
14	14	N/C	27	37	Strobe 10		60	cut	47	83	Segment R
15	15	Strobe 14		38	cut	36	61	Strobe 6	48	84	Segment E
16	16	Dot	28	39	Strobe 10		62	cut	49	85	Strobe 1
17	17	Strobe 14		40	cut	37	63	Strobe 5	50	86	Segment N
18	18	Segment D	29	41	Strobe 9		64	cut	51	87	Strobe 1
19	19	Strobe 13		42	cut	38	65	Strobe 5	52	88	Segment
20	20	Dot	30	43	Strobe 9		66	cut	53	89	-100V dc
21	21	Strobe 13		44	cut		67	cut			
22	22	N/C		45	cut		68	cut			
	23	cut		46	cut	39	69	Strobe 4			

16-Character Display Glass

p/n 5670-12308-00



System 11C CPU Board

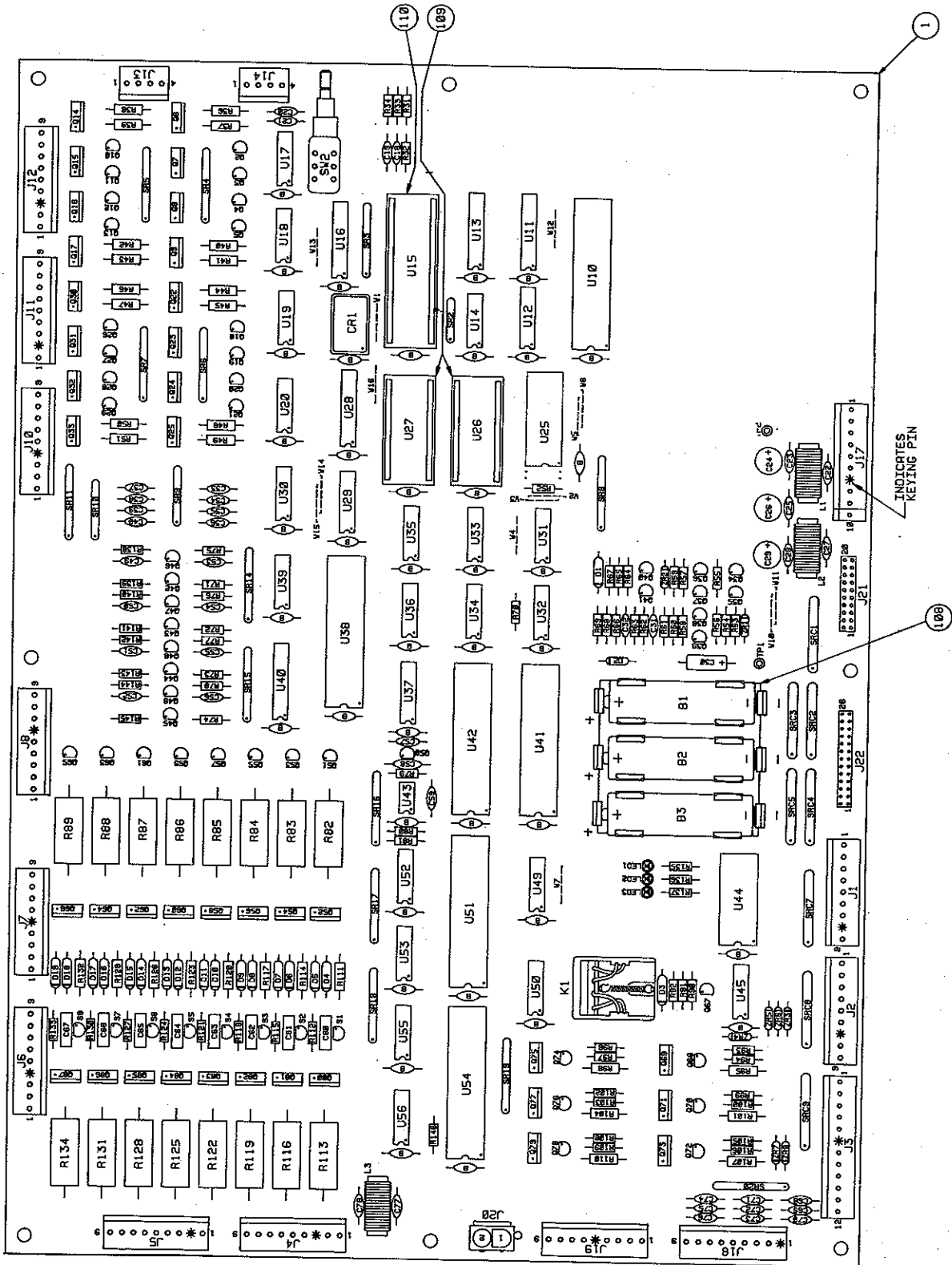
p/n D-11883-576

Part Number	Ckt Designator	Description	Part Number	Ckt Designator	Description
5764-12206-00		Bare PC Board	5012-09037-00	R113, R116, R119, R122, R125, R128, R131, R134	Resistor, 0.4Ω, 5%, 3w, Wire-Wrtd.
5281-09308-00	U16	IC, Octal Bus Xcvr, 74LS245	5010-08993-00	R36-R51, R95, R98, R101, R104, R107, R110	Resistor, 68Ω, 5%, 1/2w, C. F.
5430-08972-00	U10, U38, U41, U42, U51, U54	IC, PIA, MC6820/6821	5012-10860-00	R82-R89	Resistor, 27Ω, 5%, 2w, C. F.
5340-10139-00	U25	IC, 2K x 8 CMOS Static RAM	5010-10003-00	R62, R63	Resistor, 390Ω, 5%, 1/4w, C. F.
5280-09010-00	U44	IC, 4-16 Decoder, 74154	5010-10171-00	R67	Resistor, 56Ω, 5%, 1/4w, C. F.
5281-09246-00	U12	IC, 2-4 Decoder, 74LS139	5010-10170-00	R69	Resistor, 47Ω, 5%, 1/4w, C. F.
5075-09406-00	ZF3 - ZF8	Diode, Zener, 6.2v, 0.5w	5010-09180-00	R59, R61, W12, W13	Resistor, 220Ω, 5%, 1/4w, C. F.
5164-10998-00	Q42 - Q49	Transistor, NPN, 2N5550, TO-92	5010-09416-00	R33, R34, R71-R78, R135-R137	Resistor, 470Ω, 5%, 1/4w, C. F.
5431-09449-00	U43	IC, Timer, MC1455	5010-10631-00	R111, R114, R117, R120, R123, R126, R129, R132	Resistor, 1.2KΩ, 5%, 1/2w, C. F.
5310-09236-00	U29	IC, 14-b Counter, 4020	5019-09783-00	SR18	SIP, 9R, 10-pin, 6.8KΩ, .125w/R, 5%
5281-09743-00	U32	IC, Quad 2-Input AND, 74LS08	5019-09362-00	SF3, SR15, SR17, SR19, SR20	SIP, 9R, 10-pin, 4.7KΩ, .125w/R, 5%
5281-09247-00	U14	IC, Quad 2-Input NOR, 74LS02	5019-09808-00	SR4, SR6, SR11	SIP, 9R, 10-pin, 560Ω, .125w/R, 5%
5281-09235-00	U35	IC, Triple 3-Input NAND, 74LS10	5019-09785-00	SR16	SIP, 9R, 10-pin, 2.2KΩ, .125w/R, 5%
5280-09013-00	U36	IC, Hex Inverter, 7404	5019-10472-00	SR14	SIP, 9R, 10-pin, 3.3KΩ, .125w/R, 5%
5281-09499-00	U31, U34	IC, Quad 2-Input NAND, 74LS00	5019-09669-00	SR8	SIP, 9R, 10-pin, 1.0KΩ, .125w/R, 5%
5281-10014-00	U33	IC, Dual 4-Input NAND, 74LS20	5019-09780-00	SF9, SR10	SIP, 4R, 8-pin, 1KΩ, 5%
5281-09486-00	U28	IC, Octal D Flip-flop, 74LS374	5019-09786-00	SR2	SIP, 5R, 6-pin, 4.7KΩ, .125w/R, 5%
5281-09745-00	U37	IC, 3-8 Decoder, 74LS138	5019-09792-00	SR5, SR7	SIP, 9R, 10-pin, 2.7KΩ, .125w/R, 5%
5281-09867-00	U11, U13, U40	IC, Octal Buffer, 74LS244	5060-10396-00	SRC1 - SRC5, SRC7 - SRC9	SIP, 8R, 8C, 10-pin, 4.7KΩ & 470pfd
5280-08973-00	U17-U20, U52, U53	IC, Quad 2-Input AND, 7408	5043-08980-00	C18, C19, C21, C31, C32, C49-C56, C59, + 43 Bypass, marked B	Capacitor, 0.01 μfd, 50v(+80,-20%), Axial
5280-08974-00	U55, U56	IC, Hex Inverter, 7406	5043-09845-00	C22, C23, C25, C27, C28	Capacitor, 1K pfd, 50v(±20%), Axial
5310-09155-00	U30, U39	IC, Quad 2-Input NAND, MC14011	5043-08996-00	C70-75, C77, C78	Capacitor, 0.1 μfd, 50v(±20%), Axial
5280-08948-00	U45, U50	IC, Quad 2-Input NOR, 7402	5040-10974-00	C24, C26, C29	Capacitor, 100 μfd, Electr., 25v(+50,-10%), Axial
5280-09309-00	U49	IC, Hex Buffer, 7407	5045-09796-00	C60-C67	Capacitor, 0.1 μfd, Polycarbonate Rad., 100v(±10%)
5671-09019-00	LED1-LED3	LED, Red, Display	5043-09065-00	C33-C40, C68, C69, C76	Capacitor, 470 pfd, 50v(±20%), Axial
5521-10506-00	CR1	Oscillator, 4 MHz	5040-09545-00	C30	Capacitor, 22 μfd, Electr., 10v(+50,-10%) Axial
5162-08976-00	Q51, Q53, Q55, Q57, Q59, Q61, Q63, Q65	Transistor, NPN Darl. 2N6427, TO-92	5041-09031-00	C58	Capacitor, 1 μfd, Tant., 25v(±20%), Axial
5191-08978-00	Q52, Q54, Q56, Q58, Q60, Q62, Q64, Q66	Transistor, PNP, TIP42, TO-220	5043-09030-00	C57	Capacitor, 0.047 μfd, 50v(±20%), Axial
5162-09410-00	Q6-Q9, Q14-Q17, Q22-Q25, Q30-Q33, Q69, Q71, Q73, Q75, Q77, Q79, Q80-Q87	Transistor, NPN, TIP122, TO-220	5551-09822-00	L1-L3	Inductor, 4.7 μH, 3A
5160-08938-00	Q2-Q5, Q10-Q13, Q18-Q21, Q26-Q29, Q34-Q38, Q41, Q67, Q68, Q70, Q72, Q74, Q76, Q78	Transistor, NPN, 2N4401, TO-92	5641-09312-00]	SW1	Switch, Pushbutton, DPDT, 100v, 5A
5160-10269-00	Q40	Transistor, NPN, 2N3904, TO-92	5880-09022-00	B1-B3	Battery, Alkaline, 1.5v, AA
5190-09016-00	Q39, Q50	Transistor, PNP, 2N4403, TO-92	5881-09021-00		Battery Holder, #171
5130-09014-00	S1-S8	SCR, 30v, 0.8A, 2N5060	5700-10176-00		IC Socket, 28 pin
5070-06258-00	D3-D19	Diode, 1N4001	a)A-5343-576-1	U26	IC, Game ROM 2, 27256
5070-08919-00	D2	Diode, 1N4148, 150mA	b)A-5343-576-2	U27	IC, Game ROM 1, 27256
5070-09266-00	D1	Diode, 1N5817, 1.0A	5700-08985-00		IC Socket, 40 pin
5075-09018-00	ZR1	Diode, Zener, 1N5996A, 6.8v, 0.5w	a)5400-09150-00	U15	IC, μProcessor, 6802
5075-09059-00	ZR2	Diode, Zener, 1N5990, 3.9v, 0.5w	5824-09248-00	TP1, TP2	Test Point
5010-08992-00	R94, R97, R100, R103, R106, R109	Resistor, 560Ω, 5%, 1/4w, C. F.	20-9229		Thermal Compound
5010-09039-00	R56	Resistor, 10Ω, 5%, 1/4w, C. F.	5580-08994-01	K1	Relay, 4-pole, 40Ω, 6v
5010-09534-00	W1, W2, W4, W5, W7, W11, W14, W16	Resistor, 0Ω, 5%, 1/4w, C. F.	5791-10862-09	1J1, 1J2, 1J4-1J8, 1J10-1J12, 1J17-1J19	Connector, 9 pin (Hdr)
5010-08991-00	R31, R32, R52	Resistor, 4.7KΩ, 5%, 1/4w, C. F.	5791-10862-04	1J13, 1J14	Connector, 4 pin (Hdr)
5010-09358-00	R55, R68, R92, R146	Resistor, 1.0KΩ, 5%, 1/4w, C. F.	5791-10862-12	1J3	Connector, 12 pin (Hdr)
5010-09113-00	R79	Resistor, 33KΩ, 5%, 1/4w, C. F.	5791-10850-00	1J22	Connector, 26 pin Ribbon (Hdr)
5010-08983-00	R70, R80	Resistor, 3.3KΩ, 5%, 1/4w, C. F.	5791-09437-00	1J21	Connector, 20 pin Ribbon (Hdr)
5010-09034-00	R53, R60, R65, R90	Resistor, 10KΩ, 5%, 1/4w, C. F.	20-9491	W18, W19	Bus Wire, Jumper
5010-09086-00	R81	Resistor, 6.8KΩ, 5%, 1/4w, C. F.			
5010-08997-00	R23, R24, R91, R93, R96, R99, R102, R105, R108, R112, R115, R118, R121, R124, R127, R130, R133	Resistor, 2.7KΩ, 5%, 1/4w, C. F.			

Notes...

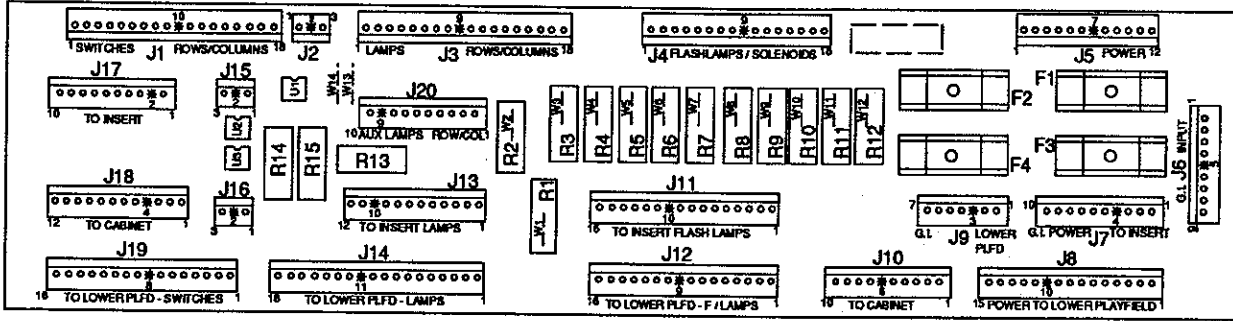
1. For Schematic, refer to drawing #16-9019.
2. Items 56 and 58 (resistors) must be mounted 1/8" above PCB surface.
3. Standard Jumper: W1, W2, W4, W5, W7, W11, W14, W16

System 11C CPU Board



Backbox Interconnect Board

p/n D-12313-576



Part Number	Ckt Designator	Description
5768-12332-00		Master Interconnect PCB
5010-09534-00	W10 - W13	Resistor, 0Ω
5012-12238-00	R14, R15	Resistor, 3.3KΩ, 5w, 10%
5012-12337-00	R13	Resistor, 1.5KΩ, 5w, 10%
5012-10023-00	R3, R4, R6	Resistor, 4Ω, 5w, 10%
5012-12188-00	R1, R2, R5, R7-R9	Resistor, 3Ω, 5w, 10%
5490-10892-00	U1 - U3	Opto Isolator 4N25
5731-09651-00	F1-F4	Fuse, 5A.S.B., 250v
5733-12060-01		Fuse Holder, F1-F4
5791-10862-03	J2, J16	Connector, 3-pin Hdr Sq Pin
5791-10862-07	J9	Connector, 7-pin Hdr Sq Pin
5791-10862-09	J6	Connector, 9-pin Hdr Sq Pin
5791-10862-10	J7, J10, J20	Connector, 10-pin Hdr Sq Pin
5791-10862-12	J5, J18	Connector, 12-pin Hdr Sq Pin
5791-10862-15	J8	Connector, 15-pin Hdr Sq Pin
5791-10862-16	J4, J11, J12, J19	Connector, 16-pin Hdr Sq Pin
5791-10862-18	J1, J3, J14	Connector, 18-pin Hdr Sq Pin
16-8850-291		PCB Label

Lamp Boards

Backbox Relay Board
(Solenoid 10 & 11 Gen. Illum)
p/n C-11998-1

Lamp Board ("5-L")
p/n C-13362

Part Number	Description	Part Number	Description
5768-12243-00	Lamp PCB	5768-12585-00	Lamp PCB
5070-09054-00	Diode, 1N4004, 1.0 A. (D1)	24-8767	Twist Lamp Socket
5580-09555-01	Relay, 24vdc, 30A. (K1)	24-8768	Bulb #555 (6.3V, 0.25A.)
5010-09534-00	Resistor 0Ω (W1, W2)	5070-09054-00	Diode, 1N4004, 1.0 A.
5791-12273-02	Header, 2-pin Sq post (J1)	5791-10871-07	Connector, 7-pin Sq post
5791-12273-07	Header, 7-pin Sq post (J2)		

Lamp Boards (continued)

Lamp Board ("3-C") p/n C-13425

Part Number	Description
5768-12597-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-05	Connector, 5-pin Sq post

Lamp Board ("3-T") p/n C-12000

Part Number	Description
5768-12245-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-05	Connector, 5-pin Sq post

Lamp Board ("3-L") p/n C-12709

Part Number	Description
5768-12409-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-05	Connector, 5-pin Sq post

Lamp Board ("3-R") p/n C-13361

Part Number	Description
5768-12584-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-05	Connector, 5-pin Sq post

Lamp Board ("20 + 3 x "F") p/n C-13374

Part Number	Description
5768-12591-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-12	Connector, 12-pin Sq post

Lamp Board ("F") p/n C-13375

Part Number	Description
5768-12592-00	Lamp PCB
24-8803	Twist Lamp Socket
24-8802	Bulb #906 (13V, 0.69A.)
5791-10871-02	Connector, 2-pin Sq post

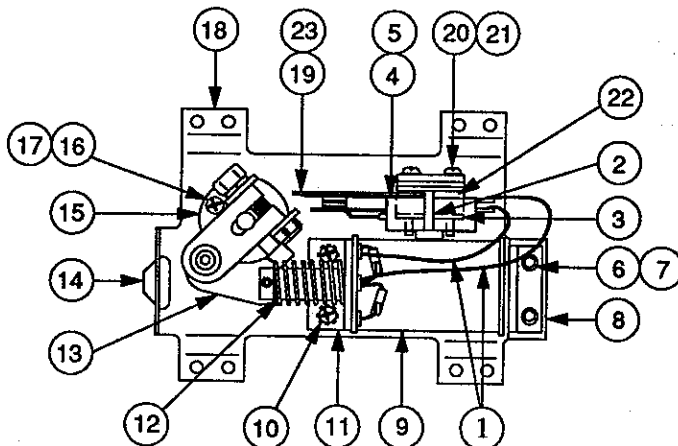
Lamp Board ("1") p/n B-12224

Part Number	Description
5768-12312-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.

Lamp Board ("8-D") p/n C-13537

Part Number	Description
5768-12613-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-11	Connector, 11-pin Sq post

Lower Right Flipper Assy p/n C-11626-R-3

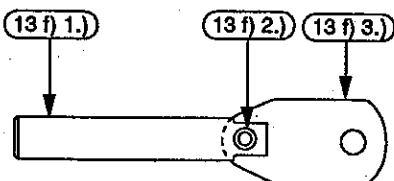


Item	Part Number	Description	Item	Part Number	Description
1	HW-30018-6	Wire, 18 AWG, Blue	g)	B-10657-R	Flipper Crank Assy, R.
2	03-7520-2	Ty-Wrap, Nylon	1.)	01-8073-R	Flipper Crank, R.
3	20-6516	Speednut, Tinnerman	2.)	17-1037	Crank Washer
4	5045-12098-00	Capacitor, 2.2 μ Fd, 250V, 20	3.)	010-01066-18	Cap Screw, 10-32x1-1/8
5	RM-21-06	Sleeve, Vinyl (Cap. leads)	4.)	4410-01127-00	Nut, 10-32 Hex Hd.
6	4010-01066-06	Cap Screw, 10-32 x 3/8, SH	5.)	4700-00107-00	Washer, 5/8 o.d.x13/64 i.d. x 12ga.
7	4701-00004-00	Lockwasher, #10 Split	6.)	4701-00004-00	Lockwasher, #10 Split
8	A-12111	Flipper Stop Assembly	7.)	RM-23-06	Tubing, H. S. 1/4 DWP
9	FL-11630	Flipper Coil (Red)	14	23-6577	Bumper Plug
10	4006-01017-04	Mach. Screw, 6-32 x 1/4	15	03-7568	Flipper Bushing
11	01-7695	Solenoid Bracket	16	4006-01005-06	Mach. Screw, 6-32 x 3/8
12	10-376	Coil Plunger Spring	17	4406-01117-00	Nut, 6-32 Hex.
13	B-10655-R	Crank Link Assembly, Right	18	C-11627-R	Flipper Base Assy, R.
a)	02-4179	Link Spacer Bushing	19	06-14G	Insulating Blade
b)	4010-01086-14	Cap Screw, 10-32 x 7/8, SH	20	4105-01019-10	Sh. Metal Screw, #5 x 5/8
c)	4700-00023-00	Washer, 5/8 x13/64 x16ga.	21	4701-00002-00	Lockwasher, #6 Split
d)	4701-00004-00	Lockwasher, #10 Split	22	23-6622	Tape, Double-sided
e)	4410-01132-00	Nut, 10-32 ESNA	23	03-7811	End of Stroke (EOS) Sw
f)	A-10656**	Flipper Link Assembly			
1.)	02-4219	Coil Plunger			
2.)	20-9370-1	Spring Pin, 5/32 dia. x 7/16			
3.)	03-8050-1	Flipper Link			

** Also See Separate Diagram

Associated Parts: 20-9250-5 Flipper Arm on Shaft
 23-6519-4 Red Rubber Ring

Flipper Link Assembly p/n A-10656

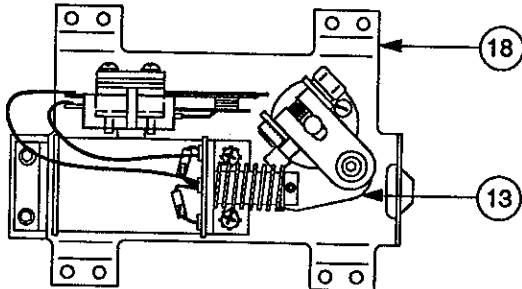


[Items listed refer to items listed for C-11626-R-3]

Item	Part No.	Description
13 f) 1.)	02-4219	Coil Plunger
13 f) 2.)	20-9370-1	Spring Pin, 5/32 dia. x 7/16
13 f) 3.)	03-8050-1	Flipper Link

Lower Left Flipper Assembly

p/n C-11626-L-3



[Parts listed replace same items of C-11626-R-3]

Item	Part No.	Description
13	B-10655-L	Crank Link Assembly, Left
g)	B-10657-L	Flipper Crank Assembly, L
1.)	01-8073-L	Flipper Crank, Left
18	C-11627-L	Flipper Base Assembly, L

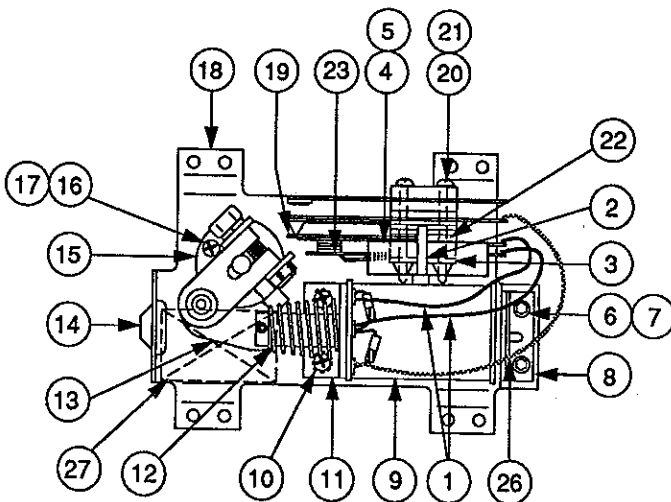
Flipper Assembly Notes...

1. Each Flipper Assembly on the Lower Playfield is mounted beneath the playfield, in conjunction with the plastic Flipper Paddle and Shaft (20-9250-5) and flipper Rubber (23-6519-4) on the upper side of the playfield.
2. The tip of the EOS Switch must travel 0.0150 (+ .010, - .000) inch, before the contacts fully open, with the flipper in the actuated position. The EOS Switch contacts must have a gap of 0.062 (± .015) inch. Adjustment of the EOS Switch must be made at a minimum distance of 0.25 inch from the switch body
3. All moving elements of the assembly must operate freely, with no evidence of binding.
4. The large end of the Coil Plunger Spring (item 12) must fit within the four lugs of the Solenoid Bracket.
5. For coil replacement, remove the Solenoid Bracket (item 11) to prevent screw damage.
6. Use Loctite™ 242 when reattaching screws to the Flipper Stop Assembly, the Solenoid Bracket, and the Flipper Bushing.
7. When replacing the Bumper Plug (Item 14) to restore proper flipper operation, readjust the flipper paddle and shaft position.
8. Solid color blue wire connects to the banded end of each diode, mounted on the connector end of the Flipper Coil (item 9). Trace color wire connects to the unbanded end of the diode.

Upper Right Flipper Assy

p/n C-13723

[Parts listed replace same items of C-11626-R-3]



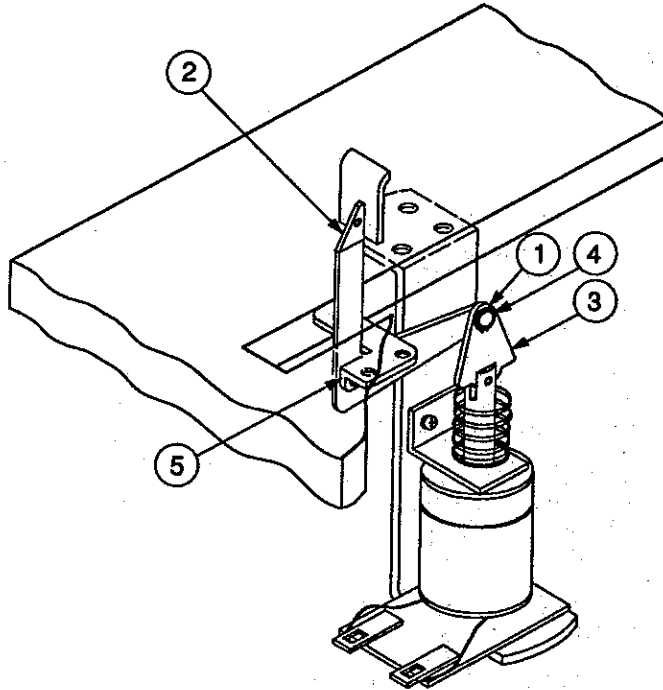
Item	Part No.	Description
13	B-13725	Crank Link Assembly
a)	02-4179	Link Spacer Bushing
f)	A-13722	Flipper Link Assembly
1.)	02-4453	Coil Plunger
2.)	20-9370-1	Spring Pin, 5/32 dia. x 7/16
3.)	03-8050-1	Flipper Link
20	4105-0100-20	Sh. Metal Screw, #5 x 1-1/4
24	01-3670	Switch Plate-Curve
25	SW-1A-183	Flipper Switch
26	HW-30018-64	Wire, 18 AWG, Blue-Yellow
27	16-8587-1019-1	Plunger Label

Associated Parts:

20-9250	Flipper Arm on Shaft
23-6519	Red Rubber Ring

Kicker Arm (Slingshot) Assembly

p/n B-12665
(Left & Right)



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

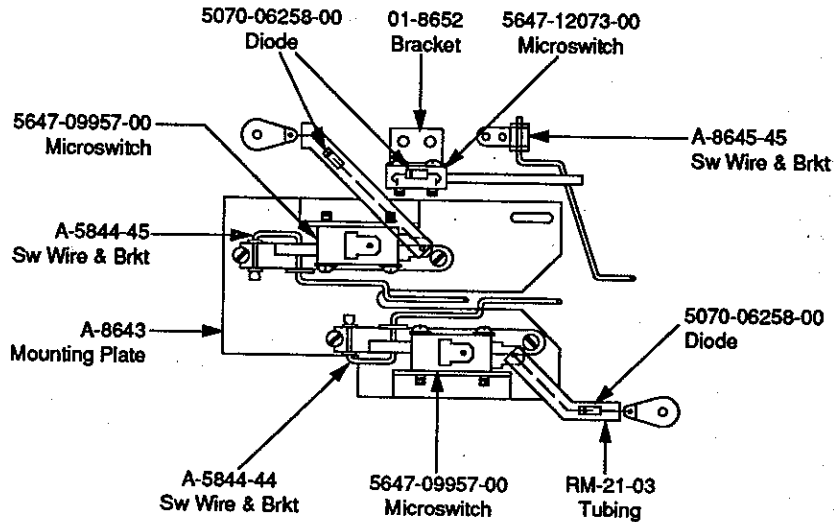
Associated Parts for Left Kicker

Part Number	Description
B-9362-L-1	Coil & Bracket Assembly
B-7572-1	Bracket & Stop Assembly
01-8-508-S	Coil Retaining Bracket
4006-01017-06	Mach. Screw, 6-32 x 3/8
4406-01119-00	Nut, 6-32 ESN
AE-23-800	Coil Assembly
03-7066	Coil Tubing

Associated Parts for Right Kicker

Part Number	Description
B-9362-R-1	Coil & Bracket Assembly
B-7572-1	Bracket & Stop Assembly
01-8-508-S	Coil Retaining Bracket
4006-01017-06	Mach. Screw, 6-32 x 3/8
4406-01119-00	Nut, 6-32 ESN
AE-23-800	Coil Assembly
03-7066	Coil Tubing

Ball Trough Switches

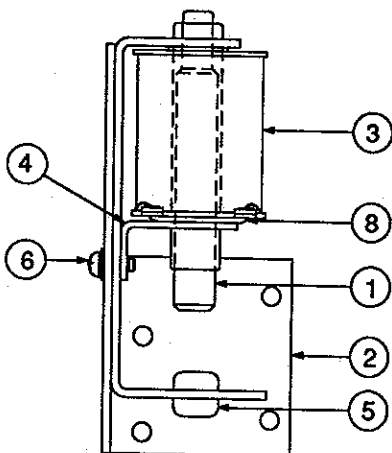


Ball Trough Switches
(Viewed from underside of playfield to show locations)

Part Number	Description	Part Number	Description
B-8925	Ball Trough Switch Plate Assy	5070-06258-00	Diode, 1N4001, 1.0A.
A-5844-44	Switch Wire & Bracket Assy	5825-06522-00	Solder Lug-Flat, #6
A-5844-45	Switch Wire & Bracket Assy	RM-21-03	Insulating Tubing, #10 x 1.75
A-8924	Bracket & Mounting Plate Assy	A-11680	Ball Trough Switch, Right
5647-09957-00	μswitch; Cntr & L Ball Trough	5647-12073-08	Submin. Switch
4004-01003-10	Mach. Screw, 4-40 x 5/8	5070-06258-00	Diode, 1N4001, 1.0A.
4005-01005-02	Mach. Screw, 5-40 x 1/8	A-8645	Switch Wire & Bracket Assy

Knocker Assembly

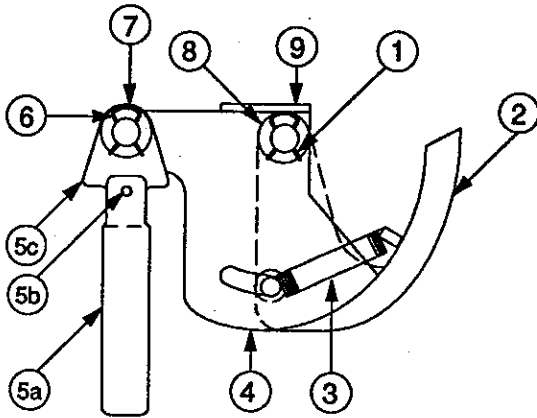
p/n B-10686-1



Item	Part Number	Description
1	A-5387	Coil Plunger Assembly
a)	02-2653	Coil Plunger
b)	03-6013	Bell Arm Ext.
2	B-7409-2	Mtg. Bracket Assembly
3	AE-23-800	Coil Sub-Assembly
4	01-8-508-T	Coil Retaining Bracket
5	23-6420	Rubber Grommet
6	4008-01017-06	Mach. Screw, 8/32 x 3/8
7	H-11835	Knocker Cable
8	03-7067-5	Coil Tubing

Ball Shooter Lane Feeder

p/n C-9638



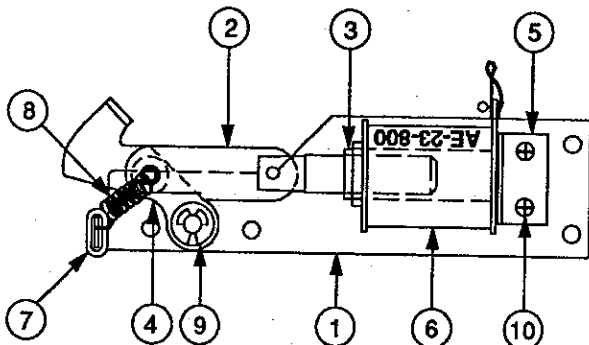
Item	Part Number	Description
1	12-6227	Hair Pin Clip
2	A-8247	Eject Cam Assembly
3	10-362	Ejector Spring (Plain)
4	A-6949-L	Spring Plate Assembly
5	A-8050-1	Coil Plunger Assy, 2-1/8
a)	02-3407-2	Coil Plunger, 2-1/8
b)	20-8716-5	Roll Pin, 1/8 x 7/16
c)	03-8085	Armature Link
6	12-6227	Hair Pin Clip
7	4700-00030-00	Flatwasher, 17/64x1/2x15ga.
8	4700-00103-00	Flatwasher, 17/64 x1/2x 28ga.
9	A-8268	Mounting Bracket Assembly

Associated Parts

B-9362-L-1	Coil & Bracket Assembly
B-7572-1	Bracket & Stop Assembly
01-8-508-S	Coil Retaining Bracket
4006-01017-06	Mach. Screw, 6-32 x 3/8
4406-01119-00	Nut, 6-32 ESN
AE-23-800	Coil Assembly
03-7066	Coil Tubing

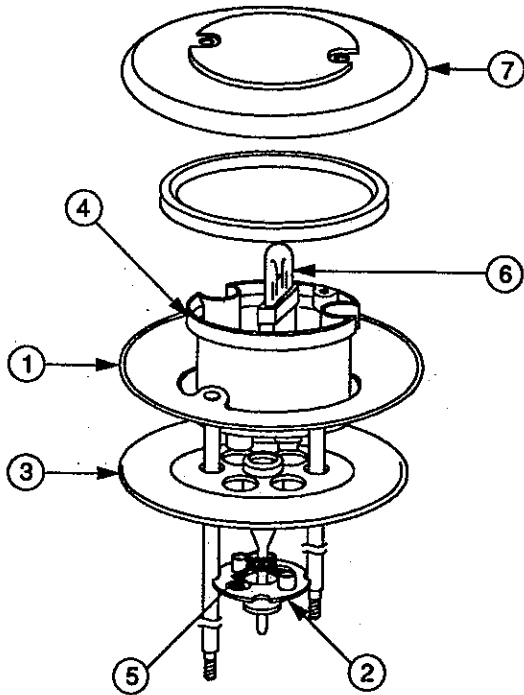
Outhole Kicker Assembly

p/n B-8039-2



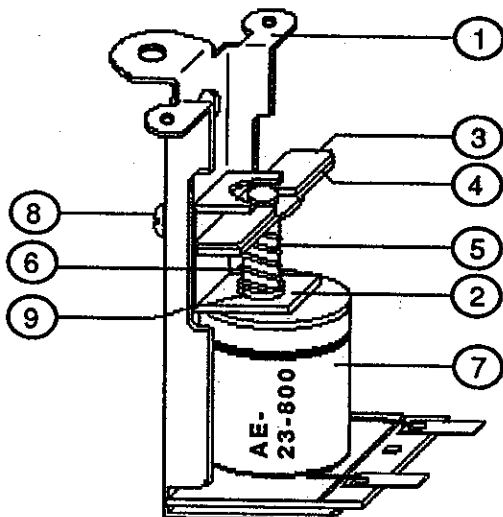
Item	Part Number	Description
1	A-6378	Mounting Plate Assembly
2	A-8335	Coil Plunger Assembly
a)	02-2364	Coil Plunger
b)	20-8716-5	Roll Pin, 1/8 x 7/16
c)	01-4251	Ball Return Link
3	03-7066	Coil Tubing
4	A-6889	Kicker Lever Assy
5	A-8038	Coil Stop Assembly
6	AE-23-800	Coil Assembly
7	03-7176-1	Striker Ring
8	10-101-4	Spring-Reset
9	20-8712-25	"E" Ring, 1/4" Shaft
10	4006-01003-03	Mach. Screw, 6-32 x 3/16

Jet Bumper Assembly p/n B-9414-1



Item	Part Number	Description
1	A-4754	Bumper Ring Assembly
2	03-6009-A5	Bumper Base - White
3	03-6035-1	Bumper Wafer - Blue
4	03-7443-5	Bumper Body - White
5	10-7	Spring - Jet Bumper
6	A-11199	Socket & Bulb
7	03-8254-9	Jet Bumper Cap - Trans. Red

Jet Bumper Coil Assembly p/n B-9415-1



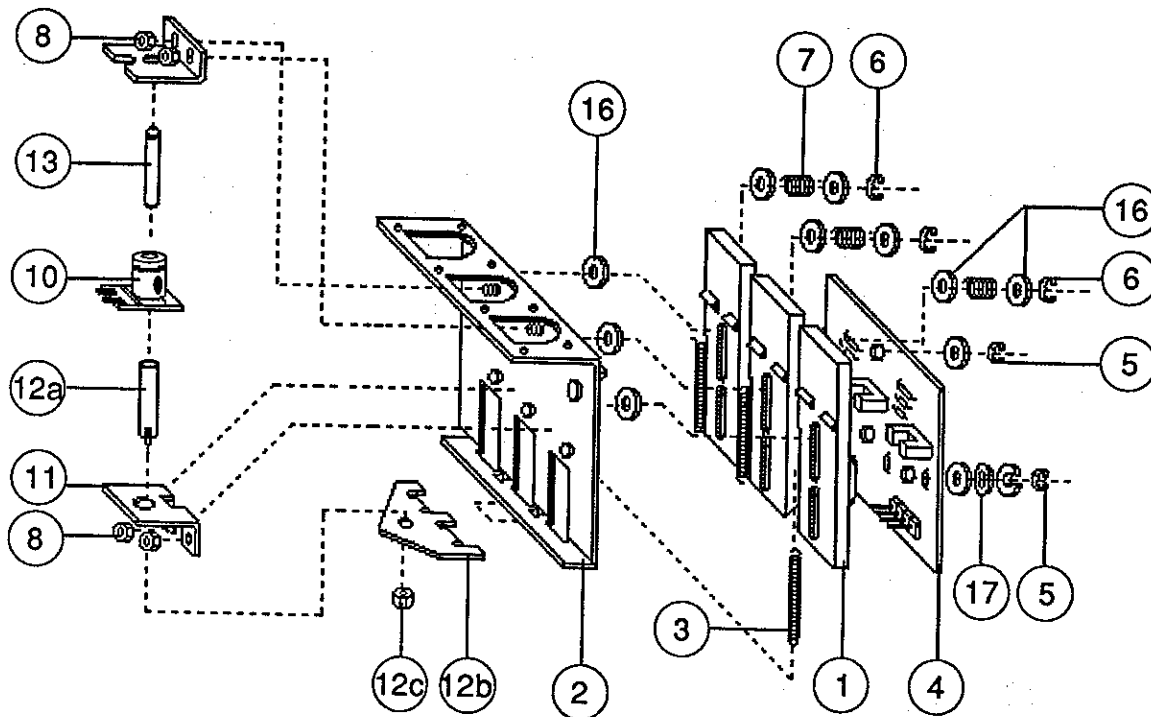
Item	Part Number	Description
1	B-7417	Bracket & Stop Assembly
2	01-1747	Coil Retaining Bracket
3	01-5492	Armature Link, Steel
4	01-5493	Armature Link, Bakelite
5	02-3406-1	Coil Plunger
6	10-326	Armature Spring
7	AE-23-800	Coil Assembly
8	4006-01017-04	Mach. Screw, 6-32 x 1/4
9	03-7066	Coil Tubing

Associated Parts

B-12030-2	Jet Bumper Sw & Diode
B-12029-2	Jet Bumper Sw & Brkt. Assy
SW-11A-37	Jet Bumper Switch Assy
01-1168	Mounting Brkt., Bumper Sw
01-3670	Switch Plate - Curved
03-7395	Switch Actuator
4005-01051-12	Mach. Screw, 5-40 x 3/4
4405-01117-00	Nut, 5-40 Hex.
5070-06258-00	Diode, 1N4001, 1.0A.

3-Bank Drop Target Assembly

p/n C-11223-1

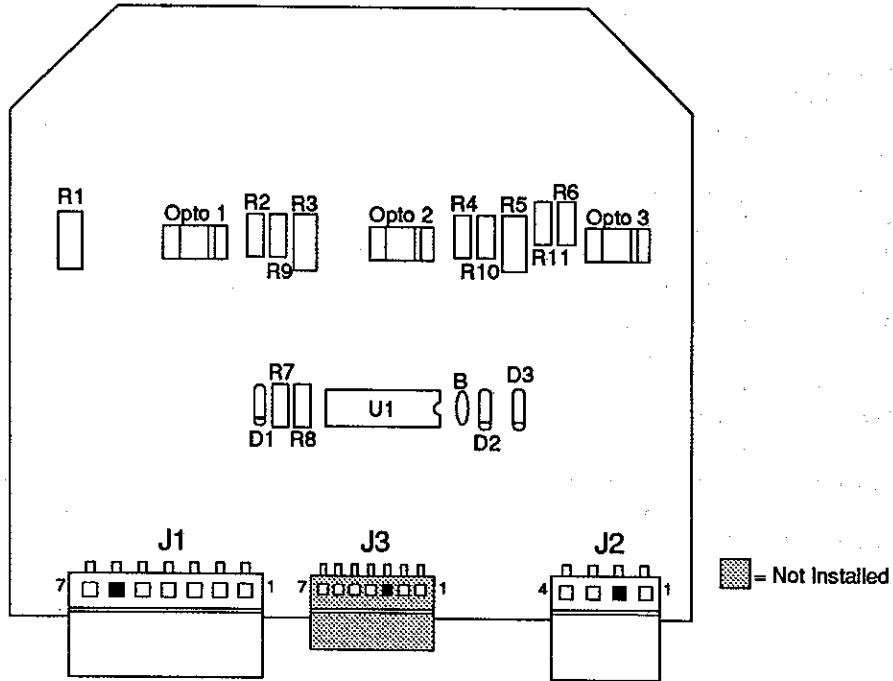


Item	Part Number	Description	Item	Part Number	Description
1	03-8036	Target, Plain	11	01-8413	Bracket Coil Mounting
2	B-13271	3-Bank Tgt Sub-Assy	12	A-11389	Plunger & Reset Plt Assy
3	10-364	Spring - Extension	a)	02-3972-1	Plunger
4	C-13205	3- Bnk. Drop Tgt. Opto Bd.	b)	01-8408	Reset Plate, 3-Bank
5	20-8712-18	"E" Ring, 3/16" Shaft	c)	4410-01132-00	Nut, 10-32 ESN
6	20-8712-25	"E" Ring, 1/4" Shaft	13	03-7066-4	Coil Tubing
7	10-392	Spring-Compression	14	4700-00016-00	Flatwasher, 3/16 x 7/16 x 17 ga.
8	4408-01119-00	Nut, 8-32 ESN	15	4008-01016-10	Mach. Screw, 8-32 x 5/8
9	A-11397	Stop Bracket Assy	16	4700-00072-00	Flatwasher, 17/64 x 1/2 x 21 ga.
10	AE-26-1200	Coil Assembly	17	23-6626	Rubber Grommet
			18	4408-01128-00	Nut, 8-32 KEPS

Associated Parts:

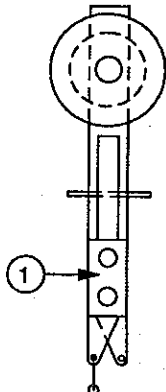
31-1463-576-2 3-Bank Drop Target Decals

3-Bank Drop Target Opto Board p/n C-13205



Part Number	Ckt Designation	Description
5768-12546-00		3-Bank Opto Board
5490-10159-00	Opto 1- Opto3	Opto Interruptor, MDL, S/G
5010-08930-00	R1, R3, R5	Resistor, 470 Ω , 1/2w, 5%, C.F.
5010-09162-00	R8	Resistor, 100K Ω , 1/4w, 5%, C.F.
5010-09324-00	R2, R4, R6	Resistor, 27K Ω , 1/4w, 5%, C.F.
5010-09324-00	R2, R4, R6	Resistor, 27K Ω , 1/4w, 5%, C.F.
5010-08773-00	R9 - R11	Resistor, 18K Ω , 1/4w, 5%, C.F.
5043-08980-00	B	Capacitor, .01 μ fd., +80 -20%
5370-12272-00	U1	I.C., Quad. Comp., LM339
5791-10869-04	J2	Connector, 4-Pin R/A Sq. Pin
5791-10869-07	J1	Connector, 7-Pin R/A Sq. Pin
5070-09054-00	D1 - D3	Diode, 1N4004, 1.0A

Standup Targets



Item	Part Number	Description
1	B-11696-1	Standup Target - Blue
1	B-11696-4	Standup Target - Red
1	B-11696-5	Standup Target - White

Upper Plastic Ramp

p/n R-13510

Item	Part Number	Description	Item	Part Number	Description
1	A-13487	Switch Gate Assembly	15	31-1557-576-3	Ramp Decal
2	A-13669	Bracket Sw Gate Assembly	16	31-1557-576-4	Ramp Decal
3	B-13668	Ball Guide Ramp Assembly	17	31-1558-576-1	Ramp Decal
4	C-13337	Single Flashlamp Assembly	18	31-1558-576-2	Ramp Decal
5	C-13489	Upper Diverter Assembly	19	31-1558-576-3	Ramp Decal
6	C-13702	Playfield Plastic Assembly	20	31-1558-576-5	Ramp Decal
7	H-13548	Ramp Cable	21	4006-01003-08	Mach. Screw, 6-32 x 1/2
8	01-9601	Ramp Flap	22	4106-01004-06	Sh. Metal Screw, #6 x 3/8
9	03-8149-9	Mini Dome-Trans. Red	23	4106-01019-08	Sh. Metal Screw, #6 x 1/2
10	03-8378	Plastic Ramp	24	4404-01119-00	Nut, 4-40 ESN
11	07-6688-22N	Rivet, 5/16 x 7/32	25	4406-01119-00	Nut, 6-32 ESN
12	31-1006-576-1	Playfield Plastic	26	4700-00003-00	Flatwasher, 1/8 x 9/32 x 21ga.
13	31-1557-576-1	Ramp Decal	27	4700-00005-00	Flatwasher, 9/64 x 7/16 x 21ga.
14	31-1557-576-2	Ramp Decal	28	4700-00011-00	Flatwasher, 11/64 x 7/16 x ga.

Lower Metal Ramp

p/n C-13470

Item	Part Number	Description
1	C-13469	Ramp Welded Assembly
a)	01-9562	Ramp Floor
b)	01-9564	Ramp Bracket
c)	01-9563	Ramp Bracket
2	01-9045	Ramp Flap
3	07-6688-16N	Rivet, 1/8" x 1/8"
4	20-9284	Spade Bolt
5	07-6700	Pop Rivet

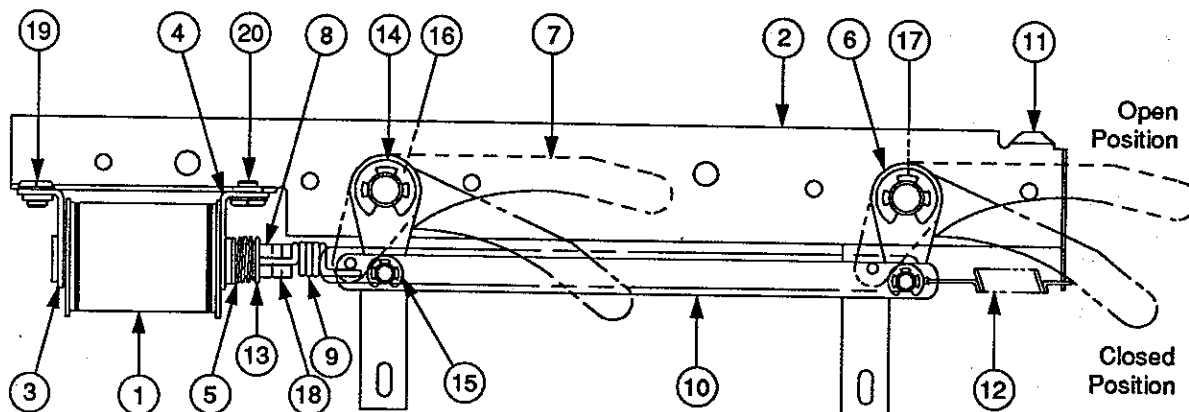
Top Metal Ramp

p/n C-13468

Item	Part Number	Description
1	01-9558	Ramp Floor
2	01-9559	Ramp Wall Outer
3	01-9560	Ramp Wall Inner
4	01-9561	Strap Mounting

Upper Diverter Assembly

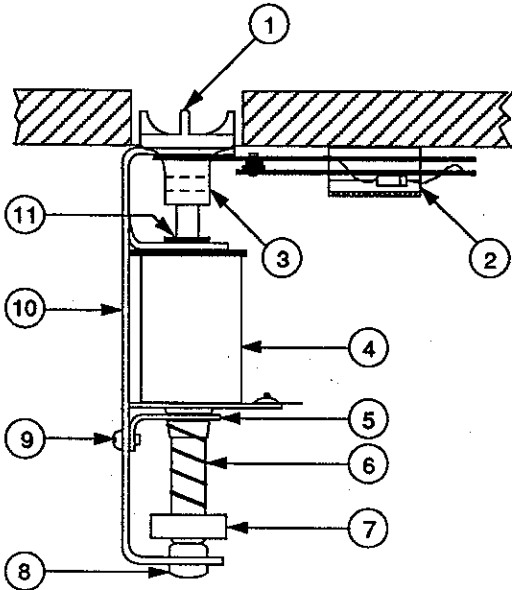
p/n C-13489



Item	Part Number	Description
1	AE-23-800	Coil Assembly
2	C-13490	Bracket Assembly
3	B-13488	Solenoid Bracket Assy
4	01-8-508-S	Solenoid Bracket
5	10-303	Master Spring
6	A-13491	Drive Arm Assembly
7	C-13432	Gate Diverter
8	02-4241	Plunger Coil
9	10-389	Gate Mechanism Spring
10	01-9588	Drive Link
11	23-6577	Plug Bumper, 5/8" D.
12	10-320	Spring Extension
13	20-8712-43	"E" Ring, 7/16" Shaft
14	20-8712-25	"E" Ring, 1/4" Shaft
15	20-8712-18	"E" Ring, 3/16" Shaft
16	4700-00073-00	Flatwasher, 9/32 x 1/2 x 21ga.
17	20-8716-2	Roll Pin, 3/32 x 5/8
18	20-8716-5	Roll Pin, 1/8 x 7/16
19	4008-01017-06	Mach. Screw, #8-32 x 3/8
20	4006-01003-06	Mach. Screw, #6-32 x 3/8

Ball Popper Assembly

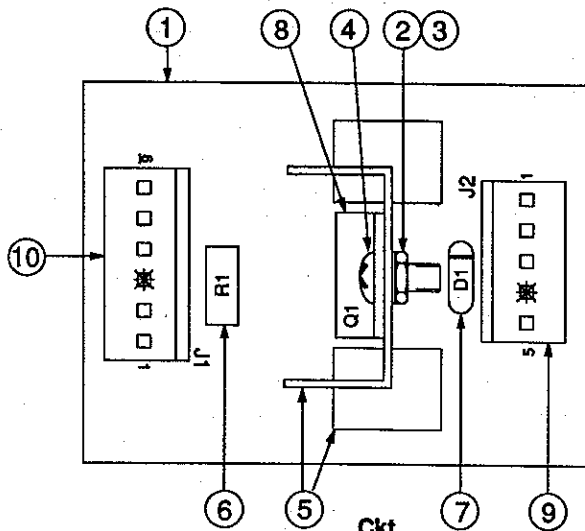
p/n D-11335-2



Item	Part Number	Description
1	03-8053	Ball Popper Cap
2	A-11657	Switch Assembly
a)	A-11658	Switch & Diode Assy
b)	01-3670-1	Switch Plate
c)	4205-01016-14	Wood Screw, #5 x 7/8
3	20-9314-7	Dowel Pin, 3/32 x 1/2
4	AE-23-800	Coil Assembly
5	A-11721	Bracket Assembly
6	10-135	Spring
7	A-11336	Armature Assembly
8	23-6420	Rubber Grommet
9	4008-01017-05	Mach. Screw, 8-32 x 5/16
10	B-11631	Ball Popper Bracket Assy
11	03-7067	Coil Tubing
12	16-8850-200	Label

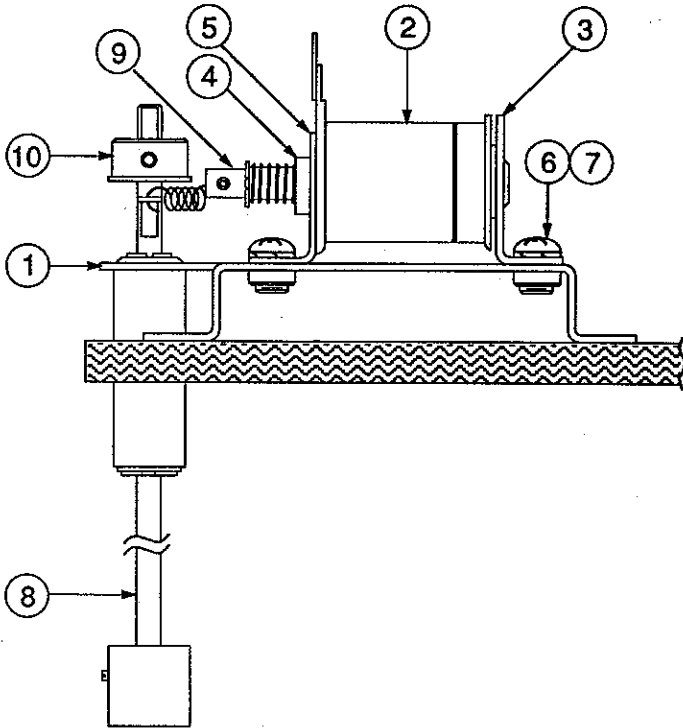
High Current Driver Assembly

p/n C-13509



Item	Part Number	Ckt Symbol	Description
1	5768-12609-00		Bare PC Board
2	4703-00015-00		Lockwasher #4, External
3	4404-01117-00		Nut, 4-40 Hex .
4	4004-01005-06		Mach. Screw, 4-40 x 3/8
5	5705-09199-00		Heatsink
6	5010-09361-00	R1	Resistor, 220Ω, 1/2w, 5%
7	5070-09054-00	D1	Diode, 1N4004, 1.0 A.
8	5191-12179-00	Q1	Transistor, TIP 36C PNP
9	5791-10862-05	J2	Connector, 5-pin Hdr
10	5791-10862-06	J1	Connector, 6-pin Hdr.

Diverter Assembly p/n B-13496

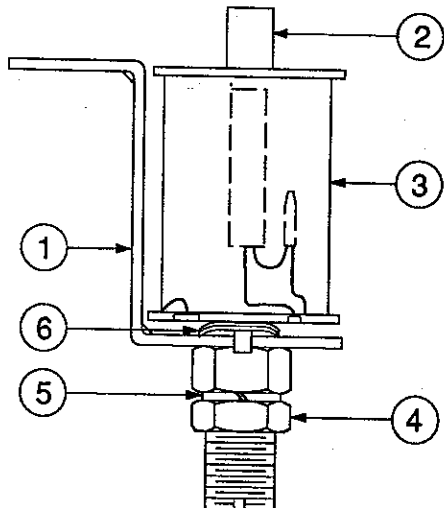


Item	Part Number	Description
1	B-13493	Mounting Bracket Assy
2	AE-24-900	Coil Assembly
3	A-10821	Flipper Stop Bracket Assy
4	03-7066	Coil Tubing
5	01-8413	Bracket Coil Tubing
6	4010-01008-06	Mach. Screw, 10-32 x 3/8
7	4701-00004-00	Lockwasher, #10 Split

Associated Parts

8	A-13494	Diverter Shaft & Paddle Shaft
a)	02-4444	Diverter
b)	03-8388	Roll Pin, 3/32 x 1/2
c)	20-8716-1	"E"-Ring, 1/4" Shaft
d)	20-8712-25	"E"-Ring, 7/16" Shaft
9	A-13278	Plunger Assembly
a)	02-4241	Coil Plunger
b)	10-389	Spring
c)	20-8712-43	"E"-Ring, 7/16" Shaft
d)	20-8716-5	Roll Pin, 1/8 x 7/16
10	A-13279	Drive Arm Assembly

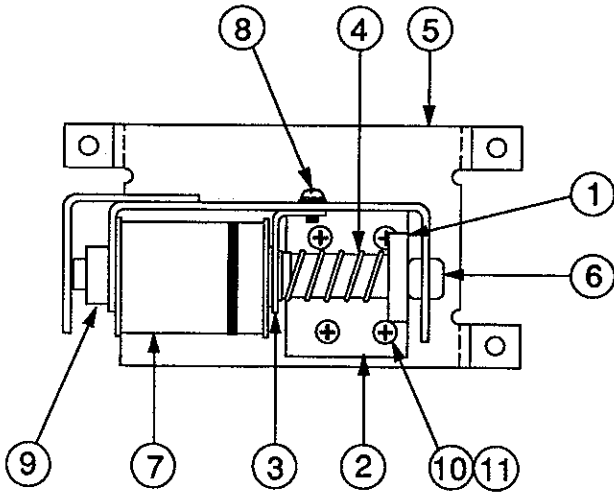
Magnet Assembly p/n B-13520



Item	Part Number	Description
1	A-13500	Magnet Mounting Bracket
2	02-4446	Magnet Rod
3	B-13522	Magnet Coil
4	4423-01135-00	Jam Nut, 7/16-20
5	4701-00007-00	Lockwasher, 7/16" (Split)
6	4705-00003-00	Spring Washer, 1/4 x 1/2 x 38ga.

LOCK Kickback Assy

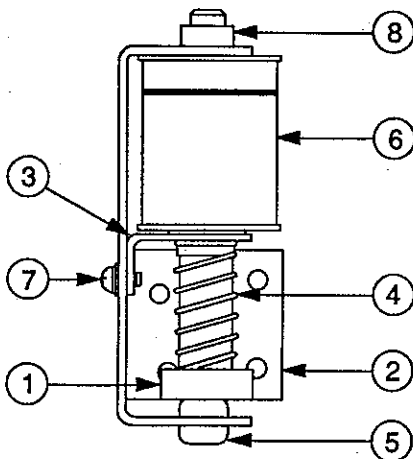
p/n B-13497



Item	Part Number	Description
1	A-13270	Bell Armature
2	A-13498	Mounting Bracket Assy
3	01-8-508-T	Solenoid Bracket
4	10-135	Solenoid Spring
5	01-9597	Base Plate
6	23-6420	Rubber Grommet
7	AE-23-800	Coil Assembly
8	4008-01017-04	Mach. Screw, #8-32 x 1/4
9	03-7067	Coil Tubing
10	4008-01017-06	Mach. Screw, #8-32 x 3/8
11	4408-01119-00	Nut, #8-32 ESN

Upper Left Kickback Assy

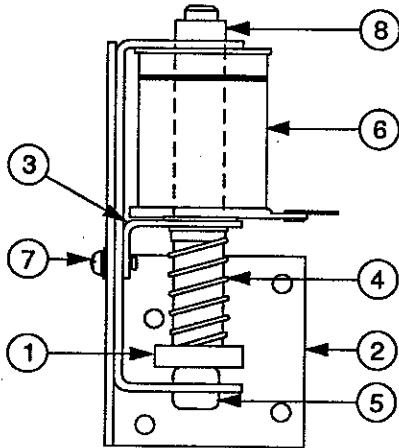
p/n B-13499



Item	Part Number	Description
1	A-6306-2	Bell Armature Assembly
2	01-9595-1	Kicker Mounting Bracket
3	01-8-508-T	Solenoid Bracket
4	10-135	Solenoid Spring
5	23-6420	Rubber Grommet
6	AE-24-900	Coil Assembly
7	4008-01017-04	Mach. Screw, #8-32 x 1/4
8	03-7067-5	Coil Tubing

Left Outlane Kickback Assy

p/n B-11873



Item	Part Number	Description
1	A-6306-2	Bell Armature Assembly
2	B-7409-2	Mounting Bracket Assy
3	01-8-508-T	Solenoid Bracket
4	10-135	Solenoid Spring
5	23-6420	Rubber Grommet
6	AE-23-800	Coil Assembly
7	4008-01017-05	Mach. Screw, #8-32 x 5/16
8	03-7067-5	Coil Tubing

Two Switch Mounting Assy

p/n B-13507

Item	Part Number	Description
1	A-13672	Two-Switch Assembly
a)	C-13606	Two-Switch PCB
b)	01-9709	Two-Switch Mounting Brkt.
c)	4002-01005-06	Mach. Screw, #2-56 x 3/8
d)	4701-00024-00	Lockwasher, #2 Split
2	01-9598	Switch Mounting Bracket
3	4006-01003-03	Mach. Screw, 6-32 x 3/16

Coin Door Assembly

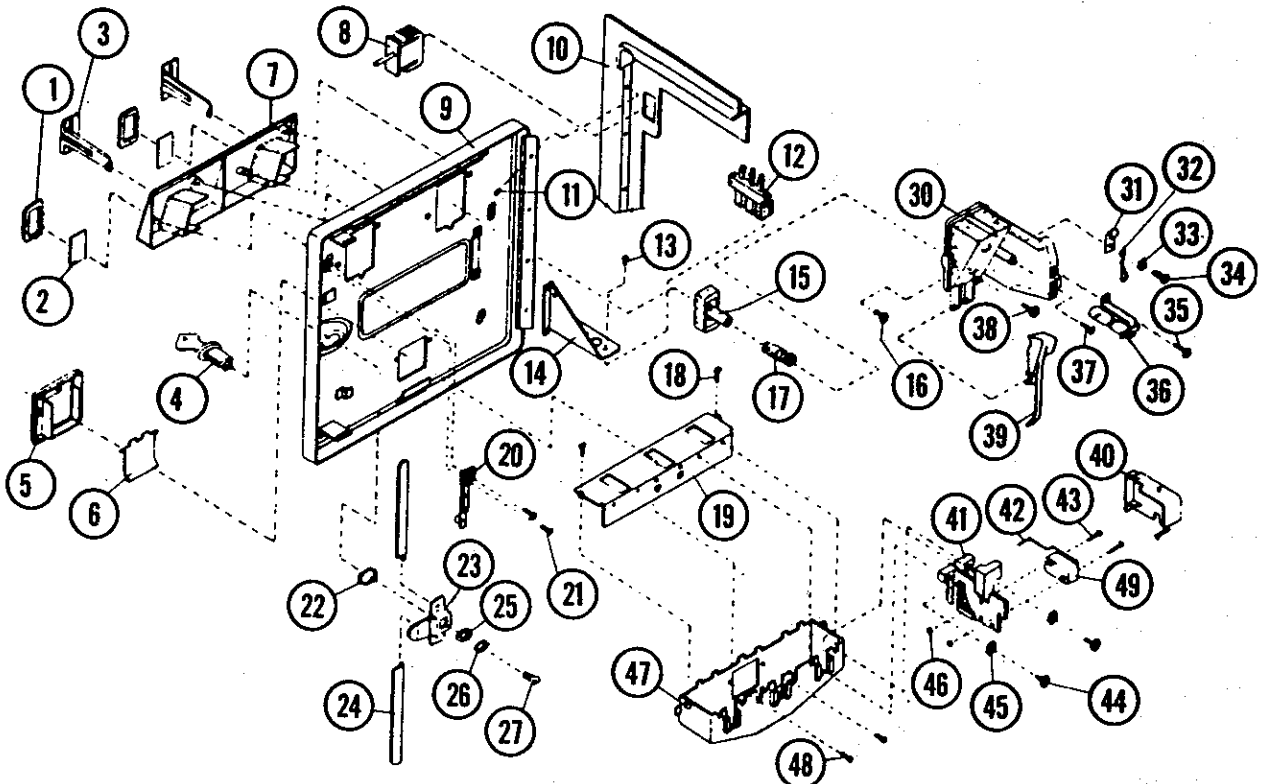
USA Door with decals, *p/n C-13155-1*

2-Chute Door - 09-17002-x 3-Chute Door - 09-17003-x ("x" is the country designator)

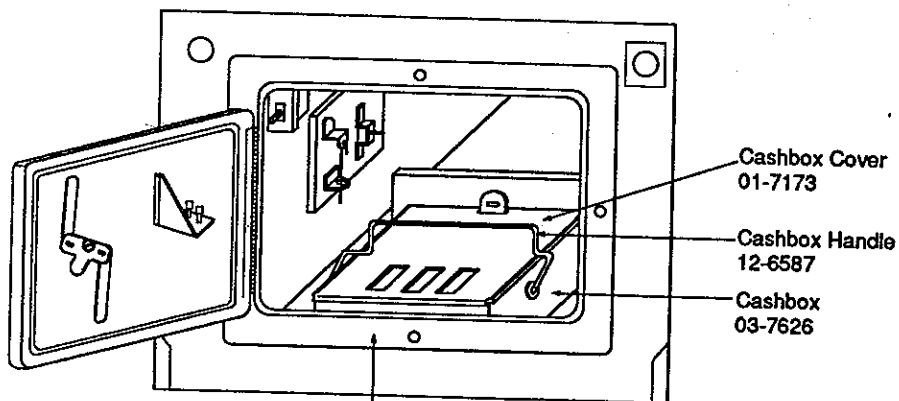
Item	Part Number	Description	Quantity
1	27-1038	Button Cover	2 or 3
2	27-1041-1→54	Price Panel	2 or 3
3	27-1026-1→15	Coin Entry Plate	2 or 3
4	27-1016	Lock Assembly	1
5	27-1061-1	Coin Return - Bezel	1
6	27-1062	Coin Return Flap	1
7	27-1021	Button Housing - 2-slot	1
	27-1022	Button Housing - 3-slot	1
8	27-1111	Interlock Switch	1
9	27-1006-1	Coin Door , 2-Slot	1
	27-1007-1	Coin Door , 3-Slot	1
10	27-1005	Coin Door Frame	1
11	27-1003	M/C Screw, 6-32 x 3/16	4
12	27-1008	Diagnostic Switch	1
13	27-1101	M/C Screw, 4-40 x 1/4	2
14	27-1102	Bracket, Diagnostic Switch	1
15	27-1037	Button	2 or 3
16	27-1078	M/C Screw, 6-32 x 3/8	2 or 3
17	27-1039	Conical Spring	2 or 3
18	27-1079	Self-tapping Screw, #6 x 1/4	2
19	27-1077-1	Coinbox Cover	1
20	27-1066	Slam Switch	1
21	27-1067	M/C Screw, 4-40 x 1/2	2
22	27-1017	Nut (key)	1
23	27-1012	Locking Cam	1
24	27-1011	Locking Arm	2
25	27-1020	Washer	1
26	27-1018	Star Washer	1
27	27-1019	M/C Screw, 1/4-28 x 5/16	1
28	Not Used		
29	Not Used		
30	27-1112	Coin Inlet Chute	2 or 3
31	27-1088	Cable Clamp	2 or 3
32	27-1025	Key Hook	1
33	27-1086	Washer, #6	2 or 3
34	27-1078	M/C Screw, 6-32 x 3/8	1 or 2
	27-1113	M/C Screw, 6-32 x 7/16	1
35	27-1079	Self-tapping Screw, #6 x 1/4	2 or 3
36	27-1084	Lamp Socket	2 or 3
	27-1085	Lamp	2 or 3
37	27-1096	Self-tapping Screw, #5 x 3/8	2 or 3
38	27-1087	M/C Screw, 6-32 x 5/8	2 or 3
39	27-1082	Lever Arm	2 or 3
40	27-1097	Switch Cover	2 or 3
41	27-1091-1	Coin Accept Chute	2 or 3
42	27-1075	Wire Form (Small)	2 or 3
	or		
	27-1093	Wire Form (Large)	
43	27-1094	M/C Screw, 4-40 x 7/8	4 or 6
44	27-1087	M/C Screw, 6-32 x 5/8	4 or 6
45	27-1086	Washer, #6	4 or 6
46	27-1095	Nut, 4-40 ESNA	4 or 6
47	27-1076-1	Coin Return Box	1
48	27-1078	M/C Screw, 6-32 x 3/8	2
49	27-1092	Microswitch	2 or 3

Coin Door Assembly

p/n C-13155-1



Pinball Front Box



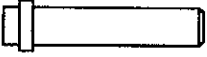
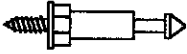
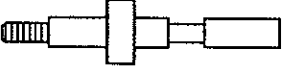


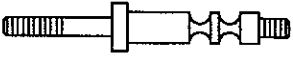
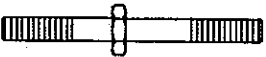
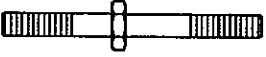


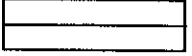

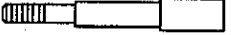
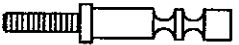
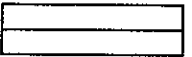



09-17002-x 09-17003-x
 2-Chute Coin Door 3-Chute Coin Door
 (x=Country Designator)

Unique Parts

Part Number	Description	Part Number	Description
A-11-927-576	Backbox Assembly	C-13468	Ramp Welded Assembly
A-11-576-PL	Playfield & Inserts	C-13470	Ramp Assembly
A-13128-576	Carton Assembly	C-13489	Upper Diverter Assembly
A-13482	Ball Guide Assembly	C-13701	Playfield Plastic Assembly
A-13494	Shaft & Diverter Assembly	C-13723	Upper Right Flipper Assembly
A-13504	Switch Gate Assembly		
A-13505	Gate Switch Assembly	D-11581-576	Audio Sound Board Assy
A-13508	Switch Mounting Assembly	D-11883-576	System 11C CPU Board
A-8552-576	Backglass Assembly	D-12247-576	Auxiliary Driver Board
		D-12313-576	Backbox Interconnect Board
B-13471	Pop Cage Welded Assembly	D-13481	Ball Guide Assembly
B-13478	Ball Guide Assembly	D-13483	Ball Guide Assembly
B-13480	Ball Guide Assembly	D-13536	Speaker/Display Assembly
B-13484	Ball Guide Assembly	D-13692	Ramp & Plastic Assembly
B-13486	Ball Guide Assembly		
B-13496	Diverter Assembly	H-12190-576	Main Backbox Cable
B-13497	LOCK Kickback Assembly	H-12192-576	Cabinet Cable
B-13499	Upper Left Kickback Assembly	H-12196-576	Secondary Cable
B-13507	2-Switch Mounting Assembly	H-12542-576	Aux Lamp Cable
B-13520	Magnet Assembly	H-13544-576	Playfield Switch Cable
B-13530	Ball Guide Assembly	H-13545-576	Playfield Lamp Cable
B-13531	Ball Guide Assembly	H-13546-576	Playfield Solenoid Cable
B-13568	Spin Target Assembly	H-13547-576	Insert Panel Cable
B-13693	Playfield Plastic Assembly	H-13549	576-Ramp Cable
B-13695	Playfield Plastic Assembly	H-13580	Solenoid Assembly Cable
B-13696	Playfield Plastic Assembly		
B-13697	Playfield Plastic Assembly	R-13485	Ball Guide Assembly
B-13698	Playfield Plastic Assembly	R-13510	Plastic Ramp Assembly
B-13699	Playfield Plastic Assembly		
B-13700	Playfield Plastic Assembly	03-7960-576-1	Playfield Mylar
B-13717	Spin Target Assembly	03-7960-576-2	Playfield Mylar
C-13337	Single Flashlamp Assembly	31-1006-576-	Playfield Plastic
C-13361	3-Lamp PCB Assembly	31-1008-576	Bottom Arch Screened
C-13362	5-Lamp PCB Assembly	31-1009-576	Screened Shooter Plate
C-13374-1	G.I. & Flashlamp Assembly	31-1357-576	Screened Backglass
C-13374	20-Lamp PCB Assembly	31-1420-576	Speaker Panel Cover
C-13375	Single Flashlamp Assembly	31-1463-576-2	3-Bnk Drop Target Decal
C-13425	3-Lamp PCB Assembly	31-1557-576	Decal Sheet - Bottom
C-13457	5-Bank Drop Target Assy	31-1558-576	Decal Sheet - Top

Metal & Plastic Posts

Metal Posts

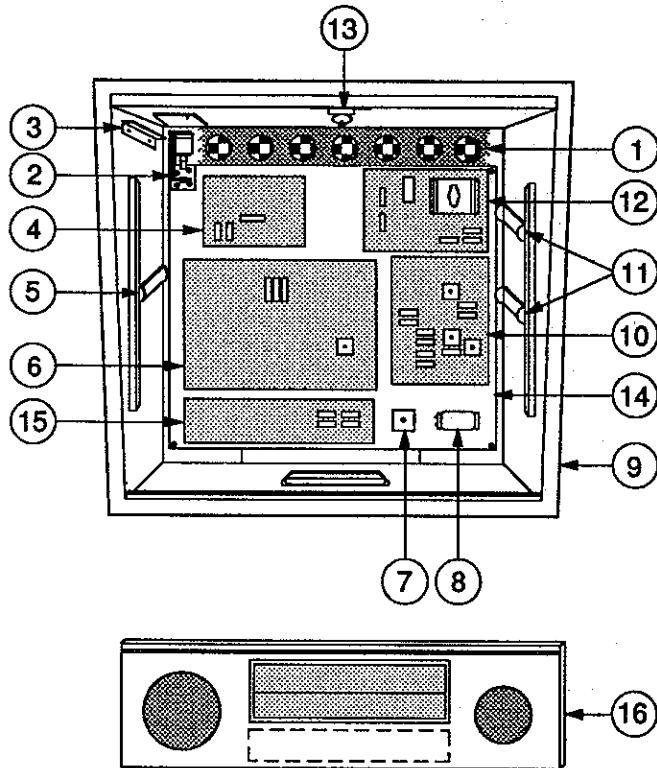
	Part No.	Description	[Quantity]
	02-3409	Spring Post	[1]
	02-3905	Bumper Post, #8 WS	[1]
	02-4008	Bumper Post, Rubber	[7]
	02-4020	Support Post	[3]
	02-4036	Bumper Post, Rubber	[9]
	02-4423	Bumper Post	[2]
	02-4424-1	Post, #6-32 / #8-32	[7]
	02-4425 -1	Post, #8-32 / #8-32	[2]
	02-4433	Post, #8 x 1-3/16"	[4]
	02-4435	Post, #8 x 1-3/16	[1]
	02-4436-1	F-F Spacer, 8-32 x 1"	[1]
	02-4436-5	F-F Spacer, 2.83"	[2]
	02-4445	Post	[1]
	02-4450	Post Double Bumper	[4]
	02-4466-1	F-F Spacer, #8-32 x 1-3/16	[1]
	02-4466-2	F-F Spacer, #8-32 x 1-1/8	[1]
	02-4466-3	F-F Spacer, #8-32 x 1-1/16	[1]
	02-4466-4	F-F Spacer, #8-32 x 1-15/16	[1]

Plastic Posts



03-8319-9 Plastic Post [22]

Backbox Parts List



Item	Part Number	Description
1	01-6645	Venting Screen
2	B-10686-1*	Knocker & Bracket Assy
3	A-12497	Upr Insert Bd Hinge Assy
4	D-13336	PCB Plate Assembly
5	A-12498	Lwr Insert Bd Hinge Assy
6	D-11883-576*	System 11C CPU Board
7	5100-09418-00	Bridge Rectifier, 100v, 35A.
8	5040-09051-00	Capacitor, 30,000 μ Fd, 25v
9	A-11-927-576	Roller Games Backbox
10	D-12247-576*	Aux. Pwr Driver Board
11	01-9047	Insert Stop Bracket
12	D-12246*	Power Supply Assembly
13	20-9637	Lock & Cam Kit
14	D-11581-576*	Audio Board Assembly
15	D-12313-576*	Backbox Interconnect Board
16	D-13536	Speaker/Display Assembly
a)	31-1422-576	Speaker Grille (Screened)
b)	31-1420-576	Speaker Panel Cover (Screened)
c)	D-12232-1*	Master Display Sub-Assembly
d)	C-13537	8-Lamp Board
e)	5555-12068-00	Speaker 4" Piezo, 50w
f)	5555-12015-00	Speaker, 4 Ω , 6" RD 10w

* Refer to Individual Unit's Parts List

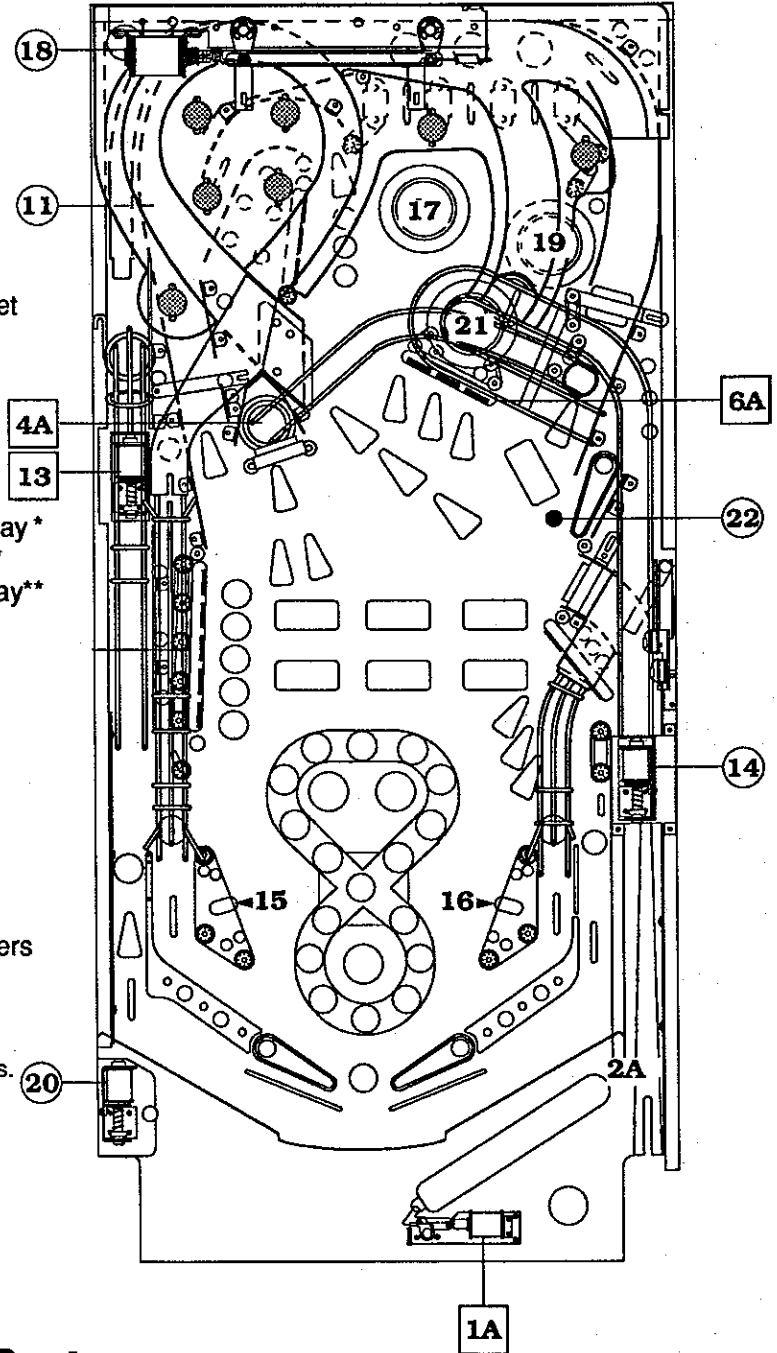
Miscellaneous Parts

Part Number	Description	Part Number	Description
A-8552-576	Backglass Assembly	576-IN	Roller Games Insert
31-1357-576	Roller Games Backglass	01-6571	Hinge Mtg. Bracket, Insert Board
03-7960-576	Playfield Mylar	01-6655	Latch-Insert Board
08-7028-T	Glass-Playfield	01-6652	Stop Bracket
08-7456	Backbox Glass, 27 x 18-7/8	31-1463-576-1	5-Bnk Drop Target Decals
31-1002-576	Playfield (Screened)	31-1463-576-2	3-Bnk Drop Target Decals
31-1006-576	Playfield Plastics	31-1524-	Decals Set
31-1008-576	Bottom Arch (Screened)	31-1557-576	Decal, Sheet Top
31-1009-576	Shooter Plate (Screened)	31-1558-576	Decal, Sheet Bottom
31-1019-554	Spin Target (Screened)	5795-10937-09	Ribbon Cable, 20-Conductor, 9"
31-1422-576	Speaker Grille (Screened)	5795-10938-27	Ribbon Cable, 26-Conductor, 27"

Solenoids/Flashers

Item	Part No.	Description
1A	AE-23-800	Outhole Kicker
1C	#906 Flashlamps	Flash 1
2A	AE-23-800	Shooter Lane Feeder
2C	#89/906 Flashlamps	Flash 2
3A		
3C	#89/906 Flashlamps	Flash 3
4A	AE-23-800	Ball Popper
4C	#89/906 Flashlamps	Flash 4
5A	Not Used	
5C	#89/906 Flashlamps	Flash 5
6A	AE-26-1200	3-Bank Drop Target Reset
6C	#89/906 Flashlamps	Flash 6
7A	AE-23-800	Knocker (Backbox)
7C	#89/906 Flashlamps	Flash 7
8A	AE-24-900	Lock Diverter
8C	#89/906 Flashlamps	Flash 8
9	#89/906 Flashlamps	Flash 9
10	5580-09555-01*	Insert Panel Gnl Illum Relay *
11	5580-09555-01*	Playfield Gnl Illum Relay *
12	5580-09555-01	Solenoid A/C Select Relay**
13	AE-24-900	Upper Kickback
14	AE-23-800	Lock Kickback
15	AE-23-800	Left Kicker ("Sling")
16	AE-23-800	Right Kicker ("Sling")
17	AE-23-800	Left Jet Bumper
18	AE-23-800	Ramp Diverter
19	AE-23-800	Right Jet Bumper
20	AE-23-800	Outlane Kickback
21	AE-23-800	Lower Jet Bumper
22	B-13522	Deepfreeze Magnet
-	FL 11630/50VDC	Lower Left & Right Flippers
-	FL 11630/50VDC	Upper Right Flipper

* - 5580-09555-01 on Relay Board, C-11998-1, for both Playfield and Insert Gen Illumination applications.
 ** - In backbox on Aux Power Driver Bd, D-12247-576.

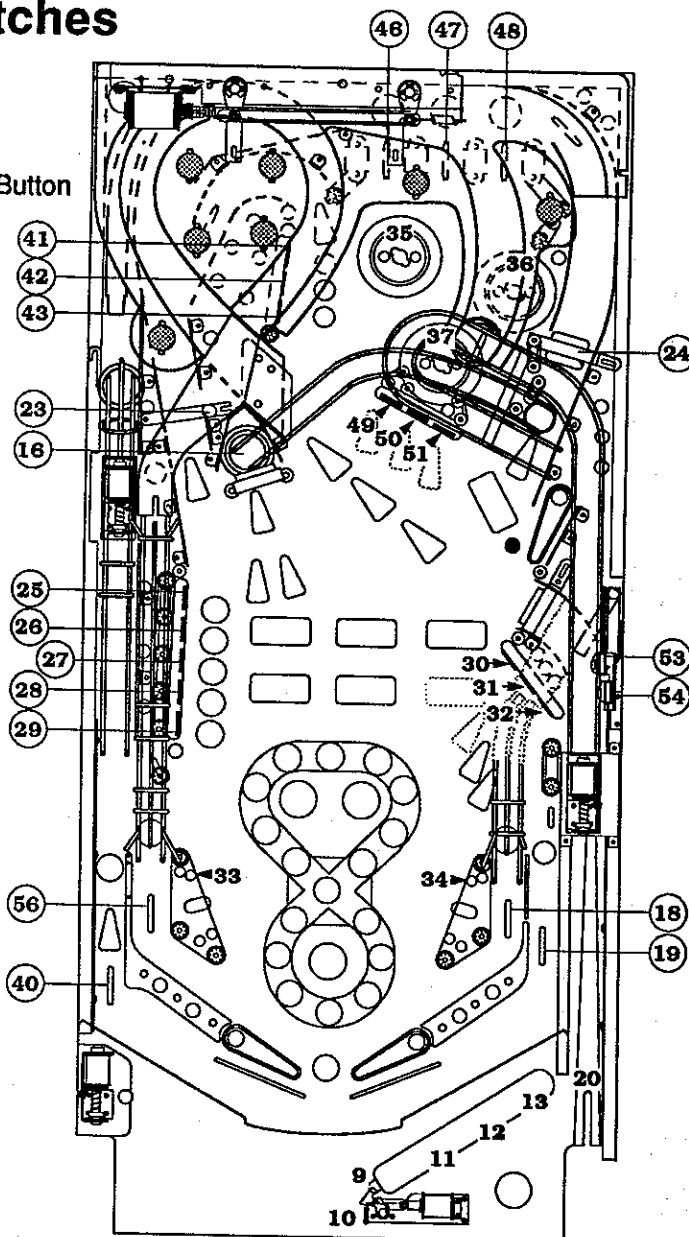


Rubber Parts

Part No.	Description	Qty	Part No.	Description	Qty	Part No.	Description	Qty
23-6300	5/16" Ring	8	23-6313-1	Grommet	1	23-6556	Sleeving, Blk	7
23-6301	3/4" Ring	2	23-6327	Shooter Tip	1	23-6599	7/16" Ring	2
23-6302	1" Ring	3	23-6519-4	Lg Red Flpr Ring	3	23-6626	Grommet	7
23-6303	1-1/4" Ring	2	23-6552	Sleeving, Yel	1			
23-6306	2-1/2" Ring	4						

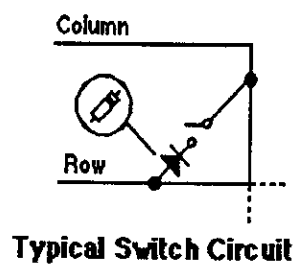
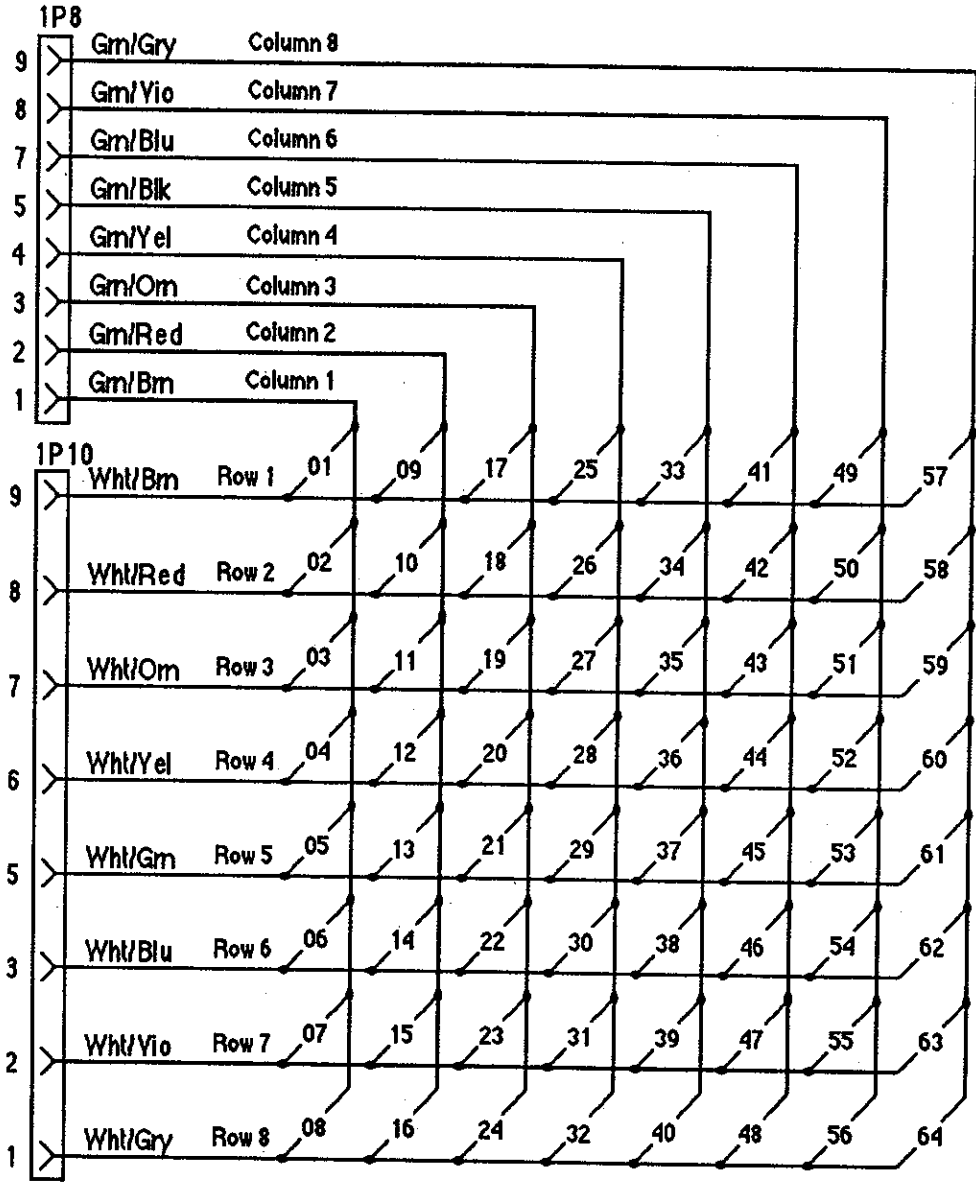
Switches

Item	Part No.	Description
1	(See Figure 2)	Plumb Bob Tilt
2	5580-09555-01	C Power-A/C Relay
3	SW-1A-126	Game START (Credit) Button
4	27-1092	R Coin Chute (USA)
5	Not Used (USA)	Center Coin Chute
6	27-1092	L Coin Chute (USA)
7	27-1066	Slam Tilt
8	27-1008	High Score Reset*
9	5647-12133-12	Outhole
10	Not Used	
11	5647-09957-00	Ball Trough #1 (left)
12	5647-09957-00	Ball Trough #2 (mdl)
13	5647-12073-08	Ball Trough #3 (right)
14		
15		
16	A-11658	Ball Popper
17	Not Used	
18	5647-12073-19	Right Return Lane
19	5647-12073-19	Right Drain Lane
20	5647-12073-04	Ball Shooter Lane
21	5647-12073-19	Left Jetway Top
22	5647-12073-19	Right Jetway Top
23	5647-12133-08	Left Spinner
24	5647-12133-08	Right Spinner
25	p/o C-13239	E (5-Bnk Dr Tgt)
26	p/o C-13239	T (5-Bnk Dr Tgt)
27	p/o C-13239	A (5-Bnk Dr Tgt)
28	p/o C-13239	K (5-Bnk Dr Tgt)
29	p/o C-13239	S (5-Bnk Dr Tgt)
30	B-11696-5	A (B R Standup)
31	B-11696-5	B (B R Standup)
32	B-11696-5	C (B R Standup)
33	-	BL Kicker***
34	-	BR Kicker***
35	B-12030-2	Left Jet Bumper
36	B-12030-2	Right Jet Bumper
37	B-12030-2	Lower Jet Bumper
38	5647-12073-11	Ramp Diverter 1
39	5647-12073-11	Ramp Diverter 2
40	5647-12073-19	Left Outlane Kickback
41	B-11696-4	1 (Top Standup)
42	B-11696-4	2 (Top Standup)
43	B-11696-4	3 (Top Standup)
44	5647-12073-19	EXTRA BALL
45	Not Used	
46	5647-12073-19	"J" Lane Rolllover
47	5647-12073-19	"E" Lane Rolllover
48	5647-12073-19	"T" Lane Rolllover
49	p/o C-13205	3-Bank Drop Target Opto
50	p/o C-13205	3-Bank Drop Target Opto
51	p/o C-13205	3-Bank Drop Target Opto
-	SW-10A-48	Left Flipper Button



Item	Part No.	Description
52	5647-12073-11	LOCK Ramp Entry
53	5647-12073-37	LOCK #1
54	5647-12073-38	LOCK #2
55	Not Used	
56	5647-12073-19	Left Return Lane
57	-	R Flipper Lane Change**
58	-	L Flipper Lane Change**
59	Not Used	
60	Not Used	
61	Not Used	
62	Not Used	
63	Not Used	
64	Not Used	
-	SW-1010A-13	Right Flipper Button

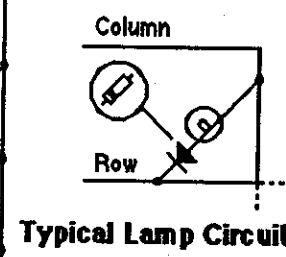
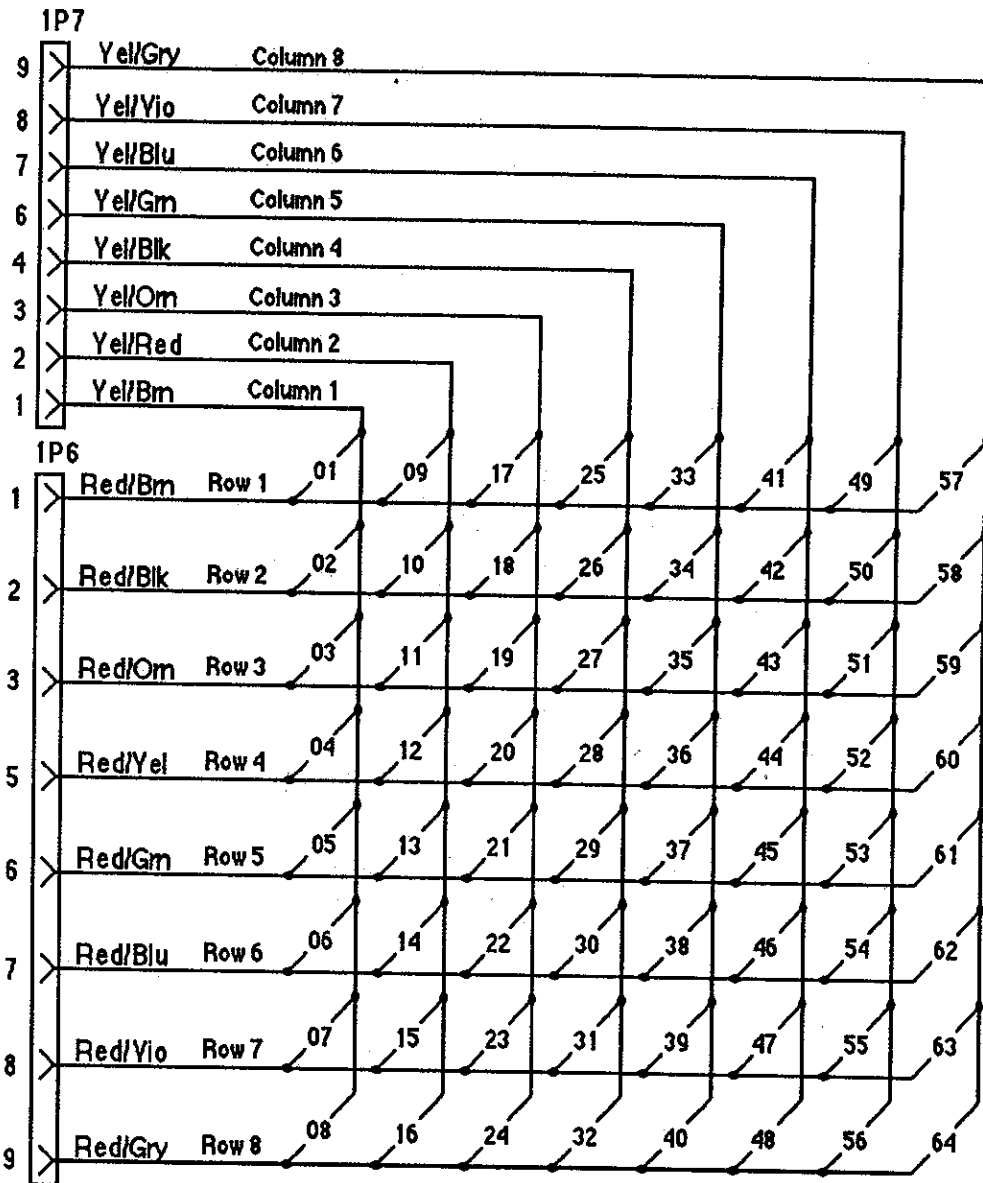
Notes: * Part Number is for entire Diagnostic Switch Assembly, including H S Reset Switch;
 ** Optotransistor on Backbox Interconnect Bd; *** [Paired Kicker Actuating Sw: A-4834-H; B-8734-1]



RollerGames Switch-Matrix Table

COLUMN \ ROW	1 Q45 GRN-BRN 1J8-1	2 Q49 GRN-RED 1J8-2	3 Q44 GRN-ORN 1J8-3	4 Q48 GRN-YEL 1J8-4	5 Q43 GRN-BLK 1J8-5	6 Q47 GRN-BLU 1J8-7	7 Q42 GRN-VIO 1J8-8	8 Q46 GRN-GRY 1J8-9
1	WHT-BRN 1J10-9 Plumb Bob Tilt 1	Outhole 9		5-Bank Dr Tgt E 25	BL Kicker ("sling") 33	Top Standup 1 41	W Top Dr Tgt 49	Flipper Flight 57
2	WHT-RED 1J10-8 C Side Power A/C Relay 2		Right Return Lane 18	5-Bank Dr Tgt T 28	BR Kicker ("sling") 34	Top Standup 2 42	A Top Dr Tgt 50	Flipper Left 58
3	WHT-ORN 1J10-7 Game Start 3	Ball Trough #1 (left) 11	Right Outlane 19	5-Bank Dr Tgt A 27	Left Jet Bumper 35	Top Standup 3 43	R Top Dr Tgt 51	
4	WHT-YEL 1J10-6 Right Coin Chute 4	Ball Trough #2 (mid) 12	Shooter Lane 20	5-Bank Dr Tgt K 28	Right Jet Bumper 36	EXTRA BALL 44	Ramp Lock Entry 52	
5	WHT-GRN 1J10-5 Center Coin Chute 5	Ball Trough #3 (right) 13	L Jetway Top 21	5-Bank Dr Tgt S 29	Lower Jet Bumper 37		Ball Lock 1 53	
6	WHT-BLU 1J10-3 Left Coin Chute 6		R Jetway Top 22	BR Standup 1 30	Ramp Diverter 1 38	J (Top Lane) 46	Ball Lock 2 54	
7	WHT-VIO 1J10-2 Slam Tilt 7		Left Spinner 23	BR Standup 2 31	Ramp Diverter 2 39	E (Top Lane) 47		
8	WHT-GRY 1J10-1 High Score Reset 8	Ball Popper 16	Right Spinner 24	BR Standup 3 32	Lower Kickback 40	T (Top Lane) 48	Left Return Lane 56	

BL = Bottom Left BR = Bottom Right

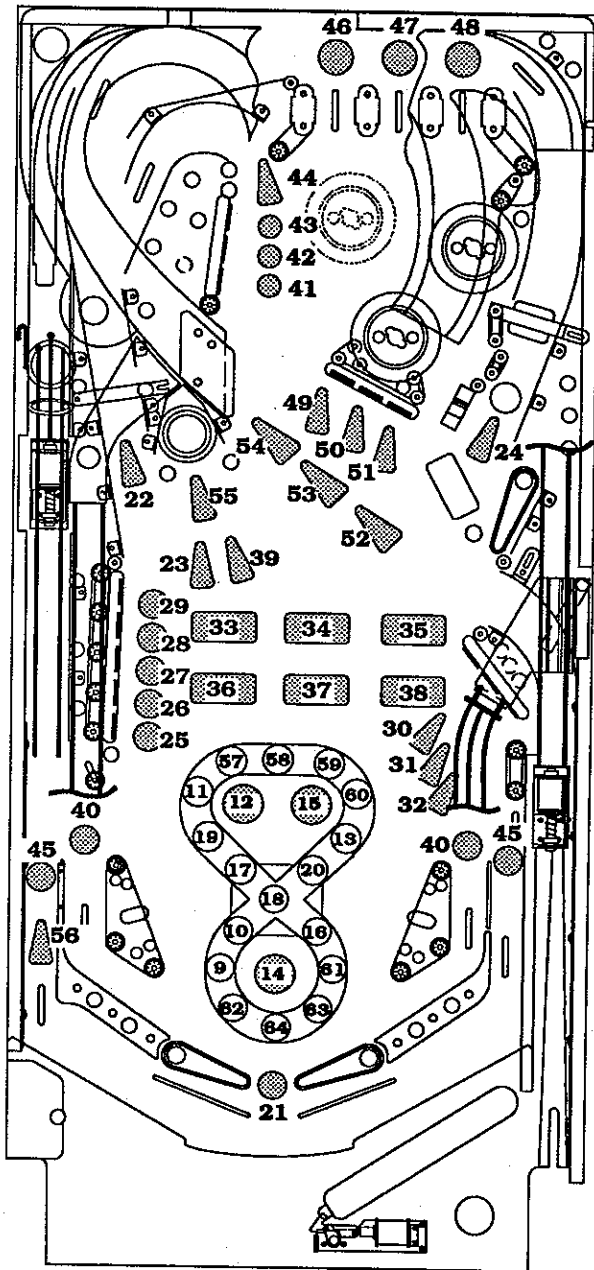


RollerGames Lamp-Matrix Table

ROW \ COLUMN	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 RED-BRN 1J6-1	W 1	Track 8 9	Track 13 17	E L Dr Tgt 25	Bad Attitude Team 1 33	Top Standup 1 41	W Top Dr Tgt 49	Track 1 57
Q81 RED-BLK 1J6-2	I 2	Track 11 10	Track 10 18	T L Dr Tgt 26	Maniacs Team 2 34	Top Standup 2 42	A Top Dr Tgt 50	Track 2 58
Q82 RED-ORN 1J6-3	L 3	Track 4 11	Track 6 19	A L Dr Tgt 27	Violators Team 3 35	Top Standup 3 43	R Top Dr Tgt 51	Track 3 59
Q83 RED-YEL 1J6-5	L 4	Bonus 2X 12	Track 9 20	K L Dr Tgt 28	Rockers Team 4 36	Extra Ball 44	Ramp Entry Jackpot 52	Track 5 60
Q84 RED-GRN 1J6-6	I 5	Track 7 13	Shoot Again 21	S L Dr Tgt 29	Hot Flash Team 5 37	Special (Outlans) 45	Ramp Entry Lock 53	Track 14 61
Q85 RED-BLU 1J6-7	A 6	Bonus 1X 14	Left Jetway 22	BR Standup A 30	T-Birds Team 6 38	J (Top Lane) 46	Ramp Entry Million 54	Track 15 62
Q86 RED-VIO 1J6-8	M 7	Bonus 4X 15	Roll Motion Ball Popper 23	BR Standup B 31	Scoring Cycle Ball Popper 39	E (Top Lane) 47	Deep Freeze Ball Popper 55	Track 16 63
Q87 RED-GRY 1J6-9	S 8	Track 12 16	Right Jetway 24	BR Standup C 32	Return Lanes 40	T (Top Lane) 48	Left Outlane Kickback 56	Track 17 64

BR = Bottom right; BL = Bottom Left ○ = Multiple Lamps

Lamps



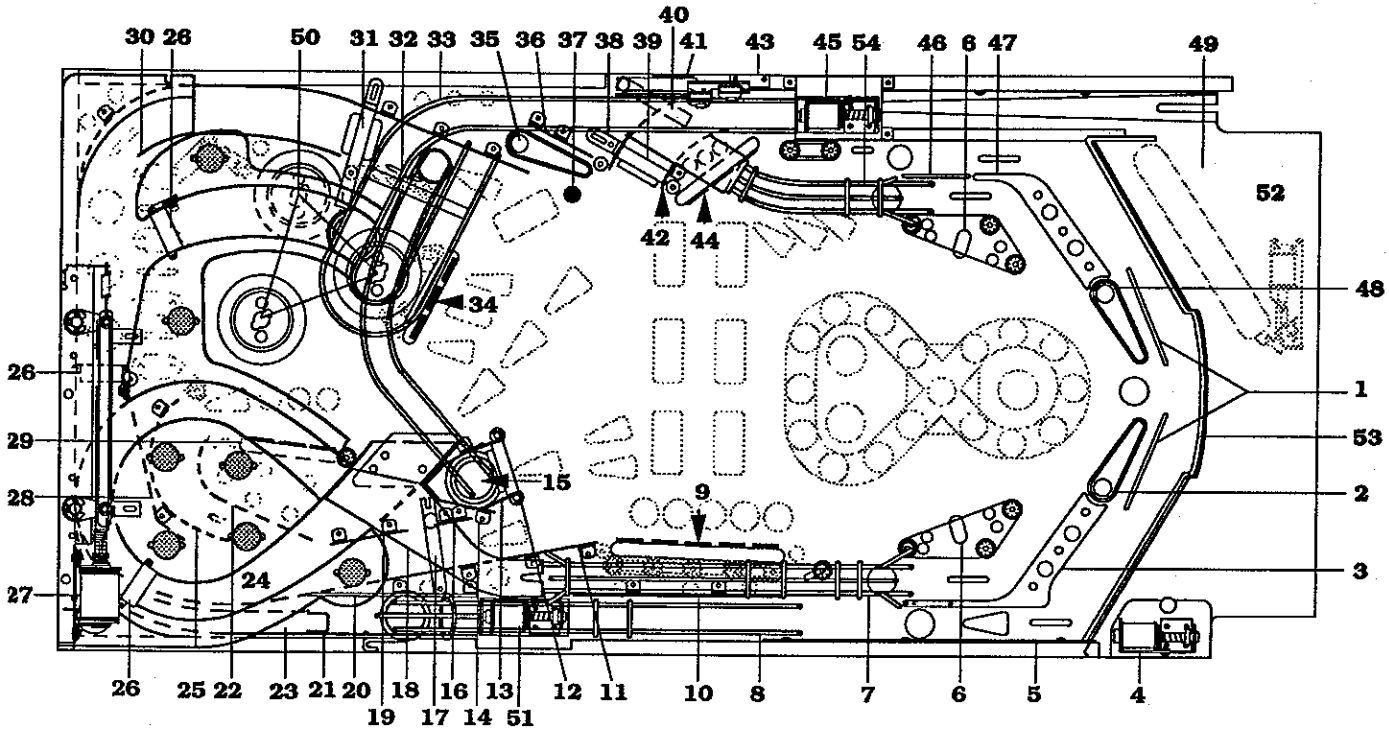
Lamp Location/Description

1	W
2	I
3	L
4	L
5	I
6	A
7	M
8	S
9	Track 8
10	Track 11
11	Track 4
12	Bonus 2X
13	Track 7
14	Bonus 1X
15	Bonus 4x
16	Track 12
17	Track 13
18	Track 10
19	Track 6
20	Track 9
21	SKATE AGAIN
22	Left Jetway
23	Roller Motion (Ball Popper)
24	Right Jetway
25	E (5-Bk Dr Tgt)
26	T (5-Bk Dr Tgt)
27	A (5-Bk Dr Tgt)
28	K (5-Bk Dr Tgt)
29	S (5-Bk Dr Tgt)
30	A (Btm R Standup)
31	B (Btm R Standup)
32	C (Btm R Standup)
33	Bad Attitude (Team 1)
34	Maniacs (Team 2)
35	Violators (Team 3)
36	Rockers (Team 4)
37	Hot Flash (Team 5)
38	T-Birds (Team 6)
39	Scoring Cycle (B Popper)
40	Lites Jetway (L & R Rtn Lanes)
41	1 (Upr Standup)
42	2 (Upr Standup)
43	3 (Upr Standup)
44	EXTRA BALL
45	SPECIAL (L & R Outlanes)
46	J (Top Lane)
47	E (Top Lane)
48	T (Top Lane)
49	W (3-Bk Dr Tgt)
50	A (3-Bk Dr Tgt)
51	R (3-Bk Dr Tgt)
52	JACKPOT (Ramp Entry)
53	LOCK (Ramp Entry)
54	MILLION (Ramp Entry)
55	DEEP FREEZE (B Popper)

Lamp Location/Description

56	AUTOMATIC WHIP (L Outlane)
57	Track 1
58	Track 2
59	Track 3
60	Track 5
61	Track 14
62	Track 15
63	Track 16
64	Track 17

Playfield Parts



Item	Part No.	Description
1	12-6468	Anti-Rebound Wire
2	C-11626-L-3	Lwr Left Flipper Assembly
a)	20-9250-5	Flipper Paddle & Shaft
3	B-8239-1	Left Flipper Return Guide
4	B-11873	Left Outlane Kickback
5	01-6917	Ball Guide
6	B-12665	Kicker Arm ("Sling") Assembly
a)	B-11203-R-1	Coil & Bracket Assembly
7	12-6896	Inner Left Wire Ramp
8	12-6894	Outer Left Wire Ramp
9	B-11696-1	Round Blue Standup Target (5)
10	B-13478	Ball Guide Assembly
11	R-13485	Ball Guide Assembly
12	A-13505	1-way Ball Gate
a)	12-6910	Gate Wire
13	A-12-6895	Ball Popper Wire Ramp
14	B-13471	Ball Popper Ball Cage
15	D-11335-1	Ball Popper
16	A-13482	Ramp Support Ball Guide
17	B-13339-1	Left Spinner Assembly
a)	31-1019-554	Left Spinner
b)	12-6780	Switch Actuator Wire
18	C-13468	Top Metal Ramp
19	B-13486	Ball Guide Assembly
20	B-13484	Inner Ball Guide Assembly
21	D-13483	L. Outer Ball Guide Assembly
22	12-6907	Wireform Ball Guide
23	C-13470	Lower Metal Ramp
24	R-13510	Upper Plastic Ramp Assembly
25	B-13530	Ball Guide Assembly
26	A-13487	Ball Gate Assembly
a)	12-6909	Gate Wire
27	C-13489	Upper Diverter Assembly
28	12-6905	Ball Guide Wireform
29	B-11696-4	Round Red Standup Target (3)
30	12-6906	Wireform Ball Guide

Item	Part No.	Description
31	B-13568	Right Spinner Assembly
a)	31-1019-554	Spinner
b)	12-6780	Switch Actuator Wire
32	12-6466-7	Wireform, 1-3/4"
33	A-12-6898	Looping Wire Ramp
34	C-11223-1	3-bank Drop Target
a)	C-13205	3-Bank Opto Board
35	C-11626-R-3	Upper Right Flipper Assembly
a)	20-9250-5	Flipper Paddle & Shaft
36	B-13480	Ball Guide Assembly
37	02-4446	Magnet Pole Piece
38	D-13481	Ball Guide Assembly
39	B-13504	1-way Ball Gate
a)	12-6911	Gate Wire
40	B-13496	Diverter Assembly
a)	A-13494	Diverter Shaft & Paddle
41	01-9589	Diverter Arm Stop Bracket
42	B-13531	Ball Guide Assembly
43	B-13507	LOCK Switches Assembly
44	B-11696-5	Round White Standup Target (3)
45	B-13497	LOCK Kickback Assembly
46	12-6466-12	Wireform, 3"
47	A-8108-R-1	Right Flipper Return
48	C-11626-R-3	Lower Right Flipper Assembly
a)	20-9250-5	Flipper Paddle & Shaft
49	31-1008-576	Bottom Arch
50	B-9414-1	Jet Bumper
51	B-13499	Upper Left Kickback
52	Parts below are located beneath Bottom Arch:	
a)	B-8623	Upper Trough Baffle Assembly
b)	C-8235	Lower Trough Baffle Assembly
c)	12-6542	Trough Baffle Wire
d)	01-3569-1	Ball Trough (runway)
e)	01-5575	Bottom Arch Mounting Bracket
f)	B-8039-2	Outhole Kicker Assembly
53	12-6842	Bottom Arch Fence
54	12-6897	Lower Right Wire Ramp

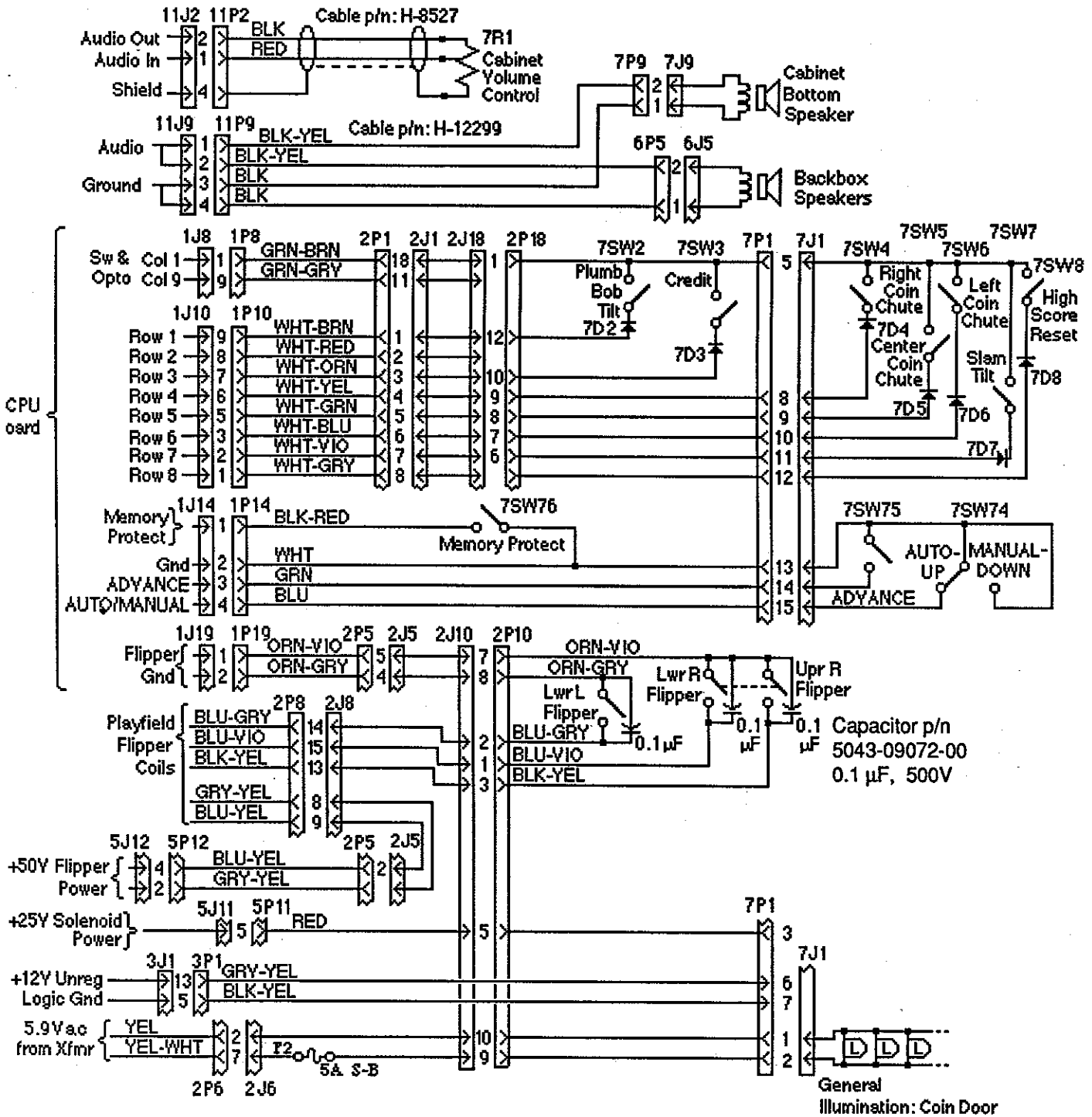
Section 3 Reference Diagrams & Schematics

- **Diagrams and Schematics:**

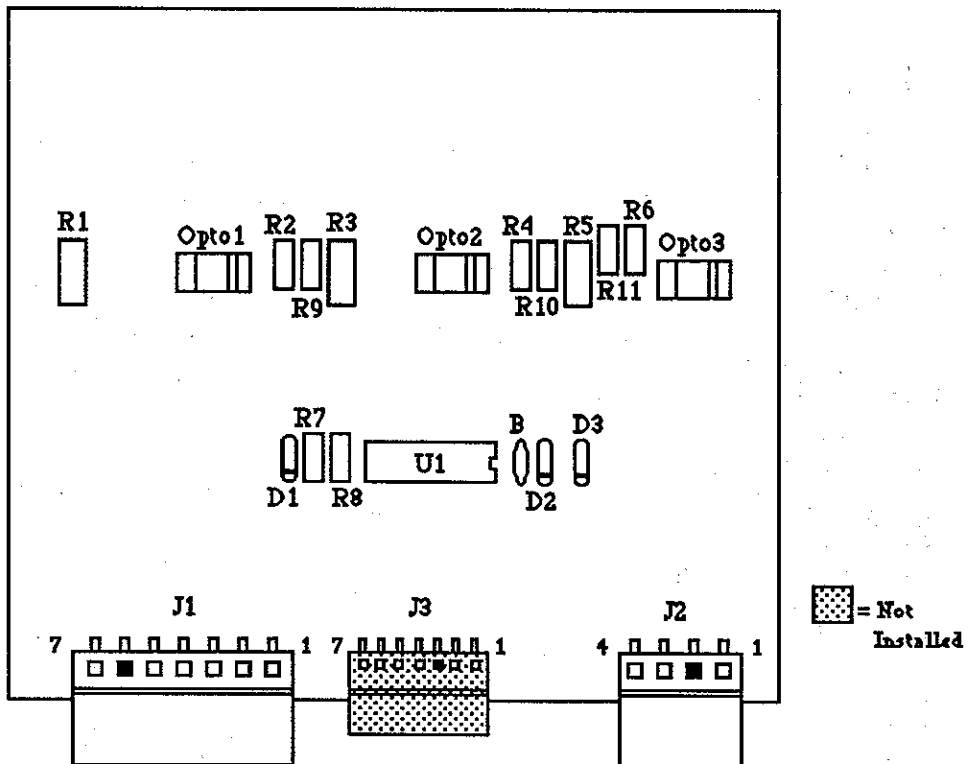
- Cabinet Wiring**
- 3-Bank Opto Board**
- Power Supply Board**
- High Current Driver Board**
- System 11C CPU Board**
- Master Display Board**
- Audio Board**
- Aux Power Driver Board**
- Backbox Interconnect Board**
- Controlled, Special, & Switched Solenoids**
- Power Wiring**
- Game Circuit Boards Interboards Signals**

- **Diagnostic Test Flowchart**

Notes...

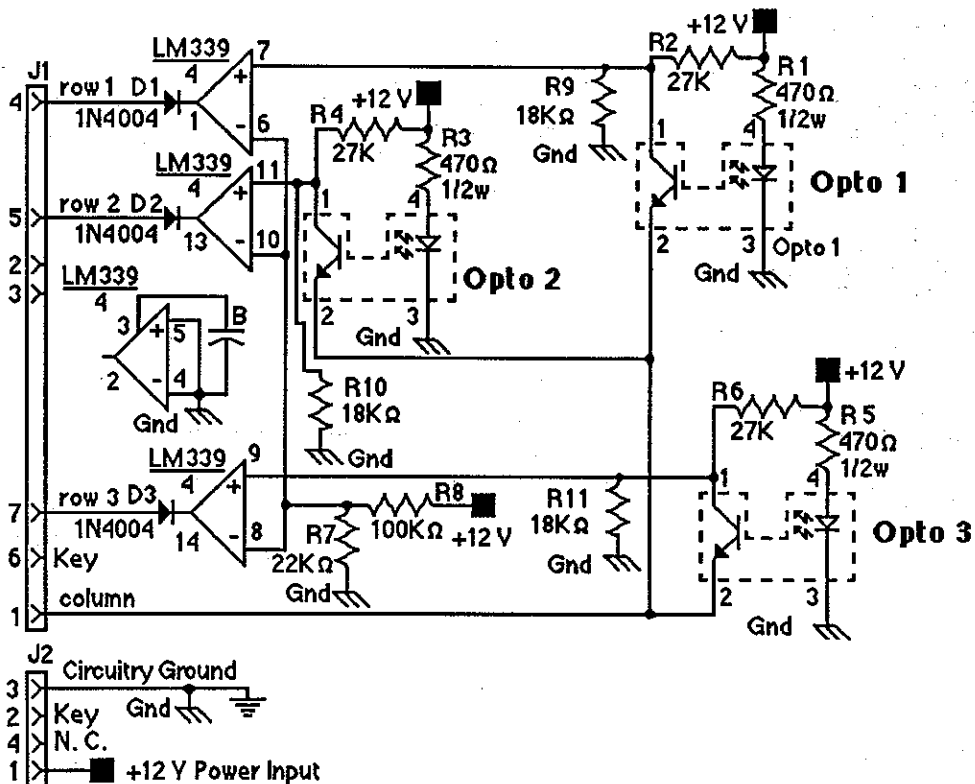


ROLLERGAMES Cabinet Wiring

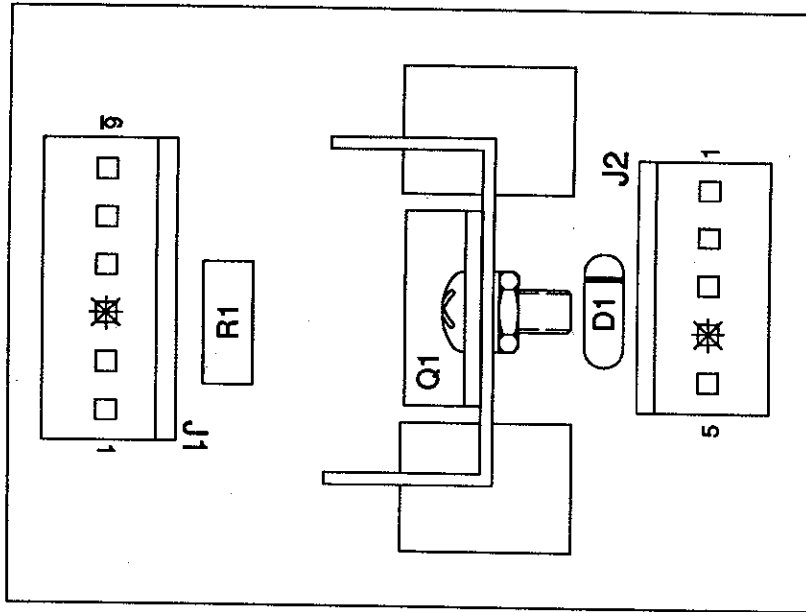


3-Bank Drop Target Opto Board

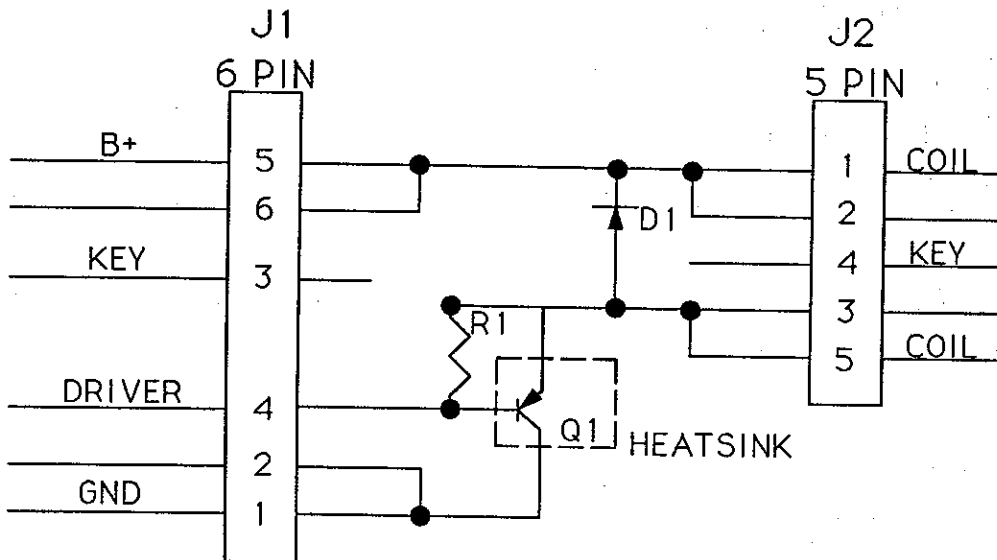
p/n C-13205



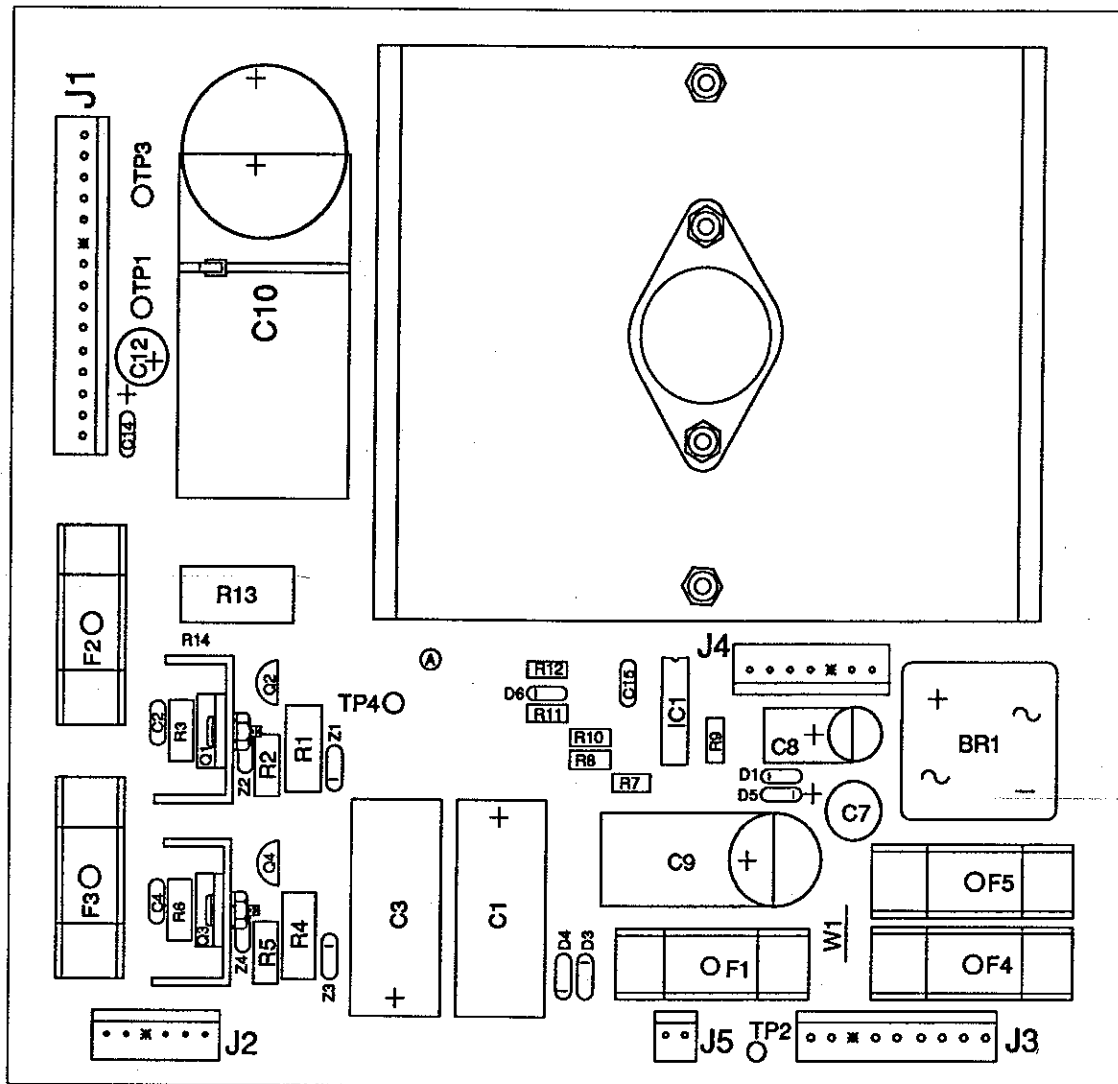
3-Bank Drop Target Opto Board & Schematic



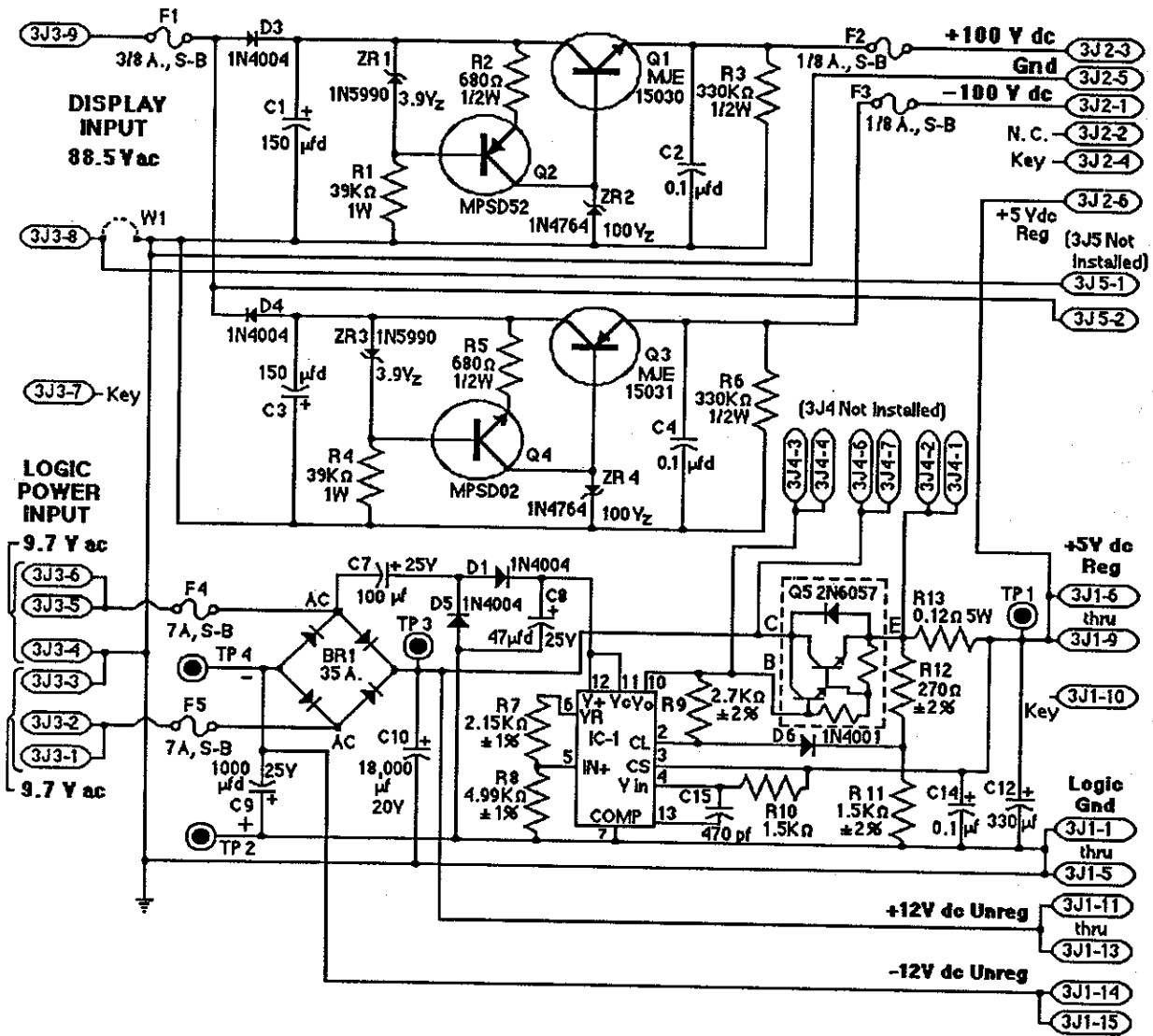
High Current Driver Assembly
p/n C-13509



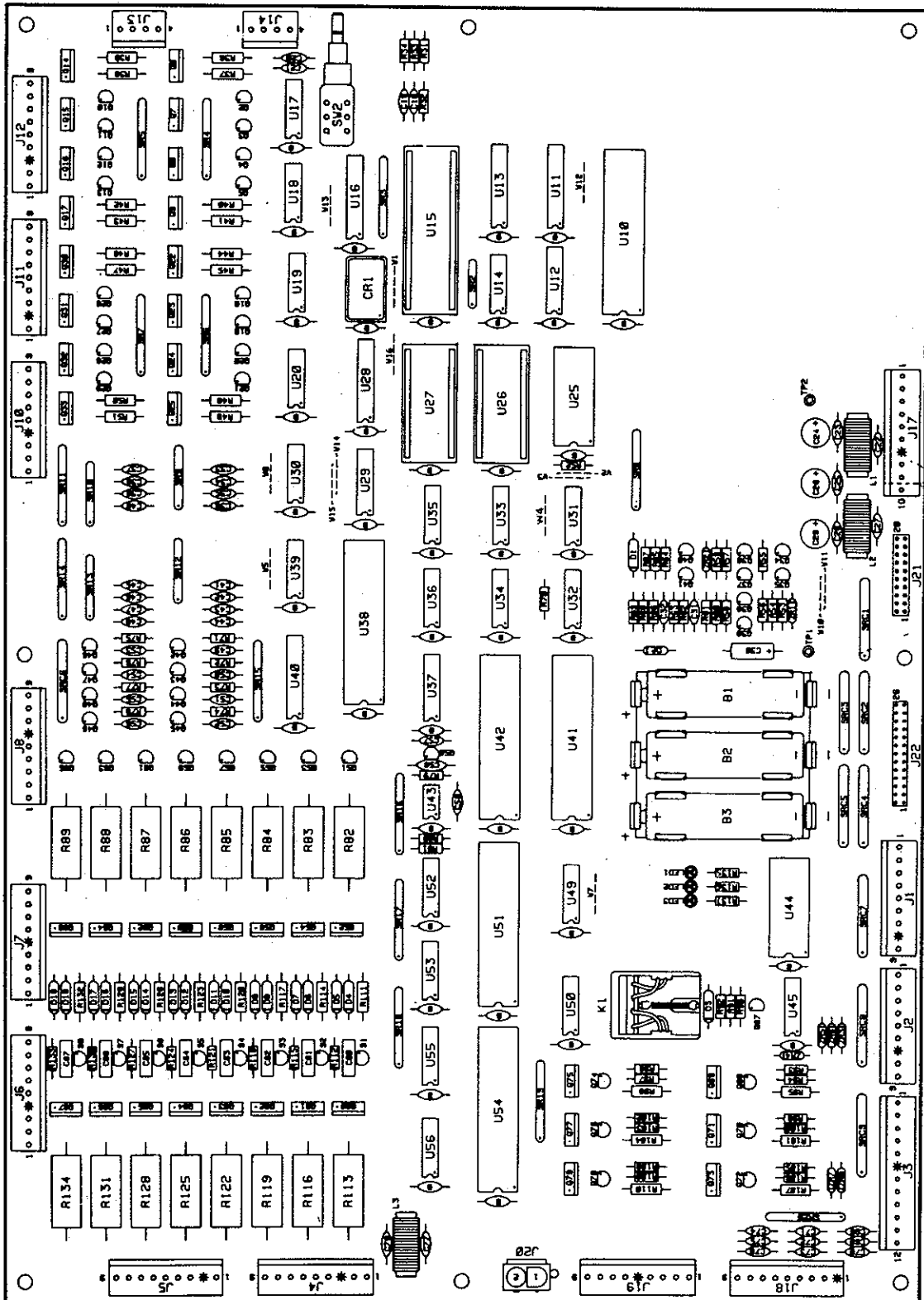
High Current Driver & Schematic



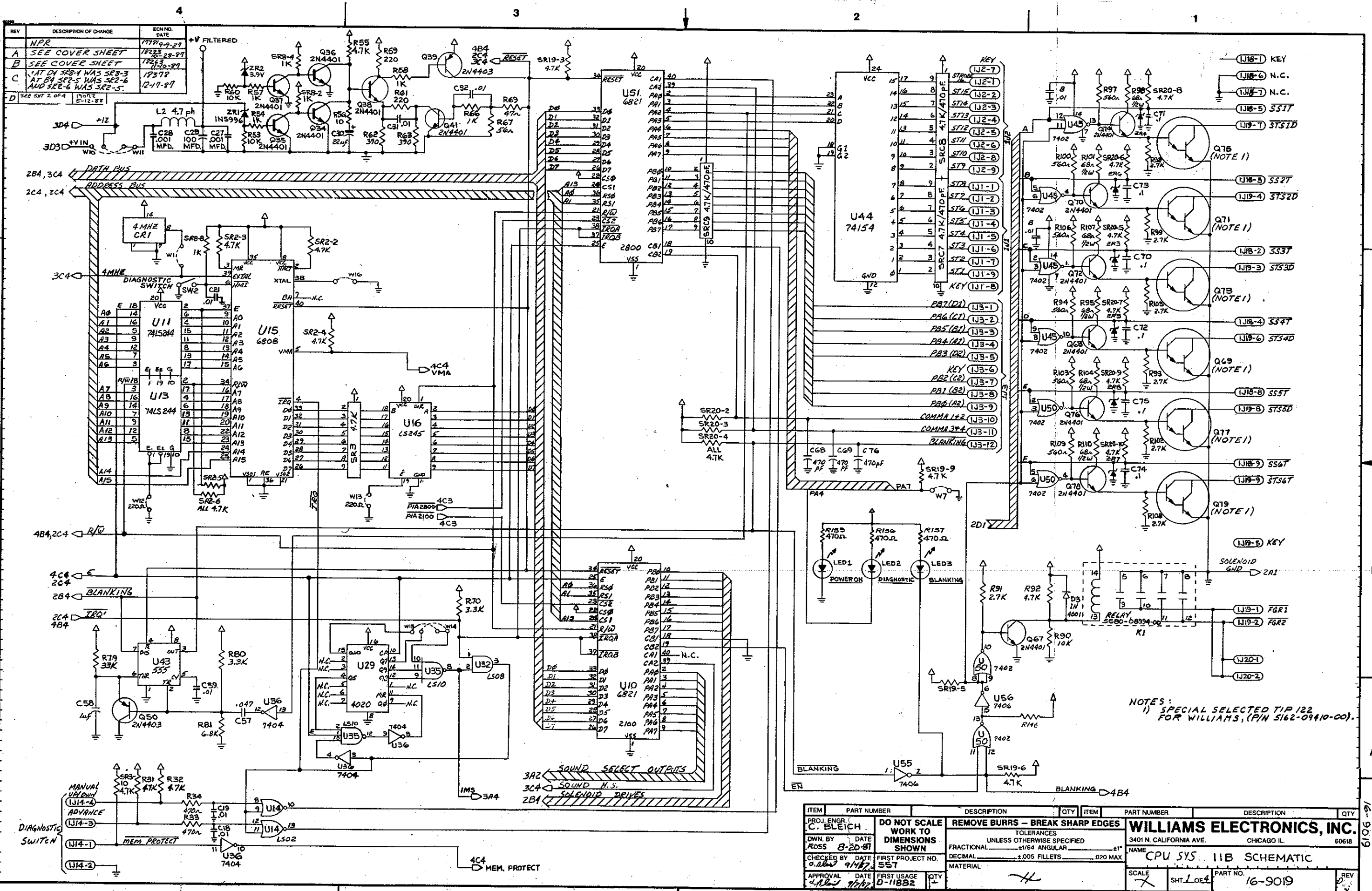
Power Supply Board



Power Supply Board Schematic



System 11C CPU Board
p/n D-11883-576

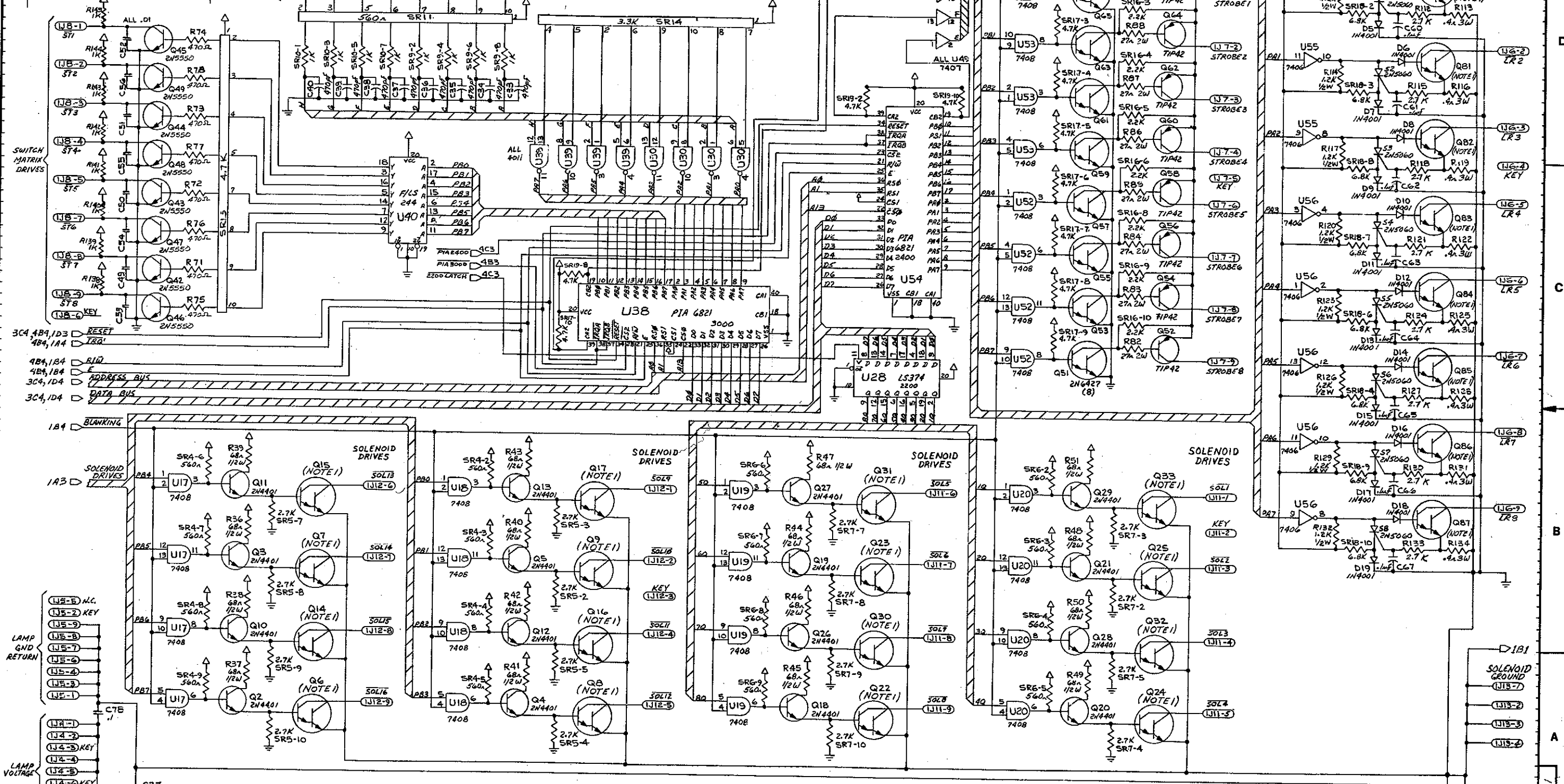


REV	DESCRIPTION OF CHANGE	ECN NO.	DATE
NPR		1779	9-9-87
A	SEE COVER SHEET	1823	28-87
B	SEE COVER SHEET	1937	7-10-87
C	AT D4 SR2-4 WAS SR2-3 AT B4 SR2-5 WAS SR2-6 AND SR2-6 WAS SR2-5.	1937B	12-17-87
D	SEE SH2 2 OF 4	1937B	5-12-88

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR	C. BLEICH	DO NOT SCALE WORK TO DIMENSIONS SHOWN		REMOVE BURRS - BREAK SHARP EDGES			
DWN BY	ROSS	DATE	8-20-87	TOLERANCES UNLESS OTHERWISE SPECIFIED			
CHECKED BY	DATE	FIRST PROJECT NO.	9/18/87	FRACTIONAL	1/64 ANGULAR	1"	1"
APPROVAL	DATE	FIRST USAGE	11/8/87	DECIMAL	.005 FILLETS	.020 MAX	
				MATERIAL			

NOTES:
1) SPECIAL SELECTED TIP 122
FOR WILLIAMS, (P/N 5162-09410-00).

REV.	DESCRIPTION OF CHANGE	ECN NO.	DATE
A	SEE COVER SHEET	179819-87	12-17-87
B	SEE COVER SHEET	182528-87	12-17-87
C	AT A4 C77 WAS C78 AND C78 WAS C77	18379	12-17-87
D	R71 THRU R78 WAS 1.5K Q42 THRU Q49 WAS 2N3904	19012	5-12-88



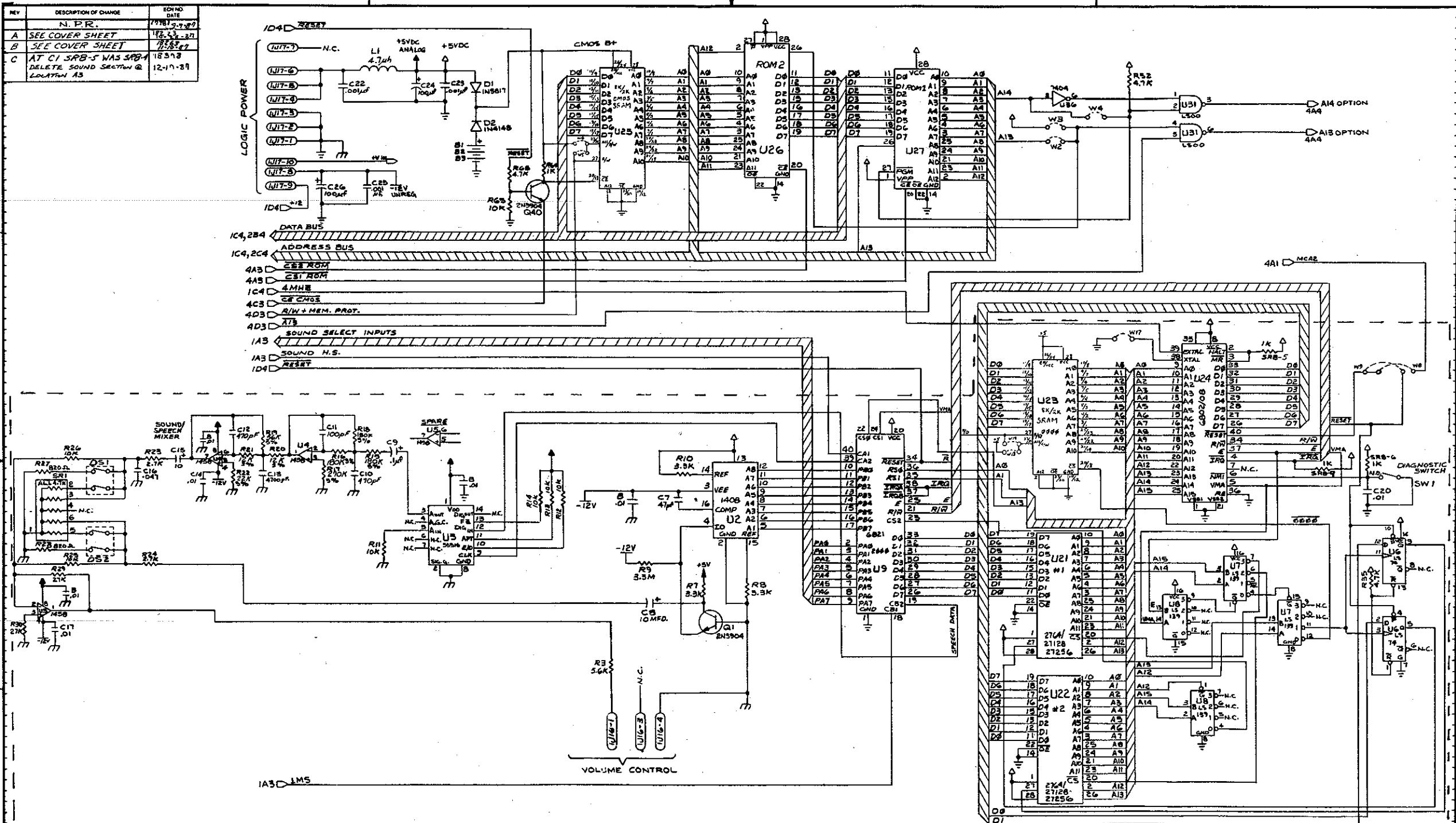
NOTES:
 1) SPECIAL SELECTED TIP 122 FOR WILLIAMS, (P/N 5162-09410-00).

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ. ENGR C. BLEICH		DO NOT SCALE WORK TO DIMENSIONS SHOWN		REMOVE BURRS - BREAK SHARP EDGES		TOLERANCES UNLESS OTHERWISE SPECIFIED	
DWN. BY ROSS		DATE 8-20-87		FRACTIONAL ±1/64 ANGULAR		DECIMAL ±.005 FILLETS .020 MAX	
CHECKED BY DATE		FIRST PROJECT NO. 551		MATERIAL		NAME CPU SYS 11B SCHEMATIC	
APPROVAL DATE		FIRST USAGE D-11882		QTY		SCALE X	
						WILLIAMS ELECTRONICS, INC. 3401 N. CALIFORNIA AVE. CHICAGO IL. 60618	
						PART NO. 16-9019	
						SHT 2 OF 4	

ROLLERGAMES 86

System 11B CPU Schematic (16-9019, Sheet 2 of 4)

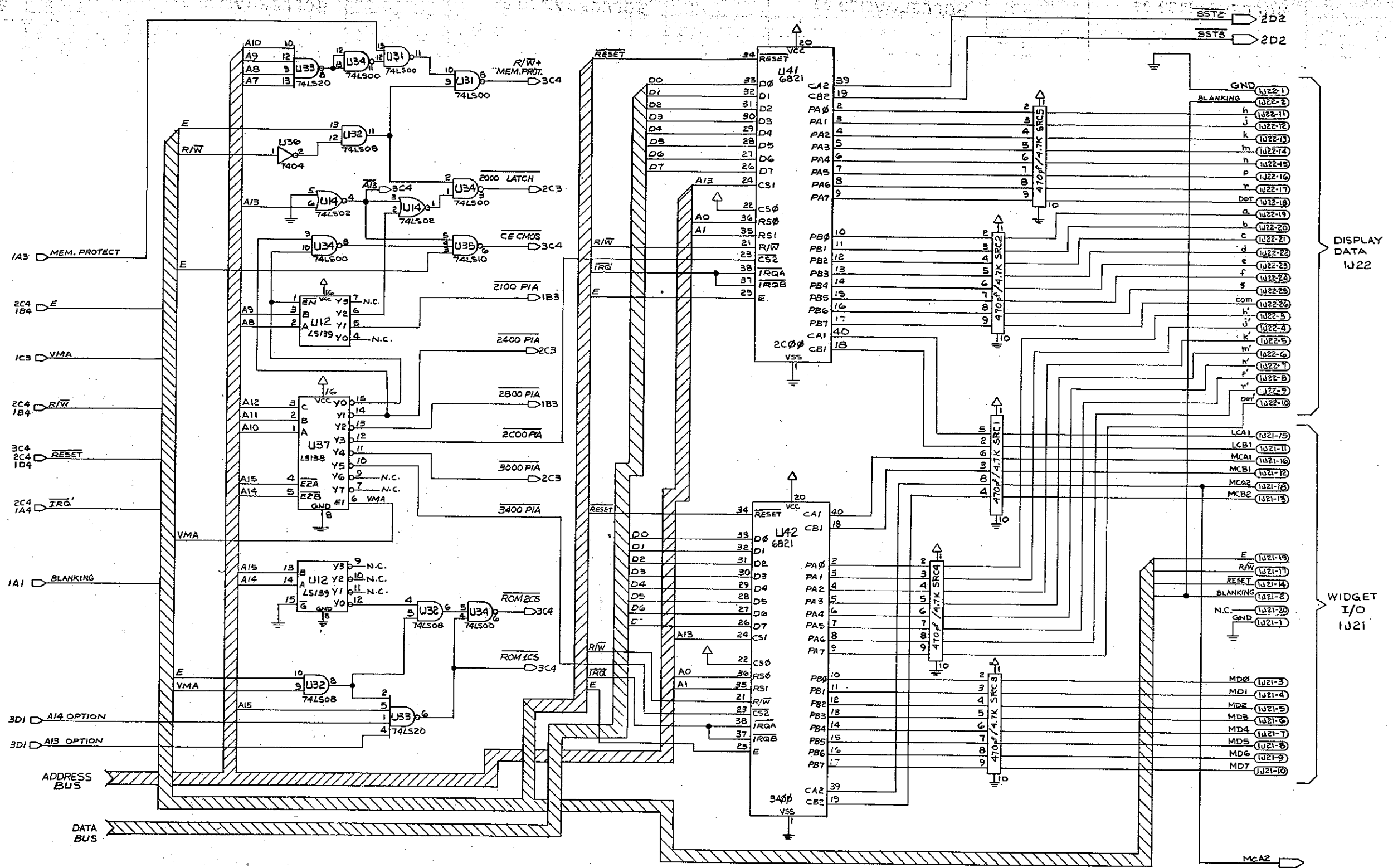
REV	DESCRIPTION OF CHANGE	EDWD DATE
	N. P.R.	1981-9-29
A	SEE COVER SHEET	1982-2-27
B	SEE COVER SHEET	1982-11
C	AT C1 SRB-5 WAS SRB-4 DELETE SOUND SECTION @ LOCATION A3	18598 12-17-89



NOTE: GAMES WITH A D-11882-2 SUB-ASSEMBLY
DO NOT USE THESE PARTS.

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR	C. BLEICH	DO NOT SCALE		REMOVE BURRS - BREAK SHARP EDGES		WILLIAMS ELECTRONICS, INC.	
DWN BY	ROSS	WORK TO DIMENSIONS SHOWN		TOLERANCES UNLESS OTHERWISE SPECIFIED		3401 N. CALIFORNIA AVE.	
CHECKED BY	DATE	FIRST PROJECT NO.		FRACTIONAL	1/64 ANGULAR	CHICAGO IL.	60618
APPROVAL DATE	DATE	FIRST USAGE		DECIMAL	1.005 FILETS	CPU SYS 11B SCHEMATIC	
				MATERIAL		SCALE	SHT 2 of 4
						PART NO.	16-9019
						REV	C

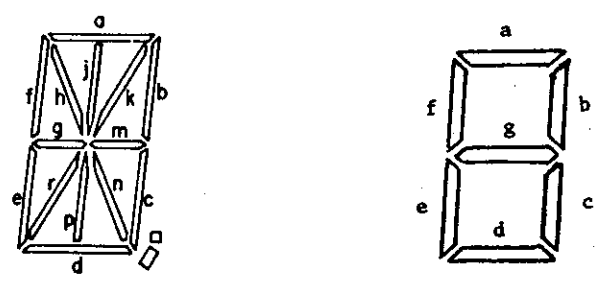
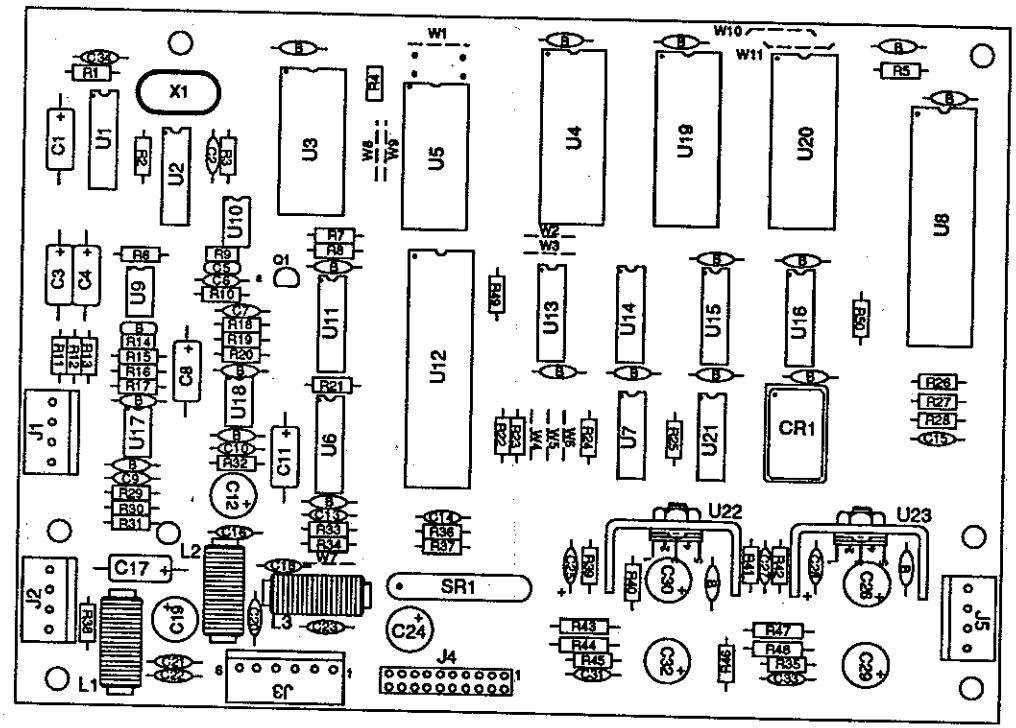
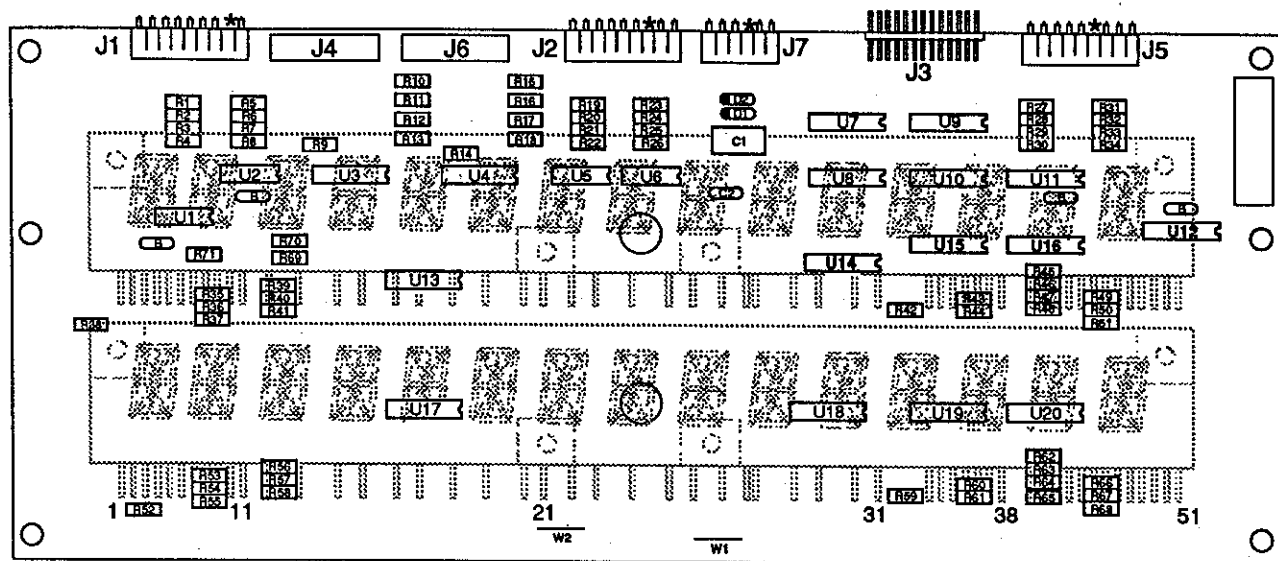
REV	DESCRIPTION OF CHANGE	ECN NO.	DATE
	N. P. R.		1/9/81
A	SEE COVER SHEET	16223	7-9-81
B	SEE COVER SHEET	16263	10-21-81
C	SEE SHEET 1-3	16310	11-20-81
D	SEE SHT 2 OF 4	16349	12-17-81
		19012	5-12-82



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ. ENGR.	C. BLEICH	DO NOT SCALE WORK TO DIMENSIONS SHOWN		WILLIAMS ELECTRONICS, INC. 3401 N. CALIFORNIA AVE. CHICAGO IL. 60618 NAME CPU SYS 11B SCHEMATIC SCALE N/S SHT 4 OF 4 PART NO. 16-9019 REV 0			
DWN. BY	ROSS	FIRST PROJECT NO.	557				
CHECKED BY	G. ROSS	FIRST USAGE	D-11882				
APPROVAL	C. BLEICH	DATE	7/7/81				

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System 11B CPU Schematic (16-9019, Sheet 4 of 4)

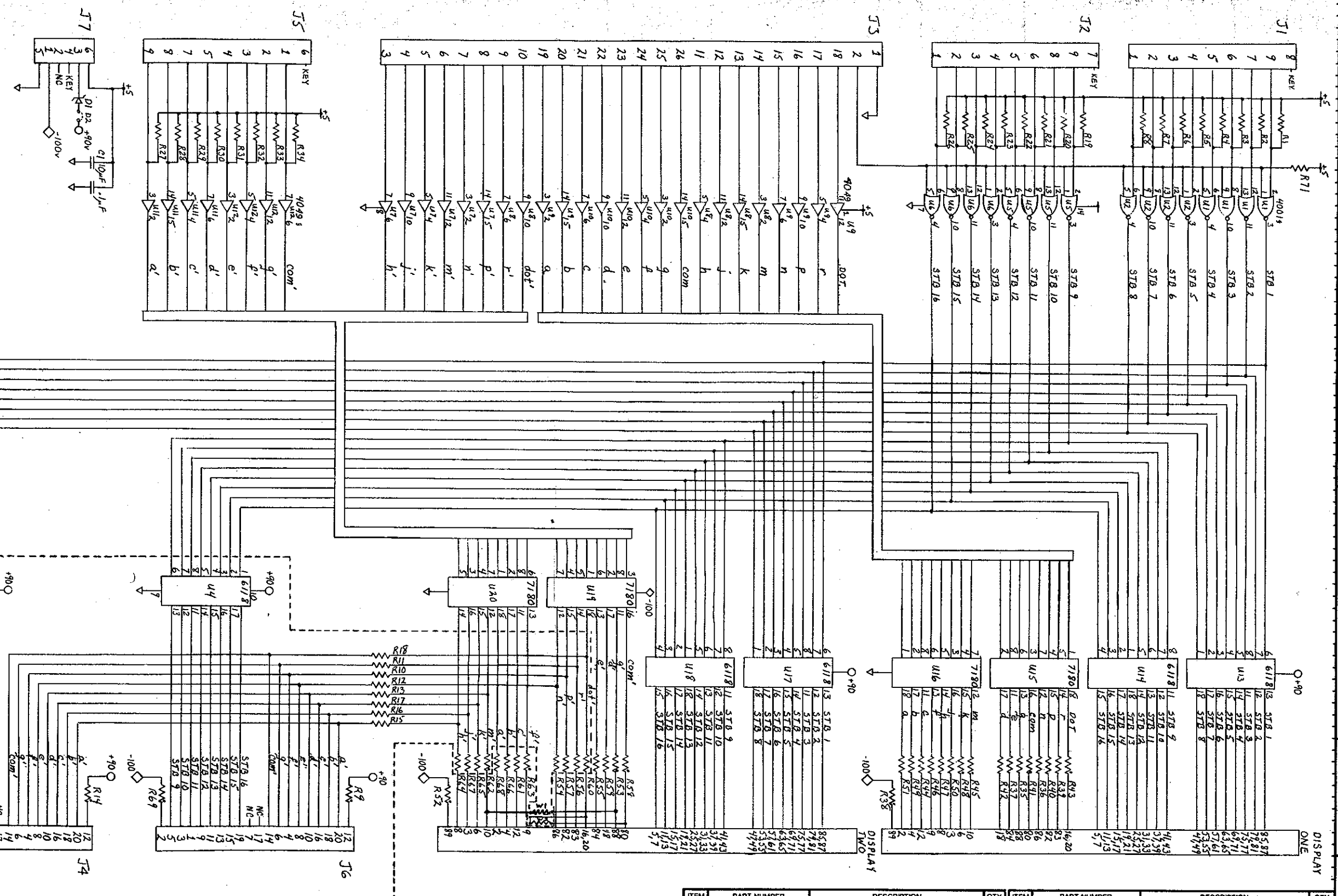


Display Characters Segment Designations

Master Display Board
p/n D-12232-1

Audio Board
p/n D-11581-576

REV	DESCRIPTION OF CHANGE	REV. NO.	DATE
-	NPR	115	11-1-88
A	4049 WAS 4056, 4049 WAS 4056, J6 WAS J7, J7 WAS J6	172	11-7-88

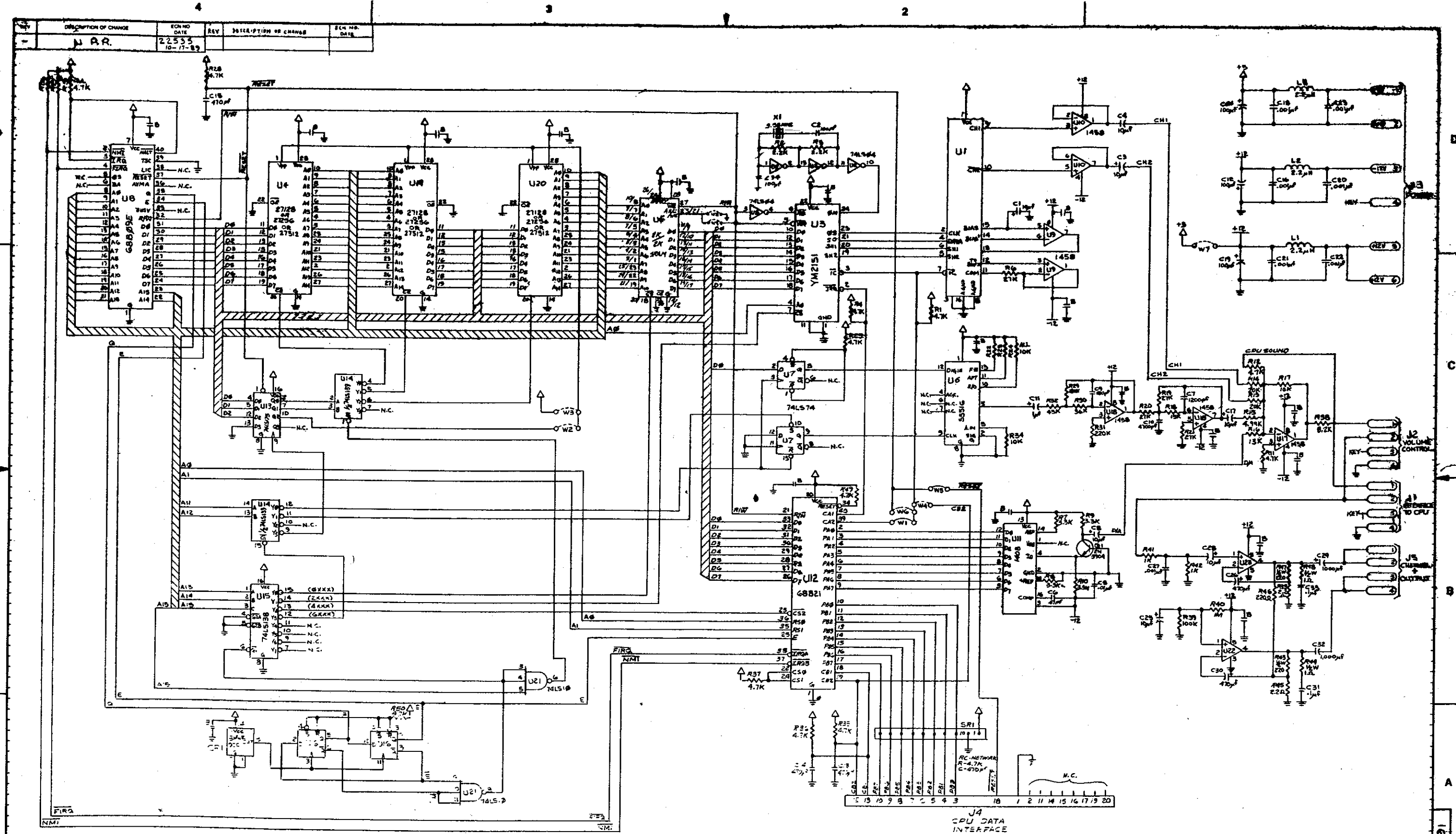


FOR USAGE OF THESE COMPONENTS REFER TO ASSEMBLY DRAWING D-12159

ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
<p>PROJ. ENGR. MARK COLDEBEAU DOWN BY M.C. DATE 3/21/88 CHECKED BY DATE 7-24-88 APPROVAL DATE 11-1-88</p>							
<p>DO NOT SCALE WORK TO DIMENSIONS SHOWN</p>				<p>REMOVE BURRS - BREAK SHARP EDGES TOLERANCES UNLESS OTHERWISE SPECIFIED FRACTIONAL ±1/64 ANGULAR ±1° DECIMAL ±.005 FILLETS .020 MAX</p>			
<p>WILLIAMS ELECTRONICS, INC. 3401 N. CALIFORNIA AVE. CHICAGO IL. 60618</p>							
<p>MASTER DISPLAY 88, SCHEMATIC</p>							
SCALE 1		SHT 1 OF 1		PART NO. 16-9033		REV A	

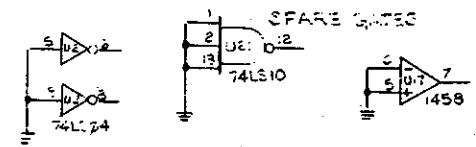
ROLLERGAMES 90

Master Display Schematic (16-9033)



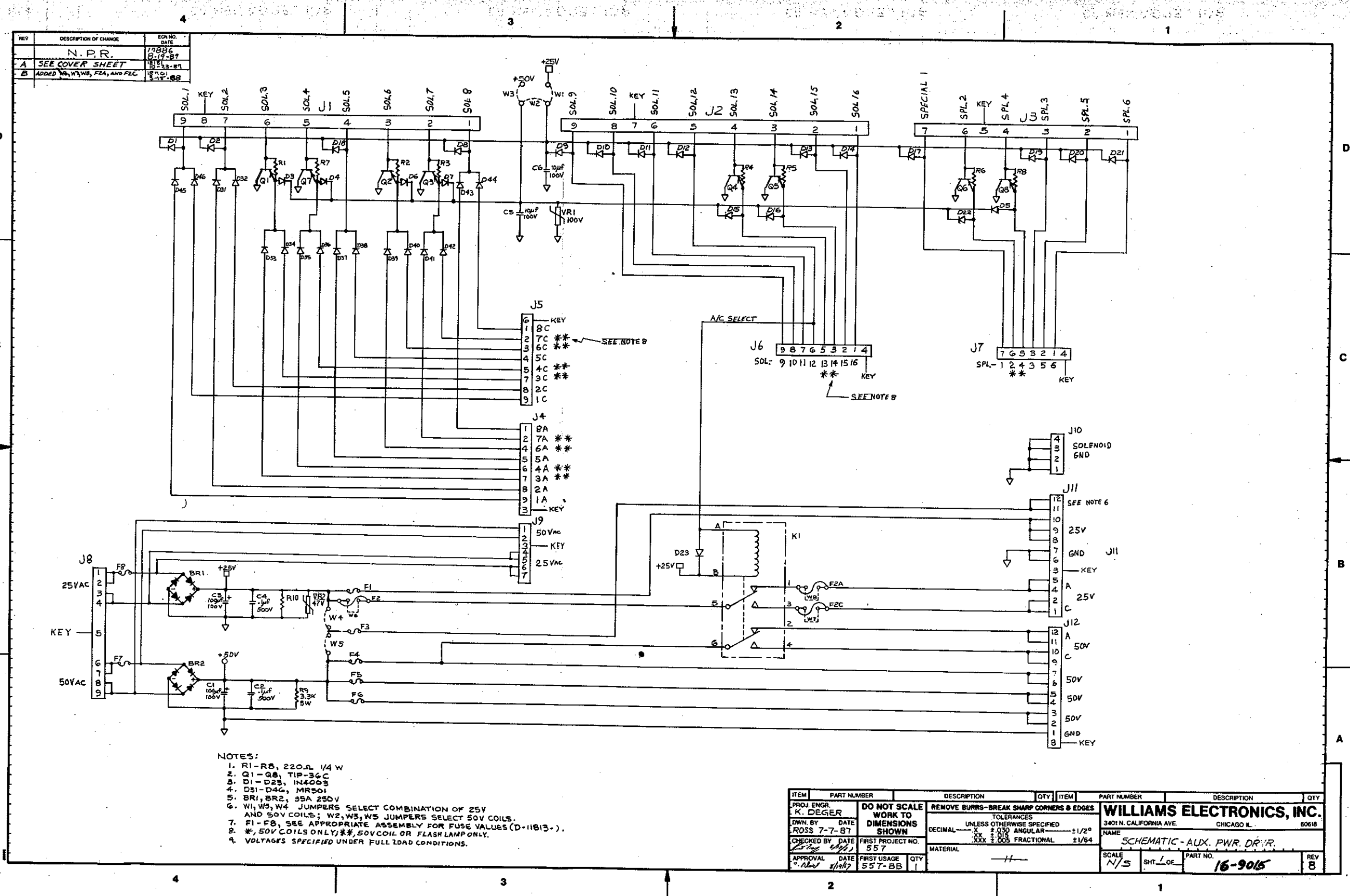
DESCRIPTION OF CHANGE	ECN NO.	REV.	DATE	DESCRIPTION OF CHANGE	ECN NO.
N.A.R.	22533	10-17-89			

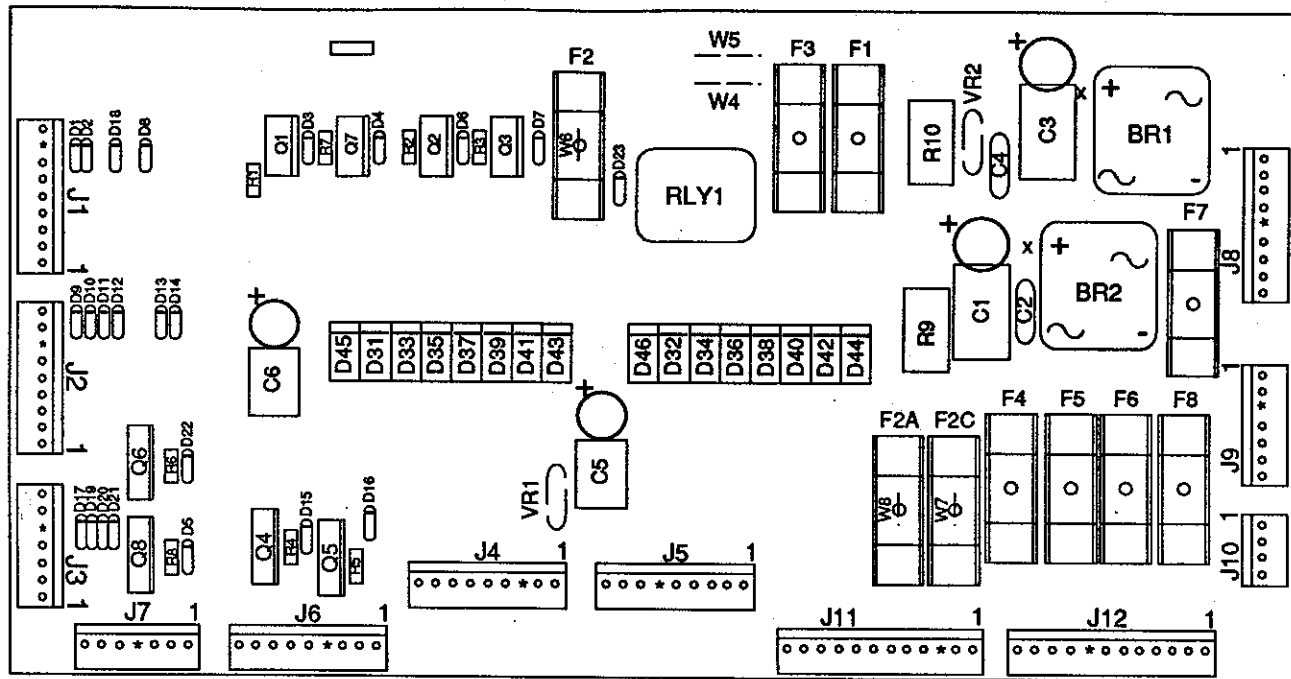
ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR	C. BLEICH	REMOVE BURRS-BREAK SHARP CORNERS & EDGES		WILLIAMS ELECTRONICS, INC. 3401 N. CALIFORNIA AVE CHICAGO IL 60618			
DWN BY	DATE	TOLERANCES UNLESS OTHERWISE SPECIFIED					
CHECKED BY	DATE	DECIMAL .X ±.030 ANGULAR ±1/2°		NAME AUDIO SYSTEM SCHEMATIC			
APPROVAL	DATE	XX ±.005 FRACTIONAL ±1/64		SCALE	N/S	SHT. L. OR L.	
FIRST PROJECT NO.	4002	MATERIAL		PART NO.	16-9084	REV.	
FIRST USAGE	D-22579-3						



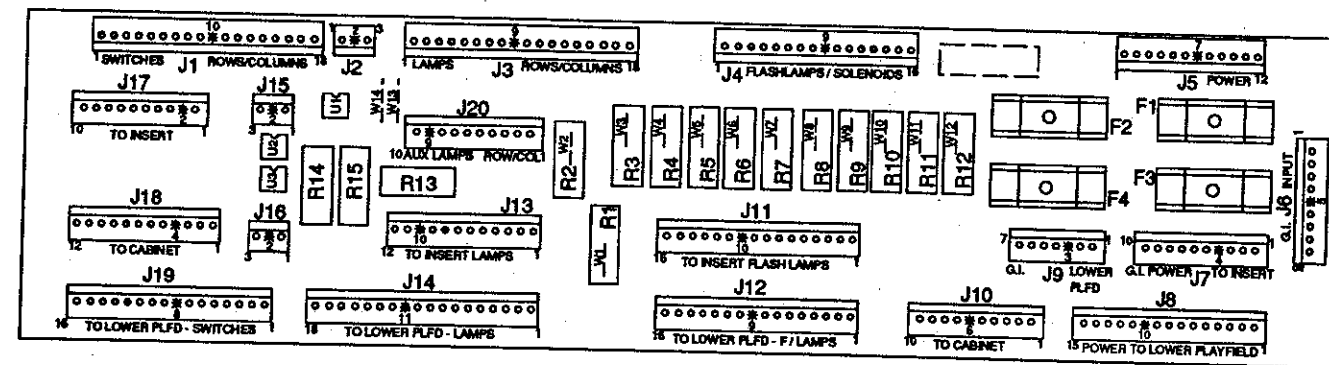
NOTES:
 - ALL COMPONENTS WITH 5 AND 6 ARE BY THE MANUFACTURER'S SPECIFICATIONS.
 - PART USED: C39, R49, U23, W7, J5, L3.

J4 CPU DATA INTERFACE

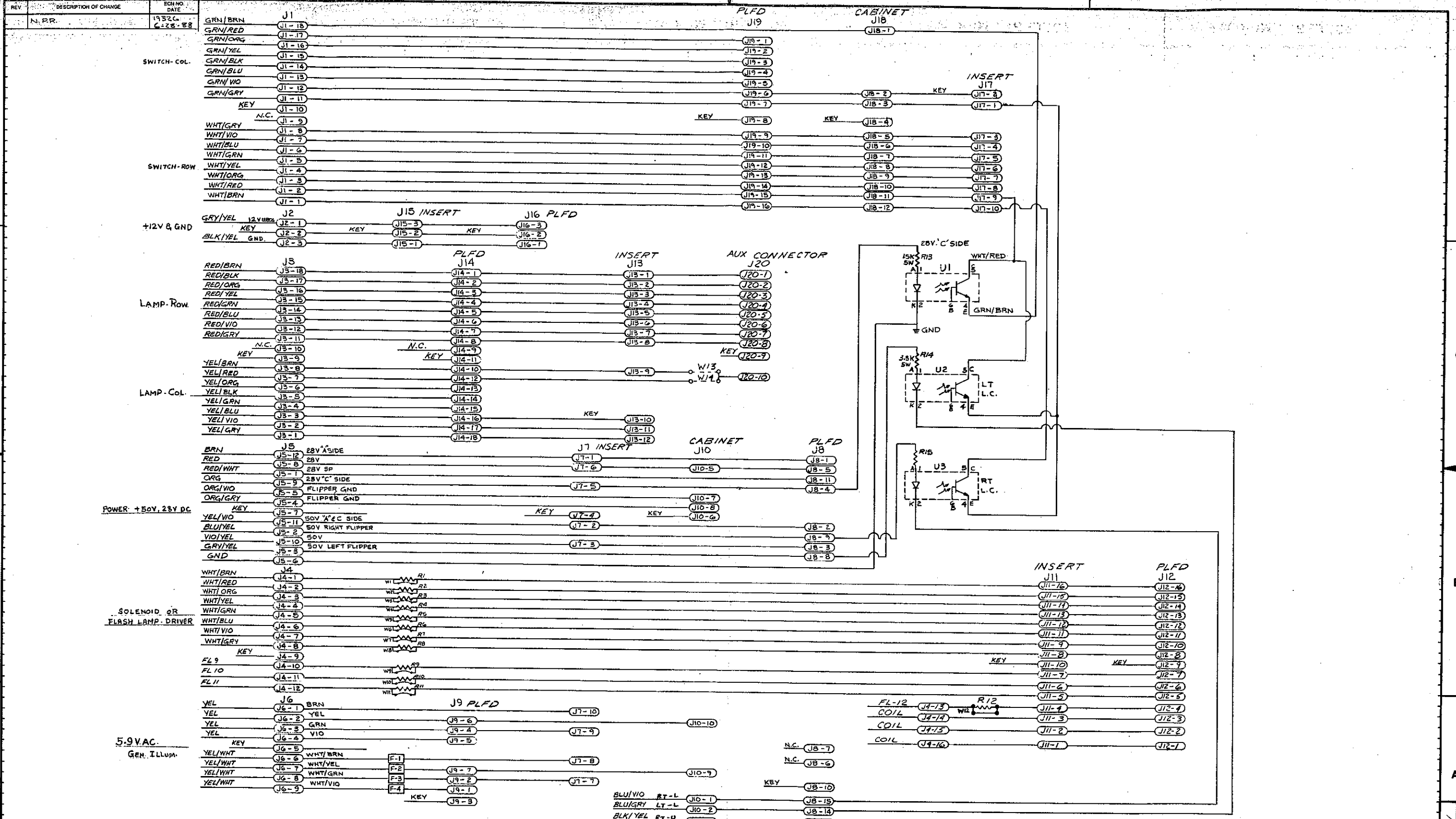




Aux Power Driver Board
p/n D-12247



Backbox Interconnect Board
p/n D-12313-576

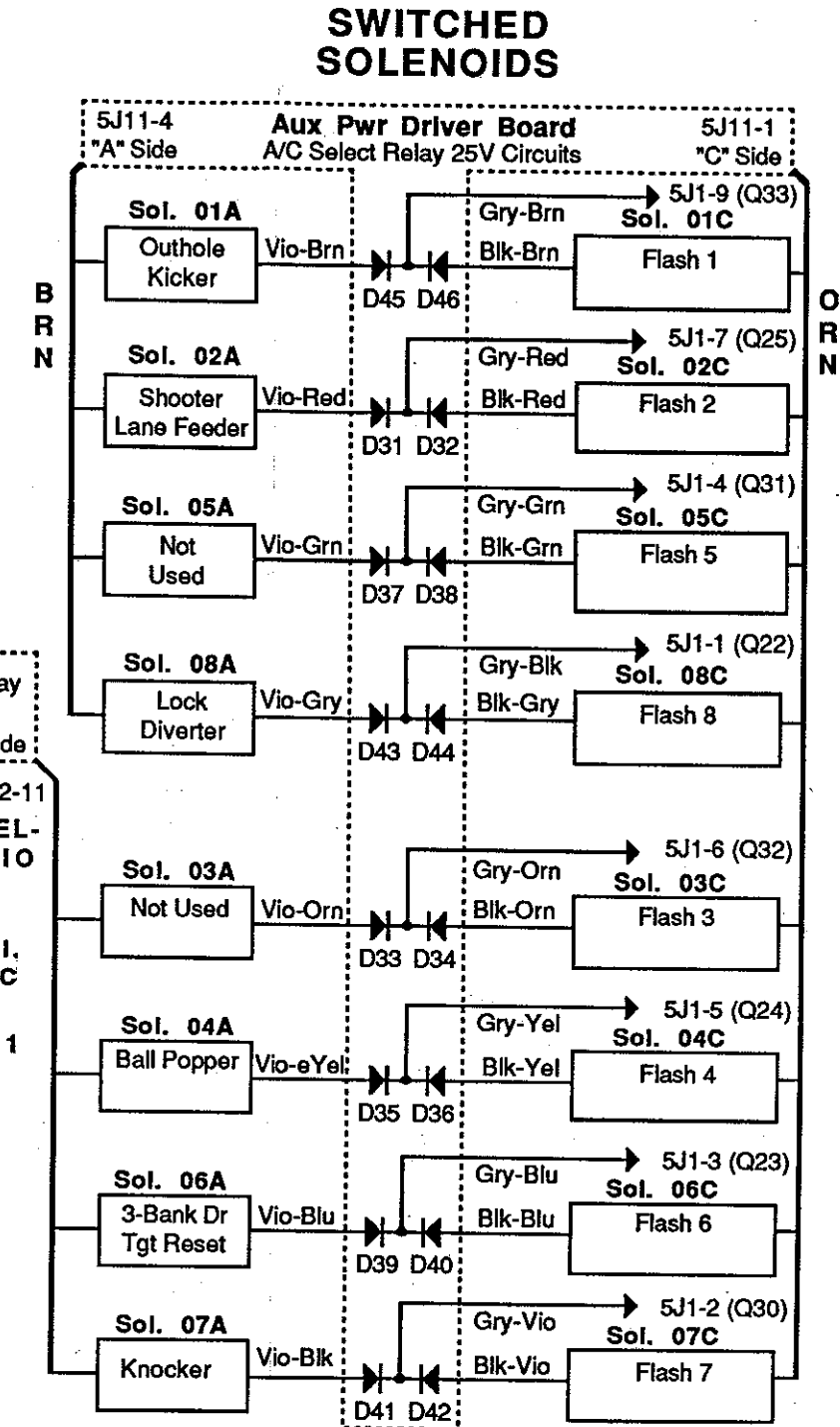
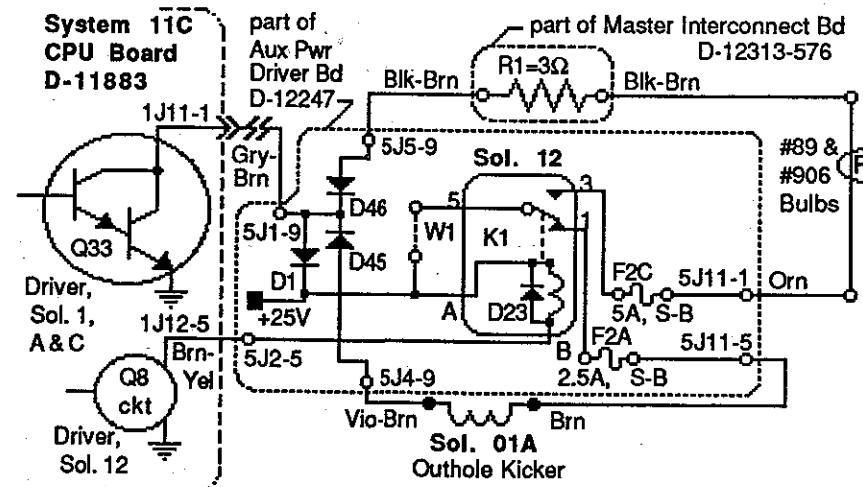
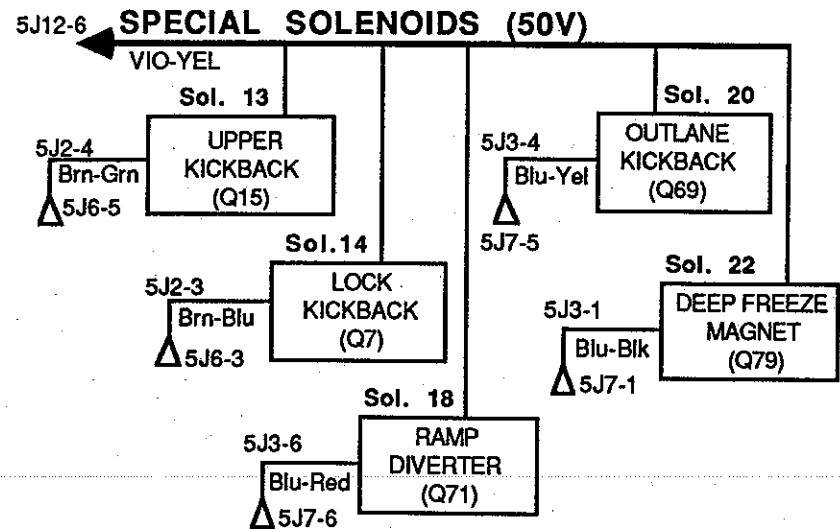
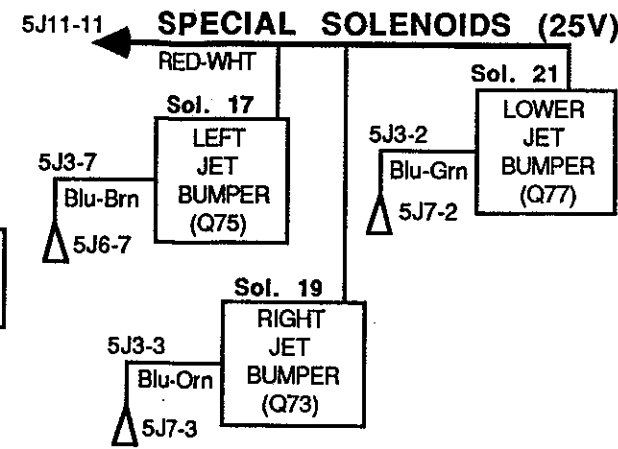
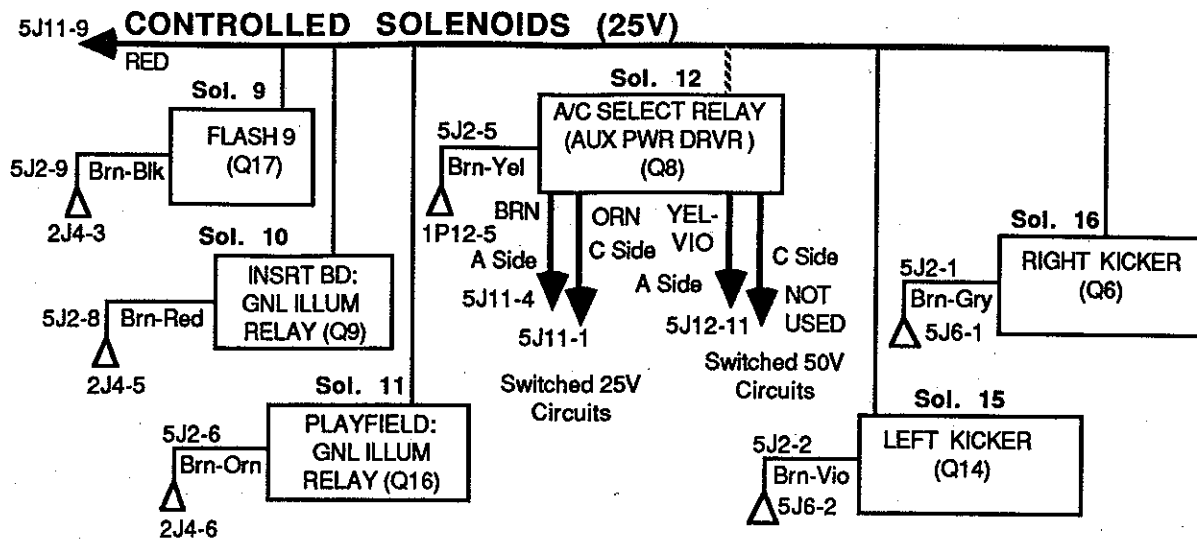


ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY	
PROJ. ENGR.	M. JAYSVAL			WILLIAMS ELECTRONICS, INC. 3401 N. CALIFORNIA AVE. CHICAGO ILL. 60618 NAME SCHEMATIC - INTERCONNECT BOARD.				
DWN. BY	Bm	DATE	6-28-88					
CHECKED BY	DATE	FIRST PROJECT NO.	567	TOLERANCES UNLESS OTHERWISE SPECIFIED DECIMAL .X ± 0.30 ANGULAR 1/2° XX ± 0.15 XXX ± 0.05 FRACTIONAL ± 1/64				
APPROVAL	DATE	FIRST USAGE	D-12313	MATERIAL	-			
				SCALE	N/S	SHT. OF 1	PART NO. 16-9032-1	REV -

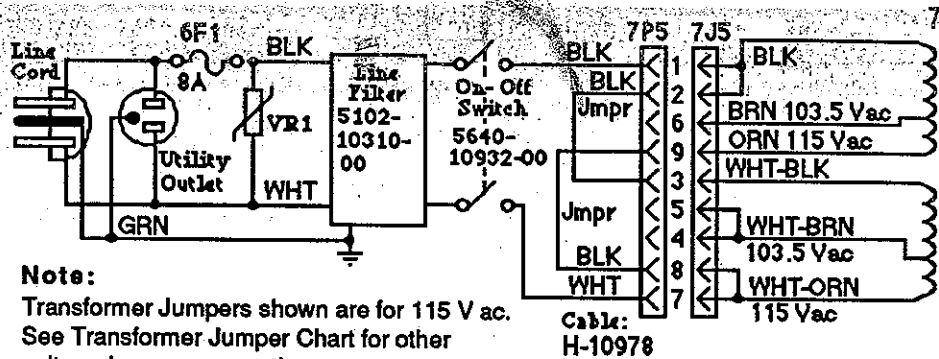
ROLLERGAMES 94

Backbox Interconnect Board Schematic (16-9032-1)

16-9032-1

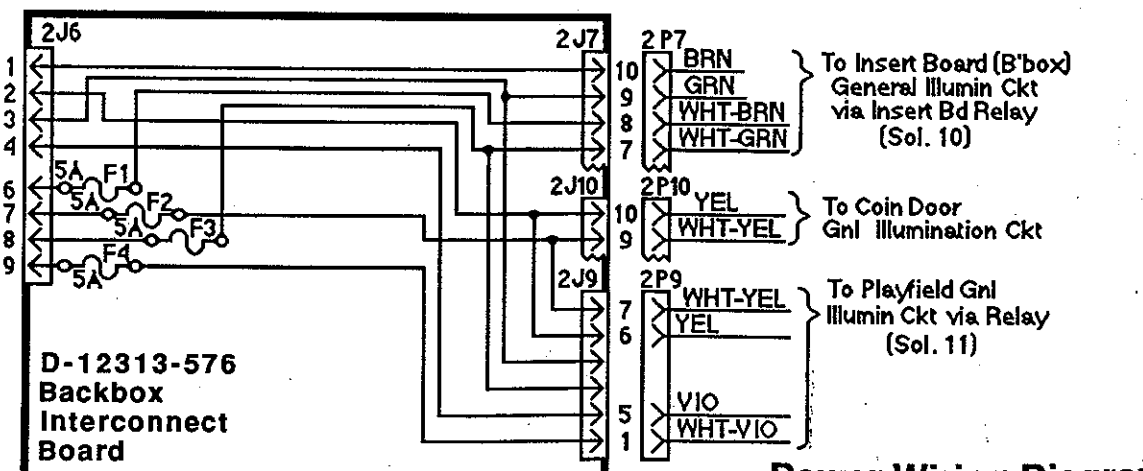
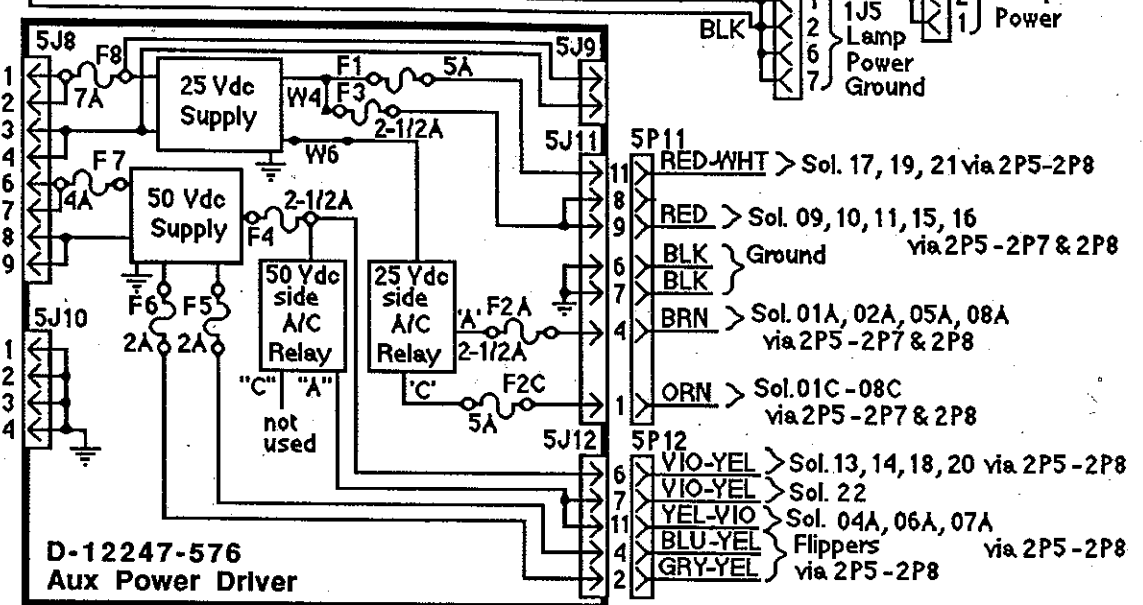
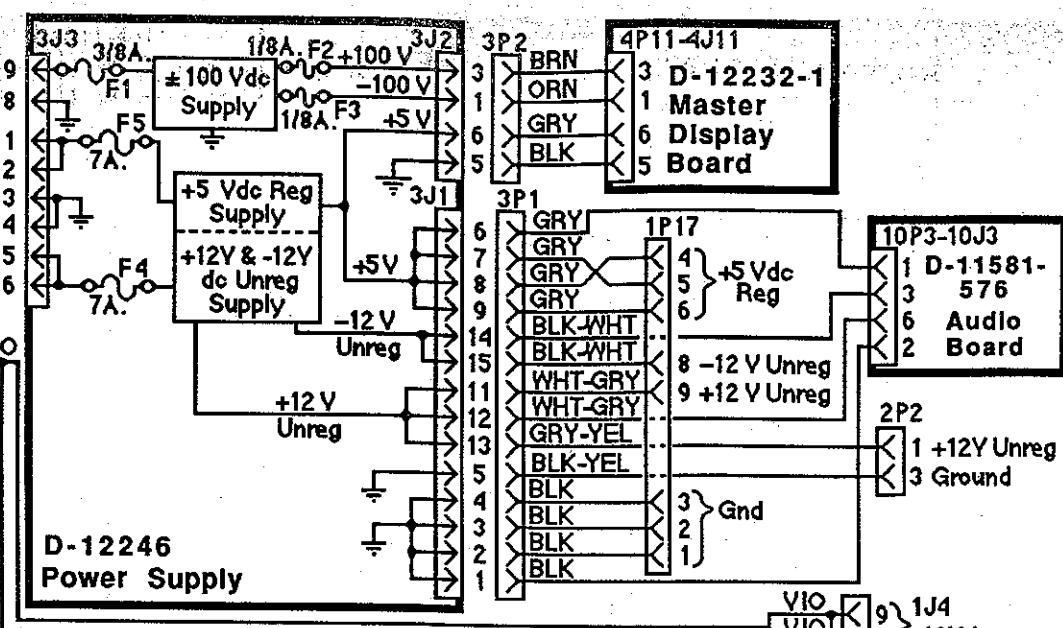
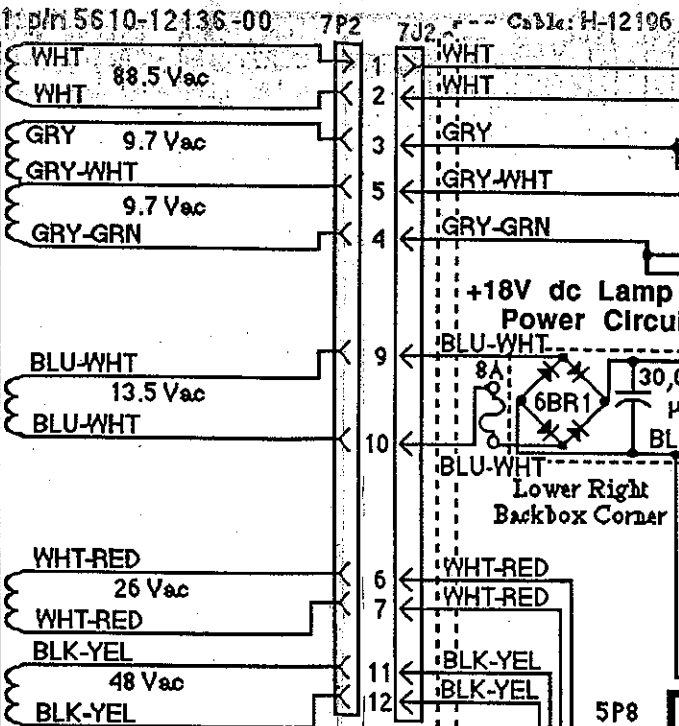
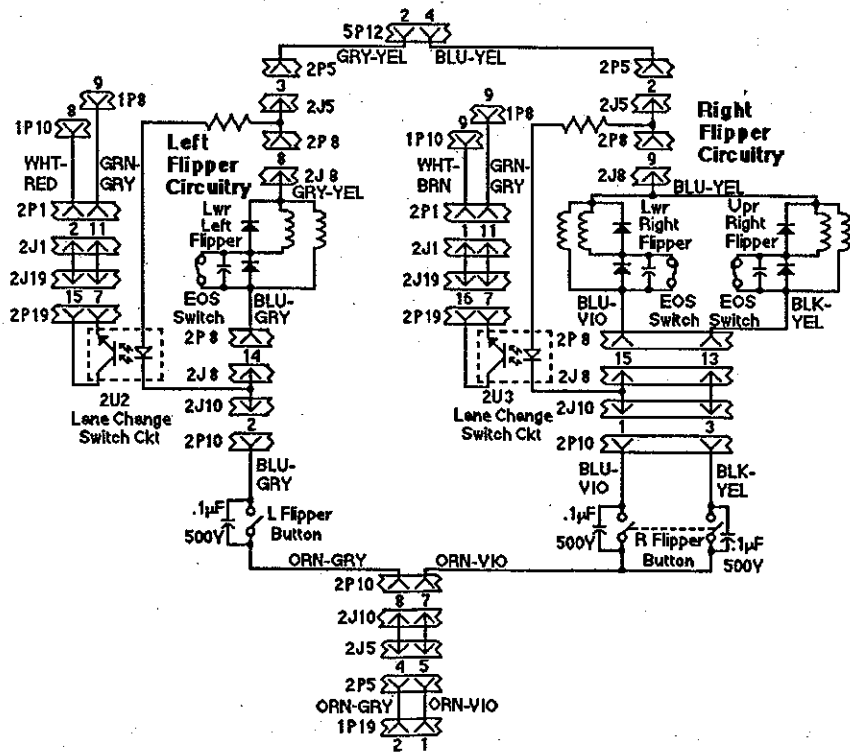


Controlled, Special, & Switched Solenoids



Note:
Transformer Jumpers shown are for 115 V ac.
See Transformer Jumper Chart for other
voltage jumper connections.

TRANSFORMER JUMPER CHART		
206/218 VAC	230 VAC	103.5 VAC
FUSE: 4A, S-B	4A, S-B	8A, N-B
VARISTOR: 275V	275V	130V
VR1	275V Varistor: 5017-09063-00 130V Varistor: 5017-09044-00	
6F1	4A, S-B Fuse: 5731-06314-00 (for 220V) 8A, N-B Fuse: 5730-09252-00 (for 115V)	



Power Wiring Diagram

SYSTEM 11B CPU INTERBOARD SIGNALS

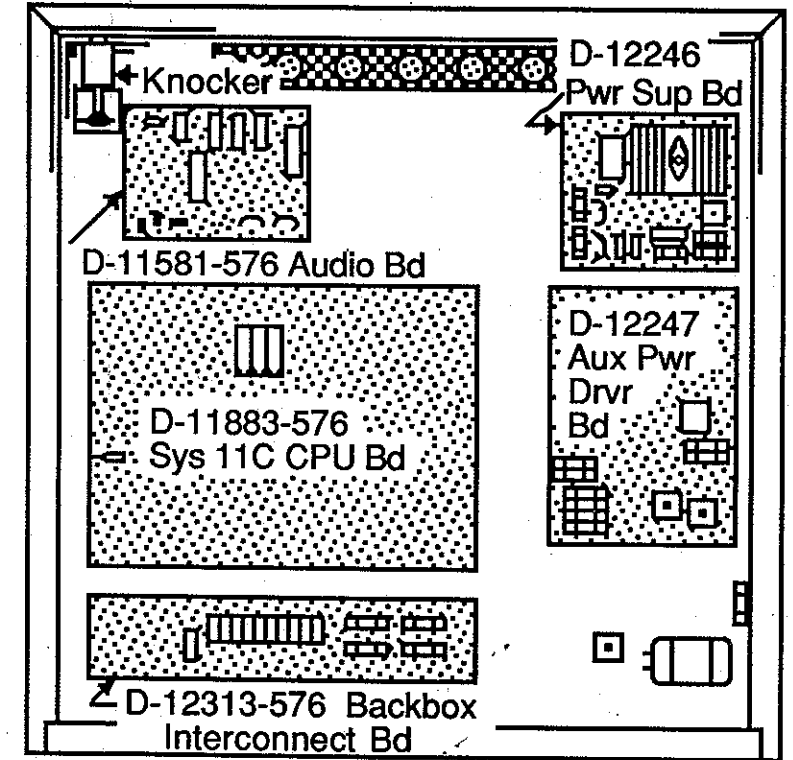
Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
1J1-1	BRN-GRY	ST-8: Display Digit Strobe / 4J1-1	1J2-1	VIO-GRY	ST-16: Display Digit Strobe / 4J2-1
1J1-2	BRN-VIO	ST-7: Display Digit Strobe / 4J1-2	1J2-2	VIO-BLK	ST-15: Display Digit Strobe / 4J2-2
1J1-3	BRN-BLU	ST-6: Display Digit Strobe / 4J1-3	1J2-3	VIO-BLU	ST-14: Display Digit Strobe / 4J2-3
1J1-4	BRN-GRN	ST-5: Display Digit Strobe / 4J1-4	1J2-4	VIO-GRN	ST-13: Display Digit Strobe / 4J2-4
1J1-5	BRN-YEL	ST-4: Display Digit Strobe / 4J1-5	1J2-5	VIO-YEL	ST-12: Display Digit Strobe / 4J2-5
1J1-6	BRN-ORG	ST-3: Display Digit Strobe / 4J1-6	1J2-6	VIO-ORG	ST-11: Display Digit Strobe / 4J2-6
1J1-7	BRN-RED	ST-2: Display Digit Strobe / 4J1-7	1J2-7	Key Pin	No Connection
1J1-8	Key Pin	No Connection	1J2-8	VIO-RED	ST-10: Display Digit Strobe / 4J2-8
1J1-9	BRN-BLK	ST-1: Display Digit Strobe / 4J1-9	1J2-9	VIO-BRN	ST-9: Display Digit Strobe / 4J2-9
1J3-1	BLU-BRN	D1 / Display BCD / 4J5-1	1J4-1	VIO	Lamp +18V dc Power
1J3-2	BLU-RED	C1 / Display BCD / 4J5-2	1J4-2	VIO	"
1J3-3	BLU-ORG	B1 / Display BCD / 4J5-3	1J4-3	Key Pin	No Connection
1J3-4	BLU-YEL	A1 / Display BCD / 4J5-4	1J4-4	--	No Connection
1J3-5	BLU-GRN	D2 / Display BCD / 4J5-5	1J4-5	--	No Connection
1J3-6	Key Pin	No Connection	1J4-6	--	No Connection
1J3-7	BLU-BLK	C2 / Display BCD / 4J5-7	1J4-7	--	No Connection
1J3-8	BLU-VIO	B2 / Display BCD / 4J5-8	1J4-8	VIO	Lamp +18V dc Power
1J3-9	BLU-GRY	A2 / Display BCD / 4J5-9	1J4-9	VIO	"
1J3-10	--	No Connection	1J6-1	RED-BRN	Lamp Row 1 (Q80) / 2J3-18
1J3-11	--	No Connection	1J6-2	RED-BLK	Lamp Row 2 (Q81) / 2J3-17
1J3-12	--	No Connection	1J6-3	RED-ORG	Lamp Row 3 (Q82) / 2J3-16
1J5-1	--	No Connection	1J6-4	Key Pin	No Connection
1J5-2	Key Pin	No Connection	1J6-5	RED-YEL	Lamp Row 4 (Q83) / 2J3-15
1J5-3	BLK	Ground (Lamp Ckt)	1J6-6	RED-GRN	Lamp Row 5 (Q84) / 2J3-14
1J5-4	BLK	Ground (Lamp Ckt)	1J6-7	RED-BLU	Lamp Row 6 (Q85) / 2J3-13
1J5-5	--	No Connection	1J6-8	RED-VIO	Lamp Row 7 (Q86) / 2J3-12
1J5-6	--	No Connection	1J6-9	RED-GRY	Lamp Row 8 (Q87) / 2J3-11
1J5-7	--	No Connection	1J8-1	GRN-BRN	Switch Col 1 (Q45) / 2J1-18
1J5-8	BLK	Ground (Lamp Ckt)	1J8-2	GRN-RED	Switch Col 2 (Q49) / 2J1-17
1J5-9	BLK	Ground (Lamp Ckt)	1J8-3	GRN-ORG	Switch Col 3 (Q44) / 2J1-16
1J7-1	YEL-BRN	Lamp Col 1 (Q65/66) / 2J3-8	1J8-4	GRN-YEL	Switch Col 4 (Q48) / 2J1-15
1J7-2	YEL-RED	Lamp Col 2 (Q63/64) / 2J3-7	1J8-5	GRN-BLK	Switch Col 5 (Q43) / 2J1-14
1J7-3	YEL-ORG	Lamp Col 3 (Q61/62) / 2J3-6	1J8-6	Key Pin	No Connection
1J7-4	YEL-BLK	Lamp Col 4 (Q59/60) / 2J3-5	1J8-7	GRN-BLU	Switch Col 6 (Q47) / 2J1-13
1J7-5	Key Pin	No Connection	1J8-8	GRN-VIO	Switch Col 7 (Q42) / 2J1-12
1J7-6	YEL-GRN	Lamp Col 5 (Q57/58) / 2J3-4	1J8-9	GRN-GRY	Switch Col 8 (Q46) / 2J1-11
1J7-7	YEL-BLU	Lamp Col 6 (Q55/56) / 2J3-3	1J9	Not Applicable	
1J7-8	YEL-VIO	Lamp Col 7 (Q53/54) / 2J3-2	1J11-1	GRY-BRN	Solenoid 1 (Q33) / 5J1-9
1J7-9	YEL-GRY	Lamp Col 8 (Q51/52) / 2J3-1	1J11-2	Key Pin	No Connection
1J10-1	WHT-GRY	Switch Row 8 / 2J1-8	1J11-3	GRY-RED	Solenoid 2 (Q25) / 5J1-7
1J10-2	WHT-VIO	Switch Row 7 / 2J1-7	1J11-4	GRY-ORG	Solenoid 3 (Q32) / 5J1-6
1J10-3	WHT-BLU	Switch Row 6 / 2J1-6	1J11-5	GRY-YEL	Solenoid 4 (Q24) / 5J1-5
1J10-4	Key Pin	No Connection	1J11-6	GRY-GRN	Solenoid 5 (Q31) / 5J1-4
1J10-5	WHT-GRN	Switch Row 5 / 2J1-5	1J11-7	GRY-BLU	Solenoid 6 (Q23) / 5J1-3
1J10-6	WHT-YEL	Switch Row 4 / 2J1-4	1J11-8	GRY-VIO	Solenoid 7 (Q30) / 5J1-2
1J10-7	WHT-ORG	Switch Row 3 / 2J1-3	1J11-9	GRY-BLK	Solenoid 8 (Q22) / 5J1-1
1J10-8	WHT-RED	Switch Row 2 / 2J1-2	1J13-1	BLK	Solenoid Ground / 5J10-1
1J10-9	WHT-BRN	Switch Row 1 / 2J1-1	1J13-2	BLK	" / 5J10-2
1J12-1	BRN-BLK	Solenoid 9 (Q17) / 5J2-9	1J13-3	BLK	" / 5J10-3
1J12-2	BRN-RED	Solenoid 10 (Q9) / 5J2-8	1J13-4	BLK	" / 5J10-4
1J12-3	Key Pin	No Connection	1J14-1	BLK-RED	Memory Protect / 7J1-4
1J12-4	BRN-ORG	Solenoid 11 (Q16) / 5J2-6	1J14-2	WHT	Ground / 7J1-3
1J12-5	BRN-YEL	Solenoid 12 (Q8) / 5J2-5	1J14-3	GRN	ADVANCE Switch / 7J1-1
1J12-6	BRN-GRN	Solenoid 13 (Q15) / 5J2-4	1J14-4	BLU	AUTO/MANUAL Switch / 7J1-2
1J12-7	BRN-BLU	Solenoid 14 (Q7) / 5J2-3	1J17-1	BLK	Ground / 3J1-2
1J12-8	BRN-VIO	Solenoid 15 (Q14) / 5J2-2	1J17-2	BLK	" / 3J1-3
1J12-9	BRN-GRY	Solenoid 16 (Q6) / 5J2-1	1J17-3	BLK	" / 3J1-4
1J16-1	RED	Volume Control Input / 10J1-1	1J17-4	GRY	Power: +5V dc / 3J1-8
1J16-2	BLK	Volume Control Output / 10J1-2	1J17-5	GRY	" / 3J1-6
1J16-3	Key Pin	No Connection	1J17-6	GRY	" / 3J1-9
1J16-4	White	Signal Ground - CPU / 10J1-4	1J17-7	Key Pin	No Connection
1J18-1	--	No Connection	1J17-8	BLK-WHT	Power: -12V dc Unreg / 3J1-14
1J18-2	--	"	1J17-9	WHT-GRY	Power: +12V dc Unreg / 3J1-12
1J18-3	--	"	1J19-1	ORG-VIO	Flipper Ground / 2J5-5
1J18-4	--	"	1J19-2	ORG-GRY	Flipper Ground / 2J5-4
1J18-5	--	"	1J19-3	BLU-ORN	Spl Solnd 3 (Q73) / 5J3-3
1J18-6	Key Pin	"	1J19-4	BLU-RED	Spl Solnd 2 (Q71) / 5J3-6
1J18-7	--	"	1J19-5	Key Pin	No Connection
1J18-8	--	"	1J19-6	BLU-YEL	Spl Solnd 4 (Q69) / 5J3-4
1J18-9	--	"	1J19-7	BLU-BRN	Spl Solnd 1 (Q75) / 5J3-7
1J19-1	BLU-GRN	Spl Solnd 5 (Q77) / 5J3-2	1J19-8	BLU-GRN	Spl Solnd 6 (Q79) / Solenoid 22
1J21	Ribbon Cable to Sound Overlay Solenoid Bd J2				
1J22	Ribbon Cable to Master Display Board 4J3				

POWER SUPPLY INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
3J1-1	BLK	Ground / 1J3-2	3J2-1	ORG	Display Power: -100V dc / 4J7-1
3J1-2	BLK	Ground / SOL. J3-4/1J17-1	3J2-2	--	No Connection
3J1-3	BLK	Ground / 1J17-2	3J2-3	BRN	Display Power: +100V dc / 4J7-3
3J1-4	BLK	Ground / 1J17-3	3J2-4	--	No Connection
3J1-5	BLK-YEL	Logic Ground / 2J2-3	3J2-5	BLK	Ground (Display ckt) / 4J7-5
3J1-6	GRY	CPU Pwr: +5V dc Reg / 10J3-1	3J2-6	GRY	Display Power: +5V dc / 4J7-6
3J1-7	GRY	" / 1J17-5	3J3-1	GRY	Transformer: 19.4V ac, 1Ø, C. T.
3J1-8	GRY	" / SOL. J3-1/1J17-4	3J3-2	GRY	Transformer: 19.4V ac, 1Ø, C. T.
3J1-9	GRY	" / 1J17-6	3J3-3	GRY-WHT	Transformer: 19.4V ac, C.T. com
3J1-10	Key Pin	No Connection	3J3-4	GRY-WHT	Transformer: 19.4V ac, C.T. com
3J1-11	WHT-GRY	CPU Pwr: +12V dc Unreg / 10J3-6	3J3-5	GRY-GRN	Transformer: 19.4V ac, 1Ø, C. T.
3J1-12	WHT-GRY	CPU Pwr: +12V dc Unreg / 1J17-9	3J3-6	GRY-GRN	Transformer: 19.4V ac, 1Ø, C. T.
3J1-13	GRY-BLK	CPU Pwr: +12V dc Unreg / 2J2-1	3J3-7	Key Pin	No Connection
3J1-14	BLK-WHT	CPU Pwr: -12V dc Unreg / 1J17-8	3J3-8	WHT	Transformer: 88.5V ac
3J1-15	BLK-WHT	CPU Pwr: -12V dc Unreg / 10J3-3	3J3-9	WHT	Transformer: 88.5V ac

AUX POWER DRIVER INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
5J1-1	GRY-BLK	CPU: Solenoid 8 (Q22) / 1J11-9	5J2-1	BRN-GRY	CPU: Solenoid 16 (Q6) / 1J12-9
5J1-2	GRY-VIO	CPU: Solenoid 7 (Q30) / 1J11-8	5J2-2	BRN-VIO	CPU: Solenoid 15 (Q14) / 1J12-8
5J1-3	GRY-BLU	CPU: Solenoid 6 (Q23) / 1J11-7	5J2-3	BRN-BLU	CPU: Solenoid 14 (Q7) / 1J12-7
5J1-4	GRY-GRN	CPU: Solenoid 5 (Q31) / 1J11-6	5J2-4	BRN-GRN	CPU: Solenoid 13 (Q15) / 1J12-6
5J1-5	GRY-YEL	CPU: Solenoid 4 (Q24) / 1J11-5	5J2-5	BRN-YEL	CPU: Solenoid 12 (Q8) / 1J12-5
5J1-6	GRY-ORG	CPU: Solenoid 3 (Q32) / 1J11-4	5J2-6	BRN-ORG	CPU: Solenoid 11 (Q16) / 1J12-4
5J1-7	GRY-RED	CPU: Solenoid 2 (Q25) / 1J11-3	5J2-7	Key Pin	No Connection
5J1-8	Key Pin	No Connection	5J2-8	BRN-RED	CPU: Solenoid 10 (Q9) / 1J12-2
5J1-9	GRY-BRN	CPU: Solenoid 1 (Q33) / 1J11-1	5J2-9	BRN-BLK	CPU: Solenoid 9 (Q17) / 1J12-1
5J3-1	BLU-BLK	CPU: Solenoid 22 (Q79) / 1J19-9	5J4-1	VIO-GRY	Solenoid 08A
5J3-2	BLU-GRN	CPU: Solenoid 21 (Q77) / 1J19-8	5J4-2	VIO-BLK	Solenoid 07A
5J3-3	BLU-ORG	CPU: Solenoid 19 (Q73) / 1J19-3	5J4-3	Key Pin	No Connection
5J3-4	BLU-YEL	CPU: Solenoid 20 (Q69) / 1J19-6	5J4-4	VIO-BLU	Solenoid 06A
5J3-5	Key Pin	No Connection	5J4-5	VIO-GRN	Solenoid 05A
5J3-6	BLU-RED	CPU: Solenoid 18 (Q71) / 1J19-4	5J4-6	VIO-YEL	Solenoid 04A
5J3-7	BLU-BRN	CPU: Solenoid 17 (Q75) / 1J19-7	5J4-7	VIO-ORN	Solenoid 03A
5J5-1	WHT-GRY	Solenoid 08C / 2J4-8	5J4-8	VIO-RED	Solenoid 02A
5J5-2	WHT-VIO	Solenoid 07C / 2J4-7	5J4-9	VIO-BRN	Solenoid 01A
5J5-3	WHT-BLU	Solenoid 06C / 2J4-6	5J6-1	BRN-GRY	Solenoid 16 / 2J4-16
5J5-4	WHT-GRN	Solenoid 05C / 2J4-5	5J6-2	BRN-VIO	Solenoid 15 / 2J4-15
5J5-5	WHT-YEL	Solenoid 04C / 2J4-4	5J6-3	BRN-BLU	Solenoid 14 / 2J4-14
5J5-6	Key Pin	No Connection	5J6-4	Key Pin	No Connection
5J5-7	WHT-ORG	Solenoid 03C / 2J4-3	5J6-5	BRN-GRN	Solenoid 13 / 2J4-13
5J5-8	WHT-RED	Solenoid 02C / 2J4-2	5J6-6	--	Solenoid 12
5J5-9	WHT-BRN	Solenoid 01C / 2J4-1	5J6-7	BRN-ORG	Solenoid 11 / 2J4-12
5J7-1	--	No Connection	5J6-8	BRN-RED	Solenoid 10 / 2J4-11
5J7-2	BLU-GRN	Solenoid 21	5J6-9	BRN-BLK	Solenoid 9 / 2J4-10
5J7-3	BLU-ORG	Solenoid 19	5J8-1	WHT-RED	Transformer: 26V ac / 7J2-6
5J7-4	Key Pin	No Connection	5J8-2	WHT-RED	Transformer: 26V ac / 7J2-6
5J7-5	BLU-YEL	Solenoid 20	5J8-3	WHT-RED	Transformer: 26V ac / 7J2-7
5J7-6	BLU-RED	Solenoid 18	5J8-4	WHT-RED	Transformer: 26V ac / 7J2-7
5J7-7	BLU-BRN	Solenoid 17	5J8-5	Key Pin	No Connection
5J9-1-6	--	No Connection	5J8-6	BLK-YEL	Transformer: 48V ac / 7J2-11
5J10-1	BLK	Solenoid Gnd / 1J13-1	5J8-7	BLK-YEL	Transformer: 48V ac / 7J2-11
5J10-2	BLK	Solenoid Gnd / 1J13-2	5J8-8	BLK-YEL	Transformer: 48V ac / 7J2-12
5J10-3	BLK	Solenoid Gnd / 1J13-3	5J8-9	BLK-YEL	Transformer: 48V ac / 7J2-12
5J10-4	BLK	Solenoid Gnd / 1J13-4	5J12-1	--	No Connection
5J11-1	ORG	+25 Vdc "C" Solenoid Pwr/2J5-9	5J12-2	GRY-YEL	+50 Vdc Flipper Pwr/ 2J5-3
5J11-2	--	No Connection	5J12-3	--	No Connection
5J11-3	Key Pin	No Connection	5J12-4	BLU-YEL	+50 Vdc Flipper Pwr/2J5-2
5J11-4	BRN	+25 Vdc "A" Solenoid Pwr/2J5-12	5J12-5	--	No Connection
5J11-5	--	No Connection	5J12-6	VIO-YEL	+50 Vdc Solenoid Pwr/2J5-10
5J11-6	BLK	Ground/2J5-6	5J12-7	VIO-YEL	+50 Vdc Solenoid Pwr/Sol. 22
5J11-7	BLK	Ground/Solenoid 22	5J12-8	Key Pin	No Connection
5J11-8	--	No Connection	5J12-9	--	No Connection
5J11-9	RED	+25 Vdc Solenoid Pwr/2J5-8	5J12-10	--	No Connection
5J11-10	--	No Connection	5J12-11	YEL-VIO	+50 Vdc Solenoid Pwr/2J5-11
5J11-11	RED-WHT	+50 Vdc Solenoid Pwr/2J5-1	5J12-12	--	No Connection
5J11-12	--	No Connection			



AUDIO BOARD INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
10J1-1	RED	Sound Input (from CPU) / 1J16-1	10J2-1	RED	Signal Level (to Vol Cntrl)
10J1-2	BLK	Sound Input (from CPU) / 1J16-2	10J2-2	BLK	Signal Level (from Vol Cntrl)
10J1-3	---	No Connection	10J2-3	---	No Connection
10J1-4	WHT	Ground / 1J16-4	10J2-4	shield	Ground
10J3-1	GRY	Power: +5 Vdc / 3J1-7	10J4	Ribbon Cable from SOL. J1	
10J3-3	BLK-WHT	Power: -12 Vdc Unreg / 3J1-15	10J5-1	BLK-YEL / Speaker	
10J3-4	---	No Connection	10J5-2	BLK-YEL / Speaker	
10J3-5	---	No Connection	10J5-3	BLK / Speaker	
10J3-6	WHT-GRY	Power: +12 Vdc Unreg / 3J1-11	10J5-4	BLK / Speaker	

MASTER DISPLAY INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
4J1-1	BRN-GRY	ST-8: Digit Display Strobe / 1J1-1	4J2-1	VIO-GRY	ST-16: Digit Display Strobe / 1J2-1
4J1-2	BRN-VIO	ST-7: Display Digit Strobe / 1J1-2	4J2-2	VIO-BLK	ST-15: Display Digit Strobe / 1J2-2
4J1-3	BRN-BLU	ST-6: Display Digit Strobe / 1J1-3	4J2-3	VIO-BLU	ST-14: Display Digit Strobe / 1J2-3
4J1-4	BRN-GRN	ST-5: Display Digit Strobe / 1J1-4	4J2-4	VIO-GRN	ST-13: Display Digit Strobe / 1J2-4
4J1-5	BRN-YEL	ST-4: Display Digit Strobe / 1J1-5	4J2-5	VIO-YEL	ST-12: Display Digit Strobe / 1J2-5
4J1-6	BRN-ORG	ST-3: Display Digit Strobe / 1J1-6	4J2-6	VIO-ORG	ST-11: Display Digit Strobe / 1J2-6
4J1-7	BRN-RED	ST-2: Display Digit Strobe / 1J1-7	4J2-7	Key Pin	No Connection
4J1-8	Key Pin	No Connection	4J2-8	VIO-RED	ST-8: Display Digit Strobe / 1J2-8
4J1-9	BRN-BLK	ST-1: Display Digit Strobe / 1J1-9	4J2-9	VIO-BRN	ST-9: Display Digit Strobe / 1J2-9
4J3	Ribbon Cable from CPU 1J22				
4J7-1	ORG	Display Power: -100V dc / 3J2-3	4J7-4	Key Pin	No Connection
4J7-2	---	No Connection	4J7-5	BLK	Ground / 3J2-1
4J7-3	BRN	Display Power: +100V dc / 3J2-4	4J7-6	GRY	Power: +5V dc / 3J2-6

BACKBOX INTERCONNECT BOARD INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
2J1-1	WHT-BRN	Switch Row 1 / 1J11-9	2J2-1	GRY-YEL	+12Vdc Unreg/3J1-13
2J1-1	WHT-RED	Switch Row 2 / 1J11-8	2J2-2	---	No Connection
2J1-3	WHT-ORG	Switch Row 3 / 1J11-7	2J2-3	BLK-YEL	Ground/3J1-5
2J1-4	WHT-YEL	Switch Row 4 / 1J11-6	2J3-1	YEL-GRY	Lamp Col 8 (Q51/52)/1J7-9
2J1-5	WHT-GRN	Switch Row 5 / 1J11-5	2J3-2	YEL-VIO	Lamp Col 7 (Q53/54)/1J7-8
2J1-6	WHT-BLU	Switch Row 6 / 1J11-3	2J3-3	YEL-BLU	Lamp Col 6 (Q55/56)/1J7-7
2J1-7	WHT-VIO	Switch Row 7 / 1J11-2	2J3-4	YEL-GRN	Lamp Col 5 (Q57/58)/1J7-6
2J1-8	WHT-GRY	Switch Row 8 / 1J11-1	2J3-5	YEL-BLK	Lamp Col 4 (Q59/60)/1J7-4
2J1-9	Key Pin	No Connection	2J3-6	YEL-ORG	Lamp Col 3 (Q61/62)/1J7-3
2J1-10	---	No Connection	2J3-7	YEL-RED	Lamp Col 2 (Q63/64)/1J7-2
2J1-11	GRN-GRY	Switch Col 8 (Q46) / 1J8-9	2J3-8	YEL-BRN	Lamp Col 1 (Q65/66)/1J7-1
2J1-12	GRN-VIO	Switch Col 7 (Q42) / 1J8-8	2J3-9	Key Pin	No Connection
2J1-13	GRN-BLU	Switch Col 6 (Q47) / 1J8-7	2J3-10	---	No Connection
2J1-14	GRN-BLK	Switch Col 5 (Q43) / 1J8-5	2J3-11	RED-GRY	Lamp Row 8 (Q87) / 1J6-9
2J1-15	GRN-YEL	Switch Col 4 (Q48) / 1J8-4	2J3-12	RED-VIO	Lamp Row 7 (Q86) / 1J6-8
2J1-16	GRN-ORG	Switch Col 3 (Q44) / 1J8-3	2J3-13	RED-BLU	Lamp Row 6 (Q85) / 1J6-7
2J1-17	GRN-RED	Switch Col 2 (Q49) / 1J8-2	2J3-14	RED-GRN	Lamp Row 5 (Q84) / 1J6-6
2J1-18	GRN-BRN	Switch Col 1 (Q45) / 1J8-1	2J3-15	RED-YEL	Lamp Row 4 (Q83) / 1J6-5
2J4-1	WHT-BRN	Solenoid 01C In / 5J5-9	2J3-16	RED-ORG	Lamp Row 3 (Q82) / 1J6-3
2J4-2	WHT-RED	Solenoid 02C In / 5J5-8	2J3-17	RED-BLK	Lamp Row 2 (Q81) / 1J6-2
2J4-3	WHT-ORG	Solenoid 03C In / 5J5-7	2J3-18	RED-BRN	Lamp Row 1 (Q80) / 1J6-1
2J4-4	WHT-YEL	Solenoid 04C In / 5J5-5	2J5-1	RED-WHT	+25Vdc (Solenoid) / 5J11-12
2J4-5	WHT-GRN	Solenoid 05C In / 5J5-4	2J5-2	BLU-YEL	Flipper Power / 5J12-4
2J4-6	WHT-BLU	Solenoid 06C In / 5J5-3	2J5-3	GRY-YEL	Flipper Power / 5J12-2
2J4-7	WHT-VIO	Solenoid 07C In / 5J5-2	2J5-4	ORG-GRY	Flipper Ground Ckt / 1J19-2
2J4-8	WHT-GRY	Solenoid 08C In / 5J5-1	2J5-5	ORG-VIO	Flipper Ground Ckt / 1J19-1
2J4-9	Key Pin	No Connection	2J5-6	BLK	Ground / 5J11-6
2J4-10	BRN-BLK	Solenoid 9 / 5J6-9	2J5-7	Key Pin	No Connection
2J4-11	BRN-RED	Solenoid 10 / 5J6-8	2J5-8	RED	+25 Vdc (Solenoid) / 5J11-9
2J4-12	BRN-ORG	Solenoid 11 / 5J6-7	2J5-9	ORG	+25 Vdc ("C" Solenoids) / 5J11-1
2J4-13	BRN-GRN	Solenoid 13 / 5J6-5	2J5-10	VIO-YEL	+50 Vdc (Solenoid) / 5J12-7
2J4-14	BRN-BLU	Solenoid 14 / 5J6-3	2J5-11	YEL-VIO	+50 Vdc (Solenoid) / 5J12-11
2J4-15	BRN-VIO	Solenoid 15 / 5J6-2	2J5-12	BRN	+25 Vdc ("A" Solenoids) / 5J11-5
2J4-16	BRN-GRY	Solenoid 16 / 5J6-1	2J7-1 - 4	---	No Connection
2J6-1	YEL	Gen Illum Pwr: 6V ac	2J7-5	ORG	+25 V dc Solenoid Pwr: Flashers Pwr
2J6-2	YEL	Gen Illum Pwr: 6V ac	2J7-6	RED	+25 V dc Solenoid Pwr: Sol. 10
2J6-3	YEL	Gen Illum Pwr: 6V ac	2J7-7	WHT-GRN	Backbox Gen Illum Pwr / 2J6-8
2J6-4	YEL	Gen Illum Pwr: 6V ac	2J7-8	WHT-BRN	Backbox Gen Illum Pwr / 2J6-6
2J6-5	Key Pin	No Connection	2J7-9	GRN	Backbox Gen Illum Pwr / 2J6-3
2J6-6	YEL-WHT	Gen Illum Pwr: 6V ac	2J7-10	BRN	Backbox Gen Illum Pwr / 2J6-1
2J6-7	YEL-WHT	Gen Illum Pwr: 6V ac			
2J6-8	YEL-WHT	Gen Illum Pwr: 6V ac			
2J6-9	YEL-WHT	Gen Illum Pwr: 6V ac			

BACKBOX INTERCONNECT BOARD INTERBOARD SIGNALS (Continued)

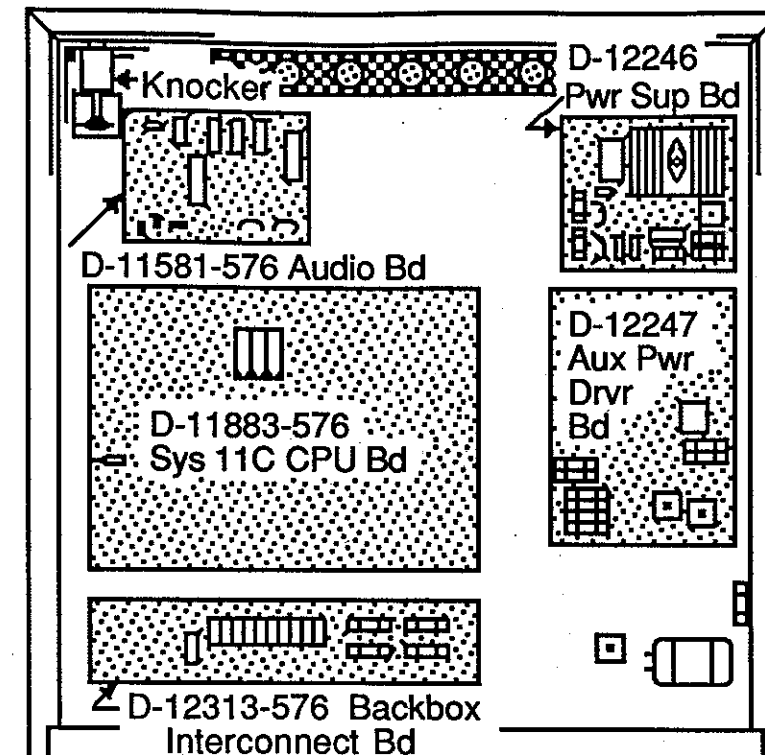
Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
2J8-1	BRN	+25 Vdc ("A" Solenoids)	2J9-1	WHT-VIO	Playfield Gen Illum Pwr / 2J6-9
2J8-2	YEL-VIO	+50 Vdc Solenoid 03A, 04A, 06A, 07A	2J9-2,3,4	---	No Connection
2J8-3	VIO-YEL	+50 Vdc Solenoid 13, 14, 18, 20	2J9-5	VIO	Playfield Gen Illum Pwr / 2J6-4
2J8-4	ORG	+25 Vdc ("C" Solenoids)	2J9-6	YEL	Playfield Gen Illum Pwr / 2J6-2
2J8-5	RED	+25 Vdc Solenoid 9-11, 15, 16	2J9-7	WHT-YEL	Playfield Gen Illum Pwr / 2J6-7
2J8-6, 7, 12	---	No Connection	2J10-1	BLU-VIO	Lower Right Flipper Switch
2J8-8	GRY-YEL	Flipper Power	2J10-2	BLU-GRY	Lower Left Flipper Switch
2J8-9	BLU-YEL	Flipper Power	2J10-3	BLK-YEL	Upper Right Flipper Switch
2J8-10	Key Pin	No Connection	2J10-4, 6	---	No Connection
2J8-11	RED-WHT	+25Vdc Solenoid 17, 19, 21	2J10-5	RED	+25 Vdc (Solenoid Pwr)
2J8-13	BLK-YEL	Upper Right Flipper	2J10-7	ORG-VIO	R Flipper Ground Ckt
2J8-14	BLU-GRY	Lower Left Flipper	2J10-8	ORG-GRY	L Flipper Ground Ckt
2J8-15	BLU-VIO	Lower Right Flipper	2J10-9	WHT-YEL	Gen Illum Pwr: 6V ac

2J11-1-5	---	No Connection	2J12-1	BRN-GRY	Solenoid 16
2J11-6	BRN-RED	Solenoid 10	2J12-2	BRN-VIO	Solenoid 15
2J11-7	BRN-BLK	Solenoid 9	2J12-3	BRN-BLU	Solenoid 14
2J11-8	---	No Connection	2J12-4	BRN-GRN	Solenoid 13
2J11-9	BLK-VIO	Solenoid 7C	2J12-5	BRN-ORG	Solenoid 11
2J11-10	---	No Connection	2J12-6	---	No Connection
2J11-11	BLK-BLU	Solenoid 6C	2J12-7	BRN-BLK	Solenoid 9
2J11-12	BLK-GRN	Solenoid 5C	2J12-8	BLK-GRY	Solenoid 08C
2J11-13	BLK-YEL	Solenoid 4C	2J12-9	---	No Connection
2J11-14	BLK-ORG	Solenoid 3C	2J12-10	BLK-VIO	Solenoid 07C
2J11-15	BLK-RED	Solenoid 2C	2J12-11	BLK-BLU	Solenoid 06C
2J11-16	---	No Connection	2J12-12	BLK-GRN	Solenoid 05C

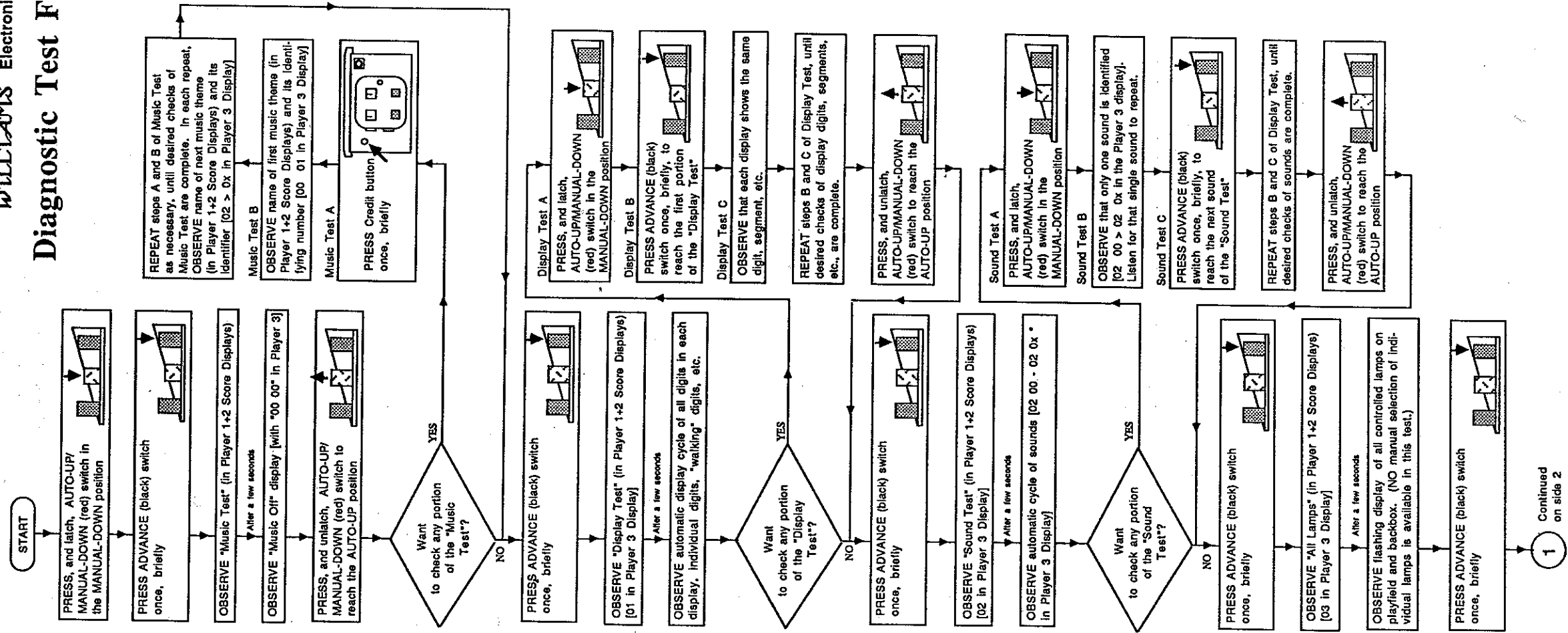
2J13-1	RED-BRN	Lamp Row 1	2J12-13	BLK-YEL	Solenoid 04C
2J13-2	RED-BLK	Lamp Row 2	2J12-14	BLK-ORG	Solenoid 03C
2J13-3	RED-ORG	Lamp Row 3	2J12-15	BLK-RED	Solenoid 02C
2J13-4	RED-YEL	Lamp Row 4	2J12-16	BLK-BRN	Solenoid 01C
2J13-5	RED-GRN	Lamp Row 5	2J15, 2J17	Not Installed	
2J13-6	RED-BLU	Lamp Row 6			
2J13-7	RED-VIO	Lamp Row 7	2J16-1	GRY-YEL	+12V dc Unreg/5-, 3-Dr Tgt Optos
2J13-8	RED-GRY	Lamp Row 8	2J16-2	---	No Connection
2J13-9	---	No Connection	2J16-3	BLK-YEL	Ground (Dr Target Opto Bds)
2J13-10	---	No Connection			
2J13-11	YEL-VIO	Lamp Col 7	2J18-1	GRN-BRN	Switch Col 1
2J13-12	YEL-GRY	Lamp Col 8	2J18-2-4	---	No Connection

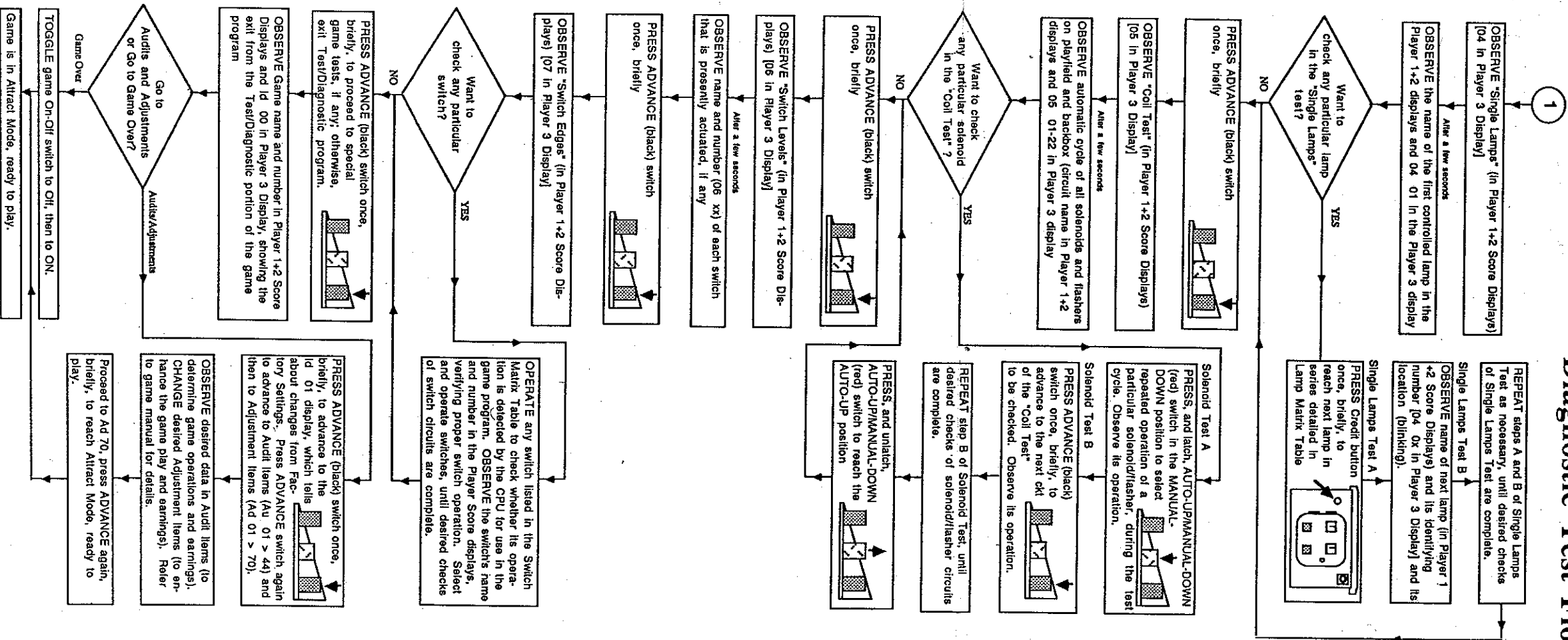
2J14-1	RED-BRN	Lamp Row 1	2J19-2	GRN-ORG	Switch Col 3
2J14-2	RED-BLK	Lamp Row 2	2J19-3	GRN-YEL	Switch Col 4
2J14-3	RED-ORG	Lamp Row 3	2J19-4	GRN-BLK	Switch Col 5
2J14-4	RED-YEL	Lamp Row 4	2J19-5	GRN-BLU	Switch Col 6
2J14-5	RED-GRN	Lamp Row 5	2J19-6	GRN-VIO	Switch Col 7
2J14-6	RED-BLU	Lamp Row 6	2J19-7	---	No Connection
2J14-7	RED-VIO	Lamp Row 7	2J19-8	Key Pin	No Connection
2J14-8	RED-GRY	Lamp Row 8	2J19-9	WHT-GRY	Switch Row 8
2J14-9	---	No Connection	2J19-10	WHT-VIO	Switch Row 7
2J14-10	YEL-BRN	Lamp Col 1	2J19-11	WHT-BLU	Switch Row 6
2J14-11	---	No Connection	2J19-12	WHT-GRN	Switch Row 5
2J14-12	YEL-RED	Lamp Col 2	2J19-13	WHT-YEL	Switch Row 4
2J14-13	YEL-ORG	Lamp Col 3	2J19-14	WHT-ORG	Switch Row 3
2J14-14	YEL-BLK	Lamp Col 4	2J19-15	WHT-RED	Switch Row 2
2J14-15	YEL-GRN	Lamp Col 5	2J19-16	WHT-BRN	Switch Row 1
2J14-16	YEL-BLU	Lamp Col 6			
2J14-17	YEL-VIO	Lamp Col 7			
2J14-18	YEL-GRY	Lamp Col 8			

2J20-1	---	No Connection	2J20-7	RED-VIO	Lamp Row 7 (Display Bd)
2J20-2	RED-BLK	Lamp Row 2 (Display Bd)	2J20-8	RED-GRY	Lamp Row 8 (Display Bd)
2J20-3	RED-ORG	Lamp Row 3 (Display Bd)	2J20-9	RED-BRN	Lamp Row 1 (Display Bd)
2J20-4	RED-YEL	Lamp Row 4 (Display Bd)	2J20-10	YEL-BRN	Lamp Col 1 (Display Bd)
2J20-5	RED-GRN	Lamp Row 5 (Display Bd)			
2J20-6	RED-BLU	Lamp Row 6 (Display Bd)			



Diagnostic Test Flowchart





Diagnostic Test Flowchart (Side 2)

RollerGames Lamp-Matrix Table

COLUMN ROW	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 1 RED-BRN 1J6-1	W 1	Track 8 9	Track 13 17	S L Dr Tgt 25	Bad Attitude Team 1 33	Top Standup 3 41	W Top Dr Tgt 49	Track 1 57
Q81 2 RED-BLK 1J6-2	I 2	Track 11 10	Track 10 18	K L Dr Tgt 26	Maniacs Team 2 34	Top Standup 2 42	A Top Dr Tgt 50	Track 2 58
Q82 3 RED-ORN 1J6-3	L 3	Track 4 11	Track 6 19	A L Dr Tgt 27	Violators Team 3 35	Top Standup 1 43	R Top Dr Tgt 51	Track 3 59
Q83 4 RED-YEL 1J6-5	L 4	Bonus 2X 12	Track 9 20	T L Dr Tgt 28	Rockers Team 4 36	Extra Ball 44	Jackpot (Ramp Entry) 52	Track 5 60
Q84 5 RED-GRN 1J6-6	I 5	Track 7 13	Skate Again 21	E L Dr Tgt 29	Hot Flash Team 5 37	Special (Outlanes) 45	Lock (Ramp Entry) 53	Track 14 61
Q85 6 RED-BLU 1J6-7	A 6	Bonus 1X 14	Left Jetway 22	BR Standup A 30	T-Birds Team 6 38	J (Top Lane) 46	Million (Ramp Entry) 54	Track 15 62
Q86 7 RED-VIO 1J6-8	M 7	Bonus 4X 15	Roller Motion (Ball Popper) 23	BR Standup B 31	Williams Bonus (Popper) 39	E (Top Lane) 47	Magnet (2) 55	Track 16 63
Q87 8 RED-GRY 1J6-9	S 8	Track 12 16	Right Jetway 24	BR Standup C 32	Lites Jetway (Return Lanes) (2) 40	T (Top Lane) 48	Atomic Whip (Left Outlane) 56	Track 17 64

BR = Bottom right; BL = Bottom Left ○ = Multiple Lamps

RollerGames Switch-Matrix Table

COLUMN ROW	1 Q45 GRN-BRN 1J8-1	2 Q49 GRN-RED 1J8-2	3 Q44 GRN-ORN 1J8-3	4 Q48 GRN-YEL 1J8-4	5 Q43 GRN-BLK 1J8-5	6 Q47 GRN-BLU 1J8-7	7 Q42 GRN-VIO 1J8-8	8 Q46 GRN-GRY 1J8-9
1 WHT-BRN 1J10-9	Plumb Bob Tilt 1	Outhole 9		5-Bank Dr Tgt S 25	BL Kicker ("sling") 33	(Top 1 Standup) 41	W Top Dr Tgt 49	Flipper Right 57
2 WHT-RED 1J10-8	C Side Power A/C Relay 2		Right Return Lane 18	5-Bank Dr Tgt K 26	BR Kicker ("sling") 34	(Top 2 Standup) 42	A Top Dr Tgt 50	Flipper Left 58
3 WHT-ORN 1J10-7	Game Start 3	Ball Trough #3 (left) 11	Right Outlane 19	5-Bank Dr Tgt A 27	Left Jet Bumper 35	(Top 3 Standup) 43	R Top Dr Tgt 51	
4 WHT-YEL 1J10-6	Right Coin Chute 4	Ball Trough #2 (mid) 12	Shooter Lane 20	5-Bank Dr Tgt T 28	Right Jet Bumper 36	EXTRA BALL 44	Ramp Lock Entry 52	
5 WHT-GRN 1J10-5	Center Coin Chute 5	Ball Trough #1 (right) 13	L Jetway Top 21	5-Bank Dr Tgt E 29	Lower Jet Bumper 37		Ball Lock 1 53	
6 WHT-BLU 1J10-3	Left Coin Chute 6		R Jetway Top 22	(BR A Standup) 30	Ramp Diverter 1 38	J (Top Lane) 46	Ball Lock 2 54	
7 WHT-VIO 1J10-2	Slam Tilt 7		Left Spinner 23	(BR B Standup) 31	Ramp Diverter 2 39	E (Top Lane) 47		
8 WHT-GRY 1J10-1	High Score Reset 8	Ball Popper 16	Right Spinner 24	(BR C Standup) 32	Left Outlane (Lower L Kickback) 40	T (Top Lane) 48	Left Return Lane 56	

BL = Bottom Left BR = Bottom Right

WARNINGS & NOTICES

WARNING

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

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

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WARNING:

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with hinged backbox DOWN!**