WARNINGS & NOTICES

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RF Interference Notice

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

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

Notice

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WARNING: **Transport this game ONLY with hinged backbox DOWN!**

THANK YOU FOR BUYING ANOTHER FINE WILLIAMS PINBALL!

PLEASE READ THIS SHEET AND KEEP IT WITH THE GAME, IT CONTAINS VALUABLE HINTS ON OPERATING WHIRLWIND FOR MAXIMUM LOCATION PROFIT.

YOUR COLLECTIONS ARE OUR CONCERN!

1. After setting Whirlwind up on location, PLEASE check the playfield pitch with a large dial protractor. Whirlwind should be set at 6-1/2 degrees of pitch with the protractor on the playfield (glass off). YOU CANNOT SET GAME PITCH BY EYE ALONE! Thousands of dollars are lost by operators every year who don't check the pitch of a game when setting it on location! Dial protractors are available at any hardware or building store at marginal cost and can be used on all of your pins. Players simply won't play a game for long with too steep a pitch, (affecting your long term earnings), or will play way too long with too flat a pitch (affecting both long AND short term earnings). We cannot stress playfield pitch too much as it relates to your cashbox!

2. Once the game is pitched properly, make sure that a full pull plunger shot goes smoothly under the top ramp and back down to the right top flipper. If it does not, there is a locking screw for the adjustment of the shooter lane ballguide just above the shooter exit point. NO REMOVAL OF PARTS IS NECESSARY! There is a cutout in the plastics to insert a Phillips screwdriver and loosen the screw. Slightly re-aim the guide and retighten the screw.

3. The spinning discs in the center of the playfield should never require oil or grease of any kind for their life. If, for some reason, height adjustment is needed, there is a label on the underside of the assembly that explains the simple procedure for adjustment.

AT WILLIAMS WE'RE WORKING FOR YOUR BOTTOM LINE!

Ken Fedesna
General Manager

John Straebel
V.P. Manufacturing

Marty Glazman
V.P. Marketing & Sales

Lesley Ross
Sales Manager

Wally Smolucha
V.P. Engineering

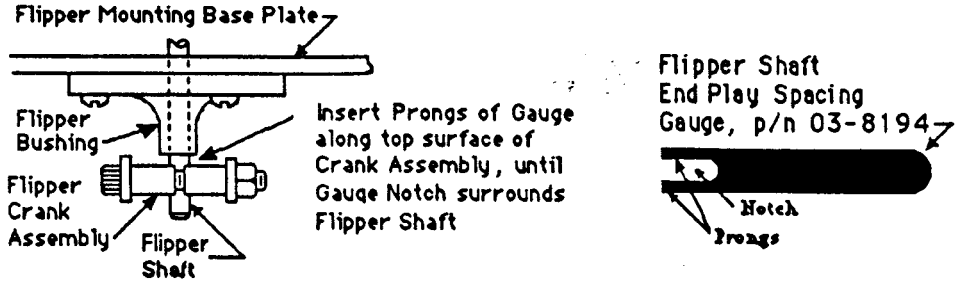
Pat Lawlor
Game Designer

Flipper Shaft End Play Spacing Gauge

Keep that great "Williams Flipper Play" on your game!

Whenever you adjust the flipper mechanism, use the Flipper Shaft End Play Spacing Gauge (p/n 03-8194) to ensure that the flipper shaft end play is correct.

With the playfield raised, slip the prongs of the gauge around the Flipper Shaft between the nylon Flipper Bushing and the Flipper Crank Assembly (with cap screw and nut gripping the shaft). Your flipper is properly adjusted, when the End Play Gauge slides smoothly around the shaft. Excessive gauge binding (too little end play) or excessive looseness ('sloppy fit') indicates that the flipper shaft end play is incorrect.



16-9045

Williams® ELECTRONICS GAMES, INC.

3401 NORTH CALIFORNIA AVENUE • CHICAGO, ILLINOIS 60618 • (312) 267-2240 • CABLE ADDRESS WILCOIN CHICAGO

OCTOBER 20, 1989

Dear Operator:

Williams has decided to temporarily stop factory installation of full playfield Mylars. The decision was made because of unpredictable Mylar adhesion problems occurring in the field. The adhesion problems are under study by our Engineers and Vendors. As soon as the problem is corrected, we will resume the installation of full playfield Mylars.

A playfield Mylar is included with this game. If you choose to use it, please follow the detailed instructions listed on the back of this letter. When cleaning the playfield before installing this Mylar, please do not use a cleaner that has petroleum based ingredients.

Playfield cleaners with petroleum distillates in them should not be used on Mylar because they destroy the adhesive used to hold the Mylar to the playfield. The result is that the edges of the Mylar peel up.

We thank you for your patience while we quickly work to find a reliable way to increase the life of the playfield.

Sincerely,

Walter E. Smolucha

Walter Smolucha
Vice President - Engineering

APPLYING PLAYFIELD MYLAR

I. Spray playfield with weak solution of Dishwashing Detergent and water. Recommend a mixture 1cc detergent to 1 Liter water (recommend "JOY" brand or any other detergent without silicones).

II. Remove backing from Mylar.

III. Apply Mylar to Playfield, aligning the edges of the Mylar to fit in the appropriate areas.

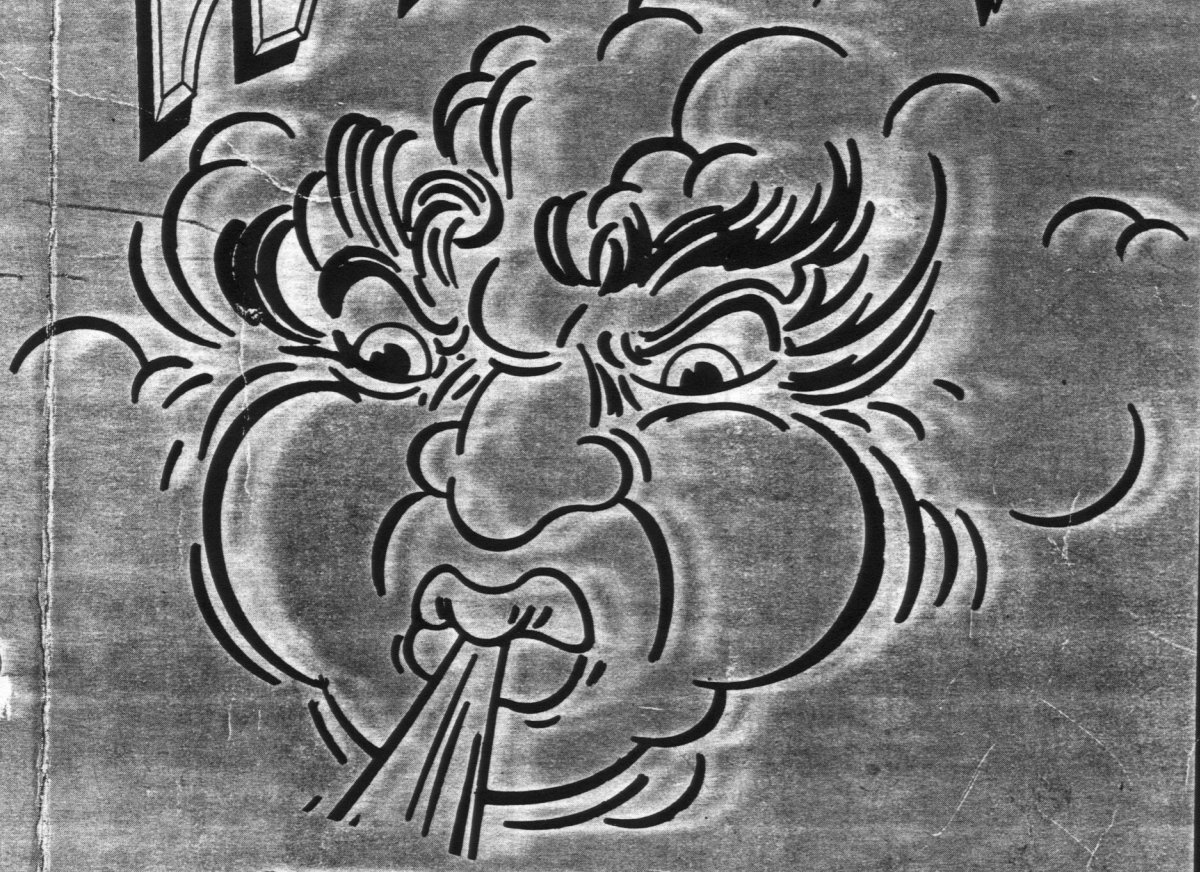
IV. Squeeze out all air bubbles.

V. Wipe dry.

VI. Allow to dry.

16-57[illegible]-101
January 1990

WHIRLWIND



OPERATIONS MANUAL

including:

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

Williams®
ELECTRONICS GAMES, INC.

Whirlwind 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 1 RED-BRN 1J6-1	Middle Standup 1	Left Outlane 9	S Arrow 17	Toll 1 25	Btm Jets Left 33	R Ramp Lock 41	L Return Lane 49	Shoot Again 57
Q81 2 RED-BLK 1J6-2	Up Jets On (Backglass) 2	Right Outlane 10	S W Arrow 18	Toll 2 26	Btm Jets Top 34	R Ramp Double 42	Left Loop 50	2X 58
Q82 3 RED-ORN 1J6-3	250K (Backglass) 3	Top Drop 50K 11	W Arrow 19	Toll 3 27	Btm Jets Right 35	L Ramp Million Plus 43	Left Standup 51	3X 59
Q83 4 RED-YEL 1J6-5	Ex. Ball On (Backglass) 4	Top Drop 75K 12	N W Arrow 20	Toll 4 28	Top Jets Left 36	L Ramp Million 44	Inner Loop Arrow 52	4X 60
Q84 5 RED-GRN 1J6-6	3-Bank 100K (Backglass) 5	Top Drop 100K 13	N Arrow 21	Toll 5 29	Top Jets Right 37	L Ramp Release 45	R Ramp L Stndup 53	5X 61
Q85 6 RED-BLU 1J6-7	500K (Backglass) 6	Top Drop 150K 14	N E Arrow 22	Toll 30 30	Top Jets Btm 38	Skill Shot Right 46	R Ramp R Stndup 54	6X Lites Ex. Ball 62
Q86 7 RED-VIO 1J6-8	Lite Million (Backglass) 7	Top Drop Quick 15	E Arrow 23	Toll 20 31	L Cellar Sign 39	Skill Shot Mid 47	Right Loop 55	6X Lites Special 63
Q87 8 RED-GRY 1J6-9	Low Jets On (Backglass) 8	Top Drop Ex. Ball 16	S E Arrow 24	Toll 10 32	R Cellar Sign 40	Skill Shot Left 48	Right Standup 56	Right Spinner 64

Whirlwind Switch-Matrix Table

ROW \ COLUMN	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	9	Left Outlane 17	Right Standup 25	Enter Left Ramp 33	Spinner 41	Top Jets (left) 49	Flipper Right 57
2 WHT-RED 1J10-8	C Side Power A/C Relay 2	Outhole 10	Left Return Lane 18	Top Sngl DropTarget 26	L Ramp Score (top) 34	Right Ramp Down 42	Top Jets (right) 50	Flipper Left 58
3 WHT-ORN 1J10-7	Game Start 3	Ball Trough #1 (left) 11	Right Cellar 19	M 3-Bank Dr Tgt (lwr) 27	L Ramp Score (bot) 35	TR Eject 43	Top Jets (bot) 51	Shooter Lane 59
4 WHT-YEL 1J10-6	Right Coin Chute 4	Ball Trough #2 (mid) 12	Left Cellar 20	M 3-Bank Dr Tgt (mid) 28	Left Loop (top) 36	R Ramp Score (top) 44	Btm Jets (left) 52	Left 110 Point 60
5 WHT-GRN 1J10-5	Center Coin Chute 5	Ball Trough #3 (right) 13	Left Standup 21	M 3-Bank Dr Tgt (top) 29	Left Loop (bot) 37	R Ramp Score (bot) 45	Btm Jets (right) 53	Right 110 Point 61
6 WHT-BLU 1J10-3	Left Coin Chute 6	14	Left Lock 1 (lwr) 22	Middle Standup 30	Right Loop (top) 38	46	Btm Jets (top) 54	62
7 WHT-VIO 1J10-2	Slam Tilt 7	Right Return Lane 15	Left Lock 2 (mid) 23	31	Right Loop (bot) 39	L Standup (R Ramp) 47	BL Kicker ("sling") 55	63
8 WHT-GRY 1J10-1	High Score Reset 8	Right Outlane 16	Left Lock 3 (top) 24	32	Inner Loop 40	R Standup (R Ramp) 48	BR Kicker ("sling") 56	64

BL = Bottom Left BR = Bottom Right TR = Top Right

Whirlwind ROM and Jumper Table

Game	System 11B CPU Rev.	P/N - U15 Game µP	P/N - U27 G. ROM 1	P/N - U26 G. ROM 2	P/N - U21 S. ROM 1	P/N - U22 S. ROM 2	P/N - U24 Sound µP	Jumpers
BIG GUNS	-	5400-09150-00	A-5343-557-2	A-5343-557-1	A-5343-557-4	A-5343-557-3	5400-09150-00	W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
SPACE STATION	-		A-5343-552-2	A-5343-552-1	A-5343-552-4	A-5343-552-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
CYCLONE	-		A-5343-564-2	A-5343-564-1	A-5343-564-4	A-5343-564-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
BANZAI RUN	-		A-5343-566-2	A-5343-566-1	A-5343-566-4	A-5343-566-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
SWORDS OF FURY	-		A-5343-559-2	A-5343-559-1	A-5343-559-4	A-5343-559-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
TAXI	-		A-5343-553-2	A-5343-553-1	A-5343-553-4	A-5343-553-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
JOKERZ	-		A-5343-567-2	A-5343-567-1	A-5343-567-4	A-5343-567-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
EARTH-SHAKER	-		A-5343-568-2	A-5343-568-1	A-5343-568-4	A-5343-568-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
Black Knight 2000	-		A-5343-563-2	A-5343-563-1	A-5343-563-4	A-5343-563-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
POLICE FORCE	-		A-5343-573-2	A-5343-573-1	A-5343-573-4	A-5343-573-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
BAD CATS	-		A-5343-575-2	A-5343-575-1	A-5343-575-4	A-5343-575-3		W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19
WHIRLWIND	-	▼	A-5343-574-2	A-5343-574-1	A-5343-574-4	A-5343-574-3	▼	W1, 2, 4, 5, 7, 8, 11, 14, 16, 17, and 19

Whirlwind Solenoid Table

Sol. No.	Function	Solenoid Type	Wire Color [1]	Connections: CPU Bd	Connections: Playfield/ Cabinet	Driver Tmstr	Solenoid Part Number Flashlamp Type (g= B'glass; p=Pl'field; bp=Bk Panel)
01A [3]	Outhole Kicker	Switched	Vio-Brn	1P11-1	5J1-9: 5J4-9 (A)	Q33	AE-23-800
01C [3]	Bottom Right Flasher	Switched	Blk-Brn	(Gry-Brn)	5J5-9 (C)	Q33	#906 flashlamp 1p
02A [3]	Shooter Lane Feeder	Switched	Vio-Red	1P11-3	5J1-7: 5J4-8 (A)	Q25	AE-23-800
02C [3]	Spinner Flasher	Switched	Blk-Red	(Gry-Red)	5J5-8 (C)	Q25	#906 flashlamp 1p
03A [3]	Right Ramp Lifter	Switched	Vio-Orn	1P11-4	5J1-6: 5J4-7 (A)	Q32	AE-24-900
03C [3]	R Ramp Top/Upr Jets Flashers	Switched	Blk-Orn	(Gry-Orn)	5J5-7(C)	Q32	#906 flashlamps 2p
04A [3]	Left Locking Kickback	Switched	Vio- Yel	1P11-5	5J1-5: 5J4-6 (A)	Q24	AE-23-800
04C [3]	R Ramp Upr Mdl/Million Flashers	Switched	Blk-Yel	(Gry-Yel)	5J5-5 (C)	Q24	#906 flashlamps 2p
05A [3]	Top Eject	Switched	Vio-Grn	1P11-6	5J1-4: 5J4-5 (A)	Q31	AE-23-800
05C [3]	Ramp Lwr Mdl/Lwr Jets Flashers	Switched	Blk-Grn	(Gry-Grn)	5J5-4 (C)	Q31	#906 flashlamps 2p
06A [3]	Knocker (in B'box)	Switched	Vio-Blu	1P11-7	5J1-3: 5J4-4 (A)	Q23	AE-23-800
06C [3]	R Ramp Bottom Flasher	Switched	Blk-Blu	(Gry-Blu)	5J5-3 (C)	Q23	#906 flashlamp 1p
07A [3]	3-Bank Drop Target Reset	Switched	Vio-Blk	1P11-8	5J1-2: 5J4-2 (A)	Q30	AE-26-1200
07C [3]	3- Dr Tgt/ M Target Flashers	Switched	Blk-Vio	(Gry-Vio)	5J5-2 (C)	Q30	#906 flashlamps 2p
08A [3]	1-Bank Drop Target Reset	Switched	Vio-Gry	1P11-9	5J1-1: 5J4-1 (A)	Q22	AE-23-800
08C [3]	Mil +/Compass Flashers	Switched	Blk-Gry	(Gry-Blk)	5J5-1 (C)	Q22	#906 flashlamps 2p
09	Left Lower Jet Bumper	Controlled	Brn-Blk	1P12-1	5J2-9: 5J6-9: 2J4-3	Q17	AE-23-800
10	Top Lower Jet Bumper	Controlled	Brn-Red	1P12-2	5J2-8: 5J6-8: 2J4-5	Q9	AE-23-800
11	Upper Playfield G I 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	Diverter	Controlled	Brn-Grn	1P12-6	5J2-4: 5J6-5	Q15	AE-26-1200
14	Under P'fld Kickbig	Controlled	Brn-Blu	1P12-7	5J2-3: 5J6-3	Q7	AE-26-1500
15	Right Lower Jet Bumper	Controlled	Brn-Vio	1P12-8	5J2-2: 5J6-2	Q14	AE-23-800
16	Lwr Playfield / B'box G I Relay	Controlled	Brn-Gry	1P12-9	5J2-1: 5J6-1	Q6	5580-12145-00 (p) [4b] / (B'box)
17	Left Upper Jet Bumper	Special #1	Blu-Brn	1P19-7	5J3-7: 5J7-7	Q75	AE-23-800 5580-09555-01 [4a]
18	Left Kicker ("sling")	Special #2	Blu-Red	1P19-4	5J3-6: 5J7-6	Q71	AE-26-1500
19	Right Upper Jet Bumper	Special #3	Blu-Orn	1P19-3	5J3-3: 5J7-3	Q73	AE-23-800
20	Right Kicker ("sling")	Special #4	Blu-Yel	1P19-6	5J3-4: 5J7-5	Q69	AE-26-1500
21	Top Lower Jet Bumper	Special #5	Blu-Grn	1P19-8	5J3-2:5J7-2	Q77	AE-23-800
22	Right Ramp Down	Special #6	Blu-Blk	1P19-9	5J3-1: 5J7-1	Q79	SM-26-600-DC
23	BP Lightning (L) Flashers	Snd O/L 1	Gry-Brn	1P21	SOL J2:SOL J4-6	Q1 [6]	#906 flashlamps 3bp
24	Blower Motor (atop B'box)	Snd O/L 2	Gry-Red	(Ribbon	SOL J2:SOL J4-5	Q4 [6]	14-7956 via Triac Bd
25	BP Thunder (M) Flasher	Snd O/L 3	Gry-Org	Cable	SOL J2:SOL J4-4	Q7 [6]	#906 flashlamps 1bp
26	BP Thunder (R) Flashers	Snd O/L 4	Gry-Org	to SOL	SOL J2:SOL J4-2	Q10 [6]	#906 flashlamps 2bp
27	Spin Wheels Motor	Snd O/L 5	Gry-Org	Bd)	SOL J2:SOL J4-1	Q13 [6]	14-7955
-	Right Flippers	-	Orn-Vio	1P19-1	2J5-5: 2J10-7	-	
	Lower Right Flipper		[Blu-Vio] [2]		[2J10-1: 2J8-15]		FL11630/50VDC
	Upper Right Flipper		[Blk-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) 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.

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Section 1

Game Operation & Test Information

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

Whirlwind (System 11B) ROM Summary

IC	DESCRIPTION	TYPE	IDENTIFIER	BOARD	PART NUMBER
Game ROM 1	32K x 8 ROM	27256	U27	CPU	A-5343-574-2
Game ROM 2	32K x 8 ROM	27256	U26	CPU	A-5343-574-1
Sound ROM 1	32K x 8 ROM	27256	U21	CPU	A-5343-574-4
Sound ROM 2	32K x 8 ROM	27256	U22	CPU	A-5343-574-3
Music/Speech ROM 1	32K x 8 ROM	27256	U4	Audio	A-5343-574-5
Music/Speech ROM 2	32K x 8 ROM	27256	U19	Audio	A-5343-574-6
Music/Speech ROM 3	32K x 8 ROM	27256	U20	Audio	A-5343-574-7

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 11B 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	5 - Aux Power Driver	9 - Insert Board
2 - Master Interconnect	6 - Backbox	10 - Audio
3 - Backbox Power Supply	7 - Cabinet	
4 - Alphanumeric Display	8 - Playfield	

Whirlwind CIRCUIT BOARDS

System 11B Circuit Boards for Whirlwind 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 11B CPU Board (p/n D-11883-574) must be equipped with the ROMs specified in the Whirlwind (System 11B) ROM Summary. CPU Board jumpers W1, W2, W4, W5, W7, W8, W11, W14, W16, W17, and W19 must be connected.

AUDIO BOARD. The Audio Board is p/n D-11581-574, including ROMs and microprocessor.

SOUND OVERLAY SOLENOID BOARD. The Sound Overlay Solenoid Board is p/n C-13287

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

AUX POWER DRIVER BOARD. The Aux Power Driver Board is D-12247-574.

MASTER INTERCONNECT BOARD. The Master Interconnect Board is D-12313-574.

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

TRIAC ASSEMBLY BOARD. The Triac Assembly Board is p/n C-13088, providing fan motor power.

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

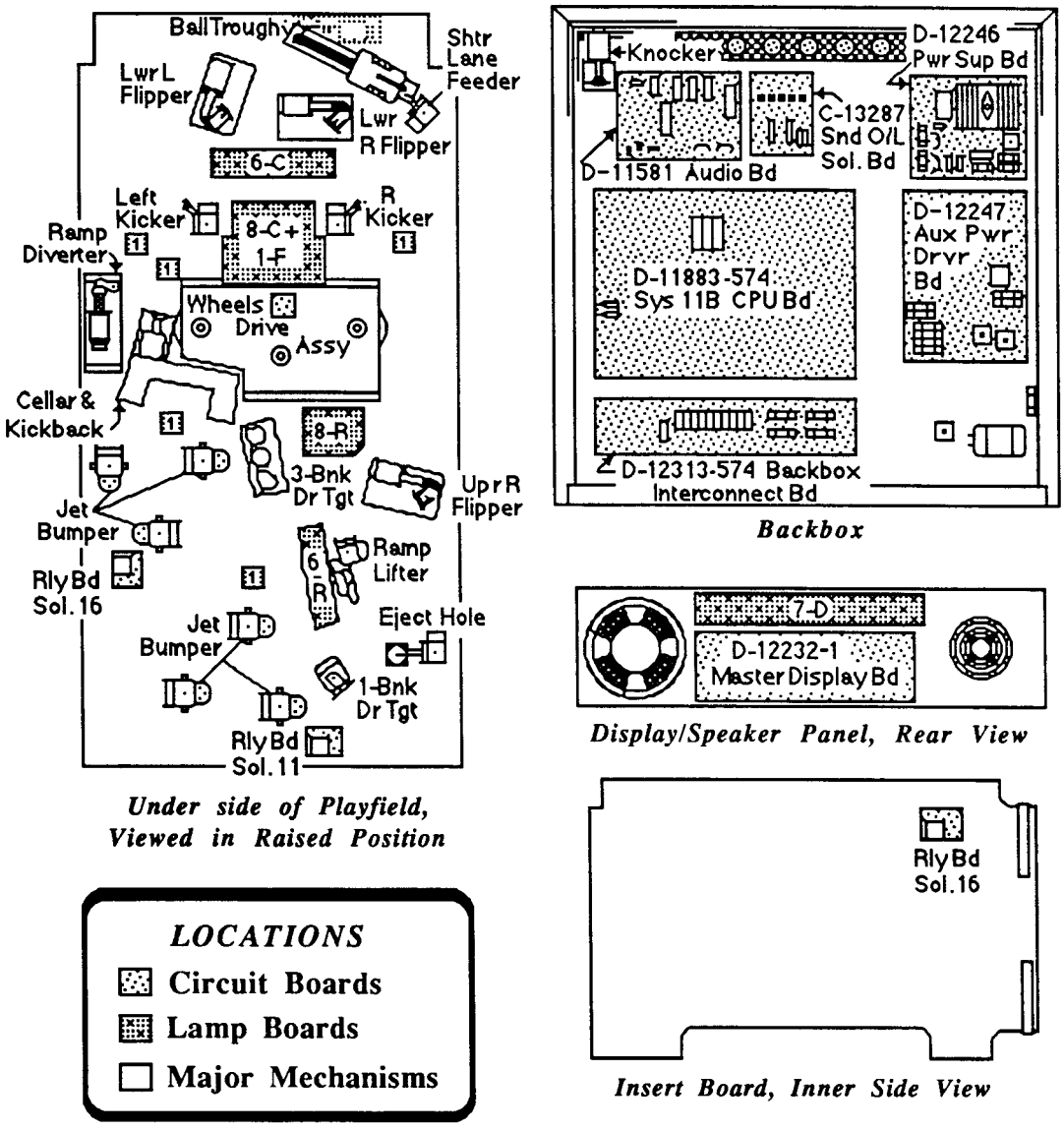


Figure 1. Locations Diagram - Game Circuit Boards and Major Mechanisms

Whirlwind GAME CONTROL LOCATIONS

Figure 2 shows the locations of the following switches, except for the last two (CPU and Sound Diagnostic switches, which are 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 is a pushbutton to the left of the coin door on the cabinet exterior.

GAME ADJUSTMENT/DIAGNOSTIC SWITCHES. Whirlwind 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 locations of the two CPU Board switches (left edge of CPU Board, Backbox View).

The CPU Diagnostic switch (SW 2) is the lower switch (of the two switches 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.

The Sound Diagnostic switch (SW 1) is the upper switch of the two mounted on the left edge of the CPU Board. This switch initiates the Sound Section Test. Refer to the Test/Diagnostic Procedures.

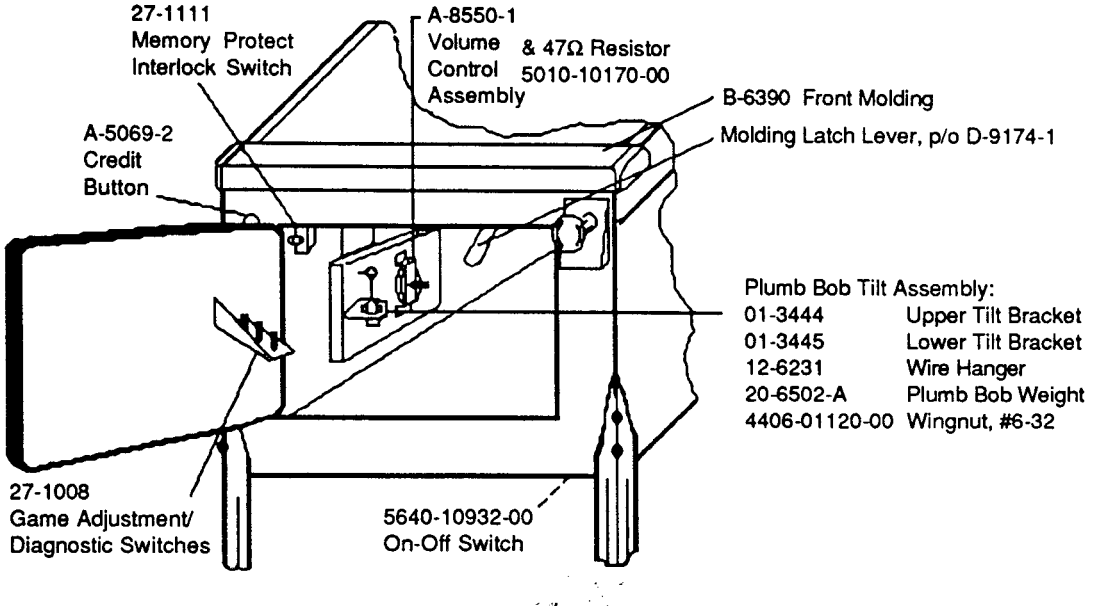


Figure 2. Pinball Game Controls Locations

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 rear leg spacers on the shaft of the leg levellers), using leg bolts. Rear leg spacers, 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.

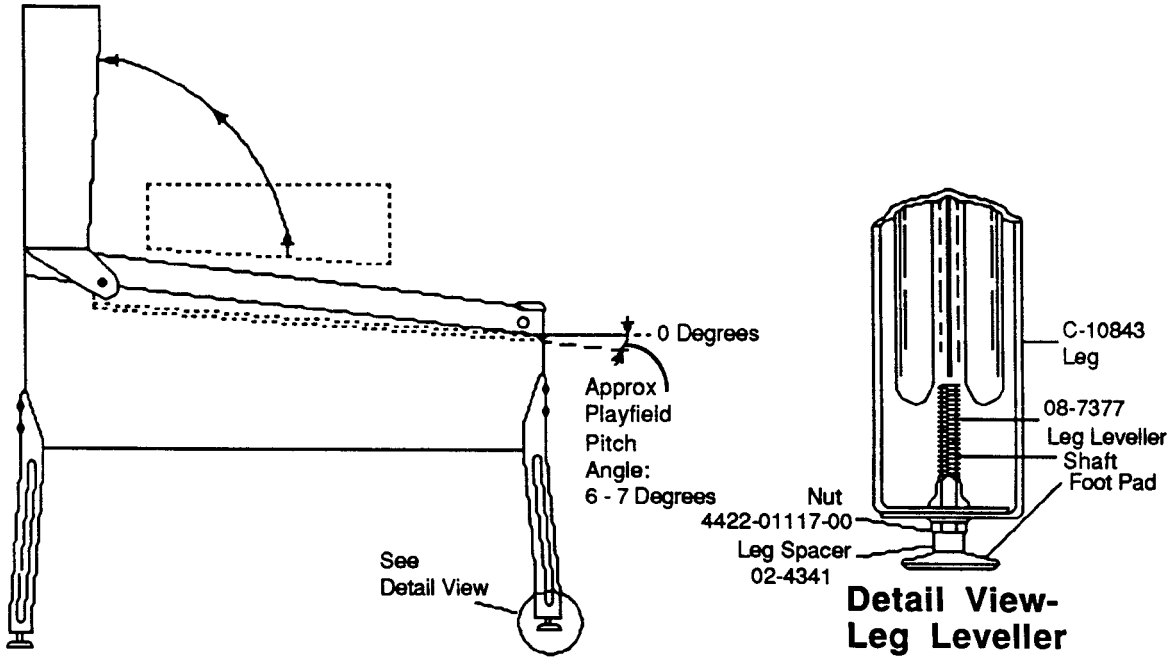


Figure 3. Pinball Assembly, Playfield Pitch Angle, and Leg Leveller Details.

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.

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. (Whirlwind: 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. Succesful completion of the tests shows that the game is ready to begin earning your investment return.

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"
   ("WHIRLWIND ... FEEL THE POWER ... OF THE WIND")*;
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 Credit button.

GAME OPERATION (Continued)

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 Credit 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 Credit 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; Whirlwind then proceeds to the Game Over Mode. With the actuation of the playfield tilt switch, or 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

Whirlwind GAME STATUS DISPLAYS

Whirlwind 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 Whirlwind 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
Whirlwind	**Id 00 574 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 11B 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 Whirlwind **Audit Table** lists the 54 Audit Items of the Whirlwind 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.)

Whirlwind Audit Table

Audit Item (Lower)	Descriptive Phrase (Upper Display)	Audit Item Value [1] (Lower Display)
AU 01	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	MILLION PLUS'S (# of times for 'Million Plus')	
30	1 MILLION SHOT (# of '1 Million' Shots)	
31	ALL MULTIBALLS (# of times for Multi-Ball)	
32	QUICK MULTIBALLS (# of 'Quick Multi-Ball' plays)	
33	CELLAR MULTIBALL (# of 'Cellar Multi-Ball' plays)	
34	1st EX. BALL LIT (# of times '1st Extra Ball' lamp was lit)	
35	2nd EX. BALL LIT (# of times '2nd Extra Ball' lamp was lit)	
36	CELLAR E. BALL LIT (# of times 'Cellar Extra Ball' lamp was lit)	
37	CELLAR SPEC. AWD. (# of SPECIALS via Cellar)	
38	SUPER CELLAR AWD. (# of 'Super Cellar' 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	1.0-1.4 MIL. SCORE (# of games ≥1M, <1.5M)	
43	1.5-1.9 MIL. SCORE (# of games ≥1.5M, <2.0M)	
44	2.0-2.9 MIL. SCORE (# of games ≥2.0M, <3.0M)	
45	3.0-3.9 MIL. SCORE (# of games ≥3.0M, <4.0M)	
46	4.0-4.9 MIL. SCORE (# of games ≥4.0M, <5.0M)	
47	5.0-5.9 MIL. SCORE (# of games ≥5.0M, <6.0M)	
48	6.0-7.9 MIL. SCORE (# of games ≥6.0M, <8.0M)	
49	8.0-9.9 MIL. SCORE (# of games ≥8.0M, <10.0M)	
50	10M - 99.9MIL. SCORE (# of games ≥10M, <99.9M)	
51	AV. MIN. GAME TIME (Average Game in Minutes)	
52	LEFT DRAINS	
53	RIGHT DRAINS	
54	MINUTES ON	

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.

Whirlwind 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 Whirlwind Game Status Displays, as shown in the Player Score Displays. A list of the Game Adjustments appears in the Whirlwind **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 Whirlwind **Game Adjustment Table** lists the 70 items of the Adjustment Information portion of the **Whirlwind** 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 Whirlwind **Game-specific Adjustmenta 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.

Whirlwind Game-specific Adjustments Table

Adjustment Item (Lower)	Descriptive Phras (Upper Display)	Factory Setti (Lower)		
		Domestic (US/Can.)	French	W Ger/ European
Ad 31	MAX. REPLAY BOOST	1 Million		
47	BLOWER SPEED	ON		
48	NORMAL FLASHERS	NORMAL		
51	GRAND H. S. T. D.	ON		
52	GRAND CREDITS	2	4	3

Whirlwind GAME STATUS DISPLAYS (Continued)

Whirlwind Game Adjustment Table

Adjustment Item (Lower)	Descriptive Phrase (Upper Display)	Factory Setting [6] (Lower) Domestic (US/Can.)	French	W Ger/ European
Ad 01	AUTO REPLAY [1] *or* FIXED REPLAY [1]	10 (%) SCORES		
02	REPLAY START (or REPLAY LEVEL 1) [1]	4,600,000		6.000.000
03	REPLAY LEVELS (or REPLAY LEVEL 2) [1]	01 (or OFF)		02
04	(REPLAY LEVEL 3) [1]	(see text)		
05	(REPLAY LEVEL 4) [1]	(see text)		
06	REPLAY AWARD	Credit		
07	SPECIAL AWARD	Credit		
08	MATCH FEATURE	10 %	8%	10%
09	BALLS / GAME	03		
10	TILT WARNING	03	01	
11	MAXIMUM EX. BALL	06	03	
12	MAXIMUM CREDITS	10	20	30
13	HIGHEST SCORES	On		
14	BACKUP HI. SCR.1	6,000,000		8.000.000
15	BACKUP HI. SCR. 2	5,500,000		7.500.000
16	BACKUP HI. SCR. 3	5,000,000		7.000.000
17	BACKUP HI. SCR. 4	4,500,000		6.500.000
18	HI. SCR.1 CREDITS	01	03	01
19	HI. SCR.2 CREDITS	01	01	00
20	HI. SCR.3 CREDITS	01	01	00
21	HI. SCR.4 CREDITS	01	01	00
22	H. S. RESET EVERY	3,000		1.000
23	FREE PLAY	NO		
24	U.S.A. 2 COINAGE (4 COINS 3 PLAYS) [2,3,4]	USA 2	French 1	German 2
25	LEFT UNITS	03	02	06
26	CENTER UNITS	12	10	12
27	RIGHT UNITS	03	20	30
28	UNITS/ CREDIT	04	05	05
29	UNITS/ BONUS	00	20	00
30	MINIMUM UNITS	00	00	00
31 - 58	Game-specific Play / Coinage Adjustments (detailed in text, the Game-specific Adjustments Setting Table and the Difficulty Setting Comparison Table)			
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	CLEAR COINS	NO		
69	CLEAR AUDITS	NO		
70	INSTALL FACTORY	NO		

NOTES:

1. 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.
2. Phrase in parentheses is Factory Setting. Phrase appears in player displays. Press Credit Button to change setting of the game pricing of Item 24.
3. 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.
4. Refer to **Pricing Table** and text describing these items.
5. Special Preset Adjustment, whose effects are noted in the Game Adjustment text.
6. Entries in Factory Setting columns for French and W. German games show only differences from entries in first (US / Can.) column.

Whirlwind GAME STATUS DISPLAYS (Continued)

One of the following Whirlwind **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.

Whirlwind
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
32	Wheel Speed	Normal	Normal	~~Normal~~	Normal	Fast
33	Top Drop Timer	15 sec	10 sec	6 sec	5 sec	4 sec
34	Enter Cellar Timer	10 sec	5 sec	3 sec	3 sec	3 sec
35	Dbl. Tolls Timer	10 sec	5 sec	3 sec	3 sec	3 sec
36	Hide in Cellar	20 sec	17 sec	14 sec	10 sec	8 sec
37	Compass Difficulty	Easy	Easy	Medium	Hard	Hard
38	Lite Quick Multiballs	3 Shots	3 Shots	3 Shots	5 Shots	5 Shots
39	Multiball Difficulty	Easy	Medium	Medium	Medium	Hard
40	Max. Million Plus	10	10	10	10	10
41	Max. Quick Multiballs	3	3	3	3	3
42	Enter Cellar Lit	Always	Always	Always	StartOn	No Mem
43	Cellar Spec./ Ex. Ball	2	2	2	2	2
44	Auto Adj Ex. Ball	50 - 60%	28 - 38%	28 - 38%	28 - 38%	28 - 38%
45	1st Ex. Ball At	6 Tolls	6 Tolls	8 Tolls	10 Tolls	12 Tolls
46	2nd Ex. Ball At	50 Tolls	50 Tolls	50 Tolls	60 Tolls	70 Tolls

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.

Whirlwind

Game Difficulty Setting Table for German / European Games

Adj #	Adj Description	**Extra Easy** Ad 62	**Easy** Ad 63	**Medium** Ad (Factory) 64	**Hard** Ad 65	**Extra Hard** Ad 66
32	Wheel Speed	Normal	Normal	Normal	Normal	Fast
33	Top Drop Timer	15 sec	10 sec	6 sec	5 sec	4 sec
34	Enter Cellar Timer	10 sec	5 sec	3 sec	3 sec	3 sec
35	Dbl. Tolls Timer	10 sec	5 sec	3 sec	3 sec	3 sec
36	Hide in Cellar	20 sec	17 sec	14 sec	10 sec	8 sec
37	Compass Difficulty	Easy	Easy	Medium	Hard	Hard
38	Lite Quick Multiballs	3 Shots	3 Shots	3 Shots	5 Shots	5 Shots
39	Multiball Difficulty	Easy	Medium	Medium	Medium	Hard
40	Max. Million Plus	10	10	10	10	10
41	Max. Quick Multiballs	3	3	3	3	3
42	Enter Cellar Lit	Always	Always	Always	Start On	No Mem
43	Cellar Spec./ Ex. Ball	2	2	2	2	2
44	Auto Adj Ex. Ball	50 - 60%	20 - 30%	20 - 30%	20 - 30%	20 - 30%
45	1st Ex. Ball At	8 Tolls	10 Tolls	12 Tolls	15 Tolls	20 Tolls
46	2nd Ex. Ball At	50 Tolls	50 Tolls	60 Tolls	70 Tolls	80 Tolls

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 Credit 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* Whirlwind **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 Credit 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 Credit 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. Whirlwind 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 Credit button to display the YES option in the lower display. Using AUTO-UP, press ADVANCE once. Whirlwind 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 Credit 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 Credit 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). Whirlwind 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 Credit 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, Whirlwind 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. Whirlwind 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. Whirlwind 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 Credit 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 Credit 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 game.

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.

GAME ADJUSTMENT PROCEDURE (Continued)

13 Highest Scores
The operator can specify (via the Credit 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.

14 Backup High Score 1
The operator can set the Backup High Score value in the upper display (for Player 1), using the Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 Credit 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 credit 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 11B 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 1/2 PRICE BUY IN

The operator can choose (via the Credit button) whether the player is allowed to 'buy-in' subsequent games at 1/2 price. The number of games offered at 1/2 price 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 for 1/2 price. NOTE: This requires that the left coin slot is always the smallest denomination of coin. When these conditions exist, the choices for Ad 31 are:

Yes - The player has 10 seconds to 'buy-in' the next game(s) at 1/2 the original cost.
No - The 'buy-in' feature is disabled.

32 WHEEL SPEED

The operator can specify (via the Credit button) the mode of spinning for the three Whirlwind Wheels. The choices are:

Off - (Conservative) The wheels NEVER spin.
Normal - The wheels spin slowly during Locks, they spin fast during both Multi-Ball Lit and Multi-Ball.
Fast - (Liberal) The wheels always spin fast.

33 TOP DROP TIMER

The operator can choose (via the Credit button) the Time Period for keeping the1-Bank Drop Target lamps lighted. In association with Ad 38, this Adjustment controls how difficult it is to get "Quick Multi-Ball" and to score the "Unlimited Million". The choices are:

NONE - (Very Liberal) The lamps are lighted, until the end of play for each ball.
1 - 99 seconds - The lamps remain lighted, until the specified Time Period elapses.

34 ENTER CELLAR TIMER

The operator can choose (via the Credit button) the Time Period for lighting of the ENTER THE CELLAR Lamp, when it is lighted by the Right Return Lane. This Adjustment controls how difficult it is to light each Super Cellar value, including Extra Ball and Special. The choices are:

NONE - (Very Liberal) The lamp is lighted, until the end of play for each ball.
1 - 99 seconds - The lamp remains lighted, until the specified Time Period elapses.

35 DOUBLE TOLLS TIMER

The operator can specify (via the Credit button) the Time Period for lighting of the +2 TOLLS WHEN LIT Lamp, when it is lighted by the Left Return Lane or the Right Ramp. This Adjustment controls how difficult it is to light the Extra Ball Lit lamp via the Right Ramp shot. NOTE: The 1st EXTRA BALL LIT Lamp can be automatically adjusted via Ad 44. The choices are:

NONE - (Very Liberal) The lamp is lighted, until the end of play for each ball.
1 - 99 seconds - The lamp remains lighted, until the specified Time Period elapses.

36 HIDE IN CELLAR

The operator can choose (via the Credit button) the Time Period for lighting of the HIDE IN THE CELLAR Lamp, when it is lighted by ending 3-ball Multi-Ball without awarding the "Million Plus" feature. This Adjustment controls the difficulty for restarting Multi-Ball play. The range of this setting is *1 - 99 seconds,* during which the lamp remains lighted.

GAME ADJUSTMENT PROCEDURE (Continued)

37 COMPASS DIFFICULTY

The operator can specify (via the Credit button) the difficulty for completing the Compass feature that lights Locks and Multi-Balls. This Adjustment controls how difficult it is to obtain 3-ball Multi-Ball play and the "Million Plus" feature. The choices are:

Easy - (Liberal) Fewer targets must be hit to reach1st and 2nd Locks and Multi-Ball.
Medium - To reach first Lock requires hitting four targets; second Lock requires hitting four more targets.
Hard - (Conservative) More targets must be hit to reach 1st and 2nd Locks and Multi-Ball.

38 LITE QUICK MULTI-BALL

The operator can specify (via the Credit button) the difficulty for lighting the QUICK MULTI-BALL LIT Lamp (on the 1-Bank drop Target) via Right Ramp shots. In association with Ad 33, this Adjustment controls how difficult it is to obtain the first Quick Multi-Ball play and the "Unlimited Million" feature. The range of settings is *1 - 5 shots,* completing the Right Ramp.

39 MULTI-BALL DIFFICULTY

The operator can choose (via the Credit button) the difficulty for obtaining 3-ball Multi-Ball play after all Locks are completed. Multi-Ball always begins by a Left Ramp shot; this allows an "Easy Multi-Ball shot via the Top Right Eject. This Adjustment controls how difficult it is to achieve 3-ball Multi-Ball play and the "Million Plus" feature. The choices are:

Easy - (Liberal) The "Easy Multi-Ball" shot (via the Top Right eject) is always available.
Medium - The "Easy Multi-Ball" shot is available only for the first Multi-Ball play.
Hard - (Conservative) The "Easy Multi-Ball" shot is NEVER available.

40 MAXIMUM "MILLION PLUS"

The operator can choose (via the Credit button) the maximum value for the "Million Plus" feature. The range of settings is *5 - 20 Million.*

41 MAXIMUM QUICK MULTI-BALLS

The operator can choose (via the Credit button) the maximum number of Quick Multi-Ball plays allowed per player. The range of settings is *0 - 99 Quick Multi-Ball plays.*

42 ENTER CELLAR LIT

The operator can specify (via the Credit button) the difficulty for lighting the ENTER CELLAR Lamps to score the "Super Cellar Door Bonus". The choices are:

NO MEM - (Very Conservative) The ENTER CELLAR lamp is always OFF, at the start of each ball.
MEM - The ENTER CELLAR lamp starts OFF. but if it is lighted by a Left Ramp shot and not collected, the lamp remains lighted for 'next ball' play.
START ON - Same as *MEM,* except the lamp is ON at game start.
ALWAYS - (Liberal) The ENTER CELLAR lamp is always ON, at the start of each ball.

43 CELLAR SPECIAL / EXTRA BALL

The operator can choose (via the Credit button) the difficulty for lighting the SPECIAL ON and the EXTRA BALL LIT ON lamps via the "Super Cellar Door Bonus" and the Mega Door Bonus features. The choices are:

00 - (Very Conservative) The SPECIAL ON and the EXTRA BALL LIT ON lamps cannot be lighted, via the "Super Cellar Door Bonus" feature.
1 - 99 - "Super Cellar Door Bonus" awards cannot exceed the specified number. Reaching this specified number disables the SPECIAL ON lamp and the EXTRA BALL LIT ON lamp portions of this feature.

GAME ADJUSTMENT PROCEDURE (Continued)

44 AUTO ADJ EXTRA BALL

The operator can choose (via the Credit button) the number of Extra Balls awarded per game, as determined by the percentage setting selected. When enabled (by a selected percentage), this adjustment affects the setting of Ad 45, which sets the number of Right Ramp 'tolls' required to light the Extra Ball Lit lamp. When enabled, the 'setting adjustment' of Ad 45 is either an increase or decrease of 1 'toll' once each week, when more than 100 games have been played, (or after each 500 games), whichever occurs first. The range of this adjustment setting is *1 - 11%* (Conservative) through *89 - 99%* (Extremely Liberal). This adjustment can also be turned off, via a setting of *0 (Off)*.

45 1st EX. BALL AT xx

The operator can choose (via the Credit button) the difficulty (required number of Right Ramp 'tolls') for lighting the EXTRA BALL LIT Lamp (near the 1-bank Drop Target) the first time. When Ad 44 is enabled, the operator can set the initial 'toll' number, after which the game program automatically adjusts the 'toll' number to achieve the percentage setting of Ad 44. When controlled by Ad 44, the value displayed is shown as "AUTO xx" to inform the operator what the 'toll' number is currently. The options are:

NONE - The EXTRA BALL LIT lamp
1 - 50 TOLLS - This is the number of Right Ramp 'tolls' required to light the EXTRA BALL LIT Lamp (near the 1-bank Drop Target) the first time.

46 2nd EX. BALL AT xx

The operator can choose (via the Credit button) the difficulty (required number of Right Ramp 'tolls') for lighting the EXTRA BALL LIT Lamp (near the 1-bank Drop Target) the second time. The options are:

NONE - The EXTRA BALL LIT lamp
50 - 99 TOLLS - This is the number of Right Ramp 'tolls' required to light the EXTRA BALL LIT Lamp (near the 1-bank Drop Target) the second time.

47 BLOWER SPEED

The operator can choose (via the Credit button) the speed of the Whirlwind blower on top of the Backbox. The choices are:

OFF - The blower NEVER operates.
ON - The Whirlwind blower operates.

48 NORMAL / DIM / DIMMEST FLASHERS

The operator can choose (viat the Credit button) the brightness of the game's flashlamps. A suggestion is to use either DIM or DIMMEST when the power supplied to the game is in the 'High Power' (over 120V ac for domestic (US and Canada) and over 230V ac for foreign games). The range of this setting is *NORMAL, DIM, DIMMEST.*

49 Custom Message

The operator can choose (via the Credit 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:

WHIRLWIND ... FEEL THE POWER ... OF THE WIND.

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:

49 Custom Message (Continued)

A. Press ADVANCE once. The operator can now enter as many as three 14-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 Credit 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.
Nbr - Only the numerical value is displayed.
No - NO display occurs.

51 GRAND H. S. T. D.

The operator can choose (via the Credit button) whether to use the "Grand Champion" feature. This feature is an <u>additional</u> High Score (NOT reset by the High Score Reset button or by Ad 22 H. S. Reset Every xxx Plays) identifying the all-time scoring leader. If this feature is enabled, via the ON setting, it can be disabled (turned off) via the OFF setting of this Adjustment. The choices are:

OFF - No "Grand Champion" entry is stored in memory.
ON - The "Grand Champion" entry is stored in memory. Each time a player exceeds the current score of the "Grand Champion" entry, a new "Grand Champion" entry replaces the previous entry.
RESET - This option clears ALL high score entries, including the "Grand Champion" entry, as soon as the ADVANCE button is pressed. After ADVANCE is pressed, the "Grand Champion" feature begins in the ON setting.

52 GRAND CREDITS

The operator can choose (via the Credit button) the number of credits to be awarded to the "Grand Champion", when this feature is ON. The range of this setting is *0 - 9 Credits,* awarded to the "Grand Champion" at the end of the game in which this High Score was achieved.

<u>53 - 58 Special Preset Adjustment Settings</u>

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.

GAME ADJUSTMENT PROCEDURE (Continued)

SPECIAL PRESET ADJUSTMENTS CAUTION (Continued)

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 Credit 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.

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 Whirlwind **Preset Game Adjustments Table for German/European Games.**

Whirlwind

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	6.000.000	6.000.000	00	6.000.000	6.000.000	00
15	Backup High Score 2	5.500.000	5.500.000	00	5.500.000	5.500.000	00
16	Backup High Score 3	5.000.000	5.000.000	00	5.000.000	5.000.000	00
17	Backup High Score 4	4.500.000	4.500.000	00	4.500.000	4.500.000	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
52	Grand Credits	3	3	0	3	3	0

53 through 58 *For French Games Only:* Install French 1, 2, 3, 4, or 5.
The operator can use these Adjustment Items to modify the style of play for the particular setting shown in the Whirlwind **Preset Adjustments Table for French Games.**

GAME ADJUSTMENT PROCEDURE (Continued)

53 through 57 *For French Games Only:* Install French 1, 2, 3, 4, or 5. (Continued)

Whirlwind

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
44	Auto Adj Extra Ball	28-38%	20-30%	70-80%	28-38%	28-38%	N/A
60	Install 5 Ball	N/A	N/A	N/A	N/A	N/A	Yes

53 ADVERTISEMENT? *(For USA / Canadian Games only)*
The operator can choose (via the Credit button) whether to display an advertisement provided by the manufacturer. The choices are:

Yes - Display the advertisement message.
No - Do NOT display the message.

54 through 58 *(For USA / Canadian Games only)*
The operator can use these Adjustment Items to modify the game pricing selection and select either the 3-ball or 5-ball style of play.

Whirlwind

Preset Game Adjustments Table for US / Canadian Games

Adj #	Adj Description	1 Coin Buy-in Ad 54	Install 3 Ball Ad 55	3 Balls/ 2 Coins Ad 56	3 Balls/ 1 Coin Ad 57	5 Balls/ 2 Coins Ad 58
02	Replay Start	-	4,600,000	4,600,000	4,600,000	8,000,000
09	Balls / Game	-	3	3	3	5
14	Backup High Score 1	-	6,000,000	6,000,000	6,000,000	9,000,000
15	Backup High Score 2	-	5,500,000	5,500,000	5,500,000	8,500,000
16	Backup High Score 3	-	5,000,000	5,000,000	5,000,000	8,000,000
17	Backup High Score 4	-	4,500,000	4,500,000	4,500,000	7,500,000
24	Coinage Setting	USA 3	-	USA 3	USA 1	USA 3
51	1 Coin Buyin	Active	Cancelled	Cancelled	Cancelled	Cancelled
64	Install Medium	No	Yes	Yes	Yes	No
65	Install Hard	No	No	No	No	Yes

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
06	Replay Award	Ball
07	Special Award	Ball
08	Match Feature	Off
11	Max. Ex. Ball	6

Ad	Name	New Setting
18	Hi Scr 1 Credits	00
19	Hi Scr 2 Credits	00
20	Hi Scr 3 Credits	00
21	Hi Scr 4 Credits	00
52	Grand Credits	00

GAME ADJUSTMENT PROCEDURE (Continued)

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	10,000,000	16	B'up Hi Score 3	8,000,000
09	Balls / Game	05	17	B'up Hi Score 4	7,500,000
14	B'up Hi Score 1	9,000,000	31	Half Price Buyin	No
15	B'up Hi Score 2	8,500,000	65	Install Hard	Yes

61 Install Novelty

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

Ad	Name	New Setting	Ad	Name	New Setting
01	Fixed Replay	SCORES	08	Match Feature	Off
02	Replay Level 1	Off	11	No Extra Ball	00
03	Replay Level 2	Off	18	Hi Scr 1 Credits	00
04	Replay Level 3	Off	19	Hi Scr 2 Credits	00
05	Replay Level 4	Off	20	Hi Scr 3 Credits	00
06	Replay Award	Audit	21	Hi Scr 4 Credits	00
07	Special Award	Score	52	Grand Credits	00

62 Install Extra Easy

The operator can change the game play difficulty adjustments to a combination that is extremely easy (sometimes called "liberal"). 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 slightly easier 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 matches 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.

65 Install Hard

The operator can change the game play difficulty adjustments to a combination that is 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.

GAME ADJUSTMENT PROCEDURE (Continued)

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 Clear Coins

The operator can request the clearing of the coinage audits (Au 01 through 04) by selecting (via the Credit 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.

69 Clear Audits

The operator can request the clearing of the non-coinage audits (Au 05 through 55) by selecting (via the Credit 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 Percentaging 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 Install Factory

The operator can request the game (via the Credit 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. This Adjustment 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 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.

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 Whirlwind, 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.)

Whirlwind Pricing Table

Country	Coin Chute Left	Center	Right	Games/Coin	*Ad 24 Display*	Pricing Functions 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
	5 Sch	-	10 Sch	2/5 Sch, 5/10 Schilling	CUSTOM	02	00	05	01	00	00
	1 Sch	5 Sch	10 Sch	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
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

GAME PRICING (Continued)

Whirlwind Pricing Table (Continued)

Country	Coin Chute Left	Center	Right	Games/Coin	Ad 24 Display	Pricing Functions 25	26	27	28	29	30
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 Florin [2]	NETHERL.	06	15	15	05	00	00
	25¢	-	1 G	1/25¢, 5/1 Guilder	CUSTOM	01	00	05	01	00	00
	1G	-	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-11B 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 Whirlwind include "Adjust Switch ##", "Pinball Missing", and Music Error". 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 - 'Main Theme' through 05 - 'Speech' (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 displays 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 "HOT SCORE", the name of the lamp currently blinking. Press the Credit 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 Credit button to proceed rapidly to the desired lamp.

WHIRLWIND 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-BRN 1 1J6-1	Middle Standup 1	Left Outlane 9	S Arrow 17	Toll 1 25	Btm Jets Left 33	R Ramp Lock 41	L Return Lane 49	Shoot Again 57
Q81 RED-BLK 2 1J6-2	Up Jets On (Backglass) 2	Right Outlane 10	SW Arrow 18	Toll 2 26	Btm Jets Top 34	R Ramp Double 42	Left Loop 50	2X 58
Q82 RED-ORN 3 1J6-3	250K (Backglass) 3	Top Drop 50K 11	W Arrow 19	Toll 3 27	Btm Jets Right 35	L Ramp Million Plus 43	Left Standup 51	3X 59
Q83 RED-YEL 4 1J6-5	Ex. Ball On (Backglass) 4	Top Drop 75K 12	NW Arrow 20	Toll 4 28	Top Jets Left 36	L Ramp Million 44	Inner Loop Arrow 52	4X 60
Q84 RED-GRN 5 1J6-6	3-Bank 100K (Backglass) 5	Top Drop 100K 13	N Arrow 21	Toll 5 29	Top Jets Right 37	L Ramp Release 45	L Return Lane 53	5X 61
Q85 RED-BLU 6 1J6-7	500K (Backglass) 6	Top Drop 150K 14	NE Arrow 22	Toll 30 30	Top Jets Btm 38	Skill Shot Right 46	R Ramp R Stndup 54	6X Lites Ex. Ball 62
Q86 RED-VIO 7 1J6-8	Lite Million (Backglass) 7	Top Drop Quick 15	E Arrow 23	Toll 20 31	L Cellar Arrow 39	Skill Shot Mid 47	Right Loop 55	6X Lites Special 63
Q87 RED-GRY 8 1J6-9	Low Jets On (Backglass) 8	Top Drop Ex. Ball 16	SE Arrow 24	Toll 10 32	R Cellar Arrow 40	Skill Shot Left 48	Right Standup 56	Right Spinner 64

TEST/DIAGNOSTIC PROCEDURES (Continued)

SOLENOID TEST.

1. (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.

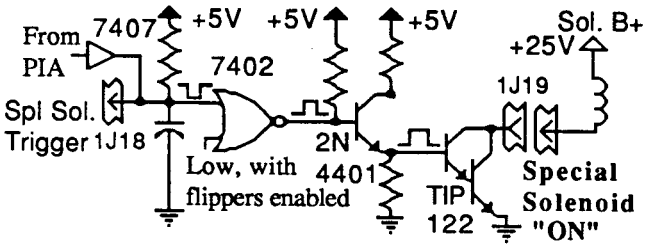
Whirlwind Solenoid Table

Sol. No.	Function	Solenoid Type	Wire Color [1]	Connections CPU Bd	Connections Playfield/ Cabinet	Driver Trnstr	Solenoid Part Number Flashlamp Type g= B'glass; p=Pl'field; bp=Bk Panel
01A[3]	Outhole Kicker	Switched	Vio-Brn	1P11-1	5J1-9: 5J4-9 (A)	Q33	AE-23-800
01C[3]	Bottom Right Flasher	Switched	Blk-Brn	(Gry-Brn)	5J5-9 (C)	Q33	#906 flashlamp 1p
02A[3]	Shooter Lane Feeder	Switched	Vio-Red	1P11-3	5J1-7: 5J4-8 (A)	Q25	AE-23-800
02C[3]	Spinner Flasher	Switched	Blk-Red	(Gry-Red)	5J5-8 (C)	Q25	#906 flashlamp 1p
03A[3]	Right Ramp Lifter	Switched	Vio-Orn	1P11-4	5J1-6: 5J4-7 (A)	Q32	AE-24-900
03C[3]	R Ramp Top/Upr Jets Flashers	Switched	Blk-Orn	(Gry-Orn)	5J5-7(C)	Q32	#906 flashlamps 2p
04A[3]	Left Locking Kickback	Switched	Vio- Yel	1P11-5	5J1-5: 5J4-6 (A)	Q24	AE-23-800
04C[3]	R Ramp Upr Mdl/Million Flashers	Switched	Blk-Yel	(Gry-Yel)	5J5-5 (C)	Q24	#906 flashlamps 2p
05A[3]	Top Eject	Switched	Vio-Grn	1P11-6	5J1-4: 5J4-5 (A)	Q31	AE-23-800
05C[3]	Ramp Lwr Mdl/Lwr Jets Flashers	Switched	Blk-Grn	(Gry-Grn)	5J5-4 (C)	Q31	#906 flashlamps 2p
06A[3]	Knocker (in B'box)	Switched	Vio-Blu	1P11-7	5J1-3: 5J4-4 (A)	Q23	AE-23-800
06C[3]	R Ramp Bottom Flasher	Switched	Blk-Blu	(Gry-Blu)	5J5-3 (C)	Q23	#906 flashlamp 1p
07A[3]	3-Bank Drop Target Reset	Switched	Vio-Blk	1P11-8	5J1-2: 5J4-2 (A)	Q30	AE-26-1200
07C[3]	3- Dr Tgt/ M Target Flashers	Switched	Blk-Vio	(Gry-Vio)	5J5-2 (C)	Q30	#906 flashlamps 2p
08A[3]	1-Bank Drop Target Reset	Switched	Vio-Gry	1P11-9	5J1-1: 5J4-1 (A)	Q22	AE-23-800
08C[3]	Mil +/Compass Flashers	Switched	Blk-Gry	(Gry-Blk)	5J5-1 (C)	Q22	#906 flashlamps 2p
09	Left Lower Jet Bumper	Controlled	Brn-Blk	1P12-1	5J2-9: 5J6-9: 2J4-3	Q17	AE-23-800
10	Top Lower Jet Bumper	Controlled	Brn-Red	1P12-2	5J2-8: 5J6-8: 2J4-5	Q9	AE-23-800
11	Upper Playfield G I 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	Diverter	Controlled	Brn-Grn	1P12-6	5J2-4: 5J6-5	Q15	AE-26-1200
14	Under P'fld Kickbig	Controlled	Brn-Blu	1P12-7	5J2-3: 5J6-3	Q7	AE-26-1500
15	Right Lower Jet Bumper	Controlled	Brn-Vio	1P12-8	5J2-2: 5J6-2	Q14	AE-23-800
16	Lwr Playfield / B'box G I Relay	Controlled	Brn-Gry	1P12-9	5J2-1: 5J6-1	Q6	5580-12145-00 (p) [4b] / (B'box) 5580-09555-01 [4a]
17	Left Upper Jet Bumper	Special #1	Blu-Brn	1P19-7	5J3-7: 5J7-7	Q75	AE-23-800
18	Left Kicker ("sling")	Special #2	Blu-Red	1P19-4	5J3-6: 5J7-6	Q71	AE-26-1500
19	Right Upper Jet Bumper	Special #3	Blu-Orn	1P19-3	5J3-3: 5J7-3	Q73	AE-23-800
20	Right Kicker ("sling")	Special #4	Blu-Yel	1P19-6	5J3-4: 5J7-5	Q69	AE-26-1500
21	Top Lower Jet Bumper	Special #5	Blu-Grn	1P19-8	5J3-2:5J7-2	Q77	AE-23-800
22	Right Ramp Down	Special #6	Blu-Blk	1P19-9	5J3-1: 5J7-1	Q79	SM-26-600-DC
23	BP Lightning (L) Flashers	Snd O/L 1	Gry-Brn	1P21	SOL J2:SOL J4-6	Q1 [6]	#906 flashlamps 3bp
24	Blower Motor (atop B'box)	Snd O/L 2	Gry-Red	(Ribbon	SOL J2:SOL J4-5	Q4 [6]	14-7956 via Triac Bd
25	BP Thunder (M) Flasher	Snd O/L 3	Gry-Org	Cable	SOL J2:SOL J4-4	Q7 [6]	#906 flashlamps 1bp
26	BP Thunder (R) Flashers	Snd O/L 4	Gry-Org	to SOL	SOL J2:SOL J4-2	Q10[6]	#906 flashlamps 2bp
27	Spin Wheels Motor	Snd O/L 5	Gry-Org	Bd)	SOL J2:SOL J4-1	Q13[6]	14-7955
-	Right Flippers	-	Orn-Vio	1P19-1	2J5-5: 2J10-7	-	
	Lower Right Flipper		[Blu-Vio] [2]		[2J10-1: 2J8-15]		FL11630/50VDC
	Upper Right Flipper		[Blk-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

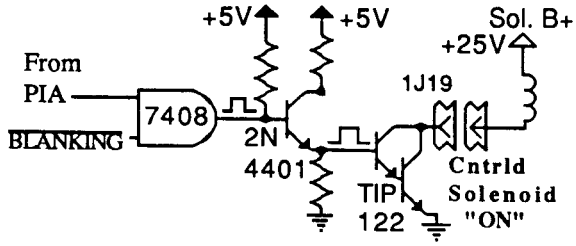
Notes: 1. Wire colors, except flipper Orn-Vio and Orn-Gry, are ground connections (to coil terminal with unbanded end of diode). Flipper Orn-Vio and Orn-Gry wires connect from CPU Board to flipper switch. 2. Flipper connections shown in braces are from flipper switch to flipper coil. 3. "A" circuits 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) 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 Bottom Right Flasher circuit (sol. 01C), which has two lamp circuits, one to the Insert Board and one to the playfield. Using this "multiplexing" technique, the same driver transistor can control actuation of two separate (A side and C side) solenoid circuits.

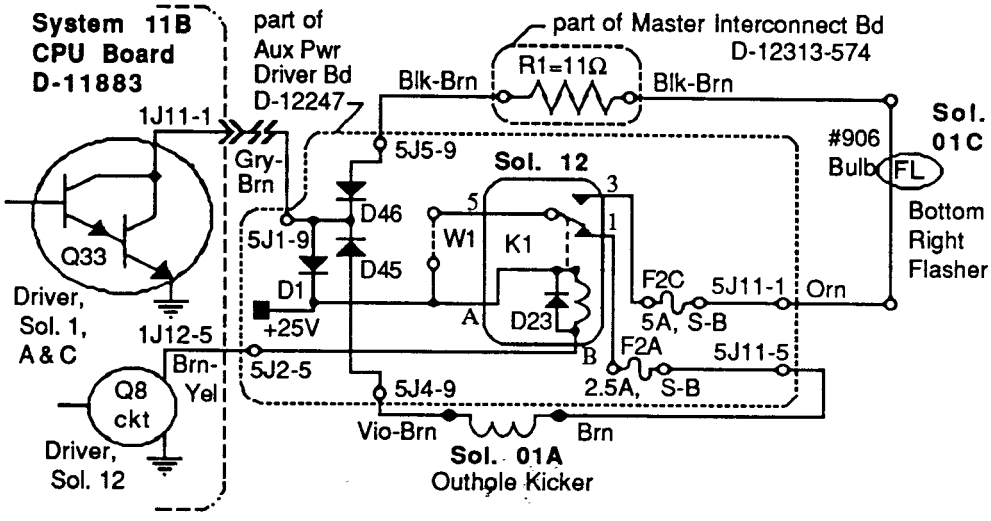


Figure 4. Typical Solenoid A/C Select Relay Circuit, showing the function of Solenoid 12, the Solenoid A/C Select Relay.

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 Whirlwind System-11B'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 Whirlwind, 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.

WHIRLWIND 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	9	Left Outlane 17	Right Standup 25	Enter Left Ramp 33	Spinner 41	Top Jets (left) 49	Flipper Right 57
2 WHT-RED 1J10-8	C Side Power A/C Relay 2	Outhole 10	Left Return Lane 18	Top Sngl DropTarget 26	L Ramp Score (top) 34	Right Ramp Down 42	Top Jets (right) 50	Flipper Left 58
3 WHT-ORN 1J10-7	Game Start 3	Ball Trough #1 (left) 11	Right Cellar 19	M 3-Bank Dr Tgt (lwr) 27	L Ramp Score (bot) 35	TR Eject 43	Top Jets (bot) 51	Shooter Lane 59
4 WHT-YEL 1J10-6	Right Coin Chute 4	Ball Trough #2 (mid) 12	Left Cellar 20	M 3-Bank Dr Tgt (mid) 28	Left Loop (top) 36	R Ramp Score (top) 44	Btm Jets (left) 52	Left 110 Point 60
5 WHT-GRN 1J10-5	Center Coin Chute 5	Ball Trough #3 (right) 13	Left Standup 21	M 3-Bank Dr Tgt (top) 29	Left Loop (bot) 37	R Ramp Score (bot) 45	Btm Jets (right) 53	Right 110 Point 61
6 WHT-BLU 1J10-3	Left Coin Chute 6	14	Left Lock 1 (lwr) 22	Middle Standup 30	Right Loop (top) 38	46	Btm Jets (top) 54	62
7 WHT-VIO 1J10-2	Slam Tilt 7	Right Return Lane 15	Left Lock 2 (mid) 23	31	Right Loop (bot) 39	L Standup (R Ramp) 47	BL Kicker ("sling") 55	63
8 WHT-GRY 1J10-1	High Score Reset 8	Right Outlane 16	Left Lock 3 (top) 24	32	Inner Loop 40	R Standup (R Ramp) 48	BR Kicker ("sling") 56	64

BL = Bottom Left BR = Bottom Right TR = Top 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-11B 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 Whirlwind 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.

C-SIDE TEST

From the Switch Test, press ADVANCE. Observe that the upper display shows a message, C-SIDE TEST, and that the lower display shows 08 (C-Side Test identifier). This test confirms that Solenoid A/C Select Relay (Sol. 12) does alternate between the "A" and "C" sides of the circuitry.

The upper display then changes to show the 'side' of the circuit being tested, alternating the relay between "SELECTED A-SIDE" and "SELECTED C-SIDE", while the lower display shows the state of the C-Side Switch. While the "SELECTED C-SIDE" test is occurring, when the C-Side Switch closes, the lower display shows "C-SIDE". When the "SELECTED A-SIDE" message appears, the word "Err" appears in the lower display to indicate that there is no electrical connnection from the C-side to the A-side. The message "Err" also appears whenever the C-Side Switch is not operating properly. Causes of improper operation can be blown fuses (F8 or F2C) or a faulty relay on the Aux Power Driver Board; failure of the 12 or 24 volt power circuits; a switch matrix failure; or faulty connections between the circuit boards in the game's backbox (CPU Board, Aux Power Driver Board, Backbox Interconnect Board). To halt the A/C Relay's operation, press MANUAL-DOWN and press ADVANCE to activate the A/C Relay manually.

ENDING THE DIAGNOSTIC TESTS.

To end the Diagnostic Tests, reach the Car Test (09 in the Player 3 display), use AUTO-UP and press ADVANCE. The backbox displays should show the Whirlwind game's Identification Information (the **Id 00** 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.

TEST/DIAGNOSTIC PROCEDURES (Continued)

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. Whirlwind 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.)

SYSTEM-11B MEMORY CHIP TEST.

A new feature is now included in the Memory Chip Test for System 11B. 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	**Display Message**	**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 connectingdevices 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-11B SOUND CIRCUITRY TESTS.

Tests of the System-11B Sound circuitry, including the Audio Board, are possible only after successful completion of the System-11B Memory Chip Test.

1. **Audio Board Test.** A brief check of the Audio Board (D-11581) circuitry occurs at game Turn-on; the game 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.

2. **General System-11B Sound Test.** Press the Sound Diagnostic Switch (SW 1) on left edge of the CPU Board. Listen for the two test sounds, showing that both the CVSD (Continuously Variable Slope Delta) Modulator, which provides the voices for Whirlwind, and the DAC (Digital-to-Analog Converter) sound circuits are functioning properly.

   If no sound is heard, refer to the text entitled "*NO SOUND ...*". If one "ring" is heard, this indicates a malfunction of the U23 RAM Chip. If either two or four "rings" is heard, this indicates a problem associated with the U21 ROM Chip. If either three or five "rings" is heard, this indicates a problem with the U22 ROM Chip.

***NO SOUND** DURING THIS TEST* (but sound can be heard during the Diagnostic Tests).
Check the sound-select inputs (pins 2 through 9 of U9) to see if they pulse during Sound Test 01. Also, check the -12 V supply voltage on the CPU Board. If this 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 VAC.
2. The CPU Board filter capacitor C26 for -12 VDC.
3. The filter capacitor C26 for excessive AC ripple (over 0.75VAC).

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 11B 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 Whirlwind game.

TEST/DIAGNOSTIC PROCEDURES (Continued)

PROBLEM ANALYSIS MESSAGES. (Continued)

Adjust 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 "Adjust 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 Whirlwind 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. Whirlwind 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 Ball Shooter switch (#14).

Music Error. This message means that no signals are coming from the Audio Board. Check the Audio Board for presence of Whirlwind ROMs. Also, check that all cables connecting the Audio Board, the "Sound Overlay Solenoid" Board, and the CPU Board are firmly seated. Turn the game Off, then On, to be sure only 1 'bing' sounds. *More than one* 'bing' or *NO* 'bing' indicates an Audio Board problem. Refer to the text about the System 11-B Sound Circuitry tests for more information.

R. Ramp UP Error / R. Ramp DOWN Error. Display of either message means that the Right Ramp did not reach its proper position. To check for 'Ramp Up' operation, switch the game Off, and then On. To check for 'Ramp Down' operation, start a game (NOTE: Operation of the Top Right Eject Hole switch delays lowering the ramp.). Ramp problem causes can include: 1) A mechanical problem preventing Ramp movement, possibly a ball stuck under the ramp, playfield plastics interfering with ramp movement, etc.; 2) The Ramp Down switch is not operating properly; 3) The fuse for the Right Ramp Up solenoid is blown or the solenoid wiring is "open" electrically (preventing solenoid operation).

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

Momentary Short. This message indicates that the game program detected a short circuit (to ground) affecting one or more of the switches listed in the switch matrix. To erase the message, analyze the reason for the switch being reported by performing the Switch Tests portion of the Test/ Diagnostic Procedures. Frequent appearance of this message requires activation of the Switch Levels Test to locate the switch causing the "WHT-xxx ROW x SHORT" message. Possible 'row short' causes are: 1) Slam Tilt (or other coin door) switch touching the grounded coin door; 2) A *leaf-type,* playfield switch touching a grounded part; 3) Players poking metallic objects (wires, coat hangers, etc.) into the game; 4) Switch cable insulation pierced or damaged allowing bare wire contact with a grounded part; 5) A 3-bank Drop Target Opto PC Board (p/n C12559 *WITHOUT diodes)* which is not connected to ground; 6) All switches in a row closing at the same time (Note: This instance is NOT a switch problem; however, for most games this is a very rare possibility).

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 Eject Hole mechanism are the pivots for the Eject Arm. Note that the mechanism of the Cellar Kickbig Arm Assembly is somewhat similar to the Eject Hole Device; it has the same lubrication requirements as the Eject Hole Device. A medium viscosity oil (20W or 30W) is very satisfactory for these devices.

Because of the functional design (arm-actuated via solenoid plunger operation), the pivot points of the Left and Right Kickers ("Slingshots") all require lubrication as a regular servicing procedure. Mechanical adjustments are simple and somewhat similar to the Eject Hole mechanism. These mechanisms should also be checked for proper fit (snugly tight) where they attach to the playfield.

Lubrication to ensure proper operation also applies to the target blades of the 3-Bank and 1-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.

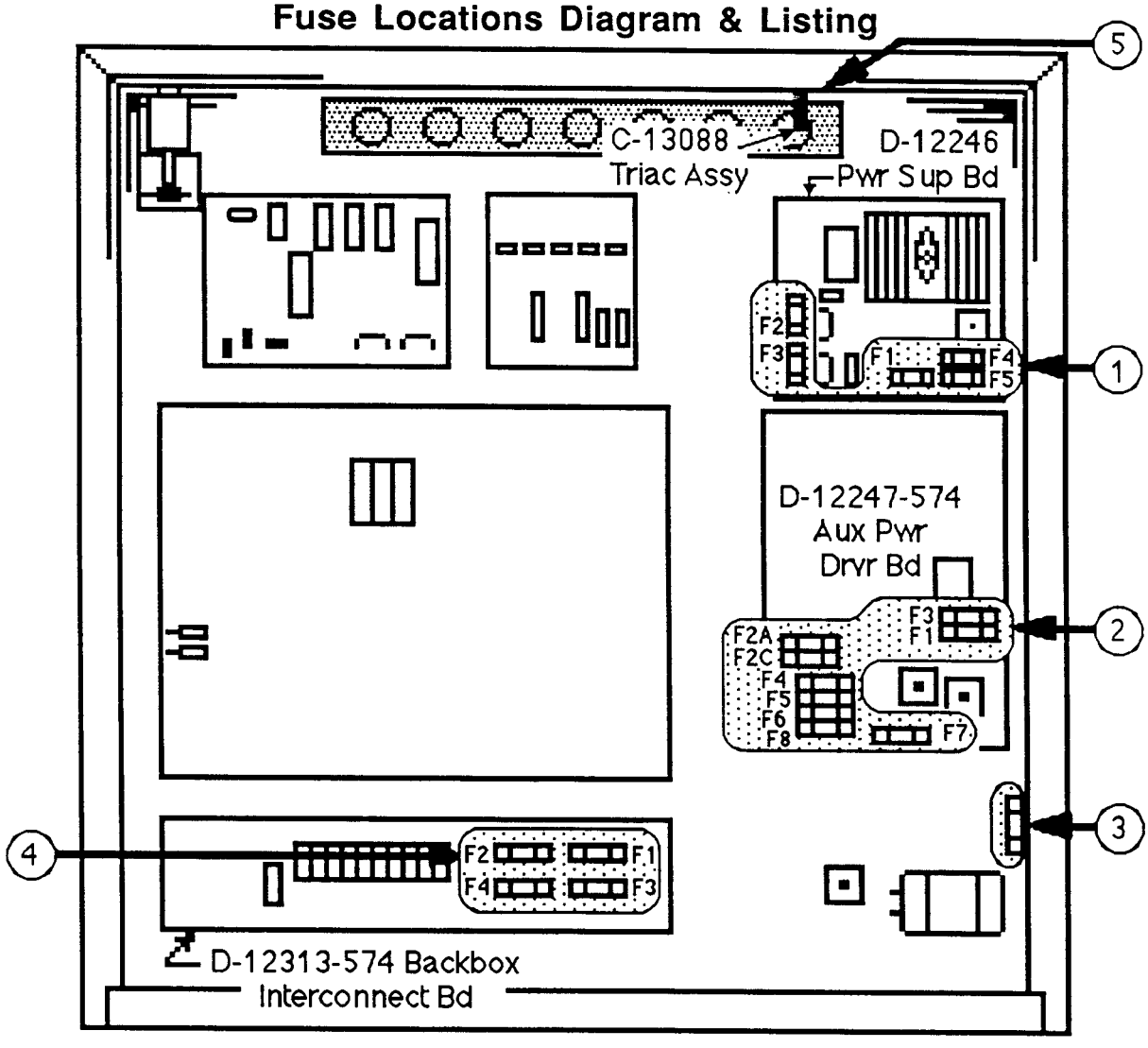
Flipper button switches and the End of Stroke (EOS) switch on the flipper tend to suffer from pitting caused by the high current in this circuit. Weak or "slow" flipper action is the result of this pitting. Carefully restore the surface of the flipper switch contact with a very fine contact file; finish the surface restoration with a contact burnishing tool. This should bring the flipper action back to its usual 'snappy' action.

CLEANING

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

Regular, more extensive, playfield cleaning is recommended. However, avoid excessive use of water and caustic or abrasive cleaners because they tend to damage the playfield surface. Playfield wax or 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 Locations Diagram & Listing



Fuse 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*

Section 2
Game Parts Information

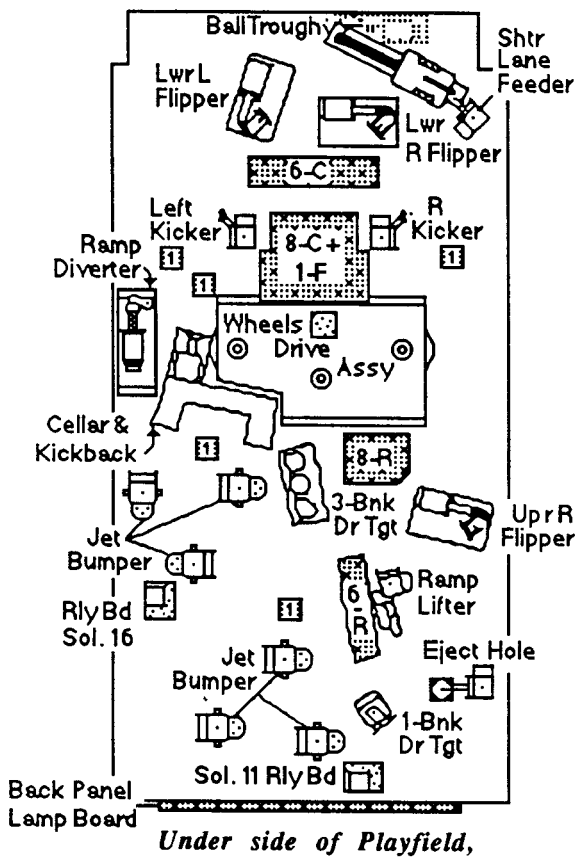
- ***Parts Lists & Diagrams***

  Locations:
  Game Circuit Boards and Major Mechanisms

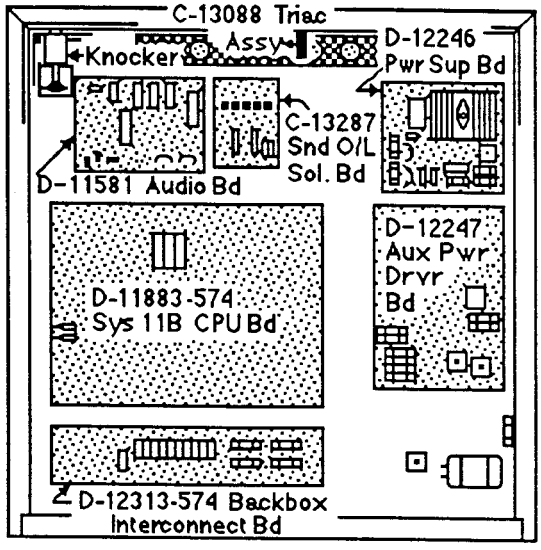
  Power Supply Board (D-12246)
  Aux Power Driver Board (D-12247-574)
  Backbox Interconnect Board (D-12313-574)
  Audio Board (D-111581-574)
  System 11-B CPU Board (D-11883-574)
  Master Display Board (D-12232-1)
  7-Segment Display & Lamp Boards

  All Major Mechanism Assemblies of Whirlwind

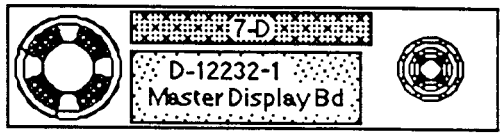
  Solenoids/Flashers & Rubber Parts
  Switches
  Lamps
  Playfield Parts



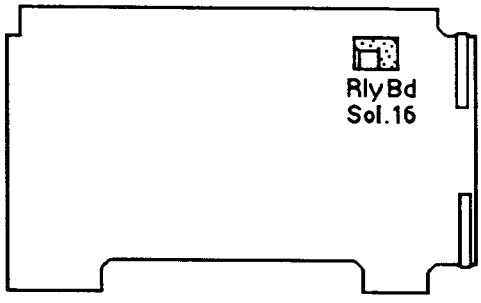
Under side of Playfield, Viewed in Raised Position



Backbox



Display/Speaker Panel, Rear View



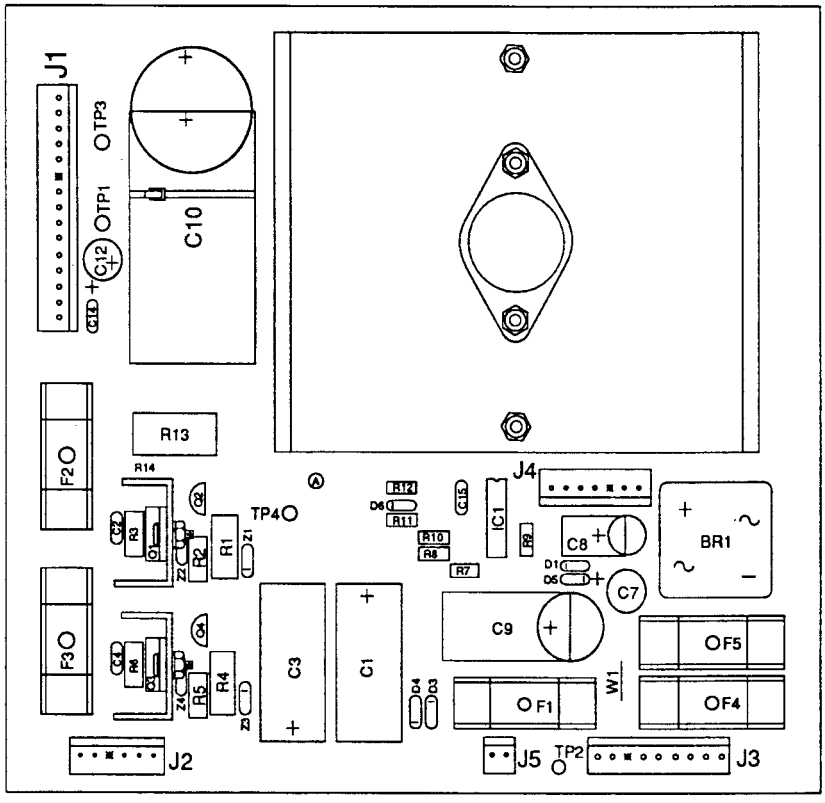
Insert Board, Inner Side View

LOCATIONS

- **Circuit Boards**
- **Lamp Boards**
- **Major Mechanisms**

Locations Diagram - Game Circuit Boards and Major Mechanisms

B-8039-2	Outhole Kicker
C-11626-L-3	Lower Left Flipper
C-11626-R-3	Lower & Upper Right Flipper
C-9638-3	Shooter Lane Feeder
B-9362-R-1	Coil & Bracket Assembly
C-13281	Lamp Board ("6-C")
B-12665	Left & Right Kicker Arm Assembly
B-11203-R-1	Coil & Bracket Assembly
C-13284-1	Lamp Board ("8-C + 1-F")
B-12224	Lamp Board ("1")
B-13276	Ramp Diverter Actuator
D-13199	Wheels Drive Assembly
C-13094-1	Motor EMI Filter Assembly
B-13225	Cellar Kickback
C-13282	Lamp Board ("8-R")
C-11223-1	3-Bank Drop Target
C-13205-1	3-Bank Opto Board
B-9414-2 &-3	Jet Bumper (6 total)
B-9415-1	Bumper Coil & Bracket Assembly (6)
C-13283	Lamp Board ("6-R")
C-11902-1	Relay Board (Sol. 16 Gen. Illum)
B-11304	Ramp Lifter Assembly
B-9361-R	TR Eject Hole Arm Assy
B-9362-L-1	Coil & Bracket Assembly
C-13312-1	1-Bank Drop Target
C-13311-R	1-Bank Opto Board
C-11902-1	Relay Board (Sol. 11 Gen. Illum)
D-13356	Back Panel Lamp Board
B-10686-1	Knocker Assembly
C-13088	Triac Assembly
D-11581-574	Audio Board
C-13287	Sound O/L Solenoid Board
D-12246	Power Supply Board
D-11883-574	System 11B CPU Board
D-12247-574	Aux Power Driver Board
D-12313-574	Backbox Interconnect Board
D-12501	Speaker Panel Lamp Board
D-12232-1	Master Display Board
C-11998-1	Relay Board (Sol. 16 Gen. Illum)

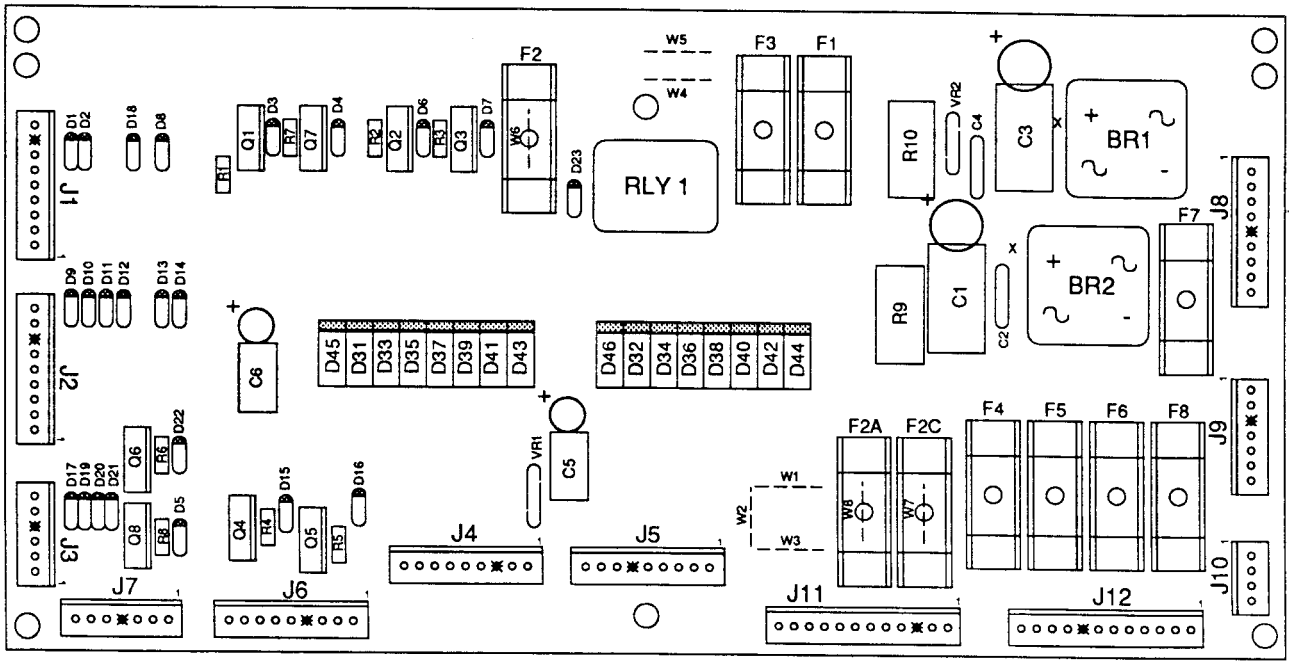


Power Supply
p/n D-12246

Item	Part Number	Ckt Symbol	Description
1	5765-12317-00		Power Supply PCB
2	5733-12060-01	F1-F5	Fuse Holder
3	5731-09432-00	F4, F5	Fuse, 7A., S-B, 250v
4	5731-12328-00	F1	Fuse, 3/8A., S-B, 250v
5	5730-12327-00	F2, F3	Fuse 1/8 A., 250v
6	5791-10862-15	J1	Connector, 15-pin Hdr, Sq
7	5791-10862-06	J2	Connector, 6-pin Hdr, Sq
8	5791-10862-09	J3	Connector, 9-pin Hdr, Sq
9	5100-09690-00	BR1	Bridge Rectifier, 35A., 200V
10	5164-12154-00	Q1	Transistor, MJE15030, NPN
11	5194-12155-00	Q3	Transistor, MJE15031, PNP
12	5194-09055-00	Q2	Transistor, MPSD52, PNP
13	5164-09056-00	Q4	Transistor, MPSD02, NPN
14	5162-09425-00	Q5	Transistor, 2N6057, NPN
15	5701-09652-00		Thermal Pad T0-3
16	4006-01003-06		Mach. Screw, 6-32 x 3/8
17	4006-01003-08		Mach. Screw, 6-32 x 1/2
18	20-9229		Thermal Compound
19	4406-01117-00		Nut, 6-32 Hex.
20	5010-09534-00	W1	Resistor,0Ω
21	4703-00007-00		Lockwasher, #6 Ext
22	5705-12330-00		Heatsink 4"
23	5705-09199-00		Heatsink 6030B
24	5070-09054-00	D1, D3 - D6	Diode, 1N4004
25	5075-09059-00	ZR1, ZR3	Zener, 1N5990, 3.9v, 1/2w
26	5075-09060-00	ZR2, ZR4	Zener, 1N4764, 100v, 1w
27	5460-09424-00	IC1	IC, Volt. Reg., MC1723C5
28	5010-09069-00	R3, R6	Resistor, 330K, 5%, 1/2w, c f
29	5010-10631-00	R2, R5	Resistor, 1.2K, 5%, 1/2w, c f
30	5010-09536-00	R1, R4	Resistor, 39K, 5%,1w
31	5013-09426-00	R7	Resistor, 2.15K, 1%, 1/4w, c f
32	5013-09427-00	R8	Resistor, 4.99K, 1%, 1/4w, c f
33	5010-09541-00	R9	Resistor, 2.7K, 2%,1/4w, c f
34	5010-09085-00	R10	Resistor, 1.5K, 5%,1/4w, c f
35	5010-09428-00	R11	Resistor, 1.5K, 2%, 1/4w, c f
36	5010-09508-00	R12	Resistor, 270Ω, 2%, 1/4w, c f
37	5012-09429-00	R13	Resistor, 0.12Ω, 5%,5w
38	5040-12324-00	C1, C3	Capacitor, 150 mfd, 160v, rad
39	5043-09072-00	C2, C4	Capacitor, 0.1 mfd, 500v, disc
40	5040-09421-00	C7	Capacitor, 100 mfd, 25v, radial
41	5040-09422-00	C8	Capacitor, 47 mfd, 50v, radial
42	5040-09420-00 5040-08893-00	C9	Capacitor, 1000 mfd, electr, 25v, axial or radial
43	5040-09419-00	C10	Capacitor, 18,000 mfd, electr, 20v, axial
44	5040-09423-00	C12	Capacitor, 330 mfd, electr, 10v, radial
45	5043-09446-00	C14	Capacitor, 0.1 mfd, 50v, disc
46	5043-09065-00	C15	Capacitor, 470 pfd
47	5824-09248-00	TP1-TP4	Terminal, #1502-1 (Test Post)
48	03-7947		Tie Wrap, 8 in. long

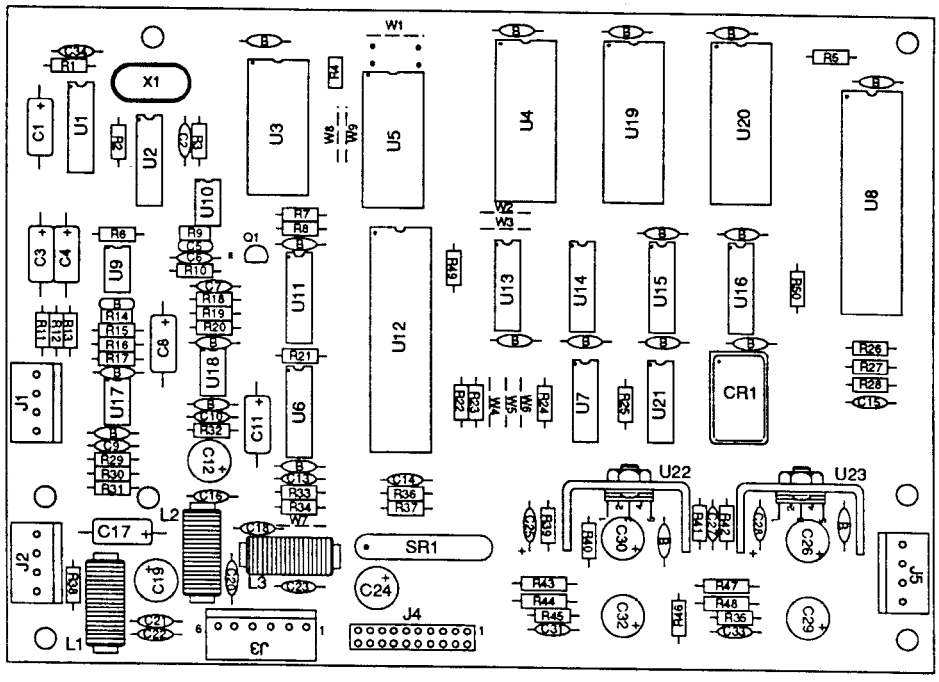
Notes: 1. Heat sink compound must be applied between transistor and heat sink.
2. Observe index mark on integrated circuit, polarity of capacitors and diodes, and position of transistors.
3. The view of Q5 and its related heat sink and hardware is from the bottom of the heatsink, to clarify installation.

Aux Power Board



Aux Power Driver Unit Board
D-12247-574

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, F4	Fuse, 2-1/2A, S-B, 250v
5731-09651-00	F1, F2C	Fuse, 5A, S-B, 250v
5731-06314-00	F7	Fuse, 4A, S-B, 250v
5731-09432-00	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
16-8850-279		PCB Label



Audio Board Assembly
p/n D-11581-574

Part Number	Ckt Designator	Description
5766-12130-00		Bare PC Board
5371-11087-00	U1	IC, D/A Conv, YM3012
a) 5700-09006-00		Socket, IC, 16-pin (U1)
5370-11086-00	U3	IC, Sound Processor, YM2151
a) 5700-09004-00		Socket, IC, 24-pin (U3)
5400-10320-00	U8	IC, µProcessor, MC68B09E
a) 5700-08985-00		Socket, IC, 40-pin (U8)
A-5343-574-5	U4	IC, Audio ROM 1
A-5343-574-6	U19	IC, Audio ROM 2
A-5343-574-7	U20	IC, Audio ROM 3
a) 5700-10176-00		Socket, IC, 28-pin (U4, U19, U20)
5371-09152-00	U11	IC, D/A Convtr, MC1408
5430-10322-00	U12	IC, PIA, MC68B21
5340-10139-00	U5	IC, RAM/S 5516-2 2Kx8
5281-09487-00	U7, U16	IC, Dual D Flipflop, 74LS74
5281-10043-00	U13	IC, 74LS175
5281-09235-00	U21	IC,Triple NAND, 74LS10
5370-09321-00	U9, U10, U17,U18	IC, Op Amp, MC1458
5281-09215-00	U2	IC, Hex Inv, 74LS04
5281-09246-00	U14	IC, 2-4 Dec, 74LS139
5281-09745-00	U15	IC, Dual Mux, 74LS138
5370-09156-00	U22, U23	IC, Audio Amp, TDA2002
a) 5705-09199-00		Heatsink, #6030B
b) 4006-01003-06		Mach. Screw, 6-32 x 3/8
c) 4406-01117-00		Nut, 6-32 Hex.
d) 4703-00007-00		Lockwasher, #6 Ext.
5160-10269-00	Q1	Transistor, 2N3904, NPN
5060-10396-00	SP1	SIP 4.7K & 470pfd, 8R8C
5010-09181-00	R44, R48	Resistor, 1.0Ω, 1/2w, 5%
5010-09161-00	R35, R45	Resistor, 2.2Ω, 1/4w, 5%
5010-09361-00	R43, R46, R47	Resistor, 220Ω, 1/2w, 5%
5010-09358-00	R41, R42	Resistor, 1KΩ, 1/4w, 5%
5010-08998-00	R2, R3	Resistor, 2.2KΩ, 1/4w, 5%
5010-08983-00	R7-R9	Resistor, 3.3KΩ, 1/4w, 5%
5010-08991-00	R1, R4, R5, R11, R25 - R28, R33, R36, R37, R49, R50	Resistor, 4.7KΩ, 1/4w, 5%
5010-09034-00	R22-R24, R17, R34	Resistor, 10KΩ, 1/4w, 5%
5010-09324-00	R6, R19, R20, R21	Resistor, 27KΩ, 1/4w, 5%

Part Number	Ckt Designator	Description
5010-09162-00	R39	Resistor, 100KΩ, 1/4w, 5%
5010-10258-00	R40	Resistor, 1MΩ, 1/4w, 5%
5010-09179-00	R10	Resistor, 3.3MΩ, 1/4w, 5%
5010-08772-00	R18	Resistor, 15KΩ, 1/4w, 5%
5010-08824-00	R32	Resistor, 43KΩ, 1/4w, 5%
5010-08846-00	R31	Resistor, 220KΩ, 1/4w, 5%
5010-08991-00	R12	Resistor, 4.7KΩ, 1/4w, 5%
5010-09219-00	R38	Resistor, 8.2KΩ, 1/4w, 5%
5010-09331-00	R16	Resistor, 13KΩ, 1/4w, 5%
5010-09333-00	R29	Resistor, 180KΩ, 1/4w, 5%
5010-09342-00	R30	Resistor, 36KΩ, 1/4w, 5%
5010-09534-00	W3, W9	Resistor, 0Ω
5010-10985-00	R14, R15	Resistor, 20KΩ, 1/4w, 5%
5013-09427-00	R13	Resistor, 4.9KΩ, 1/4w, 5%
5040-09343-00	C1, C3, C4, C8, C17	Capacitor, 10µfd, 20v, ±20%
5040-10974-00	C12, C19, C24	Capacitor, 100µfd, 35v
5040-09776-00	C26, C30	Capacitor, 470µfd, 16v; +50, -10%
5040-09365-00	C11	Capacitor, 1µfd, 63v, +50 -10%
5040-12006-00	C29, C32	Capacitor, 1000µfd, 16v, 20%
5041-09243-00	C25, C28	Capacitor, 10µfd, 10v,±10%
5043-08980-00	C5, B (20)*	Capacitor, 0.01µfd, 50v,+80, -20%
5043-08996-00	C31, C33	Capacitor, 0.1µfd, 50v, ±20%
5043-09065-00	C13 - C15	Capacitor, 470 pfd, 50v, ±20%
5043-09492-00	C2, C34	Capacitor, 100 pfd, 50v, ±10%
5043-09844-00	C6	Capacitor, 47 pfd, 50v, ±20%
5043-09845-00	C16, C18, C20 - C23, C27	Capacitor, 1000 pfd, 50v, ±20%
5046-09346-00	C7	Capacitor, 1200pfd, 50V, ±5%
5046-09350-00	C9	Capacitor, 180pfd, 100V, ±5%
5048-10992-00	C10	Capacitor, 4700pfd, 50v,
5370-09691-00	U6	IC, 55536, CVSD
5520-09020-00	X1	Crystal, 3.58 MHz
5521-10931-00	CR1	Oscillator, 8 MHz
5551-09822-00	L1 - L3	Inductor, 4.7 µH, 3A.
5791-09437-00	J4	Connector, 20 pin, (Hdr), Rib. Cbl
5791-10862-04	J1, J2, J5	Connector, 4 pin (Hdr)
5791-10862-06	J3	Connector, 6 pin (Hdr)
16-8850-281		PCB I.D. Label
20-9229		Thermal Compound
Not Installed	W1, W2, W4-W8	

Notes: [1] *20 capacitors (shown on diagram with "B" symbol) provide +5VDC filtering for ICs. [2] All capacitors are ceramic, 50v, axial, unless otherwise noted. [3] All resistors are 5%, 1/4w, Carbon Film, unless otherwise noted.

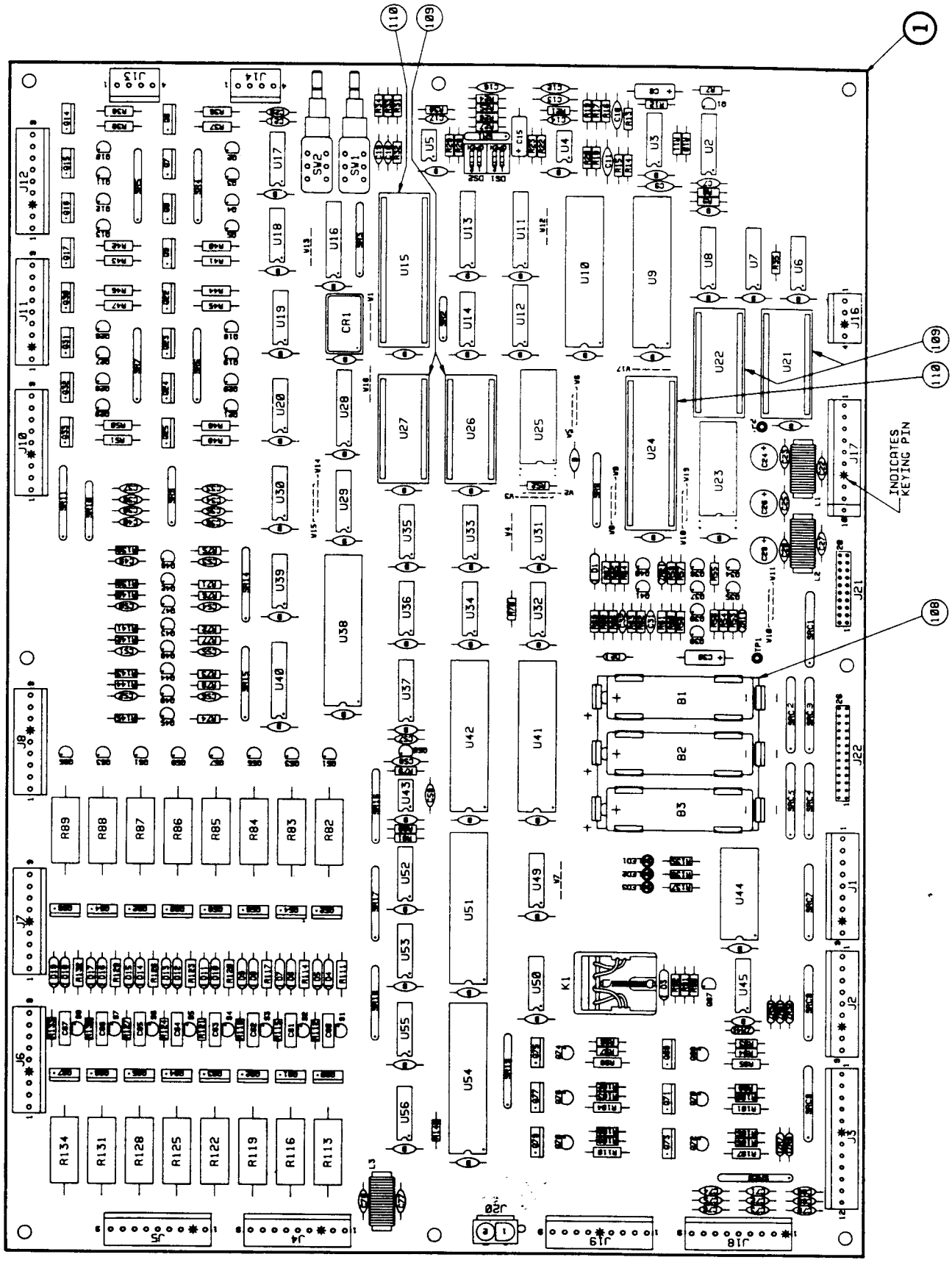
System 11B CPU Board
P/n D-11883-574

Item	Part No.	Ckt Designator	Description
1	5764-12206-00		Bare P. C. Board
2	5370-09691-00	U3	IC, CVSD Mod., 55536
3	5370-09321-00	U4, U5	IC, Dual Op Amp, 1458
4	5281-09308-00	U16	IC, Octal Bus Xcvr, 74LS245
5	5430-08972-00	U9, U10, U38, U41, U42, U51, U54	IC, PIA, MC6820/6821
6	5340-10139-00	U25	IC, 2K x 8 CMOS Static RAM
7	5280-09010-00	U44	IC, 4-16 Decoder, 74154
8	5281-09246-00	U7, U8, U12	IC, 2-4 Decoder, 74LS139
9	5075-09406-00	ZR3 - ZR8	Diode, Zener, 6.2v, 0.5w
10	5164-10998-00	Q42 - Q49	Transistor, NPN, 2N5550, TO-92
11	5281-09487-00	U6	IC, Dual D Flip-flop,74LS74
12	5431-09449-00	U43	IC, Timer, MC1455
13	5310-09236-00	U29	IC, 14-b Counter, 4020
14	5281-09743-00	U32	IC, Quad 2-Input AND, 74LS08
15	5281-09247-00	U14	IC, Quad 2-Input NOR, 74LS02
16	5281-09235-00	U35	IC, Triple 3-Input NAND, 74LS10
17	5280-09013-00	U36	IC, Hex Inverter, 7404
18	5281-09499-00	U31, U34	IC, Quad 2-Input NAND, 74LS00
19	5281-10014-00	U33	IC, Dual 4-Input NAND, 74LS20
20	5281-09486-00	U28	IC, Octal D Flip-flop, 74LS374
21	5371-09152-00	U2	IC, D/A Converter, MC1408
22	5281-09745-00	U37	IC, 3-8 Decoder, 74LS138
23	5340-09878-00	U23	IC, 2K x 8 Static RAM, 2016
24	Not Used		
25	5281-09867-00	U11, U13, U40	IC, Octal Buffer, 74LS244
26	5280-08973-00	U17-U20, U52, U53	IC, Quad 2-Input AND, 7408
27	5280-08974-00	U55, U56	IC, Hex Inverter, 7406
28	5310-09155-00	U30, U39	IC, Quad 2-Input NAND, MC14011
29	5280-08948-00	U45, U50	IC, Quad 2-Input NOR, 7402
30	5280-09309-00	U49	IC, Hex Buffer, 7407
31	5671-09019-00	LED1-LED3	LED, Red, Display
32	5521-10506-00	CR1	Oscillator, 4 MHz
33	5162-08976-00	Q51, Q53, Q55, Q57, Q59, Q61, Q63, Q65	Transistor, NPN Darl. 2N6427, TO-92
34	5191-08978-00	Q52, Q54, Q56, Q58, Q60, Q62, Q64, Q66	Transistor, PNP, TIP42, TO-220
35	5162-09410-00	Q6-Q9, Q14-Q17, Q22-Q25, Q30-Q33, Q69, Q71, Q73, Q75, Q77, Q79, Q80-Q87	Transistor, NPN, TIP122, TO-220
36	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
37	5160-10269-00	Q1, Q40	Transistor, NPN, 2N3904, TO-92
38	5190-09016-00	Q39, Q50	Transistor, PNP, 2N4403, TO-92
39	5130-09014-00	S1-S8	SCR, 30v, 0.8A, 2N5060
40	5070-06258-00	D3-D19	Diode, 1N4001
41	5070-08919-00	D2	Diode, 1N4148, 150mA
42	5070-09266-00	D1	Diode, 1N5817, 1.0A
43	5075-09018-00	ZR1	Diode, Zener, 1N5996A, 6.8v, 0.5w
44	5075-09059-00	ZR2	Diode, Zener, 1N5990, 3.9v, 0.5w
45	5010-08992-00	R94, R97, R100, R103, R106, R109	Resistor, 560Ω, 5%, 1/4w, C. F.
46	5010-09039-00	R56	Resistor, 10Ω, 5%, 1/4w, C. F.
47	5010-09534-00	W1, W2, W4, W5, W7, W8, W11, W14, W16, W17, W19	Resistor, 0Ω, 5%, 1/4w, C. F.
48	5010-08991-00	R31, R32, R35, R52 R55, R68, R92, R146	Resistor, 4.7KΩ, 5%, 1/4w, C. F.
49	5010-09358-00	R54, R57, R58, R64, R66, R138-R145	Resistor, 1.0KΩ, 5%, 1/4w, C. F.
50	5010-09113-00	R79	Resistor, 33KΩ, 5%, 1/4w, C. F.
51	5010-08983-00	R7, R8, R10, R70, R80	Resistor, 3.3KΩ, 5%, 1/4w, C. F.
52	5010-09034-00	R11-R14, R25, R26, R53, R60, R65, R90	Resistor, 10KΩ, 5%, 1/4w, C. F.
53	5010-09086-00	R81	Resistor, 6.8KΩ, 5%, 1/4w, C. F.
54	5010-09363-00	R3	Resistor, 5.6KΩ, 5%, 1/4w, C. F.
55	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.
562	5012-09037-00	R113, R116, R119, R122, R125, R128, R131, R134	Resistor, 0.4Ω, 5%, 3w, Wire-Wnd.
57	5010-08993-00	R36-R51, R95, R98, R101, R104, R107, R110	Resistor, 68Ω, 5%, 1/2w, C. F.
582	5012-10860-00	R82-R89	Resistor, 27Ω, 5%, 2w, C. F.
59	Not Used		
60	Not Used		
61	5010-10987-00	R19	Resistor, 56KΩ, 5%, 1/4w, C. F.
62	5010-10003-00	R62, R63	Resistor, 390Ω, 5%, 1/4w, C. F.
63	5010-10171-00	R67	Resistor, 56Ω, 5%, 1/4w, C.F.
64	5010-10170-00	R69	Resistor, 47Ω, 5%, 1/4w, C. F.
65	5010-09160-00	R59, R61, W12, W13	Resistor, 220Ω, 5%, 1/4w, C. F.
66	5010-09416-00	R33, R34, R71-R78, R135-R137	Resistor, 470Ω, 5%, 1/4w, C. F.
67	5010-09179-00	R9	Resistor, 3.3MΩ, 5%, 1/4w, C. F.
68	Not Used		
69	5010-10631-00	R111, R114, R117, R120, R123, R126, R129, R13	Resistor, 1.2KΩ, 5%, 1/2w, C. F.
70	Not Used		
71	Not Used		
72	5010-09120-00	R17	Resistor, 270KΩ, 5%, 1/4w, C. F.
73	5010-09333-00	R15, R16, R18	Resistor, 180KΩ, 5%, 1/4w, C. F.
74	5010-09324-00	R29, R30	Resistor, 27KΩ, 5%, 1/4w, C. F.
75	5010-09269-00	R20, R21	Resistor, 12KΩ, 5%, 1/4w, C. F.
76	5010-09356-00	R27, R28	Resistor, 820Ω, 5%, 1/4w, C. F.
77	5019-09783-00	SR18	SIP, 9R, 10-pin, 6.8KΩ, .125w/R, 5%
78	5019-09362-00	SR3, SR15, SR17, SR19, SR20	SIP, 9R, 10-pin, 4.7KΩ, .125w/R, 5%
79	5019-09808-00	SR4, SR6, SR11	SIP, 9R, 10-pin, 560Ω, .125w/R, 5%
80	5019-09785-00	SR16	SIP, 9R, 10-pin, 2.2KΩ, .125w/R, 5%
81	5019-10472-00	SR14	SIP, 9R, 10-pin, 3.3KΩ, .125w/R, 5%
82	5019-09669-00	SR8	SIP, 9R, 10-pin, 1.0KΩ, .125w/R, 5%
83	5019-09780-00	SR9, SR10	SIP, 4R, 8-pin, 1KΩ, 5%
84	5019-09786-00	SR1, SR2	SIP, 5R, 6-pin, 4.7KΩ, .125w/R, 5%
85	5019-09792-00	SR5, SR7	SIP, 9R, 10-pin, 2.7KΩ, .125w/R, 5%
86	5060-10396-00	SRC1 - SRC5, SRC7 - SRC9	SIP, 8R, 8C,10-pin, 4.7KΩ & 470pfd
87	5010-08774-00	R22	Resistor, 22KΩ, 5%, 1/4w, C. F.
88	5043-08980-00	C14, C17-C21, C31, C32, C49-C56, C59, +54 Bypass, marked B	Capacitor, 0.01 µfd, 50v(+80,-20%), Axial
89	5043-09845-00	C22, C23, C25, C27, C28	Capacitor, 1K pfd, 50v(±20%), Axial
90	5043-08996-00	C9, C70-75, C77, C78	Capacitor, 0.1 µfd, 50v(±20%), Axial
91	5040-09343-00	C8, C15	Capacitor, 10 µfd, Electr., 20v(±20%), Axial
92	5043-09844-00	C7	Capacitor, 47 pfd, 50v(±20%), Axial
93	5040-10974-00	C24, C26, C29	Capacitor, 100 µfd, Electr., 25v(+50,-10%), Axial
94	Not Used		
95	5045-09796-00	C60-C67	Capacitor, 0.1 µfd, Polycarbonate Rad., 100v(±10%)
96	5043-09065-00	C33-C40, C68, C69, C76, C10, C12	Capacitor, 470 pfd, 50v(±20%), Axial
97	5040-09545-00	C30	Capacitor, 22 µfd, Electr., 10v(+50,-10%), Axial
98	5041-09031-00	C58	Capacitor, 1 µfd, Tant., 25v(±20%), Axial
99	5043-09030-00	C16, C57	Capacitor, 0.047 µfd, 50v(±20%), Axial
100	Not Used		
101	5043-09492-00	C11	Capacitor, 100 pfd, ceramic,100v(±20%)
102	Not Used		
103	5048-10992-00	C13	Capacitor, 4700 pfd, ceramic,50v(±10%)
104	5551-09822-00	L1-L3	Inductor, 4.7 µH, 3A
105	5641-09312-00} 5641-09653-00}	SW1, SW2	Switch, Pushbutton, DPDT, 100v, 5A
106	5880-09022-00	B1-B3	Battery, Alkaline, 1.5v, AA
107	20-9491	W18, W19	Bus Wire, Jumper
108	5881-09021-00		Battery Holder, #171
109	5700-10176-00		IC Socket, 28 pin
a)	A-5343-574-1	U26	IC, Game ROM 2, 27128
b)	A-5343-574-2	U27	IC, Game ROM 1, 27256
c)	A-5343-574-3	U22	IC, Sound ROM 2, 27256
d)	A-5343-574-4	U21	IC, Sound ROM 1, 27256
110	5700-08985-00		IC Socket, 40 pin
a)	5400-09150-00	U15	IC, µProcessor, 6802
b)	5400-09150-00	U24	IC, µProcessor, 6802
111	5824-09248-00	TP1, TP2	Test Point
112 - 115	Not Used		
116	20-9229		Thermal Compound
117	5580-08994-01	K1	Relay, 4-pole, 40Ω, 6v
118	5791-10862-09	1J1, 1J2, 1J4-1J8, 1J10-1J12, 1J17-1J19	Connector, 9 pin (Hdr)
119	5791-10862-04	1J13, 1J14,1J16	Connector, 4 pin (Hdr)
120	5791-10862-12	1J3	Connector, 12 pin (Hdr)
121	Not Used		
122	5791-10850-00	1J22	Connector, 26 pin Ribbon (Hdr)
123	5791-09437-00	1J21	Connector, 20 pin Ribbon (Hdr)

Notes...

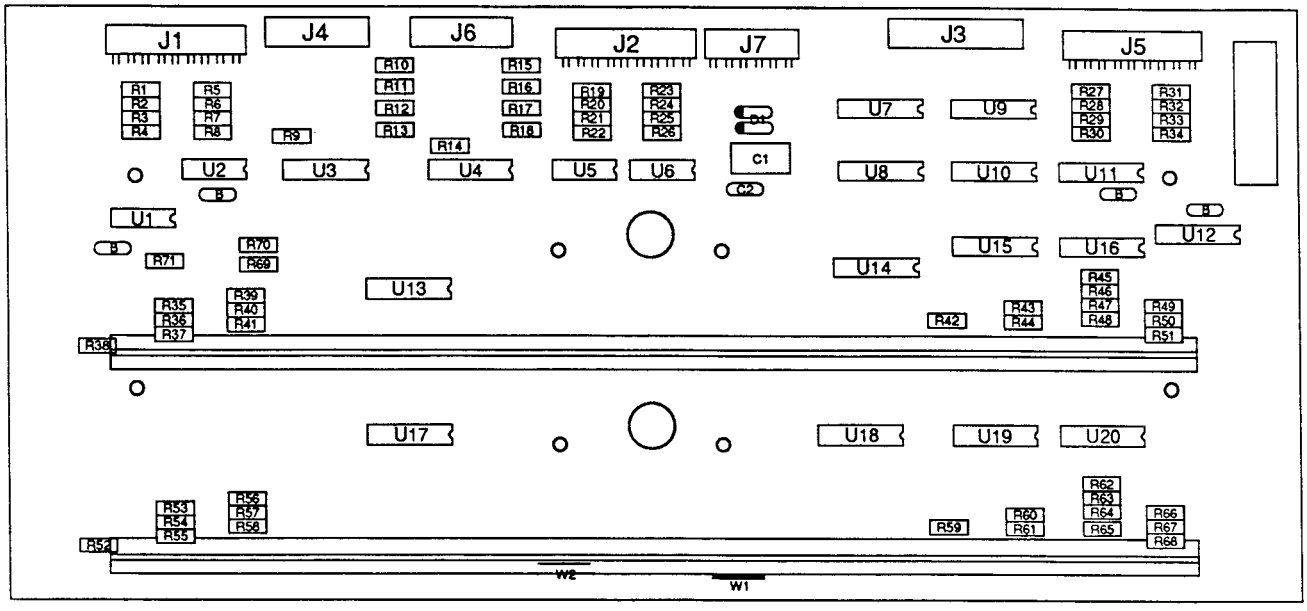
1. For Schematic, refer to drawing #16-9019.
2. Items 56 and 58 (resistors) must be mounted 1/8" above PCB surface.
3. Standard Jumper: W1, W2, W4, W5, W7, W8, W11, W14, W16, W17, W19.

System 11B CPU Board



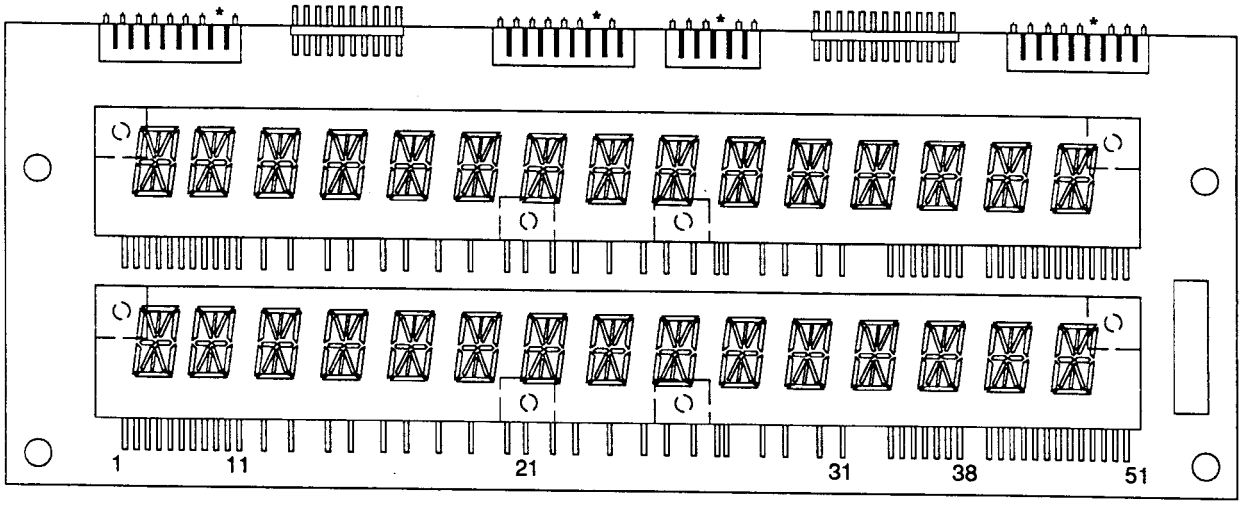
System 11B CPU Board (D-11883)

Master Display Board



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 µfd, 20v, ±20%
5043-08980-00	Bypass	Axial Cap, 0.01µfd, 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, 18KΩ, 1/4w, 5%
5010-10258-00	R38, R52	Resistor, 1MΩ, 1/4w, 5%
5010-10927-00	R36, R39, R40, R42, R47, R48, R50, R51, R54, R56, R57, R59, R64, R65, R67, R68	Resistor, 8.2KΩ, 1/2w, 5%
5010-08981-00	R37, R44, R46, R49, R55, R61, R63, R66	Resistor, 10KΩ, 1/2w, 5%
03-8088-1	Support	Support, Display
16-8850-234		PCB I.D. Label
23-6634		Cover, Display



16-Character Display Glass
p/n 5670-12308-00

Pinout Table for Williams Display Glasses
used on Master Display Board, D-12232-1 or -2

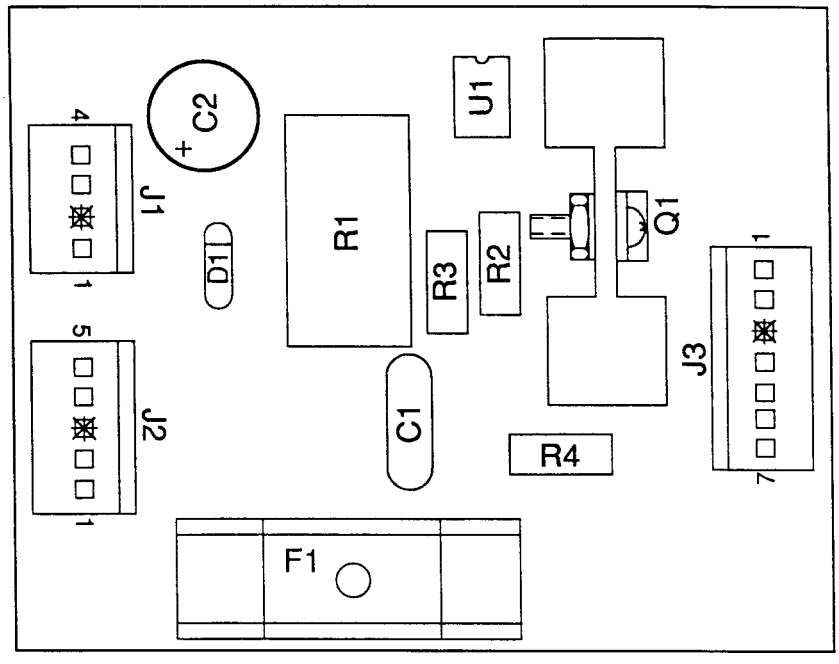
Board Pin #	Glass Pin #	Signal/ Function
1	1	N/C
2	2	Segment A
3	3	Segment J
4	4	Segment B
5	5	Strobe 16
6	6	Segment K
7	7	Strobe 16
8	8	Segment H
9	9	Segment F
10	10	Segment M
11	11	Strobe 15
12	12	Segment C
13	13	Strobe 15
14	14	N/C
15	15	Strobe 14
16	16	Dot
17	17	Strobe 14
18	18	Segment D
19	19	Strobe 13
20	20	Dot
21	21	Strobe 13
22	22	N/C
	23	cut

Board Pin #	Glass Pin #	Signal/ Function
	24	cut
23	25	Strobe 12
	26	cut
24	27	Strobe 12
	28	cut
	29	cut
	30	cut
25	31	Strobe 11
	32	cut
26	33	Strobe 11
	34	cut
	35	cut
	36	cut
27	37	Strobe 10
	38	cut
28	39	Strobe 10
	40	cut
29	41	Strobe 9
	42	cut
30	43	Strobe 9
	44	cut
	45	cut
	46	cut

Board Pin #	Glass Pin #	Signal/ Function
31	47	Strobe 8
	48	cut
32	49	Strobe 8
	50	cut
	51	cut
	52	cut
33	53	Strobe 7
	54	cut
34	55	Strobe 7
	56	cut
35	57	Strobe 6
	58	cut
	59	cut
	60	cut
36	61	Strobe 6
	62	cut
37	63	Strobe 5
	64	cut
38	65	Strobe 5
	66	cut
	67	cut
	68	cut
39	69	cut

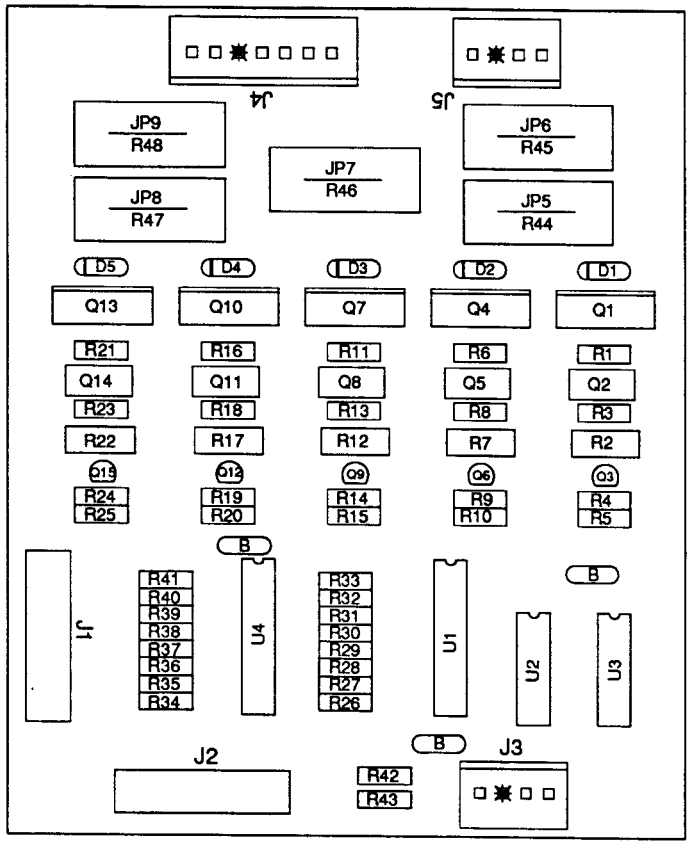
Board Pin #	Glass Pin #	Signal/ Function
	70	cut
40	71	Strobe 4
	72	cut
	73	cut
	74	cut
41	75	Strobe 3
	76	cut
42	77	Strobe 3
	78	cut
43	79	Strobe 2
44	80	Comma
45	81	Strobe 2
46	82	Segment P
47	83	Segment R
48	84	Segment E
49	85	Strobe 1
50	86	Segment N
51	87	Strobe 1
52	88	Segment
53	89	-100V dc

Triac Driver Assembly



Triac Driver Assembly
p/n C-13088

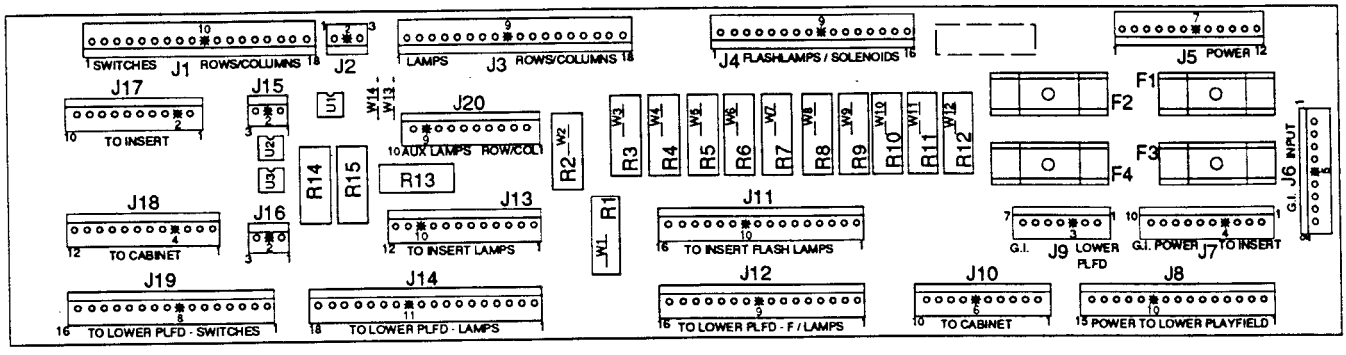
Item	Part Number	Ckt Designator	Description
1	5768-12520-00	-	Triac Driver PCB
2	5791-10862-04	J1	Connector, 4-pin Hdr, Sq Pin
3	5791-10862-05	J2	Connector, 5-pin Hdr, Sq Pin
4	5791-10862-07	J3	Connector, 7-pin Hdr, Sq Pin
5	5733-12060-01		Fuse Holder (F1)
6	5731-09651-00	F1	Fuse, 1A, S-B, 250v
7	5131-12543-00	Q1	Triac ISL, 400V, 10A.
8	5705-12464-00	-	Heatsink
9	5012-12530-00	R1	Resistor, 680Ω, 5w, 10%
10	5010-08930-00	R2	Resistor, 470Ω, 1/2w, 5%
11	5010-09441-00	R3	Resistor, 100Ω, 1/2w, 5%
12	5010-09789-00	R4	Resistor, 39Ω, 1/2w, 5%
13	5045-09795-00	C1	Capacitor, .01µfd, 400V (±10%) Metalized Poly
14	5040-09537-00	C2	Capacitor, 100µfd, 100V (±20%)
15	5070-09054-00	D1	Diode, 1N4004, 1.0A.
16	5490-09805-00	U1	IC, 3030 Triac Driver
17	4004-01005-06	-	Mach. Screw, 4-40 x 3/8
18	4404-01117-00	-	Nut, 4-40 Hex.
19	4703-00015-00	-	Lockwasher, #4 External



Sound Overlay Solenoid Board
p/n C-13287

Part Number	Ckt Designation	Description
5768-12568-00		Bare Sound O/LSolenoid PCB
5010-08991-00	R4, R9, R14, R19, R24	Resistor, 4.7KΩ, 1/4w, 5%
5010-08993-00	R2, R7, R12, R17, R22	Resistor, 68Ω, 1/2w, 5%
5010-08997-00	R3, R8, R13, R18, R23	Resistor, 2.7KΩ, 1/4w, 5%
5010-09034-00	R42, R43	Resistor, 10KΩ, 1/4w, 5%
5010-09160-00	R1, R6, R11, R16, R21	Resistor, 220Ω, 1/4w, 5%
5010-09358-00	R26 - R41	Resistor, 1KΩ, 1/4w, 5%
5010-09416-00	R5, R10, R15, R20, R25	Resistor, 470Ω, 1/4w, 5%
5010-09534-00	JP6, JP9	Resistor, 0Ω (Jumper Wire)
5012-10023-00	R44	Resistor, 4Ω, 5w, 10%
5012-12163-00	R46, R47	Resistor, 11Ω, 5w, 10%
5043-08980-00	B	Capacitor, .01µfd, 50v, +80,-20%
5070-09054-00	D1 - D5	Diode, 1N4004, 1.0A.
5162-09410-00	Q2, Q5, Q8, Q11, Q14	Transistor, NPN DARL. TIP 122
5190-10270-00	Q3, Q6, Q9, Q12, Q15	Transistor, TO-92, 2N3906, PNP
5191-12179-00	Q1, Q4, Q7, Q10, Q13	Transistor, TIP36C, PNP
5281-09247-00	U3	IC, 74LS02, Quad Nor
5281-09308-00	U4	IC, 74LS245, TRN CV
5281-09486-00	U1	IC, 74LS374, 8DF/F
5281-09500-00	U2	IC, 74LS32, QUAD
5791-09437-00	J1, J2	Connector, 20-Pin, (Hdr), Rib. Cbl.
5791-10862-04	J3, J5	Connector, 4-Pin, STR Sq. Pin
5791-10862-07	J4	Connector, 7-Pin, STR Sq. Pin

Backbox Interconnect Board



Backbox Interconnect Board
D-12313-574

Part Number	Ckt Designator	Description
5768-12332-00		Master Interconnect PCB
5010-09534-00	W9 - W13	Resistor, 0Ω
5012-12238-00	R14, R15	Resistor, 3.3KΩ, 5w, 10%
5012-12337-00	R13	Resistor, 1.5KΩ, 5w, 10%
5012-10024-00	R3-R5, R7, R8	Resistor, 5.6Ω, 5w, 10%
5012-12163-00	R1, R2, R6	Resistor, 11Ω, 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
16-8850-280		PCB. I.D. Label

Lamp Boards

Back Panel Lamp Board
p/n D-13356

Part Number	Description
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V., 0.25A.)
24-8802	Bulb #906 (13V., 0.69A.)
24-8803	Twist Lamp Socket
5768-12583-00	Lamp PCB
5791-10871-03	Connector, 3-pin Sq.
5791-10871-06	Connector, 6-pin Sq.

Speaker Panel Lamp Board
p/n D-12501

Part Number	Description
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V., 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0A.
5768-12377-00	Lamp PCB
5791-10871-09	Connector, 9-pin Sq.

Lamp Boards

Lamp Board ("6-C")
p/n C-13281

Part Number	Description
5768-12565-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-08	Connector, 8-pin sq post

Lamp Board ("6-R")
p/n C-13283

Part Number	Description
5768-12563-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-08	Connector, 8-pin sq post

Lamp Board ("8-R")
p/n C-13282

Part Number	Description
5768-12566-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-10	Connector, 10-pin Sq post

Lamp Board ("8-C" + "1-F")
p/n C-13284-1

Part Number	Description
5768-12519-00	Lamp PCB
24-8767	Twist Lamp Socket
24-8768	Bulb #555 (6.3V, 0.25A.)
5070-09054-00	Diode, 1N4004, 1.0 A.
5791-10871-07	Connector, 7-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.

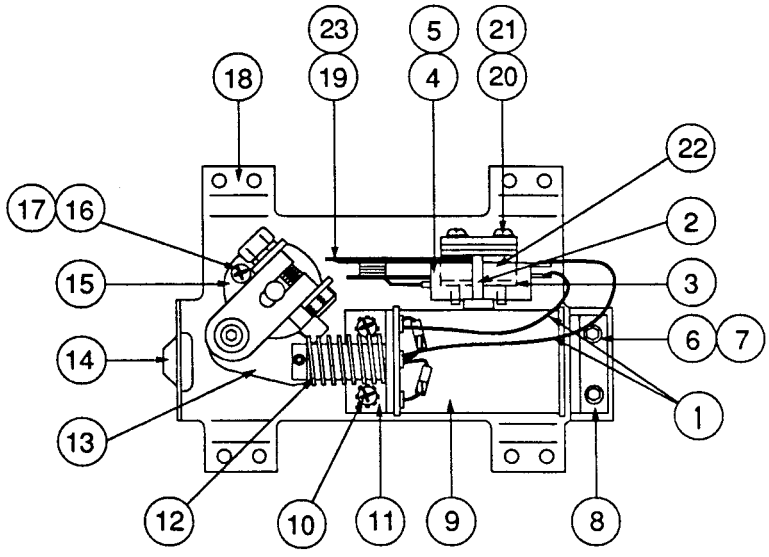
Playfield Relay Boards
(Solenoids 11 & 16 Gen. Illum)
p/n C-11902-1

Part Number	Description
5768-12221-00	PC Board
5070-09054-00	Diode, 1N4004, 1.0A.
5580-12145-00	Relay, 24vdc, 30A.
5791-12273-02	Header, 2-pin Sq post (J1)
5791-12273-07	Header, 7-pin Sq post (J2)

Backbox Relay Board
(Solenoid 16 Gen. Illum)
p/n C-11998-1

Part Number	Description	
5768-12243-00	PC Board	
5070-09054-00	Diode, 1N4004, 1.0A.	(D1)
5580-09555-01	Relay, 24vdc, 30A.	(K1)
5010-09534-00	Resistor, 0Ω	(W1, W2)
5791-12273-02	Header, 2-pin Sq post	(J1)
5791-12273-07	Header, 7-pin Sq post	(J2)

Flipper Assembly



Lower & Upper Right Flipper Assembly
C-11626-R-3

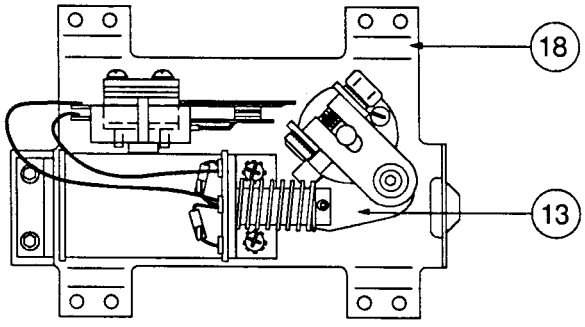
Item	Part Number	Description	Item	Part Number	Description
1	HW-30018-6	Wire, 18 AWG, Blue	g)	B-10657-R	Flipper Crank Assy, R.
2	03-7520-2	Ty-Wrap, Nylon	1.)	01-8073-R	Flipper Crank, R.
3	20-6516	Speednut, Tinnerman	2.)	17-1037	Crank Washer
4	5045-12098-00	Capacitor, 2.2 µFd, 250V, 20%	3.)	4010-01066-18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

** Also See Separate Diagram

Associated Parts:

20-9250-6	Flipper Arm on Shaft
23-6519-4	Red Rubber Ring

Flipper Assembly



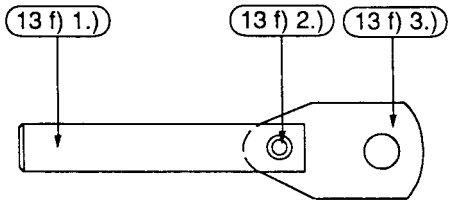
Lower Left Flipper Assembly p/n C-11626-L-3

(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 (20-9250-6) 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 ther 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.

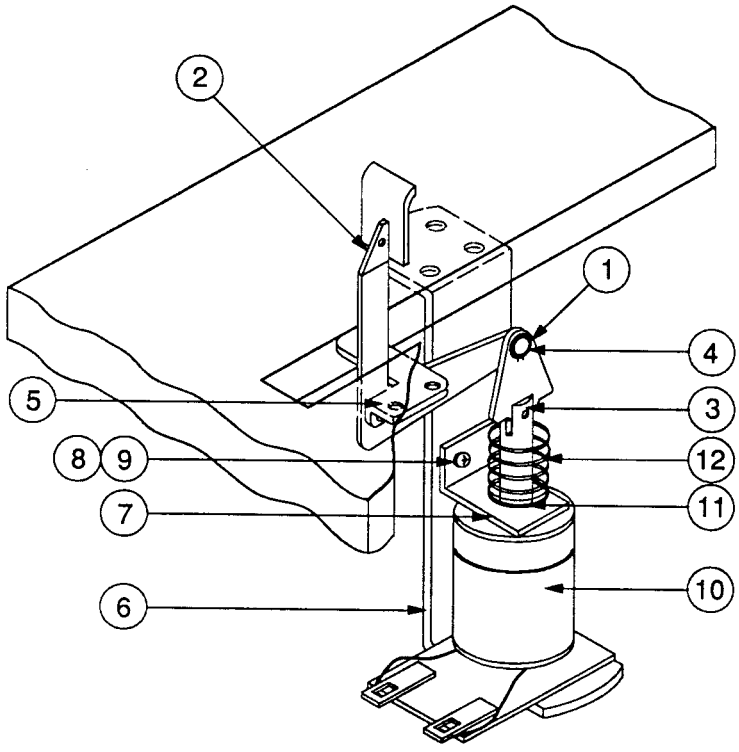


Flipper Link Assembly p/n A-10656

[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

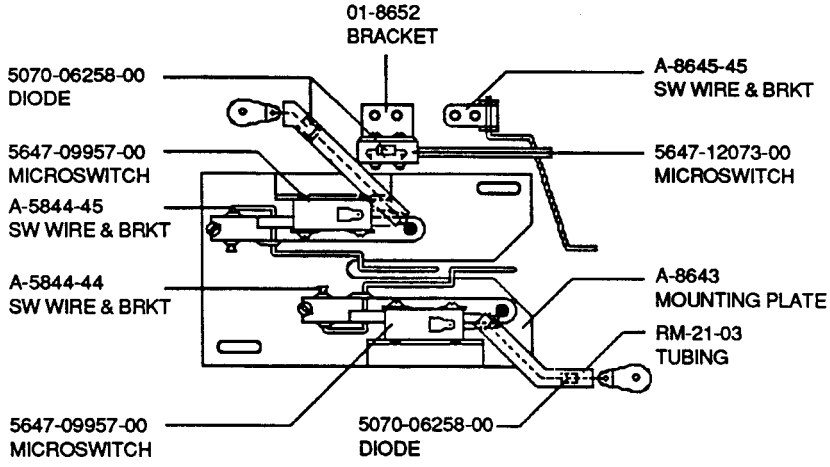
Kicker Arm Assembly



Left & Right Kicker Arm (Slingshot) Assembly
p/n B-12665
(Including Associated Parts)

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 o.d. x 1/2 i.d. x 15ga.
5	A-5653	Mounting Bracket Assy
6	B-11203-R-1	Coil & Bracket Assembly
7	01-8-508-S	Coil Retaining Bracket
8	4006-01017-06	Mach. Screw, 6-32 x 3/8
9	4406-01119-00	Nut, 6-32 ESN
10	AE-26-1500	Coil Assembly
11	03-7066	Coil Tubing
12	10-128	Spring

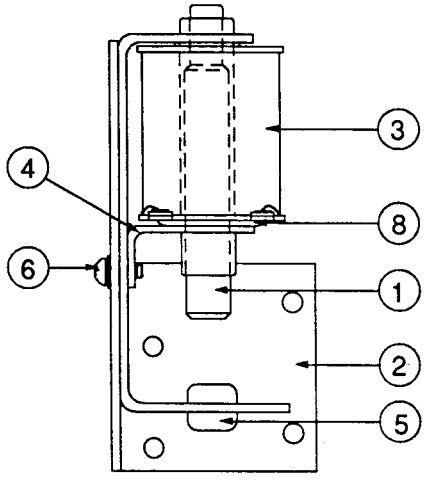
Ball Trough Switches



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

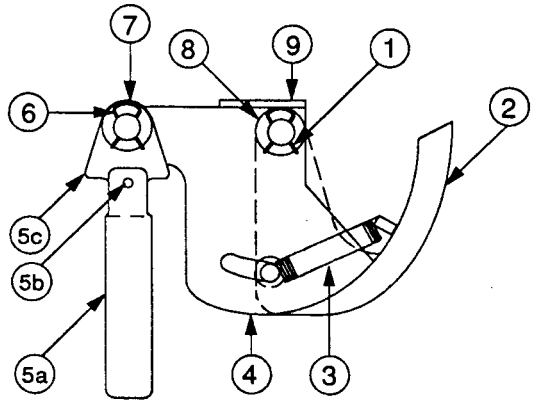
Knocker Assembly



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



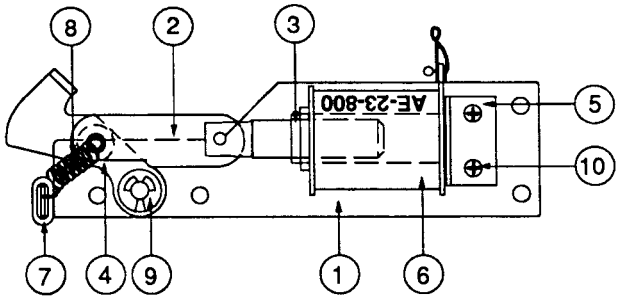
Ball Shooter Lane Feeder
p/n C-9638-3

Item	Part Number	Description
1	12-6227	Hair Pin Clip
2	A-8247	Eject Cam Assy
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, 17/64 x 1/2 x 15 ga.
8	4700-00103-00	Flatwasher, 17/64 x 1/2 x 28 ga.
9	A-8268-2	Eject Cam Bracket Assembly

Associated Parts

B-9362-R-1	Coil & Bracket Assy
B-7572-1	Bracket & Stop Assy
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

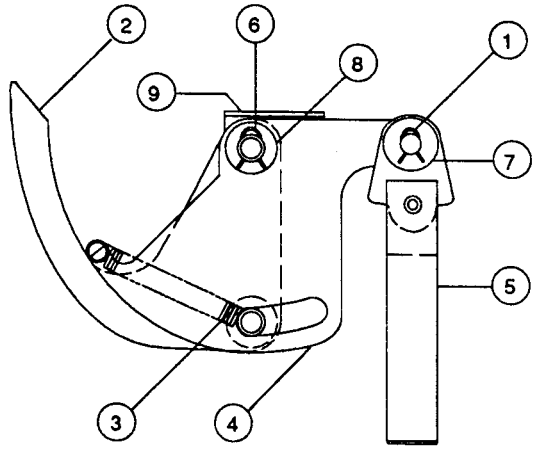
Outhole Kicker Assembly



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 Assembly
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

Eject Hole Arm Assembly



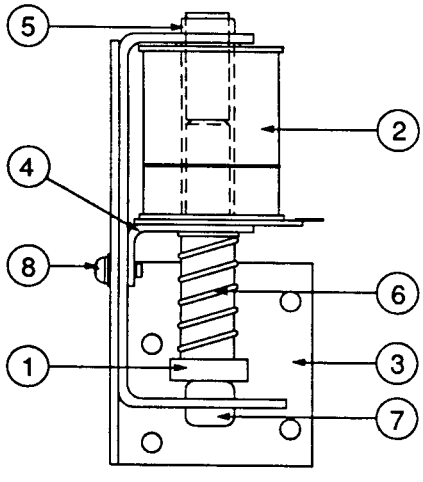
Associated Parts

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

TR Eject Hole Arm Assembly p/n B-9361-R

Item	Part Number	Description
1	12-6227	Hair Pin Clip
2	A-7471-R	Eject Cam Assembly
3	10-362	Eject-Spring (Plain)
4	A-6949-R	Spring Plate Assembly
5	A-8050-1	Plunger Assembly
a)	02-3407	Coil Plunger
b)	20-8716-5	Roll Pin
c)	03-8085	Armature Link
6	12-6227	Hair Pin Clip
7	4700-00030-00	Flatwasher, 17/64 x 1/2 x 15ga.
8	4700-00103-00	Flatwasher, 17/64 x 1/2 x 28ga.
9	A-8268	Mounting Bracket Assy

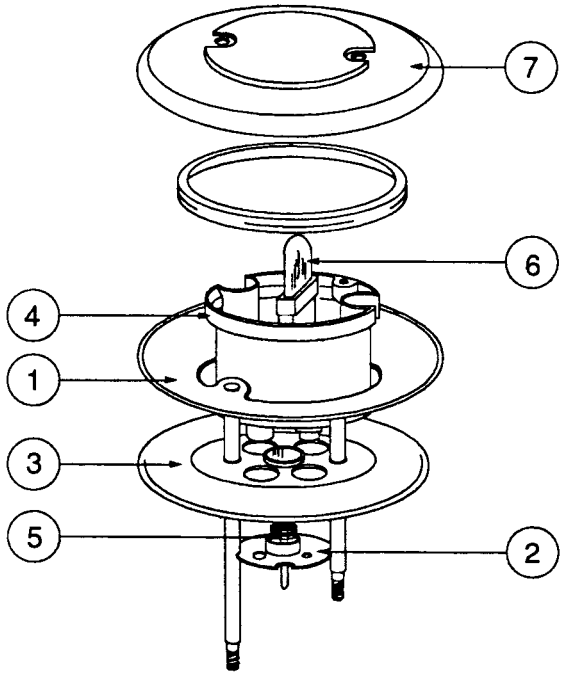
Bottom Arch Kickback Assembly



Bottom Arch Kickback Assembly p/n B-13269

Item	Part Number	Description
1	A-13270	Bell Armature Assembly
2	AE-23-800	Coil Sub-Assembly
3	B-7409-2	Mtg. Bracket Assembly
4	01-8-508-T	Coil Retaining Bracket
5	03-7067	Coil Tubing
6	10-135	Solenoid Spring
7	23-6420	Rubber Grommet
8	4008-01017-05	Mach. Screw, 8/32 x 5/16

Jet Bumper & Coil Assembly



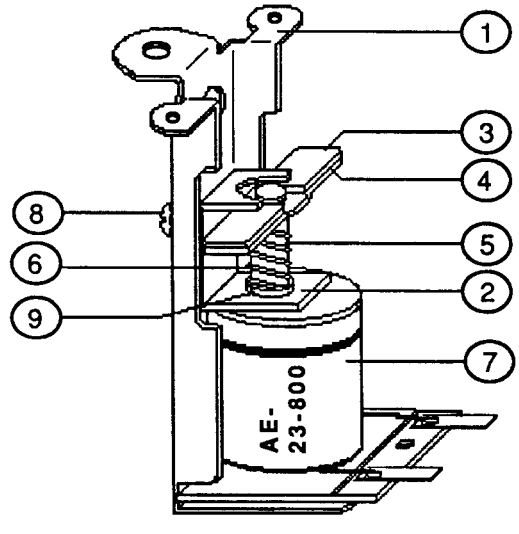
Yellow Jet Bumper Assembly p/n B-9414-2

Item	Part Number	Description
1	A-4754	Bumper Ring Assy
2	03-6009-A5	Bumper Base-Wht
3	03-6035-5	Bumper Wafer-Yel
4	03-7443-5	Bumper Body-Wht
5	10-7	Spring-Jet Bumper
6	A-11199	Socket & Bulb Assy
7	03-8254-16	Jet Bumper Cap - Trans. Yel

Red Jet Bumper Assembly p/n B-9414-3

(Parts Listed Replace same items of B-9414-2)

Item	Part Number	Description
3	03-6035-4	Bumper Wafer-Red
7	03-8254-9	Jet Bumper Cap -Trans. Red



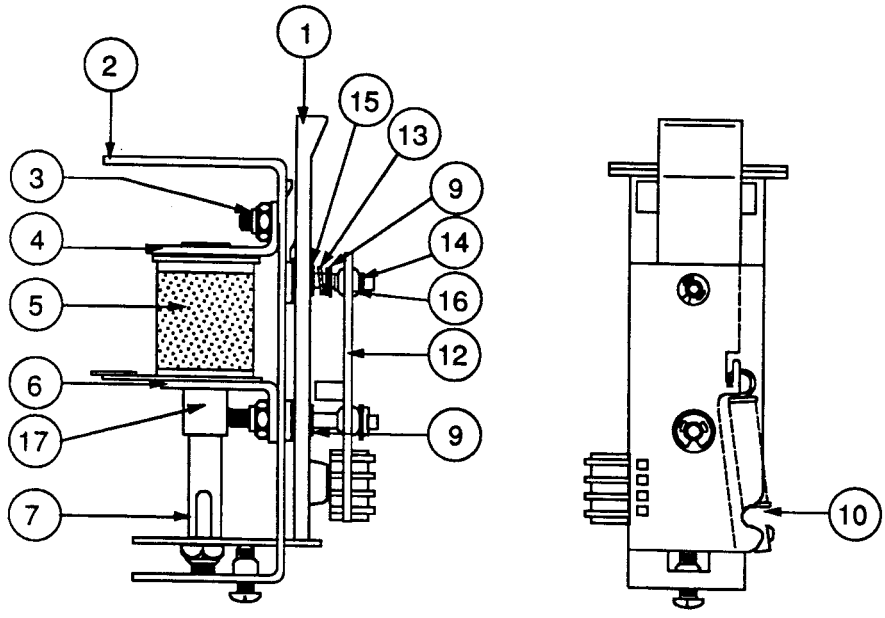
Jet Bumper Coil Assembly p/n B-9415-1

Item	Part Number	Description
1	B-7417	Bracket & Stop Assy
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 Part:.

B-12030-2	Jet Bumper Sw & Diode

1-Bank Drop Target Assembly



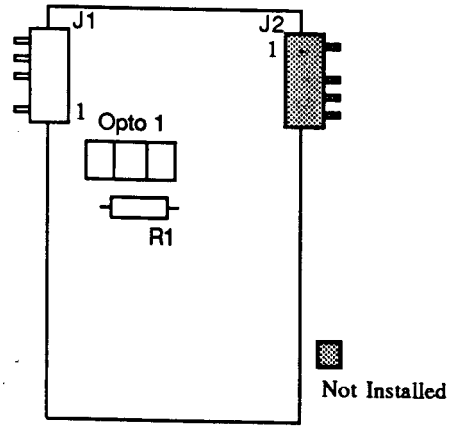
1-Bank Drop Target Assembly
p/n C-13312-1

Item	Part Number	Description	Item	Part Number	Description
1	03-8036	Plain Target	10	10-364	Spring - Extension
2	B-11213	Drop Target Sub-Assy	11	4700-00016-00	Flatwasher, 3/16 x 7/16 x 17ga.
3	4408-0119-00	Nut, 8-32 ESN	12	C-13311-R	1-Bank Opto Board
4	A-11397	Stop Bracket Assembly	13	10-392	Spring - Compression
5	AE-23-800	Coil Assembly	14	20-8712-18	"E" Ring, 3/16" Shaft
6	01-8413	Bracket - Coil Mounting	15	4700-00072-00	Flatwasher, 17/64 x 1/2 x 21ga.
7	A-11388	Plate & Reset Assembly	16	23-6626	Rubber Grommet
8	4008-01016-10	Mach. Screw, 8-32 x 5/8	17	03-7066-4	Coil Tubing
9	20-8712-25	"E" Ring, 1/4" Shaft			

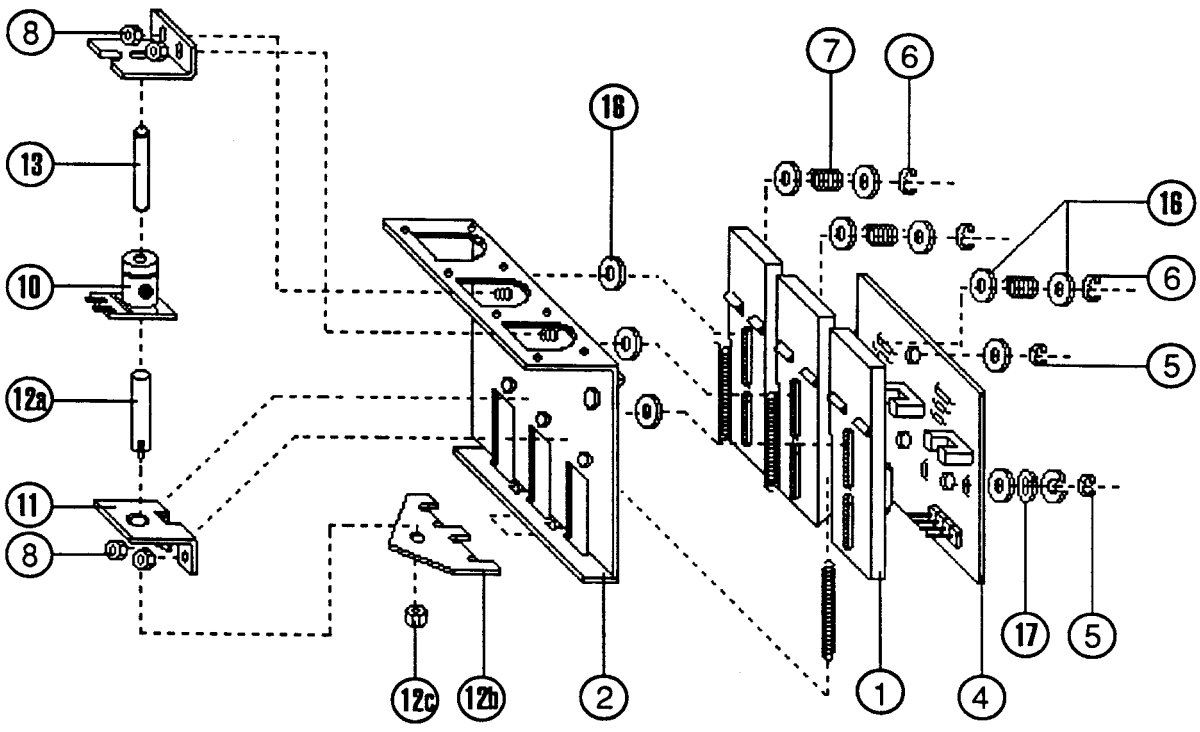
Associated Part:. 31-1463-574-4 Drop Target Decal

1-Bank Drop Target Opto Board
p/n C-13311-R

Part Number	Ckt Symbol	Description
5768-12576-00		One Bank Drop Tgt. PCB
5010-08930-00	R1	Resistor, 470Ω, 1/2w, 5%
5490-12451-00	OPTO 1	Opto Inter LG 10mA.
5791-12548-05	J1	Connnector, 5-pin Lck. Sq. Pin



3-Bank Drop Target

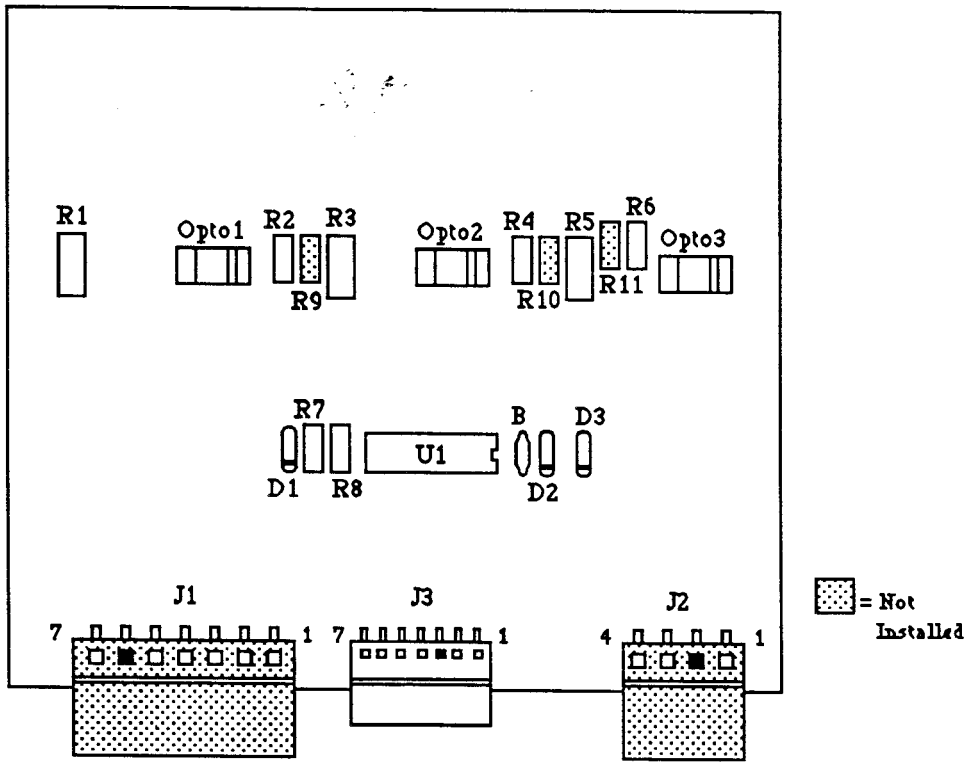


3-Bank Drop Target
p/n C-11223-3

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

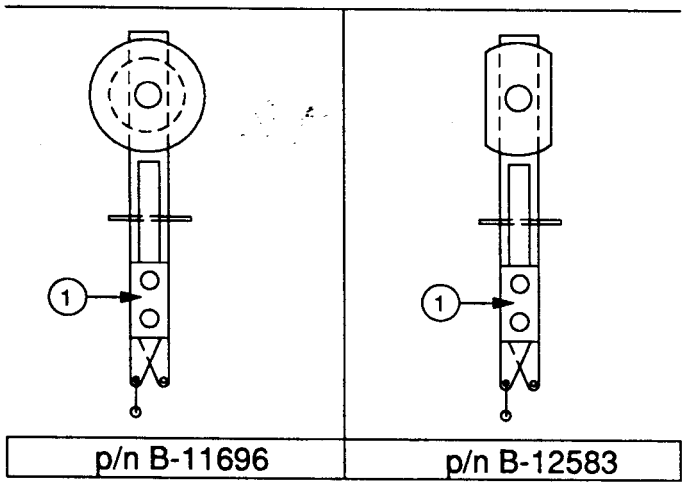
Associated Parts:.

31-1463-574-1, -2, -3	Drop Target Decal



3-Bank Drop Target Opto Board
p/n C-13205-1

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, 100KΩ, 1/4w, 5%, C.F.
5010-09324-00	R2, R4, R6	Resistor, 27KΩ, 1/4w, 5%, C.F.
5010-08774-00	R7	Resistor, 22KΩ, 1/4w, 5%, C.F.
5043-08980-00	B	Capacitor, .01µfd., +80 -20%
5370-12272-00	U1	I.C., Quad. Comp., LM339
5791-12548-07	J3	Connector, 7-Pin Lck. Sq.
5070-09054-00	D1 - D3	Diode, 1N4004, 1.0A



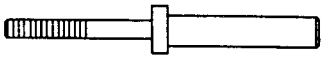
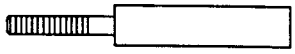
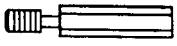
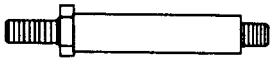
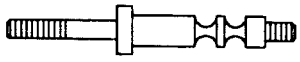
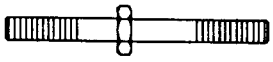
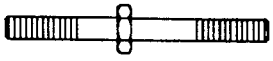
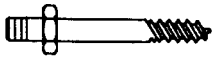
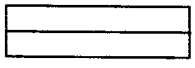
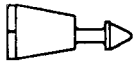
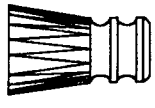
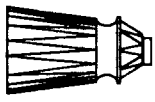
Standup Target Assemblies
(Including Diode)

Item	Part Number	Description
1	B-11696-5	Standup Target - White
1	B-11696-15	Standup Target - Orange
1	B-12583-4	Oblong Standup Tgt - Red
1	B-12583-6	Oblong Standup Tgt - Yellow

Posts

Part Number	Description	Qty.	Part Number	Description	Qty.
02-4003	Bumper Post, 8-32 MS	7	02-4426-1	Post, #6-32 / #8-32 SMS	11
02-4056	Bumper Post	1	02-4433	Post, #8 x 1-3/16"	5
02-4057	Bumper Post	6	02-4434	Post, #8 x 1"	4
02-4334-14	Mounting Post, 3.25"	1	02-4435	Post, #8 x 1-3/16	2
02-4334-15	Mounting Post, 3.19"	1	02-4436-1	F-F Spacer , 8-32 x 1"	3
02-4335-12	Mounting Post, 1.38"	2	02-4436-2	F-F Spacer , 8-32 x 2.31"	1
02-4342-1	Bumper Post, thd.	1	02-4436-3	F-F Spacer , 8-32 x 2.69"	1
02-4423	Bumper Post	1	02-4436-4	F-F Spacer , 8-32 x 3.12"	1
02-4424-1	Post, #6-32 / #8-32	15	03-8247-13	Star Post (Clear)	25
02-4424-2	Post, #6-32 / #8-32	4	03-8044-9	Mini-Post Trans. Red	2
02-4425-2	Post, #8-32 / #8-32	2	03-8044-13	Mini Plastic Post - Clear	2
			03-8319-13	Star Post # 8 - Clear	5

Metal & Plastic Posts

	Part No.	Description
	02-4003	Bumper Post, 8-32
	02-4056	Bumper Post
	02-4057	Bumper Post
	02-4334	Mounting Post
	02-4335	Mounting Post, 1.38"
	02-4342	Bumper Post, Threaded
	02-4423	Bumper Post
	02-4424	Post, #6-32 / #8-32
	02-4425	Post, #8-32 / #8-32
	02-4426	Post, #6-32 / #8-32
	02-4433	Post, #8 x 1-3/16"
	02-4434	Post, #8 x 1"
	02-4435	Post, #8 x 1-3/16
	02-4436	F-F Spacer, 8-32 x Length
	03-8044	Mini-Post
	03-8247	Plastic Post
	03-8319	Plastic Post

Wheels Drive Assembly
p/n D-13199

Item	Part Number	Description	Item	Part Number	Description
1	01-9406	Bracket Mounting	12	20-9610	Bearing - Flange
2	02-4418	Shaft	13	20-9639	Metric MS Screw
3	02-4419	Adjusting Screw	14	31-1536-574-1	Decal - Large
4	03-8343	Pinion	15	31-1536-574-2	Decal - Medium
5	03-8344	Gear, 72T	16	31-1536-574-3	Decal - Small
6	03-8345	Gear, 84T	17	4006-01076-04	Set Screw, 6-32 x 1/4
7	03-8346	Gear, 115T	18	4008-01017-08	Mach. Screw, 8-32 x 1/2
8	03-8347	Gland	19	4008-01041-08	Mach. Screw, 8-32 x 1/2
9	03-8363	Nut-Locking	20	4108-01004-06	Sh. Metal Screw, #8x3/8
10	14-7955	Motor	21	4700-00016-00	Flatwasher, 3/16 x 7/16 x 17ga.
11	16-8587-1000	Label-Adjustment Motor			

Playfield Ramp Assemblies

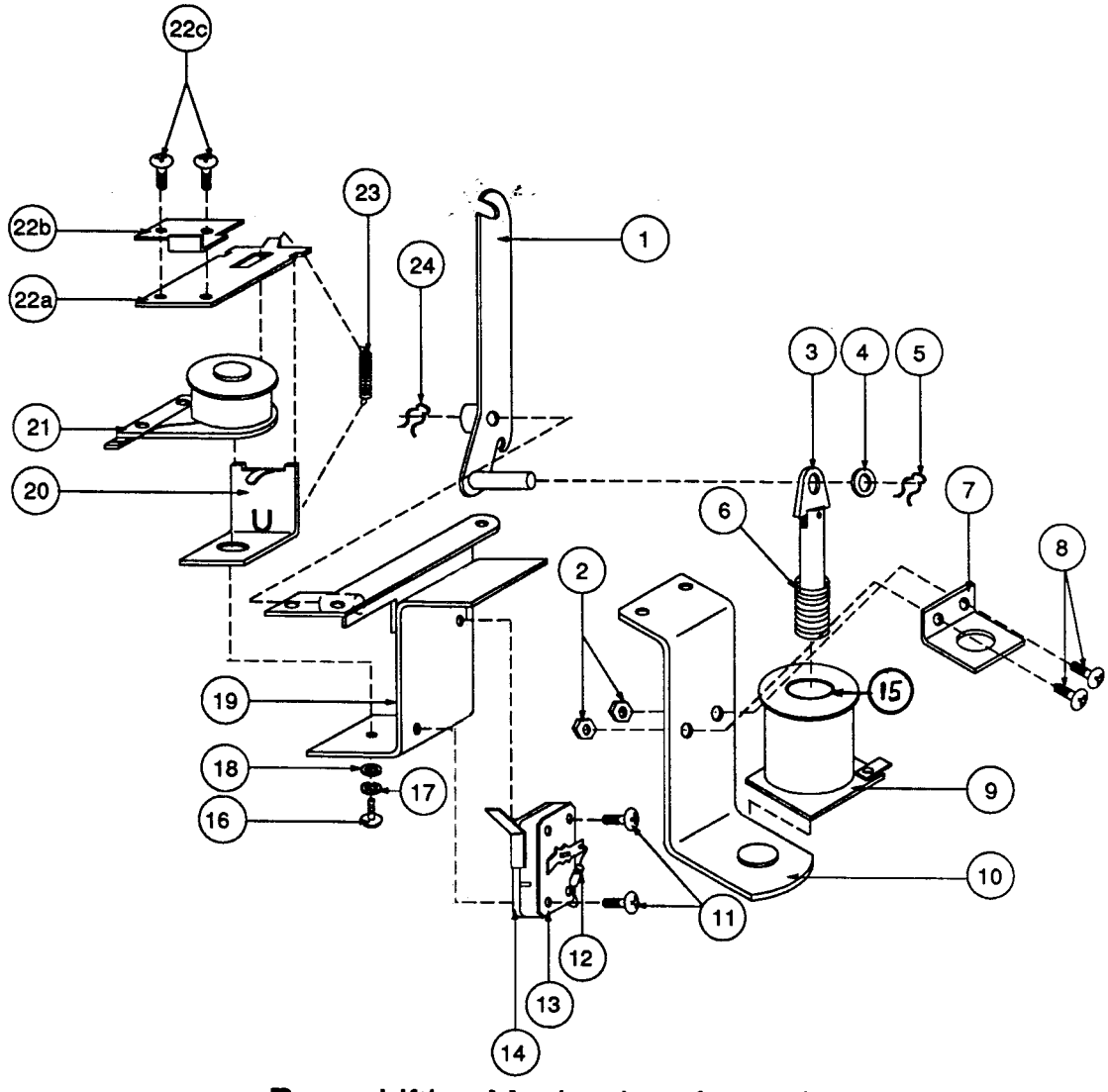
Left Ramp Assembly
p/n R-13129

Item	Part Number	Description
1	A-12506	Switch Gate Assembly
2	A-7438-1	Terminal Strip Assembly
3	01-8641	Bracket - Switch
4	01-8774	Bracket - Switch
5	01-9387	Ramp Flap
6	03-8335	Rear Ramp
7	5647-12073-11	µSwitch
8	5647-12133-04	µSwitch

Right Ramp Assembly
p/n R-13190

Item	Part Number	Description
1	B-13233	Lifting Ramp Assy
2	B-13300	Switch & Bracket Assy
3	01-9499	Plate - Bearing
4	03-8171-9	T/L Dome Tr- Red
5	03-8172-13	T/L Dome Tr- Red
6	03-8342	Ramp - Left
7	03-8369	Cover - Switch
8	24-8802	Bulb #906 (13V, .69A)
9	24-8812	Socket - Light

Ramp Lifting Mechanism



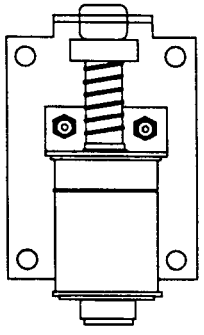
Ramp Lifting Mechanism Assembly
p/n B-11304
& Associated Parts

Item	Part Number	Description	Item	Part Number	Description
1	A-11137	Lift Crank Assembly	15	03-7066	Tubing, Coil
2	4406-01119-00	Nut, 6-32 ESN	16	4008-01021-07	Mach. Screw, 8-32 x 7/16
3	A-8050	Plunger Assembly, 2-1/4"	17	4701-00003-00	Lockwasher, #8 Split
4	4700-00073-00	Flatwasher, 9/32x1/2x21ga.	18	4700-00089-00	Flatwasher,11/64x7/16x16ga.
5	12-6227	Hairpin Clip	19	B-11302	Lift Mech Bracket Assy
6	10-128	Spring	20	A-6892	Frame & Eyelet Assy
7	01-8-508-S	Coil Retaining Bracket	21	SM-26-600-DC	Coil Assembly
8	4006-01017-06	Mach. Screw, 6-32 x 3/8	22	A-11139	Armature Assembly
9	AE-26-1500	Coil Assembly	a)	A-8936	Armature Sub-Assembly
10	B-7572-1	Bracket & Stop Assembly	b)	01-8390	Lift Crank Lock
11	4004-01003-10	Mach. Screw, 4-40 x 5/8	c)	4006-01003-03	Mach. Screw, 6-32 x 3/16
12	5070-06258-00	Diode, 1N4001, 1.0A.	23	10-363	Extension Spring
13	A-7438-1	Terminal Strip Assembly	24	12-6227	Hairpin Clip
14	5647-12001-00	Microswitch			

Cellar & Kickback Assembly

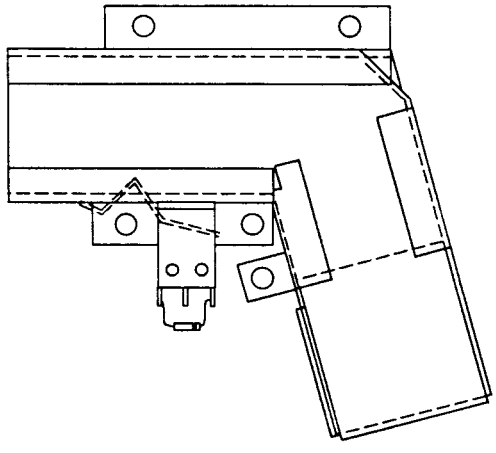
Kickback Assembly p/n B-13225

Kickback Asembly B-23225

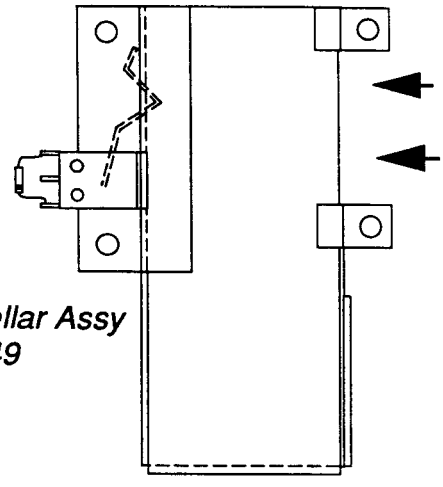


Item	Part Number	Description
1	A-13270	Bell Armature Assy
2	AE-26-1500	Coil Sub-Assembly
3	A-13226	Mounting Bracket Assy
4	01-9423	Coil Bracket
5	03-7067	Coil Tubing
6	10-135	Spring
7	23-6420	Rubber Grommet
8	4408-01119-00	Nut, 8-32 ESN

Right Cellar Assy B-13350



Left Cellar Assy B-13349



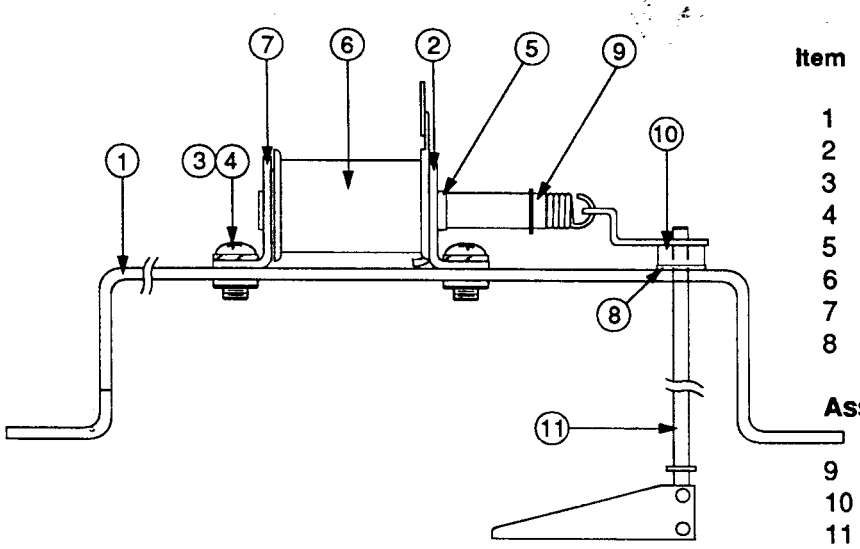
Left Cellar Assembly p/n B-13349

Item	Part Number	Description
1	B-13223	Left Cellar Sub-Assy
2	5647-12073-25	µSwitch, Subminiature
3	01-8240	Nut Plate, #2-56
4	4002-01005-08	Mach. Screw, 2-56 x 1/2
5	4701-00024-00	Lockwasher, #2 Split
6	5070-06258-00	Diode, 1N4001, 1.0A.

Right Cellar Assembly p/n B-13350

Item	Part Number	Description
1	B-13221	Right Cellar Sub-Assy
2	5647-12073-25	µSwitch, Subminiature
3	01-8240	Nut Plate, #2-56
4	4002-01005-08	Mach. Screw, 2-56 x 1/2
5	4701-00024-00	Lockwasher, #2 Split
6	5070-06258-00	Diode, 1N4001, 1.0A.

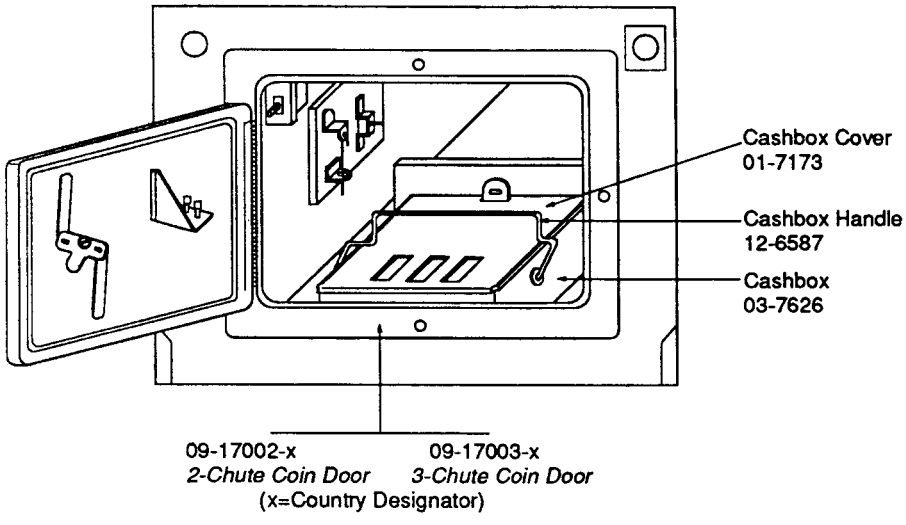
Diverter Assembly



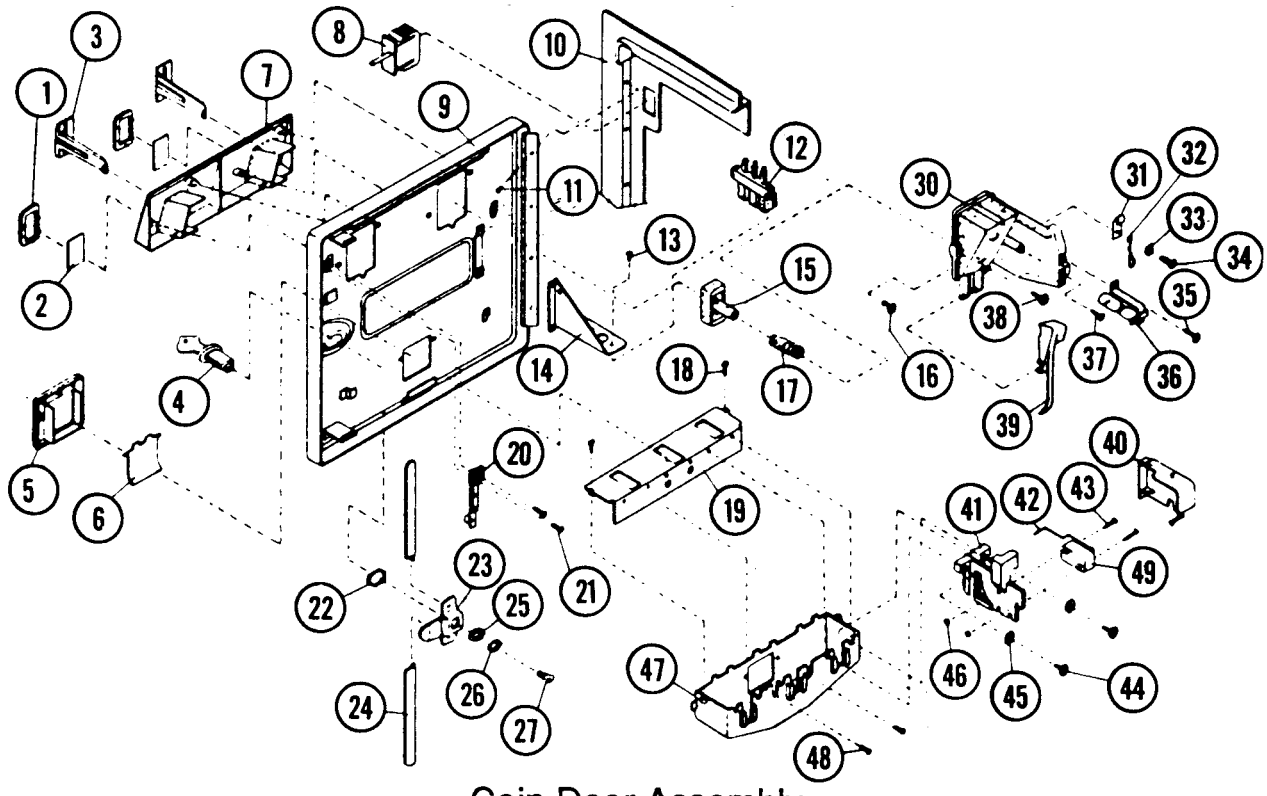
Diverter Assembly
p/n B-13276

Item	Part Number	Description
1	B-13277	Bracket Diverter Assy
2	01-8413	Bracket Coil Mounting
3	4701-00004-00	Lockwasher, #10 (Split)
4	4010-01008-06	Mach. Screw, 10-32x3/8
5	03-7066	Tubing Coil
6	AE-26-1200	Coil Assembly
7	A-10821	Flipper Stop Bracket
8	20-8790	Nylined Bearing
Associated Parts:.		
9	A-13278	Plunger Assembly
10	A-13279	Drive Arm Assembly
11	B-13280	Shaft / Ball Guide Assy

Pinball Front Box Assembly



Coin Door Assembly



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)

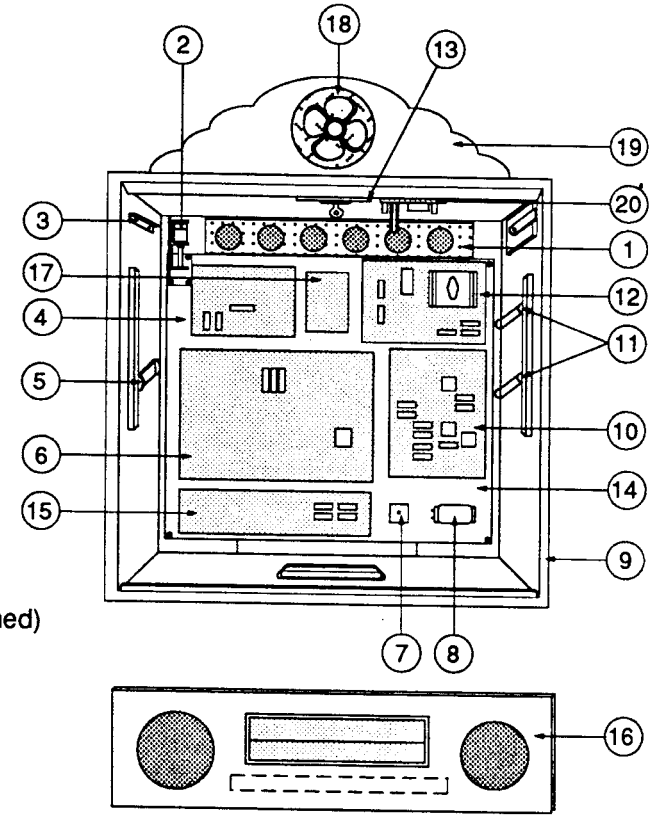
Item	Part No.	Description	Quantity	Item	Part No.	Description	Quantity
1	27-1038	Button Cover	2 or 3	27	27-1019	M/C Screw, 1/4-28 x 5/16	1
2	27-1041-1→54	Price Panel	2 or 3	28	Not Used		
3	27-1026-1→15	Coin Entry Plate	2 or 3	29	Not Used		
4	27-1016	Lock Assembly	1	30	27-1112	Coin Inlet Chute	2 or 3
5	27-1061-1	Coin Return - Bezel	1	31	27-1088	Cable Clamp	2 or 3
6	27-1062	Coin Return Flap	1	32	27-1025	Key Hook	1
7	27-1021	Button Housing - 2-slot	1	33	27-1086	Washer, #6	2 or 3
	27-1022	Button Housing - 3-slot	1	34	27-1078	M/C Screw, 6-32 x 3/8	1 or 2
8	27-1111	Interlock Switch	1		27-1113	M/C Screw, 6-32 x 7/16	1
9	27-1006-1	Coin Door , 2-Slot	1	35	27-1079	Self-tapping Screw, #6 x 1/4	2 or 3
	27-1007-1	Coin Door , 3-Slot	1				
10	27-1005	Coin Door Frame	1	36	27-1084	Lamp Socket	2 or 3
11	27-1003	M/C Screw, 6-32 x 3/16	4		27-1085	Lamp	2 or 3
12	27-1008	Diagnostic Switch	1	37	27-1096	Self-tapping Screw, #5 x 3/8	2 or 3
13	27-1101	M/C Screw, 4-40 x 1/4	2				
14	27-1102	Bracket, Diagnostic Sw	1	38	27-1087	M/C Screw, 6-32 x 5/8	2 or 3
15	27-1037	Button	2 or 3	39	27-1082	Lever Arm	2 or 3
16	27-1078	M/C Screw, 6-32 x 3/8	2 or 3	40	27-1097	Switch Cover	2 or 3
17	27-1039	Conical Spring	2 or 3	41	27-1091-1	Coin Accept Chute	2 or 3
18	27-1079	Self-tapping Screw, #6 x 1/4	2	42	27-1075 or 27-1093	Wire Form (Small) Wire Form (Large)	2 or 3
19	27-1077-1	Coinbox Cover	1				
20	27-1066	Slam Switch	1	43	27-1094	M/C Screw, 4-40 x 7/8	4 or 6
21	27-1067	M/C Screw, 4-40 x 1/2	2	44	27-1087	M/C Screw, 6-32 x 5/8	4 or 6
22	27-1017	Nut (key)	1	45	27-1086	Washer, #6	4 or 6
23	27-1012	Locking Cam	1	46	27-1095	Nut, 4-40 ESNA	4 or 6
24	27-1011	Locking Arm	2	47	27-1076-1	Coin Return Box	1
25	27-1020	Washer	1	48	27-1078	M/C Screw, 6-32 x 3/8	2
26	27-1018	Star Washer	1	49	27-1092	Microswitch	2 or 3

Unique Parts List

Part Number	Description
A-11-574-PL	Playfield & Inserts
A-11-927-574	Backbox Assembly
A-12258-3	8-32 Stud Plate Assy
A-13128-574	Carton Assembly
A-13270	Bell Armature Assy
A-13273-L	Ramp Sup Bracket Assy
A-13273-R	Ramp Sup Bracket Assy
A-13274-L	Left Flipper Return Frame
A-13274-R	Right Flipper Return Frame
A-13278	Plunger Assembly
A-13279	Drive Arm Assy
A-13359	Ball Guide Assembly
A-13360	Ball Guide Assembly
A-13379	Lock Plate Assembly
A-13385	Ball Guide Assembly
A-13415-L	Playfield Plastic Assy
A-13415-R	Playfield Plastic Assy
A-13443	Stop Ball Eject Assy
A-8552-574	Backglass Assembly
A-8567-574	Domestic Cashbox Assy
B-13225	Cellar Kickback Assy
B-13233	Lifting Ramp Assembly
B-13269	Bottom Arch Kicker Assy
B-13276	Ramp Diverter Actuator
B-13280	Diverter Arm & Shaft Assy
B-13289	3-Switch & Bracket Assy
B-13300	Switch & Bracket Assy
B-13319	Ball Guide Assembly
B-13320	Ball Guide Assembly
B-13333	Ball Guide Assembly
B-13339	Spinning Target Assy
B-13349	Left Cellar Loop
B-13350	Right Cellar Loop & Runway
B-13351	R Ramp L Entry Ball Guide
B-13377	Cellar Sign Bridge Assy
B-13399	R Ramp R Entry Ball Guide
B-13416	Playfield Plastic Assy
B-13417	Playfield Plastic Assy
B-13418	Playfield Plastic Assy
B-13419	Playfield Plastic Assy
B-13420	Playfield Plastic Assy
B-13421	Playfield Plastic Assy
B-13422	Playfield Plastic Assy
B-13423	Playfield Plastic Assy
B-13424	Ramp Cover Assy
B-9414-3	Red Jet Bumper Assy
C-13205-1	3-Bnk Opto Board
C-13281	6-Lamp PCB
C-13282	8-Lamp PCB
C-13283	6-Lamp PCB
C-13284-1	8-Lamp PCB
C-13287	Sound O/L Assembly
C-13310	Motor EMI Filter Assy
C-13311-R	1-Bnk Opto Board
C-13312-1	1-Bnk Drop Target Assy
C-13317	Ball Guide Assy
C-13318	Ball Guide Assy
C-13321	Single Flashlamp Assy
C-13332	Ball Guide Assy
C-13334	Ball Guide Assy
C-13335	Ball Guide Assy
D-11920-13	574-Mech Panel Assy
D-13191	Wire Chute Assy
D-13199	Wheels Drive Assembly
D-13356	Back Panel Lamp Bd
D-13383	Ball Guide Assy
D-13384	Ball Guide Assy
R-13129	Left Ramp Assy
R-13190	Right Ramp Assy
01-9510	Plate-Post Adj #8
01-9511	Plate-Post Adj #8
01-9521	Ball Guide
02-4252-32	Spacer, 2"
02-4334-14	Mounting Post, 3.25
02-4334-15	Mounting Post, 3.19
02-4335-12	Mounting Post, 1.38
02-4418	Shaft
02-4423	Bumper Post
02-4424-1	Post, #6-32 / #8-32
02-4424-2	Post, #6-32 / #8-32
02-4425-1	Post, #8-32 / #8-32
02-4425-2	Post, #8-32 / #8-32
02-4426-1	Post, #6-32 / #8 SMS
02-4429	Crank Pin
02-4433	Post, #8 x 1-3/16"
02-4434	Post, #8 x 1"
02-4435	Post, #8 x 1-3/16
02-4436-1	F-F Spacer, 8-32 x 1"
02-4436-2	F-F Spacer, 8-32 x 2.31"
02-4436-3	F-F Spacer, 8-32 x 2.69"
02-4436-4	F-F Spacer, 8-32 x 3.12"
31-1002-574	Screened Playfield
31-1006-574	Playfield Plastic Complete
31-1006A-574	Playfield Plastic Sheet
31-1008-574	Screened Bottom Arch
31-1009-574	Screened Shooter Plate
31-1357-574	Screened Backglass
31-1463-574	Drop Target Decal Set
31-1536-574	Wheels Drive Decals
31-1539-574	Ramp Decal Sheet (Top)
31-1540-574	Ramp Decal Sheet (Bottom)

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-11883-574*	System 11B CPU Board
7	5100-09418-00	Bridge Rectifier, 100v, 35A.
8	5040-09051-00	Capacitor, 30,000 µFd, 25v
9	A-11-927-574	***Whirlwind***, Backbox
10	D-12247-574*	Aux. Pwr Driver Board
11	01-9047	Insert Stop Bracket
12	D-12246*	Power Supply Assembly
13	20-9637	Lock & Cam Kit
14	D-11581-574*	Audio Board Assembly
15	D-12313-574*	Backbox Interconnect Board
16	D-13355	Speaker/Display Assembly
a)	31-1422-574	Speaker Grille (Screened)
b)	31-1420-574	Speaker Panel Cover (Screened)
c)	D-12232-1*	Master Display Sub-Assembly
d)	D-12501	7-Lamp Speaker Panel Assy
e)	5555-12068-00	Speaker 4" Piezo, 50w
f)	5555-12015-00	Speaker, 4Ω, 6" RD 10w
17	C-13287*	Sound O/L Solenoid Board
18	C-13459	Fan Assembly
18a)	14-7956	Blower Motor
18b)	03-8375	Fan Blade
18c)	01-9531	Mounting Bracket
19	03-8374	Cloud
20	C-13088*	Triac Driver Assembly



* Refer to Individual Unit's Parts List

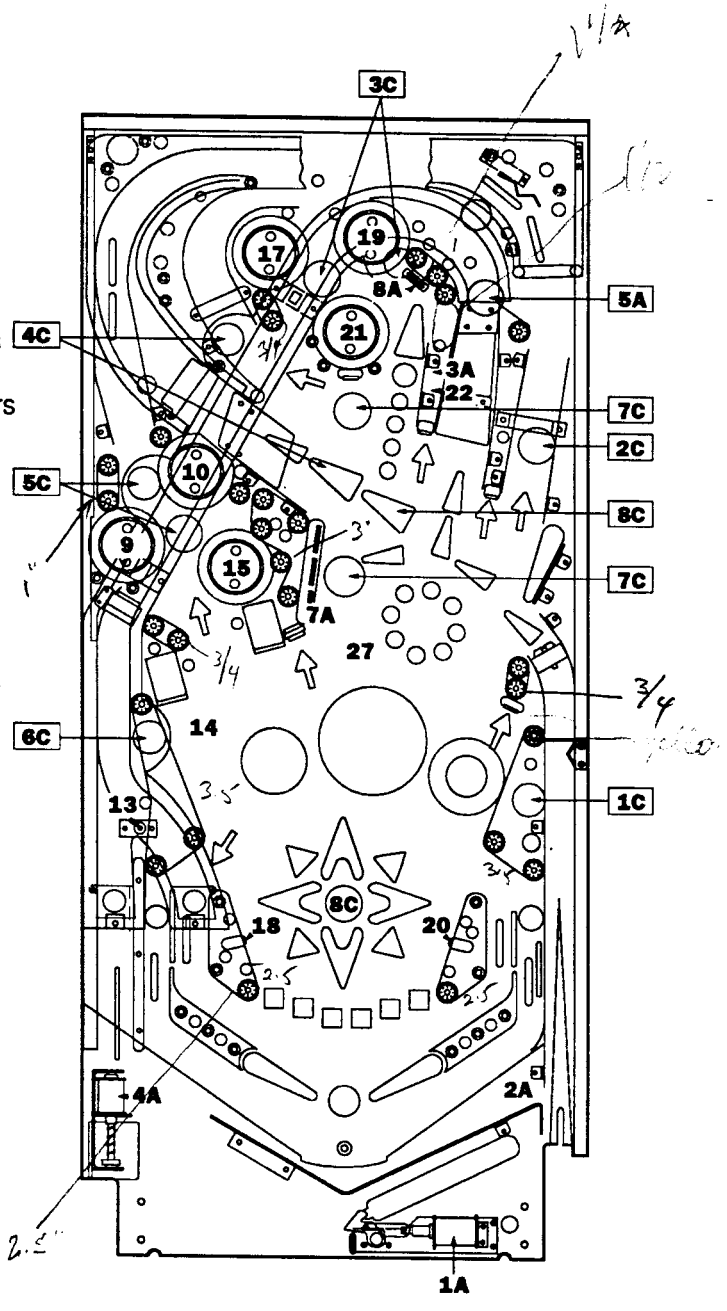
Miscellaneous *Whirlwind* Parts

Part Number	Description
A-8552-574	Backglass Assembly
31-1357-574	***Whirlwind***, Backglass
03-7960-574	Playfield Mylar
08-7028-T	Glass-Playfield
08-7456	Backbox Glass, 27 x 18-7/8
31-1002-574	Playfield (Screened)
31-1006-574	Playfield Plastics
31-1006A-574	Playfield Plastic (Screened)
31-1008-574	Bottom Arch (Screened)
31-1009-574	Shooter Plate (Screened)
31-1019-554	Spin Target (Screened)
31-1524-	Gear Decals Set

Part Number	Description
574-IN	***Whirlwind***, Insert
01-6571	Hinge Mtg. Bracket, Insert Board
01-6655	Latch-Insert Board
01-6652	Stop Bracket
31-1463-574	Drop Target Decals Set
31-1539-574	Decal Sheet - Ramp Top
31-1540-574	Decal Sheet - Ramp Bottom
31-1422-574	Speaker Grille (Screened)
5795-10937-09	Ribbon Cable, 20-Conductor, 9"
5795-10938-27	Ribbon Cable, 26-Conductor, 27"
5795-09453-00	Ribbon Cable, 20-Conductor, 12"

Solenoids/Flashers

Item	Part No.	Description
1A	AE-23-800	Outhole Kicker
1C	#906 Flashlamp	Bottom Right Flasher
2A	AE-23-800	Shooter Lane Feeder
2C	#906 Flashlamp	Spinner Flasher
3A	AE-24-900	Right Ramp Entry Lifter
3C	#906 Flashlamps	Ramp Top & Upr Jets Flashers
4A	AE-23-800	Left Locking Kickback
4C	#906 Flashlamps	Ramp Upr Mdl & Million Flashers
5A	AE-23-800	Top Right Eject
5C	#906 Flashlamps	Ramp Lwr Mdl / Lwr Jets Flashers
6A	AE-23-800	Knocker (Backbox)
6C	#906 Flashlamp	Ramp Bottom (L P'fld) Flasher
7A	AE-26-1200	3-Bank Drop Target Reset
7C	#906 Flashlamps	3-Dr Tgt & Mdl Target Flashers
8A	AE-23-800	1-Bank Drop Target Reset
8C	#906 Flashlamps	Million + & Compass Flashers
9	AE-23-800	Left Bottom Jet Bumper
10	AE-23-800	Top Bottom Jet Bumper
11	5580-12145-00*	Upper Playfield Gnl Illum Relay *
12	5580-09555-01	Solenoid A/C Select Relay**
13	AE-26-1200	Ramp Diverter
14	AE-26-1500	Cellar Kickback
15	AE-23-800	Right Btm Jet Bumper
16	* & ***	Lwr P'fld & B'box G I Relays
17	AE-23-800	Left Top Jet Bumper
18	AE-26-1500	Left Kicker ("Sling")
19	AE-23-800	Right Top Jet Bumper
20	AE-26-1500	Right Kicker ("Sling")
21	AE-23-800	Lower Top Jet Bumper
22	SM-26-600-DC	Right Ramp Entry Down
23	#906 Flashlamps	Left Lightning (BP) Flashers
24	14-7956/Triac	Blower Motor (Backbox)
25	#906 Flashlamps	Mdl Thunder (BP) Flasher
26	#906 Flashlamps	Right Thunder (BP) Flashers
27	14-7955	Wheels Spinner Motor
-	FL 11630/50VDC	Lower Left & Right Flippers
-	FL 11630/50VDC	Upper Right Flipper



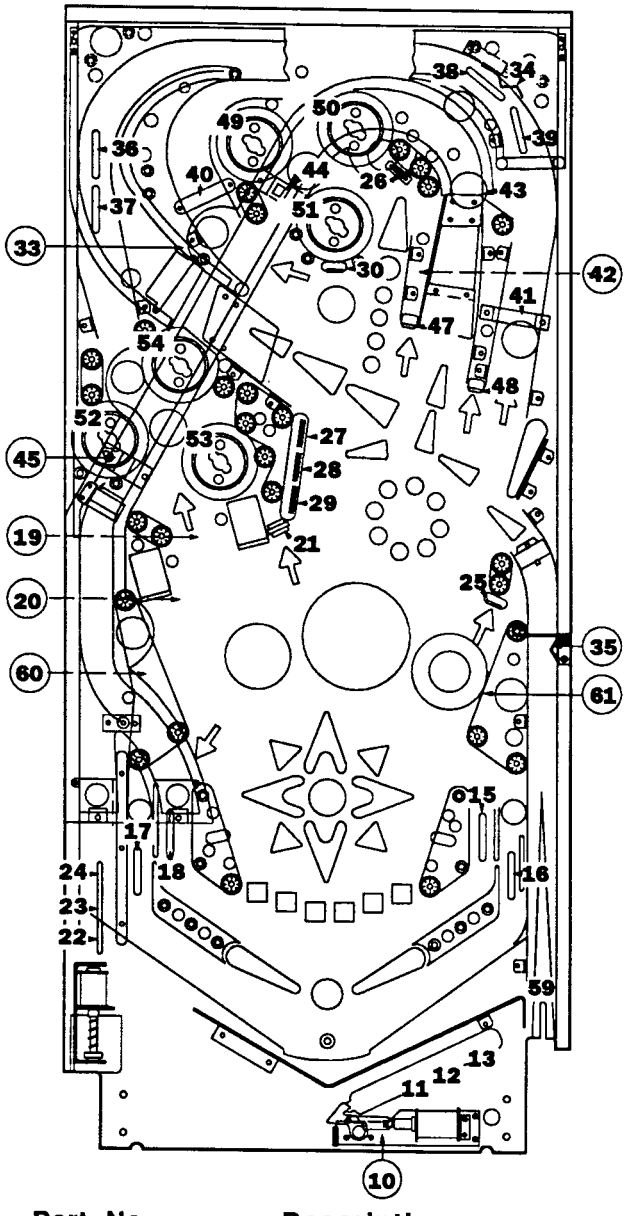
* - 5580-12145-00 on Relay Board, C-11902-1, for both Upr & Lwr Playfield Gen Illiumination applications.
** - In backbox on Aux Power Driver Bd, D-12247-574.
*** - 5580-09555-01 on Relay Board, C-11998-1, for Insert Bd Gen Illumination.

Rubber Parts

Part No.	Description	Qty	Part No.	Description	Qty	Part No.	Description	Qty
23-6300	5/16" Ring	3	23-6305	2" Ring	2	23-6519-4	Lg Red Flpr Ring	6
23-6301	3/4" Ring	4	23-6306	2-1/2" Ring	2	23-6552	Sleeving, Yel	1
23-6302	1" Ring	2	23-6308	3-1/2" Ring	4	23-6556	Sleeving, Blk	7
23-6303	1-1/4" Ring	3	23-6313-1	Grommet	1	23-6626	Grommet	5
23-6304	1-1/2" Ring	6	23-6327	Shooter Tip	1	23-6629	Bumper Pad	2

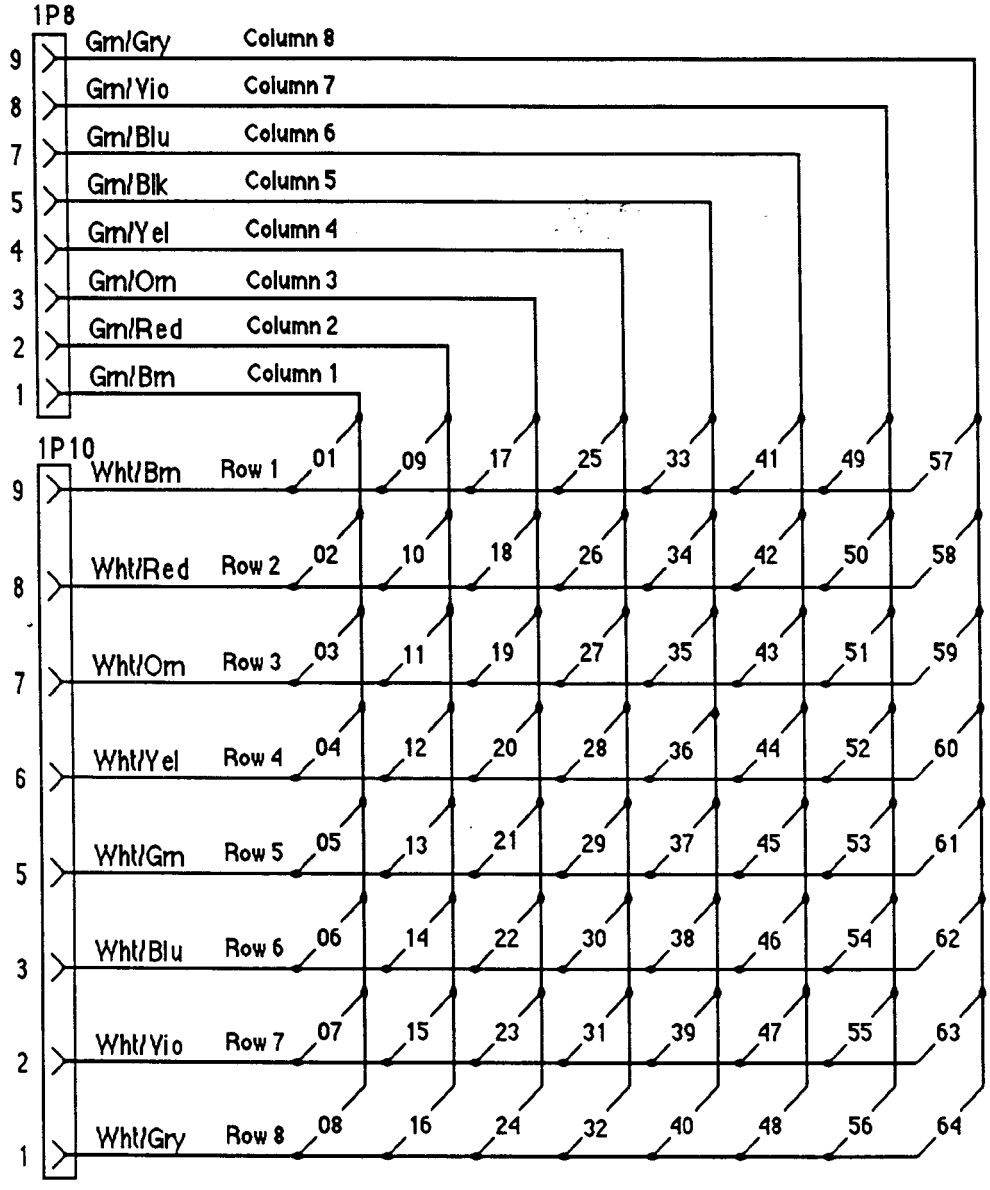
Switches

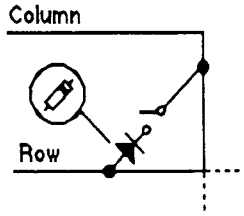
Item	Part No.	Description
1	(See Figure 2)	Plumb Bob Tilt
2	5580-09555-01	C Power-A/C Relay
3	SW-1A-126	Game Start (Credit) Button
4	27-1092	R Coin Chute (USA)
5	Not Used (USA)	Center Coin Chute
6	27-1092	L Coin Chute (USA)
7	27-1066	Slam Tilt
8	27-1008	High Score Reset*
9	Not Used	
10	5647-12133-12	Outhole
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	Not Used	
15	5647-12073-19	Right Return Lane
16	5647-12073-19	Right Drain Lane
17	5647-12073-19	Left Drain Lane
18	5647-12073-19	Left Return Lane
19	5647-12073-25	Right Cellar
20	5647-12073-25	Left Cellar
21	B-12583-6	Left Standup
22	5647-12073-32	Left Lock 1 (lwr)
23	5647-12073-33	Left Lock 2 (mid)
24	5647-12073-34	Left Lock 3 (upr)
25	B-11696-15	Right Standup
26	p/o C-13311	1-Bank Drop Target Opto
27	p/o C-13205-1	3-Bank Drop Target Opto
28	p/o C-13205-1	3-Bank Drop Target Opto
29	p/o C-13205-1	3-Bank Drop Target Opto
30	B-11696-5	Middle Standup
31	Not Used	
32	Not Used	
33	5647-12073-11	Enter Left Ramp
34	5647-12133-04	L Ramp Score (top)
35	5647-12073-21	L Ramp Score (btm)
36	5647-12073-19	Left Loop (top)
37	5647-12073-19	Left Loop (btm)
38	5647-12073-19	Right Loop (top)
39	5647-12073-19	Right Loop (btm)
40	5647-12133-08	Inner Loop
41	5647-12133-08	Spinner
42	5647-12001-00	Right Ramp Down
43	5647-12133-11	Top Right Eject
44	5647-12073-21	R Ramp Score (top)
45	5647-12073-21	R Ramp Score (btrm)
46	Not Used	
47	B-12583-6	Left Standup (R Ramp)
48	B-12583-4	Right Standup (R Ramp)
49	B-12030-2	Left Top Jet Bumper
50	B-12030-2	Right Top Jet Bumper
51	B-12030-2	Lower Top Jet Bumper
-	SW-10A-48	Left Flipper Button



Item	Part No.	Description
52	B-12030-2	Left Bottom Jet Bumper
53	B-12030-2	Right Bottom Jet Bumper
54	B-12030-2	Upper Bottom Jet Bumper
55	-	BL Kicker***
56	-	BR Kicker***
57	-	R Flipper Lane Change**
58	-	L Flipper Lane Change**
59	5647-12073-04	Ball Shooter Lane
60	5647-12133-13	Left 110 Point
61	5647-12133-13	Right 110 Point
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]



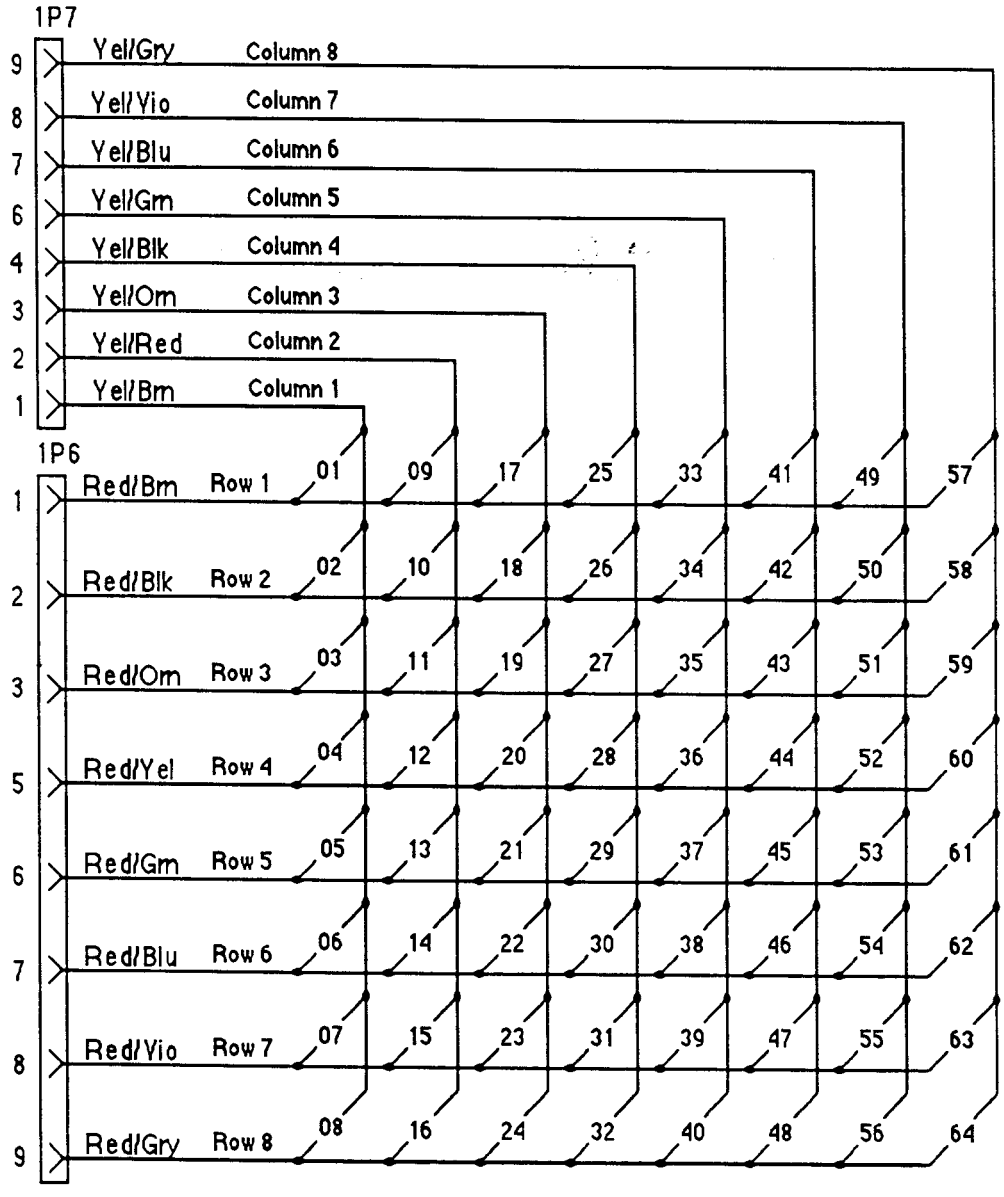


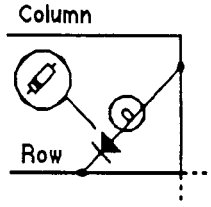
Typical Switch Circuit

WHIRLWIND Switch-Matrix Table

ROW \ COLUMN	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	9	Left Outlane 17	Right Standup 25	Enter Left Ramp 33	Spinner 41	Top Jets (left) 49	Flipper Right 57
2 WHT-RED 1J10-8	C Side Power A/C Relay 2	Outhole 10	Left Return Lane 18	Top Sngl DropTarget 26	L Ramp Score (top) 34	Right Ramp Down 42	Top Jets (right) 50	Flipper Left 58
3 WHT-ORN 1J10-7	Game Start 3	Ball Trough #1 (left) 11	Right Cellar 19	M 3-Bank Dr Tgt (lwr) 27	L Ramp Score (bot) 35	TR Eject 43	Top Jets (bot) 51	Shooter Lane 59
4 WHT-YEL 1J10-6	Right Coin Chute 4	Ball Trough #2 (mid) 12	Left Cellar 20	M 3-Bank Dr Tgt (mid) 28	Left Loop (top) 36	R Ramp Score (top) 44	Btm Jets (left) 52	Left 110 Point 60
5 WHT-GRN 1J10-5	Center Coin Chute 5	Ball Trough #3 (right) 13	Left Standup 21	M 3-Bank Dr Tgt (top) 29	Left Loop (bot) 37	R Ramp Score (bot) 45	Btm Jets (right) 53	Right 110 Point 61
6 WHT-BLU 1J10-3	Left Coin Chute 6	14	Left Lock 1 (lwr) 22	Middle Standup 30	Right Loop (top) 38	46	Btm Jets (top) 54	62
7 WHT-VIO 1J10-2	Slam Tilt 7	Right Return Lane 15	Left Lock 2 (mid) 23	31	Right Loop (bot) 39	L Standup (R Ramp) 47	BL Kicker ("sling") 55	63
8 WHT-GRY 1J10-1	High Score Reset 8	Right Outlane 16	Left Lock 3 (top) 24	32	Inner Loop 40	R Standup (R Ramp) 48	BR Kicker ("sling") 56	64

BL = Bottom Left BR = Bottom Right TR = Top Right



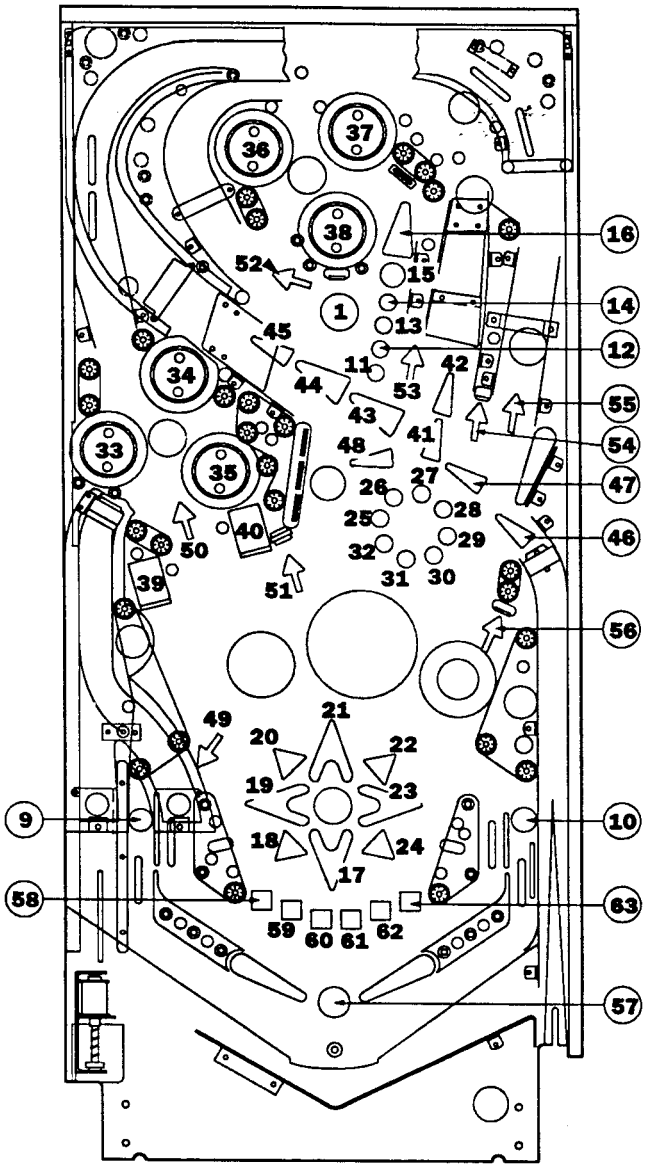


Typical Lamp Circuit

WHIRLWIND Lamp-Matrix Table

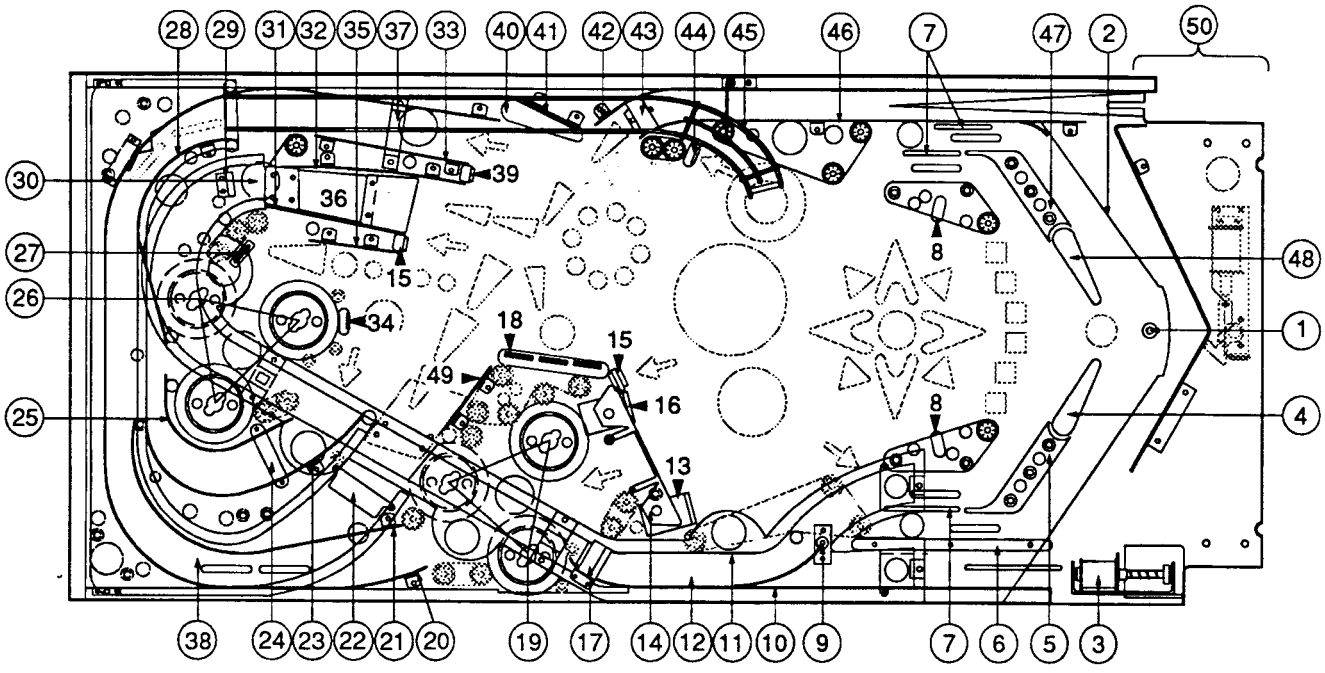
COLUMN / ROW	1 Q66 YEL-BRN 1J7-1	2 Q64 YEL-RED 1J7-2	3 Q62 YEL-ORN 1J7-3	4 Q60 YEL-BLK 1J7-4	5 Q58 YEL-GRN 1J7-6	6 Q56 YEL-BLU 1J7-7	7 Q54 YEL-VIO 1J7-8	8 Q52 YEL-GRY 1J7-9
Q80 1 RED-BRN 1J6-1	Middle Standup 1	Left Outlane 9	S Arrow 17	Toll 1 25	Btm Jets Left 33	R Ramp Lock 41	L Return Lane 49	Shoot Again 57
Q81 2 RED-BLK 1J6-2	Up Jets On (Backglass) 2	Right Outlane 10	S W Arrow 18	Toll 2 26	Btm Jets Top 34	R Ramp Double 42	Left Loop 50	2X 58
Q82 3 RED-ORN 1J6-3	250K (Backglass) 3	Top Drop 50K 11	W Arrow 19	Toll 3 27	Btm Jets Right 35	L Ramp Million Plus 43	Left Standup 51	3X 59
Q83 4 RED-YEL 1J6-5	Ex. Ball On (Backglass) 4	Top Drop 75K 12	N W Arrow 20	Toll 4 28	Top Jets Left 36	L Ramp Million 44	Inner Loop Arrow 52	4X 60
Q84 5 RED-GRN 1J6-6	3-Bank 100K (Backglass) 5	Top Drop 100K 13	N Arrow 21	Toll 5 29	Top Jets Right 37	L Ramp Release 45	L Return Lane 53	5X 61
Q85 6 RED-BLU 1J6-7	500K (Backglass) 6	Top Drop 150K 14	N E Arrow 22	Toll 30 30	Top Jets Btm 38	Skill Shot Right 46	R Ramp R Stndup 54	6X Lites Ex. Ball 62
Q86 7 RED-VIO 1J6-8	Lite Million (Backglass) 7	Top Drop Quick 15	E Arrow 23	Toll 20 31	L Cellar Arrow 39	Skill Shot Mid 47	Right Loop 55	6X Lites Special 63
Q87 8 RED-GRY 1J6-9	Low Jets On (Backglass) 8	Top Drop Ex. Ball 16	S E Arrow 24	Toll 10 32	R Cellar Arrow 40	Skill Shot Left 48	Right Standup 56	Right Spinner 64

Lamps



Lamp	Location/Description
1	Middle Standup
2	Up Jets On (Backglass)
3	250K (Backglass)
4	Ex. Ball On (Backglass)
5	3-Bank 100K (Backglass)
6	500K (Backglass)
7	Lite Million (Backglass)
8	Low Jets On (Backglass)
9	SPECIAL (Left Outlane)
10	SPECIAL (Right Outlane)
11	Top Drop 50K
12	Top Drop 75K
13	Top Drop 100K
14	Top Drop 150K
15	Top Drop QUICK
16	Top Drop Ex. Ball
17	S Compass Arrow
18	S W Compass Arrow
19	W Compass Arrow
20	N W Compass Arrow
21	N Compass Arrow
22	N E Compass Arrow
23	E Compass Arrow
24	S E Compass Arrow
25	Toll 1
26	Toll 2
27	Toll 3
28	Toll 4
29	Toll 5
30	Toll 30
31	Toll 20
32	Toll 10
33	Left Bottom Jet Bumper
34	Top Bottom Jet Bumper
35	Right Bottom Jet Bumper
36	Left Top Jet Bumper
37	Right Top Jet Bumper
38	Lower Top Jet Bumper
39	Left Cellar Sign
40	Right Cellar Sign
41	LOCK (Right Ramp)
42	2 TOLLS (Right Ramp)
43	MILLION PLUS (L Ramp)
44	MILLION (Left Ramp)
45	RELEASE (Left Ramp)
46	SHOT (Skill Shot Right)
47	SKILL (Skill Shot Middle)
48	SUPER (Skill Shot Left)
49	NE (Left Return Lane)
50	SW (Left Loop)
51	NW (Left Standup)
52	SW (Inner Loop Arrow)
53	NW (L Standup-R Ramp)
54	NE (R Standup-R Ramp)
55	SE (Right Loop)
56	SE (Right Standup Target)
57	Shoot Again
58	2X
59	3X
60	4X
61	5X
62	6X Lites Ex. Ball
63	6X Lites Special
64	Spinner

Playfield Parts



Item	Part No.	Description
1	02-4003	Post
a)	23-6300	Rubber
2	12-6842	Bottom Arch Fence
3	B-13269	Left LOCK Kickback
4	C-11626-L-3	Lwr Left Flipper Assembly
a)	20-9250-6	Lg Flipper Paddle & Shaft
5	A-13274-L	Left Flipper Return Frame
6	01-9521	Ball Guide
7	12-6466-10	Wireform
8	B-12665	Kicker Arm ("Sling") Assembly
a)	B-11203-R-1	Coil & Bracket Assembly
9	B-13280	Diverter Arm & Shaft Assembly
a)	B-13276	Diverter Actuator Assembly
10	C-13318	Ball Guide Assembly
11	B-13319	Ball Guide Assembly
12	R-13190	Right Ramp Assembly
13	B-13349	Left Cellar Loop
a)	B-13225	Cellar Kickback Assembly
14	B-13377	Cellar Sign Bridge Assembly
15	B-12583-6	Oblong Yellow Standup Target
16	B-13350	Right Cellar Loop & Runway
17	A-8244-L	One-way Ball Gate
18	C-11223-1	3-Bank Drop Target
a)	C-13205-1	3-Bank Opto Board
19	B-9414-2	Yellow Jet Bumper
a)	B-9415-1	Bumper Coil/Bracket Assembly
20	D-13384	Ball Guide Assembly
21	C-13335	Ball Guide Assembly
22	A-12506	Ball Gate Assembly
a)	12-6824	Gate Wire
23	C-13334	Ball Guide Assembly
24	A-13376	Ball Gate Assembly
a)	12-6505	Gate Wire
b)	12-6785	Switch Actuating Wire
25	B-13333	Ball Guide Assembly
26	B-9414-3	Red Jet Bumper
a)	B-9415-1	Bumper Coil/Bracket Assembly

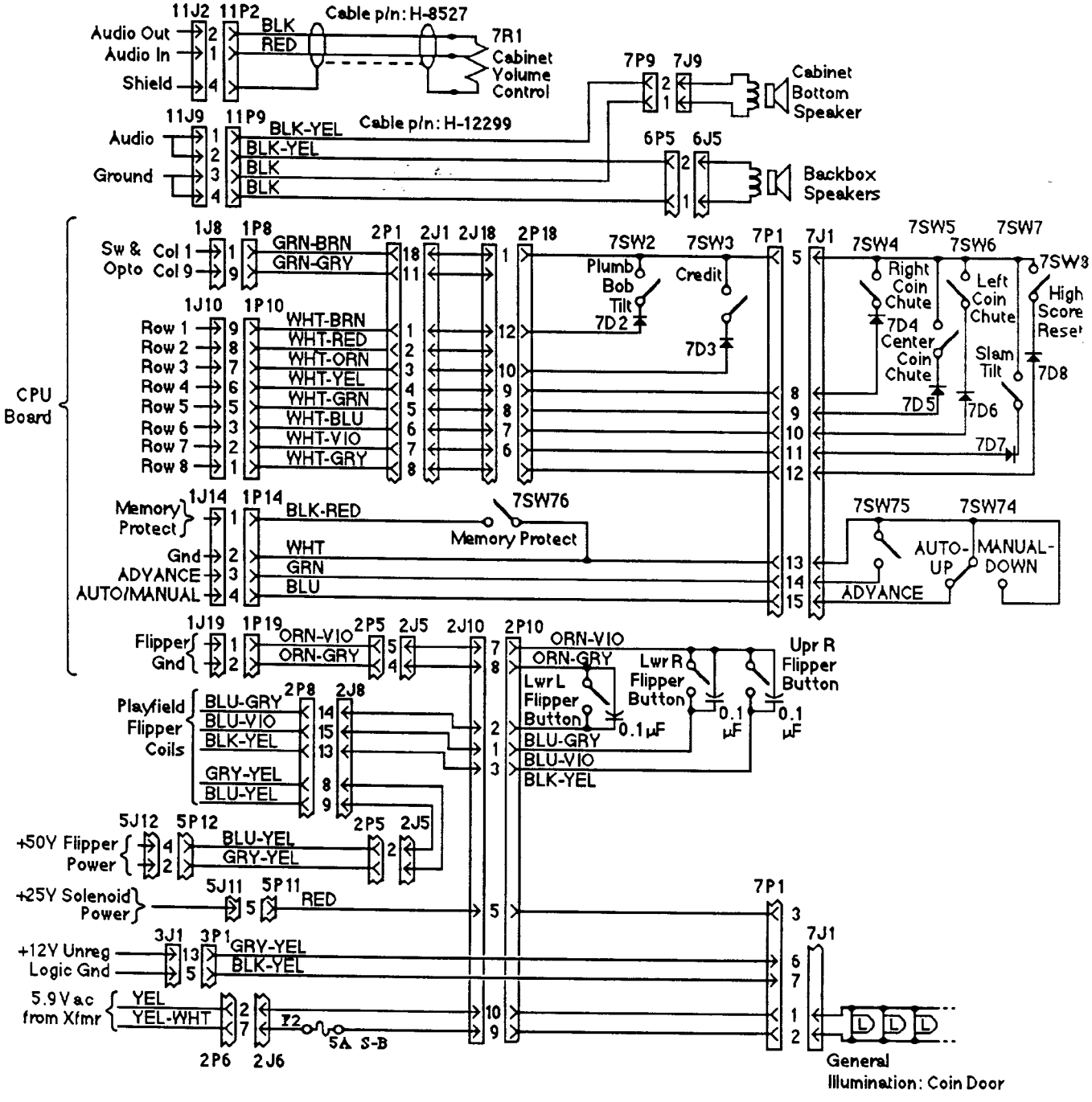
Item	Part No.	Description
27	C-13312-1	1-Bank Drop Target
a)	C-13311	1-Bank Opto Board
28	C-13332	Ball Guide Assembly
29	01-9522	Eject Hole Ball Deflector
30	B-9361-R	Top Right Eject Hole
a)	B-9362-L-1	Coil & Bracket Assembly
b)	03-7351-1-9	Tr Red Plastic Ball Seat
31	B-13351	R Ramp L Entry Ball Guide
32	B-13399	R Ramp R Entry Ball Guide
33	B-13320	Ball Guide Assembly
34	B-11696-5	Mdl (Round White)Standup Target
35	A-13359	Ball Guide Assembly
36	B-13233	Lifting Ramp Assembly
37	B-13339	Spinner Assembly
a)	12-6780	Switch Actuator Wire
38	R13129	Left Ramp Assembly
39	B-12583-4	R Ramp (Oblong Red) Standup Target
40	C-11626-R-3	Upper Right Flipper Assembly
a)	20-9250-6	Flipper Arm on Shaft
41	A-13385	Ball Guide Assembly
42	D-13383	Ball Guide Assembly
43	A-8244-R	One-way Ball Gate
44	B-11696-15	R (Round Orange) Standup Target
45	D-13191	Wire Chute Assembly
46	C-13317	Ball Guide Assembly
47	A-13274-R	Right Flipper Return Frame
48	C-11626-R-3	Lower Right Flipper Assembly
a)	20-9250-6	Flipper Arm on Shaft
49	A-13360	Ball Guide Assembly
50	Parts below are located beneath Bottom Arch:	
a)	B-8623	Upper Trough Baffle Assembly
b)	C-8235	Lower Trough Baffle Assembly
c)	12-6542	Baffle Wire
d)	01-3569-1	Ball Trough (runway)
e)	01-5575	Bottom Arch Mounting Bracket
f)	B-8039-2	Outhole Kicker Assembly

Section 3
Reference Diagrams & Schematics

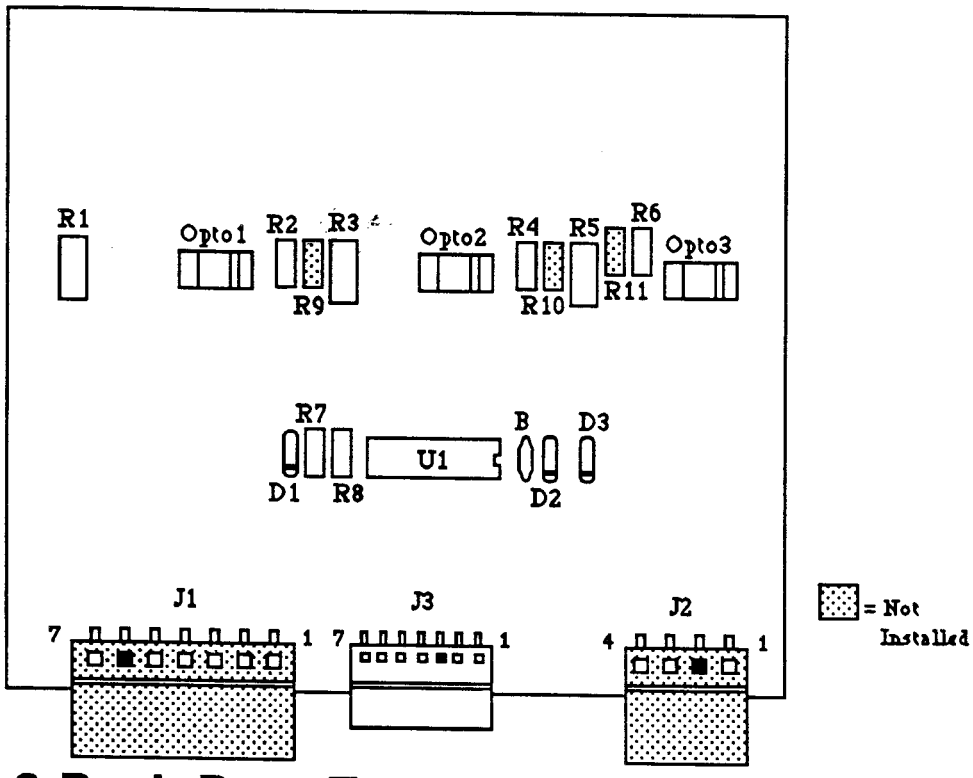
- **Diagrams and Schematics:**

  Cabinet Wiring
  3-Bank Opto Board
  Sound Overlay Solenoid Board
  Triac PCB Assembly
  1-Bank Opto Board
  Power Supply Board
  System 11B 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**

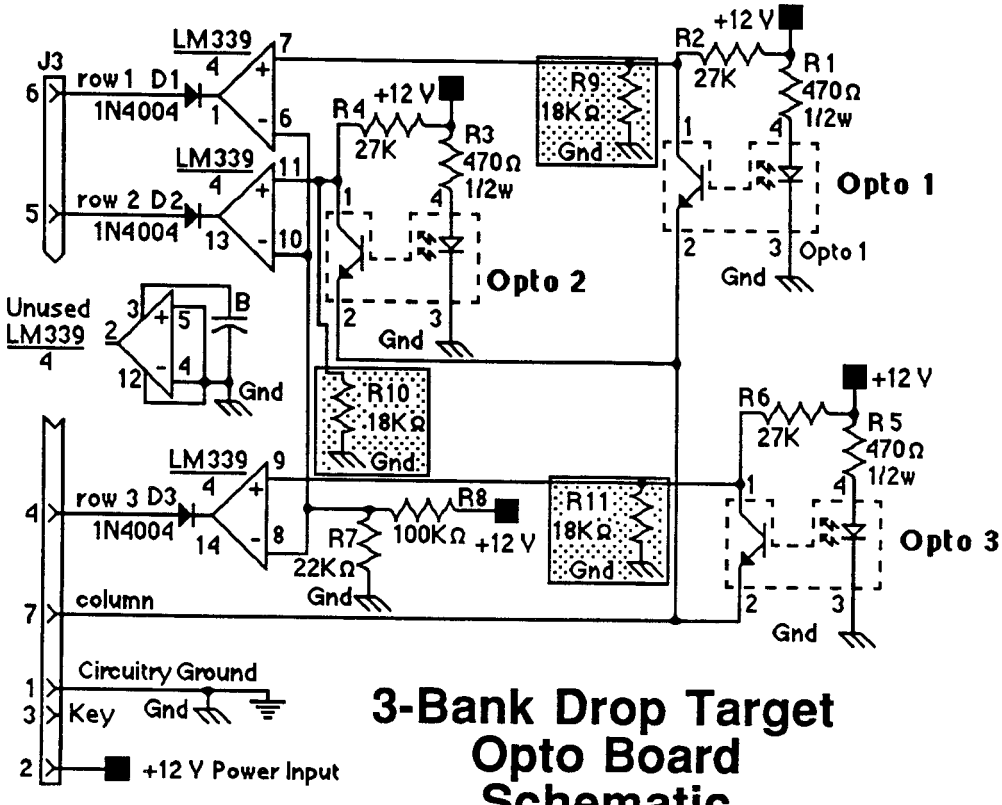


Whirlwind Cabinet Wiring



3-Bank Drop Target Opto Board

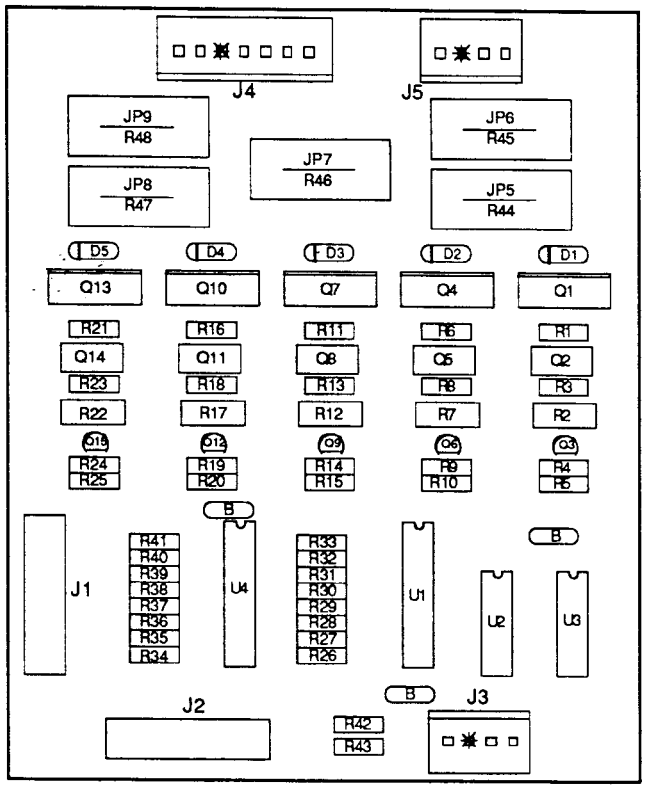
p/n C-13205

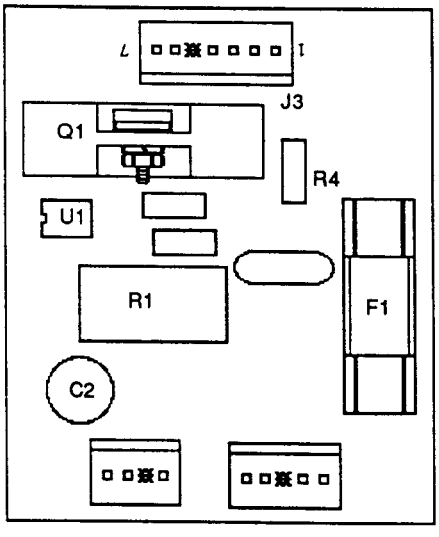


3-Bank Drop Target Opto Board Schematic

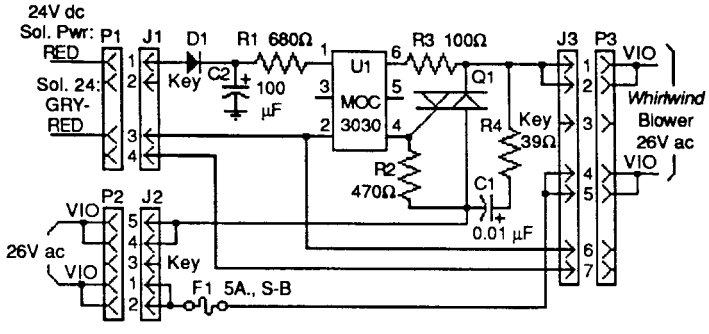
Sound Overlay Solenoid Board
p/n C-13287

(Schematic on next page)

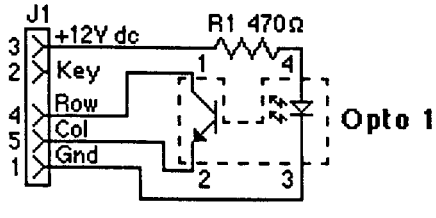




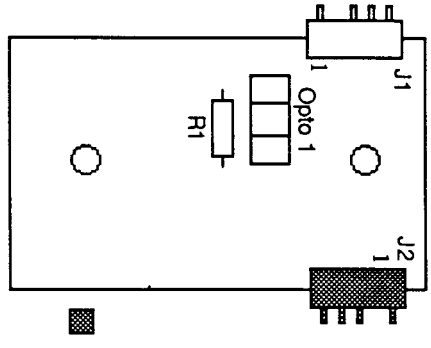
Triac PCB Assembly
p/n C-13088



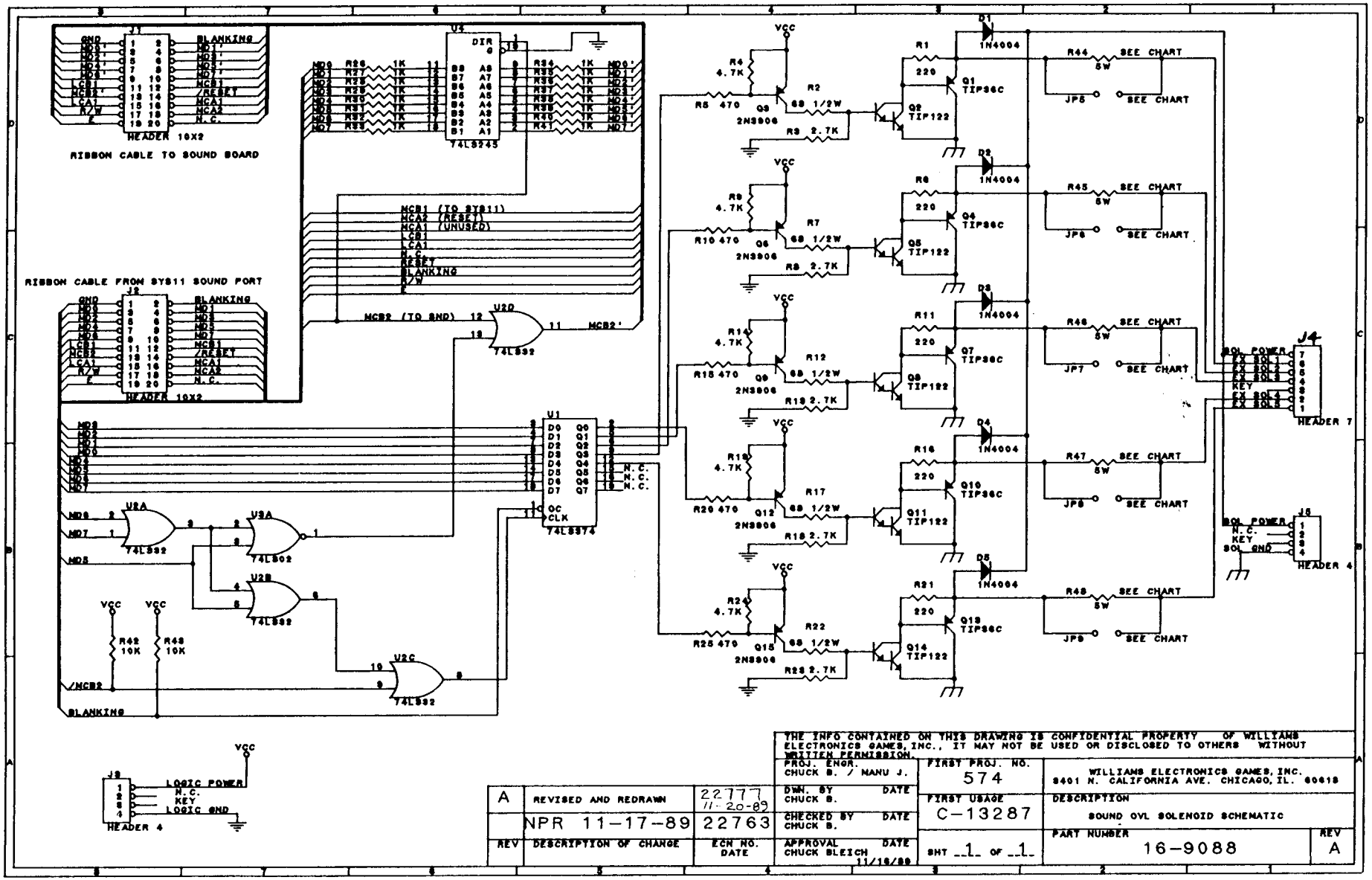
Triac PCB Assembly Schematic



1-Bank Drop Target Opto Board Schematic



1-Bank Drop Target Opto Board
p/n C-13311-R



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REV	DESCRIPTION OF CHANGE	ECN NO. DATE
A	REVISED AND REDRAWN	22777 11-20-89
	NPR 11-17-89	22763

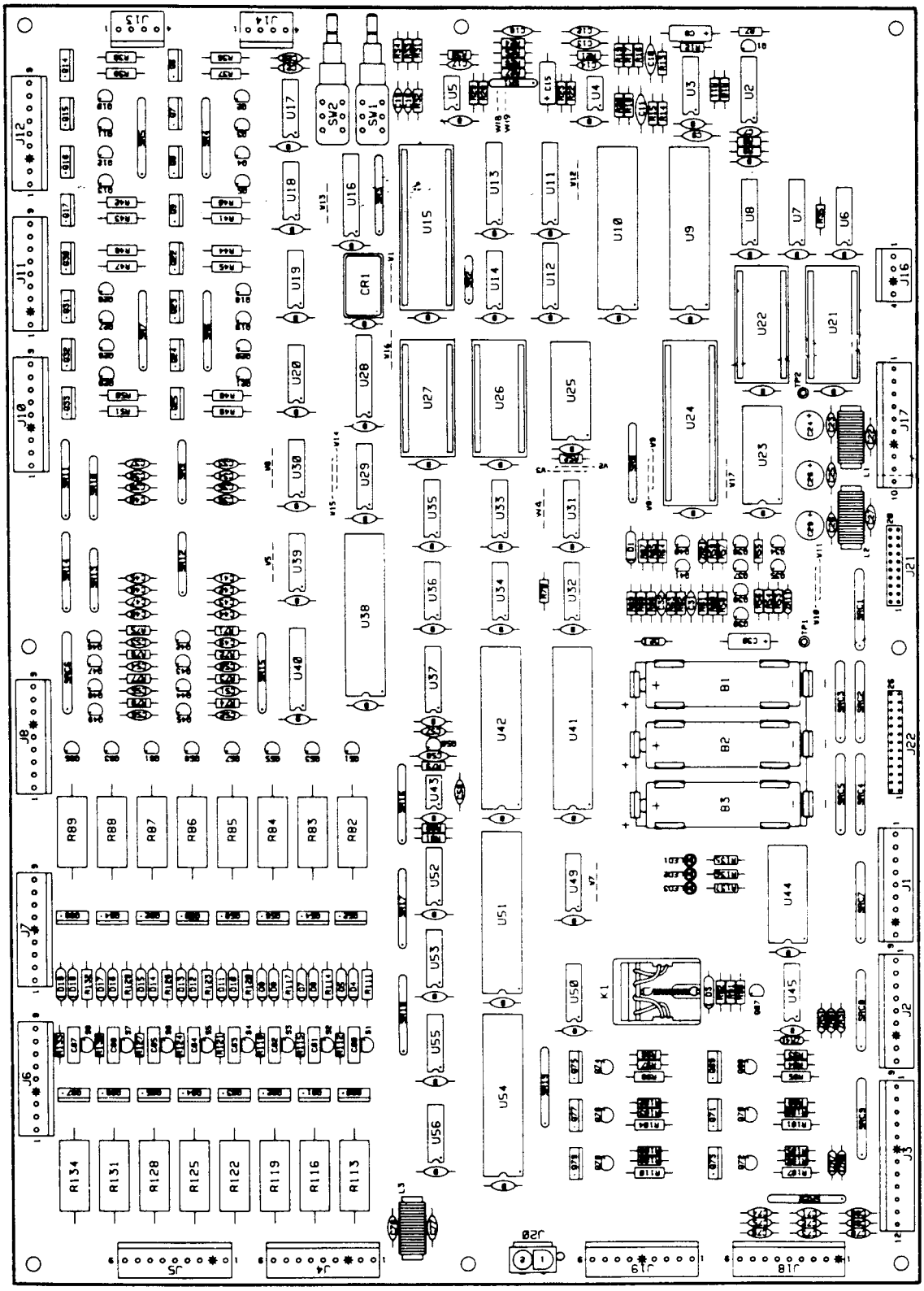
PROJ. ENGR. CHUCK B. / MANU J.
DWN. BY CHUCK B. DATE
CHECKED BY CHUCK B. DATE
APPROVAL CHUCK BLEICH DATE 11/16/89

FIRST PROJ. NO. 574
FIRST USAGE C-13287
SHT 1 OF 1

WILLIAMS ELECTRONICS GAMES, INC.
9401 N. CALIFORNIA AVE. CHICAGO, IL. 60618

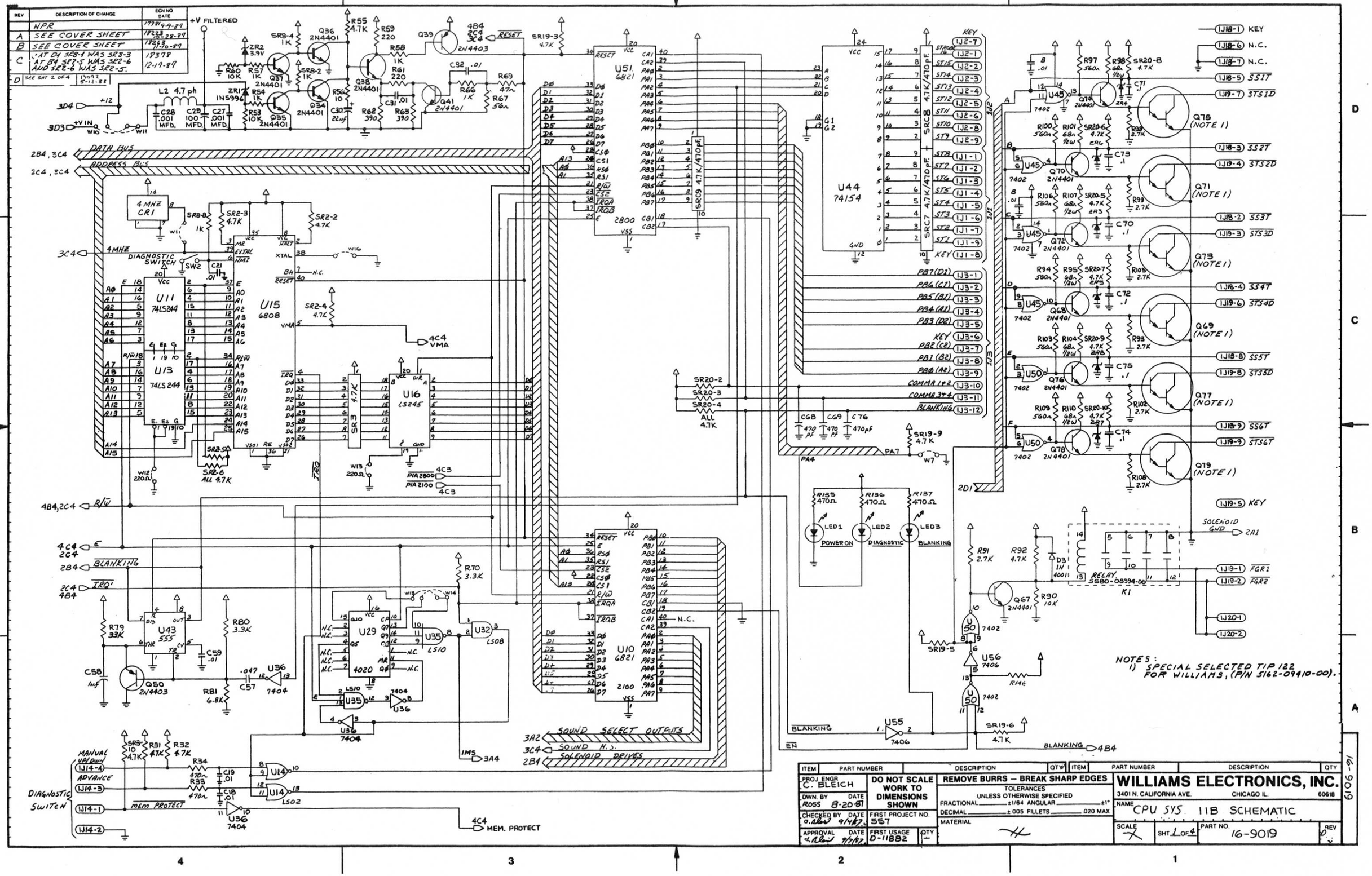
DESCRIPTION
SOUND OVL SOLENOID SCHEMATIC

PART NUMBER 16-9088 REV A



SYSTEM 11B CPU BOARD
p/n D-11883

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	NPR	19999 9-9-87
A	SEE COVER SHEET	19223 10-28-87
B	SEE COVER SHEET	19243 11-10-87
C	AT D4 SR8-1 WAS SR8-3 AT B4 SR2-5 WAS SR2-6 AND SR2-6 WAS SR2-5.	19378 12-17-87
D	SEE SHT 2 OF 4	19612 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 8-20-87 | CHECKED BY C. Bleich 9/4/87 | APPROVAL C. Bleich 9/7/87

FIRST PROJECT NO. 557 | FIRST USAGE D-11882 | QTY 1

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ± .005 FILLETS .020 MAX
MATERIAL

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL. 60618

NAME CPU SYS. 11B SCHEMATIC

SCALE X | SHT 1 OF 4 | PART NO. 16-9019 | REV D

16-9019

System 11B CPU Schematic (16-9019, Sheet 1 of 4)

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	NPR	17981/9-9-86
A	SEE COVER SHEET	18203 10-22-87
B	SEE COVER SHEET	18269 11-10-87
C	AT A4 C77 WAS C78 AND C78 WAS C77	18398 12-17-87
D	R71 THRU R78 WAS 1.5K Q42 THRU Q49 WAS 2N3904	17092 5-12-86

SWITCH MATRIX INPUT

KEY

SWITCH MATRIX DRIVES

ALL .01

SR15 4.7K

SR11 560Ω

3.3K SR14

ALL 4011

U40 F/LS 244

U54 PIA 6821 2400

U38 PIA 6821 3000

U28 LS374 2200

ALL U45 7407

18 VDC

STROBE1 STROBE2 STROBE3 STROBE4 KEY STROBE5 STROBE6 STROBE7 STROBE8

U53 7408 U52 7408 U55 7406 U56 7406

LAMP 1

SOLENOID DRIVES

U17 7408 U18 7408 U19 7408 U20 7408

Q11 Q15 (NOTE 1) Q7 Q3 Q14 Q10 Q6 Q2 Q13 Q17 (NOTE 1) Q9 Q5 Q16 Q12 Q8 Q4 Q27 Q31 (NOTE 1) Q23 Q19 Q30 Q26 Q22 Q18 Q29 Q33 (NOTE 1) Q25 Q21 Q32 Q28 Q24 Q20 2N4401

SOL13 SOL14 SOL15 SOL16 SOL9 SOL10 SOL11 SOL12 SOL5 SOL6 SOL7 SOL8 SOL1 SOL2 SOL3 SOL4

LAMP GND RETURN

LAMP VOLTAGE

C78 .1 C77 .1 L3 4.7uH

18VDC

18B1 SOLENOID GROUND

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 — DRWN BY ROSS 8-20-87 — CHECKED BY A. Allen 9/1/87 — APPROVAL C. Bleich 9/9/87

DO NOT SCALE WORK TO DIMENSIONS SHOWN

REMOVE BURRS – BREAK SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECMAL ± .005 FILLETS .020 MAX

FIRST PROJECT NO 557 — FIRST USAGE D-11882 — QTY —

MATERIAL X

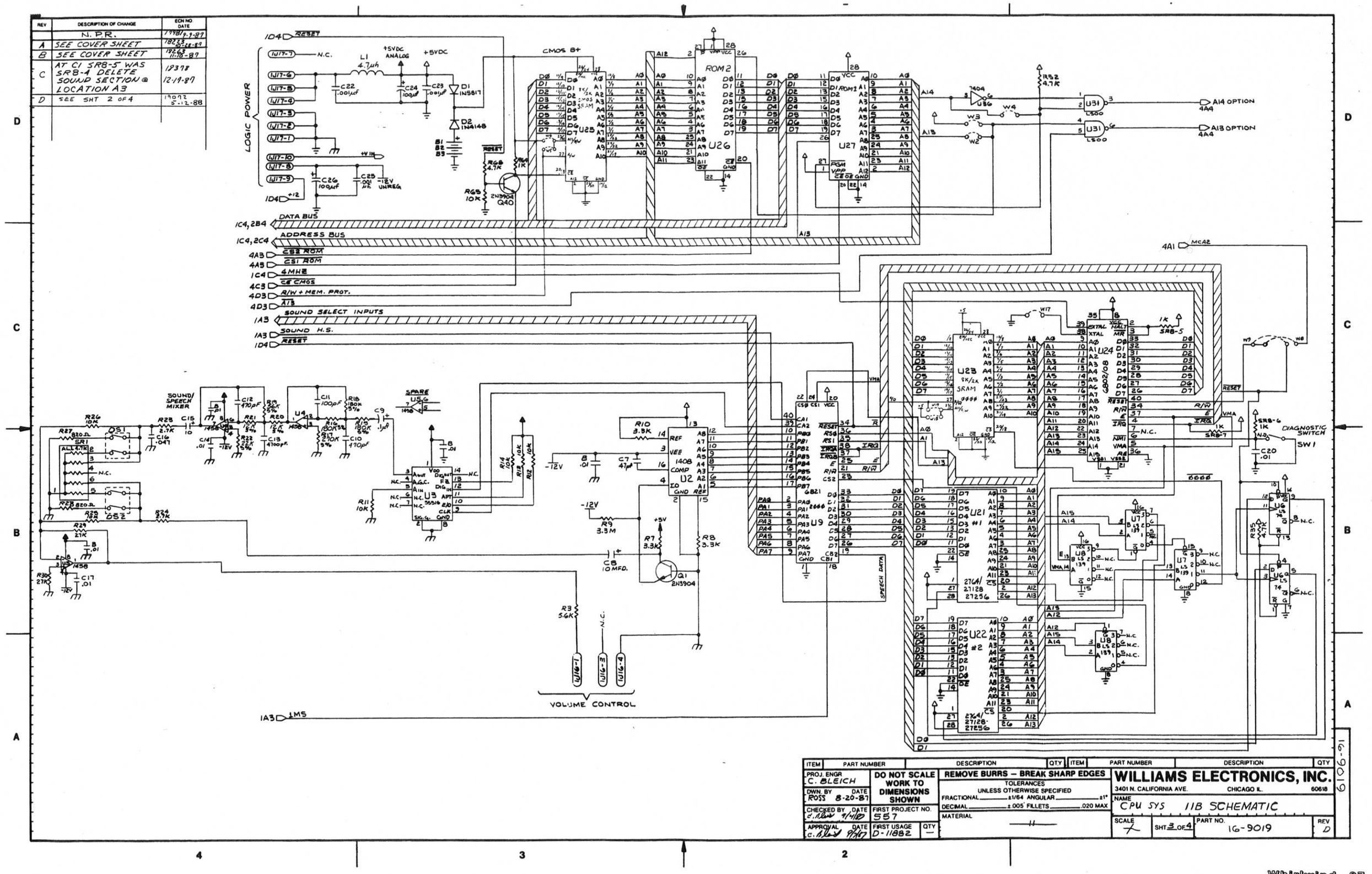
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL. 60618

NAME CPU SYS 11B SCHEMATIC

SCALE X — SHT 2 OF 4 — PART NO 16-9019 — REV D

16-9019

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N. P. R.	19981 9-9-87
A	SEE COVER SHEET	19253 10-28-87
B	SEE COVER SHEET	19263 11-10-87
C	AT C1 SR8-5 WAS SR8-4 DELETE SOUND SECTION @ LOCATION A3	19378 12-9-87
D	SEE SHT 2 OF 4	19072 5-12-88



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ. ENGR C. BLEICH
DWN. BY ROSS DATE 8-20-87
CHECKED BY C. Bleich DATE 9/4/87
APPROVAL C. Bleich DATE 9/9/87

DO NOT SCALE WORK TO DIMENSIONS SHOWN

FIRST PROJECT NO. 557
FIRST USAGE D-11882 QTY —

REMOVE BURRS – BREAK SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECMAL ±.005 FILLETS .020 MAX
MATERIAL —

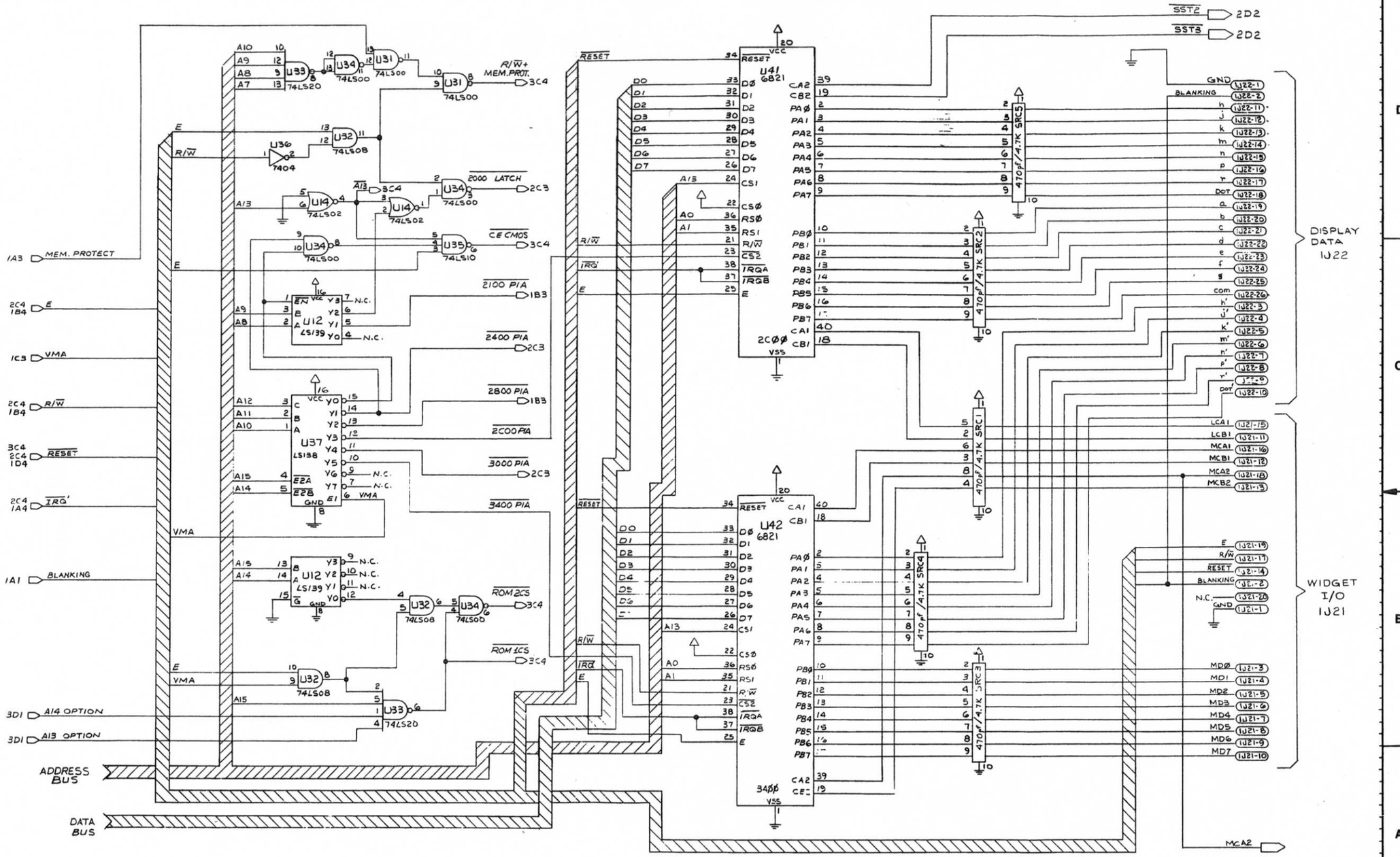
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL. 60618

NAME CPU SYS 11B SCHEMATIC
SCALE — SHT 3 OF 4 PART NO. 16-9019 REV D

16-9019

System 11B CPU Schematic (16-9019, Sheet 3 of 4)

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N. P. R.	17981 7-7-87
A	SEE COVER SHEET	18223 10-26-87
B	SEE COVER SHEET	18265 11-16-87
C	SEE SHEET 1-3	18378 12-10-87
D	SEE SHT 2 OF 4	19012 5-12-88



ITEM	PART NUMBER	DESCRIPTION	QTY	ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ. ENGR: C. BLEICH
DWN BY: POSS 8-20-87
CHECKED BY: C. Bleich 9/4/87
APPROVAL: C. Bleich 9/7/87

DO NOT SCALE WORK TO DIMENSIONS SHOWN

REMOVE BURRS – BREAK SHARP EDGES

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64 ANGULAR ±1°
DECIMAL ± 005 FILLETS .020 MAX
MATERIAL —

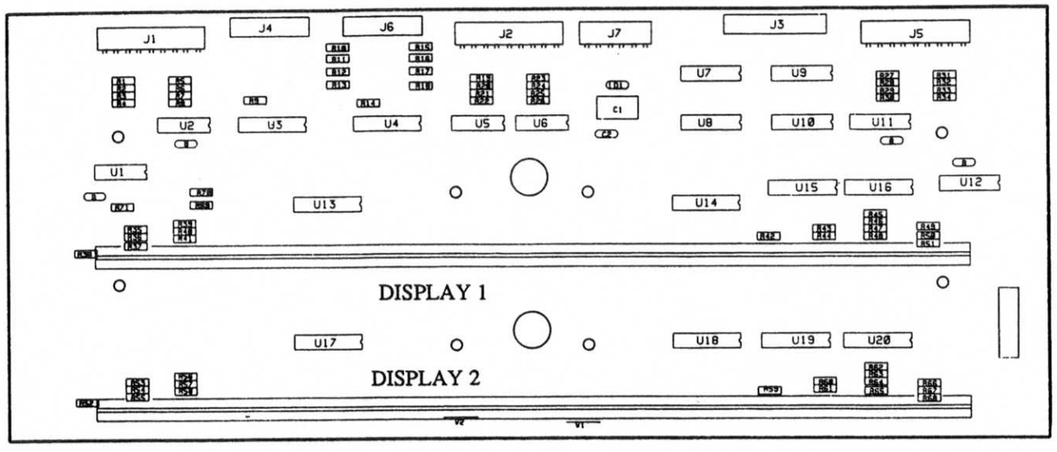
FIRST PROJECT NO. 557
FIRST USAGE D-11882 QTY —

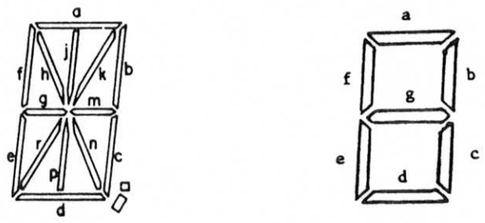
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE. CHICAGO IL. 60618

NAME: CPU SYS IIB SCHEMATIC
SCALE: N/S
SHT 4 OF 4
PART NO: 16-9019
REV: D

16-9019

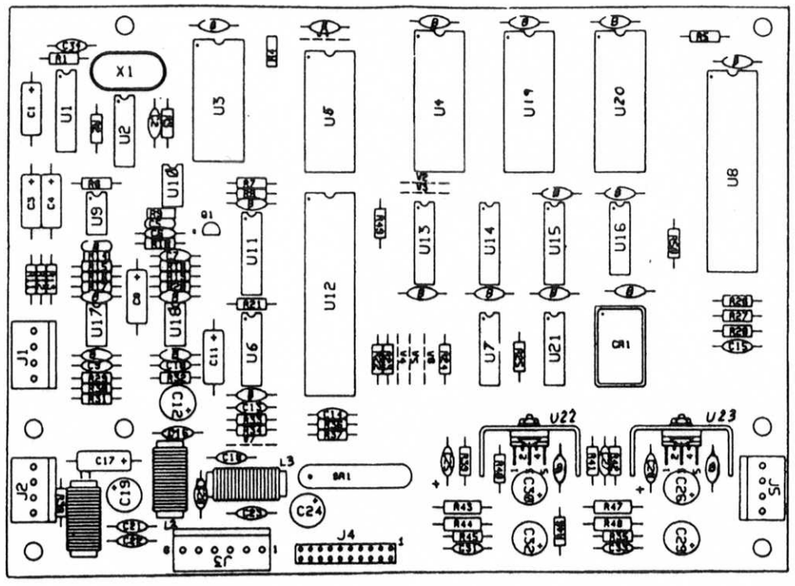
Whirlwind 88





Display Characters Segment Designations

MASTER DISPLAY BOARD
p/n D-12232-1



AUDIO BOARD ASSEMBLY
p/n D-11581-574

REV	DESCRIPTION OF CHANGE	ECN NO. DATE
—	NPR	19159 1-1-88
A	4049 was 4050; 4049 was 4050's; J6 was J4 was J6	19926 11-7-88

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

ITEM	PART NUMBER	DESCRIPTION	QTY

ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ. ENGR. MARK COLDEBELLA	DO NOT SCALE WORK TO DIMENSIONS SHOWN	REMOVE BURRS – BREAK SHARP EDGES	WILLIAMS ELECTRONICS, INC.
DWN. BY M.C. DATE 3/21/88		TOLERANCES UNLESS OTHERWISE SPECIFIED	3401 N. CALIFORNIA AVE. CHICAGO IL. 60618
CHECKED BY M.C. DATE 7-29-88	FIRST PROJECT NO. 553	FRACTIONAL ±1/64 ANGULAR ±1°	NAME MASTER DISPLAY 88, SCHEMATIC
APPROVAL DATE	FIRST USAGE D-12232	DECIMAL ±.005 FILLETS .020 MAX	SCALE 1 SHT 1 OF 1
	QTY 1	MATERIAL	PART NO. 16-9033 REV A

16-9033

Master Display Schematic (16-9033)

REV	DESCRIPTION OF CHANGE	ECN NO DATE
-	N.P.R.	16726 2-27-87
A	SEE COVER SHEET 5-26-88	19214
B	SEE COVER SHEET 9-21-88	19521 9-26-88
C	1.5KΩ WAS 1KΩ	20092 12-2-88

NOTES:
- ALL CAPACITORS WITH "B" ARE BYPASS AND HAVE A VALUE OF .01μf.
- LAST USED C34, R48, U23, W7, J5, L3.

SPARE GATES

74LS04 · 74LS10 · 1458

J4 CPU DATA INTERFACE

J1 INTERFACE TO CPU · J2 VOLUME CONTROL · J3 POWER · J5 CHANNEL + OUTPUT

ITEM	PART NUMBER	DESCRIPTION	QTY
PROJ ENGR C. BLEICH		DO NOT SCALE WORK TO DIMENSIONS SHOWN	
DWN BY DATE JROSS 1/22/87		REMOVE BURRS-BREAK SHARP CORNERS & EDGES	
CHECKED BY DATE Chuck Haas 2/27/87		FIRST PROJECT NO 554	
APPROVAL DATE Dave V. Reed 3/4/87		FIRST USAGE D-11579	QTY 1

TOLERANCES UNLESS OTHERWISE SPECIFIED: DECIMAL X ±.030, XX ±.015, XXX ±.005; ANGULAR ±1/2°; FRACTIONAL ±1/64

MATERIAL —

WILLIAMS ELECTRONICS, INC. 3401 N. CALIFORNIA AVE CHICAGO IL 60618

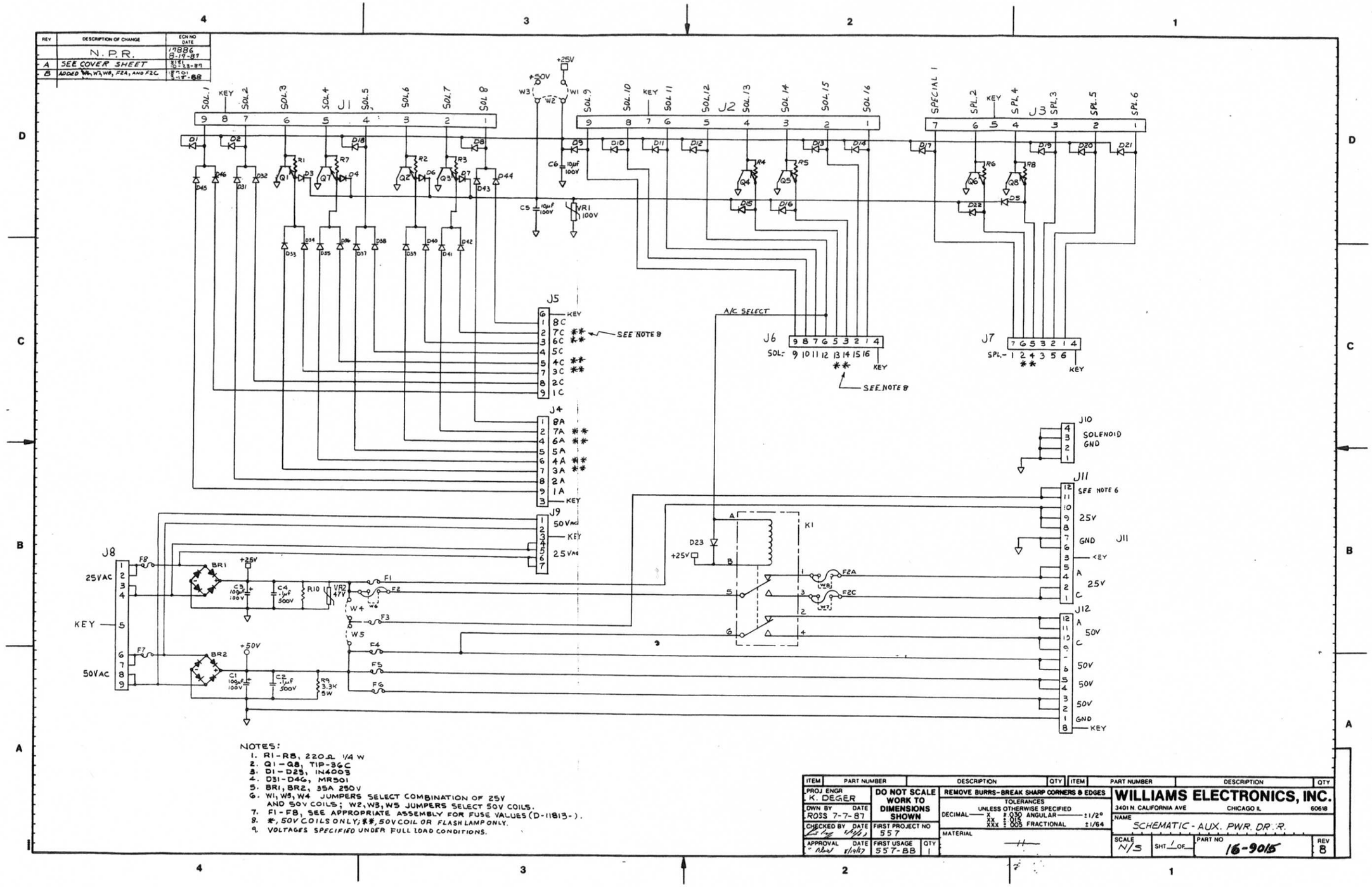
NAME: AUDIO SYSTEM SCHEMATIC

SCALE N/S · SHT 1 OF 1 · PART NO 16-8999 · REV C

16-8999

Audio System Schematic (16-8999)

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N.P.R.	19886 8-19-87
A	SEE COVER SHEET	19901 10-13-87
B	ADDED W4, W5, W6, F2A, AND F2C	19901 5-17-88



NOTES:
1. R1-R8, 220Ω 1/4 W
2. Q1-Q8, TIP-36C
3. D1-D23, IN4003
4. D31-D46, MR501
5. BR1, BR2, 35A 250V
6. W1, W3, W4 JUMPERS SELECT COMBINATION OF 25V AND 50V COILS; W2, W3, W5 JUMPERS SELECT 50V COILS.
7. F1-F8, SEE APPROPRIATE ASSEMBLY FOR FUSE VALUES (D-11813-).
8. *, 50V COILS ONLY; **, 50V COIL OR FLASH LAMP ONLY.
9. VOLTAGES SPECIFIED UNDER FULL LOAD CONDITIONS.

ITEM	PART NUMBER	DESCRIPTION	QTY

ITEM	PART NUMBER	DESCRIPTION	QTY

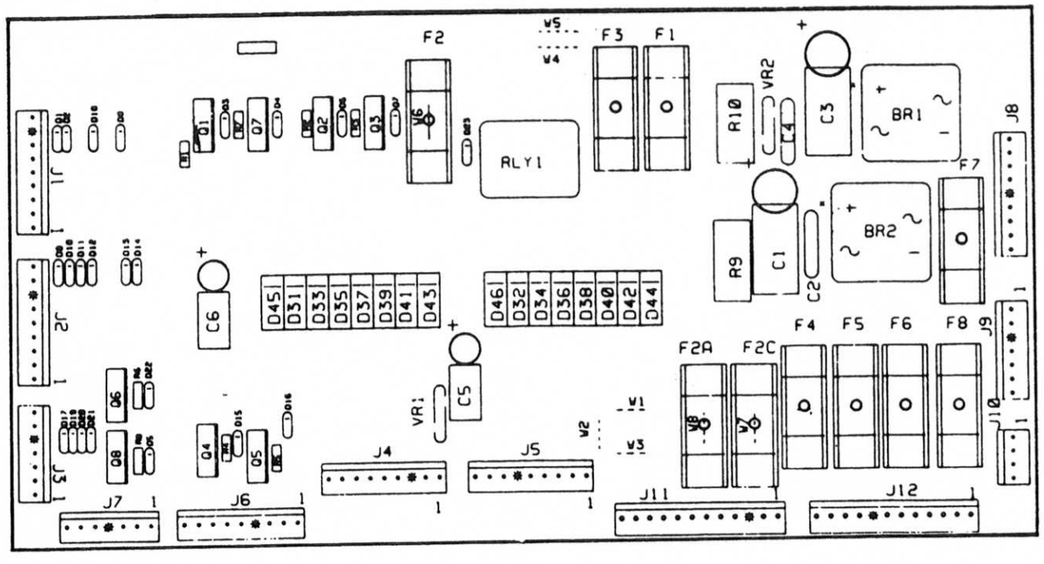
PROJ ENGR: K. DEGER
DWN BY / DATE: ROSS 7-7-87
CHECKED BY / DATE:
APPROVAL / DATE:
DO NOT SCALE WORK TO DIMENSIONS SHOWN
FIRST PROJECT NO: 557
FIRST USAGE: 557-88
QTY: 1

REMOVE BURRS-BREAK SHARP CORNERS & EDGES
TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMAL — X ± .030 ANGULAR ±1/2°; XX ± .015; XXX ± .005 FRACTIONAL ±1/64
MATERIAL

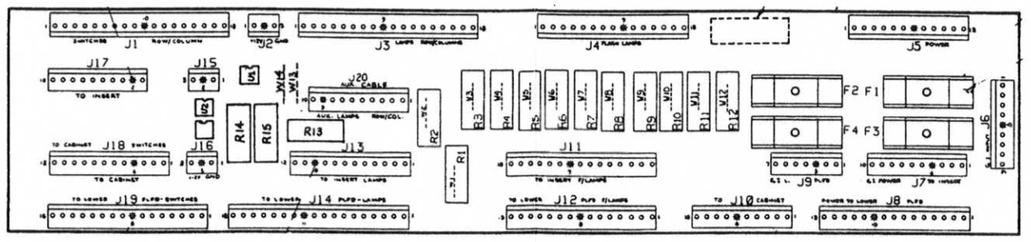
WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618

NAME: SCHEMATIC - AUX. PWR. DR. P.
SCALE: N/S
SHT 1 OF
PART NO: 16-9015
REV: B

Aux Power Driver Schematic (16-9015)



AUX POWER DRIVER UNIT BOARD
p/n D-12247



BACKBOX INTERCONNECT BOARD
p/n D-12313-574

REV	DESCRIPTION OF CHANGE	ECN NO DATE
	N P R.	13326 6-28-88

J1

GRN/BRN J1-18
GRN/RED J1-17
GRN/ORG J1-16
GRN/YEL J1-15
GRN/BLK J1-14
GRN/BLU J1-13
GRN/VIO J1-12
GRN/GRY J1-11
KEY J1-10
N.C. J1-9
WHT/GRY J1-8
WHT/VIO J1-7
WHT/BLU J1-6
WHT/GRN J1-5
WHT/YEL J1-4
WHT/ORG J1-3
WHT/RED J1-2
WHT/BRN J1-1

SWITCH-COL.
SWITCH-ROW

PLFD J19

J19-1 J19-2 J19-3 J19-4 J19-5 J19-6 J19-7 KEY J19-8 J19-9 J19-10 J19-11 J19-12 J19-13 J19-14 J19-15 J19-16

CABINET J18

J18-1 J18-2 J18-3 KEY J18-4 J18-5 J18-6 J18-7 J18-8 J18-9 J18-10 J18-11 J18-12

INSERT J17

J17-8 J17-1 J17-3 J17-4 J17-5 J17-6 J17-7 J17-8 J17-9 J17-10

J2

GRY/YEL 12V UNREG J2-1
KEY J2-2
BLK/YEL GND J2-3

+12V & GND

J15 INSERT

J15-3 KEY J15-2 KEY J15-1

J16 PLFD

J16-3 J16-2 J16-1

J3

RED/BRN J3-18
RED/BLK J3-17
RED/ORG J3-16
RED/YEL J3-15
RED/GRN J3-14
RED/BLU J3-13
RED/VIO J3-12
RED/GRY J3-11
N.C. J3-10
KEY J3-9
YEL/BRN J3-8
YEL/RED J3-7
YEL/ORG J3-6
YEL/BLK J3-5
YEL/GRN J3-4
YEL/BLU J3-3
YEL/VIO J3-2
YEL/GRY J3-1

LAMP-ROW
LAMP-COL

PLFD J14

J14-1 J14-2 J14-3 J14-4 J14-5 J14-6 J14-7 J14-8 N.C. J14-9 KEY J14-11 J14-10 J14-12 J14-13 J14-14 J14-15 J14-16 J14-17 J14-18

INSERT J13

J13-1 J13-2 J13-3 J13-4 J13-5 J13-6 J13-7 J13-8 J13-9 KEY J13-10 J13-11 J13-12

AUX CONNECTOR J20

J20-1 J20-2 J20-3 J20-4 J20-5 J20-6 J20-7 J20-8 KEY J20-9 J20-10

W13

J5

BRN J5-12 28V "A" SIDE
RED J5-8 28V
RED/WHT J5-1 28V SP
ORG J5-9 28V "C" SIDE
ORG/VIO J5-5 FLIPPER GND
ORG/GRY J5-4 FLIPPER GND
KEY J5-7
YEL/VIO J5-11 50V "A" & C SIDE
BLU/YEL J5-2 50V RIGHT FLIPPER
VIO/YEL J5-10 50V
GRY/YEL J5-3 50V LEFT FLIPPER
GND J5-6

POWER +50V, 28V DC

J7 INSERT

J7-1 J7-9 J7-5 KEY J7-4 J7-2 J7-3

CABINET J10

J10-5 J10-7 J10-8 KEY J10-6

PLFD J8

J8-1 J8-5 J8-11 J8-4 J8-2 J8-9 J8-3 J8-8

J4

WHT/BRN J4-1 R1
WHT/RED J4-2 R2
WHT/ORG J4-3 R3
WHT/YEL J4-4 R4
WHT/GRN J4-5 R5
WHT/BLU J4-6 R6
WHT/VIO J4-7 R7
WHT/GRY J4-8 R8
KEY J4-9
FL 9 J4-10 R9
FL 10 J4-11 R10
FL 11 J4-12 R11

SOLENOID OR FLASH LAMP DRIVER

J6

YEL J6-1 BRN
YEL J6-2 YEL
YEL J6-3 GRN
YEL J6-4 VIO
KEY J6-5
YEL/WHT J6-6 WHT/BRN
YEL/WHT J6-7 WHT/YEL
YEL/WHT J6-8 WHT/GRN
YEL/WHT J6-9 WHT/VIO

5.9 V.AC. GEN ILLUM.

F-1 F-2 F-3 F-4

J9 PLFD

J9-6 J9-4 J9-5 J9-7 J9-2 J9-1 KEY J9-3

J7-10 J7-9 J7-8 J7-7

J10-10 J10-9

N.C. J8-7
N.C. J8-6
KEY J8-10

BLU/VIO RT-L J10-1 J8-15
BLU/GRY LT-L J10-2 J8-14
BLK/YEL RT-U J10-3 J8-13
BLK/BLU LT-U J10-4 J8-12

28V "C" SIDE

15K 5W R13 WHT/RED
J1 GRN/BRN
GND

3.5K 5W R14
U2 LT L.C.

R15
U3 RT L.C.

INSERT J11

J11-16 J11-15 J11-14 J11-13 J11-12 J11-11 J11-9 J11-8 KEY J11-10 J11-7 J11-6 J11-5 J11-4 J11-3 J11-2 J11-1

PLFD J12

J12-16 J12-15 J12-14 J12-13 J12-12 J12-11 J12-10 J12-8 KEY J12-9 J12-7 J12-6 J12-5 J12-4 J12-3 J12-2 J12-1

FL-12 COIL J9-13
COIL J9-14
COIL J9-15
COIL J9-16

R12 W12

ITEM	PART NUMBER	DESCRIPTION	QTY

ITEM	PART NUMBER	DESCRIPTION	QTY

PROJ ENGR M. JAYSWAL
DWN BY DATE Dan 6-28-88
CHECKED BY DATE 6/28/88
APPROVAL DATE 6/28/88

DO NOT SCALE WORK TO DIMENSIONS SHOWN

FIRST PROJECT NO. 567
FIRST USAGE D-12313 QTY 1

REMOVE BURRS-BREAK SHARP CORNERS & EDGES

TOLERANCES
UNLESS OTHERWISE SPECIFIED
DECIMAL X ±.030 ANGULAR ±1/2°
XX ±.015
XXX ±.005 FRACTIONAL ±1/64

MATERIAL —

WILLIAMS ELECTRONICS, INC.
3401 N. CALIFORNIA AVE CHICAGO IL 60618

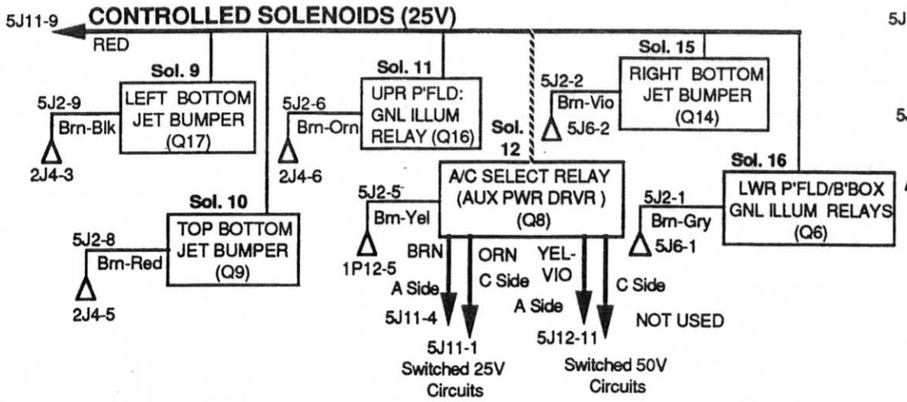
NAME SCHEMATIC - INTERCONNECT BOARD.

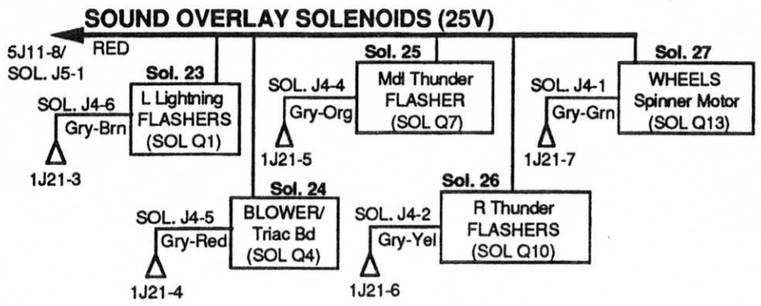
SCALE N/S SHT 1 OF 1 PART NO. 16-9052-1 REV -

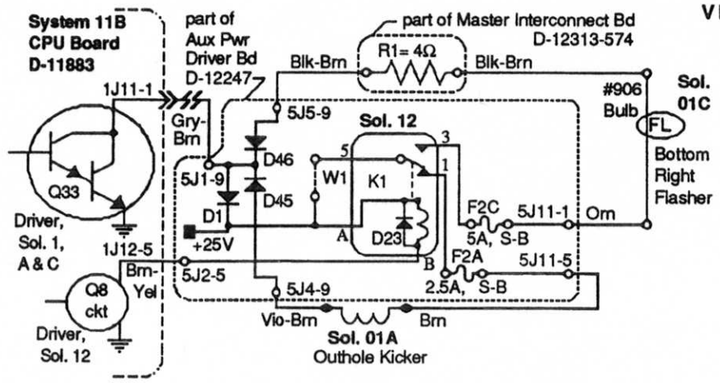
16-9032-1

Whirlwind 94

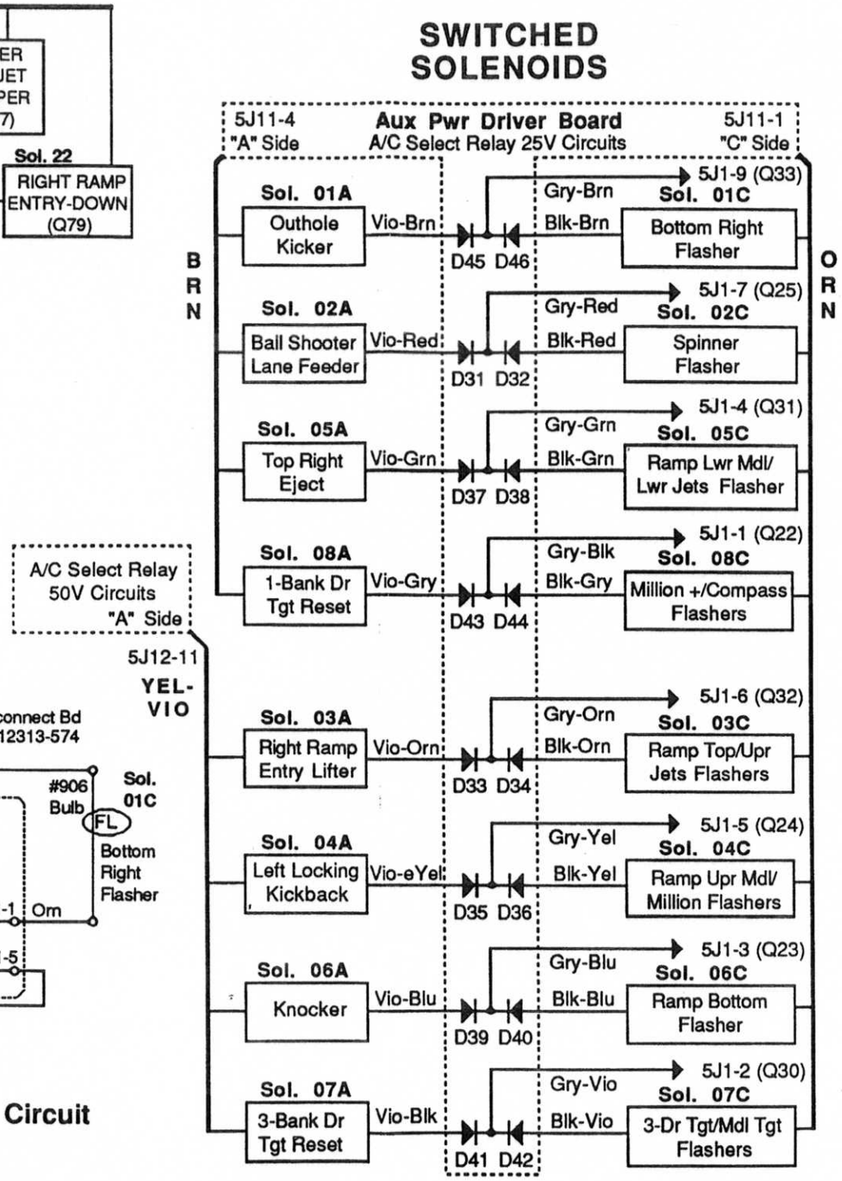
Backbox Interconnect Board Schematic (16-9032-1)

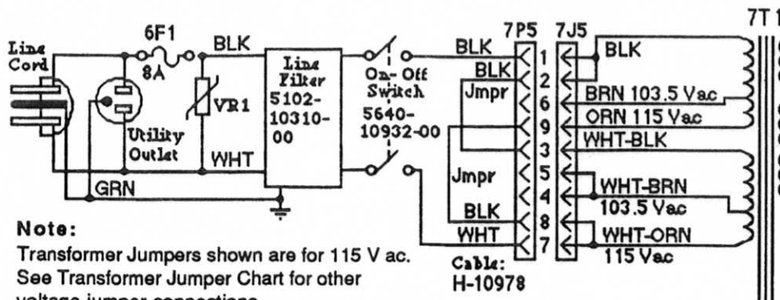




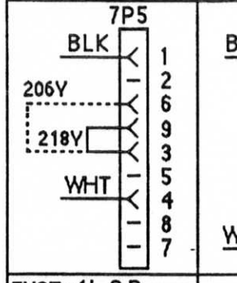
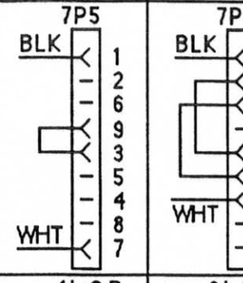
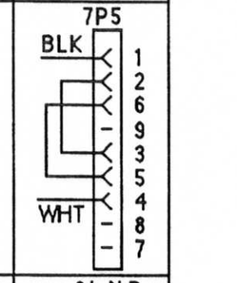


Typical A/C Select (Switched Solenoid) Circuit

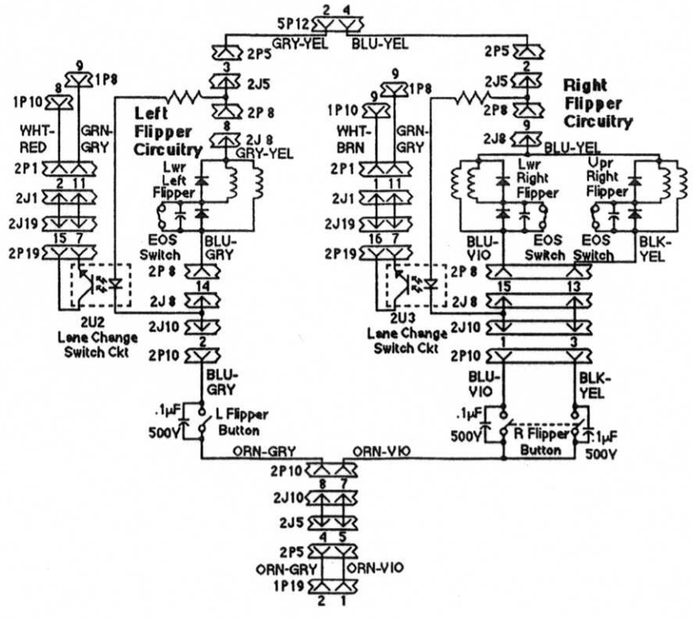


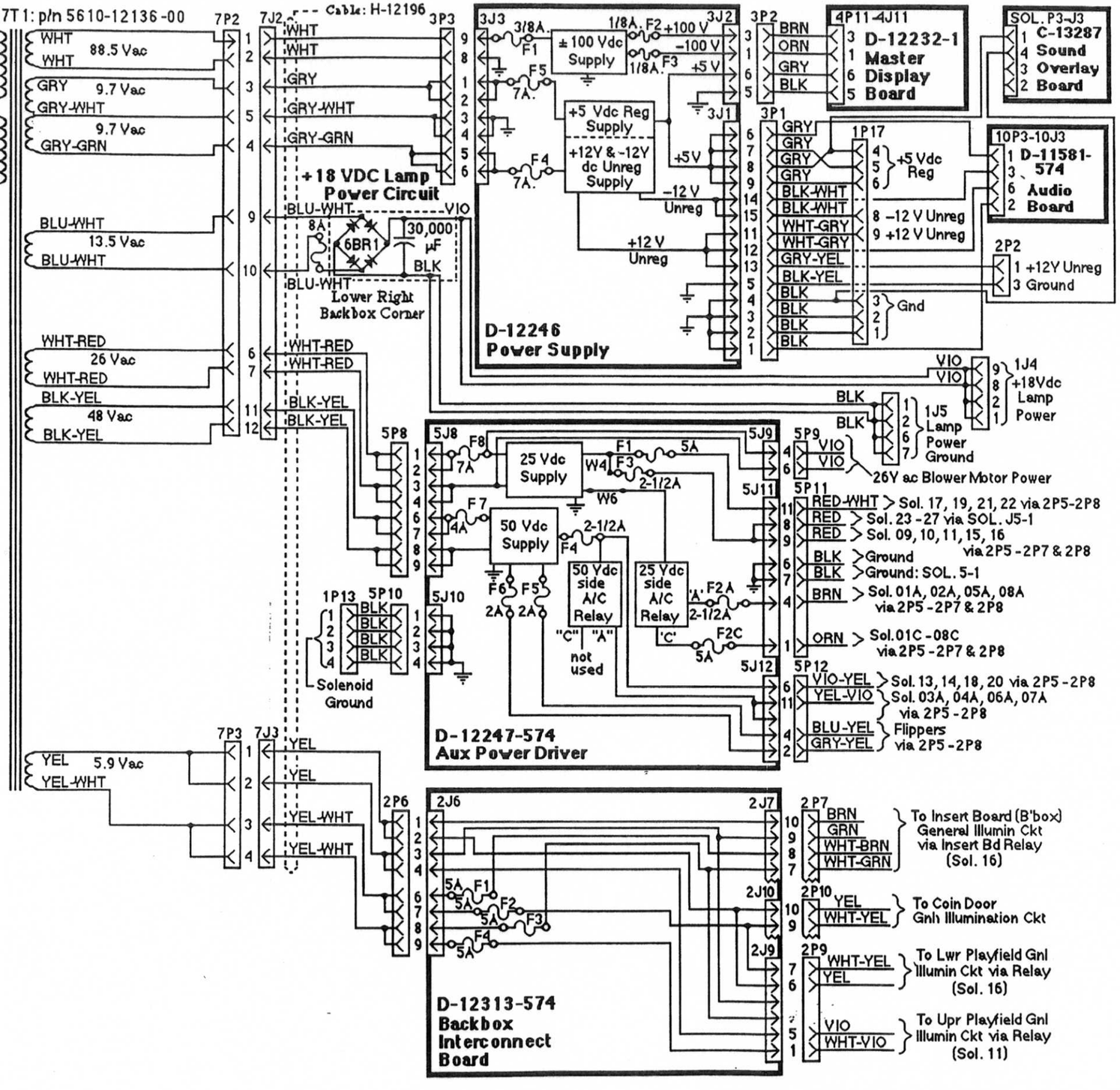


Note:
Transformer Jumpers shown are for 115 V ac.
See Transformer Jumper Chart for other voltage jumper connections.

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
1J1-1	BRN-GRY	ST-8: Display Digit Strobe / 4J1-1
1J1-2	BRN-VIO	ST-7: Display Digit Strobe / 4J1-2
1J1-3	BRN-BLU	ST-6: Display Digit Strobe / 4J1-3
1J1-4	BRN-GRN	ST-5: Display Digit Strobe / 4J1-4
1J1-5	BRN-YEL	ST-4: Display Digit Strobe / 4J1-5
1J1-6	BRN-ORG	ST-3: Display Digit Strobe / 4J1-6
1J1-7	BRN-RED	ST-2: Display Digit Strobe / 4J1-7
1J1-8	Key Pin	No Connection
1J1-9	BRN-BLK	ST-1: Display Digit Strobe / 4J1-9
1J3-1	BLU-BRN	D1 / Display BCD / 4J5-1
1J3-2	BLU-RED	C1 / Display BCD / 4J5-2
1J3-3	BLU-ORG	B1 / Display BCD / 4J5-3
1J3-4	BLU-YEL	A1 / Display BCD / 4J5-4
1J3-5	BLU-GRN	D2 / Display BCD / 4J5-5
1J3-6	Key Pin	No Connection
1J3-7	BLU-BLK	C2 / Display BCD / 4J5-7
1J3-8	BLU-VIO	B2 / Display BCD / 4J5-8
1J3-9	BLU-GRY	A2 / Display BCD / 4J5-9
1J3-10	---	No Connection
1J3-11	---	No Connection
1J3-12	---	No Connection
1J5-1	---	No Connection
1J5-2	Key Pin	No Connection
1J5-3	BLK	Ground (Lamp Ckt)
1J5-4	BLK	Ground (Lamp Ckt)
1J5-5	---	No Connection
1J5-6	---	No Connection
1J5-7	---	No Connection
1J5-8	BLK	Ground (Lamp Ckt)
1J5-9	BLK	Ground (Lamp Ckt)
1J7-1	YEL-BRN	Lamp Col 1 (Q65/66) /2J3-8
1J7-2	YEL-RED	Lamp Col 2 (Q63/64) /2J3-7
1J7-3	YEL-ORG	Lamp Col 3 (Q61/62) /2J3-6
1J7-4	YEL-BLK	Lamp Col 4 (Q59/60) /2J3-5
1J7-5	Key Pin	No Connection
1J7-6	YEL-GRN	Lamp Col 5 (Q57/58) /2J3-4
1J7-7	YEL-BLU	Lamp Col 6 (Q55/56) /2J3-3
1J7-8	YEL-VIO	Lamp Col 7 (Q53/54) /2J3-2
1J7-9	YEL-GRY	Lamp Col 8 (Q51/52) /2J3-1
1J10-1	WHT-GRY	Switch Row 8 /2J1-8
1J10-2	WHT-VIO	Switch Row 7 /2J1-7
1J10-3	WHT-BLU	Switch Row 6 /2J1-6
1J10-4	Key Pin	No Connection
1J10-5	WHT-GRN	Switch Row 5 /2J1-5
1J10-6	WHT-YEL	Switch Row 4 /2J1-4
1J10-7	WHT-ORG	Switch Row 3 /2J1-3
1J10-8	WHT-RED	Switch Row 2 /2J1-2
1J11-9	WHT-BRN	Switch Row 1 /2J1-1
1J12-1	BRN-BLK	Solenoid 9 (Q17) / 5J2-9
1J12-2	BRN-RED	Solenoid 10 (Q9) / 5J2-8
1J12-3	Key Pin	No Connection
1J12-4	BRN-ORG	Solenoid 11 (Q16) / 5J2-6
1J12-5	BRN-YEL	Solenoid 12 (Q8) / 5J2-5
1J12-6	BRN-GRN	Solenoid 13 (Q15) /5J2-4
1J12-7	BRN-BLU	Solenoid 14 (Q7) / 5J2-3
1J12-8	BRN-VIO	Solenoid 15 (Q14) / 5J2-2
1J12-9	BRN-GRY	Solenoid 16 (Q6) / 5J2-1
1J16-1	RED	Volume Control Input / 10J1-1
1J16-2	BLK	Volume Control Output / 10J1-2
1J16-3	Key Pin	No Connection
1J16-4	White	Signal Ground - CPU / 10J1-4
1J18-1	---	No Connection
1J18-2	---	"
1J18-3	---	"
1J18-4	---	"
1J18-5	---	"
1J18-6	Key Pin	"
1J18-7	---	"
1J18-8	---	"
1J18-9	---	"
1J21		Ribbon Cable to Sound Overlay Solenoid Bd J2
1J22		Ribbon Cable to Master Display Board 4J3

Connector	Wire Color	Signal Designation/Description
1J2-1	VIO-GRY	ST-16: Display Digit Strobe / 4J2-1
1J2-2	VIO-BLK	ST-15: Display Digit Strobe / 4J2-2
1J2-3	VIO-BLU	ST-14: Display Digit Strobe / 4J2-3
1J2-4	VIO-GRN	ST-13: Display Digit Strobe / 4J2-4
1J2-5	VIO-YEL	ST-12: Display Digit Strobe / 4J2-5
1J2-6	VIO-ORG	ST-11: Display Digit Strobe / 4J2-6
1J2-7	Key Pin	No Connection
1J2-8	VIO-RED	ST-10: Display Digit Strobe / 4J2-8
1J2-9	VIO-BRN	ST-9: Display Digit Strobe / 4J2-9
1J4-1	VIO	Lamp +18V dc Power
1J4-2	VIO	"
1J4-3	Key Pin	No Connection
1J4-4	---	No Connection
1J4-5	---	No Connection
1J4-6	---	No Connection
1J4-7	---	No Connection
1J4-8	VIO	Lamp +18V dc Power
1J4-9	VIO	"
1J6-1	RED-BRN	Lamp Row 1 (Q80) /2J3-18
1J6-2	RED-BLK	Lamp Row 2 (Q81) /2J3-17
1J6-3	RED-ORG	Lamp Row 3 (Q82) /2J3-16
1J6-4	Key Pin	No Connection
1J6-5	RED-YEL	Lamp Row 4 (Q83) /2J3-15
1J6-6	RED-GRN	Lamp Row 5 (Q84) /2J3-14
1J6-7	RED-BLU	Lamp Row 6 (Q85) /2J3-13
1J6-8	RED-VIO	Lamp Row 7 (Q86) /2J3-12
1J6-9	RED-GRY	Lamp Row 8 (Q87) /2J3-11
1J8-1	GRN-BRN	Switch Col 1 (Q45) /2J1-18
1J8-2	GRN-RED	Switch Col 2 (Q49) /2J1-17
1J8-3	GRN-ORG	Switch Col 3 (Q44) /2J1-16
1J8-4	GRN-YEL	Switch Col 4 (Q48) /2J1-15
1J8-5	GRN-BLK	Switch Col 5 (Q43) /2J1-14
1J8-6	Key Pin	No Connection
1J8-7	GRN-BLU	Switch Col 6 (Q47) /2J1-13
1J8-8	GRN-VIO	Switch Col 7 (Q42) /2J1-12
1J8-9	GRN-GRY	Switch Col 8 (Q46) /2J1-11
1J9		Not Applicable
1J11-1	GRY-BRN	Solenoid 1 (Q33) / 5J1-9
1J11-2	Key Pin	No Connection
1J11-3	GRY-RED	Solenoid 2 (Q25) / 5J1-7
1J11-4	GRY-ORG	Solenoid 3 (Q32) / 5J1-6
1J11-5	GRY-YEL	Solenoid 4 (Q24) / 5J1-5
1J11-6	GRY-GRN	Solenoid 5 (Q31) / 5J1-4
1J11-7	GRY-BLU	Solenoid 6 (Q23) / 5J1-3
1J11-8	GRY-VIO	Solenoid 7 (Q30) / 5J1-2
1J11-9	GRY-BLK	Solenoid 8 (Q22) / 5J1-1
1J13-1	BLK	Solenoid Ground / 5J10-1
1J13-2	BLK	" / 5J10-2
1J13-3	BLK	" / 5J10-3
1J13-4	BLK	" / 5J10-4
1J14-1	BLK-RED	Memory Protect / 7J1-4
1J14-2	WHT	Ground / 7J1-3
1J14-3	GRN	ADVANCE Switch / 7J1-1
1J14-4	BLU	AUTO/MANUAL Switch / 7J1-2
1J17-1	BLK	Ground / 3J1-2
1J17-2	BLK	" / 3J1-3
1J17-3	BLK	" / 3J1-4
1J17-4	GRY	Power: +5V dc / 3J1-8
1J17-5	GRY	" / 3J1-6
1J17-6	GRY	" / 3J1-9
1J17-7	Key Pin	No Connection
1J17-8	BLK-WHT	Power: -12V dc Unreg / 3J1-14
1J17-9	WHT-GRY	Power: +12V dc Unreg / 3J1-12
1J19-1	ORG-VIO	Flipper Ground /2J5-5
1J19-2	ORG-GRY	Flipper Ground /2J5-4
1J19-3	BLU-ORN	Spl Solnd 3 (Q73) / 5J3-3
1J19-4	BLU-RED	Spl Solnd 2 (Q71) / 5J3-6
1J19-5	Key Pin	No Connection
1J19-6	BLU-YEL	Spl Solnd 4 (Q69) / 5J3-4
1J19-7	BLU-BRN	Spl Solnd 1 (Q75) / 5J3-7
1J19-8	BLU-GRN	Spl Solnd 5 (Q77) / 5J3-2
1J19-9	BLU-BLK	Spl Solnd 6 (Q79) / 5J3-1

POWER SUPPLY INTERBOARD SIGNALS

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

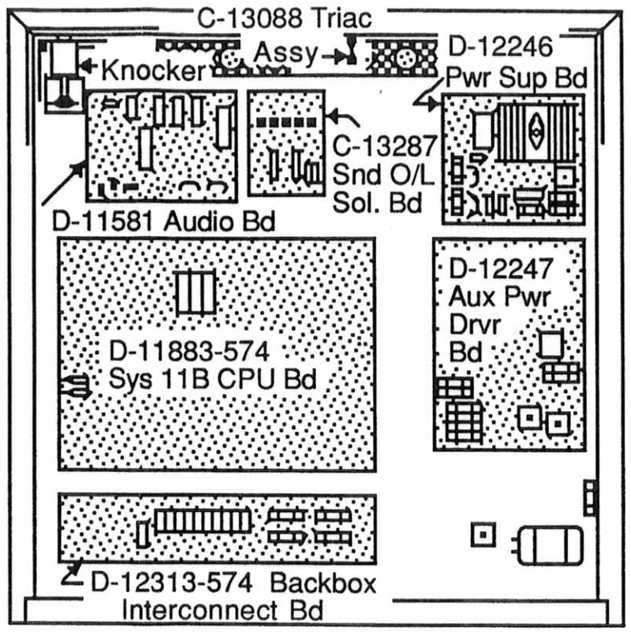
AUX POWER DRIVER INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description
5J1-1	GRY-BLK	CPU: Solenoid 8 (Q22) / 1J11-9
5J1-2	GRY-VIO	CPU: Solenoid 7 (Q30) / 1J11-8
5J1-3	GRY-BLU	CPU: Solenoid 6 (Q23) / 1J11-7
5J1-4	GRY-GRN	CPU: Solenoid 5 (Q31) / 1J11-6
5J1-5	GRY-YEL	CPU: Solenoid 4 (Q24) / 1J11-5
5J1-6	GRY-ORG	CPU: Solenoid 3 (Q32) / 1J11-4
5J1-7	GRY-RED	CPU: Solenoid 2 (Q25) / 1J11-3
5J1-8	Key Pin	No Connection
5J1-9	GRY-BRN	CPU: Solenoid 1 (Q33) / 1J11-1
5J3-1	BLU-BLK	CPU: Solenoid 22 (Q79) / 1J19-9
5J3-2	BLU-GRN	CPU: Solenoid 21 (Q77) / 1J19-8
5J3-3	BLU-ORG	CPU: Solenoid 19 (Q73) / 1J19-3
5J3-4	BLU-YEL	CPU: Solenoid 20 (Q69) / 1J19-6
5J3-5	Key Pin	No Connection
5J3-6	BLU-RED	CPU: Solenoid 18 (Q71) / 1J19-4
5J3-7	BLU-BRN	CPU: Solenoid 17 (Q75) / 1J19-7
5J5-1	WHT-GRY	Solenoid 08C /2J4-8
5J5-2	WHT-VIO	Solenoid 07C /2J4-7
5J5-3	WHT-BLU	Solenoid 06C /2J4-6
5J5-4	WHT-GRN	Solenoid 05C /2J4-5
5J5-5	WHT-YEL	Solenoid 04C /2J4-4
5J5-6	Key Pin	No Connection
5J5-7	WHT-ORG	Solenoid 03C /2J4-3
5J5-8	WHT-RED	Solenoid 02C /2J4-2
5J5-9	WHT-BRN	Solenoid 01C /2J4-1
5J7-1	BLU-BLK	Solenoid 22
5J7-2	BLU-GRN	Solenoid 21
5J7-3	BLU-ORG	Solenoid 19
5J7-4	Key Pin	No Connection
5J7-5	BLU-YEL	Solenoid 20
5J7-6	BLU-RED	Solenoid 18
5J7-7	BLU-BRN	Solenoid 17
5J9-1 - 3 & 5	---	No Connection
5J9-4 & 6	VIO	26V ac Blower Pwr/Triac J2-1,2/4,5
5J10-1	BLK	Solenoid Gnd / 1J13-1
5J10-2	BLK	Solenoid Gnd / 1J13-2
5J10-3	BLK	Solenoid Gnd / 1J13-3
5J10-4	BLK	Solenoid Gnd / 1J13-4
5J11-1	ORG	+25 Vdc "C" Solenoid Pwr/2J5-9
5J11-2	---	No Connection
5J11-3	Key Pin	No Connection
5J11-4	BRN	+25 Vdc "A" Solenoid Pwr/2J5-12
5J11-5	---	No Connection
5J11-6	BLK	Ground/2J5-6
5J11-7	BLK	Ground/SOL. 5-4
5J11-8	RED	+25 Vdc Solenoid Pwr/SOL. J5-1
5J11-9	RED	+25 Vdc Solenoid Pwr/2J5-8
5J11-10	---	No Connection
5J11-11	RED-WHT	+50 Vdc / Sol. 22
5J11-12	---	No Connection

Connector	Wire Color	Signal Designation/Description
5J2-1	BRN-GRY	CPU: Solenoid 16 (Q6) / 1J12-9
5J2-2	BRN-VIO	CPU: Solenoid 15 (Q14) / 1J12-8
5J2-3	BRN-BLU	CPU: Solenoid 14 (Q7) / 1J12-7
5J2-4	BRN-GRN	CPU: Solenoid 13 (Q15) / 1J12-6
5J2-5	BRN-YEL	CPU: Solenoid 12 (Q8) / 1J12-5
5J2-6	BRN-ORG	CPU: Solenoid 11 (Q16) / 1J12-4
5J2-7	Key Pin	No Connection
5J2-8	BRN-RED	CPU: Solenoid 10 (Q9) / 1J12-2
5J2-9	BRN-BLK	CPU: Solenoid 9 (Q17) / 1J12-1
5J4-1	VIO-GRY	Solenoid 08A
5J4-2	VIO- BLK	Solenoid 07A
5J4-3	Key Pin	No Connection
5J4-4	VIO-BLU	Solenoid 06A
5J4-5	VIO-GRN	Solenoid 05A
5J4-6	VIO-YEL	Solenoid 04A
5J4-7	VIO-ORN	Solenoid 03A
5J4-8	VIO-RED	Solenoid 02A
5J4-9	VIO-BRN	Solenoid 01A
5J6-1	BRN-GRY	Solenoid 16 /2J4-16
5J6-2	BRN-VIO	Solenoid 15 /2J4-15
5J6-3	BRN-BLU	Solenoid 14 /2J4-14
5J6-4	Key Pin	No Connection
5J6-5	BRN-GRN	Solenoid 13 /2J4-13
5J6-6	---	Solenoid 12
5J6-7	BRN-ORG	Solenoid 11 /2J4-12
5J6-8	BRN-RED	Solenoid 10 /2J4-11
5J6-9	BRN-BLK	Solenoid 9 /2J4-10
5J8-1	WHT-RED	Transformer: 26V ac / 7J2-6
5J8-2	WHT-RED	Transformer: 26V ac / 7J2-6
5J8-3	WHT-RED	Transformer: 26V ac / 7J2-7
5J8-4	WHT-RED	Transformer: 26V ac / 7J2-7
5J8-5	Key Pin	No Connection
5J8-6	BLK-YEL	Transformer: 48V ac / 7J2-11
5J8-7	BLK-YEL	Transformer: 48V ac / 7J2-11
5J8-8	BLK-YEL	Transformer: 48V ac / 7J2-12
5J8-9	BLK-YEL	Transformer: 48V ac / 7J2-12
5J12-1	---	No Connection
5J12-2	GRY-YEL	+50 Vdc Flipper Pwr/ 2J5-3
5J12-3	---	No Connection
5J12-4	BLU-YEL	+50 Vdc Flipper Pwr/2J5-2
5J12-5	---	No Connection
5J12-6	VIO-YEL	+50 Vdc Solenoid Pwr/2J5-10
5J12-7	---	No Connection
5J12-8	Key Pin	No Connection
5J12-9	---	No Connection
5J12-10	---	No Connection
5J12-11	YEL-VIO	+50 Vdc Solenoid Pwr/2J5-11
5J12-12	---	No Connection

TRIAC INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description
J1-1	RED	+25V dc Solenoid Power
J1-2	Key Pin	No Connection
J1-3	GRY-RED	SOL Solenoid 24
J1-4	---	No Connection
J2-1	VIO	26V ac Motor Pwr Input/5J9-4
J2-2	VIO	26V ac Motor Pwr Input/5J9-4
J2-3	Key Pin	No Connection
J2-4	VIO	26V ac Motor Pwr Input/5J9-6
J2-5	VIO	26V ac Motor Pwr Input/5J9-6
J3-1	VIO	26V ac Blower Motor Pwr
J3-2	VIO	26V ac Blower Motor Pwr
J3-3	Key Pin	No Connection
J3-4	VIO	26V ac Blower Motor Pwr
J3-5	VIO	26V ac Blower Motor Pwr
J3-6	---	No Connection
J3-7	---	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

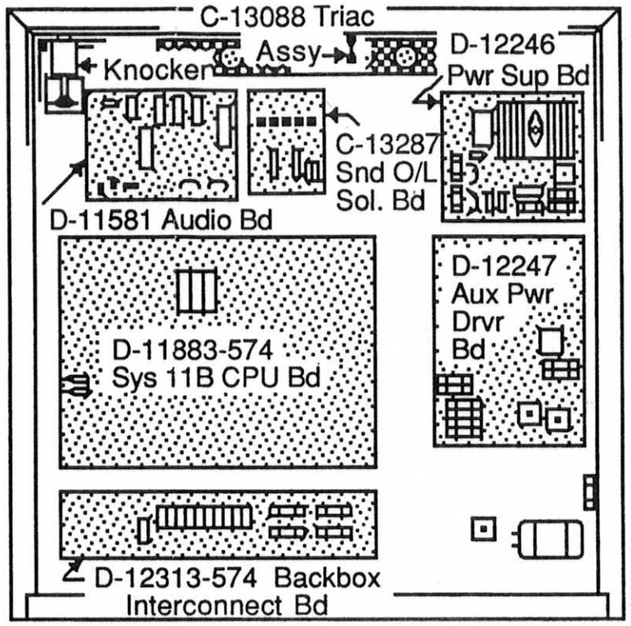
Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
2J1-1	WHT-BRN	Switch Row 1 /1J11-9	2J2-1	GRY-YEL	+12Vdc Unreg/3J1-13
2J1-1	WHT-RED	Switch Row 2 /1J11-8	2J2-2	---	No Connection
2J1-3	WHT-ORG	Switch Row 3 /1J11-7	2J2-3	BLK-YEL	Ground/3J1-5
2J1-4	WHT-YEL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

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, 23 - 27	2J9-7	WHT-YEL	Playfield Gen Illum Pwr/2J6-7
2J8-6, 7,12		No Connection			
2J8-8	GRY-YEL	Flipper Power	2J10-1	BLU-VIO	Lower Right Flipper Switch
2J8-9	BLU-YEL	Flipper Power	2J10-2	BLU-GRY	Lower Left Flipper Switch
2J8-10	Key Pin	No Connection	2J10-3	BLK-YEL	Upper Right Flipper Switch
2J8-11	RED-WHT	+25Vdc Solenoid 17, 19, 21, 22	2J10-4, 6	---	No Connection
2J8-13	BLK-YEL	Upper Right Flipper	2J10-5	RED	+25 Vdc (Solenoid Pwr)
2J8-14	BLU-GRY	Lower Left Flipper	2J10-7	ORG-VIO	R Flipper Ground Ckt
2J8-15	BLU-VIO	Lower Right Flipper	2J10-8	ORG-GRY	L Flipper Ground Ckt
			2J10-9	WHT-YEL	Gen Illum Pwr: 6V ac
2J12-1	BRN-GRY	Solenoid 16	2J10-10	YEL	Gen Illum Pwr: 6V ac
2J12-2	BRN-VIO	Solenoid 15			
2J12-3	BRN-BLU	Solenoid 14	2J13-1	RED-BRN	Lamp Row 1
2J12-4	BRN-GRN	Solenoid 13	2J13-2	RED-BLK	Lamp Row 2
2J12-5	BRN-ORG	Solenoid 11	2J13-3	RED-ORG	Lamp Row 3
2J12-6	BRN-RED	Solenoid 10	2J13-4	RED-YEL	Lamp Row 4
2J12-7	BRN-BLK	Solenoid 9	2J13-5	RED-GRN	Lamp Row 5
2J12-8	BLK-GRY	Solenoid 08C	2J13-6	RED-BLU	Lamp Row 6
2J12-9	---	No Connection	2J13-7	RED-VIO	Lamp Row 7
2J12-10	BLK-VIO	Solenoid 07C	2J13-8	RED-GRY	Lamp Row 8
2J12-11	BLK-BLU	Solenoid 06C	2J13-9	---	No Connection
2J12-12	BLK-GRN	Solenoid 05C	2J13-10	---	No Connection
2J12-13	BLK-YEL	Solenoid 04C	2J13-11	YEL-VIO	Lamp Col 7
2J12-14	BLK-ORG	Solenoid 03C	2J13-12	YEL-GRY	Lamp Col 8
2J12-15	BLK-RED	Solenoid 02C			
2J12-16	BLK-BRN	Solenoid 01C	2J16-1	GRY-YEL	+12V dc Unreg/1-, 3-Dr Tgt Optos
			2J16-2	---	No Connection
2J14-1	RED-BRN	Lamp Row 1	2J16-3	BLK-YEL	Ground (Dr Target Opto Bds)
2J14-2	RED-BLK	Lamp Row 2			
2J14-3	RED-ORG	Lamp Row 3	2J18-1	GRN-BRN	Switch Col 1
2J14-4	RED-YEL	Lamp Row 4	2J18-2 - 4	---	No Connection
2J14-5	RED-GRN	Lamp Row 5	2J18-5	WHT-GRY	Switch Row 8
2J14-6	RED-BLU	Lamp Row 6	2J18-6	WHT-VIO	Switch Row 7
2J14-7	RED-VIO	Lamp Row 7	2J18-7	WHT-BLU	Switch Row 6
2J14-8	RED-GRY	Lamp Row 8	2J18-8	WHT-GRN	Switch Row 5
2J14-9	---	No Connection	2J18-9	WHT-YEL	Switch Row 4
2J14-10	YEL-BRN	Lamp Col 1	2J18-10	WHT-ORG	Switch Row 3
2J14-11	---	No Connection	2J18-11	---	No Connection
2J14-12	YEL-RED	Lamp Col 2	2J18-12	WHT-BRN	Switch Row 1
2J14-13	YEL-ORG	Lamp Col 3			
2J14-14	YEL-BLK	Lamp Col 4	2J19-1	GRN-RED	Switch Col 2
2J14-15	YEL-GRN	Lamp Col 5	2J19-2	GRN-ORG	Switch Col 3
2J14-16	YEL-BLU	Lamp Col 6	2J19-3	GRN-YEL	Switch Col 4
2J14-17	YEL-VIO	Lamp Col 7	2J19-4	GRN-BLK	Switch Col 5
2J14-18	---	No Connection	2J19-5	GRN-BLU	Switch Col 6
			2J19-6	GRN-VIO	Switch Col 7
2J15, 2J17 Not Installed			2J19-7	GRN-GRY	Switch Col 8
			2J19-8	Key Pin	No Connection
2J20-1, 9	---	No Connection	2J19-9	WHT-GRY	Switch Row 8
2J20-2	RED-BLK	Lamp Row 2 (Display Bd)	2J19-10	WHT-VIO	Switch Row 7
2J20-3	RED-ORG	Lamp Row 3 (Display Bd)	2J19-11	WHT-BLU	Switch Row 6
2J20-4	RED-YEL	Lamp Row 4 (Display Bd)	2J19-12	WHT-GRN	Switch Row 5
2J20-5	RED-GRN	Lamp Row 5 (Display Bd)	2J19-13	WHT-YEL	Switch Row 4
2J20-6	RED-BLU	Lamp Row 6 (Display Bd)	2J19-14	WHT-ORG	Switch Row 3
2J20-7	RED-VIO	Lamp Row 7 (Display Bd)	2J19-15	WHT-RED	Switch Row 2
2J20-8	RED-GRY	Lamp Row 8 (Display Bd)	2J19-16	WHT-BRN	Switch Row 1
2J20-10	YEL-BRN	Lamp Col 1 (Display Bd)			

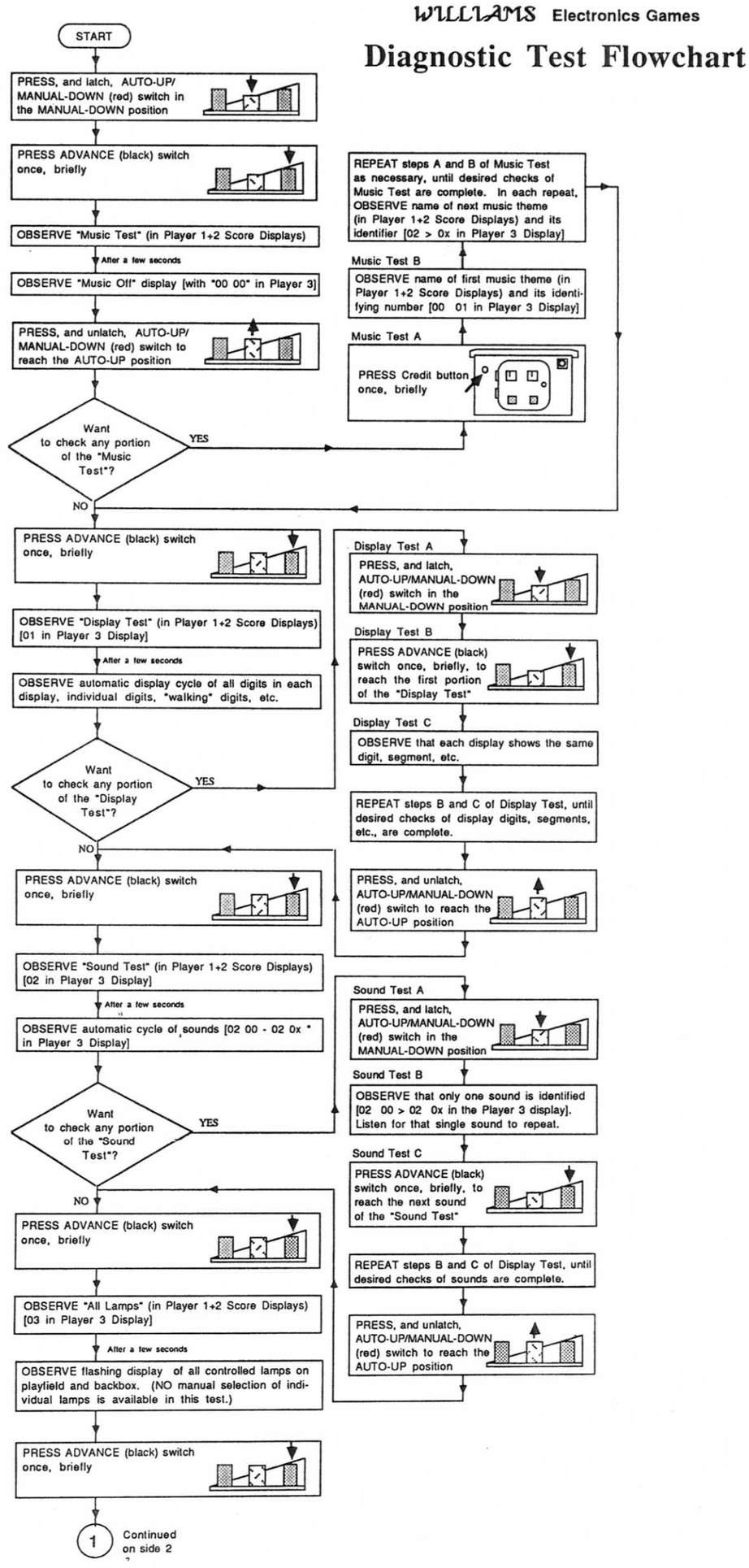
SOUND OVERLAY SOLENOID INTERBOARD SIGNALS

Connector	Wire Color	Signal Designation/Description	Connector	Wire Color	Signal Designation/Description
J1		Ribbon Cable to 4J4 on Audio Board	J2		Ribbon Cable from 1J21 on CPU Board
J3-1	GRY	+5 V dc Logic Pwr / 3J1-8/1J17-4	J4-1	GRY-GRN	SOL Solenoid 27
J3-2, 3	---	No Connection	J4-2	GRY-YEL	SOL Solenoid 26
J3-4	BLK	Logic Ground / 3J1-2/1J17-1	J4-3	---	No Connection
			J4-4	GRY-ORG	SOL Solenoid 25
J5-1	RED	+25V dc Solenoid Power	J4-5	GRY-RED	SOL Solenoid 24 / Triac J1-3
J5-2, 3	---	No Connection	J4-6	GRY-BRN	SOL Solenoid 23
J5-4	BLK	Ground / Solenoid ckt	J4-7	RED	+25V dc Solenoid Power



WILLIAMS Electronics Games

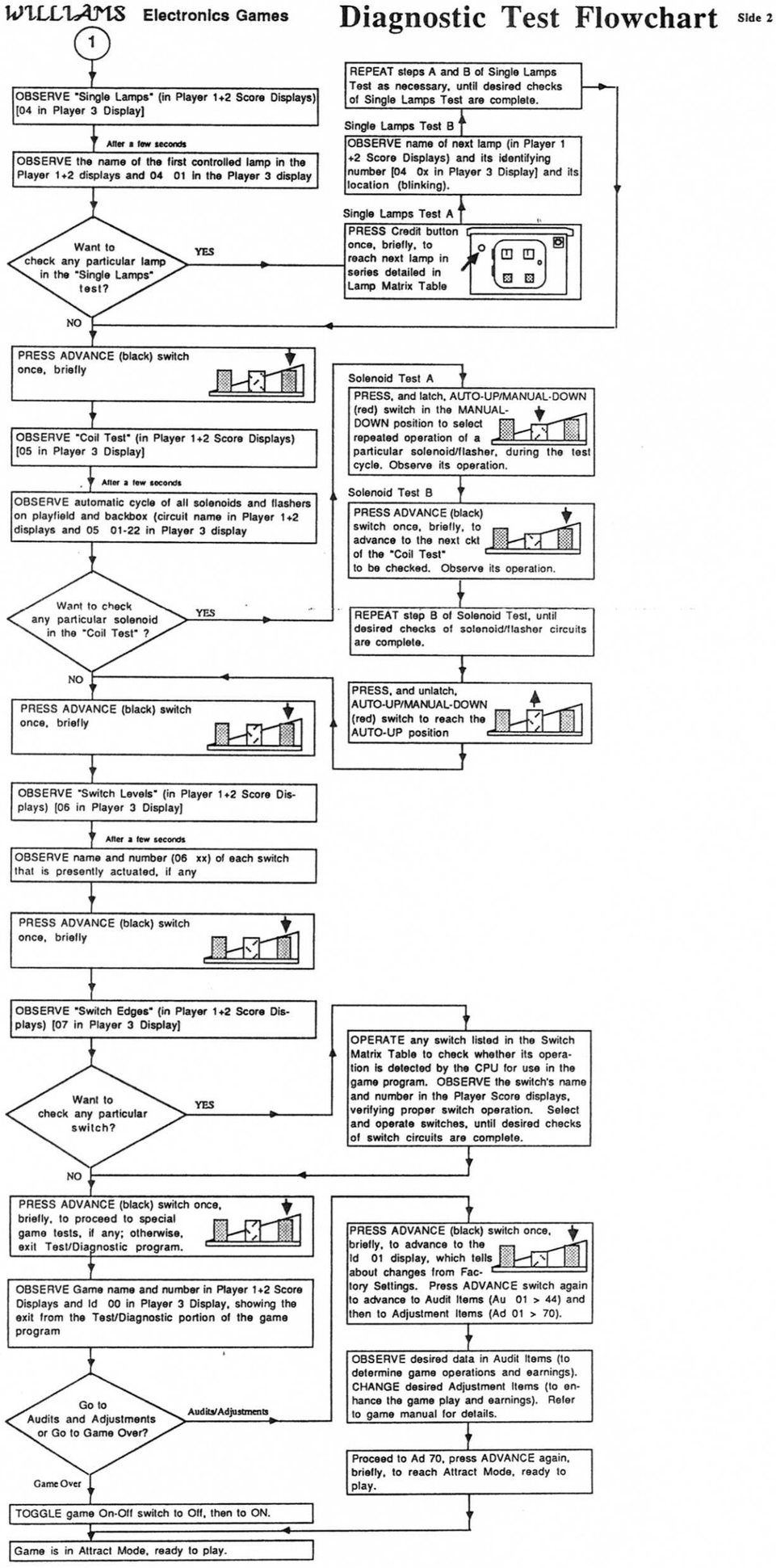
Diagnostic Test Flowchart



DIAGNOSTIC TEST FLOWCHART (SIDE 1)

Whirlwind 99

WILLIAMS Electronics Games

Diagnostic Test Flowchart

Side 2