Find-It-In-Front: Dr. Pinball Section

The inside cover & the front pages
DR. ❶ thru DR. ⑩ covers the basics

Alot of questions get answered here...

DR. DR. DR. DR.

NO YES END PREV QUIT

The Portals™ Service Menu,
Section 3, is your Technical Friend...

STERN PINBALL, INC.

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SPI PN#:
780-5072-01

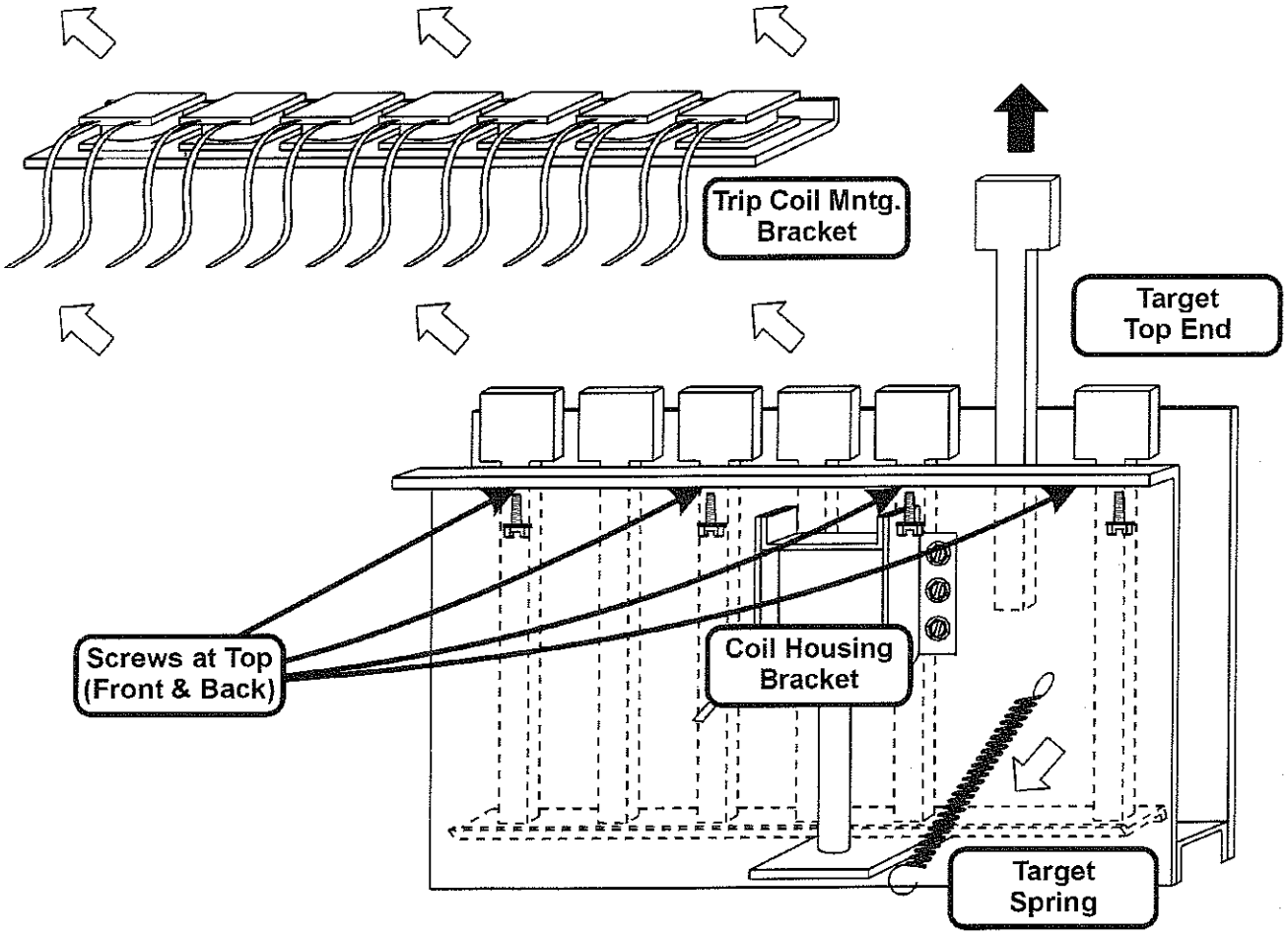
STERN PINBALL, INC.

We have designed a ***new Drop Target Assembly*** (SPI Part Nº: 500-6345-XX Series) which was used in our previous game, **Striker Extreme** (4-Bank) and in this game, **Sharkey's Shootout** (7-Bank). To shorten the learning curve, we have listed the proce- dure for replacing the targets below. The unit is extremely well built and solid and will reduce the number of service calls and mainten- ance involved with Drop Target Assemblies. Targets are still in that "wear-part" category so we felt it important to highlight this procedure.

Drop Target Replacement Procedure

(on a 1-, 4- or 7-Bank Drop Target 500-6345-XX Series Only)

1. DISCONNECT POWER AND REMOVE UNIT FROM PLAYFIELD.
2. REMOVE RED-MARKED SCREWS (FRONT & BACK AT TOP).
3. REMOVE TRIP COIL MOUNTING BRACKET (TOP PLATE).
4. REMOVE DROP TARGET SPRING. (REMOVAL OF COIL HOUSING BRACKET (3 SCREWS), WILL ONLY BE NECESSARY TO GAIN ACCESS TO HIDDEN SPRINGS).
5. REMOVE DROP TARGET FROM TOP END.
6. REASSEMBLE IN REVERSE ORDER.





New to our Pinball Games?
Don't forget to go over **Section 3, Chapter 1, Portals™ Service Menu Introduction.** *If using Diagnostics...very useful!* Got confused? Comments? Questions? Call Technical Support at 800-542-5377 or 708-345-7700.

ENSURE 4 PINBALLS ARE INSTALLED FOR PROPER OPERATION OF:

1 2 3 4

Sharkey's SHOOTOUT

DIAGNOSTIC AIDS

The *display reads* "OPERATOR ALERT..."

— A message displayed during Game Mode or Power-Up to alert the operator of a problem.

OPERATOR ALERT works by monitoring any *switch activated coil* that has the potential to trap a ball when disabled (e.g. in the Auto Launch, Scoop, Eject, etc.). If this assembly has a closed switch indicating a ball is stuck or the switch is *stuck closed*, the **CPU/Sound Board** will activate the coil ten times. If the switch remains closed, the game will display a message indicating there is a problem (e.g. "**OPERATOR ALERT AUTO LAUNCH NOT WORKING**"). This not only warns the operator of a problem immediately, but indicates exactly where the operator should look to resolve it.

The *display flashes* "OPEN THE COIN DOOR"

— This indicates that CMOS RAM memory (CPU Loc. U212) has been corrupted.

This is caused by either failure in memory (e.g. batteries are dead or faulty **RAM**) or upon installation of updated version of code. Opening the Coin Door will initiate a Factory Restore, by opening the Memory Protect Switch. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Board**.

CPU DIP SWITCH SETTINGS

(Location of Dip Switch [SW300] is on the CPU/Sound Board)

Custom Factory Adjustments By Country (All countries not noted use the "USA Setting")

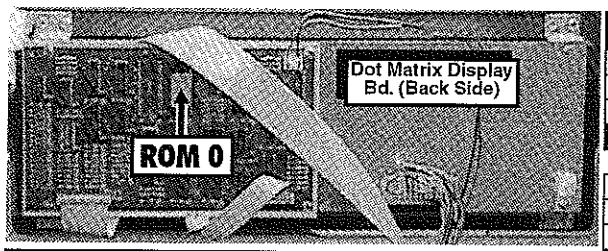
CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
USA	ON								
	OFF	▼	▼	▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
EURO	ON	▲	▲	▲	▲				
	OFF					▼	▼	▼	▼
AUSTRIA	ON	▲							
	OFF		▼	▼	▼	▼	▼	▼	▼
BELGIUM	ON		▲						
	OFF	▼		▼	▼	▼	▼	▼	▼
BRAZIL	ON	▲		▲	▲				
	OFF		▼			▼	▼	▼	▼
CANADA	ON	▲	▲						
	OFF			▼	▼	▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
FRANCE	ON			▲	▲				
	OFF	▼	▼			▼	▼	▼	▼
GERMANY	ON	▲	▲	▲					
	OFF				▼	▼	▼	▼	▼
ITALY	ON				▲				
	OFF	▼	▼	▼		▼	▼	▼	▼
JAPAN	ON	▲			▲				
	OFF		▼	▼		▼	▼	▼	▼
NETHERLANDS (HOLLAND / DUTCH)	ON				▲				
	OFF	▼	▼			▼	▼	▼	▼

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
NORWAY	ON		▲		▲				
	OFF	▼		▼		▼	▼	▼	▼
SWEDEN	ON	▲	▲		▲				
	OFF			▼		▼	▼	▼	▼
SWITZERLAND	ON			▲	▲				
	OFF	▼	▼			▼	▼	▼	▼
UK	ON	▲		▲					
	OFF		▼		▼	▼	▼	▼	▼
UK FOR NEW 50p, 2£ COIN MECH	ON		▲	▲	▲				
	OFF	▼				▼	▼	▼	▼

ROM SUMMARY TABLE



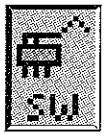
The Display Controller Board (holds the Display ROM Loc: ROM0) is positioned behind the 128 X 32 Dot Matrix Display Board.

I.C. NAME	TYPE	BD. NAME	LOC.	PART Nº
Game ROM	1MB	CPU / Sound Bd.	U210	965-0333-72
Sound EPROM	512K	CPU / Sound Bd.	U7	965-0334-72
Display EPROM	4MB	Display Cntlr. Bd.	ROM 0	965-0335-72
Display EPROM	N/C	Display Cntlr. Bd.	ROM 1	N/A
Voice ROM 1	8MB	CPU / Sound Bd.	U17	965-0336-72
Voice ROM 2	8MB	CPU / Sound Bd.	U21	965-0337-72
Voice ROM 3	8MB	CPU / Sound Bd.	U36	965-0338-72
Voice ROM 4	N/C	CPU / Sound Bd.	U37	N/A

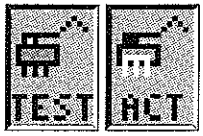
For Game, Sound & Voice ROM Locations see DR. 4.



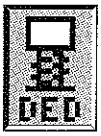
From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU



From the Diagnostics Menu GO TO SWITCH MENU



From the Switch Menu GO TO SWITCH OR ACTIVE SWITCH TEST



From the Switch Menu GO TO DEDICATED SWITCH TEST

SWITCH MATRIX GRID & DEDICATED SWITCHES

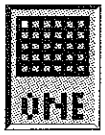
Diode On Terminal Strip:

Column (Drive) / Row (Return)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (POST SAVE™) on Cabinet side 1	PLAYFIELD GLASS SWITCH on Cabinet 9	7-BANK DROP TRGT (1) On Assembly 17	STAND-UP TARGET (P) AYOFF On Assembly 25	MYSTERY BALL OPTO #1 On Assembly 33	LEFT RAMP ENTER On Assembly 41	LEFT TURBO BUMPER On Assembly 49	LEFT OUTLANE Under Playfield 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	LOCKDOWN SWITCH on Cabinet 10	7-BANK DROP TRGT (2) On Assembly 18	STAND-UP TARGET P (A) YOFF On Assembly 26	MYSTERY BALL OPTO #2 On Assembly 34	LEFT RAMP EXIT On Assembly 42	RIGHT TURBO BUMPER On Assembly 50	LEFT RETURN LANE Under Playfield 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) On Assembly 11	7-BANK DROP TRGT (3) On Assembly 19	STAND-UP TARGET PA (Y) OFF On Assembly 27	MYSTERY BALL OPTO #3 On Assembly 35	UNDER-TROUGH On Assembly 43	BOTTOM TURBO BUMPER On Assembly 51	LEFT SLINGSHOT On Assembly 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 On Assembly 12	7-BANK DROP TRGT (4) On Assembly 20	STAND-UP TARGET PAY (O) FF On Assembly 28	MYSTERY BALL OPTO #4 On Assembly 36	SUPER VUK On Assembly 44	TOUR. START BUTTON Cabinet Front 52	RIGHT OUTLANE Under Playfield 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 On Assembly 13	7-BANK DROP TRGT (5) On Assembly 21	STAND-UP TARGET PAYO (F) F On Assembly 29	NOT USED 37	SNEAK-IN Under Playfield 45	STAND-UP TRGT (CENTER) On Assembly 53	RIGHT RETURN LANE Under Playfield 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO On Assembly 14	7-BANK DROP TRGT (6) On Assembly 22	STAND-UP TARGET PAYOF (F) On Assembly 30	SPINNER (LT ORBIT) On Assembly 38	LEFT TOP LANE Under Playfield 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT On Assembly 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO On Assembly 15	7-BANK DROP TRGT (7) On Assembly 23	LEFT ORBIT Under Playfield 31	RIGHT ORBIT BOTTOM Above Playfield 39	MIDDLE TOP LANE Under Playfield 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (POST SAVE™) on Cabinet side 8	SHOOTER LANE Under Playfield 16	SINGLE DROP TRGT On Assembly 24	INSIDE RIGHT ORBIT Under Playfield 32	RIGHT ORBIT TOP Under Playfield 40	RIGHT TOP LANE Under Playfield 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

GND / IC U206 INPUTS	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DS-3
4: U206 GRY-YEL CN6-P5	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side DS-4
5: U206 GRY-GRN CN6-P7	#5 UPPER FLIPPER BUTTON in Cabinet side DS-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door DS-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door DS-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door DS-8



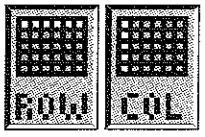
From the Diagnostics Menu GO TO LAMP MENU



From the Lamp Menu GO TO SINGLE LAMP TEST



From the Lamp Menu GO TO TEST ALL LAMPS



From the Lamp Menu GO TO ROW OR COLUMN TEST

LAMP MATRIX GRID

Diode On Terminal Strip:

Column (18v) / Row (GND)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	ARCH LED CHECK 1 Tournie Only 1	ARCH LED CHECK 2 Tournie Only 2	ARCH LED CHECK 3 Tournie Only 3	ARCH LED CHECK 4 Tournie Only 4	ARCH LED CHECK 5 Tournie Only 5	ARCH LED CHECK 6 Tournie Only 6	LEFT POST SAVE™ #555 Bulb 7	RIGHT POST SAVE™ #555 Bulb 8
2: Q34 RED-BLK J12-P2	JEANETTE LEE #44 Bulb 9	STICKS #555 Bulb 10	DR. WOOD #555 Bulb 11	SHARKEY #555 Bulb 12	TEX #555 Bulb 13	MR. GREY #555 Bulb 14	8 BALL LOWER #555 Bulb 15	9 BALL LOWER #44 Bulb 16
3: Q35 RED-ORG J12-P3	PRIZE MONEY $100,000 #555 Bulb 17	PRIZE MONEY $50,000 #555 Bulb 18	PRIZE MONEY $25,000 #555 Bulb 19	PRIZE MONEY $10,000 #555 Bulb 20	PRIZE MONEY $5,000 #555 Bulb 21	PRIZE MONEY $1,000 #555 Bulb 22	SHOOT AGAIN #555 Bulb 23	BOTTOM UP POST #555 Bulb 24
4: Q36 RED-YEL J12-P4	(P) AYOFF #555 Bulb 25	P (A) YOFF #555 Bulb 26	PA (Y) OFF #555 Bulb 27	PAY (O) FF #555 Bulb 28	PAYO (F) F #555 Bulb 29	PAYOF (F) #555 Bulb 30	TOP RIGHT JACKPOT ARROW #555 Bulb 31	COLLECT COMBINATION #555 Bulb 32
5: Q37 RED-ORN J12-P5	7-BANK (1) BALL #555 Bulb 33	7-BANK (2) BALL #555 Bulb 34	7-BANK (3) BALL #555 Bulb 35	7-BANK (4) BALL #555 Bulb 36	7-BANK (5) BALL #555 Bulb 37	7-BANK (6) BALL #555 Bulb 38	7-BANK (7) BALL #555 Bulb 39	ADVANCE BUMPER POOL #555 Bulb 40
6: Q38 RED-BLU J12-P6	(P) OOL #555 Bulb 41	P (O) OL #555 Bulb 42	PO (O) L #555 Bulb 43	POO (L) #555 Bulb 44	COLLECT HURRY UP #555 Bulb 45	SINGLE D/T (8 BALL) #555 Bulb 46	SINGLE D/T (LOCK) #555 Bulb 47	LOWER RIGHT JACKPOT ARROW #555 Bulb 48
7: Q39 RED-VIO J12-P8	HURRY UP #555 Bulb 49	UPPER 9 BALL #555 Bulb 50	TOP LEFT JACKPOT ARROW #555 Bulb 51	MYSTERY ? BALL #555 Bulb 52	START COMBINATION #555 Bulb 53	RAMP JACKPOT ARROW #555 Bulb 54	9 BALL (SIGN) DOT 19 #555 Bulb 55	REVERSE ENGL. (SIGN) DOT 19 #555 Bulb 56
8: Q40 RED-GRY J12-P9	(C) UE #555 Bulb 57	C (U) E #555 Bulb 58	CU (E) #555 Bulb 59	SKILL SHOT #555 Bulb 60	LEFT TURBO BUMPER DOT 19 #555 Bulb 61	RT TURBO BUMPER DOT 19 #555 Bulb 62	BOT TURBO BUMPER DOT 19 #555 Bulb 63	8 BALL (SIGN) DOT 19 #555 Bulb 64
9: Q41 RED-WHT J12-P10	ADVANCE PRIZE MONEY #555 Bulb 65	EXTRA BALL #555 Bulb 66	R. INSIDE JACKPOT ARROW #555 Bulb 67	NOT USED 68	NOT USED 69	NOT USED 70	START BUTTON #555 Bulb 71	TOURNAMENT BUTTON #555 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80



▼ BACKBOX LAYOUT LOCATIONS: Fuses, Bridges, Relays & ROMs ▼

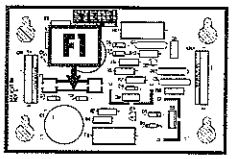
CAUTION: *For continued protection against risk of fire, replace only with same type of fuse having the same electrical rating!*

QUICK REFERENCE FUSE CHART

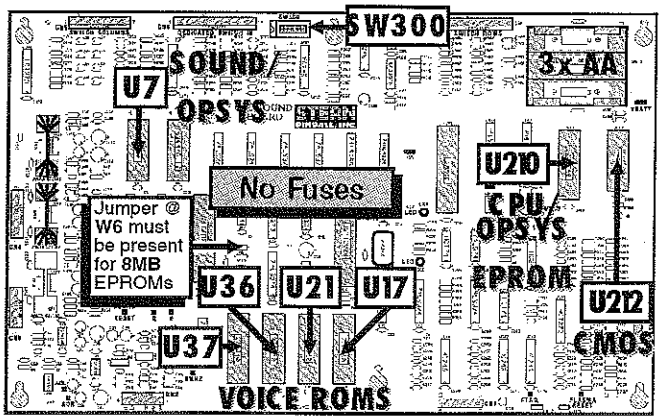
Backbox Fuses			
LOC: DISPLAY POWER SUPPLY (P.S.) BOARD			
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC: I / O POWER DRIVER BOARD			
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	**4A 250v S.B.**	50v DC	Magnet(s) (Mystery Ball & Playfield)
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT to WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL to WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN to WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO to WHT-VIO)
F28	3A 250v S.B.	24v AC	Motors / Aux. (If Used)
Cabinet Fuses			
LOC: SERVICE (AC) OUTLET BOX (Cabinet Bottom)			
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)
Sharkey's Shootout P/F Fuses			
LOC: UNDER PLAYFIELD (By Assemblies Listed)			
n/a	3A 250v S.B.	50v DC	Rt. Flipper (BLU-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Lt. Flipper (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Upper Flipper (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Right Orbit Magnet (VIO-YEL⇆BLK)
n/a	4A 250v S.B.	50v DC	Mystery Ball Magnet (VIO-YEL⇆BLK)

For Backbox & Cabinet General Parts, review Section 4, Chapter 1, Parts Identification & Location (The Pink Pages).
For Schematics and/or Component Parts on above Boards, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

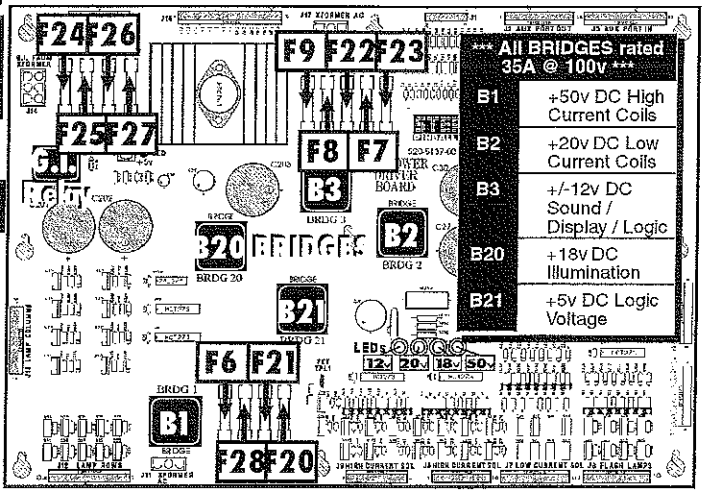
Display Power Supply Board

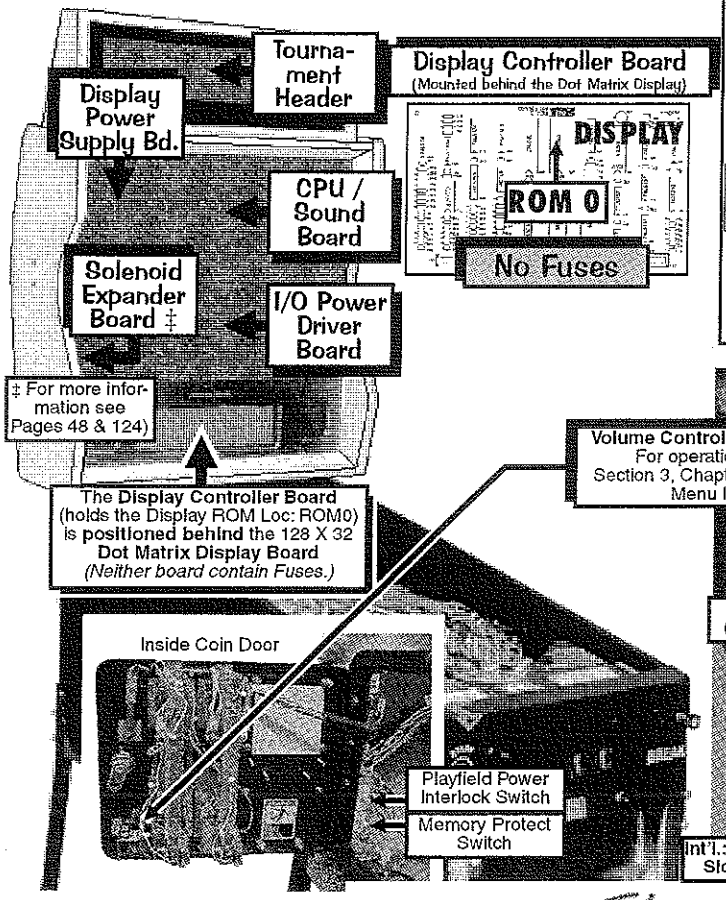


CPU / Sound Board



I/O Power Driver Board





FIND-IT-IN-FRONT: Dr. Pinball Section Explained

The key technical data from various parts of the manual were extracted and combined into the **"Find- It-In-Front: Dr. Pinball Section."** This section (pages **DR. ❶ - ⑩**) will assist the technician in locating important technical information needed to troubleshoot the Pinball Machine. **Dr. Pinball** is also available in a Flow Chart Help Format in the Game Display. To access, enter the **Portals™ Service Menu**.

How It Works

First, the operator / technician must enter the ***Service Menu Mode*** (for a complete description of the **Portals™ Service Menu** and **ICONS *Read!*** Section 3, Chapter 1). To get into the ***Service Menu Mode***, power-up the game (if not already) and open the **Coin Door**. On the **Coin Door** is the **Portals™ Service Switch Set** (**Red**, **Green** & **Black Buttons**).

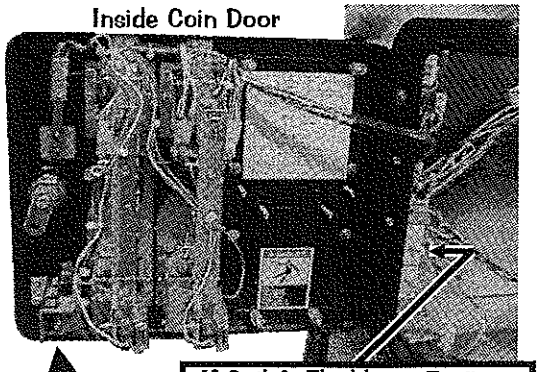
Step 1: Push down the **Black "BEGIN TEST" Button**. Looking at the Video Display you will momentarily see the introductory screen followed by the **MAIN MENU**.

Step 2: Move through the Menus by pushing the **Red "LEFT"** or **Green "RIGHT" Buttons**.



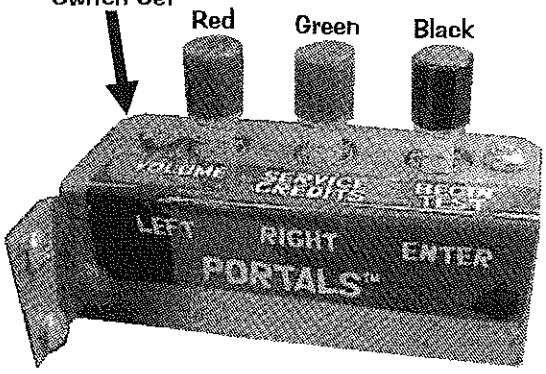
Step 3: Select or activate the *Icons* by pushing the **Black "ENTER" Button**.

Inside Coin Door



If Coil & Flashlamp Testing, the Playfield Power Interlock Switch must be pulled out.

Portals™ Service Switch Set



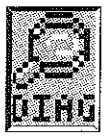
While in the **Portals™ Service Menu**, the **Start Button** can be used in lieu of the **Black Button**; the **Left** & **Right Flipper Buttons** can be used in lieu of the **Red** & **Green Buttons**. However, in *Switch* or *Active Switch Tests* ***only*** the **Red** & **Green Buttons** can be used.



In our **Portals™ Service Menu**, selecting the "DR." *Icon* will bring the operator/technician into Dr. Pinball (Flow Chart Menus), the "on-screen" diagnostic aide. This is a feature that will allow you to utilize the power of the micro-processor assisting in troubleshooting a problem with the machine in a Flow Chart format *(Just follow along & answer the questions.)*.



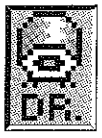
While in the **MAIN MENU**, select the "DIAG" *Icon*, then select the Cross "DR." *Icon* (the last *Icon* before the "PREV" *Icon*). This will bring you (the operator / technician) into **DR. PINBALL** (Flow Chart Menus) which offers you a choice of three (3) Sub-Menus: Coil "DR.," Switch "DR." & Lamp "DR." *Icons*. Selecting a particular sub-menu will give you a choice of which specific Flipper, Coil, Switch or Lamp circuit needs to be diagnosed. The display will now ask a question or give a procedure to follow such as *"Does the lamp turn on?"* or *"Check bridge rectifier BR-20, if short replace."* When *Dr. Pinball* asks a question or requests a procedure, respond by selecting the appropriate *Mini-Icon*, and continue.

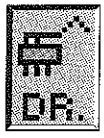


From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



From the Diagnostics Menu GO TO DR. PINBALL →







From the Dr. Pinball Menu GO TO COIL, SWITCH OR LAMP FLOW CHARTS

The following are the *Mini-Icons* with explanations for the **Dr. Pinball Sub-Menus**:



Select a Coil, Lamp, Switch or Flipper to diagnose with the "-" or "+" *Icon*; select the "RUN" *Icon* to activate the choice. The "PREV" *Icon* goes back to previous question. The "QUIT" *Icon* exits Portals completely.



Seen when a question is being asked on the Display. Select the "YES" *Icon* or "NO" *Icon* to answer the question given. The "END" *Icon* lets you select a new item to test.

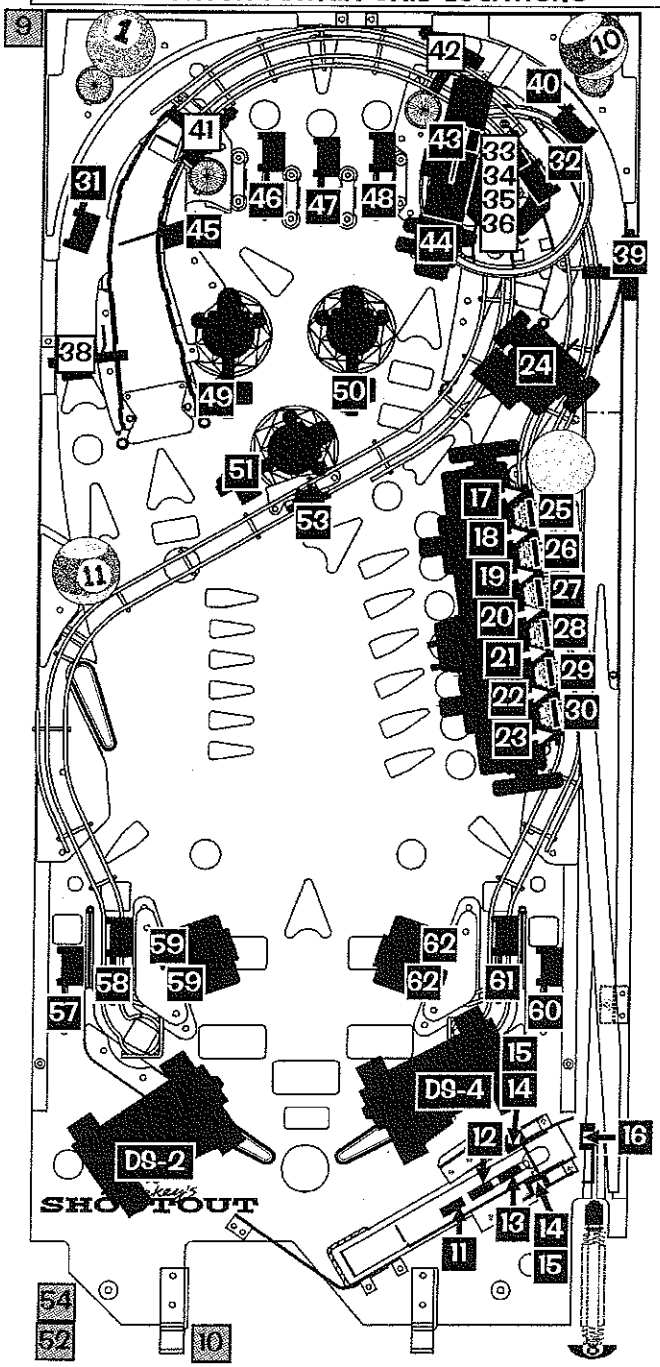


Seen when diagnosis is given. Select any *Icon* for your next step. The "?" *Icon* gives Help.

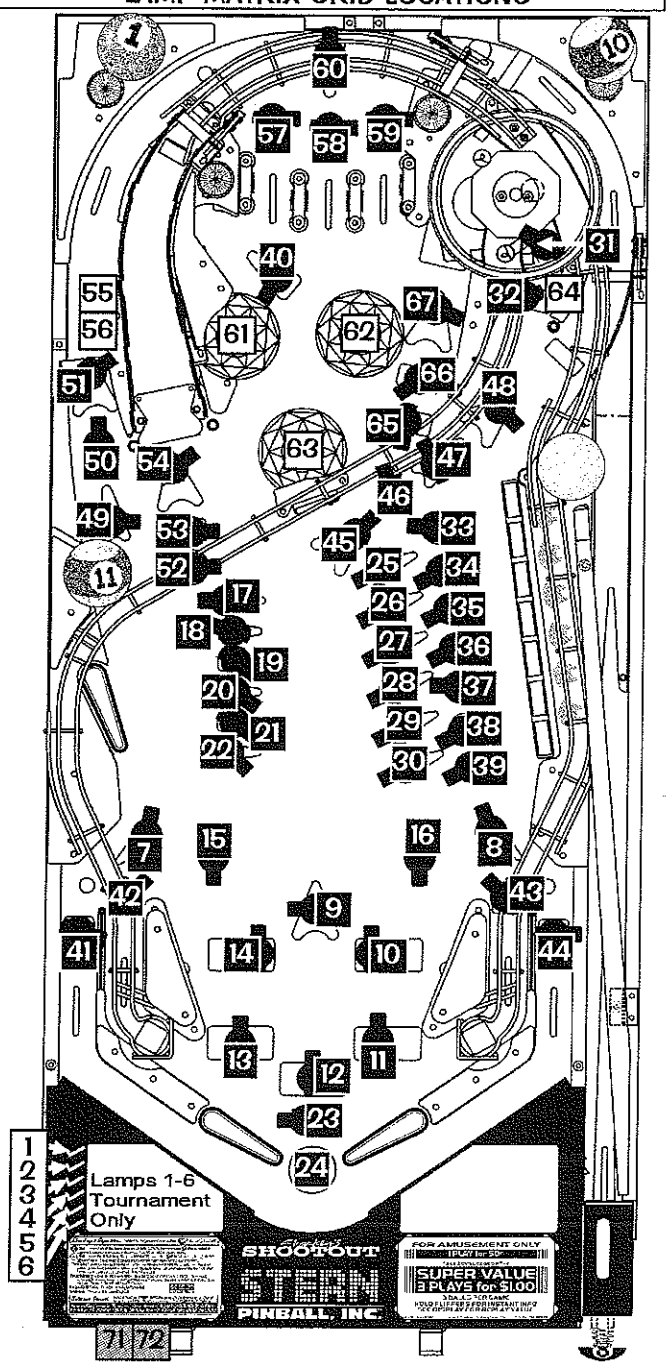


In Coil Flow Chart Menu, select the "PULSE" *Icon* to pulse the coil selected.

SWITCH MATRIX GRID LOCATIONS

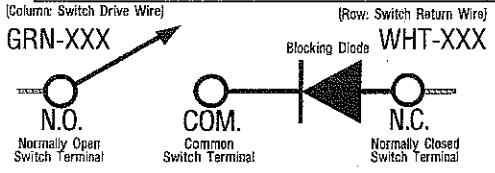


LAMP MATRIX GRID LOCATIONS

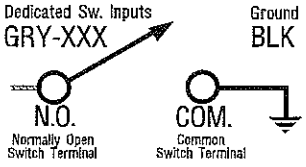


Legend Note: ☐ = Switches/Lamps mounted above P/F. ■ = Switches/Lamps mounted below the P/F. ▒ = ...mounted on Cabinet.

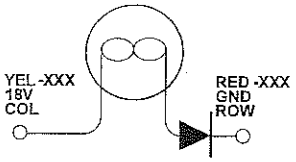
TYPICAL SWITCH SCHEMATIC

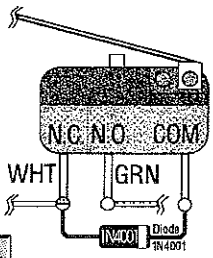


DEDICATED SWITCH SCHEMATIC



TYPICAL LAMP SCHEMATIC





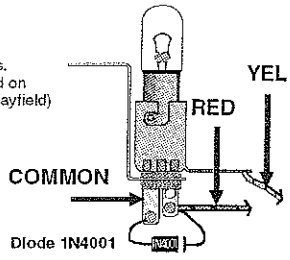
Note:
All Switches require diodes. Some diodes are located on Terminal Strips OR Diode Boards (under playfield) & not on the switch itself.

Diode On Terminal Strip

Diode On Diode Board

Note:
All Lamps require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the lamp itself.

Diode On Terminal Strip

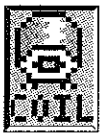


Sam's SHOOTOUT

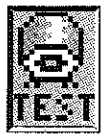
Find-It-In-Front: Dr. Pinball



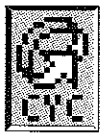
From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



From the Diagnostics Menu GO TO COIL MENU →



From the Coil Menu GO TO COIL TEST →



From the Coil Menu GO TO CYCLING COILS

COILS DETAILED CHART TABLE

	High Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#4	SINGLE DROP TRGT (TRIP)	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	32-1250 515-6916-01
#5	7-BANK DROP TARGET (RESET)	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#6	SINGLE DROP TARGET (RESET)	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#7	FLASH: SVUK, R. ORBIT X2	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#8	FLASH: JACKPOT X3	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

	High Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	TOP ORBIT MAGNET	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	VIO-YEL	J10-P3	50v DC	24-780 090-5061-00
#13	MYSTERY BALL MAGNET	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T

Diode On Terminal Strip (if noted)

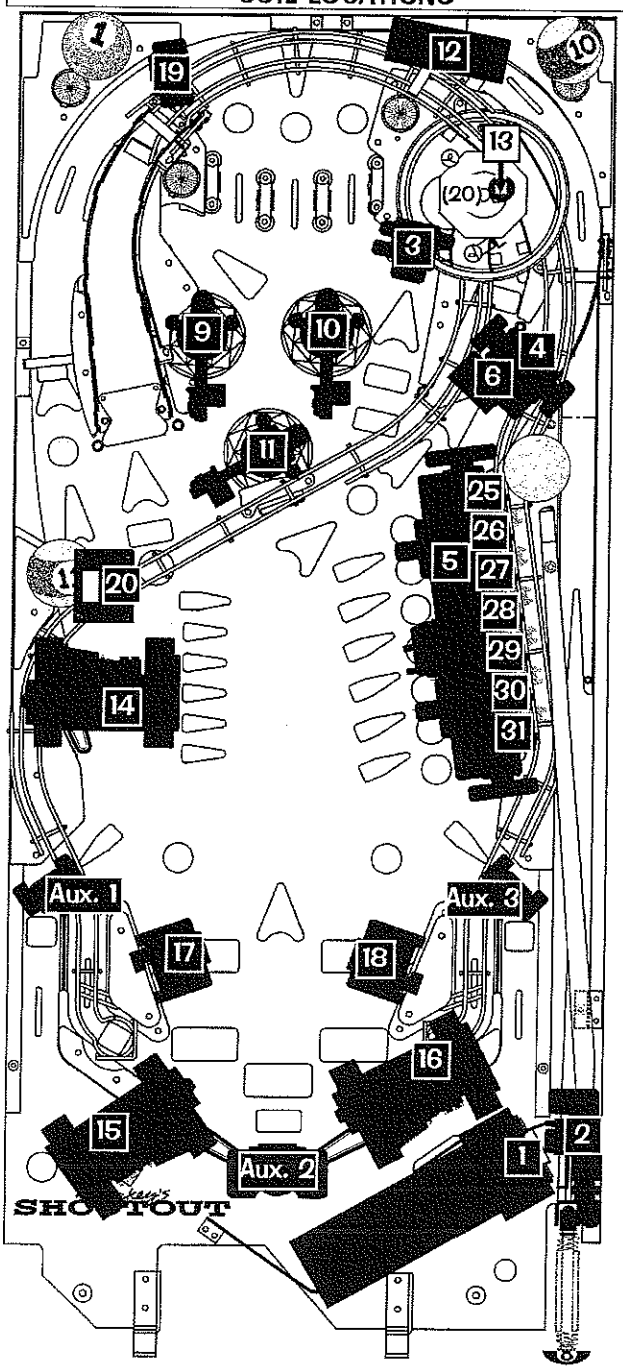
	Low Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	BALL DEFLECTOR	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#20	MTR DRV RELAY BD	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	BRN	J7-P1	20v DC	Relay Bd. 520-5010-00
#21	FLASH: LEFT CORNER X2	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#22	FLASH: RIGHT ORBIT X1	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#23	FLASH: MYSTERY BALL X2	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

	Low Current Coils Group 2	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#25	7-BANK DROP TRGT (1) (TRIP)	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	BRN	J7-P1	20v DC	32-1250 515-6916-01
#26	7-BANK DROP TRGT (2) (TRIP)	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	BRN	J7-P1	20v DC	32-1250 515-6916-01
#27	7-BANK DROP TRGT (3) (TRIP)	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	BRN	J7-P1	20v DC	32-1250 515-6916-01
#28	7-BANK DROP TRGT (4) (TRIP)	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	BRN	J7-P1	20v DC	32-1250 515-6916-01
#29	7-BANK DROP TRGT (5) (TRIP)	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	BRN	J7-P1	20v DC	32-1250 515-6916-01
#30	7-BANK DROP TRGT (6) (TRIP)	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	BRN	J7-P1	20v DC	32-1250 515-6916-01
#31	7-BANK DROP TRGT (7) (TRIP)	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	BRN	J7-P1	20v DC	32-1250 515-6916-01
#32	FLASH: 9 BALL X1	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

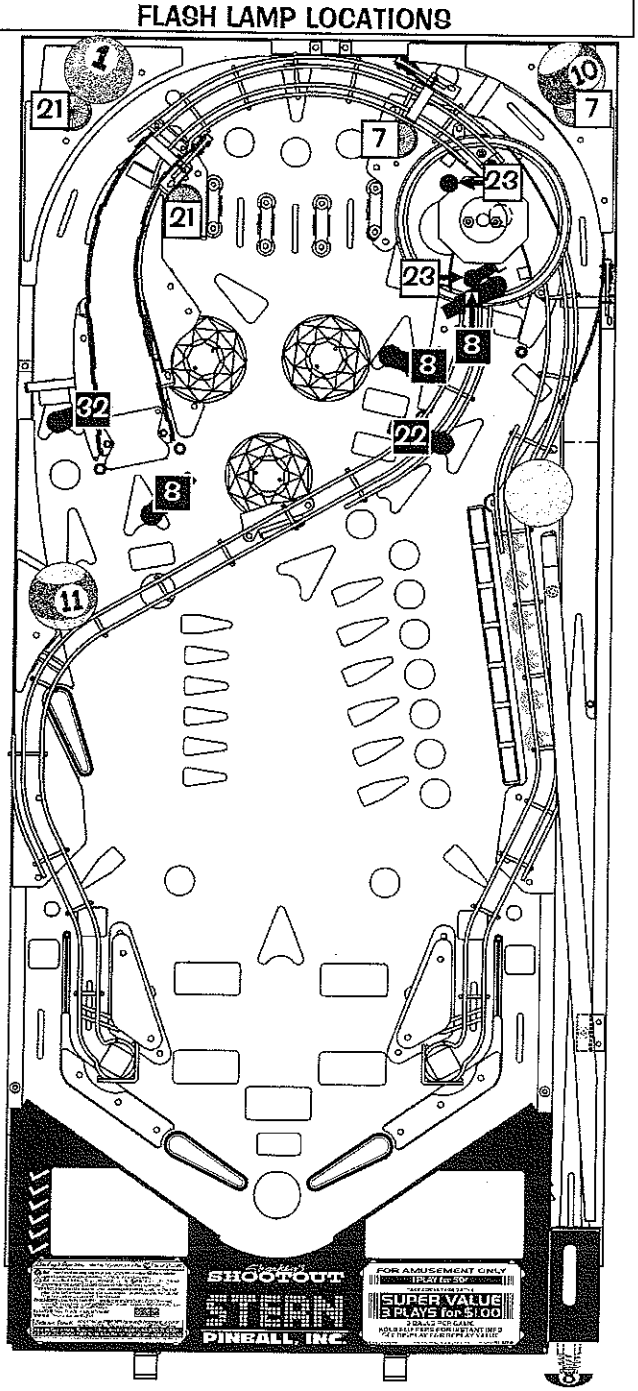
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: #7-#8, #21-#23 & #32)

	Auxilliary (Low Current Coils)	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
	AUX 1: LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	CN2-P5	BRN	J7-P1	20v DC	26-1200 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	CN2-P4	BRN	J7-P1	20v DC	23-1100 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	CN2-P3	BRN	J7-P1	20v DC	26-1200 090-5044-00T

COIL LOCATIONS

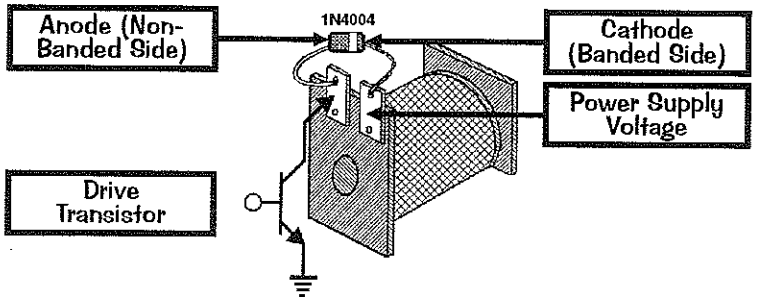


FLASH LAMP LOCATIONS



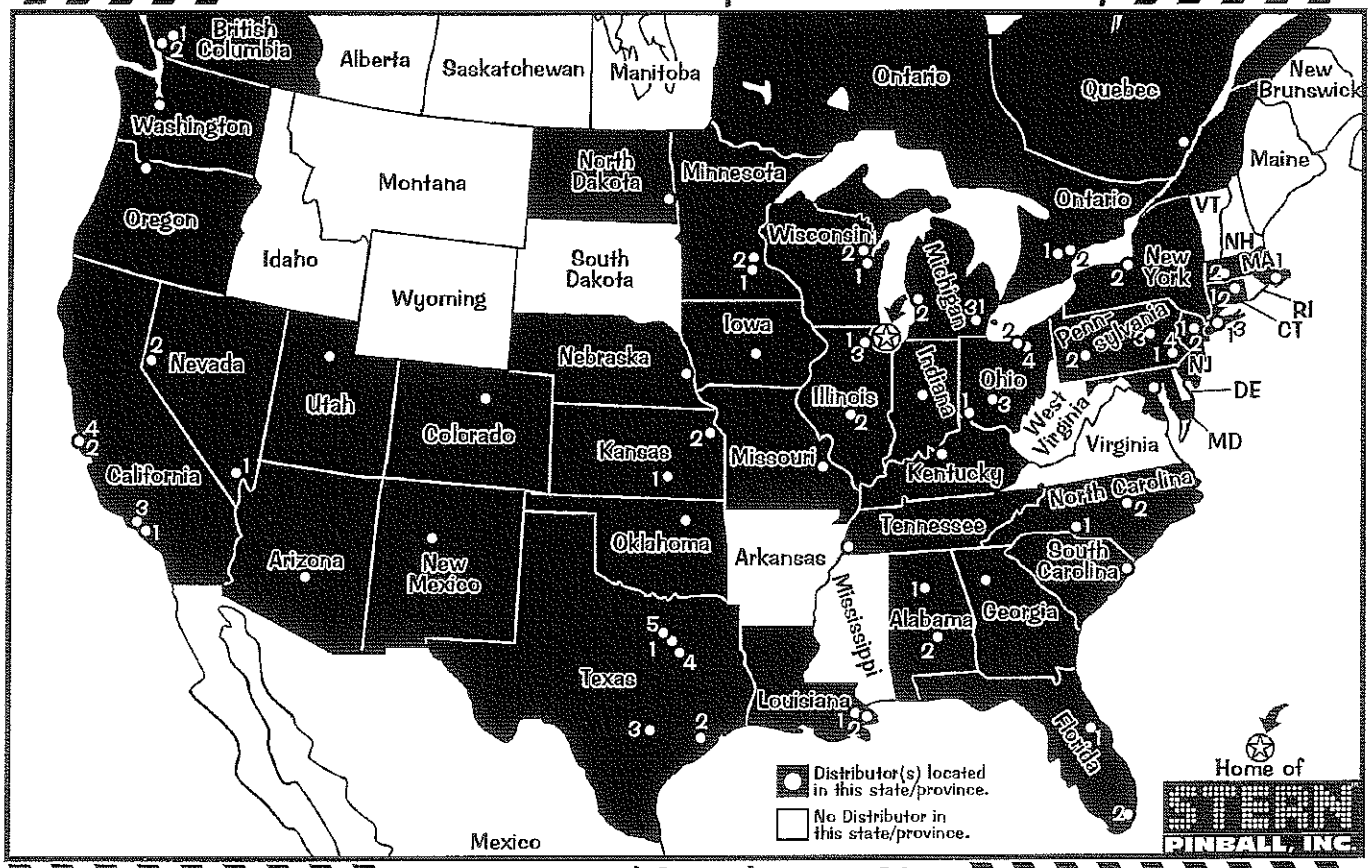
Legend Note: ☐ = Coils/Flashers mounted above P/F. ■ = Coils/Flashers mounted below the P/F. ▒ = ...mounted in/on Cabinet.

TYPICAL COIL WIRING

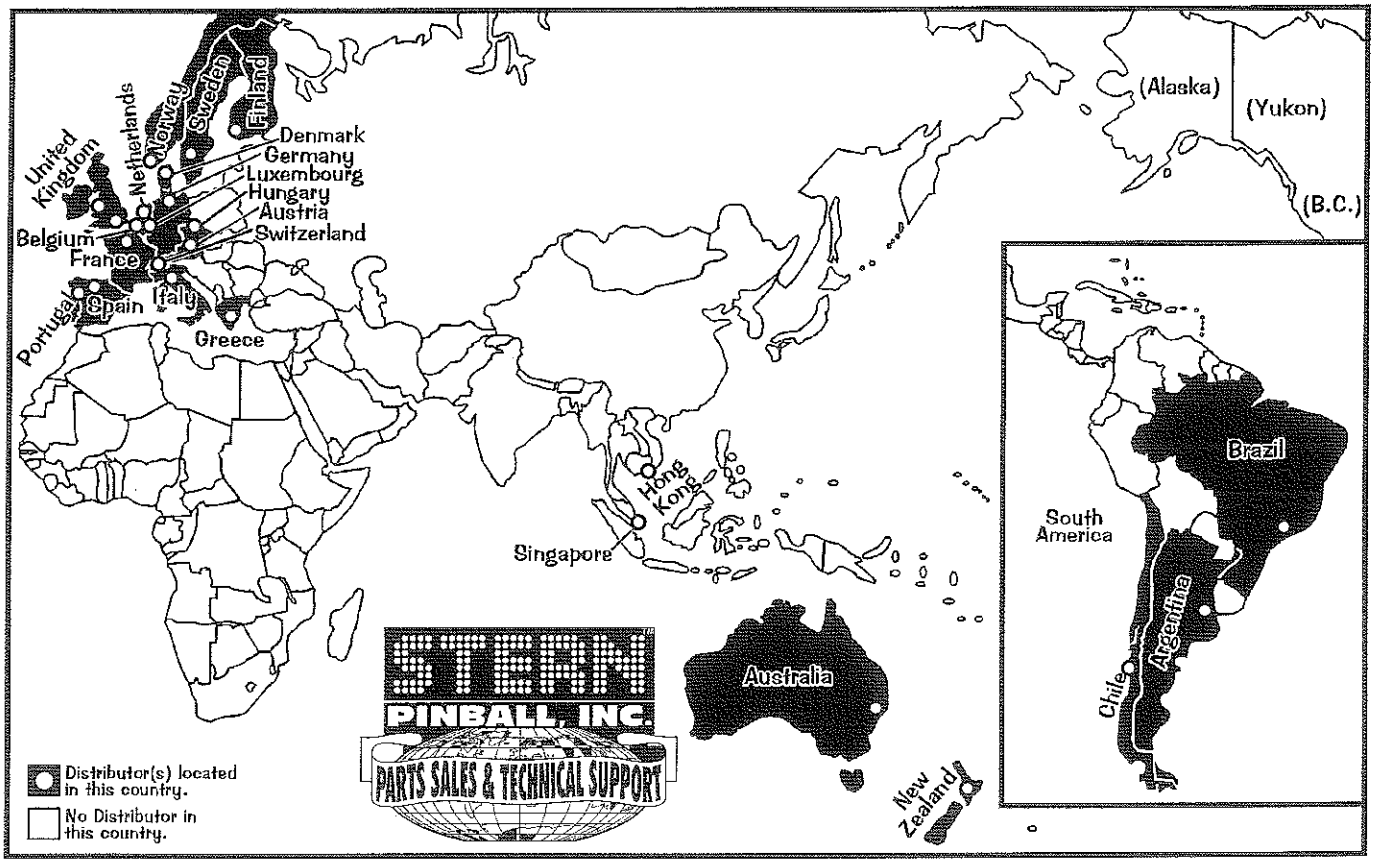


Note:
All Coils require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the coil itself.
D iode
O n
T erminal
S trip

Domestic Pinball & Redemption Distributors Map



International Distributors Map



For *Parts & Service*, call your nearest Distributor. View the above maps & the directories on the next page to locate your closest Distributor in your state, province, or country. Distributors and phone numbers are subject to change. Call **Stern™ Pinball, Inc.** *(Parts Sales & Technical Support)* with any questions or if your Distributor cannot help you: **1-800-542-5377** (in **USA** or **Canada**) or **1-708-786-5463**.

Domestic Pinball & Redemption Distributors Directory

ALABAMA
Birmingham Vending
Birmingham (1)
1-205-324-7526

Franco Distributing
Montgomery (2)
1-334-834-3455

ARIZONA
Betson West
Phoenix
1-602-233-0190

Mountain Coin
Phoenix
1-602-269-7596

BRITISH COLUMBIA
Can. Coin Machine
Burnaby (1)
1-604-420-4008

Pacific Vending
Vancouver (2)
1-604-324-2164

CALIFORNIA
Betson West
Buena Park (1)
1-714-228-7500
So. San Francisco (2)
1-650-952-4220

C.A. Robinson
Los Angeles (3)
1-323-735-3001
San Francisco (4)
1-650-871-4280

COLORADO
Mountain Coin
Denver
1-303-427-2133

Warehouse of Games
Denver
1-303-893-4300

CONNECTICUT
Betson Enterprises
Milford (1)
1-203-878-6966

T & M Distributing
Willimantic (2)
1-860-456-4231

FLORIDA
Birmingham Vending
Orlando (1)
1-407-425-1505

Florida (cont.)
Brady Distributing
Miami (2)
1-305-621-1415
Orlando (1)
1-407-872-1666

GEORGIA
Greater Southern Dist.
Atlanta
1-404-352-3040

ILLINOIS
American Vending
Elk Grove Village (1)
1-847-439-9400
Springfield (2)
1-217-492-9400

Atlas Distributing
Elk Grove Village (3)
1-847-952-7500

IOWA
Greater America Dist.
Johnston
1-515-278-4455

Moss Distributing
Des Moines
1-515-266-6422

INDIANA
Atlas Distributing
Indianapolis
1-317-786-6892

Cleveland Coin
Indianapolis
1-317-895-4270

Shaffer Distributing
Indianapolis
1-317-899-2530

KANSAS
United Dist., Inc.
Wichita (1)
1-316-263-6181

Warehouse of Games
Lenexa (2)
1-913-492-9800

KENTUCKY
Atlas Distributing
Louisville
1-502-966-5266

LOUISIANA
AMA Distributors, Inc.
Metairie (1)
1-504-835-3232

Louisiana (cont.)
New Orleans Novelty
New Orleans (2)
1-504-888-3500

MARYLAND
State Sales & Service
Baltimore
1-410-646-4100

Weiner Distributing
Baltimore
1-410-525-2600

MASSACHUSETTS
Betson Ent. (NECO)
Norwood (1)
1-781-769-9760

Gekay Sales
E. Longmeadow (2)
1-413-525-2700

MICHIGAN
Atlas Distributing
Redford (1)
1-313-794-4880
Wyoming (2)
1-616-241-1472

Cleveland Coin
Livonia (3)
1-734-432-1040

MINNESOTA
Hanson Distributing
Bloomington (1)
1-612-884-6604

Lieberman Music
Minneapolis (2)
1-612-887-5299

MISSOURI
Shaffer Distributing
St. Louis
1-314-645-3393

Warehouse of Games
St. Louis
1-314-469-6767

NEBRASKA
Central Dist.
Omaha
1-402-493-5600

Greater America Dist.
Omaha
1-402-553-2812

NEVADA
Mountain Coin
Las Vegas (1)
1-702-798-0900

Nevada (cont.)
Reno Game Sales
Reno (2)
1-775-829-2080

NEW JERSEY
Betson Enterprises
Carlstadt (1)
1-201-438-1300

State Sales & Service
Carteret (2)
1-732-750-2700

NEW MEXICO
Mountain Coin
Albuquerque
1-505-345-7706

NEW YORK
Betson Enterprises
New Hyde Park (1)
1-516-354-4647
Syracuse (2)
1-315-455-5400

Deith Distributing
Roslyn Heights (3)
1-516-621-1234

T & M Distributing
Syracuse (2)
1-315-432-1932

NORTH CAROLINA
Brady Distributing
Charlotte (1)
1-704-357-6284

Operators Distributing
Archdale (2)
1-336-884-5714

NORTH DAKOTA
M.H. Associates, Inc.
Fargo
1-701-282-7877

OHIO
Atlas Distributing
Cincinnati (1)
1-513-851-4100

Cleveland Coin
Cleveland (2)
1-216-692-0960

Shaffer Distributing
Columbus (3)
1-614-421-6800
Macedonia (4)
1-330-467-4850

OKLAHOMA
Galaxy Distributing
Tulsa
1-918-835-1166

ONTARIO
New Way Sales
Rexdale (1)
1-416-674-8000

Starburst Coin Mach.
Toronto (2)
1-416-251-2122

OREGON
Dunis Distributing
Portland
1-503-234-5491

PENNSYLVANIA
Betson Enterprises
King Of Prussia (1)
1-610-265-1155
Pittsburgh (2)
1-412-331-8703

Cleveland Coin
Pittsburgh (2)
1-412-323-8400

Green Coin
Pittsburgh (2)
1-412-881-8804

Roth Novelty (Superior)
Wilkes-Barre (3)
1-570-824-9994

State Sales & Service
Bensalem (4)
1-215-638-1122

QUEBEC
Laniel Automatic Mach.
Montreal
1-514-731-8571

SOUTH CAROLINA
Green Coin
Mrytle Beach
1-843-626-1900

TENNESSEE
Brady Distributing
Memphis
1-901-345-7811

Green G.A.M.E.S.
Memphis
1-901-353-1000

TEXAS
Commercial Music
Dallas (1)
1-214-741-6381

H.A. Franz, & Co.
Houston (2)
1-713-523-7366

H.A. Franz, & Co.
San Antonio (3)
1-210-226-6322

Master Sales
Corsicana (4)
1-903-874-4740

Southgate Amusement
Houston (2)
1-713-691-7335
San Antonio (3)
1-210-225-3844

Southgate/Moss Dist.
Irving (5)
1-972-721-4600

UTAH
Mountain Coin
Salt Lake City
1-801-262-5494

Struve Distributing
Salt Lake City
1-801-328-1636

WASHINGTON
Music Vend
Seattle
1-206-682-5700

WISCONSIN
Pioneer Sales & Svc.
Green Bay (1)
1-920-336-5800
Menomonee Falls (2)
1-262-781-1420

Viking Vending
Menomonee Falls (2)
1-262-255-6580

Note: For states and Canadian Provinces which do not have Distributors, call the neighboring state or province with the city closest to you (indicated with a white dot). States or Provinces with more than 1 city containing a distributor are numbered. View the map on the previous page.

International Distributors Directory

ARGENTINA
Universe Electronics
Buenos Aires
011-54-1-865-4730

Electroport (Florencia)
Mar Del Plata
011-54-223-495-5532

AUSTRALIA
A. Hankin & Co.
New Castle
011-61-249-298-4857

Amusement Mach. Dist.
Matraville
011-61-29-316-6000

AUSTRIA
Nova Games
See Germany

Parts & Service Only
R. Rupp
011-43-34-529-6105
Tab
011-43-72-297-8040

BELGIUM
Nova Games
See Germany

Parts & Service Only
National Music Co.
011-32-2-414-4596

Belgium (continued)
Parts & Service Only
Spin S.A.
011-32-4-362-7677

BRAZIL
Unimax Trading
São Paulo
011-55-11-533-5615

CHILE
Cuinsa
Santiago
011-56-2-641-8520

DENMARK
Nova Games
See Germany

FINLAND
Nova Games
See Germany

Parts & Service Only
Pelika Ray-Oy
011-358-94-370-2925

FRANCE
Avranches Automatic
Ducey
011-33-23-389-6162

Kunick Paris
Aubervilliers Cedex
011-33-14-811-3131

France (continued)
Kunick Group
Devecey
011-33-38-156-8620

SFA
Paris
011-33-15-326-8080

GERMANY
Nova Games
Hamburg
011-49-4-053-8060

Parts & Service Only
Bally Wulff (Berlin)
011-49-3-062-0020
Bally Wulff (Hannover)
011-49-511-358-5368

GREECE
Nova Games
See Germany

Parts & Service Only
Elcoin
011-30-1-492-9357
Greece Coin
011-30-1-577-7012

HONG KONG
Bondeal Limited
Kowloon
011-85-22-487-9089

HUNGARY
Nova Games
See Germany

Parts & Service Only
Flipper Rex
011-36-1-132-6512

ITALY (RSM)
TechnoPlay S.A.
San Marino
011-37-0-890-0361

LUXEMBOURG
Nova Games
See Germany

NETHERLANDS
Nova Games
See Germany

Parts & Service Only
AWA
011-31-2-069-4260
Errèt Industries
011-31-75-645-6111

NEW ZEALAND
Amco Machine Supplies
Auckland
011-64-9-846-7606

NORWAY
Nova Games
See Germany

Norway (continued)
Parts & Service Only
Vendcomatic
011-47-2-291-8383

PORTUGAL
Nova Games
See Germany

Parts & Service Only
Jacinto & Martins, Lda.
011-35-121-496-3744

SINGAPORE
Parts & Service Only
Valibel Technologies
011-65-748-8404

SPAIN
Nova Games
See Germany

Parts & Service Only
AmuseTEC, S.L.
011-34-93-739-6827
Sente, S.A.
011-34-91-541-7112

SWEDEN
Nova Games
See Germany

Parts & Service Only
Truemax AB
011-46-4-015-3635

SWITZERLAND
Nova Games
See Germany

Parts & Service Only
Novomat, A.G.
011-41-62-388-8961

UNITED KINGDOM
Deith Leisure
Surrey, England
011-44-181-336-1222

Electrocoin
London, England
011-44-208-965-2055

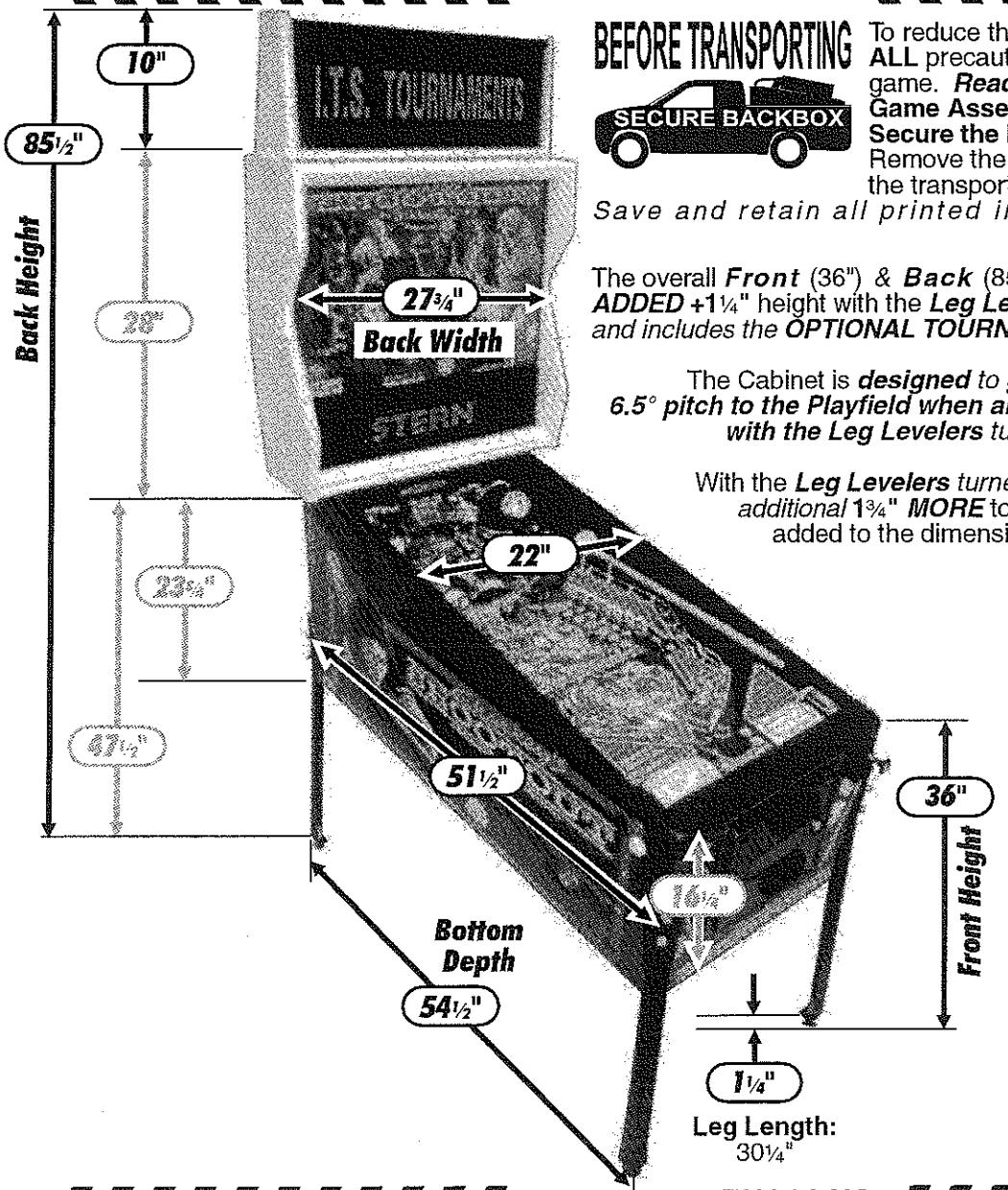
Electrocoin Aftersales
Cardiff, S. Wales
011-44-2-920-614-000

POWER REQUIREMENTS

This game ***must be connected to a properly grounded outlet to reduce shock hazard*** & insure proper game operation. See Sec. 5, Schematics & Troubleshooting, Chp. 3, Cabinet Wiring (Transformer Power Wiring), for transformer connections required for **Normal**, **High**, and **Low Line** conditions.

Normal Line:	110v AC - 125v AC @ 60Hz	
Domestic uses an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION CURRENT: **2.8AMP** WATTAGE: **329W**	MAX OPERATION CURRENT: **8AMP** WATTAGE: **940W**
High Line:	218v AC - 240v AC @ 50Hz	
Export uses 5AMP 250v Slo-Blo Fuses. (*England & Hong Kong use an 8AMP 250v S/B Fuse.)	AVG OPERATION CURRENT: **1.8AMP** WATTAGE: **412W**	MAX OPERATION CURRENT: **5AMP** | **8AMP*** (England & Hong Kong use an 8A F.) WATTAGE: **1145W** | **1832W***
Low Line:	95v AC - 108v AC @ 50Hz / 60Hz	
Export Japan Only uses an 8AMP 250v Slo-Blo Fuse.	AVG OPERATION CURRENT: **2.6AMP** WATTAGE: **264W**	MAX OPERATION CURRENT: **8AMP** WATTAGE: **812W**

TRANSPORTATION



BEFORE TRANSPORTING

To reduce the possibility of damage, observe **ALL** precautions whenever transporting the game. ***Read & follow*** *Section 1, Chapter 1,* **Game Assembly Procedures**, & **How to Secure the Backbox for Transporting**. Remove the legs & secure the game within the transporting vehicle.

Save and retain all printed information on the game.

The overall ***Front*** (36") & ***Back*** (85½") dimensions reflect the ***ADDED*** **+1¼"** height with the ***Leg Levelers*** *turned all the way* ***in*** *and includes the* ***OPTIONAL TOURNAMENT HEADER****;*

The Cabinet is ***designed*** *to give the recommended* ***6.5° pitch to the Playfield when all four (4) Legs are installed with the Leg Levelers*** *turned all the way* ***in****.*

With the ***Leg Levelers*** *turned all the way* ***out****, an additional* **1¾"** ***MORE*** to the overall height should be added to the dimensions.

Shipping Box Dimensions

Height: 56"
Width: 31"
Depth: 31"

Approximate Unboxed Weight:

Wt. 260lbs. (+/- 10)

CAUTION

At least 2 people are required to move and maneuver this game. Use proper moving equipment & extreme care while handling!

GAME DIMENSIONS

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Stern™ Pinball, Inc. ©October 2000

Game Set-Up

Game Assembly Procedures

(Reference Find-It-In-Front: Dr. Pinball)

1. After the game is removed from the shipping carton, the following steps should be followed before initial game play. ***CAUTION:*** *At least 2 people are required to move and maneuver game. Use proper moving equipment & extreme care while handling.* **Pinball game is 260lbs (+/- 10).**
   Refer to **DR.** for Power Requirements, Transportation and Game Dimensions.

2. The four (4) Cabinet Legs (Leg Levelers are attached) are in the corner packing material of the crate, install as outlined in Item 3. A large Allen Wrench (use for securing the backbox in the up an down position) is inserted & taped to the rear of the cabinet. Leg Bolts, Steel Balls and any miscellaneous parts are in the cash box.

3. Support rear of cabinet and attach rear legs using two leg bolts for each leg. Support front of cabinet and attach front legs using two leg bolts for each leg.

4. While assuring that no cables are being pinched, carefully raise the backbox and secure it in its upright position with the Allen Wrench in the hole in the back of the cabinet and rotating the wrench 270° (¾ turn).

5. Remove the Coin Door & Backbox Keys from the playfield glass or Ball Shooter Plunger; unlock the Backbox and open.

6. Check all connectors in the backbox for loose wire terminations. Reseat any loose wire by pushing in on the terminal. Push on all connectors plugged into the CPU/Sound Board, I/O Power Driver Board, and the Display Power Bd. to check that they are properly seated. Ensure Fluorescent Light Tube is seated correctly. Check that all fuses are seated properly. Close and lock the Backbox and secure its' keys back inside the Coin Door.

7. Remove the Front Molding & carefully remove the playfield glass and set it aside.

8. Remove all shipping tie downs, shipping blocks, packing foam, shipping instruction pages, etc. (if any) inside the cabinet. ***READ ALL PRINTED INFORMATION!*** Shipping instructions, labels and/or decals describe warnings, cautions, and/or important information specific to the game.

9. Raise the playfield and support it, by lifting the Prop Rod (located on the left, inside the cabinet). The end of the Prop Rod should be placed into the hole under playfield. See the illustration "Easy Access Service System" opposite this page.

10. Visually inspect all cabinet cables and connector terminations; ensure no wires or cables are pinched and that cable harnesses are not pulled tight.

11. Remove the Plumb Bob tilt from the parts package and install on the pendulum wire on the inside left of the cabinet. Check the plumb tilt and adjust as required. See Section 4, Chapter 1, Parts Identification & Location.

12. Lower the playfield and ensure game is level side-to-side by adjusting Leg Levelers, if required. See the illustration "Leg Leveler Adjustment" opposite this page.

13. With the Leg Levelers turned all the way in (1.25" from floor to bottom of leg), the game pitch is 6.5°; depending on the condition of the floor, adjust the Leg Levelers as required.

The playfield incline affects difficulty of play. Use the recommended incline; Game difficulty is best varied using game adjustments.

14. If desired, perform any self tests at this time. See Section 3, Chapter 1, Portals™ Service Menu Introduction, and Chapter 2, Go To Diagnostics Menu, for instructions on how to enter "Begin Play Test" and "Game Specific" to test components on the game.

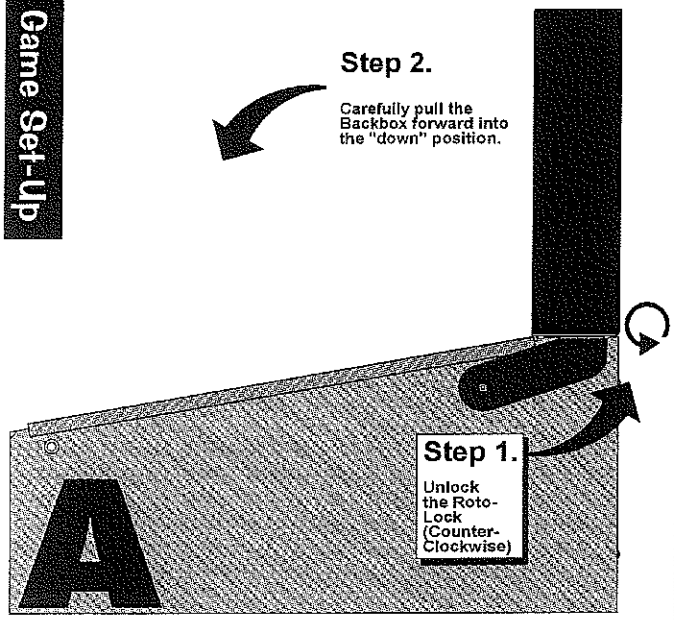
15. **INSTALL (4) BALLS** on the playfield near the outhole and carefully reinstall the playfield glass. (Amount of balls are always specified on decal attached to the lock down assembly.)

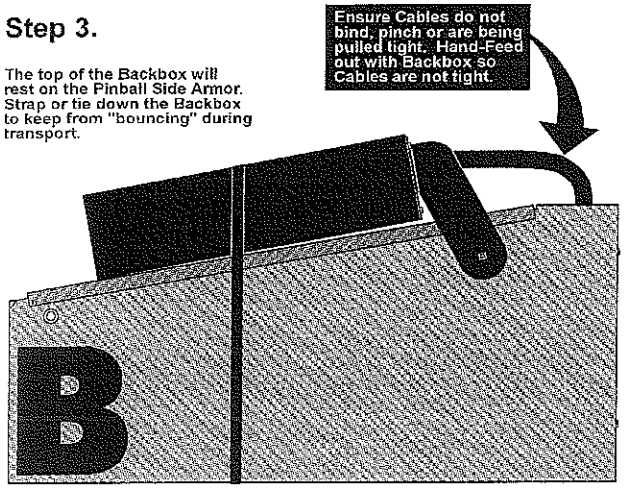
16. If desired, make Game Pricing (Standard and/or Custom) and Add-A-Ball, Novelty, or X-Ball Play adjustments at this time. See Section 3, Chapter 4, Go To Adjustments Menu, for instructions on how to enter adjustments. Follow instructions in the tables provided in the manual for suggestions of customizing changes.

➡Per CE "The appliance has to be placed in a horizontal position."
"This appliance is not to be cleaned by a Water Jet."



How to Secure the Backbox for Transporting





See Section 4, Chapter 1, Backbox (Back Side/ Front Side) Assemblies, for part numbers.

Leg Leveler Adjustment

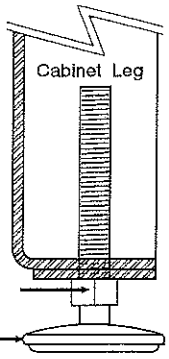
This cabinet is designed to automatically have a 6.5° pitch without any Leg Leveler adjustment!

Attach the four (4) Leg Assemblies to cabinet corners with the eight (8) leg bolts provided. See Section 4, Chapter 1, Cabinet - General Parts, for part numbers.

YOUR PLAYFIELD PITCH IS NOW AT 6.5° AS REQUIRED FOR PROPER GAME PLAY!

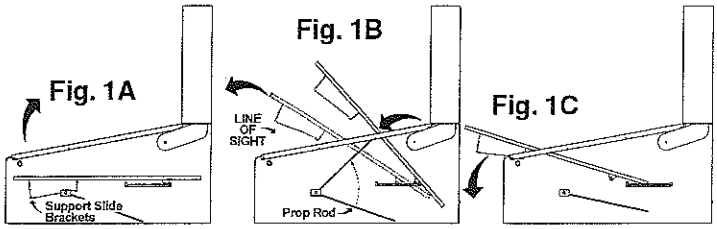
Verify 6.5° pitch. Minor adjustment(s) may be necessary depending on the location floor being level.

For custom adjustment greater than >6.5° can be acheived by turning out the rear leg leveler(s), however, it is not recommended.



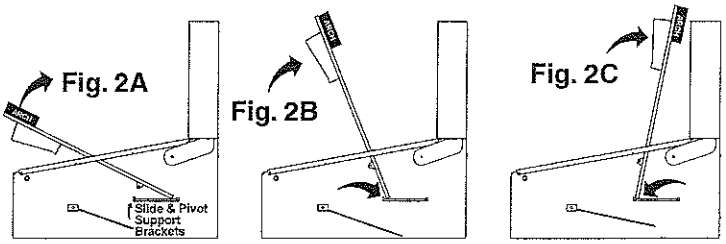
Easy Access Service System - 3 Positions

Carefully lift the playfield ***using the Left and Right Ball Guides*** upward.



Positions 1 & 2

When lifted high enough, the ***Playfield Support Slide Brackets*** (Fig. 1A) can be seen & can clear the cabinet front. At this time, pull the playfield toward the front of the cabinet, checking that the mechanical components clear the cabinet front, then rest the playfield on the ***Playfield Support Slide Brackets*** at the front channel of cabinet (Fig. 1C); Or, the ***Prop Rod*** (located on the right inside of cabinet) can be used by positioning the ***Prop Rod*** end into the receiving playfield hole (Fig. 1B).



Position 3

With the playfield at rest, hold the sides & pull toward the front of the cabinet (approx. 6" to 8"), until resistance is felt from ***Edge Slide Brackets*** stopping against the ***Slide & Pivot Support Brackets*** located on either side of the cabinet (Fig. 2A). At this time, *swivel the playfield* toward the Backbox, then rest on the top edge (Fig. 2B & 2C).

Game Operation & Features

Start of Game Features

Starting a Normal Game

Insert coin(s). The game generates a sound for the first coin & for each subsequent coin with the display indicating the number of credits posted. Press the **Start Button** and a start-up sound is produced, and the posted credits are reduced by one. Subsequent players can be added (**up to 4 can play!**) by pressing the **Start Button** before the end of ball 1 (with sufficient credit in the game).

The display now indicates the player or # of players selected from the total depressions of the **Start Button**. The display indicates the ball in play, and a ball is served to the *Shooter Lane*. An introduction is shown followed by Skill Shot Graphics and/or instructions. Pressing the **Start Button** after ball 1 of any player will start a new game (if credits are available), ***but only*** if the **Start Button** is depressed for 2-3 seconds. This delay is to avoid accidental "re-starts" of a game. *(Note: Any partial credit remaining during game play after the end of ball 1, or power down, will be eliminated.)*

Starting Team Play (Doubles!)

Team Play is a four player game. The totals for players 1 & 3 (Team 1) and players 2 & 4 (Team 2) are displayed individually as well as the combined score for both teams. Team Play only works in a 4-Player game. In all other cases, the individual scores are shown.

Starting League Play

After credit is posted, while holding in the **Left Flipper Button**, press the **Start Button**. League Play has now begun. The differences between Normal Game Play and League/Tournament Play are: There is no "auto-percentaging" (awarding extra balls, specials, etc. to players with very low scores on the second or third ball). Mystery Features are awarded in a set order rather than random in Normal Game Play. Percentage Game Features are not automatically advanced as they are for the Regular Play Features.

Starting Pinball Wizard Play

After credit is posted, while holding in the **Right Flipper Button**, press the **Start Button**. Pinball Wizard Play has now begun. The same as League/Tournament Play, but ooooooooh! so much gosh darn harder!

Starting I.T. Tournament Play

incredible TECHNOLOGIES™

Your game must be equiped with the Optional IT Tournament Header (located over the Backbox). This is an optional feature which does not affect normal game play. Tournament Rules are outlined in a separate Tournament Manual Supplement included in the IT Tournament Kit.

Note: Between games, press & hold the **RIGHT BUTTON** for *detailed instructions On-Screen.* Press the **LEFT BUTTON** to page down. The **START BUTTON** exits.

During Game Features

Feature Mode & Combination Shots

Features are lit on the playfield and started by completing *certain shots* (e.g. completion of Target Banks, Orbit(s), Ramp(s) and/or any combination of the shots).

Multiball

Multiball is started after completion of certain features. Multiball may vary with the amount of balls used depending on game style.

Replay Feature

Replay awards are given as the player exceeds a High Score Level during game play. This can be adjusted with Adjustment 3, Replay Awards (Default=**CREDIT**, adjustable). Players exceeding the High Score Levels can receive: **CREDIT**, **EXTRA BALL**, or **SPECIAL**. Adjust to **NONE** if a replay award is not desired.

End of Game Features

Game Endings

When all player(s) have played all balls (including any Extra Balls), the game ends. If power is interrupted during the course of a game, it will end that game (***see Starting a Normal Game***). Closure of the Plumb Bob Tilt Switch according to the number of tilts set (Default = 2, adjustable) or its prolonged closure will end the current Ball-In-Play. Closure of the Slam Tilt Switch on the coin door ends the current game(s).

Match Feature

At the end of each ball, earned bonuses are collected. At the end of the last ball of a game (including any extra balls, if applicable), earned bonuses are collected, then the system produces a random 2-digit number (a multiple of 10; 00 to 90). Matching the last 2 digits of the player's score with this number awards a credit. In Adj. 11, Match Percentage (Default=**9%**, adjustable) can be changed from 0-10%. Changing the percentage to **0%** displays the "Match Animation" at the end of the game, however, will never match (to award a credit). Changing this adjustment to **OFF** will not display the "Match Animation" nor award a credit.

Entering Initials/Name (Adjustable, see Sec. 3, Chp. 4, Adj. 32, High Score Initials)

If player achieved a new high score in any of the 3 categories (Regular, Wizard or Special Game Feature), the player may enter their 3 initials or 10-Letter Name. Use the **Left** & **Right Flipper Buttons** to choose letter or character as seen on the Dot Display. Hitting the Start Button locks in the letter or character and proceeds to the next letter. The game then proceeds into the *Game-Over Mode* and then to the *Attract Mode*.

*Note: A **Custom Message** (Adjustable, see Sec. 3, Chp. 4, Adj. 34) can be displayed during the Attract Mode; enter letters in the same fashion.*

Sec. 2: Game Op.

Continued Next Page.

Auto Percentaging

This game is equipped with an Auto Percentaging Adjustment. The replay percent is automatically adjusted or you can set a fixed replay score. The factory default percentage is **10%**. Four levels may be selected. Adjust- ments allow awarding of a "credit" or an "extra ball" as each level is exceeded. With the ***Autopercentage Feature***, if the actual replay percentage is higher or lower than that desired, the game will automatically adjust for the new recommended percentage score(s). See Section 3, Chapter 4, Go To Adjustments Menu, Adj. 1 & Adj. 2. You may choose to make a different "score-to-beat" adjustment; this is done by utilizing Adj. 2, Replay Levels.

Instruction Card

Below is a **COPY** of the Game Instruction Card (SPI Nº: 755-5172-00 USA) which is included with every game. For the Optional Tournament Instruction Card Copy, see the IT Tournament Manual Supplement. If your card is lost or damaged, simply **COPY** this page and *cut out* the Instruction Card as a *temporary replacement* until a *new card is ordered.* (***Hint:*** **COPY & CUT** along the dotted line and fold in the center to keep the "COPY" sturdy.)

COPY & CUT

Sharkey's SHOOTOUT

For more detailed game rules, visit our website @ www.SternPinball.com and click on the "Sharkey's Shootout" Pop Bumper Link.

FOLD HERE

Sharkey's Objective: *Defeat all 6 opponents at either* **8 Ball** *or* **9 Ball.**

8 Ball Shoot **7 Pool Ball Drop Targets** ***IN ANY ORDER,*** then shoot the **8 Ball** to defeat lit opponent *(defeating an opponent collects Prize Money at the current level.).*

9 Ball Shoot **Pool Ball Drop Targets** ***IN ORDER;*** shoot the **8 Ball** followed by the **9 Ball** to defeat lit opponent *(defeating an opponent collects Prize Money at the current level.).*

Trick Shot After defeating an opponent, shoot the **Roving Drop Targets** to build the *Trick Shot* value. Shoot *flashing Arrows collect value.* Collecting the *Trick Shot* value ends the *Trick Shot Feature* and begins a pool game with the next opponent.

Prize Money Complete the **P-A-Y-O-F-F Targets** to collect *Prize Money. Prize Money* value advances to the next level in the ***Right Hole*** *near bumpers.* Completing **P-A-Y-O-F-F** also lights the Left, Center & Right **Post Save™** *Feature.*

Extra Ball Collect *Prize Money* to light ***Extra Ball.***

Multiball Shoot **Lock** to start **Multiball.**

STERN PINBALL, INC.

Between Games: *Pressing either* **FLIPPER BUTTON** *will allow the player to step through the displays in the Attract Mode.*

Note to Beginners: To score better, shoot at the (((FLASHING SHOTS))) // Be sure to LOOK UP at the Dot Display for instructions when possible.

Mfg. Stern™Pinball, Inc. © 2000 Post Save™ ® © 2000 Sharkey's Shootout Pinball. All Rights Reserved. SPI Part Nº: 755-5172-00 USA

Post Save™: Post Save Buttons are each located below the Flipper Buttons on the Cabinet Sides. When this Feature is lit, press the Left or Right Button to raise the Left or Right Outlane Post; pressing both simultaneously raises the Center Post.



Portals™ Service Menu Introduction

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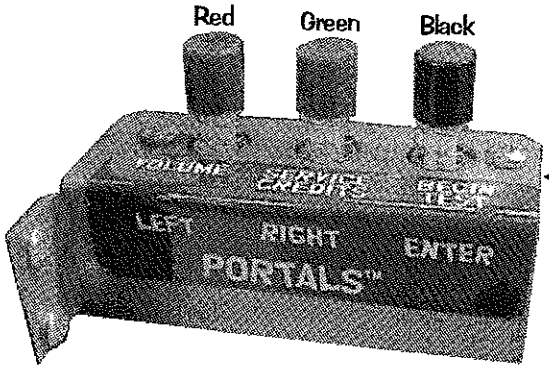
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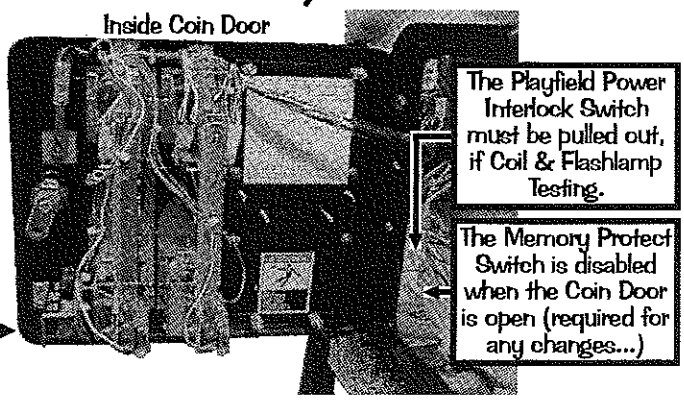
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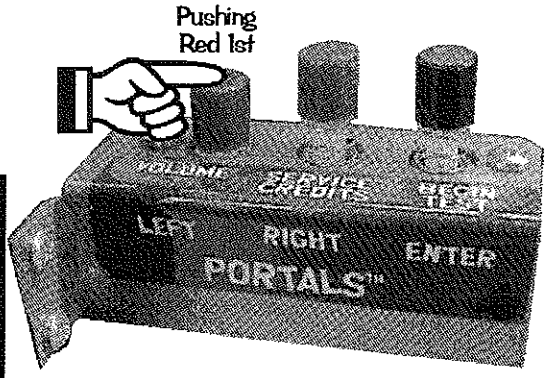
Service Switch Set (Red, Green & Black Buttons) Access & Use

The ***Service Switch Set*** provides access for ***three (3) functions*** available for your use. They are **Volume Menu**, **Service Credits Menu** and **Portals™ Service Menu**. All are accessed separately depending on which colored button (**Red**, **Green** or **Black**) is ***pushed first***.





To access any of these ***three (3) functions*** you must first open the **Coin Door** (see pictorial above) with the Game in the ***Attract Mode*** *(not already in any Function or Menu stated below).*

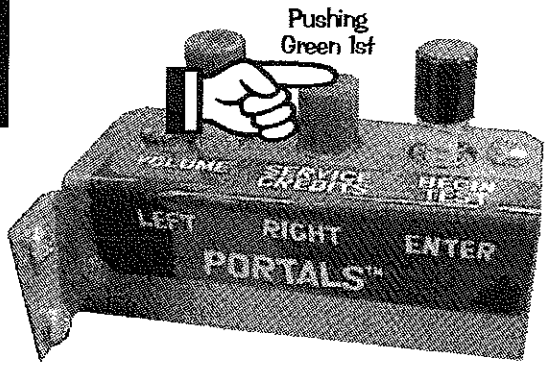


Function 1, Volume Menu

Pushing the ***Red Button*** first, enters the ***Volume Menu***. While in this Mode, to **DECREASE** the volume, hold down or depress the **Red "LEFT" Button** until desired the volume is achieved; to **INCREASE** the volume, hold down or depress the **Green "RIGHT" Button** until the desired volume is achieved.

Note: *Pushing the **Left** or **Right Flipper Buttons** operates the same as the **Red** or **Green Buttons** of the Service Switch Set, while in this Volume Mode.*

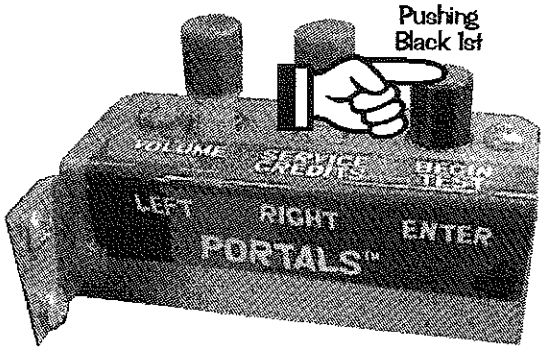
Set between **0** and **31**; **15** is the *Factory Default.* Once your adjustments are made, this menu will ***automatically exit*** a few seconds after the last button depression.



Function 2, Service Credits Menu

Pushing the ***Green Button*** first, adds ***Service Credits*** *(will not affect your audits as "paid" credits).* This is useful for the technician to test the game in regular play without affecting the game audits. Each depression adds **1 credit**; up to **50 credits** can be applied. **Adjustment 15, Credit Limit**, determines this *(the Factory Default is 30, however, it can be changed from 04-50; see Chapter 4 of this Section for details).* Once your credits are added, this menu will ***automatically exit*** a few seconds after the last button depression.

Note: *This function is disabled if **Adjustment 33, Free Play**, is set to **YES**. The Service Credits are limited to the Credit Limit in addition to any paid credits present in the game (e.g. If the Credit Limit is 30, and there are 8 paid credits present, only 22 Service Credits can be applied.).*



Function 3, Portals™ Service Menu

Pushing the ***Black Button*** first, enters the ***Portals™ Service Menu***. Once in, move through the menus and sub-menus by pushing down or depressing the **Red "LEFT"** or **Green "RIGHT" Buttons**.

Note: *Pushing the **Left** or **Right Flipper Buttons** operates the same as the **Red** or **Green Buttons** of the Service Switch Set, while in this Service Mode.*

Select or activate the *Icon* chosen *(the Icon will be "flashing")* by pushing down or depressing the **Black "ENTER" Button**.

Note: *Pushing the **Start Button** operates the same as the **Black Button** of the Service Switch Set, while in this Service Mode.*

Please read the remainder of this Chapter for more information on the **Portals™ Service Menu**. The remaining six (6) Chapters of this Section explains all *Icons* & ***Menus*** in detail. ***Read! Read! Read!***

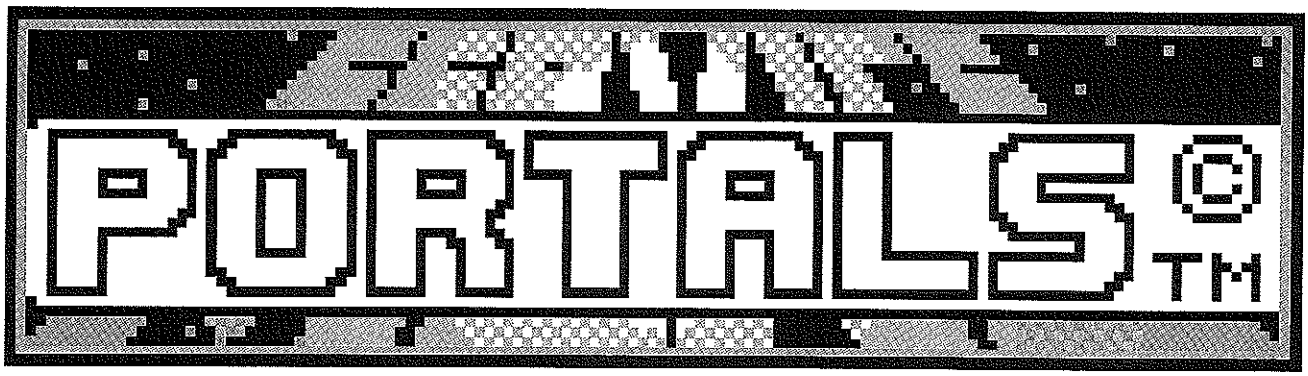


Important: The ***Dual Switch Bracket*** holds the ***Playfield Power Interlock*** & ***Memory Protect Switches***. It is located just inside the Coin Door frame *(see pictorial of the **Coin Door** on the previous page)*. The Button Switch at the top is the ***Playfield Power Interlock Switch***. It must be pulled out for electro-mechanical device testing or diagnostic purposes (this is required). If this button is pushed in, the ***Playfield Power*** is diasabled while the **Coin Door** is **OPEN**. The Button Switch at the bottom is the ***Memory Protect Switch***. It is enabled while the **Coin Door** is **CLOSED**; *meaning any adjustment changes that are made **will not be written to memory***. If changing adjustments is required, ensure the **Coin Door** is **OPEN** to disable this switch, thus allowing for desired changes.

How to Use This Section

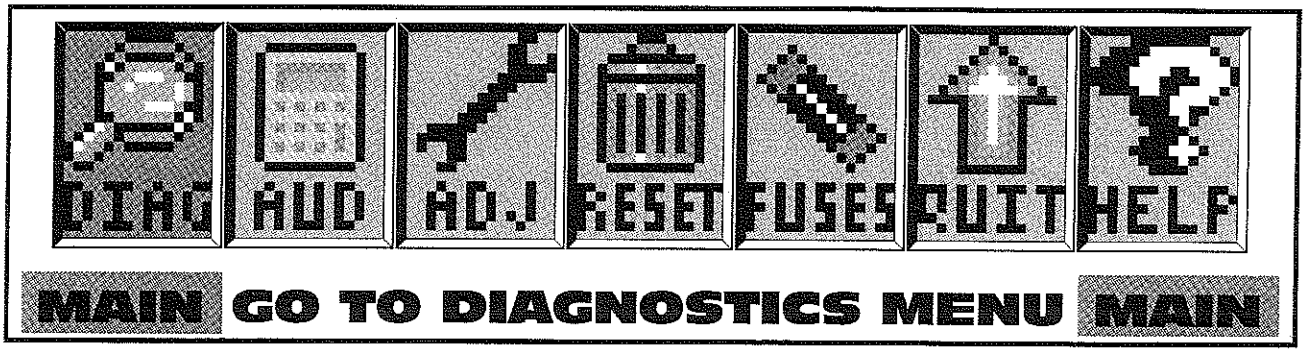
This section will cover all functions available in the **Portals™ Service Menu** in a *Step-By-Step* process. This section is divided into chapters which coincide with the **MAIN MENU**. The following pages in this chapter will instruct the operator on how to move through the menus. It's simple, easy and fun to use!

To get into the **Service Menu Mode** review **"Function 3, Portals™ Service Menu"** on the previous page. Push down the **Black "BEGIN TEST" Button** to begin. Looking at the Video Display you will momentarily see the introductory screen "**Service Menu**" with a *satellite flying from right to left pulling a banner* "**Portals©TM**" followed by the **MAIN MENU**:



Use the **Red "LEFT" & Green "RIGHT" Buttons** (or **Left** & **Right Flipper Buttons**) to move the selected ***Icon*** left or right, and the **Black "ENTER" Button** (or **Start Button**) to activate the selected ***Icon***. The use of the Service Switch Set (**Red, Green**, & **Black Buttons**) *is required* in **Switch Test** or **Active Switch Test**, as the **Start & Flipper Buttons** are a part of this test.

The **MAIN MENU** now appears with the "DIAG" *Icon* (**DIAGNOSTICS MENU**) flashing:



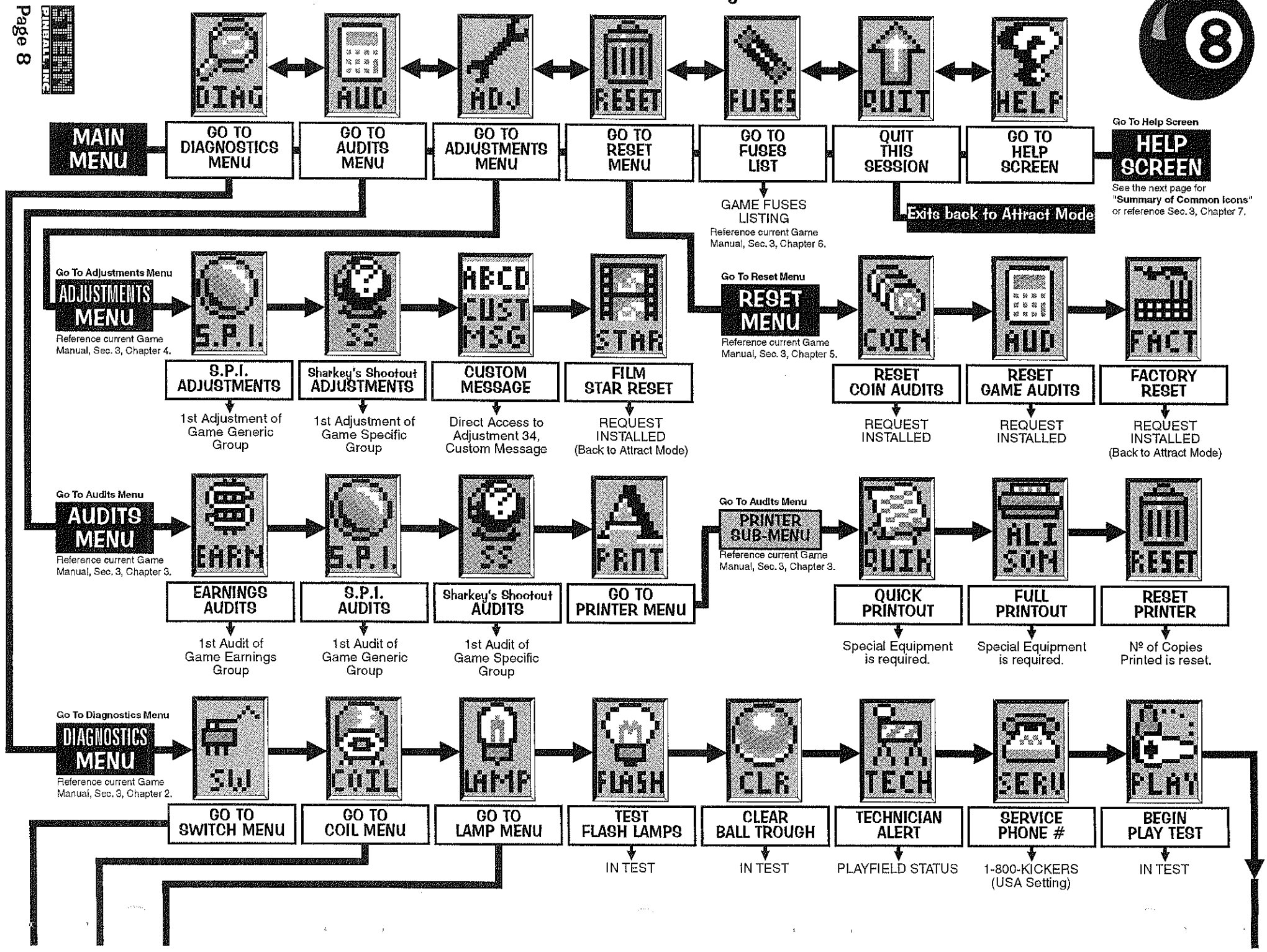
As the operator views the Menu Screen(s), the ⇦ MORE ⇨ MORE symbols indicates that there are more *Icons* to select in each direction. The *Icon* selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the *Icon* and the Menu Screen will change to the menu selected. Select the **"PREV"** *Icons* to move backwards through the menu levels. Select the **"QUIT"** *Icon* to completely exit the Service Mode.

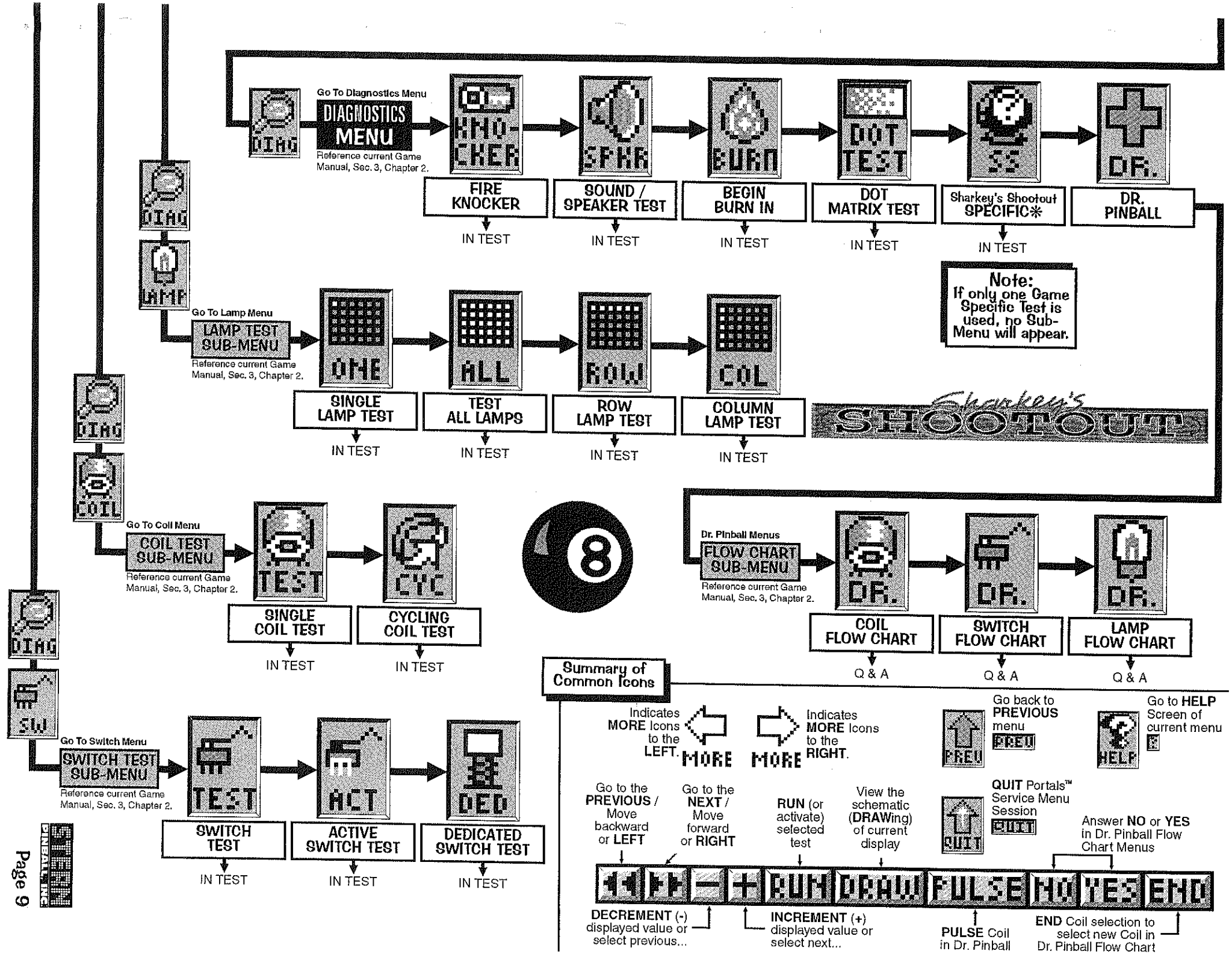
View the **Portals™ Service Menu Icon Tree** on the next pages for a complete overview of all menus used in this system. View the last chapter (HELP) if more information is required. Selecting the "QUIT" *Icon* with the **Red "LEFT"** or **Green "RIGHT" Buttons** (or either **Flipper Button**), then pressing the **Black "ENTER" Button** (or **Start Button**) will exit the Service Mode. This applies to the large and small "QUIT" *Icons.*

The **chapters** in this **section**, which coincide with the **MAIN MENU**, will also provide more detailed information which could not fit in the display. Use both the manual and the display to help customize, troubleshoot and/or diagnose faults, if any.

Continued Next Page.

Portals™ Service Menu Icon Tree for Sharkey's Shootout Pinball Game




Go To Diagnostics Menu
DIAGNOSTICS MENU
Reference current Game Manual, Sec. 3, Chapter 2.
FIRE KNOCKER
SOUND / SPEAKER TEST
BEGIN BURN IN
DOT MATRIX TEST
Sharkey's Shootout SPECIFIC*
DR. PINBALL
IN TEST
Note: If only one Game Specific Test is used, no Sub-Menu will appear.
Go To Lamp Menu
LAMP TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
SINGLE LAMP TEST
TEST ALL LAMPS
ROW LAMP TEST
COLUMN LAMP TEST
Sharkey's SHOOTOUT
Go To Coil Menu
COIL TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
SINGLE COIL TEST
CYCLING COIL TEST
Dr. Pinball Menus
FLOW CHART SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
COIL FLOW CHART
SWITCH FLOW CHART
LAMP FLOW CHART
Q & A
Go To Switch Menu
SWITCH TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
SWITCH TEST
ACTIVE SWITCH TEST
DEDICATED SWITCH TEST
Summary of Common Icons
Indicates MORE Icons to the LEFT.
Indicates MORE Icons to the RIGHT.
Go back to PREVIOUS menu
Go to HELP Screen of current menu
Go to the PREVIOUS / Move backward or LEFT
Go to the NEXT / Move forward or RIGHT
RUN (or activate) selected test
View the schematic (DRAWing) of current display
QUIT Portals™ Service Menu Session
Answer NO or YES in Dr. Pinball Flow Chart Menus
DECREMENT (-) displayed value or select previous...
INCREMENT (+) displayed value or select next...
PULSE Coil in Dr. Pinball
END Coil selection to select new Coil in Dr. Pinball Flow Chart

Portals™ Service Menu Example

This example will demonstrate activation of *Icons* in the **DIAGNOSTICS MENU**. The example will show activation of the "SW" *Icon* (**GO TO SWITCH MENU**). In this menu, the switches can be tested individually and also all active switches can be tested. Use the same technique to access all the *Icons* in the **Portals™ Service Menu**. Follow **Portals™ Service Menu Icon Tree** on the previous pages as a guide to help navigate through the entire system (Also, go to the chapter in this manual explaining the icon(s) selected.).

If the display is in any other menu other than the **MAIN MENU**, use the **Red "LEFT"** & **Green "RIGHT" Buttons** to select the "PREV" *Icon* and press the **Black "ENTER" Button** to activate the **ICON** thus moving back to the previous menu. Do so until **MAIN MENU** appears.

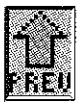
Chapters 2 through 7 will cover all menu items within the **Portals™ Service Menu**. The *Icon* is shown preceding the text. Find the *Icon* in the **Portals™ Service Menu** by navigating with the **Red** or **Green Buttons**. Each chapter started is from the **MAIN MENU**. Within the chapter, the sub-menu's will be covered sequentially with their explanation & function. If the operator *"gets lost"*, select and activate the "PREV" *Icon* until the display indicates **MAIN MENU**. For more help, see Chapter 7.



The "MORE" *symbols* are indicating that *"more icons"* are available which don't appear in the display and which way to move the selection to view the *Icons*.



Important Note:



Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. ***If no Icons appear in the display because of a testing function or special display (e.g. Help, Schematic Display, etc.), press any service button to exit to the previous menu or sub-menu.***

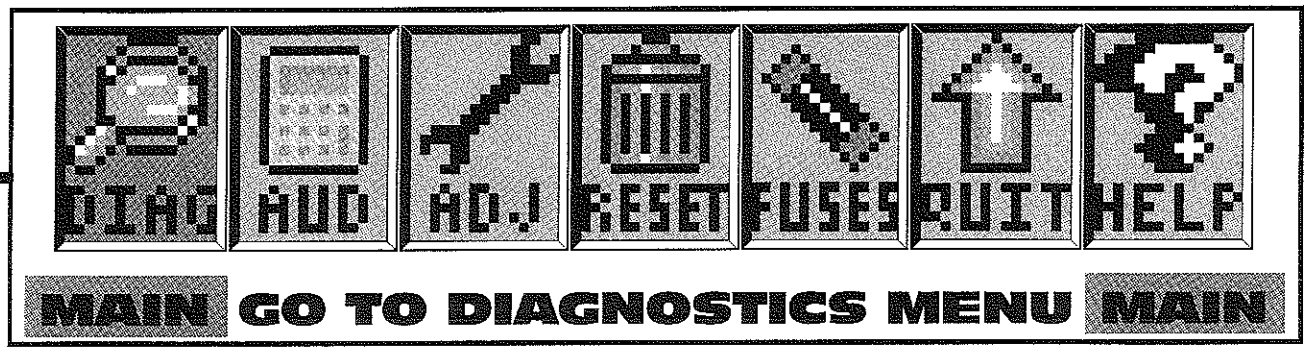


Selecting & activating the "QUIT" *Icon* from any display will exit the *Service Session*.

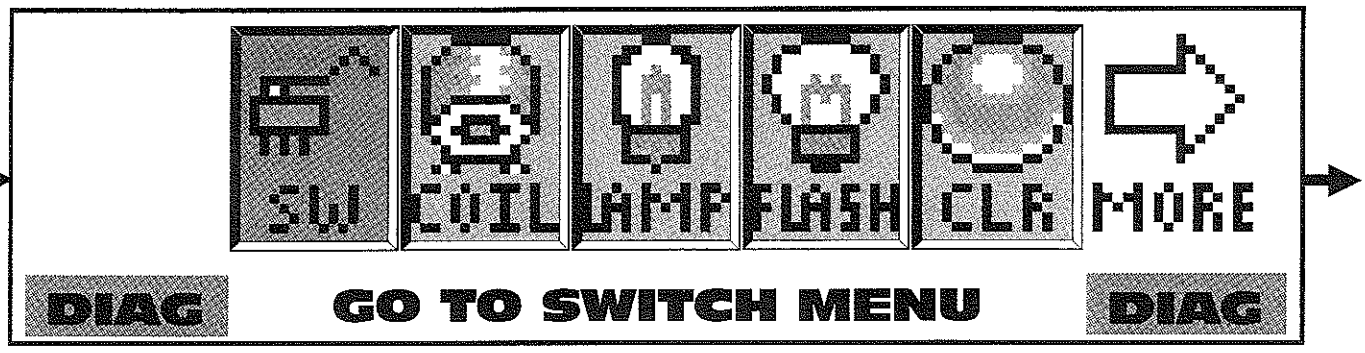


Selecting & activating the "HELP" *Icon* will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

Example: From the **MAIN MENU**, use the **Red "LEFT"** or **Green "RIGHT" Buttons** to select the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**).

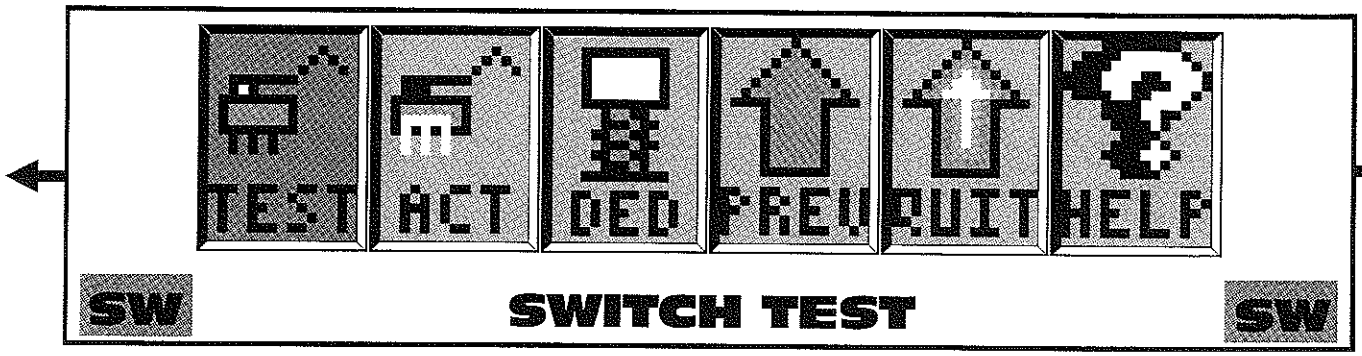


Press the **Black "ENTER" Button** to activate this **ICON**. This will bring up the **DIAGNOSTICS MENU**.

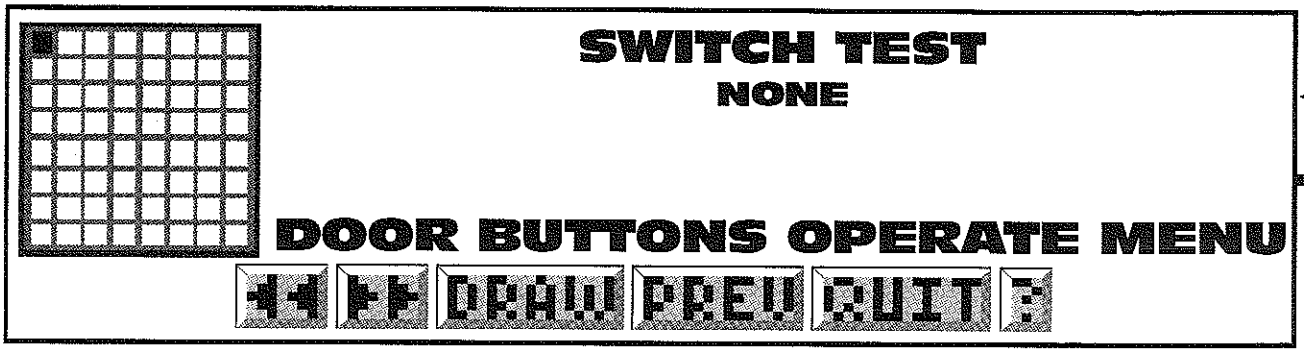


The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing. Press the **Black Button** to *activate* this icon. This will bring up the **SWITCH TEST MENU**.

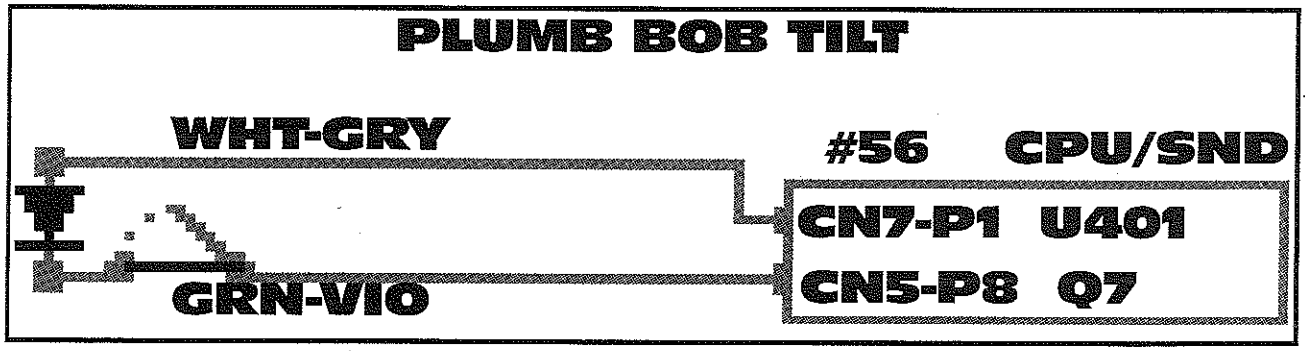
The **SWITCH TEST MENU** now appears with the "TEST" *Icon* (**SWITCH TEST**) flashing:
Press the **Black "ENTER" Button** to *activate* this icon. This will bring up the **Switch Test Display**.



The **Switch Test Display** now appears.



All switches can be tested one at a time (When possible, use a pinball to close any playfield switches; rolling the ball at Stand-Up Targets or over/under switches is suggested. Use finger for all non-playfield switches.) As each switch is closed, the respective Switch Matrix Grid Position (1-64) will be lit. To view the schematic for the switch selected, press the **Red** or **Green Buttons** to select the "DRAW" *Icon*. Press the **Black Button** to *activate* this icon. This will bring up the **Switch Schematic Display** for the switch being closed.



An example is shown with Switch #56, Plumb Bob Tilt, selected. The display describes the switch in the Switch Matrix which includes the name of the switch, the Return (Row) Wire and the Drive (Column) Wire, drive transistor, the part number (not shown in the above example) and the "Pin-Outs" from the CPU/Sound Board.

While in Switch or Active Switch Tests, the **Flipper & Start Buttons** are deactivated. Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and activate the "**MINI-ICONS**" at the bottom of the display. In Switch Test, if the "Left Arrow" or "Right Arrow" *Icon* is activated, the display will go to the previous tests (Active and Dedicated Switch Tests). Use the **Red** or **Green Buttons** to change the selected **ICON** to "PREV"*Icon*. Press the **Black "ENTER" Button** to go to the previous menu.

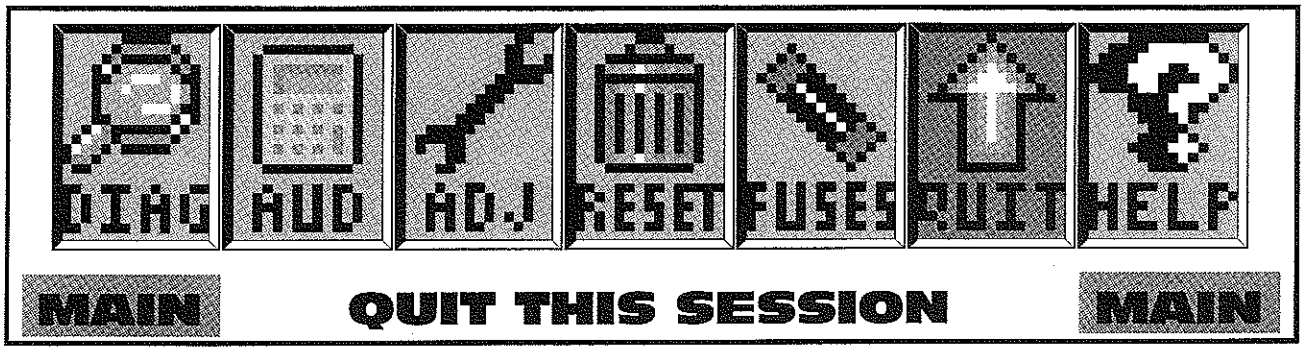
Note:
In **Dedicated Switch Test**, the **Flipper & Start Buttons** are to be used instead of the **Red, Green** & **Black Service Buttons**, as these buttons are deactivated for this test.

Exit out of the sub-menu by activating the big "PREV" *Icon* in the menu. This will bring up the **DIAGNOSTICS MENU**. The Switch Test Session is now complete. See the next page about exiting the **Portals™ Service Menu**.

Continued Next Page.

Exiting the Portals™ Service Menu

All *Icons* will be covered in the chapters of this section with the exception of the "QUIT" *Icon*, in the **MAIN MENU**. Both the large and small *Icons* if selected and activated, will exit the user from the **Portals™ Service Menu**. The display will return back to the **ATTRACT MODE**! To re-enter the **Portals™ Service Menu** follow the instructions at the beginning of this chapter.



If more help is required, see Chapter 7 of this section, and view the various help displays in the game.

Your Notes

Go To Diagnostics Menu

Special Note: If the ***display flashes*** **"OPEN THE DOOR"** the game is indicating that memory has been corrupted. This is caused be either failure in memory (e.g. batteries are dead and/or faulty **RAM**) or upon installation of updated version of game code. Opening the **Coin Door** will initiate a *Factory Restore (Reset)*, by opening the ***Memory Protect Switch***. Check battery voltage at **VBATT Test Point** on the **CPU/Sound Board**.

Overview

The **Portals™ Service Menu System** provides tests for sounds, display, lamps, switches and coils. Each feature may be tested manually or automatically after entering the **Portals™ Service Menu** (see Chapter 1 of this section). Select the "DIAG" *Icon* from the **MAIN MENU** to go to the **DIAGNOSTICS MENU**. The automatic tests (e.g. ***Cycling Coils***, ***Test Flash Lamps***) may be used for a quick verification of automatic test functions and the manual tests (***Begin Play Test***, ***Single Lamp / All / Row / Column Tests***, and ***Game Specific Test***.) may be used for troubleshooting. All *Icons* and there usages are explained throughout this chapter.

During game play, activation of switches and operation of coils with associated switches are monitored. If the **CPU/Sound Board** does not detect a switch transition ("Stuck Open" / "Stuck Closed") for 50 games, it is considered faulty. When operation of a coil should close or open a switch and does not, the coil is considered faulty. In the Attract Mode, faulty switches and coils (if any) are reported (Select the "TECH" *Icon*, ***Technician Alert***, from the **DIAGNOSTICS MENU**). *Note that reporting of an unused switch does not constitute a problem and that a bad coil could mean that the associated switch requires adjustment.*

⚠ **CAUTION:** Remove pinballs from the Ball Trough prior to lifting the playfield for servicing. This can easily be done in the **Portals™ Service Menu System**. Select the "DIAG" *Icon* from the **MAIN MENU** to go to the **DIAGNOSTICS MENU**. Select the "CLR" *Icon* to enter the **CLEAR BALL TROUGH MENU**. Select the "RUN" *Icon* & press the **Start Button** to remove one ball at a time. This is also useful to retrieve one ball for game testing in ***Begin Play Test*** & ***Game Specific Test***. ***Important:*** The **Power Interlock Switch** must be pulled out.



GO TO DIAGNOSTICS MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "DIAG" *Icon* in the **MAIN MENU** with either **Flipper** or **Red "LEFT"** & **Green "Right" Buttons** (upon entry of the **Portals™ Service Menu**, the system defaults with the selection of the "DIAG" *Icon* flashing) and press the **Start** or **Black "ENTER" Buttons**. The **DIAGNOSTICS MENU** appears.



The "MORE" *symbols* are indicating that *"more icons"* are available which don't appear in the display and which way to move the selection to view the *Icons*.



Important Notes:



Exit any sub-menu and return to the **MAIN** MENU by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.



Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.



In Diagnostics, selecting & activating the "-" or "+" *Icons* moves test forwards/backwards.



Selecting & activating the "RUN" *Icon* repeats the test on the coil or flash lamp left off at.



Selecting & activating the "ARROW" *Icons* moves between tests in the sub-menu.

Selecting & activating the "DRAW" *Icon* will show the schematic for that switch or coil.

Some tests require navigation through the menu(s) and selection of the *Icons* with **ONLY** the **Red "LEFT," Green "RIGHT"** and **Black "ENTER" Buttons**. This is required in ***Switch*** & ***Active Switch Tests***, as the **Flipper** & **Start Buttons** are a part of the test.



In ***Single Coil Test***, ***Cycling Coil Test***, ***Test Flash Lamps***, ***Clear Ball Trough***, ***Begin Play Test*** & ***Sharkey's Specific*** Menu's, ***the*** **Power Interlock Switch** (inside Coin Door) must be pulled out. (See ***Access & Use*** in Chapter 1 of this section for the location.)

If the Power Interlock Switch is not pulled out, all electro-mechanical devices (such as Coils) cannot be tested (20v & 50v DC power is disabled). Closing the Coin Door will automatically reset this switch.

Go To Switch Menu

From the **DIAGNOSTICS MENU**, select the "SW" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Switches are configured in an 8 x 8 Matrix of Columns (Switch Drives) and Rows (Switch Returns) with up to 64 switches possible. The Switch Test Menu consists of three (3) parts: Switch Test, Active Switches, and Dedicated Switch Test.

Note: The Flipper & Start Buttons are deactivated during Switch Tests.

Switch Test

To initiate, from the **SWITCH MENU**, select the "TEST" *Icon* with the **Red** or **Green Button** & press the **Black Button**. In Switch Test, close each switch and observe the display. The display will describe the switch in the Switch Matrix, which includes the switch name, Return (Row) Wire, Drive (Column) Wire, Part Nº, and the "Pin-Outs" from the CPU/SOUND Board. When the switch is released, the information of the last switch closed will remain in the display until another switch is closed or the test is exited. To view the switch schematic, select the "DRAW" *Mini-Icon* with the **Red** or **Green Button** & press the **Black Button**.

Active Switch Test

To initiate, from the **SWITCH MENU**, select the "ACT" *Icon* with either **Red** or **Green Button** & press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Switch Menu or selecting either of the "ARROW" *Icons* will move through the tests. If any switches are stuck closed (or made from the presence of a pinball), the display sequences through the Switch Names, Return (Row) Wire, Drive (Column) Wire, Drive Transistor, Part Nº, and the "Pin-Outs" from the CPU/SOUND Board. This cycle continues until all switches are cleared or until the test is exited.

Dedicated Switch Test

To initiate, from the **SWITCH MENU**, select the "DED" *Icon* with either **Flipper Button** & press the **Start Button** (The service switches are deactivated during this test.). The display will describe the switch which includes the Switch Name, Return (Row) Wire, Drive (Column) Wire, Part Nº, and the "Pin-Outs" from the CPU/SOUND Board.

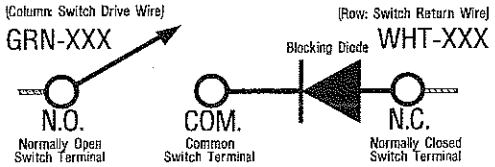
SWITCH MATRIX GRID & DEDICATED SWITCHES

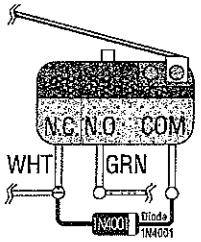
D iode O n T erminal S trip :

Column (Drive) / Row (Return)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (POST SAVE™) on Cabinet side 1	PLAYFIELD GLASS SWITCH on Cabinet 9	7-BANK DROP TRGT (1) On Assembly DOTS 17	STAND-UP TARGET (P) AYOFF On Assembly 25	MYSTERY BALL OPTO #1 On Assembly 33	LEFT RAMP ENTER On Assembly 41	LEFT TURBO BUMPER On Assembly 49	LEFT OUTLANE Under Playfield 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	LOCKDOWN SWITCH on Cabinet 10	7-BANK DROP TRGT (2) On Assembly DOTS 18	STAND-UP TARGET P (A) YOFF On Assembly 26	MYSTERY BALL OPTO #2 On Assembly 34	LEFT RAMP EXIT On Assembly 42	RIGHT TURBO BUMPER On Assembly 50	LEFT RETURN LANE Under Playfield 58
3: U400 WHT-ORG CN7-P7	6TH COIN SLOT On Coin Door 3	4-BALL TROUGH #1 (LEFT) On Assembly 11	7-BANK DROP TRGT (3) On Assembly DOTS 19	STAND-UP TARGET PA (Y) OFF On Assembly 27	MYSTERY BALL OPTO #3 On Assembly 35	UNDER-TROUGH On Assembly 43	BOTTOM TURBO BUMPER On Assembly 51	LEFT SLINGSHOT On Assembly 59
4: U400 WHT-YEL CN7-P6	RIGHT COIN SLOT On Coin Door 4	4-BALL TROUGH #2 On Assembly 12	7-BANK DROP TRGT (4) On Assembly DOTS 20	STAND-UP TARGET PAY (O) FF On Assembly 28	MYSTERY BALL OPTO #4 On Assembly 36	SUPER VUK On Assembly DOTS 44	TOUR. START BUTTON Cabinet Front 52	RIGHT OUTLANE Under Playfield 60
5: U401 WHT-GRN CN7-P5	CENTER COIN SLOT / DBA On Coin Door 5	4-BALL TROUGH #3 On Assembly 13	7-BANK DROP TRGT (5) On Assembly DOTS 21	STAND-UP TARGET PAYO (F) F On Assembly 29	NOT USED 37	SNEAK-IN Under Playfield 45	STAND-UP TRGT (CENTER) On Assembly 53	RIGHT RETURN LANE Under Playfield 61
6: U401 WHT-BLU CN7-P3	LEFT COIN SLOT On Coin Door 6	4-BALL TROUGH VUK OPTO On Assembly 14	7-BANK DROP TRGT (6) On Assembly DOTS 22	STAND-UP TARGET PAYOF (F) On Assembly 30	SPINNER (LT ORBIT) On Assembly 38	LEFT TOP LANE Under Playfield 46	START BUTTON Cabinet Front 54	RIGHT SLINGSHOT On Assembly 62
7: U401 WHT-VIO CN7-P2	5TH COIN SLOT On Coin Door 7	4-BALL STACKING OPTO On Assembly 15	7-BANK DROP TRGT (7) On Assembly DOTS 23	LEFT ORBIT Under Playfield 31	RIGHT ORBIT BOTTOM Above Playfield 39	MIDDLE TOP LANE Under Playfield 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (POST SAVE™) on Cabinet side 8	SHOOTER LANE Under Playfield DOTS 16	SINGLE DROP TRGT On Assembly DOTS 24	INSIDE RIGHT ORBIT Under Playfield 32	RIGHT ORBIT TOP Under Playfield 40	RIGHT TOP LANE Under Playfield 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

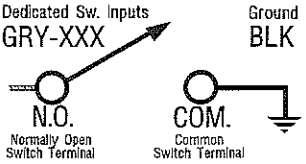
IC U206 INPUTS / GND	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) in Cabinet side DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DS-3
4: U206 GRY-YEL CN6-P5	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) in Cabinet side DS-4
5: U206 GRY-GRN CN6-P7	#5 UPPER FLIPPER BUTTON in Cabinet side DS-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door DS-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door DS-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door DS-8

Typical Switch Schematic & Wiring



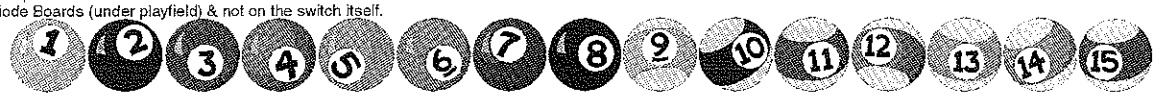


Dedicated Switch Schem.



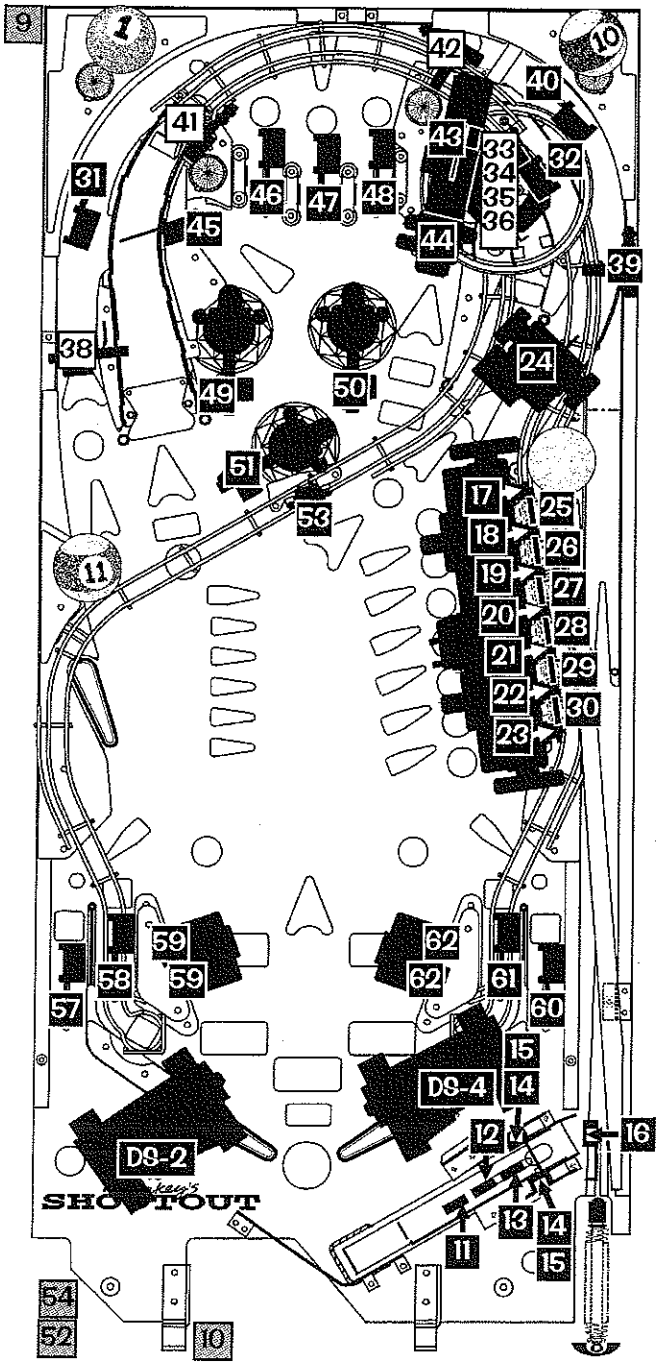
Note:
All Switches require diodes. Some diodes are located on Terminal Strips OR Diode Boards (under playfield) & not on the switch itself.

D iode
O n
T erminal
S trip



Switch Matrix Grid Descriptions with Part Numbers and Locations

The Switch locations correspond with the Switch Nº in the Part Number Table shown & the Switch Matrix Grid (previous page).



‡ Sw. 14 / Sw. 15 have both REC/TRANS on 1 board respectively.

DOTS: Diode On Terminal Strip

Legend Note:

= Switches mounted above playfield.

= Switches mounted below playfield.

= Switches mounted in/on the cabinet.

* The following switches are located in the cabinet and are not noted in the diagram above:

1 2 4 5 6 8 55 56

The following switches are not used: 37 63 64 *Switches for Future Use:* 3 & 7

Sw. Nº	Col. Nº	Row Nº	See Notes	Switch Matrix Description	Part Nº
				Note: The ¥ Coin Switch (for Japan) is 180-5091-00	
1	1	1		LEFT BUTTON (POST SAVE™)	180-5160-00
2*	1	2		4TH COIN SLOT	180-5024-00
3*	1	3		*6TH COIN SLOT*	*(Future Use)*
4*	1	4		RIGHT COIN SLOT	180-5024-00
5*	1	5		CENTER COIN SLOT / DBA	
6*	1	6		LEFT COIN SLOT	
7*	1	7		*5TH COIN SLOT*	*(Future Use)*
8	1	8		RIGHT BUTTON (POST SAVE™)	180-5160-00
9*	2	1		PLAYFIELD GLASS SWTICH	180-5123-00
10*	2	2		LOCKDOWN SWITCH	
11	2	3		4-BALL TROUGH #1 (LEFT)	180-5119-02
12	2	4		4-BALL TROUGH #2	
13	2	5		4-BALL TROUGH #3	
14‡	2	6		4-BALL TROUGH VUK OPTO — BOT TRANS: / BOT REC:	520-5173-00 / 520-5174-00
15‡	2	7		4-BALL STACKING OPTO — TOP TRANS: / TOP REC:	520-5173-00 / 520-5174-00
16	2	8	DOTS	SHOOTER LANE	180-5157-00
17	3	1	DOTS	7-BANK DROP TRGT (1)	180-5158-00
18	3	2	DOTS	7-BANK DROP TRGT (2)	
19	3	3	DOTS	7-BANK DROP TRGT (3)	
20	3	4	DOTS	7-BANK DROP TRGT (4)	
21	3	5	DOTS	7-BANK DROP TRGT (5)	
22	3	6	DOTS	7-BANK DROP TRGT (6)	
23	3	7	DOTS	7-BANK DROP TRGT (7)	
24	3	8	DOTS	SINGLE DROP TARGET	
25	4	1		STAND-UP TARGET (P) AYOFF	500-6189-16R
26	4	2		STAND-UP TARGET P (A) YOFF	
27	4	3		STAND-UP TARGET PA (Y) OFF	
28	4	4		STAND-UP TARGET PAY (O) FF	
29	4	5		STAND-UP TARGET PAYO (F) F	
30	4	6		STAND-UP TARGET PAYOF (F)	
31	4	7		LEFT ORBIT — on Lt. Mount R/O	500-6227-01
32	4	8		INSIDE RT ORBIT — on Rt. Mount R/O	500-6227-02
33	5	1		MYSTERY BALL OPTO #1	520-5194-00
34	5	2		MYSTERY BALL OPTO #2	
35	5	3		MYSTERY BALL OPTO #3	
36	5	4		MYSTERY BALL OPTO #4	
37	5	5		NOT USED	
38	5	6		SPINNER (LT ORBIT)	180-5010-04
39	5	7		RIGHT ORBIT BOT — on Gate	180-5087-00
40	5	8		RIGHT ORBIT TOP — on Rt. Mount R/O	500-6227-02
41	6	1		LEFT RAMP ENTER — on Gate	180-5087-00
42	6	2		LEFT RAMP EXIT — on Gate	
43	6	3		UNDERTROUGH	180-5057-00
44	6	4	DOTS	SUPER VUK	180-5052-00
45	6	5		SNEAK-IN — on Rt. Mount R/O	500-6227-02
46	6	6		LEFT TOP LANE — on Rt. Mount R/O	
47	6	7		MIDDLE TOP LANE — on Rt. Mount R/O	
48	6	8		RIGHT TOP LANE — on Rt. Mount R/O	
49	7	4		LEFT TURBO BUMPER	180-5015-03
50	7	2		RIGHT TURBO BUMPER	
51	7	3		BOTTOM TURBO BUMPER	
52	7	4		TOUR. START BUTTON — Switch Only	180-5174-00
53	7	5		STAND-UP TRGT (CENTER)	500-6228-05
54	7	6		START BUTTON — Switch Only	180-5174-00
55*	7	7		SLAM TILT — On Coin Door	180-5022-00
56*	7	8		PLUMB BOB TILT — HANGER / CONTACT	535-5319-00 / 535-7563-01
57	8	1		LEFT OUTLANE — on Rt. Mount R/O	500-6227-02
58	8	2		LEFT RETURN LANE — on Rt. Mount R/O	
59	8	3		LEFT SLINGSHOT — Leaf Switch X2	180-5054-00
60	8	4		RIGHT OUTLANE — on Rt. Mount R/O	500-6227-02
61	8	5		RT RETURN LANE — on Rt. Mount R/O	
62	8	6		RIGHT SLINGSHOT — Leaf Switch X2	180-5054-00
63	8	7		NOT USED	
64	8	8		NOT USED	

Go To Coil Menu

From the **DIAGNOSTICS MENU**, select the "COIL" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The coils are listed in groups. Coils 01-16 are typically High Current Coils (although Low Current Coils may be used in these positions & will be noted). Coils 17-32 are typically Low Current Coils. Flash Lamps are typically used in positions 26-32 (although may be used in any position & will be noted), read **Single Coil Test** below.

Single Coil Test

To initiate, from the **COIL MENU**, select the "TEST" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Ensure the **Power Interlock Switch** is pulled out. Select either the "-" or "+" *Icons*. Start with the "+" *Icon* to start the manual Coil Test from #1 (The test runs through all Coils and Flash Lamps #1-#32 & AUX 1-3 *(Auxilliary Low Current Coils)*. Press the **Black Button** on the "+" *Icon*, as each coil is selected, the display will describe the Coil or Flash Lamp Name with the corresponding number, the wire with colors, the "Pin-Outs" from the I/O Power Driver Board, the Coil Voltage & Gauge-Turns (e.g. 23-800). Press the **Black Button** again to move forward in the test. To test and view a particular Coil or Flash Lamp, select the "RUN" *Icon* and press the **Black Button**. Each time the **Black Button** is pushed, the Coil or Flash Lamp will fire on the Playfield and/or Backbox, with the display indicating the Coil or Flash Lamp information. Continue with the same procedure to run through the entire test.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.

Cycling Coil Test

To initiate, from the **COIL MENU**, select the "CYC" *Icon* with either **Red** or **Green Button** and press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Coil Menu or selecting either of the "ARROW" *Icons* will move to Cycling Coil Test (selecting again will return to Coil Test). The test pulses each regular Coil or Flash Lamp sequentially (cycling) on the Playfield and Backbox. The display indicates "CYCLING COILS."

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.

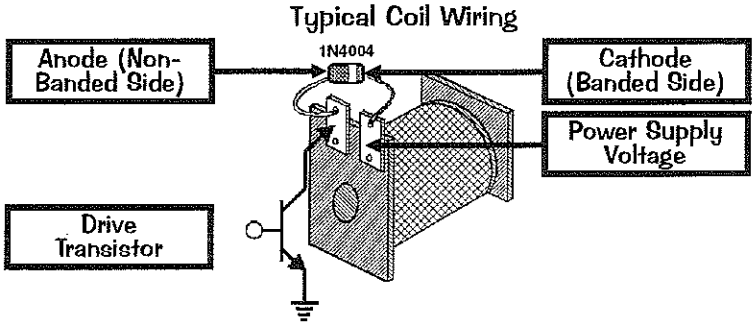
Coil & Flash Lamp Descriptions

#	Type	Coil / Flash Lamp Descriptions
1	**Coil**	TROUGH UP-KICKER (VUK) (26-1200)
2	**Coil**	AUTO LAUNCH (24-940)
3	**Coil**	SUPER VUK (23-800)
4	**Coil**	SINGLE DROP TRGT (TRIP) (32-1250)
5	**Coil**	7-BANK DROP TARGET (RESET) (23-1100)
6	**Coil**	SINGLE DROP TARGET (RESET) (24-94f0)
7	**Flash**	FLASH: SVUK, R. ORBIT X2 (#906 Bulb)
8	**Flash**	FLASH: JACKPOT X3 (#89 Bulb)
9	**Coil**	LEFT TURBO BUMPER (26-1200)
10	**Coil**	RIGHT TURBO BUMPER (26-1200)
11	**Coil**	BOTTOM TURBO BUMPER (26-1200)
12	**Coil**	TOP ORBIT MAGNET (24-780)
13	**Coil**	MYSTERY BALL MAGNET (22-650)
14	**Coil**	UPPER FLIPPER [50V RED/YEL] (23-1100)
15	**Coil**	LEFT FLIPPER [50V RED/YEL] (23-1100)
16	**Coil**	RIGHT FLIPPER [50V RED/YEL] (23-1100)

#	Type	Coil / Flash Lamp Descriptions
17	**Coil**	LEFT SLINGSHOT (23-800)
18	**Coil**	RIGHT SLINGSHOT (23-800)
19	**Coil**	BALL DEFLECTOR (26-1200)
20	**Coil**	MTR DRV RELAY BD (520-5010-00)
21	**Flash**	FLASH: LEFT CORNER X2 (#906 Bulb)
22	**Flash**	FLASH: RIGHT ORBIT X1 (#89 Bulb)
23	**Flash**	FLASH: MYSTERY BALL X2 (#89 Bulb)
24	**Coil**	(OPTIONAL COIN METER)
25	**Coil**	7-BANK DROP TRGT (1) (TRIP) (32-1250)
26	**Coil**	7-BANK DROP TRGT (2) (TRIP) (32-1250)
27	**Coil**	7-BANK DROP TRGT (3) (TRIP) (32-1250)
28	**Coil**	7-BANK DROP TRGT (4) (TRIP) (32-1250)
29	**Coil**	7-BANK DROP TRGT (5) (TRIP) (32-1250)
30	**Coil**	7-BANK DROP TRGT (6) (TRIP) (32-1250)
31	**Coil**	7-BANK DROP TRGT (7) (TRIP) (32-1250)
32	**Flash**	FLASH: 9 BALL X1 (#89 Bulb)

See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram**.

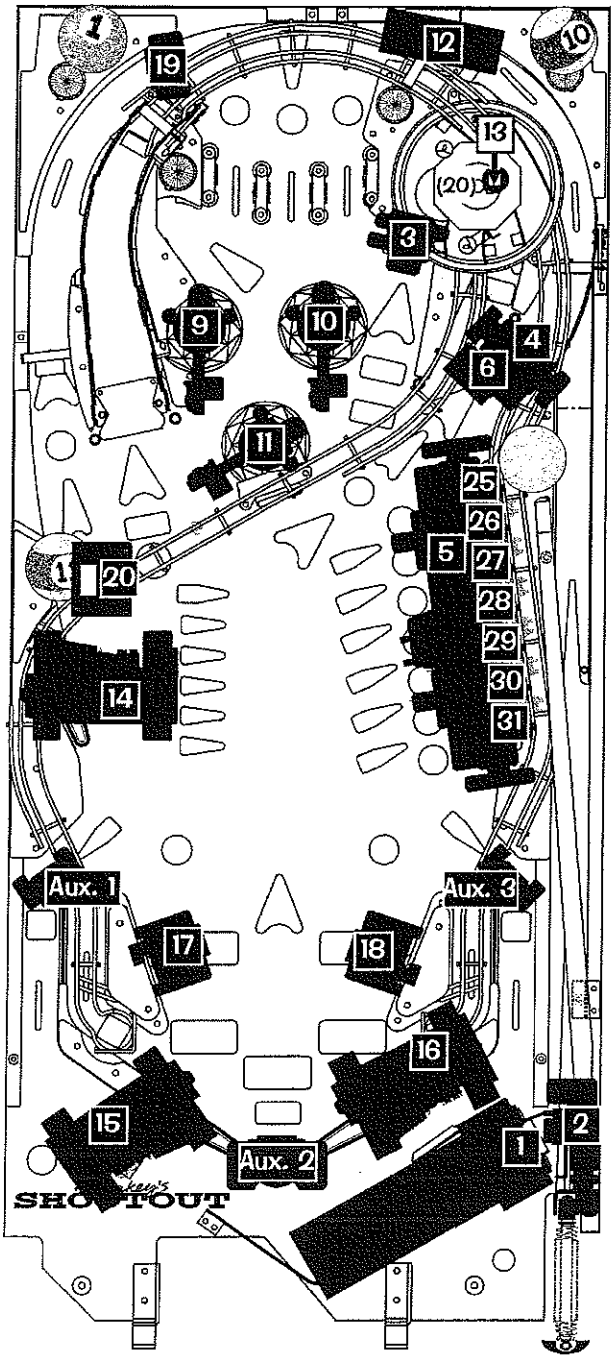
Typical Coil Wiring

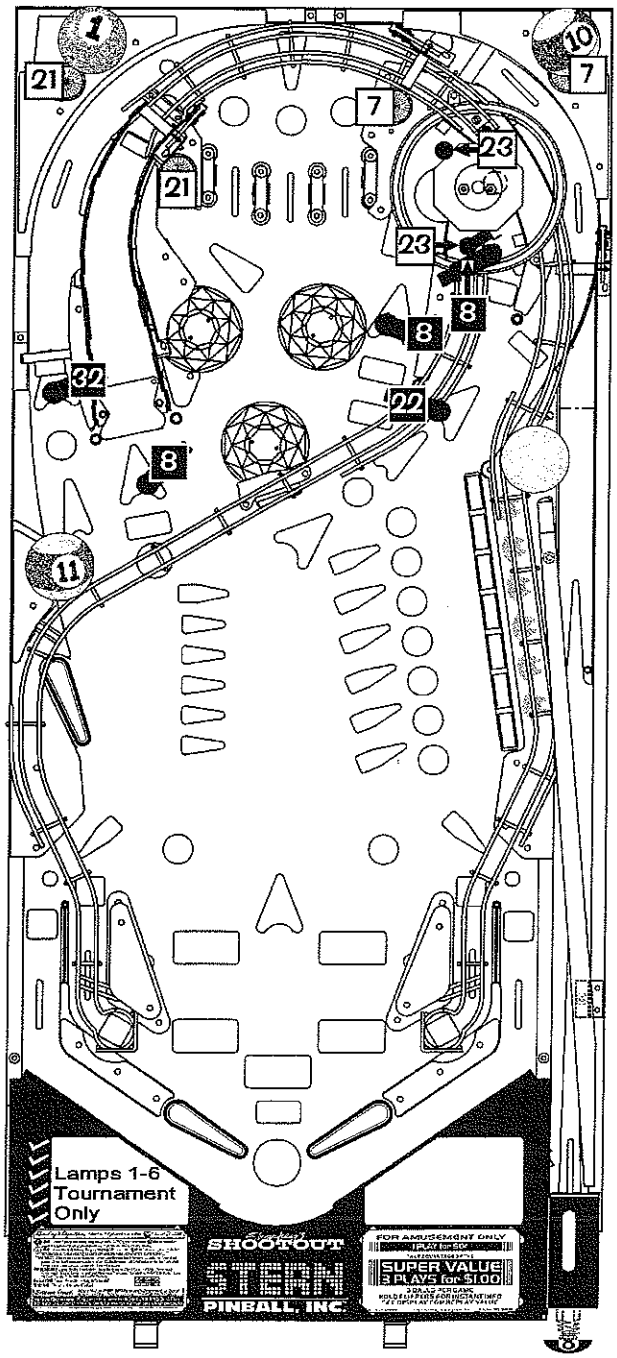


Note:
All Coils require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the coil itself.
D iode
O n
T erminal
S trip



Coil & Flash Lamp Locations





Use the previous page and the following two (2) pages in conjunction with above Coil and Flash Lamp Maps.

Legend Note:

☐ = Coils and Flash Lamps mounted above playfield.

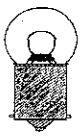
■ = Coils and Flash Lamps mounted below playfield.

The following Coil is optional:

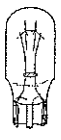
24

The following Coil(s) are Not Used:

The following Bulb Types are used for Flash Lamps:



#89 Bulb
(Bayonet)
165-5000-89

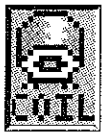


#906 Bulb
(Wedge Base)
165-5004-00

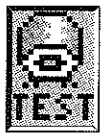
The following Flash Lamp(s) are Not Used:



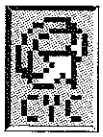
From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



From the Diagnostics Menu GO TO COIL MENU →



From the Coil Menu GO TO COIL TEST →



From the Coil Menu GO TO CYCLING COILS

COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#4	SINGLE DROP TRGT (TRIP)	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	32-1250 515-6916-01
#5	7-BANK DROP TARGET (RESET)	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#6	SINGLE DROP TARGET (RESET)	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#7	FLASH: SVUK, R. ORBIT X2	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#8	FLASH: JACKPOT X3	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

High Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	TOP ORBIT MAGNET	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	VIO-YEL	J10-P3	50v DC	24-780 090-5061-00
#13	MYSTERY BALL MAGNET	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T

Diode On Terminal Strip (if noted)

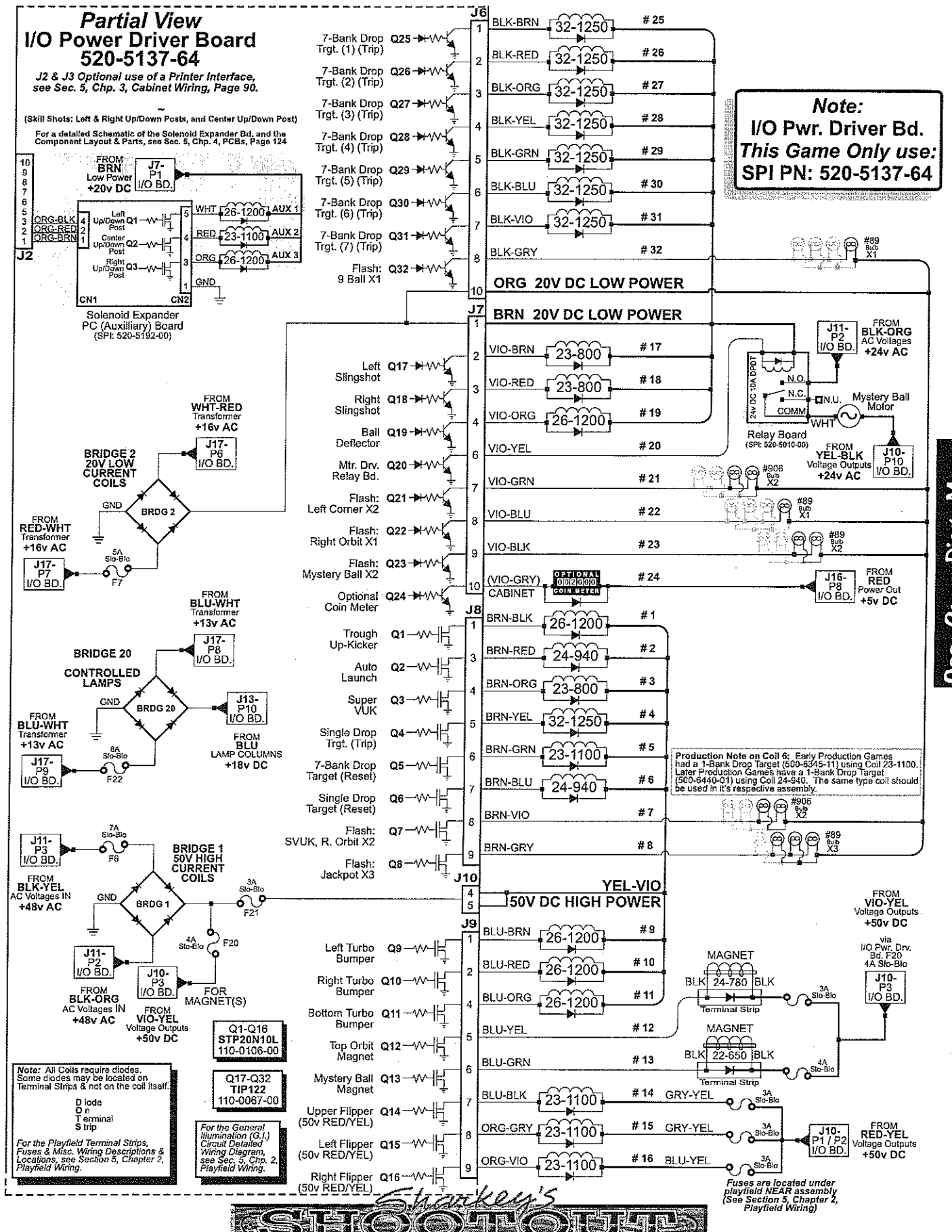
Low Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	BALL DEFLECTOR	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#20	MTR DRV RELAY BD	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	BRN	J7-P1	20v DC	Relay Bd. 520-5010-00
#21	FLASH: LEFT CORNER X2	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#22	FLASH: RIGHT ORBIT X1	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#23	FLASH: MYSTERY BALL X2	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

Low Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#25	7-BANK DROP TRGT (1) (TRIP)	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	BRN	J7-P1	20v DC	32-1250 515-6916-01
#26	7-BANK DROP TRGT (2) (TRIP)	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	BRN	J7-P1	20v DC	32-1250 515-6916-01
#27	7-BANK DROP TRGT (3) (TRIP)	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	BRN	J7-P1	20v DC	32-1250 515-6916-01
#28	7-BANK DROP TRGT (4) (TRIP)	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	BRN	J7-P1	20v DC	32-1250 515-6916-01
#29	7-BANK DROP TRGT (5) (TRIP)	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	BRN	J7-P1	20v DC	32-1250 515-6916-01
#30	7-BANK DROP TRGT (6) (TRIP)	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	BRN	J7-P1	20v DC	32-1250 515-6916-01
#31	7-BANK DROP TRGT (7) (TRIP)	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	BRN	J7-P1	20v DC	32-1250 515-6916-01
#32	FLASH: 9 BALL X1	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

Note: In Test Flash Lamps Menu ('Flash' Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: #7-#8, #21-#23 & #32)

Auxilliary (Low Current Coils)		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
AUX 1: LEFT UP/DOWN POST		Q1	Sol. Expander (Aux. Board)	WHT	CN2-P5	BRN	J7-P1	20v DC	26-1200 090-5044-00T
AUX 2: CENTER UP/DOWN POST		Q2	Sol. Expander (Aux. Board)	RED	CN2-P4	BRN	J7-P1	20v DC	23-1100 090-5030-00T
AUX 3: RIGHT UP/DOWN POST		Q3	Sol. Expander (Aux. Board)	ORG	CN2-P3	BRN	J7-P1	20v DC	26-1200 090-5044-00T




Partial View
I/O Power Driver Board
520-5137-64
J2 & J3 Optional use of a Printer Interface, see Sec. 5, Chp. 3, Cabinet Wiring, Page 90.
(Skill Shots: Left & Right Up/Down Posts, and Center Up/Down Post)
For a detailed Schematic of the Solenoid Expander Bd, and the Component Layout & Parts, see Sec. 5, Chp. 4, PCBs, Page 124
Solenoid Expander PC (Auxiliary) Board (SPI: 520-5192-00)
Note: I/O Pwr. Driver Bd. This Game Only use: SPI PN: 520-5137-64
ORG 20V DC LOW POWER
BRN 20V DC LOW POWER
YEL-VIO 50V DC HIGH POWER
BRIDGE 2 20V LOW CURRENT COILS
BRIDGE 20 CONTROLLED LAMPS
BRIDGE 1 50V HIGH CURRENT COILS
Relay Board (SPI: 520-5010-00)
Mystery Ball Motor
Production Note on Coil 6: Early Production Games had a 1-Bank Drop Target (500-6345-11) using Coil 23-1100. Later Production Games have a 1-Bank Drop Target (500-6440-01) using Coil 24-940. The same type coil should be used in it's respective assembly.
Q1-Q16 STP20N10L 110-0106-00
Q17-Q32 TIP122 110-0067-00
Note: All Coils require diodes. Some diodes may be located on Terminal Strips & not on the coil itself.
For the Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, see Section 5, Chapter 2, Playfield Wiring.
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.
Fuses are located under playfield NEAR assembly (See Section 5, Chapter 2, Playfield Wiring)
Sec. 3: ... Diag. Menu

Go To Lamp Menu

From the **DIAGNOSTICS MENU**, select the "LAMP" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Controlled lamps are configured in and 8 x 10 Matrix of Columns (Lamp Drives) and Rows (Lamp Returns) with up to 80 lamps possible. The Lamp Test Menu consists of four (4) parts: Single Lamp Test, Test All Lamps, Row Lamp Test and Column Lamp Test.

Single Lamp Test

To initiate, from the **LAMP MENU**, select the "ONE" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select either the "-" or "+" *Icons*. Start with the "+" *Icon* to start the manual Lamp Test from Column 1, Row 1, Switch 1. Press the **Black Button** on the "+" *Icon*, as each lamp is selected, the lamp will light at it's location on the playfield as well as the display, indicating the Lamp Matrix Grid Position, lamp name with the corresponding number, Return (Row) Wire & Color, Drive (Column) Wire & Color, and associated drive transistors. Press the **Black Button** again to move forward in the test. To test and view a particular lamp, select the "RUN" *Icon* and press the **Black Button**. Each time the **Black Button** is pushed, the lamp will light-up on the playfield, with the display indicating the lamp information. Continue with the same procedure to run through the entire test.

Test All Lamps

To initiate, from the **LAMP MENU**, select the "ALL" *Icon* with either **Red** or **Green Button** and press the **Black Button**. If still in Single Lamp Test (or any 1 of the 4 tests), select the "PREV" *Icon* to return to Lamp Menu or selecting either of the "ARROW" *Icons* will move through the tests, keep activating until Test All Lamps is displayed. The display will indicate "ALL LAMPS ON" and the lamps on the playfield will be lit, alternating between the rows in the Lamp Matrix Grid.

Row & Column Lamp Tests

To initiate, from the **LAMP MENU**, select the "ROW" or "COL" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black Button**. If still in a previous test, select the "PREV" *Icon* to return to Lamp Menu or selecting either of the "ARROW" *Icons* will move through the tests, keep activating until Row or Column Lamp Test (whichever desired) is displayed. In this test, each set of lamps in each Row or Column of the Lamp Matrix Grid (respective to each test) will light-up on the playfield and is indicated in the display.

LAMP MATRIX GRID

Diode On Terminal Strip:

Row (GND) \ Column (18v)	1: U17 YEL-BRN J13-P9	2: U16 YEL-RED J13-P8	3: U15 YEL-ORG J13-P7	4: U14 YEL-BLK J13-P6	5: U13 YEL-GRN J13-P5	6: U12 YEL-BLU J13-P4	7: U11 YEL-VIO J13-P3	8: U10 YEL-GRY J13-P1
1: Q33 RED-BRN J12-P1	ARCH LED CHECK 1 Tournie Only 1	ARCH LED CHECK 2 Tournie Only 2	ARCH LED CHECK 3 Tournie Only 3	ARCH LED CHECK 4 Tournie Only 4	ARCH LED CHECK 5 Tournie Only 5	ARCH LED CHECK 6 Tournie Only 6	LEFT POST SAVE™ #555 Bulb 7	RIGHT POST SAVE™ #555 Bulb 8
2: Q34 RED-BLK J12-P2	JEANETTE LEE #44 Bulb 9	STICKS #555 Bulb 10	DR. WOOD #555 Bulb 11	SHARKEY #555 Bulb 12	TEX #555 Bulb 13	MR. GREY #555 Bulb 14	8 BALL LOWER #555 Bulb 15	9 BALL LOWER #44 Bulb 16
3: Q35 RED-ORG J12-P3	PRIZE MONEY $100,000 #555 Bulb 17	PRIZE MONEY $50,000 #555 Bulb 18	PRIZE MONEY $25,000 #555 Bulb 19	PRIZE MONEY $10,000 #555 Bulb 20	PRIZE MONEY $5,000 #555 Bulb 21	PRIZE MONEY $1,000 #555 Bulb 22	SHOOT AGAIN #555 Bulb 23	BOTTOM UP POST #555 Bulb 24
4: Q36 RED-YEL J12-P4	(P) AYOFF #555 Bulb 25	P (A) YOFF #555 Bulb 26	PA (Y) OFF #555 Bulb 27	PAY (O) FF #555 Bulb 28	PAYO (F) F #555 Bulb 29	PAYOF (F) #555 Bulb 30	TOP RIGHT JACKPOT ARROW #555 Bulb 31	COLLECT COMBINATION #555 Bulb 32
5: Q37 RED-GRN J12-P5	7-BANK (1) BALL #555 Bulb 33	7-BANK (2) BALL #555 Bulb 34	7-BANK (3) BALL #555 Bulb 35	7-BANK (4) BALL #555 Bulb 36	7-BANK (5) BALL #555 Bulb 37	7-BANK (6) BALL #555 Bulb 38	7-BANK (7) BALL #555 Bulb 39	ADVANCE BUMPER POOL #555 Bulb 40
6: Q38 RED-BLU J12-P6	(P) OOL #555 Bulb 41	P (O) OL #555 Bulb 42	PO (O) L #555 Bulb 43	POO (L) #555 Bulb 44	COLLECT HURRY UP #555 Bulb 45	SINGLE D/T (8 BALL) #555 Bulb 46	SINGLE D/T (LOCK) #555 Bulb 47	LOWER RIGHT JACKPOT ARROW #555 Bulb 48
7: Q39 RED-VIO J12-P3	HURRY UP #555 Bulb 49	UPPER 9 BALL #555 Bulb 50	TOP LEFT JACKPOT ARROW #555 Bulb 51	MYSTERY ? BALL #555 Bulb 52	START COMBINATION #555 Bulb 53	RAMP JACKPOT ARROW #555 Bulb 54	9 BALL (SIGN) DOTS #555 Bulb 55	REVERSE ENGL. (SIGN) DOTS #555 Bulb 56
8: Q40 RED-GRY J12-P9	(C) UE #555 Bulb 57	C (U) E #555 Bulb 58	CU (E) #555 Bulb 59	SKILL SHOT #555 Bulb 60	LEFT TURBO BUMPER DOTS #555 Bulb 61	RT TURBO BUMPER DOTS #555 Bulb 62	BOT TURBO BUMPER DOTS #555 Bulb 63	8 BALL (SIGN) DOTS #555 Bulb 64
9: Q41 RED-WHT J12-P10	ADVANCE PRIZE MONEY #555 Bulb 65	EXTRA BALL #555 Bulb 66	R. INSIDE JACKPOT ARROW #555 Bulb 67	NOT USED 68	NOT USED 69	NOT USED 70	START BUTTON #555 Bulb 71	TOURNAMENT BUTTON #555 Bulb 72
10: Q42 NOT USED RED J12-P11	NOT USED 73	NOT USED 74	NOT USED 75	NOT USED 76	NOT USED 77	NOT USED 78	NOT USED 79	NOT USED 80



Lamp Matrix Grid Locations

The lamp locations correspond with the Lamp Nº in the Lamp Matrix Grid on the previous page.

Legend Note:

= Lamps mounted above playfield.

= Lamps mounted below playfield.

= Lamps mounted on cabinet.

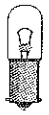
The following Lamps are not used:

55 56 64 68-70 73-80

The following Bulbs are used in the Lamp Matrix Grid (See Table Grid on previous page for details):

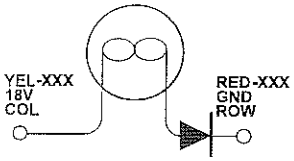


#555 Bulb (Wedge)
165-5002-00

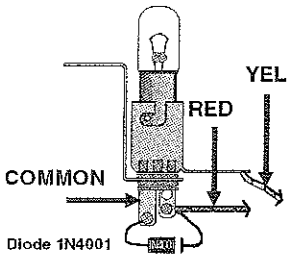


#44 Bulb (Bayonet)
165-5000-44

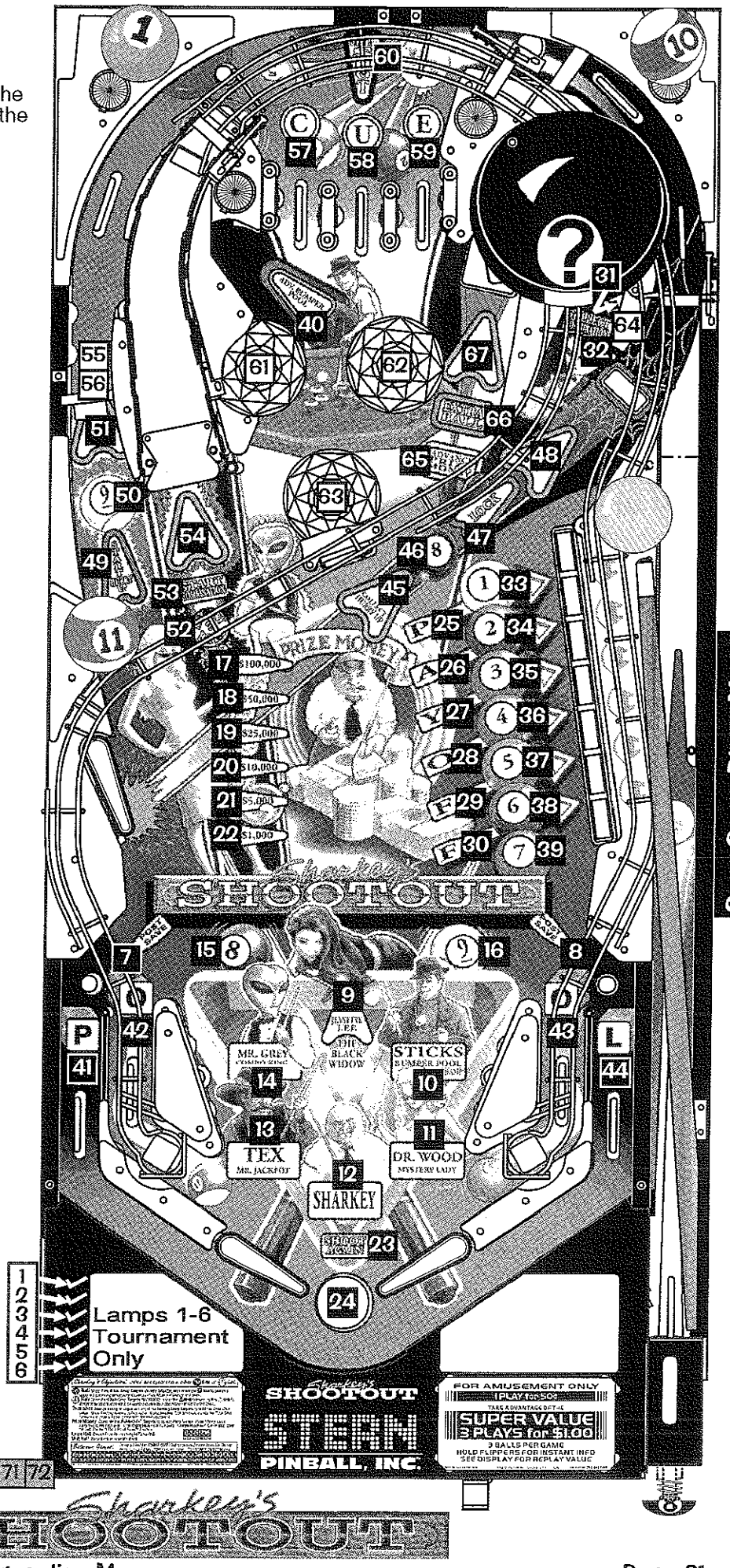
Typical Lamp Schematic



Typical Lamp Wiring



Note:
All Lamps require diodes.
Some diodes are located on Terminal Strips (under playfield) & not on the lamp itself.
D iode
O n
T erminal
S trip





Test Flash Lamps

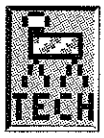
From the **DIAGNOSTICS MENU**, select the "FLASH" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate "CYCLING FLASHERS" and all the Flash Lamps will cycle continuously until the test is exited. This test is allows the technician to easily spot any burned-out bulbs and replace them. Flashers tested are Flash Lamps in Positions: **Q1-Q32** and in this game Flash Lamp(s) are in Position(s): **Q7-Q8, Q21-Q23**.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.



Clear Ball Trough

From the **DIAGNOSTICS MENU**, select the "CLR" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. This is provided to allow the technician a simple method of removing the balls from the trough and also, to test functionality of the trough, ensuring proper trough operation. After selecting this *Icon* the display will show a graphic of the ball trough with balls in the trough with it's corresponding switch number. Select the "RUN" *Icon* to eject the ball in the first position. Simultaneously, the display and the playfield will eject the ball to the Trough Up-Kicker, eject from the Trough Up-Kicker into the Shooter Lane and will be ejected onto the playfield where the technician can easily retrieve the pinball or allow the ball(s) to re-enter the trough to continue Clear Ball Trough Test. ***Important:*** The **Power Interlock Switch** must be pulled out. ⚠ **Caution:** *Continuous use of above test may overheat the Trough Up-Kicker Coil.* ⚠



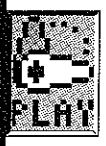
Technician Alert

From the **DIAGNOSTICS MENU**, select the "TECH" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate if there are any faulty switches (i.e., switches that are normally closed but remain open or open switches that have not been closed (activated) in 50 games.)



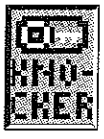
Service Phone

From the **DIAGNOSTICS MENU**, select the "SERV" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the display will indicate a phone number to call if technical assistance is required (the phone number is different for each *Country Dip Switch Setting*).



Begin Play Test

From the **DIAGNOSTICS MENU**, select the "PLAY" *Icon* with either **Red "LEFT"** or **Green "RIGHT"** Button and press the **Black "ENTER" Button**. After selecting this *Icon* the technician can test certain play functions to insure all switch activated coils function without entering game play. For example, by rolling the ball over the Shooter Lane switch, the Autoplunger should fire. If it kicks to early or too late, the switch actuator should be adjusted to compensate for this error. If it fails to fire, use the Switch Test or Coil Test to help determine the cause of the failure. During this function, similar tests may be performed on the "Ejects", Slingshots, Vertical Up-Kickers, Pop Bumpers, etc. in the game. For unique Play Test functions, select the "GAME SPECIFIC" *Icon* in the **DIAGNOSTICS MENU**. ***Important:*** The **Power Interlock Switch** must be pulled out.



Fire Knocker

From the **DIAGNOSTICS MENU**, select the "KNOCKER" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The digitally mastered "Knocker" is sounded.

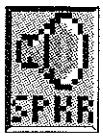


Sound / Speaker Test

From the **DIAGNOSTICS MENU**, select the "SPKR" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The BSMT 2000 Sound System produces true digital stereo sound from Backbox & Cabinet Speakers or *"Mono"* on the Cabinet Speaker (when used by itself). After selecting this *Icon*, select the "-" or "+" *Icons* and press the **Black "ENTER" Button** to activate the first test. Repeat to visually see & hear all tests. Select the "RUN" *Icon* to activate the test chosen without moving to the next test.

Note: *During Sound Tests, the display shows the speaker identification and the corresponding sound(s). The sound functions allow verification that both channels are functioning properly & that the speaker connections are correct.*

Sound / Speaker Test Continued Next Page



Speaker Phase Testing

Continued

Connections to each of speakers are polarized and each must be connected appropriately for the best quality sound. If one speaker has the positive and negative connections reversed with respect to the other one, bass frequencies will not be produced properly and the overall sound quality will be poor. To test for proper speaker phasing, use the sound test to cycle through the Backbox & Cabinet, and Backbox Sine (repeated) functions. If the Cabinet Sine produces more volume and bass than the Left Sine, the speakers are connected properly. If it produces the same or less, one speaker is connected improperly. To isolate and correct reversed speaker connections, one of two methods may be used.

1. Check each speaker for polarity markings. If the speakers have polarity markings, verify that the Backbox Speaker RED/WHT Wire and the Cabinet Speaker YEL/WHT Wire is connected to the negative (-) terminal.

2. Disconnect the speaker output connector from the CPU / Sound Board and connect a 1.5-volt battery across each speaker pair one at a time while observing the speakers. Make sure the positive battery terminal is connected to the positive lead (CN4, Pin-3 (RED/BLK) or Pin-6 (YEL/BLK)) each time. As the connection is made, check speaker cone movement; proper connections are indicated by outward movement.

Auto / Manual Tests	Sounds Produced
Speaker Test	**Tone**
Sound/OPSYS EPROM (Loc. U7)	**Level 1-3+ (Music Test)**
Voice ROMs: 1 (U17) 2 (U21) 3 (U36)	**Speech Pattern 1-3+**

Note: For ROM Locations, see Page* DR. 1. *For ROM Usage (Summary Table) see Page* DR. 3 *in the "Find-It-In-Front: Dr. Pinball Section". Voice ROMs (U17, U21, U36) which are 8MB must have a Jumper at W6 on the CPU/Sound Board to function properly.



Begin Burn In

From the **DIAGNOSTICS MENU**, select the "BURN" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the Begin Burn-In Test will start. At this stage the game will exercise all CPU I/O Functions (Dot Matrix Display Test, Coil Testing, Lamp Testing, Sound, etc.). This is provided to constantly exercise sounds, coils, etc... Cumulative Burn-In minutes will be displayed. To reset Burn-In minutes to 00, select the "RESET" *Icon* in the **MAIN MENU** and select the "FACT" *Icon* (Factory Reset). See Chapter 5, Go To Reset Menu, of this section.



Dot Matrix Test

From the **DIAGNOSTICS MENU**, select the "DOT TEST" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. After selecting this *Icon* the Dot Matrix Test immediately begins. The display will immediately illuminate & cycle for 1 pass of each test continuously for each of the following tests:

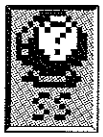
1. Illuminates 1 vertical column of dots, turning it off & illuminating the next column, until each column has been individually lit, while the other columns are off.
2. Illuminates 1 horizontal row of dots, turning it off & illuminating the next row, until each row has been individually lit, while the other rows are off.
3. Illuminates all the dots, except for one column from left to right.
4. Illuminates all the dots, except for one row from top to bottom.
5. Illuminates every other dot lit, in both the rows and columns.
6. Illuminates all dots at 30%, 70% & 100% brightness.

Note: Pressing any button will exit the test & return to **DIAGNOSTICS MENU**.

Dot Matrix Display Explained

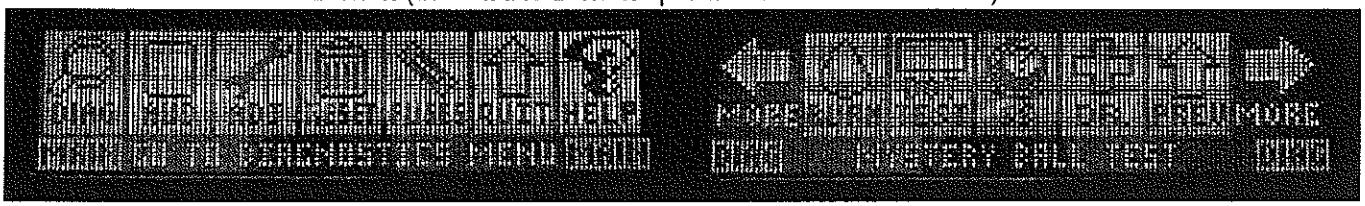
The display utilizes a Micro-Processor Control Board mounted in piggyback fashion to the Dot Matrix Display (128 X 32) Driver Board. The purpose behind this board is to provide more information to the operator as well as displaying graphics to the player.

The board is controlled by a 6809E Microprocessor and its personality ROM (Unique to the Game). It receives Data, Reset & Clock Information from the CPU/Sound Board via the ribbon cable and sends back multiple Status and Busy Signals to the CPU. This is to insure synchronized communication between the CPU and the Display Controller Board. The Drivers for the rows and columns are provided on 5 surface mounted integrated circuits on the Dot Matrix Display Driver Board.



Sharkey's Shootout (Mystery Ball Test)

To initiate, from the **DIAGNOSTICS MENU**, select the "SS" *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** (the **LEFT** and **RIGHT FLIPPER Buttons** operates in the same manner) and press the **Black "ENTER" Button** (the **START Button** operates in the same manner).



This will bring up the **MYSTERY BALL TEST MENU**. This menu is used to test the Operation of the **Mystery Ball Motor** and the **Mystery Ball Motor OPTO PC Board Switches**.

Important: The **Power Interlock Switch** must be pulled out for this *test to function* while the **Coin Door** is **OPEN**.

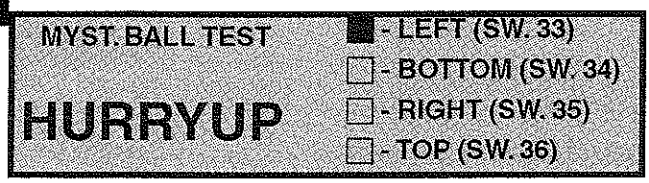
This test is provided to allow the technician a simple method of testing the ***Motor Operation (Q20)*** and the ***4-Position OPTO Board (SPI PN: 520-5194-00) Switches,* ☐ *- OP1 (Sw. 33),* ☐ *- OP2 (Sw. 34),* ☐ *- OP3 (Sw. 35) and* ☐ *- OP4 (Sw. 36)***. These OPTO Switches close when the Motor Cam Flag Bracket passes between the OPTOs (software controlled), thus breaking the light-beam.

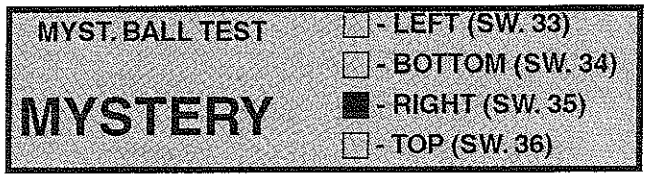
Upon entering this Test Menu, the display will indicate the switch status of the ***Mystery Ball Motor*** and the last position the motor is in will be indicated (or active). For example, if the Motor is correctly in position for **OP1**, the ☐ will be solid ■. If the Mystery Ball Signs are inbetween, **none** of the Switch Indicator boxes will be "filled." With eight (8) signs and four (4) OPTOs, four (4) signs will use two (2) OPTOs for positioning.

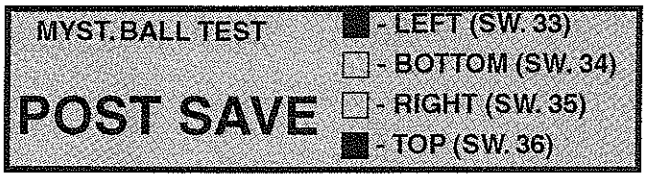
Motor & OPTO Switch Test Procedure:

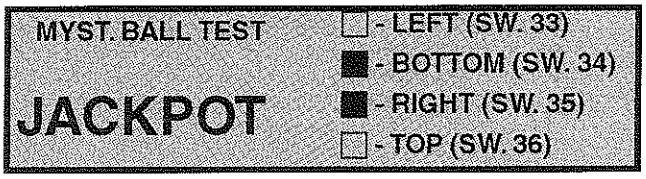
Select the "PULSE" *Icon* to pulse the motor (in steps). Continuously activating the "PULSE" *Icon* will continue the Motor to turn and cycle through all OPTO Positions. Select the "RUN" *Icon* to automatically cycle the motor to the next correct position. The Cam Plate rotates clockwise. *Note: Watch display as the* ☐ *is filled* ■ *indicating the Switch Closure(s); four (4) signs use two OPTOs.*

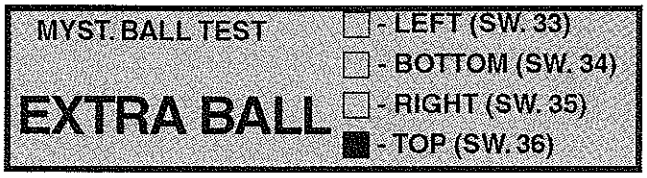
If the Mystery Ball Sign selection is on **HURRYUP** ■ **- LEFT (Sw. 33)** and the "RUN" *Icon* is activated, the motor will turn clockwise to the next sign selection **POST SAVE** ■ **- TOP (Sw. 36)** and ■ **- LEFT (Sw. 33)** Selecting the "RUN" *Icon* will automatically cycle the motor to the next open switch(es) (OPTO) and then will stop. Select the "RUN" *Icon* again to continue (cycle) to the other positions. Watch the *Dot Matrix Display* to ensure the **Switches 33 (OP1), 34 (OP2), 35 (OP3)** & **36 (OP4)** are being indicated as closed as the motor stops (☐ will turn solid ■). The eight (8) signs and positions are noted below:

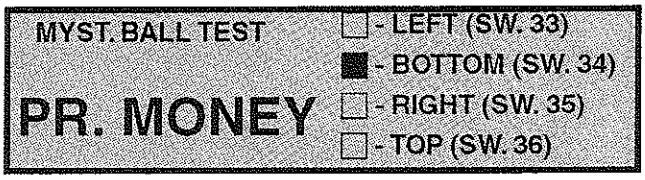


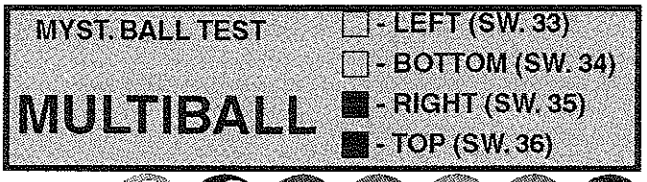


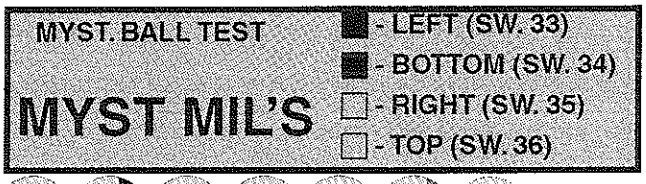














Dr. Pinball (Flow Chart Menus)

To initiate, from the **DIAGNOSTICS MENU**, select the Cross "DR." *Icon* with either the **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. This will bring you (the operator / technician) into **DR. PINBALL** (Flow Chart Menus) which offers you a choice of three sub-menus: Coil "DR.," Switch "DR." and Lamp "DR." *Icons.* Selecting a particular sub-menu will give you a choice of which specific Coil (any and all coil assemblies such as Flippers, VUKs, Magnets, etc.), Switch or Lamp circuit needs to be diagnosed. The display will now ask a question or give a procedure to follow such as "Does the lamp turn on?" or "Check bridge rectifier BR-20, if short replace." When Dr. Pinball asks a question or request a procedure the Dr. will expect a response such as "NO" or "YES" (see below examples of the *Mini-Icons* which will prompt the operator). You the operator/technician must respond by using your **Flipper Buttons** to "SELECT" a *Mini-Icon* and the **Start Button** to "ENTER" your selection.

The following are the *Mini-Icons* with explanations for the Dr. Pinball Sub-Menus to follow:



→ Select a Coil, Lamp or Switch to diagnose with "-" or "+" *Icon*; Then select the "RUN" *Icon* to activate the choice.
"PREV" goes back to previous question.
"QUIT" exits Portals completely.
Help "?" gives direction on button usage.



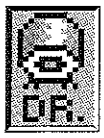
→ Seen when a question is being asked on the Display. Select "YES" or "NO" to answer the question given.
"END" lets you select a new item to test.
"PREV", "QUIT" and "?" (see first example above).



→ Seen when diagnosis is given. Select any *Icon* for your next step.
"END" lets you select a new item to test.
"PREV", "QUIT" and "?" (see first example above).

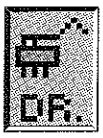


→ In Coil Flow Chart Menu, select "PULSE" to pulse the coil selected.
"END" lets you select a new item to test.
"PREV", "QUIT" and "?" (see first example above).



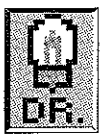
Coil Flow Chart

To initiate, from the **DR. PINBALL MENU**, select the Coil "DR." *Icon* with either the **Red** or **Green Button** and press the **Black Button**. This is the Coil Flow Chart. Follow the questions, answering by using the *Mini-Icons* in the display.



Switch Flow Chart

To initiate, from the **DR. PINBALL MENU**, select the Switch "DR." *Icon* with either the **Red** or **Green Button** and press the **Black Button**. This is the Switch Flow Chart. Follow the questions, answering by using the *Mini-Icons* in the display.



Lamp Flow Chart

To initiate, from the **DR. PINBALL MENU**, select the Lamp "DR." *Icon* with either the **Red** or **Green Button** and press the **Black Button**. This is the Lamp Flow Chart. Follow the questions, answering by using the *Mini-Icons* in the display.

Game Audit Table for

Sharkey's SHOOTOUT

STERN PINBALL, INC.

Copy for Field Audit Tracking Performance (Use blank columns to fill-in Audit Info.).

Earnings Audits 1-12

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
1	TOTAL PAID CREDITS		5	COINS THRU LEFT SLOT		9	TOTAL COINS	
2	FREE GAME PERCENTAGE		6	COINS THRU RIGHT SLOT		10	TOTAL EARNINGS	
3	AVERAGE BALL TIME		7	COINS THRU CENTER SLOT		11	METER CLICKS	
4	AVERAGE GAME TIME		8	COINS THRU 4TH SLOT		12	SOFTWARE METER	

S.P.I. Audits 13-55

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
13	TOTAL BALLS PLAYED		28	20M—49.9M SCORES		43		
14	TOTAL EXTRA BALLS		29	50M—69.9M SCORES		44		
15	EXTRA BALL PERCENT		30	70M—99.9M SCORES		45		
16	REPLAY 1 AWARDS		31	100M—129.9M SCORES		46		
17	REPLAY 2+ AWARDS		32	130M+ SCORES		47		
18	TOTAL REPLAYS		33	AVERAGE SCORES		48		
19	REPLAY PERCENT		34	SERVICE CREDITS		49		
20	TOTAL SPECIALS		35	BALL SEARCH STARTED		50		
21	SPECIAL PERCENT		36	LOST BALL FEEDS		51		
22	TOTAL MATCHES		37	LOST BALL GAME STARTS		52	LEFT FLIPPER USED	
23	HIGH SCORE AWARDS		38	LEFT DRAINS		53	RIGHT FLIPPER USED	
24	HIGH SCORE PERCENT		39	CENTER DRAINS		54		
25	TOTAL FREE PLAYS		40	RIGHT DRAINS		55		
26	TOTAL PLAYS		41	SLAM TILTS				
27	0—19.9M SCORES		42	TOTAL BALLS SAVED				

Sharkey's Shootout Audits 56-99 (All Audits Subject to Change)

	Audit Name	Fill-In		Audit Name	Fill-In		Audit Name	Fill-In
56	LEFT ORBIT		72	BUMPER POOL HITS		88	BEAT JEANETTE 8-BALL	
57	RAMP STARTED		73	BUMPER POOL ADVANCED		89	STARTED THE WEB	
58	RAMP MADE		74	HURRYUP STARTED		90	MULTIBALL STARTS	
59	CENTER TARGET		75	HURRYUP COMPLETED		91	2+ MULTIBALL STARTS	
60	VUK FROM FRONT		76	MYSTERY AWARDS		92	TOTAL JACKPOTS	
61	INSIDE ORBIT		77	MILLION PLUS STARTED		93	TOTAL SUPER JACKPOTS	
62	RIGHT ORBIT		78	MILLION PLUS COMPLETED		94	CUE COMPLETED	
63	DROP BANK COMPLETED		79	MYSTERY EXTRA BALLS		95	BUMPER HITS	
64	PAYOFF COMPLETED		80	MYSTERY MULTIBALLS		96	PRIZE MONEY EX. BALLS	
65	LEFT RETURN LANE		81	SPECIAL H-U STARTED		97	LEFT POST USED	
66	RIGHT RETURN LANE		82	SPECIAL H-U COMPLETED		98	CENTER POST USED	
67	LEFT OUTLANE		83	EIGHT BALL WINS		99	RIGHT POST USED	
68	RIGHT OUTLANE		84	NINE BALL WINS			CPU Version:	
69	POOL COMPLETED		85	BEAT ONE OPPONENT			Display Version:	
70	SKILL SHOTS AWARDED		86	BEAT TWO OPPONENTS			Date Audited:	
71	BUMPER POOL STARTED		87	REACHED JEANETTE			Audited By:	

Location:

Go To Audits Menu

Overview

The **Portals™ Service Menu System** provides 99 Audit Functions for accounting purposes and for evaluation of *Game Difficulty Adjustments*. The Audit Functions are divided into 3 groups: • **Earnings (Coin) Audits**, are the first 12 most-used Audits • **S.P.I. Audits**, are the Game Play Generic Audits 13-55 • **Sharkey's Shootout Audits**, are the Game Play Specific Audits 56-99; Audits left open (blank space in gray, e.g. Audits 43-51, 54 & 55) are currently ***Not Used,*** allowing for ***Future Expansion,*** if any, or are ***Proprietary***. If the code version is upgraded, view Audits in the display & write the audit(s) in the blank(s) if any audit(s) were added. Each group may be viewed in the **Portals™ Service Menu** (see Chapter 1, **Portals™ Service Menu Introduction**, of this Section). View all audits with the **Game Audit Table** provided on the previous page.



GO TO AUDITS MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "AUD" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **AUDITS MENU** appears.

Important Notes:



Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.



Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.



Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



Selecting & activating the "ARROW" *Icons* selects the next or previous audit in the group.



Earnings Audits (1-12)

From the **AUDITS MENU**, select the "EARN" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st audit in this group. Continue to select either of the "ARROW" *Icons* to view each audit one at a time. The display will describe the audit number, the audit name, and the audit total or value. The current audit will remain in the display until the next audit is chosen or when the sub-menu is exited.

Au. Nº	Audit Name	Audit Definition
Au. 1	**Total Paid Credits**	Provides the total number of paid credits.
Au. 2	**Free Game Percentage**	This percentage is derived from dividing Audit 25, Total Free Plays, by Audit 26, Total Plays.
Au. 3	**Average Ball Time**	In seconds, the average ball time is derived from the total play time divided by Audit 13, Total Balls Played.
Au. 4	**Average Game Time**	The average game time is expressed in minutes and seconds.
Au. 5	**Coins Thru Left Slot**	Provides the total number of times Coin Switch (Sw. 6) was closed.
Au. 6	**Coins Thru Right Slot**	Provides the total number of times Coin Switch (Sw. 4) was closed.
Au. 7	**Coins Thru Center Slot**	Provides the total number of times Coin Switch (Sw. 5) was closed.
Au. 8	**Coins Thru 4th Slot**	Provides the total number of times Coin Switch (Sw. 2) was closed.
Au. 9	**Total Coins**	Provides the total amount of coins registered through all the slots.
Au. 10	**Total Earnings**	The total cash value accumulated since the last *Factory Restore* occurred (see Chapter 5, Go to Reset Menu, of this section).
Au. 11	**Meter Clicks**	Provides the total number of money clicks accumulated. (Based on the country's lowest coin denomination used for the game credit.)
Au. 12	**Software Meter**	Provides the continuing total of Meter Clicks. This audit cannot be reset; the display shows the constant addition of Meter Clicks.



S.P.I. Audits (13-55)

From the **AUDITS MENU**, select the "S.P.I." *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st audit in this group. Continue to select either of the "ARROW" *Icons* to view each audit one at a time. The display will describe the audit number, the audit name, and the audit total or value. The current audit will remain in the display until the next audit is chosen or when the sub-menu is exited.

Au. Nº	Audit Name	Audit Definition
Au. 13	Total Balls Played	Provides the total number of regular and extra balls.
Au. 14	Total Extra Balls	Provides the total number of extra balls awarded.
Au. 15	Extra Balls Percent	Provides the percentage total from dividing Audit 14, Total Extra Balls, by Audit 26, Total Plays.
Au. 16	Replay 1 Awards	Provides the total awards (Credit, Extra Ball, Or Audit) for level 1.
Au. 17	Replay 2+ Awards	Provides the total awards (Credit, Extra Ball, Or Audit) for level(s) 2 or higher.
Au. 18	Total Replays	Provides the total awards (Credits, Extra Balls, Or Audit Only) for exceeding replay score levels.
Au. 19	Replay Percent	Provides the percentage total from dividing Audit 18, Total Replays, by Audit 26, Total Plays. The percentage reflects replay total awards for exceeding replay score levels.
Au. 20	Total Specials	Provides the total awards (Credits, Extra Balls, Or Scores) for making specials.
Au. 21	Special Percent	This percentage is derived from dividing Audit 20, Total Specials, by Audit 26, Total Plays.
Au. 22	Total Matches	Provides the total credits awarded for matching the last two digits of the score with the system-generated Match Number at the end of the game. Percentage of match credits is adjustable from 0% to 10% by Adjustment 11, Match Percentage, if enabled. (See Chapter 4, Go to Adjustments Menu, of this section.)
Au. 23	High Score Awards	Provides the total credits awarded for exceeding the High-Score-To-Date scores.
Au. 24	High Score Percent	This percentage is derived from dividing Audit 23, High Score Awards, by Audit 26, Total Plays.
Au. 25	Total Free Plays	Provides the total free credits for replays, High-Score-To-Date, Specials, and Match.
Au. 26	Total Plays	This total is derived by adding the sum of Audit 1, Total Paid Credits, and Audit 25, Total Free Plays. Note that free credits are not recorded in the Audit until they are actually used.
Au. 27	0—19.9M Scores	Provides the total number of games the Player's final score was between 0 and 19,900,000 points.
Au. 28	20M—49.9M Scores	Provides the total number of games the Player's final score was between 20,000,000 and 49,900,000 points.
Au. 29	50M—69.9M Scores	Provides the total number of games the Player's final score was between 50,000,000 and 69,900,000 points.
Au. 30	70M—99.9M Scores	Provides the total number of games the Player's final score was between 70,000,000 and 99,900,000 points.
Au. 31	100M—129.9M Scores	Provides the total number of games the Player's final score was between 100,000,000 and 129,900,000 points.
Au. 32	130M+ Scores	Provides the total number of games the Player's final score was over 130,000,000 points.
Au. 33	Average Scores	This total is derived from adding the Final Score of each game to a table and dividing this sum by Audit 26, Total Plays.
Au. 34	Service Credits	Provides the total number of times Dedicated Switch (DS-7) was closed, not in the Portals™ Service Menu. (See Chapter 1, Introduction [*Access & Use*] for instructions on how to receive Service Credits.)
Au. 35	Ball Search Started	Provides the total number of times the game performed a ball search.
Au. 36	Lost Ball Feeds	Provides the total number of times the game added a ball to play when it could not find a ball after ball search.



S.P.I. Audits Continued.

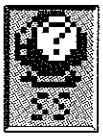
Audit Name		Audit Definition
Au. 37	Lost Ball Game Starts	Provides the total number of times the game started with a ball missing from the ball trough at the start of a game.
Au. 38	Left Drains	Provides the total number of times Rollover Switch 57 was closed.
Au. 39	Center Drains	Provides the total number of times the game ball had drained with the last switch closed was not Sw. 57 or Sw. 60.
Au. 40	Right Drains	Provides the total number of times Rollover Switch 60 was closed.
Au. 41	Slam Tilts	Provides the total number of times Contact Switch 55 was closed.
Au. 42	Total Balls Saved	Provides the total number of times this feature was used. This feature is enabled at the start of each ball and is disabled as soon as the ball makes contact with 5 game switches or allocated time expired.
Au. 43-Au. 51		These audits are ***Not Used***, allowing for ***Future Expansion***, if any, and/or ***Proprietary*** (used for programming).
Au. 52	Left Flipper Used	Provides the total number of times Dedicated Sw. (DS-1) was closed.
Au. 53	Right Flipper Used	Provides the total number of times Dedicated Sw. (DS-3) was closed.
Au. 54-Au. 55		These audits are ***Not Used***, allowing for ***Future Expansion***, if any, and/or ***Proprietary*** (used for programming).

Sharkey's Shootout Audits (56-99) (All Audits Subject to Change)

From the **AUDITS MENU**, select the "SS" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st audit in this group. Continue to select either of the "ARROW" *Icons* to view each audit one at a time. The display will describe the audit number, the audit name, and the audit total or value. The current audit will remain in the display until the next audit is chosen or when the sub-menu is exited.

Au. Nº	Audit Name	Audit Definition
Au. 56	Left Orbit	Provides the total number of times the Left Orbit Switch 31 was closed.
Au. 57	Ramp Started	Provides the total number of times this feature was started. †
Au. 58	Ramp Made	Provides the total number of times the Ramps Switches 41 & 42 were closed.
Au. 59	Center Target	Provides the total number of times the Center Trgt. Sw. 53 was closed.
Au. 60	VUK from Front	Provides the total number of times the VUK Switch 44 was closed.
Au. 61	Inside Orbit	Provides the total number of times the Rollover Switch 32 was closed.
Au. 62	Right Orbit	Provides the total number of times the both Right Orbit Top & Bottom Switches 39 & 40 were closed.
Au. 63	Drop Bank Completed	Provides the total number of times the Drop Targets Switches 17-23 were closed.
Au. 64	Payoff Completed	Provides the total number of times the Stand-Up Target Switches 25-30 were closed.
Au. 65	Left Return Lane	Provides the total number of times the Rollover Switch 58 was closed.
Au. 66	Right Return Lane	Provides the total number of times the Rollover Switch 61 was closed.
Au. 67	Left Outlane	Provides the total number of times the Rollover Switch 57 was closed.
Au. 68	Right Outlane	Provides the total number of times the Rollover Switch 60 was closed.
Au. 69	Pool Completed	Provides the total number of times this feature was completed. †
Au. 70	Skill Shots Awarded	Provides the total number of times this feature was awarded. †
Au. 71	Bumper Pool Started	Provides the total number of times the Pop Bumper Switches 49-51 were closed during the featured Mode.
Au. 72	Bumper Pool Hits	Provides the total number of times this feature was completed. †
Au. 73	Bumper Pool Advanced	Provides the total number of times this feature was awarded. †

† Multiple variations of switch closures (see Diagnostics) are used to determine completion of the feature stated.
‡ Multiple variations of switch closures (see Diagnostics) are used to determine the lighting of the feature stated.



Sharkey's Shootout Audits Continued (All Audits Subject to Change)

Audit Name		Audit Definition
Au. 74	Hurryup Started	Provides the total number of times this feature was started. †
Au. 75	Hurryup Completed	Provides the total number of times this feature was completed. †
Au. 76	Mystery Awards	Provides the total number of times this feature was awarded. †
Au. 77	Million Plus Started	Provides the total number of times this feature was started. †
Au. 78	Million Plus Completed	Provides the total number of times this feature was completed. †
Au. 79	Mystery Extra Balls	Provides the total number of times this feature was started via the Mystery Feature.
Au. 80	Mystery Multiballs	Provides the total number of times Multiball was played.
Au. 81	Special H-U (Hurryup) Started	Provides the total number of times this feature was started. †
Au. 82	Special H-U Completed	Provides the total number of times this feature was completed. †
Au. 83	Eight Ball Wins	Provides the total number of times this feature was won. †
Au. 84	Nine Ball Wins	Provides the total number of times this feature was won. †
Au. 85	Beat One Opponent	Provides the total number of times this feature was completed. †
Au. 86	Beat Two Opponents	Provides the total number of times this feature was completed. †
Au. 87	Reached Jeanette	Provides the total number of times this feature was completed. †
Au. 88	Beat Jeanette 8-Ball	Provides the total number of times this feature was completed. †
Au. 89	Started the Web	Provides the total number of times this feature was started. †
Au. 90	Multiball Starts	Provides the total number of times Multiball was started without locking balls. †
Au. 91	2+ Multiball Starts	Provides the total number of times Multiball was played more than once by a single player in one game. †
Au. 92	Total Jackpots	Provides the total number of times this feature was completed. †
Au. 93	Total Super Jackpots	Provides the total number of times this feature was completed. †
Au. 94	Cue Completed	Provides the total number of times this feature was completed. †
Au. 95	Bumper Hits	Provides the total number of times this feature was completed. †
Au. 96	Prize Money Ex. Balls	Provides the total number of times this feature was lit. ‡
Au. 97	Left Post Used	Provides the total number of times the Left Post Save Button Switch 1 was closed while the Post Save™ Feature was lit. ‡
Au. 98	Center Post Used	Provides the total number of times the both the Left & Right Post Save Buttons Switches 1 & 8 were closed while the Post Save™ Feature was lit. ‡
Au. 99	Right Post Used	Provides the total number of times the Right Post Save Button Switch 8 was closed while the Post Save™ Feature was lit. ‡

† Multiple variations of switch closures (see Diagnostics) are used to determine completion of the feature stated.
‡ Multiple variations of switch closures (see Diagnostics) are used to determine the lighting of the feature stated.

Use the below space for any additions and/or changes, if any (see the Dot Matrix Display):

Au.

Au.

Au.

Au.

Au.

Au.



Go To Printer Menu

From the **AUDITS MENU**, select the "PRNT" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **PRINTER MENU** appears.

Special equipment is required for this Sub-Menu

The **Portals™ Service Menu System** provides 3 Audit Printing Adjustment Functions to print information on a "Hand-Held" printer, download game information to a Laptop PC or clear the printout count. A printer interface board, hand-held printer and/or a special software program is required to run this menu. Entering this menu and selection/activation of the *Icons* without this equipment/software will not affect the game.



Quick Printout (Printer Interface)

From the **PRINTER MENU**, select the "QUIK" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select the "+" *Icon* and press the **Black Button** to start the printout. Only the Earnings Audits can be printed out to a "Hand-Held" Printer.



Full Printout (Alison Interface Program)

From the **PRINTER MENU**, select the "ALISON" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select the "+" *Icon* and press the **Black Button** to start the download. A special software program and a Lap Top PC is required. All game audits (Earnings, S.P.I. & Game Specific) can be retrieved.



Reset Printer (№ of Copies Printed Reset)

From the **PRINTER MENU**, select the "RESET" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select the "+" *Icon* and press the **Black Button** to start the clear the "№ of copies printed" count total.

RESETTING AUDIT NOTES:



Audit Note: 1st Way to Reset Audits

To reset audits, from the **MAIN MENU**, select the "ADJ" *Icon*. See Chapter 4, Go to Adjustments Menu, of this section.



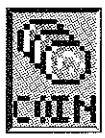
Select the "S.P.I." *Icon*, from the **ADJUSTMENT MENU**, and advance to Adj. 8, Reset Coin Audits, with the "RIGHT ARROW" *Icon*. Select the "+" *Icon* to change setting to **YES**. When enabled, the *Coin Audits* (5-11) will be reset to zero.

Advance to Adj. 9, Reset Game Audits, with the "RIGHT ARROW" *Icon*. Select the "+" *Icon* to change setting to **YES**. When enabled, *all the audits* will be reset to zero, **except** for the *Coin Audits* (5-11) ***and*** Audit 12, Software Meter (the only audit which cannot be reset to zero).

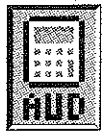


Audit Note: 2nd Way to Reset Audits

To reset audits, from the **MAIN MENU**, select the "RESET" *Icon*. See Chapter 5, Go to Reset Menu, of this section.



Selection of the "COIN" *Icon*, from the **RESET MENU**, will reset the *Coin Audits* (5-11) to zero.



Selection of the "AUD" *Icon*, from the **RESET MENU**, will reset all audits to zero, **except** for the *Coin Audits* (5-11) ***and*** Audit 12, Software Meter (the only audit which cannot be reset to zero).

Game Adjustment Table for

Sharkey's SHOOTOUT

STERN PINBALL, INC.

Some adjustments have a "Drop-Down" Table for further customization.

S.P.I. Adjustments 1-45

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
1	REPLAYS: FIXED/AUTO ‡	...10%...		23	DEFAULT HIGH SCORE #3	250,000,000	
2	REPLAY LEVELS ‡	1 ...		24	DEFAULT HIGH SCORE #4	225,000,000	
3	REPLAY AWARD	CREDIT		25	DEFAULT HIGH SCORE #5	200,000,000	
4	FREE GAME LIMIT	05		26	DEFAULT HIGH SCORE #6	175,000,000	
5	EXTRA BALL LIMIT	03		27	DEFAULT HIGH SCORE #7	150,000,000	
6	GAME DIFFICULTY ‡	MODERATE		28	DEFAULT HIGH SCORE #8	125,000,000	
7	GAME PRICING ‡	USA3		29	DEFAULT HIGH SCORE #9	100,000,000	
8	RESET COIN AUDITS	NO		30	DEFAULT HIGH SCORE #10	75,000,000	
9	RESET GAME AUDITS	NO		31	HSTD RESET COUNT	2,000	
10	RESET HIGH SCORES	NO		32	HIGH SCORE INITIALS	3 Initials	
11	MATCH PERCENTAGE	9%		33	FREE PLAY	NO	
12	BALLS PER GAME	03		34	CUSTOM MESSAGE	ON	
13	TILT WARNINGS	01		35	FLASH LAMP POWER	NORMAL	
14	REPLAY BOOST	YES		36	COIL PULSE POWER	NORMAL	
15	CREDIT LIMIT	30		37	KNOCKER VOLUME	NORMAL	
16	ALLOW HIGH SCORES	YES		38	GAME RESTART	YES	
17	HIGH SCORE #1 AWARDS	01		39	EXTRA BALL PERCENTAGE	25%	
18	HIGH SCORE #2 AWARDS	00		40	BILL VALIDATOR	NO	
19	HIGH SCORE #3 AWARDS	00		41	TOURNAMENT MODE	NONE	
20	HIGH SCORE #4 AWARDS	00		42	UK COIN MECH. TYPE	CURRENT:	
21	DEFAULT HIGH SCORE #1	300,000,000		43	BKGRND MUSIC VOLUME	01	
22	DEFAULT HIGH SCORE #2	275,000,000		44	LOCATION ID	00	
				45	GAME ID	00	

PLEASE NOTE: *All Factory Settings (Defaults) described in the tables above/below and within the Adjustment Definitions are for USA Settings only (CPU/Snd Bd. Dip Sw. 300 Settings 1-8 are all "OFF"). Different countries may have different Factory Settings (Defaults). ‡ Adj. 1, 2, 6 & 7 have "Drop-Down" Tables, see definitions.*

ALSO NOTE: *Adjustment 42 can only be adjusted if using UK Dip Switch Option Setting 2.*

Sharkey's Shootout Adjustments 46-52

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
46	EXTRA BALL MEMORY	ON		49	TOP POST COMES UP	NOT...	
47	MULTIBALL CRITERION	MODERATE		50	FREEZE TIME	AUTO	
48	UK POST SAVE™ ENABLED	NO		51	POST SAVE™ TIME	0:06	
				52	TOURNAMENT BUTTON	OFF	

PLEASE NOTE: *Adjustment 47 can only be adjusted if the game has the UK ePROM installed (UK ONLY).*

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides 52 Adjustment Functions to vary game difficulty or to customize (e.g. Adjusting: High Score Levels; Balls per game; Game Pricing; Default High Scores; etc.). The Adjustment Functions are divided into 2 groups: • **S.P.I. Adjustments**, are the Game Play Generic Adjustments (1-45) • **Sharkey's Shootout Adjustments**, are the Game Play Specific Adjustments (46-52); Any Adjustment(s) left open or are currently *Not Used*, are allowing for Future Expansion, if any, or are Proprietary. If the code version is upgraded, view Adjustments in the display & write the adjustment(s) in the blank(s) if any adjustment(s) were added. Each group may be viewed manually after entering the **Portals™ Service Menu** (see Chapter 1, **Portals™ Service Menu Introduction**, of this Section). All adjustments can be viewed at a glance with the **Game Adjustment Table** provided on the previous page. If a value is changed, the display will indicate **REQUEST INSTALLED**.

Important: *The **Coin Door** must be **OPEN** allowing the **Memory Protect Switch** to be disabled so changes can be made.*



GO TO ADJUSTMENTS MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "ADJ" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **ADJUSTMENTS MENU** appears.

Important Notes:



Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.



Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.



Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



In Adjustments, selecting & activating the "-" *Icon* decrements the value setting. Selecting & activating the "+" *Icon* increments the value setting.



Selecting & activating the "ARROW" *Icons* selects the next or previous adj. in the group.



S.P.I. Adjustments (1-45)

From the **ADJUSTMENTS MENU**, select the "S.P.I." *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st adjustment in this group. Continue to select either of the "ARROW" *Icons* to view each adjustment one at a time. Select either the "-" or "+" *Icons* to change the value, if desired. The display will describe the adjustment number, the adjustment name, and the adjustment total or value. The current adjustment will remain in the display until the next adjustment is chosen or when the sub-menu is exited.

Adj. Nº	Adjustment Name	Adjustment Definition
Adj. 1	Replays: Fixed / Auto	Set between **01% - 50%** and **Fixed** (0%) for Replay Levels. Default is **10%**. Four levels may be selected. Adjustments allow awarding of a credit or an extra ball as each level is exceeded. With the ***Autopercentage Feature***, if the actual replay percentage is higher or lower than that desired, the game will automatically adjust for the new recommended percentage score(s).
Adj. 2	Replay Levels	Set between **1 - 4** or **NONE** for the number of replay levels to be active. A "Drop-Down" Table appears (after selection of number of replay levels) showing Replay Level 1. Adjust Replay Level 1 between 10M - 9.99B. Adjust Replay Level 2, 3 and/or 4 respectively.
Adj. 3	Replay Award	Set for replays to award: **CREDIT, EXTRA BALL, NONE** or **SPECIAL** (When score threshold is achieved, a Playfield Special is lit.) Default is **CREDIT**.
Adj. 4	Free Game Limit	Set between **01 - 09** or **NO FREE GAMES**. Default is **05**. Adjust the maximum number of *Free Games* that may be accumulated per game.
Adj. 5	Extra Ball Limit	Set between **01 - 09** or **NO EXTRA BALLS**. Default is **03**. Adjust the maximum number of *Extra Balls* that may be accumulated per game.

Adjustment Name	Adjustment Definition

Adj. 6 Game Difficulty

Set to **EXTRA EASY, EASY, MODERATE, HARD** or **EXTRA HARD.** *(Note: Additional game features which are not adjusted may also change when adjusting this adjustment; see below table.)* Default is **MODERATE.** Any one of the ***INSTALL*** settings (in a "Drop-Down" Table) for this adjustment may be activated to automatically select settings for multiple adjustments affecting game difficulty. Select and activate the "-" or "+" *Icons* to choose the difficulty level required. After activation, the individual adjustments may be readjusted, if desired. Refer to the **Install Adjustment Table** below for details.

Adjustments which change when set to:	Extra Easy	Easy	Moderate	Hard	Extra Hard
(46) Extra Ball Memory	ON	ON	ON	OFF	OFF
(47) Multiball Criterion	EASY	EASY	MODERATE	HARD	HARD

Play Rules: Novelty & 4-Ball, plus Add-A-Ball Settings

The following three combinations are recommended for situations where local laws restrict certain game features regarding the use of replays or the number of balls per game:

Novelty Play Rules - Set to establish recommended settings for no Free Play or Extra Balls:

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
1	Replays: Fixed/Auto	Fixed	5	Extra Ball Limit	00
2	Replay Levels	None	11	Match Percentage	Off
3	Replay Award	None	17	High Score #1 Awards	1
4	Free Game Limit	0	18	High Score #2 Awards	0

4-Ball Play Rules - Set to establish recommended settings for 4-Ball Play:

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
1	Replays: Fixed/Auto	07%	5	Extra Ball Limit	3
2	Replay Levels	1	11	Match Percentage	4
3	Replay Award	Credit	12	Balls Per Game	5
4	Free Game Limit	5	17	High Score #1 Awards	1
			18	High Score #2 Awards	0

Add-A-Ball Settings -To disable awarding of credits and provide awards with an Extra Ball:

Adj.	Adjustment Name	Setting	Adj.	Adjustment Name	Setting
3	Replay Award	Extra Ball	16	Allow High Scores	No
4	Free Game Limit	00	17-20	High Score #1 - #4 Awards	0
11	Match Percentage	Off			

Adj. 7 Game Pricing

Set between USA1 thru **UK6** or **CUSTOM**. Default is **USA3** *(foreign Game Pricing Options are in the Standard Pricing Select Table on the following pages).* There are two methods available for coin switch programming: Standard & Custom. Standard pricing uses a single adjustment as seen in the first display. See the Standard Pricing Table. If "Custom" is selected, a "Drop-Down" Table appears. Select a pricing scheme shown in the Custom Pricing Table as seen below.

With Adjustment 7 set to **CUSTOM** operating the **Black "Enter" Button** again initiates a drop down menu representing coin switch pulses for the LEFT, CENTER, RIGHT and 4TH Coin Slots. The prescribed the number of pulses are required for 1 Credit. For example, if *Left Coin Pulses,* was set to 02 and *Coin Switch Pulses Required for 1 Credit*, to 01 a coin in the Left Slot would produce 2 Credits. Further, if *Left Coin Pulses,* was set to 01 and *Coin Switch Pulses Required for 1 Credit*, to 02, 2 Coins in the Left Slot would be required for 1 Credit.

Coin Switch Pulses Required for Bonus Credit may be set to post bonus credits when a minimum amount of coins are inserted at one time. For example, if *Left Coin Pulses* was set to 01, *Coin Switch Pulses Required for 1 Credit* to 01 and *Coin Switch Pulses Required for Bonus Credit* to 04, 1 Credit would be posted for each of the first 3 Coins in the Left Slot and 2 Credits for the 4th Coin.

S.P.I. Adjustment 7 Continues on the next page.

S.P.I. Adjustment 7 Continued.

Standard/Custom Pricing - Set for the desired pricing scheme from the Standard Pricing Table as indicated on the Dot Matrix Display. For Custom Pricing, set to **CUSTOM**. When set to **CUSTOM**, the following adjustments are utilized to tailor each individual coin chute:

Left Coin Switch Pulses	Set the number of pulses registered for closure of the Left Coin Switch; **00** to **99**.
Right Coin Switch Pulses	Set the number of pulses registered for closure of the Right Coin Switch; **00** to **99**.
Center Coin Switch Pulses	Set the number of pulses registered for closure of the Center Coin Switch; **00** to **99**.
4th Coin Switch Pulses	Set the number of pulses registered for closure of the Fourth Coin Switch; **00** to **99**.
Coin Switch Pulses Required for 1 Credit	Set the number of pulses required to post one credit; **00** to **99**.
Coin Switch Pulses Required for Bonus Credit	Set the number of pulses required to award the 1st Bonus credit(s); **00** to **99**.
Coin Sw. Pulses Req. for 2nd Bonus Credit	Set the number of pulses required to award the 2nd Bonus credit; **00** to **99**.
Credits awarded for 1st Bonus	Set the number of credits awarded for achieving the first Bonus level; **00** to **99**.

Custom Pricing Table

Coin Mechanisms					< < < Adjustments > > >							
LEFT	CENTER	RIGHT	4TH	*Plays/Coins*	LEFT Pulses	CENTER Pulses	RIGHT Pulses	4TH Pulses	Pulses /Credit	Pulses /Bonus	Pulses /2nd Bonus	Credit /1st Bonus
25¢	$1.00	25¢	N/U	1/25¢ 3/50¢	01	04	01	00	01	02	00	01
				1/25¢ 5/$1.00	01	04	01	00	01	04	00	01
				1/25¢ 6/$1.00	05	20	05	00	04	20	00	01
5SCH	10SCH	10SCH	N/U	1/10 S	01	02	02	00	02	00	00	00
				1/10 S 4/30 S	04	08	08	00	06	00	00	00
10*p*	50*p*	£1	20*p*	1/30*p* 2/50*p* 5/£1	01	06	15	02	03	00	00	00
				1/50*p* 3/£1	01	05	15	02	05	00	00	00
				1/30*p* 4/£1	01	05	12	02	03	00	00	00
20¢	N/U	$1.00	N/U	1/60¢ 2/$1.00	01	00	05	00	03	05	00	01

Below and the following page is the **Standard Pricing Select Table** for the individual countries listed. The *Pricing Scheme* is determined in two ways - **1:** The CPU/Sound Board Dip Switch (Sw. 300) Setting; and, **2:** The Country Setting Option. For each country listed, the Dip Switch Setting is shown (Column 1). At this time, not all countries have a *unique* Dip Switch Setting. For the countries without a unique setting, the USA Setting (or all positions in the "OFF" position) is used. In lieu of determining the best *Pricing Scheme* for your location, "pre-sets" were made available which would best suit any given situation. If the Factory Default setting is not the selection you feel is best for your location, choose any of the other pre-set settings. If any of these settings do not suit your needs, then **CUSTOM PRICING** will need to be accomplished (however, any "custom" changes made here will be lost after a **FACTORY RESET** so it is suggested to write down your unique set-up).

The Standard Pricing Select Table Explained:

Column 1: CPU/Sound Board Dip Switch 300 Settings: (self-explanatory). **Column 2:** Country Setting Option: The different available pre-sets are listed. **Columns 3-6:** Coin Mechanisms - These show the coinage through the available slots on the Coin Doors. Different countries use different Coin Doors. For example, USA style Coin Doors, which have only 2 coin acceptors (left & right) may utilize the "Center" slot cable for an optional Bill Validator. Different Coin Doors may have up to 4 coin acceptors. **Columns 7-10:** Pricing Scheme Explained - Shows the number of plays received for the monies required determined by the setting selected.

Standard Pricing Select Table

CPU/SOUND BOARD DIP SWITCH 300 SETTINGS	COUNTRY SETTING OPTION	Coin Mechanisms COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	Pricing Scheme Explained *Number of 'Plays' for Price Amount Shown*			
	USA 1	25¢	$1.00	25¢		1 /25¢			
	USA 2					1 /50¢	2 /75¢	3 /$1.00	
	USA 3 (Default)					1 /50¢			
	USA 4					1 /50¢			
	USA 5					1 /50¢	5 /$2.00		
	USA 6					1 /50¢	2 /'4 X 25¢'	3 /$1.00 Bill	← Used to promote the Bill Validator
	USA 7					1 /50¢	4 /$1.50	6 /$2.00	
	USA 8					1 /50¢	3 /$1.00		
	Euro 1 (Default)	20¢	50¢	€1.00	€2.00	1 /50¢			
	Euro 2					2 /50¢			
	Euro 3					1 /50¢	5 /€2.00		
	Euro 4					1 /50¢	3 /€1.00		
	Euro 5					1 /€1.00	2 /€1.50	3 /€2.00	
	Euro 6					1 /€1.00	5 /€2.00		

Standard Pricing Select Table - (Continued)

CPU DIP SWITCH SETTINGS, Location SW300 CPU/SOUND BOARD	COUNTRY SETTING OPTION † ‡	Coin Mechanisms — COINS THRU ... SLOT: LEFT	CENTER	RIGHT	4TH	Pricing Scheme Explained — *Number of "Plays" for Price Amount Shown*			
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼▼▼▼▼▼▼▼	Austria †	Please Note: for all USA Settings, see previous page (bottom).							
		5S	10S	10S		1 /10S	2 /15S	3 /20S	
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Australia 1 ‡	20¢	$A 1	$A 2		1 /$A 1	3 /$A 2		
	Australia 2 ‡					1 /$A 1			
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼ ▼▼▼▼▼▼	(Belgium †)	5 BF	20 BF	50 BF		1 /20 BF	3 /50 BF		
		This country uses unique Tokens and/or Debit Cards *only* (pricing varies).							
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ ▲ / OFF ▼ ▼▼▼▼▼	(Brazil †)	1 'coin'	4 'coins'	1 'coin'		1 /'2 coins'			
Pos. 1 2 3 4 5 6 7 8 / ON ▲▲ / OFF ▼▼▼▼▼▼	Canada †	25¢	25¢	Can$ 1		1 /50¢	2 /75¢	3/ Can$ 1	
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Denmark 1 ‡	1 DKr	5 DKr	10 DKr	20 DKr	1 /3 DKr	2 /5 DKr		
	Denmark 2 ‡					1 /2 DKr	3 /5 DKr	7 /10DKr	
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Finland ‡	1 Fmk	5 Fmk			1 /5 Fmk	4 /10 Fmk		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼ ▼▼▼▼▼▼	France 1 †	1 Fr	5 Fr	10 Fr	20 Fr	1 /3 Fr	2 /5 Fr	5 /10 Fr	11 /20 Fr
	France 2					1 /5 Fr	3 /10 Fr	7 /20 Fr	
	France 3					1 /3 Fr	2 /5 Fr	4 /10 Fr	9 /20 Fr
	Germany 1	1 DM	2 DM	5 DM		1 /1 DM	6/'1 X 5 DM'		
Pos. 1 2 3 4 5 6 7 8 / ON ▲▲▲ / OFF ▼▼▼▼▼	Germany 2					1 /2 DM	2 /3 DM	3 /4 DM	4 /5 DM
	Germany 3 †					1 /2 DM	2 /3 DM	3 /4 DM	5 /5 DM
	Germany 4					1 /1 DM	6 /5 DM		
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Greece ‡	50 Dr		100 Dr		1 /50 Dr	3 /100 Dr		
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Hong Kong ‡	1 HK$	2 HK$	5 HK$		1 /5 HK$			
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Hungary ‡	10 Ft	10 Ft	20 Ft		1 /20 Ft	3 /40 Ft		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼▼ ▼▼▼▼▼	Italy 1 †	500 Lit		500 Lit		1 /500 Lit			
	Italy 2					1 /1000 Lit	3 /2000 Lit		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼▼ ▼▼▼▼▼	Japan 1 †			100¥		1 /100¥			
	Japan 2					1 /100¥	3 /200¥		
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Korea ‡	100 Won		100 Won		1 /100 Won			
Pos. 1 2 3 4 5 6 7 8 / ON ▲ / OFF ▼▼ ▼▼▼▼▼	Netherlands 1	1 Fls.	1 Fls.	2.5 Fls.		1 /1 Fls.	3 /2.5 Fls.		
	Netherlands 2 †		2.5 Fls.	5 Fls.		1 /1 Fls.	3 /2.5 Fls.	6 /5 Fls.	
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	New Zealand 1 ‡	$NZ 1		$NZ 2		1 /$NZ 1			
	New Zealand 2 ‡					1 /$NZ 1	3 /$NZ 2		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼ ▼ ▼▼▼▼▼	Norway 1 †	10 NKr	5 NKr	20 NKr		2 /10 NKr	1 /5 NKr	4 /20 NKr	
	Norway 2					1 /10 NKr	3 /20 NKr		
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼▼▼▼▼▼▼	Spain ‡	100 Pts		500 Pts		1 /100 Pts	6 /500 Pts		
Pos. 1 2 3 4 5 6 7 8 / ON ▲▲ ▲ / OFF ▼ ▼▼▼▼▼	Sweden 1 †	1 SKr	5 SKr	10 SKr		1 /10 SKr	2 /15 SKr	3 /20 SKr	
	Sweden 2					1 /5 SKr	2 /10 SKr		
Pos. 1 2 3 4 5 6 7 8 / ON / OFF ▼▼ ▲▲ ▼▼▼▼	Switzerland 1 †	1 SwF	2 SwF	5 SwF		1 /1 SwF	6 /5 SwF		
	Switzerland 2					1 /1 SwF	3 /2 SwF	9 /5 SwF	
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼ ▼▼▼▼▼▼	UK 1 †	10p	50p	£1	20p	3 /£1	7 /£2	The Pricing Scheme using the New UK Dip Sw. Setting (with 2, 3 & 4 = ON), is the same (UK1 - UK6). Use only with the *New Style Coin Mech. The New 50p & £2* Coins can be accomodated in 5th & 6th Coin Slots.	
	UK 2					4 /£1	8 /£2		
Dip Switch Setting for New 50p / £2:	UK 3					1 /50p	2 /£1	5 /£2	
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ ▲ / OFF ▼ ▼▼▼▼▼	UK 4					1 /30p	2 /60p	3 /90p	4 /£1
	UK 5					1 /£1	3 /£2	This is "software controlled" by noting the presence/non-presense of pulses via style Coin Mech is used, see new adjustment to accomodate.	
SEE NOTES IN PRICING SCHEME	UK 6					3 /£2	Normal Coin Slots 1-4 (Left, Center, Right & 4th). If an old		

Notes: † Indicates Factory Default for that setting; ‡ Indicates a USA Dip Switch Setting (all positions in the "OFF" position).



S.P.I. Adjustments Continued.

	Adjustment Name	Adjustment Definition
Adj. 8	**Reset Coin Audits**	Set to **YES** or **NO**. Default is **NO**. ⚠When set to **YES** *(select the "+" Icon to change)* all *Coin Audits* (Audits 5-11), will be reset to zero.
Adj. 9	**Reset Game Audits**	Set to **YES** or **NO**. Default is **NO**. ⚠When set to **YES** *(select the "+" Icon to change)* all audits will be reset to zero, except for the *Coin Audits* (Audits 5-11) and Audit 12, Software Meter (the only audit which cannot be reset to zero).
Adj. 10	**Reset High Scores**	Set to **YES** or **NO**. Default is **NO**. When set to **YES** *(select the "+" Icon to change)* all the High Score Levels and associated initials will be restored to the backup settings.
Adj. 11	**Match Percentage**	Set between **0% - 10%** or **OFF**. Default is **9%**. At **0%** the match display occurs at the end of the game but never awards a credit.
Adj. 12	**Balls Per Game**	Set between **02 - 05**. Default is **03**. Adjusts the number of balls per game.
Adj. 13	**Tilt Warnings**	Set to **00**, **01** or **03**. Default is **01**. Adjusts the number of plumb bob tilt switch closures before the ball in play is tilted.
Adj. 14	**Replay Boost**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, exceeding a replay will set a temporary replay level for each time a replay level is surpassed. This new level will equal the previous replay level (when the replay was awarded) plus 50M for each following game, until the replays have all been played (then the previous level is resumed).
Adj. 15	**Credit Limit**	Set between **04 - 50**. Default is **30**. Adjusts the maximum number of credits that may be posted.
Adj. 16	**Allow High Scores**	Set to **YES** or **NO**. Default is **YES**. When set to **YES** if a player exceeds any 1 of the 4 High Scores, the player may receive an award (depending on Adj. 3, Replay Award). Set to **NO** to disable this feature. There are 10 High Scores that will allow the player to enter their initials (or name) (See Adj. 32, Initials), however, only the top 4 can receive an award if this adjustment is enabled.
Adj. 17	**High Score #1 Awards**	Set between **00 - 05**. Default is **01**. Adjusts the number of awards awarded for exceeding Level 1 *(the highest of the four (4) Levels)*.
Adj. 18	**High Score #2 Awards**	Set between **00 - 03**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 2.
Adj. 19	**High Score #3 Awards**	Set between **00 - 02**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 3.
Adj. 20	**High Score #4 Awards**	Set between **00 - 01**. Default is **00**. Adjusts the number of awards awarded for exceeding Level 4.
Adj. 21	**Default High Score #1**	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M)*. Default is **300,000,000**. Adjusts the desired ***High Score Level*** to which Level 1 may be achieved (not affected by **Adj. 31**).
Adj. 22	**Default High Score #2**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M)*. Default is **275,000,000**. Adjusts the desired ***High Score Level*** to which Level 2 may be achieved (not affected by **Adj. 31**).
Adj. 23	**Default High Score #3**	Set between **1,000,000 - 9,999,000,000***0* or **00** *(increments of 1M)*. Default is **250,000,000**. Adjusts the desired ***High Score Level*** to which Level 3 may be achieved (not affected by **Adj. 31**).
Adj. 24	**Default High Score #4**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M)*. Default is **225,000,000**. Adjusts the desired ***High Score Level*** to which Level 4 may be achieved (not affected by **Adj. 31**).
Adj. 25	**Default High Score #5**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M)*. Default is **200,000,000**. Adjusts the desired ***High Score Level*** to which Level 5 may be achieved (not affected by **Adj. 31**).
Adj. 26	**Default High Score #6**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M)*. Default is **175,000,000**. Adjusts the desired ***High Score Level*** to which Level 6 may be achieved (not affected by **Adj. 31**).
Adj. 27	**Default High Score #7**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M)*. Default is **150,000,000**. Adjusts the desired ***High Score Level*** to which Level 7 may be achieved (not affected by **Adj. 31**).

	Adjustment Name	Adjustment Definition
Adj. 28	**Default High Score #8**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **125,000,000**. Adjusts the desired ***High Score Level*** to which Level 8 may be achieved (not affected by **Adj. 31**).
Adj. 29	**Default High Score #9**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **100,000,000**. Adjusts the desired ***High Score Level*** to which Level 9 may be achieved (not affected by **Adj. 31**).
Adj. 30	**Default High Score #10**	Set between **1,000,000 - 9,999,000,0000** or **00** *(increments of 1M).* Default is **75,000,000**. Adjusts the desired ***High Score Level*** to which Level 10 may be achieved (not affected by **Adj. 31**).
Adj. 31	**HSTD Reset Count**	Set between **100 - 9,900** or **OFF** *(increments of 100).* Default is **2,000**. **HSTD** (**H**igh **S**core **T**o **D**ate). Adjusts the number of games between automatic resets of high score levels to backup settings and ball time averager adjustments. Set to **OFF** for "no reset or adjustment".
Adj. 32	**High Score Initials**	Set to **3 INITIALS** or **10 LETTER**. Default is **3 INITIALS**. When set to **3 INITIALS**, player is allowed only 3 initials to input. When set to **10 LETTER NAME**, player is allowed to enter 10 initials to input.
Adj. 33	**Free Play**	Set to **YES** or **NO**. Default is **NO**. When set to **YES**, no coins are required for *Game Play.*
Adj. 34	**Custom Message**	Set to **ON, CHANGE** or **OFF**. Default is **ON**. When set to **CHANGE** *(select the "+" Icon to change settings until "CHANGE" appears in the display, then select the ">>" Icon to access.) This adjustment can be accessed in two (2) ways by either selecting the "SEGA" Icon* and advancing to this **Adjustment 34**, or can be directly accessed by selecting the "ABCD CUST MSG" *Icon* in the **ADJUSTMENTS MENU**.  View the definition at the end of this chapter under the **Custom Message** entry for the operation explanation.
Adj. 35	**Flash Lamp Power**	Set to **NORMAL, DIM** or **OFF**. Default is **NORMAL**. When set to **DIM** the Flash Lamps impulse power is reduced by **25%** and when set to **OFF** the Flash Lamps will not flash.
Adj. 36	**Coil Pulse Power**	Set to **NORMAL, HARD** or **SOFT**. Default is **NORMAL**. When **HARD** the coil pulse power is ***increased*** by **12.5%** of the normal pulse rate. When set to **SOFT** the coil pulse power is ***decreased*** by **12.5%** of the normal pulse rate. These adjustments are provided to compensate for Low Line or High Line voltage conditions where the solenoids appear to kicking too weak or too hard. Adjust as required.
Adj. 37	**Knocker Volume**	Set to **NORMAL, LOW** or **OFF**. Default is **NORMAL**. When set to **LOW**, the volume is decreased 50%. When set to **OFF**, no sound is heard when the "knocker" is sounded.
Adj. 38	**Game Restart**	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, a new game may be started during any ball after the first ball is completed (if credits are available). Pressing the **Start Button** during the first ball will add additional players. When set to **NO**, the game disables the **Start Button** after the first ball until the final ball is in play. Review Section 2, Chapter 1, Game Operations & Features for details.
Adj. 39	**Extra Ball Percentage**	Set between **0% - 50%.** This adjustment allows the operator to adjust how frequently the ***Extra Ball Feature*** is made available to the player.
Adj. 40	**Bill Validator**	Set to **YES** or **NO**. Default is **NO**. When set to **YES**, in *Game Attract Mode* the Display will show an "*Insert Bill Animation.*" When set to **NO**, the Display will show an "*Insert Coin Animation.*"
Adj. 41	**Tournament Mode**	Set to **NONE, IFPA, EXPO, PAPA** or **HOME**. Default is **NONE**. Tournament Mode determines the default conditions to quickly prepare a game for tournament play. When this setting is changed ***all audits will be reset*** and ***all adjustments will be initiated*** to the particular style selected. *The game will then return to Game Over Attract Mode*, as if a *Factory Reset* had been performed. **NONE** - Same as a Factory Reset conditions. **IFPA** - Straight 50¢ play, No Replay, No Extra Ball, No High Scores, 2 Tilt Warnings and No Match. **EXPO or PAPA** - Same as **IFPA** settings except ***Free Play*** is enabled. **HOME** - Sets game for ***Free Play, Extra Ball Play, No Replay, 10% Match*** & ***30% Extra Ball.***



S.P.I. Adjustments Continued.

Adjustment Name	Adjustment Definition
Adj. 42 UK Coin Mech. Type	**/////// THIS ADJUSTMENT CAN ONLY BE ADJUSTED IF THE GAME HAS THE UK EPROM INSTALLED FOR UK SETTINGS and HAS THE DIP SWITCH SETTING OPTION 2 SET (2, 3 & 4 ON) ///////** Set to **CURRENT: 2 POUND AT #5** if using a Coin Control Mech 74-1129-104**U** (latest version). Set to **OLD: 2 POUND AT #6** if using older version Coin Control Mech 74-1129-104. Default is **CURRENT: 2 POUND AT #5**.
Adj. 43 Bkgrnd (Background) Music Volume	Set between **01 - 15**. Default is **01**. After volume is set via Portals Service Buttons (See Sec. 3, Chp. 1, ...Intro) this adjustment can be utilized to adjust the background music (1 all the way on, 15 all the way off) while keeping the Special Sound FX the same level.
Adj. 44 Location ID	Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a location identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*
Adj. 45 Game ID	Set between **00** to **9999**. Default is **00**. This adjustment allows the operator to assign a game identification number to the audit print-out sheet. *(Will not be affected by Factory Reset.)*

Please Note: *For more details on Audit Printing, review Section 3, Chapter 3, Go To Audits Menu (Go To Printer Menu, Page 31). For more details on Factory Reset, review Section 3, Chapter 5, Go To Reset Menu.*

Sharkey's Shootout Adjustments (46-52)

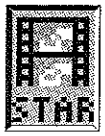
From the **ADJUSTMENTS MENU**, select the "SS" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st adjustment in this group. Continue to select either of the "ARROW" *Icons* to view each adjustment one at a time. Select either the "-" or "+" *Icons* to change the value, if desired. The display will describe the adjustment number, the adjustment name, and the adjustment total or value. The current adjustment will remain in the display until the next adjustment is chosen or when the sub-menu is exited.

Adj. Nº	Adjustment Name	Adjustment Definition
Adj. 46	**Extra Ball Memory**	Set to **ON** or **OFF**. Default is **ON**. When set to **ON**, the lit 'Extra Ball' light will be retained in memory from ball-to-ball for the same player. When set to **OFF**, the lit 'Extra Ball' light will go out at the end of each ball.
Adj. 47	**Multiball Criterion**	Set to **EASY, MODERATE** or **HARD**. Default is **MODERATE**. Determines how the Multiball Feature is started and played.
Adjustment Note: Settings for above Adjustments 46 & 47 will change automatically if Adjustment 6 is changed, see Page 34.		
Adj. 48	**UK Post Save™ Enabled**	Set to **YES** or **NO**. Default is **NO**. When set to **NO** this feature is available when lit. Set to **YES** for this feature to remain on regardless of feature being lit (UK ONLY).
Adj. 49	**Top Post Comes Up**	Set to (1) "**ANY HELPFUL TIME**," (2) "**NOT LOCKS, TRICKSHOT**," (3) "**AND NOT FOR SUPER JPOT**," (4) "**AND NOT FOR 8-BALL**," (5) "**AND NOT FOR HURRYUP**," (6) "**AND NOT DURING THE WEB**" or (7) "**WHAT POST?**". Default is "**NOT LOCKS, TRICKSHOT.**" Determines how the Top Post reacts in game play. Set to any of the following to customize game play if desired: (1) Any time a shot is lit on the Right Orbit, the post comes up to feed the ball to the Upper Flipper. (2) Post will NOT come up for locks or trickshot lit on the right Orbit, but will for other things (undefined). (3) Post will NOT come up for locks or trickshot or Super Jackpot. (4) Post will NOT come up for locks or trickshot or Super Jackpot or when the 8-ball is lit. (5) Post will NOT come up for locks or trickshot or Super Jackpot or when the 8-ball it lit or to feed the ball while Hurryup is running. (6) Post will NOT come up, except to keep the ball in the Top Lanes during skill-shot (ball launch). (7) The post is not used. **Manual Note:** *Numbers in (parens) do not show in display, used to reference.*
Adj. 50	**Freeze Time (Ball Save)**	Set to **OFF, 0:01-0:15** or **AUTO**. Default is **AUTO**. When set to **OFF** this feature is unavailable. Set between **0:01** through **0:15** (single increments) for the ball to be sent back into play if the time set is not met (per ball). Set to **AUTO** to automatically adjust the Freeze Timer based on the average ball time.
Adj. 51	**Post Save™ Time**	Set between **0:04-0:25**. Default is **0:06**. Determines the time setting for the Post Save™ Feature Lamp time-out. (Post Save's can only be activated when lit.)
Adj. 52	**Tournament (Start) Button**	Set to **OFF** or **ON**. Default is **OFF**. When set to **OFF** this feature is unavailable. *(Required only when using the game in Tournament Mode...special Tournament Kit Required)*



Custom Message

To go directly to ***Adjustment 34, Custom Message,*** from the **ADJUSTMENT MENU**, select the "CUST MSG" *Icon* either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. At the top left corner of the Display, the letter **A** is indicated (blinking) in the first available position (Thirty-Six (36) characters including spaces are available). Vary the letter(s) by operating the Left and Right Flipper Buttons (or **"RED"** or **"GREEN" Buttons**). With the desired letter indicated, depress the **Start Button** to lock in the letter and advance to the next character. Repeat this procedure until the desired message is completed in the display. Select the "<" or ">" characters to back-space (erase) and/or to move forward in an already typed message. After completion, press the **"BLACK" Button**, **"REQUEST INSTALLED"** is indicated and then exits this sub-menu.



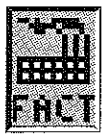
Film Star Reset

To reset the game with *Special Home Settings* (*not the normal Factory Setting*), from the **ADJUSTMENT MENU**, select the "STAR" *Icon* either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. This *Special Setting* automatically changes ***Adjustment 6, Game Difficulty,*** to **EASY** and ***Adjustment 33, Free Play,*** to **YES**. This setting is determined to be ideal for the home environment.



Take Note:

To **Restore** or **Reset** any of the adjustments to the *Factory Settings (Default)*, review Sec. 3, Chp. 5, **Go To Reset Menu**. Follow the "RESET" *Icon* or "FACT" *Icon* and their explanations.





Go To Reset Menu

Overview

The **Portals™ Service Menu System** provides three (3) functions to reset adjustments and/or audits back to the *Factory Setting*. See Chapter 3, Go to Audits Menu, and Chapter 4, Go to Adjustments Menu, for the Game Audits & Adjustments Information. If a reset of ***Coin*** or ***Game Audits*** is performed, the display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. If a **Factory Reset** is performed, the display will indicate **REQUEST INSTALLED**, the ***Service Session*** is *exited* & returns to the ***Attract Mode***. Please note that once reset, all customized settings are lost! Certain *Audits & Adjustments* cannot be reset (refer to the details below).



GO TO RESET MENU

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "RESET" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **RESET MENU** appears.

Important Notes:



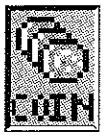
Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icon.*



Selecting & activating the "QUIT" *Icon* from the display will exit the Service Session.



Selecting & activating the "HELP" *Icon* from the display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



Reset Coin Audits

From the **RESET MENU**, select the "COIN" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All Coin Audits (See **Fig. 1**) will be reset to Factory Settings. The display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. Coin Audits can also be reset from the **ADJUSTMENTS MENU, S.P.I. ADJUSTMENT 8**. See Chapter 4, Go to Adjustments Menu, of this section. After selecting this *Icon*, all of the ***Coin Audits (5-11)*** are reset to zero.



Reset Game Audits

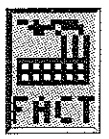
From the **RESET MENU**, select the "AUD" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All Game Audits (See **Fig. 2**) will be reset to Factory Settings. The display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. Game Audits can also be reset from the **ADJUSTMENTS MENU, S.P.I. ADJUSTMENT 9**. See Chapter 4, Go to Adjustments Menu, of this section. After selecting this *Icon*, all of the ***Audits*** are reset to zero, except for the Coin Audits (Audits 5-11) and Audit 12, Software Meter. Audit 12 is the only audit which cannot be reset.

Fig. 1

• Reset Coin Audits	
Earnings Audits (Coin Audits Only 5-11)	
Au. Nº	Description
1-4	The first 4 Audits in the game.
5	Coins Thru Left Slot
6	Coins Thru Right Slot
7	Coins Thru Center Slot
8	Coins Thru 4th Slot
9	Total Coins
10	Total Earnings
11	Meter Clicks
12	Software Meter
13 +	The remainder of the Audits.

Fig. 2

• Reset Game Audits	
Earnings (1-4), Generic/Specific Audits (13+)	
Au. Nº	Description
1-4	The first 4 Audits in the game.
5	Coins Thru Left Slot
6	Coins Thru Right Slot
7	Coins Thru Center Slot
8	Coins Thru 4th Slot
9	Total Coins
10	Total Earnings
11	Meter Clicks
12	Software Meter
13 +	The remainder of the Audits.

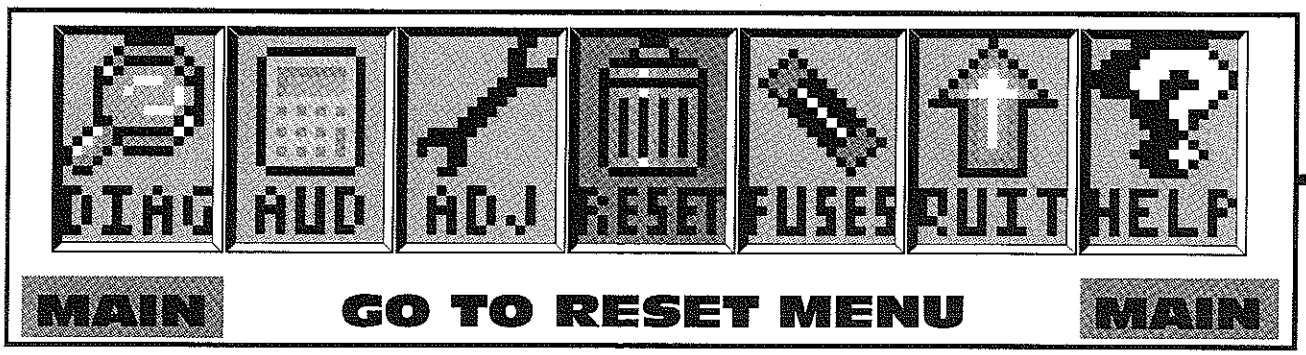


Factory Reset

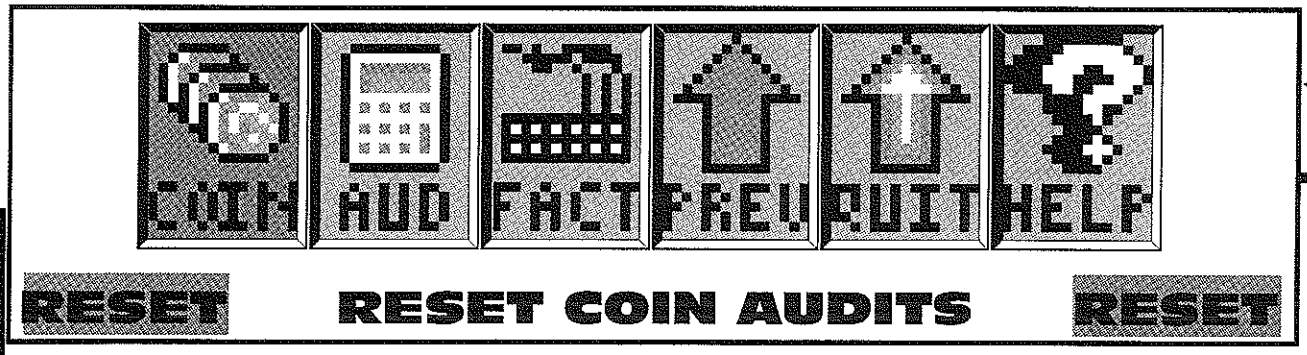
From the **RESET MENU**, select the "FACT" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All adjustments will be reset to *Factory Settings* (except for Proprietary Adjustments). The display will indicate **REQUEST INSTALLED** and exit the Service Session. See Chapter 4, Go to Adjustments Menu, of this section, for the *Factory Settings* in the **Game Adjustment Table**.

Example:

From the **MAIN MENU**, use the **Red** or **Green Buttons** to select the "RESET" *Icon* (**GO TO RESET MENU**).



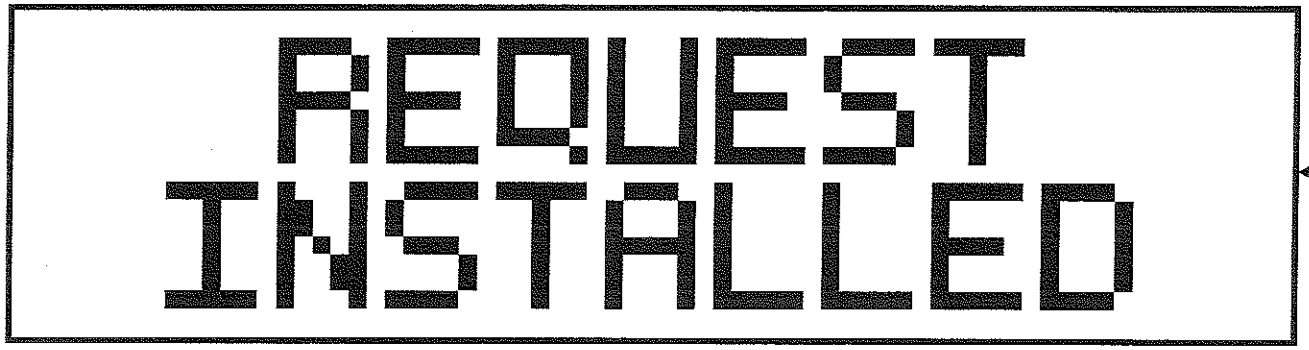
Press the **Black Button** to activate this **ICON**. This will bring up the **RESET MENU**.



The **RESET MENU** now appears with the "COIN" *Icon* (**RESET COIN AUDITS**) flashing:

DO NOT PRESS THE START BUTTON **AFTER SELECTING ANY THREE OF THESE ICONS UNLESS THIS IS WHAT IS DESIRED (SETTINGS WILL BE LOST)! PLEASE READ THE PREVIOUS PAGE FOR EXACTLY WHAT WILL HAPPEN IF ANY OF THESE THREE ICONS ARE ACTIVATED.**

From the **RESET MENU**, select any of the *Icons* ("COIN", "AUD" or "FACT") with either **Red** or **Green Button** and press the **Black Button** to activate the **ICON** chosen.



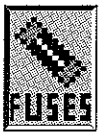
If the "COIN" or "AUD" *Icons* are chosen and activated, the affected audits (see previous page) will be reset, the display will indicate **REQUEST INSTALLED** and the display will return to the **RESET MENU**.

If the "FACT" *Icon* is chosen and activated, all adjustments will be reset back to the *Factory Settings.* The display will indicate **REQUEST INSTALLED** (momentarily), the ***Service Session*** is automatically *exited* and returns to the ***Attract Mode***.

Go To Fuses List

Overview

The **Portals™ Service Menu System** provides a current Fuse List for this game. The fuses are located in the Backbox (on the Display Power Supply Board and the I/O Power Driver Board), and also in the Cabinet (under the playfield by the Flippers and/or by any unique assembly, such as magnets). See the front of this manual (page **DR.** 2) for the complete Fuse List in the *Quick Reference Fuse Chart* and note the drawings.



GO TO FUSES LIST

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "FUSES" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st fuse in this group. Continue to select either of the "ARROW" *Icons* to view each fuse one at a time. The display will describe the fuse identification number (e.g. F1, F6, F7, etc.), location of fuse (i.e. Backbox: Board name located on; or Cabinet: Under the playfield or in Service Outlet), rating of fuse (e.g. 5A 250v S.B. - i.e. 5 Amp, 250 volt, Slo-Blo), and 'use of fuse' (e.g. 90v DC High Voltage Power, etc.). The current fuse listed will remain in the display until the next fuse is chosen or when the sub-menu is exited.

Important Notes:



Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.



Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.



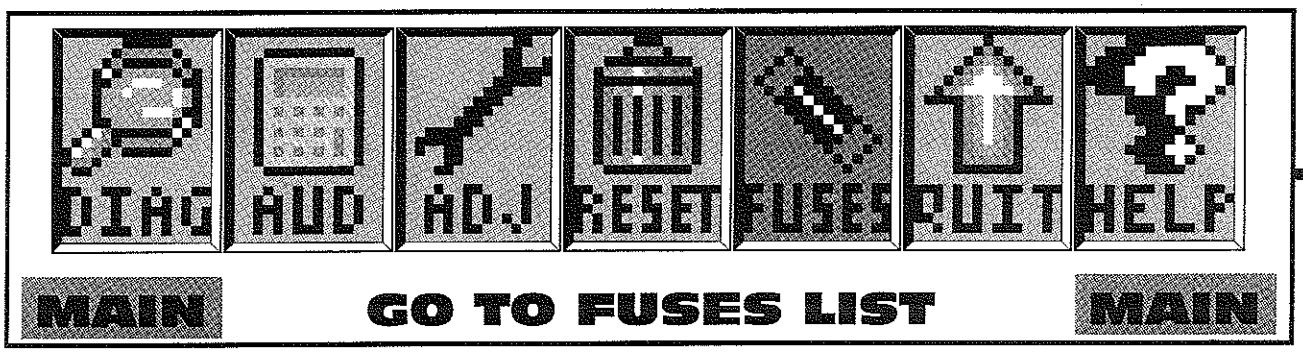
Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



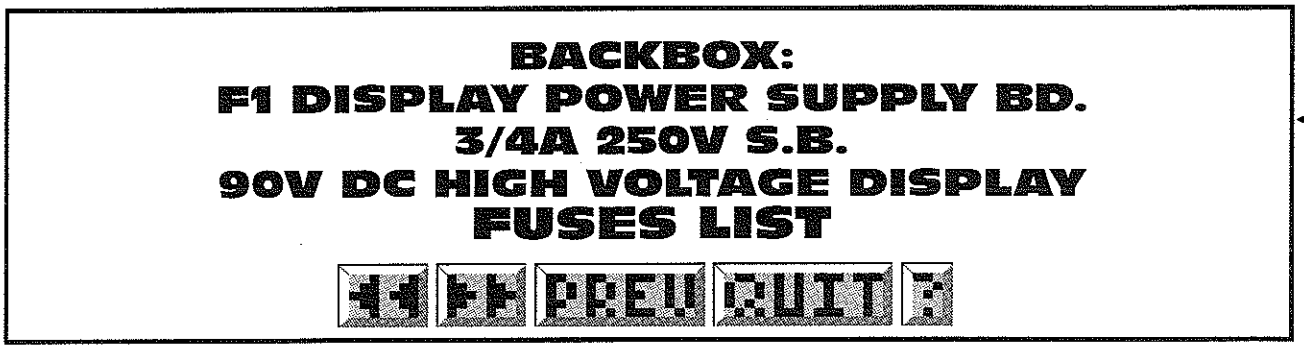
Selecting & activating the "ARROW" *Icons* selects the next or previous fuse in this group.

Example:

From the **MAIN MENU**, use the **Red** or **Green Buttons** to select the "FUSES" *Icon* (**GO TO FUSES LIST**).



Press the **Black Button** to activate this **ICON**. This will bring up the **FUSES LIST**.



▼ BACKBOX LAYOUT LOCATIONS: Fuses, Bridges, Relays & ROMs ▼

CAUTION: *For continued protection against risk of fire, replace only with same type of fuse having the same electrical rating!*

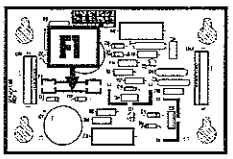
QUICK REFERENCE FUSE CHART

Backbox Fuses			
LOC:	DISPLAY POWER SUPPLY (P.S.) BOARD		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	I / O POWER DRIVER BOARD		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	**4A 250v S.B.**	50v DC	Magnet(s) (Mystery Ball & Playfield)
F21	3A 250v S.B.	50v DC	Coils
F22	8A 250v S.B.	18v DC	Controlled Lamps
F23	4A 250v S.B.	5v DC	Logic
F24	5A 250v S.B.	6.3v AC	G.I. Lamps (BRN-WHT to WHT-BRN)
F25	5A 250v S.B.	6.3v AC	G.I. Lamps (YEL to WHT-YEL)
F26	5A 250v S.B.	6.3v AC	G.I. Lamps (GRN to WHT-GRN)
F27	5A 250v S.B.	6.3v AC	G.I. Lamps (VIO to WHT-VIO)
F28	3A 250v S.B.	24v AC	Motors / Aux. (If Used)
Cabinet Fuses			
LOC:	SERVICE (AC) OUTLET BOX (Cabinet Bottom)		
n/a	8A 250v S.B.	115v AC	Main Fuse Line (Domestic or USA)
n/a	5A 250v S.B.	220v AC	Main Fuse Line (International)
Sharkey's Shootout P/F Fuses			
LOC:	UNDER PLAYFIELD (By Assemblies Listed)		
n/a	3A 250v S.B.	50v DC	Rt. Flipper (BLU-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Lt. Flipper (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Upper Flipper (GRY-YEL⇆RED-YEL)
n/a	3A 250v S.B.	50v DC	Right Orbit Magnet (VIO-YEL⇆BLK)
n/a	4A 250v S.B.	50v DC	Mystery Ball Magnet (VIO-YEL⇆BLK)

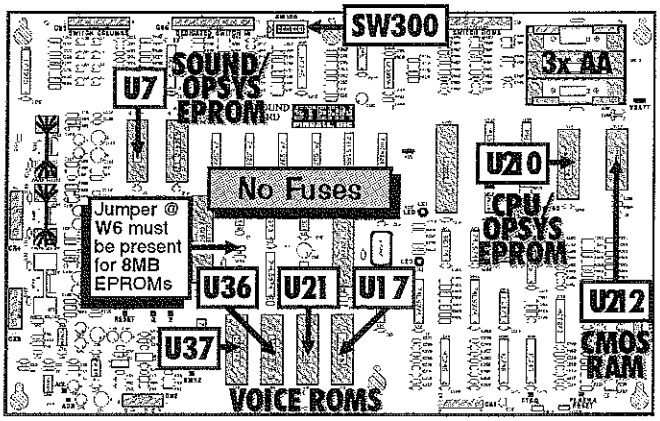
For Backbox & Cabinet General Parts, review Section 4, Chapter 1, Parts Identification & Location (The Pink Pages).
For Schematics and/or Component Parts on above Boards, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

Sec. 3: ... Fuses List

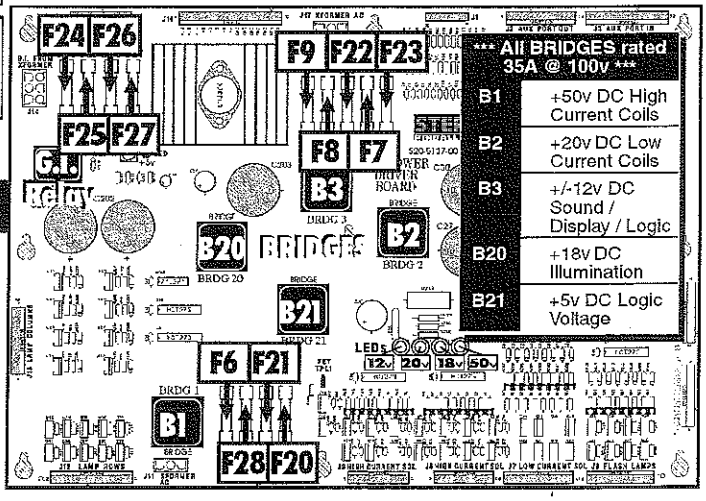
Display Power Supply Board

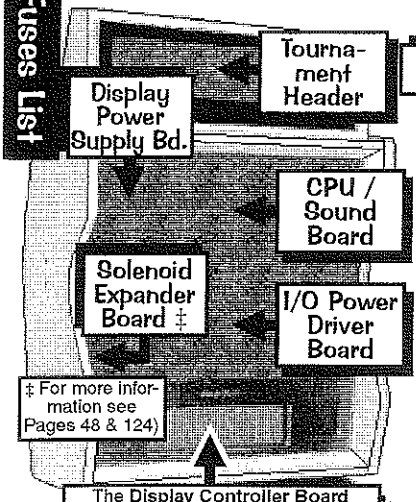


CPU / Sound Board



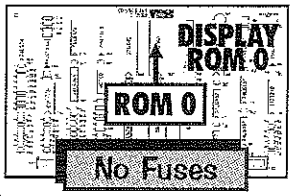
I/O Power Driver Board





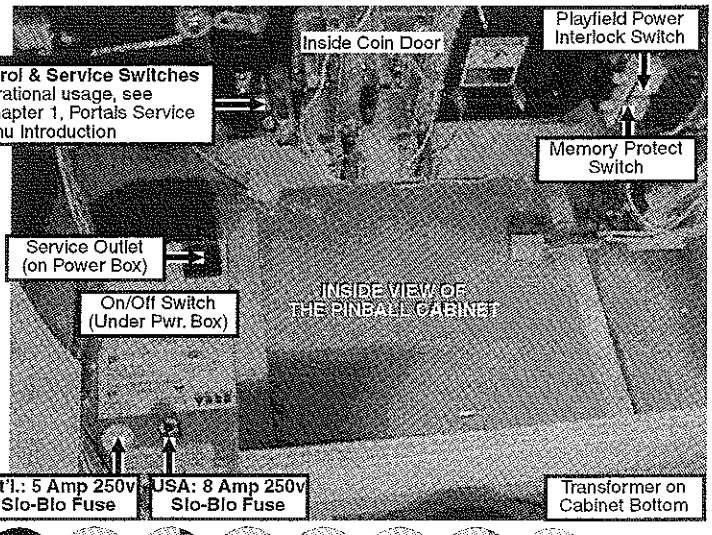
‡ For more information see Pages 48 & 124)

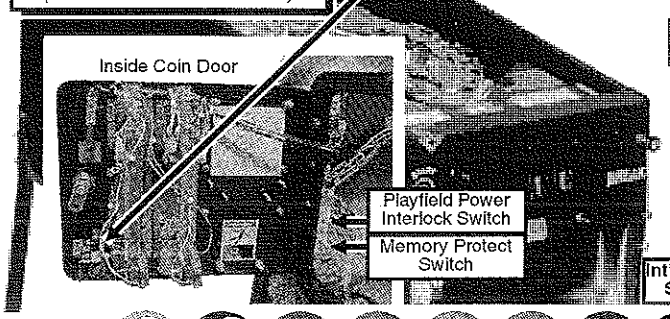
Display Controller Board
(Mounted behind the Dot Matrix Display)



The Display Controller Board (holds the Display ROM Loc: ROM0) is positioned behind the 128 X 32 Dot Matrix Display Board *(Neither board contain Fuses.)*

Volume Control & Service Switches
For operational usage, see Section 3, Chapter 1, Portals Service Menu Introduction





Go To Help Screen

Overview

The **Portals™ Service Menu System** provides help screens in each display (except if the display is in a testing mode). Each screen is basic and some terms may vary. At the beginning of each chapter in this section, *Icons* are shown and described to give detail of the particular function of the individual *Icons*. The table on the previous page was designed to help answer some questions of situations which may arise.



GO TO HELP SCREEN

With the game in the Attract Mode, open the Coin Door and press the **Black "BEGIN TEST" Button**. Select the "HELP" *Icon* in the **MAIN MENU** with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. The **HELP SCREEN** appears cycling through the different icon usages pertinent to that menu level.

MENU HELP SCREEN
USE THE RED OR GREEN BUTTONS TO CHANGE THE SELECTED ICON. PRESS THE BLACK BUTTON TO ACTIVATE THE SELECTED ICON. THE FLIPPER & START BUTTONS FUNCTION IN THE SAME WAY.

Important Notes:



Exit any sub-menu and return to the **MAIN MENU** by selecting & activating the "PREV" *Icons*. If no *Icons* appear in the display because of a testing function or special display (e.g. "Help"), press any button to exit.



Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



Selecting & activating the "QUIT" *Icon* from any display will exit the Service Session.



These "Mini-Icons" vary in functionality depending in what sub-menu they are used. Refer to the beginning of each chapter in this section for the function they serve in that menu or select the "HELP" *Icons* in the display where the *Icon* in question is being used.

Review Chapter 1, Introduction: How to enter the **Portals™ Service Menu**. The chapter outlines the entire **Portals™ Service Menu**. View the **Icon Tree** in this manual which describes the names and menu descriptions of each *Icon*. View the display, after selecting and activating either of the "HELP" or "?" *Icons*.

Review Chapter 2, Go to Diagnostics Menu: Find all the tests needed to troubleshooting the game.

Review Chapter 3, Go to Audits Menu: Gather play information and printing functions (downloading).

Review Chapter 4, Go to Adjustments Menu: Customize the game to vary difficulty of play or to change functions of the game.

Review Chapter 5, Go to Reset Menu: Reset audits and adjustments to Factory Settings.

Review Chapter 6, Go to Fuses Menu: View the location & descriptions of the game fuses (the same information is referenced in the Fuse Chart Table on **DR.**).

This concludes the **Portals™ Service Menu**. Review the Table of Contents at the beginning of this manual, and the detailed Table of Contents for Section 3 to quickly find the information required. The remainder of the sections in this manual will cover all the parts in this game and provide helpful information to aide in troubleshooting. If questions still arise after reading this Section completely, call our Technical Support Department.

PORTALS™ SERVICE MENU
PROBLEM/SOLUTION TABLE

Use this table for a quick simple solution(s) guide. For more technical assistance view Section 5.

PROBLEM	SOLUTION
Will not enter the Service Mode after depressing the **Black "BEGIN TEST" Button**.	• Check the Service Switch(es) (**Red, Green & Black Buttons**) for loose connections or bad Ground. • Check the associated wiring harness to/from the CPU Board Connector CN6. • Check CPU Board, possibly failed.
All Service Buttons (**Red, Green** and **Black**) appear nonfunctional.	• Check the Service Switches for poor connections or broken wires.
The **Green Service Button** in the Attract Mode will not enter the Service Credits Menu to add Service Credits.	• Check to make sure the Game is not in "Free Play." *If the game is set to Free Play, adding Service Credits is not required.* • Check the Service Switche(s) for poor connections or broken wires.
The display blanks out.	• Check the Dot Matrix Display for loose wiring harness connections. • Check F1 (3/4A Fuse) on the Display Pwr. Supply Bd. Refer to Section 5, Chapter 4, Schematics & Troubleshooting.
Icons *"scroll"* along continuously in the **MAIN MENU**.	• If the Service Switch Set and/or the Coin Door was replaced, ensure the Locking Mechanism on the **Green Button** is removed. If the Green Button "clicks" and locks into an up/down position, the Green Button has this lock switch. Remove it. (Ref. to Svc. Bulletin #74.)
The **Start** and **Flipper Buttons** do not select or activate *Icons* in the **SWITCH TEST MENU**.	• This is normal. These switches are deactivated, as they are a part of the Switch Test. Use the **Red "LEFT" or Green "RIGHT" & Black "ENTER" Buttons** in this Sub-Menu (See Chapter 1).
Can't move selection of *Icon* with the **Left** and/or **Right Flipper Buttons**.	• Check the **Flipper Buttons** for loose connections or bad Ground and refer to Section 5, Chapter 2, Playfield Wiring, #-Flipper Circuit Wiring Diagram. • This is normal ***only*** in Diagnostic's Switch & Active Switch Tests (see previous Problem).
Some *Icons* appear non-functional in the **PRINTER MENU(S)**.	• If no printing equipment is connected, the "-" *Icon*, "+" *Icon* and "RUN" *Icon* will appear not to function (see Chapter 5).
Some *Icons* appear non-functional in the **GAME SPECIFIC MENU** under the **DIAGNOSTICS MENU**.	• If there is no other test under this Menu, the "Left Arrow" & "Right Arrow" *Icons* will appear not to function. The remaining *Icons* should function as normal. *Note: If there is no Game Specific Special Test, the "**GAME SPECIFIC**" Icon will not invoke another display.*
The display returns to the **ATTRACT MODE** exiting the Service Session from the **FACTORY RESET MENU**.	• This is normal. After a **FACTORY RESET**, the Service Session is automatically exited (see Chapter 4 (end) or Chapter 6).
In **COIL TEST MENU**, the coils and flashlamps ***do not*** fire after activating the "RUN" *Icon*.	• Ensure the **POWER INTERLOCK SWITCH** (See figure on front inside cover) ***is pulled out***.
In **ADJUSTMENTS MENU**, with the Coin Door **CLOSED**, adjustments are not getting changed as desired while using the **Flipper** & **Start Buttons** to select *Icons* and change values.	• This is normal. The ***Memory Protect Switch*** is enabled when the Coin Door is **CLOSED**. Changes can be made with the Coin Door **OPEN** only.
In **Portals™ Service Menu**, the volume cannot be adjusted with the **Red** or **Green Buttons**.	• The Volume adjustment can only be made when in the **Attract Mode**. The **Volume Mode** is entered by pressing the **Red "VOLUME" Button**. Then use the **Red** or **Green Button** to increase/decrease volume. (Red "LEFT" decrements; Green "RIGHT" increments.)
In **Portals™ Service Menu**, the display seems to lock up, or the Help Display appears to be non-functional.	• If you cannot clear the situation by exiting back one Menu, exit completely out of the **Portals™ Service Menu**, and re-enter. If the problem persists, call Technical Support for additional help.

Parts Identification & Location (The Pink Pages)

Overview

This section provides the Part Nºs and locations of all the components in this pinball machine. The parts are arranged in three groups: **BACKBOX**, **CABINET** & **PLAYFIELD**. Generic parts which may change as production continues (quantity and/or size) are listed together. Quantities greater than 0 indicates that the part is used in this game. Since quantity changes *may occur*, an item indicating "0" may be used. Compare the item which needs to be replaced with the drawings provided (the *Posts, Sockets, Bulbs & Rubber Rings* are drawn actual size). Major Assemblies & Ramps are detailed in the Blue Pages, Chapter 2. **Important:** Read all "**Take Note:**" items.



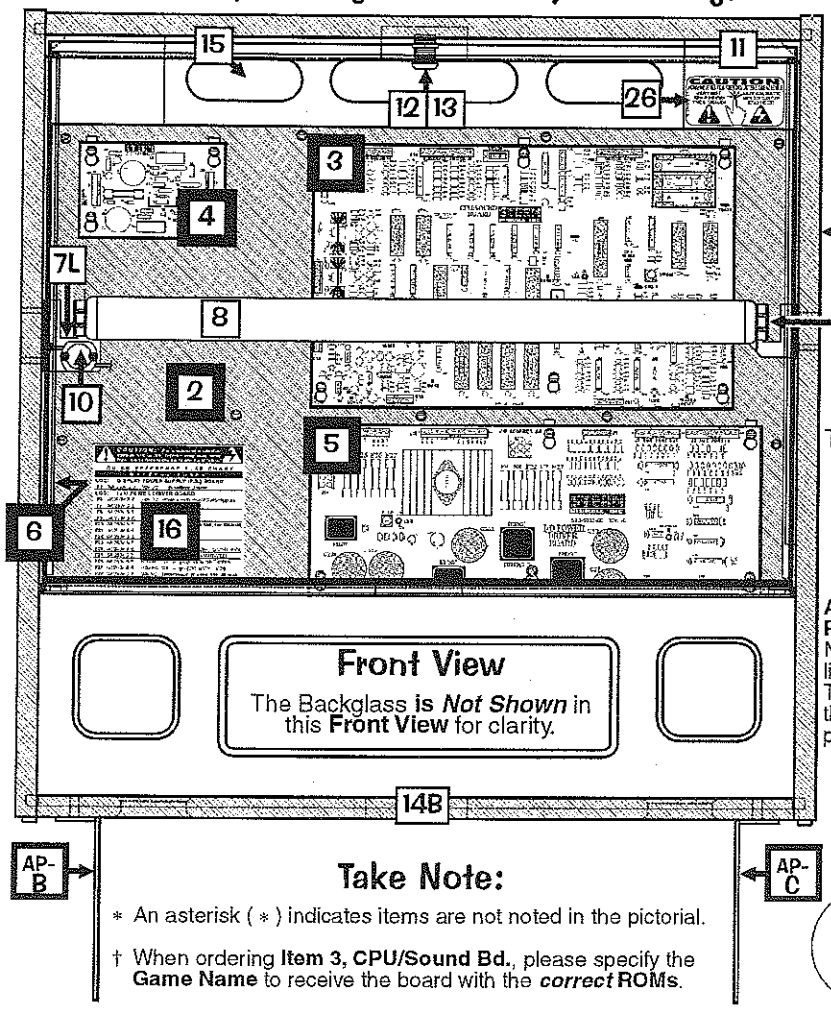
OPTIONAL TOURNAMENT HEADER

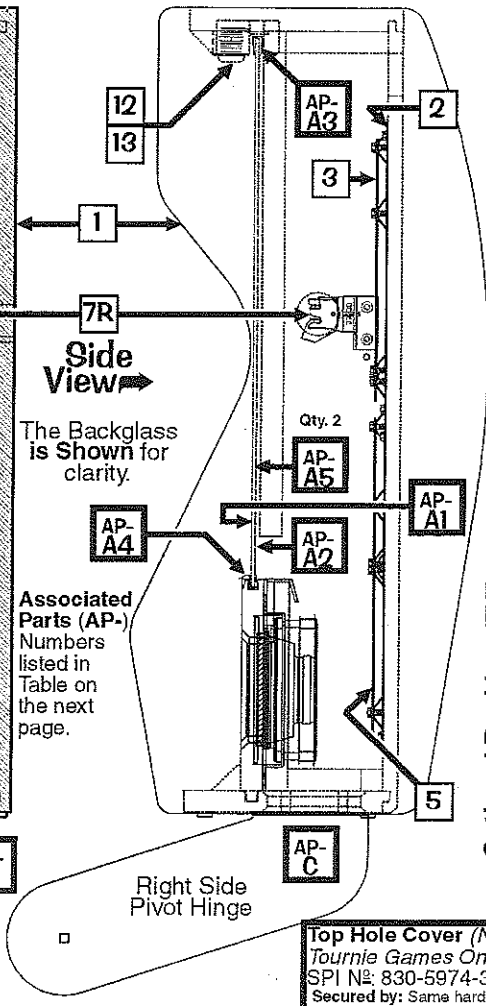
CABINET

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Major Assembly Drawings 64-80

Backbox (Sharkey's Shootout) Assembly, 505-6002-72-72 (Items 1-25)





Optional Backbox IT Tournament Header Information (containing unique parts & schematics) is located in a separate manual.

Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.

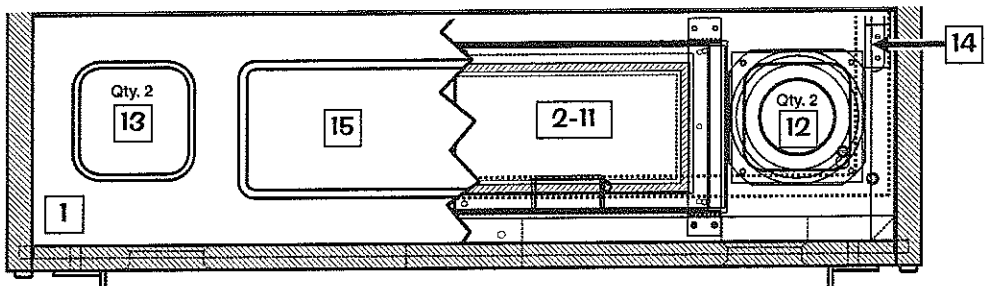
† When ordering **Item 3, CPU/Sound Bd.**, please specify the **Game Name** to receive the board with the ***correct*** **ROMs**.

Top Hole Cover *(Non-Tournie Games Only)*
SPI №: 830-5974-34
Secured by: Same hardware as Item 13 in below table.

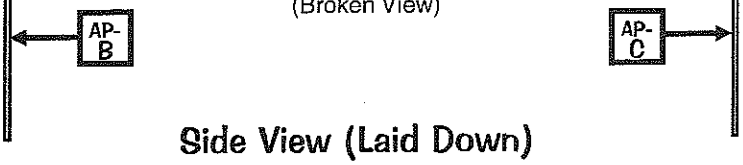
№	BACKBOX PART NAME	QTY.	SPI PART №
1	Backbox (Showcase IV: **Sharkey's ...**)	1	525-5505-02
	Item 1 comes with White T-Molding installed.		
2	PCB Metal Mounting Plate	1	535-5809-04
	Item 2 is secured to Item 1 by: #8 X 1/2" SHWH AB (Zinc) (Qty. 8) (234-5101-00), #10 Washer 7/32" ID X .5" OD X 1/16" (Qty. 4) (242-5003-00) and #8 Lock Washer (Qty. 2) (246-5001-00)		
3 †	CPU/Snd. Bd. (Note: 32K RAM w/PAL)	1	520-5136-64
4	Display Power Supply Board	1	520-5138-00
5	I/O Power Driver Board	1	520-5137-64
	Items 3, 4 & 5 are secured to Item 2 by: #8-32 X 3/8" HWH MS (Qty. 19) (237-5903-00)		
6	Solenoid Expander Board	1	520-5192-00
	Item 6 is required for this Game *to support the Left & Right Outlane Ball Deflectors & Center Up/Down Post Assemblies not supported in the Normal Coil Matrix of Q1-Q32.*		
7L	Fluorescent Light Bracket Assy. Left	1	515-6545-00
	ORDERING ABOVE (ITEM 7) SUB-ASSY PART № WILL INCLUDE:		
7A	Fluorescent Light Bracket Left	1	535-7739-00
7B	Lamp Holder (Self-Locking)	1	077-5214-00
7C	#6-32 X 5/8" PPH MS (Sems) Zinc	1	232-5203-00
7D	Starter Base (with Leads)	1	077-5213-00
7E	#4-40 X 1/2" PPH MS (Sems) Zinc	2	237-5813-00
7R	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	ORDERING ABOVE (ITEM 7) SUB-ASSY PART № WILL INCLUDE:		
7A	Fluorescent Light Bracket Right	1	535-7739-01
7B-7C	Identical to Items 7B-7C above		See 6B-6C
	Items 7L & 7R are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 2/per) (231-5012-00), #10-24 Keps Nut (Qty. 2/per) (240-5207-00) **and** 3/4" X 3" Reinforced Strapping Tape (Qty. 1, Sold in 12" Lengths only) (626-5040-00)		
8	Fluorescent Tube (F20T12CW)	1	165-5031-02
9*	Ground Strap (5") (by Item 11)	1	600-5006-05
10	Starter - Fluorescent (FS2 Light)	1	165-5011-01

№	BACKBOX PART NAME	QTY.	SPI PART №
11	Ballast SP2/K 5/8" Core 120v 50/60 Hz 13W	1	010-5015-00
	Ballast Mounting Plate		535-8657-00
	Item 11 is secured to Item 1 by: #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5102-04)		
12	Lock Mounting Plate for 2000	1	535-8128-01
13	Camlock (Cam 440X) & Key	1	355-5018-02
	Items 12-13 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)		
14A	*#1 Roto Lock Male (on Cabinet)*	*1*	*355-5006-01*
14B	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
	Item 14B is secured by: #10-24 X 1-3/4" CBSN (Qty. 2) (231-5022-00), #10-24 Keps Nut (Qty. 2) (240-5207-00) **and** #10 Washer 7/32" ID X .5" OD X 1/16" (Qty. 2) (242-5003-00)		
15	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
	Item 15 is secured by: Staple 5/16" (Qty. 24) (631-5000-00)		
16	Fuse Description Decal (Generic)	1	820-6152-00
17*	Fuse Description Decal Game № 72	1	820-6152-72
18*	Fuse Label (UL)	1	820-6143-00
19*	Backbox Date Label	1	820-5091-00
20*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
21*	Ribbon Cable, 26-Pin (30")	1	036-5001-30
	Item 20 (20-Pin) connects the CPU/Sound Board to the I/O Power Driver Board. **Item 21 (26-Pin) connects** the CPU/Sound Board to the Display Controller Board.		
22*	1/4" Clamp (Double)	3	040-5000-23
23*	1/2" Clamp (Single)	1	040-5000-06
24*	3/4" Clamp (Single)	3	040-5000-08
25*	1" Clamp (Single)	6	040-5000-09
	Items 22-25 secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 13) (234-5101-00)		
26	"CAUTION - VERY HOT" Decal	1	820-6266-00

Speaker Panel Assy. for the Backbox (Sharkey's ...), 515-6888-03 (Items 1-15)
and Assoc. Parts: Backglass Assembly & Pivot Hinges (Left & Right) (See Below Table)



Front View
(Broken View)



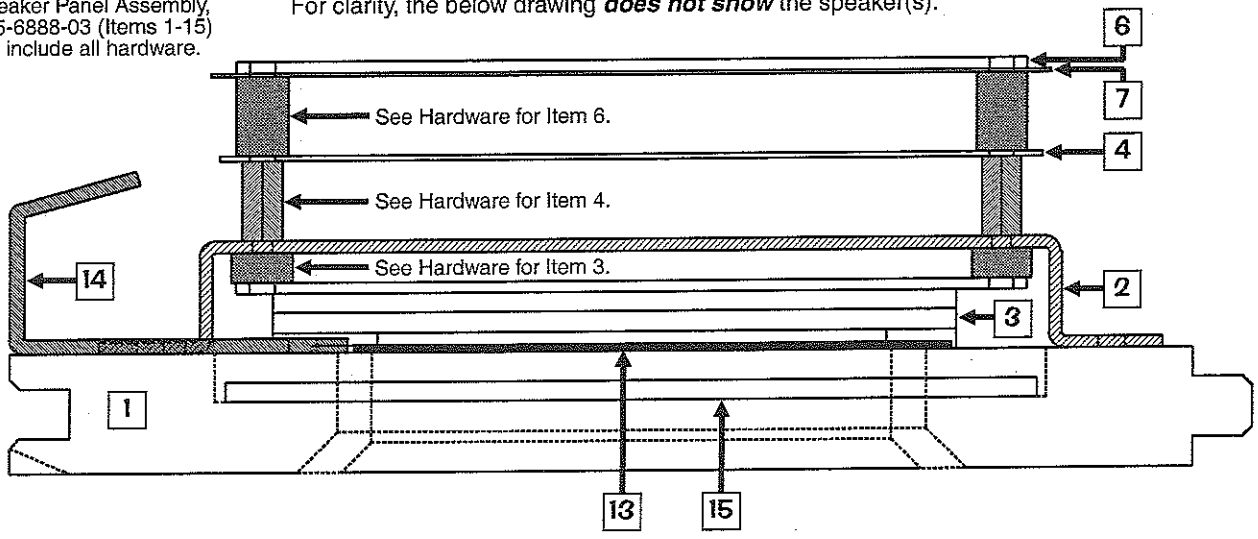
Take Note:

* An asterisk (*) indicates items are not noted in the pictorials.

1. Ordering the complete Speaker Panel Assembly, 515-6888-03 (Items 1-15) will include all hardware.

Side View (Laid Down)

For clarity, the below drawing ***does not show*** the speaker(s).



№	SPEAKER PANEL PART NAME	QTY.	SPI PART №
1	Speaker Panel (Black Wood)	1	525-5515-00
2	Dot Matrix Disp. Bd. Mounting Bracket	2	535-8368-01
	Item 2 is secured to Item 1 by: #8 X 5/8" HWH AB (Zinc) (Qty. 4/per) (234-5102-04)		
3	Dot Matrix Display Board 128 X 32	1	520-5052-00
	Item 3 is secured to Item 2 by (at corners): 3/16" X 3/8" Spacer Gray (Qty. 4) (254-5000-18) **and** #6-32 X 1/2" HWH Swage (Serr) Zinc (Qty. 4) (237-5976-03) **Item 3 is secured to Item 4 (at the top center) by:** 3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-04) **and** #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 1) (232-5200-00)		
4	Static Shield (Steel Plate)	1	535-6437-00
	Item 4 is secured to Item 2 by: 1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 4) (254-5008-03) **and** #6-32 X 1/2" PPH MS (Sems) Zinc (Qty. 2, on Left Side only) (232-5202-00)		
5*	Edge Protector (on Item 4)	2	545-5592-01
6	Display Controller Board FCC-FEB98	1	520-5055-03
	Item 6 is secured to Item 4 by: 1/2" X 5/16" X .144 ID Spacer Tap (Qty. 3) (254-5014-00), #6-32 X 3/4" PPH MS (Sems) Zinc (Qty. 3) (237-5504-00), 1/2" X 1/4" Hex Spacer #6-32 Tap. (Qty. 1) (254-5008-03) **and** #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5200-00)		
7	RF Shield	1	820-5092-00
	Item 7 is secured inbetween: "Item 6" and its' mounting hardware described.		
8*	Ground Strap (25") (on Items 4, 6, 12)	4	600-5006-25
9*	1/2" Clamp (Single) (Not Required)	0	040-5000-06
10*	Ribbon Cable, 14-Pin	1	036-5260-00
	Item 10 (14-Pin) connects the Dot Matrix Disp. Board to the Disp. Controller Board.		
11*	Foam 3/16" Thk. X 1/4" X 36"	6	626-5026-00
	Above Item 11 is self-adhesive. Located between Items 3 & 17. Sold in 12" Lengths only.		
12	Speaker (Shld.) 4" 8Ω MG Elec #4060SH	2	031-5004-01
13	Speaker Grill (Black w/no Artwork)	2	535-8081-01

№	SPEAKER PANEL PART NAME	QTY.	SPI PART №
14	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 13 & 14 are secured by: #8 X 5/8" HWH AB (Zinc) **(Items 12/13:** Qty. 4/per; **Item 14:** Qty. 2/per) (234-5102-04)		
15	Plastic Shield (Display Cover)	1	545-5884-00
	Item 15 is secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 8) (234-5000-00)		

The Associated Parts AP-A thru AP-C are also noted in the Backbox Assembly drawings on the previous page.

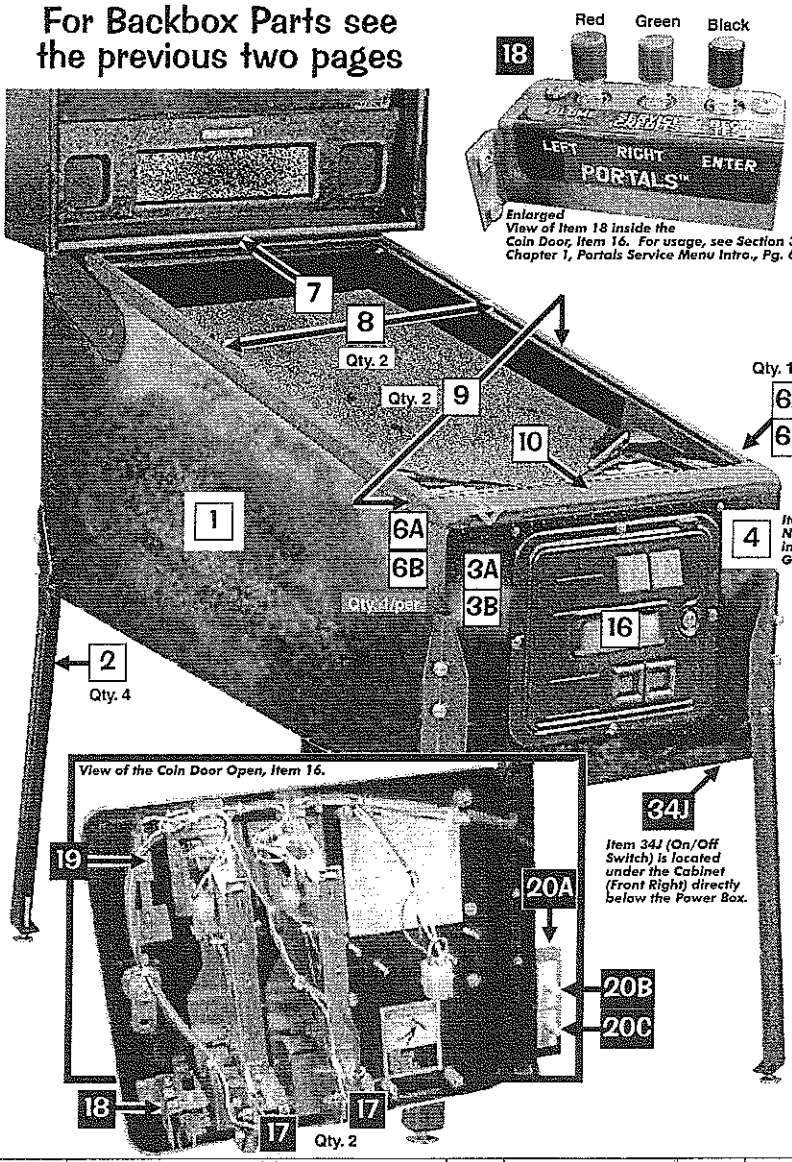
ASSOC. PARTS ARE NOT INCLUDED WITH BACKBOX/SPKR. PANEL ASSY'S.

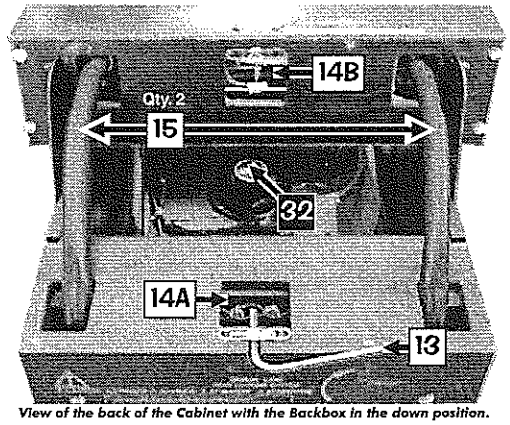
№	ASSOC. BACKBOX PART NAME	QTY.	SPI PART №
AP-A	Backglass Assembly (Game № 72)	1	515-5450-00-72
	ORDERING ABOVE (ITEM AP-A) ASSY. PART № WILL INCLUDE:		
AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
AP-A2	Screened Film (Game № 72)	1	830-5272-00
AP-A3	Top Plastic Channel - 26"	1	545-5018-15
AP-A4	Bottom Plastic Lift Channel - 26-1/16"	1	545-5021-01
AP-A5	Plastic Edging (Left/Right) - 18-1/8"	2	545-5018-14
AP-A6*	Tape (double-sided) (12" Length) *Note: AP-A6 secures AP-A5 to AP-A1*	1/2	626-5005-00
AP-B	Pivot Hinge Left	1	535-7999-00
AP-C	Pivot Hinge Right	1	535-7999-01

Items AP-B & AP-C are secured to Backbox by: 1/4"-20 X 1-1/4" C.B. Sq. Neck (Qty. 4) (231-5003-00), 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1) (242-5009-00)
Items AP-B & AP-C are secured to Cabinet by: 1/4"-20 X 7/8" Carriage Bolt Sq. Neck (Qty. 2) (231-5014-00), Hinge Spacer (Qty. 2) (530-5099-00), Washer 1/4" I.D. X 7/8" O.D. X 1/8" Yellow (Qty. 1/per) (242-5016-01), Fend Washer 1/4" I.D. X 1" O.D. (Qty. 1/per) (242-5009-00) **and** 1/4"-20 Flange Nut (Qty. 1/per) (240-5300-00)

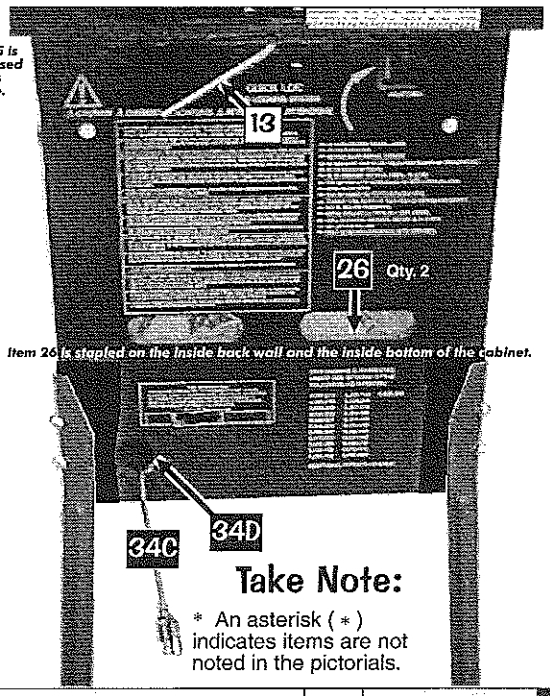
Cabinet - General Parts & Switches

For Backbox Parts see the previous two pages





View of the back of the Cabinet with the Backbox in the down position.



Item 26 is stapled on the inside back wall and the inside bottom of the cabinet.

Take Note:

* An asterisk (*) indicates items are not noted in the pictorials.

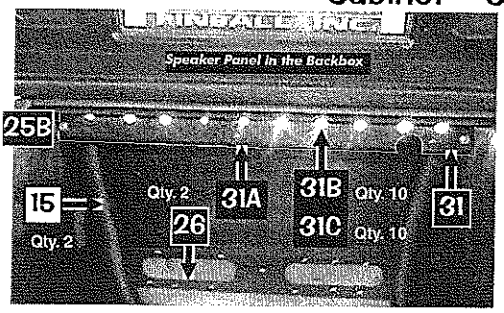
Sec. 4: Parts Id. ...

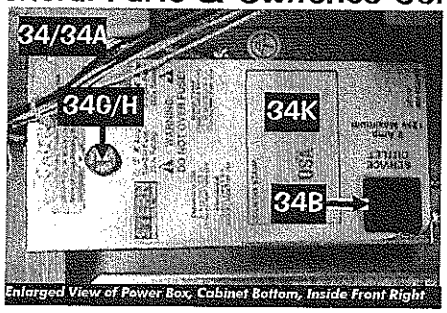
Nº	CABINET PART NAME	QTY.	SPI PART Nº
1	Game Nº 72 Screened Cabinet (Plain)	1	525-6000-72
2	Black Leg & Leveler Assembly	4	500-5921-50
	Item 2 is secured by: Leg Bolt Back Plate (Qty. 1/per) (535-5703-00) **and** Leg Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (2/per) (231-5001-01) *To order just a Leg Leveler (3/8" - 16 X 3") use SPI Nº: 500-5017-00. A Leg "without" a Leg Leveler is not available.*		
3A	Start Button Assy. (1" Rnd. w/Lamp RED)	1	500-6388-02
3B	Tournie Button Assy. (1" Rnd. w/Lamp YEL)	1	500-6388-06
	Items 3A/3B includes the Switch. FOR SWITCH ONLY SEE: Next Page, Item 25.		
4	❽-Ball Shooter (Plunger) Assembly	1	500-6146-50-04
	Item 4 is secured by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (234-5003-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00). **FOR A BREAKDOWN OF PARTS SEE: Sec. 4, Chp. 2, Drawings..., Page 64.**		
5	Large Rd. Auto Launch Assy.	0	500-6121-XX
	Item 5 includes the Switch. FOR SWITCH ONLY SEE: Next Page, Item 25. ***NOT USED***		
6A	Flipper Button Assembly Red	2	500-5026-32
6B	Up-Post Button Assembly White	2	500-5026-38
	Items 6A/6B are secured by: Pal Nut for Flipper Button (Metal) (Qty. 2/per) (240-5003-01) **and is fitted with:** O-Ring 11/32" X 7/32" X 1/16" (Qty. 1/per) (545-5850-00) **Item 6 *DOES NOT* include the Switch. FOR SWITCHES SEE:** Next Page, Items 23A/B.		
7	Rear Glass Channel 20-3/8" Length	1	545-5038-00
8	Plastic Channel 42-5/8" Lg. (Lt. & Rt.)	2	545-5017-00
9	Side Armor "with holes" (Lt. & Rt.)	2	535-7297-02
	Item 9 is secured by: #10-24 X 1" Carriage Bolt Sq. Neck (2/per) (231-5021-00), #10-24 Hex Nut (2/per) (240-5202-00) **and** #8 X 5/8" T20 Tmp. Prf. (2/per) (237-5947-00)		
10	Front Molding - Black	1	500-5757-01-00
11*	Foam Rubber 3/8" X 3/16" X 20-3/8"	1	626-5001-00

Nº	CABINET PART NAME	QTY.	SPI PART Nº
12*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00
13	Hex Key Allen Wrench 5/16"	1	777-0001-00
14A	#1 Roto Lock Male	1	355-5006-01
14B	*#1 Roto Lock Female (on Backbox)*	*1*	*355-5006-02*
	Item 14A is secured by: #10-24 X 1-3/4" Carr. Bolt Sq. Neck (Qty. 2) (231-5022-00), #10-24 Nylon Stop Nut (Qty. 2) (240-5206-00) **and** #10 Washer 7/32" X .5" X 1/16" (Qty. 2) (242-5003-00)		
15	Corrugated Tubing Black 1¼"ø X 2.6' Lg.	2	605-5008-00
	Above Item 15 covers the Cables Wiring Harnesses going into the Backbox from the Cab.		
16	Coin Door (with Validator) USA only	1	500-5018-172
	Item 16 is secured by: 1/4"-20 X 1-1/4" Carriage Bolt Sq. Neck (Qty. 4) (231-5003-00) 1/4"-20 Flange Nut (Qty. 4) (240-5300-00) **and** Fend Washer 1/4" I.D. X 1" O.D. (Qty. 3) (242-5009-00) ***NOTE:** For Coin Door other than USA call Technical Support for SPI Part Nº.*		
17	Coin Door Switch (USA)	2	180-5024-00
	Coin Door Switch (¥ Japan)	n/a	180-5091-00
18	Diagnostics Service Switches (X3)	1	180-5012-03
	Item 18 is secured to Coin Door by: Diagnostics Sw. Bracket (Qty. 1) (535-6860-01)		
19	Slam Tilt Switch (On Coin Door)	1	180-5022-00
20	Dual Switch Assembly	1	500-5808-00
	ORDERING ABOVE (ITEM 20) ASSEMBLY PART Nº WILL INCLUDE:		
20A	Mounting Bracket	1	535-6958-00
20B	Playfield Power Interlock Sw. (Top)	1	180-5136-00
20C	Memory Protect Switch (Bottom)	1	180-5000-00
	Item 20 is secured to Cabinet by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2) (234-5101-00)		

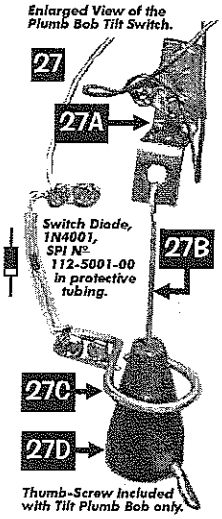
Parts Table & Views continue on the Next Page.

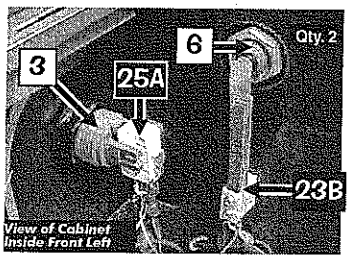
Cabinet - General Parts & Switches Continued

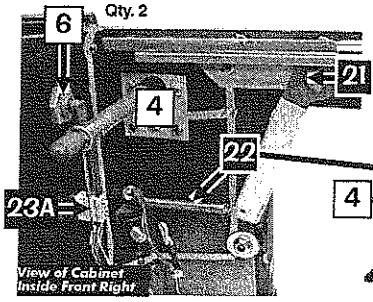


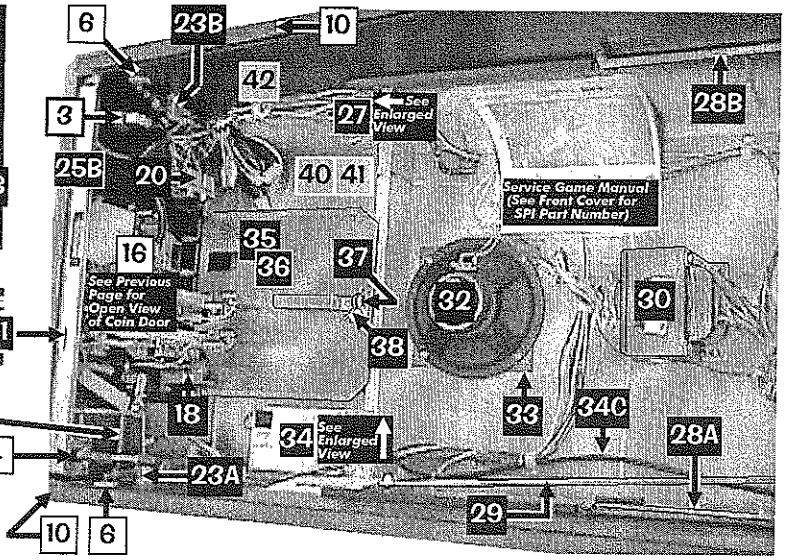


Items 39, 40 & 41 (Shaker Motor and related items) are NOT REQUIRED in this game.









№	CABINET PART NAME	QTY.	SPI PART №
21	Front Molding Lockdown Assembly	1	500-5020-01
	Item 21 is secured by: #10-24 X 1-1/4" Carr. Bolt (Qty. 2) (231-5012-00), #10-24 Keps Nut (Qty. 2) (240-5207-00), #8 X 5/8" HWH AB Zinc (Qty. 4) (234-5102-04) **and** #10 Washer 7/32" ID X 1/2" OD X 1/16" (Qty. 1) (242-5003-00)		
22	Lockdown Spring (connected to handle)	1	265-5008-00
23A	Flipper Switch - **Self-Cleaning**	3	180-5160-00
23B	Flipper Sw. - **X2 Stack for Lwr & Upr Flippers**	1	180-5164-00
24*	Foam Strip (2 on 23A; 1 on 23B)	3	626-5042-00
25A	Start & Tournie Buttons **(SWITCH ONLY)**	2	180-5174-00
25B	Micro Switch (Roller)	2	180-5123-00
26	Grills 2-1/2" X 18" (on Back & Bottom)	2	545-5072-02
27	Cabinet Plumb Bob Tilt Switch	1	n/a
	ORDER ONLY INDIVIDUAL PARTS NEEDED (NO ASSY. NUMBER):		
27A	Bracket for Hanger Wire	1	535-5221-00
27B	Hanger Wire	1	535-5319-00
27C	Contact Wire Form	1	535-7563-01
27D	Plumb Bob Weight (includes Thumb-Screw)	1	535-5029-00
	Items 27A & 27C are secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)		
28A	Slide & Pivot Support Bracket - Right	1	535-5989-00
28B	Slide & Pivot Support Bracket - Left	1	535-5990-00
	Items 28A & 28B are secured by: #10-24 X 1-1/4" Carriage Bolt Sq. Neck (3/per) (231-5012-00) **and** #10-24 KEPS Nut (3/per) (240-5207-00)		
29	Prop Rod	1	535-7553-00
	Item 29 is secured by: #10-24 X 1-3/4" Carriage Bolt Sq. Neck (Qty. 1) (231-5022-00), Washer #10 7/32" ID X .5" OD X 1/16" Thk (Qty. 1) (242-5003-00) **and** #10-24 Nylon Stop Nut (Qty. 1) (240-5206-00)		
30	Transformer with Ballast Winding	1	010-5012-00
	Item 30 is secured by: 1/4"-20 X 5/8" PPH MS (Zinc) (Qty. 4) (237-5854-00) **and** 1/4" Split Lock Washer (Qty. 4) (244-5000-00)		
	Item 17 Specifications: *PRI 103.5 / 115 / 207 / 230V 50/60Hz 750VA Class 130 EPB0*		
31	Cabinet Light Board Assembly	1	500-6434-00-72
	ORDERING ABOVE (ITEM 31) ASSEMBLY PART № WILL INCLUDE:		
31A	Cabinet Light Board (Sharkey's ...)	1	525-5570-00
31B	2-Lug Stand-Up Lg. Shell Socket (GIs)	10	077-5031-00
31C	#44 Bulb BLUE (Small Bayonet Type)	10	165-5053-05
31D*	Cover Decal	1	820-6267-23
	Item 31 is secured by: #8-32 X 1-1/2" HWH MS (Serr) Zinc (Qty. 2) (237-5946-00) **and** #8 Washer (Qty. 2) (242-5005-00). ***Note:** Item 31D is included by ordering the complete assembly and may not be available by itself, whereas the entire Decal Sheet Set (820-6267-XX) must be ordered.*		

№	CABINET PART NAME	QTY.	SPI PART №
32	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
33	Speaker Grill 7" X 7"	1	545-5072-03
	Items 32 & 33 are secured by: #6-32 X 1-1/4" Fin Shank Screw (Qty. 4) (237-5883-00) **and** #6-32 Keps Nut (Qty. 4) (240-5008-00)		
34	Power Input Box Sub-Assy. for 2000	1	515-5360-07
	ORDERING ABOVE (ITEM 34) SUB-ASSY. PART № WILL INCLUDE:		
34A	Power Box (Plain)	1	535-5932-00
34B	Service Outlet (for USA)	1	180-5008-01
34C	Line Cord 10' ROJ 3" Max.	1	034-5000-10
34D	Recessed Cup for Line Cord	1	545-5122-00
34E*	Line Filter	1	150-5000-00
34F*	Varistor TNR159211KM	1	150-5001-00
34G	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
34H	Fuse Holder	1	205-5001-00
34I*	On/Off Switch Bracket	1	535-8318-00
34J	On/Off Rocker Sw. (Arcolectric C1350AB)	1	180-5001-01
34K	Power Box Decal	1	820-6123-03
35	Cash Box Plastic Bottom	1	545-5090-00
36	Cash Box Cover (Validator)	1	535-5013-03
37	Cash Box Lock Bracket (wire)	1	535-7562-00
38	Large Hair-Pin Clip	1	535-7772-00
39*	Shaker Motor (Vibrator) Assy.	0	515-5893-01
	ORDERING ABOVE (ITEM 39) SUB-ASSY. PART № WILL INCLUDE:		
39A	Shaker Motor 10.5v DC 2950 RPM CW	1	041-5029-01
39B	Shaker Motor Mounting Bracket	1	535-6711-01
39C	Shaker Motor Leg Bracket	1	535-6711-02
39D	Insulator	1	545-5425-00
39E	Shaker Motor Weight	2	535-6727-01
39F	#10-32 X 5/8" Lg. Soc. Set Screw	2	237-5911-00
39G	#8-32 X 1/4" HWH MS (Taptite)	4	237-5964-01
39H*	Capacitor - Tecate .1 MFD 500v	1	130-5000-00
39I	M5X.8X8MM PHMS w/Patch	4	237-6014-00
	Item 39 secured by: #8-32 T-Nut (Qty. 4) (240-5101-00) **and** #8 X 5/8" HWH SWAGE (Ser) Zinc (Qty. 4) (237-5975-03)		
40	Shaker Motor Plastic Cover Housing	0	545-5241-00
	Item 40 secured to Item 39B by: #8-32 X 3/8" HWH MS (Taptite) (Qty. 2) (237-5967-00)		
41	Shaker Motor P.C. Board	0	520-5065-00
	Item 41 secured by: 3/8" Slf. Rtn. Spacer White (Qty. 4) (254-5007-01) **and** #6 X 3/4" HWH AB (Zinc) (Qty. 4) (234-5003-00)		

Playfield - General Parts & Switches (Below)

Nº	BELOW PLAYFIELD PART NAME	QTY.	SPI PART Nº
1	Playfield Support Slide Bracket	2	535-6862-02

Item 1 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2/per) (234-5101-00) **and** #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 1/per) (237-5975-03)

2	Edge Slide Bracket	2	535-5988-00

Item 2 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 3/per) (237-5840-00)

3	Pivot Pin Bracket Welded Assy.	2	500-5329-00

Item 3 is secured by: #8-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 2/per) (237-5975-03)

4	Diode Terminal Strip 2-Lug (810) Isolated	3	055-5203-00
5	Diode Terminal Strip 3-Lug (613) Isolated	4	055-5204-03
6	Diode Terminal Strip 5-Lug (824) Isolated	1	055-5204-05
7	Diode Terminal Strip 7-Lug Isolated	2	055-5204-07

Items 4, 5, 6 & 7 are secured by: #6 X 3/8" HWH AB Zinc (Qty. 1-2/per) (234-5000-00).
NOTE:** 1N4001 Diodes (112-5001-00) are for Switches and/or Lamps.* ***See Also, Sec. 5, Chp. 2, Playfield Terminal Strips, Fuses & Misc. Wiring Desc. & Locations, Pg. 87.

8A	3A 250v Slo-Blo Fuse	4	200-5000-08
	Fuse Clip Holder (Socket)		205-5000-01
8B	4A 250v Slo-Blo Fuse	1	200-5000-06
	Fuse Clip Holder (Socket)		205-5000-01

Items 8A/8B, Fuse Clip Holder (Socket) 205-5000-01 are part of a set of 12 (205-5000-12). You can order them as individuals (...-01) or a set of 12 (...-12).
Items 8A/8B are secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00)

Nº	BELOW SWITCHES PART NAME	QTY.	SPI PART Nº
A	Micro **(Shooter Lane)** Sw. Assembly	1	500-6096-00
ORDERING ABOVE (ITEM A) ASSEMBLY PART Nº WILL INCLUDE:			
A1*	**Micro Switch**	1	**180-5157-00**
	Diode, 1N4001 (On Terminal Strip)	0	112-5001-00
A2*	Switch Mounting Bracket	1	535-6173-00
A3*	Switch Body Protect Plate	1	535-6539-00
A4*	#2-56 X 1/2" **HWH SER UNS #4HD TR3 BO**	2	237-5937-02
A5*	#2-56 Hex Nut	2	240-5301-00

Item A is secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2) (234-5001-02)

B	Micro Sw. Assy. R/O Lt. Mnt. **Lite Force**	1	500-6227-01
C	Micro Sw. Assy. R/O Rt. Mnt. **Lite Force**	10	500-6227-02

Items B & C are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00)

D	Stand-Up Trgt. 1" Sphr. (Gold) **Rvrs. Mnt.**	6	500-6189-16R
E	Stand-Up Target Rectangle (Blue)	1	500-6228-05

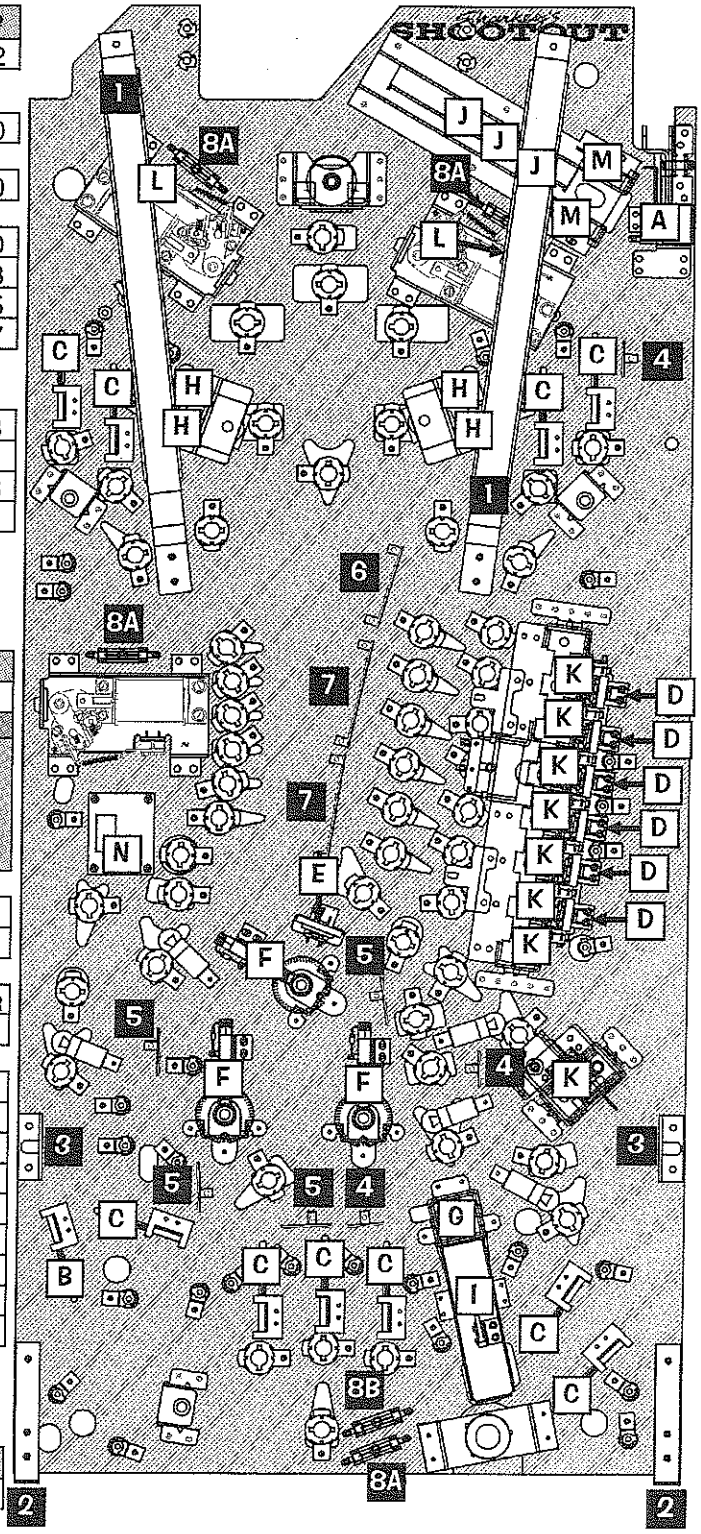
Items D & E are secured by: #8 X 3/4" HWH AB (Zinc) (Qty. 2/per) (234-5103-00)

F	Micro Switch (on Turbo (Pop) Bumper)	3	180-5015-03
G	Micro Switch (on Super VUK)	1	180-5052-00
H	Stack **(Blade)** Switch (on Slingshots)	4	180-5054-00
I	Micro **(Hi-Form)** Sw. (on Under-Trough)	1	180-5057-00
J	Micro **(Lite Force, Roller)** Sw. (on Ball Trough)	3	180-5119-02
K	Micro Switch (on Drop Targets)	8	180-5158-00
L	EOS Switch (on Lower Flippers)	2	180-5149-00
M	Dual OPTO TRANS Bd. (on Ball Trough)	1	520-5173-00
	Dual OPTO REC Board (on Ball Trough)		520-5174-00

Items F thru M are on Major Assemblies: For securing hardware of Switches F-M, see the assemblies the switch is located on in the **Blue Pages, Section 2, Chapter 2.**

Nº	MISC. PCB PART NAME	QTY.	SPI PART Nº
N	Aux. Relay Board	1	520-5010-00

Item N is secured by: 3/8" Slf. Rtn. Spacer White (Qty. 4) (254-5007-01) **and** #6 X 3/4" HWH AB (Zinc) (Qty. 4) (234-5003-00)

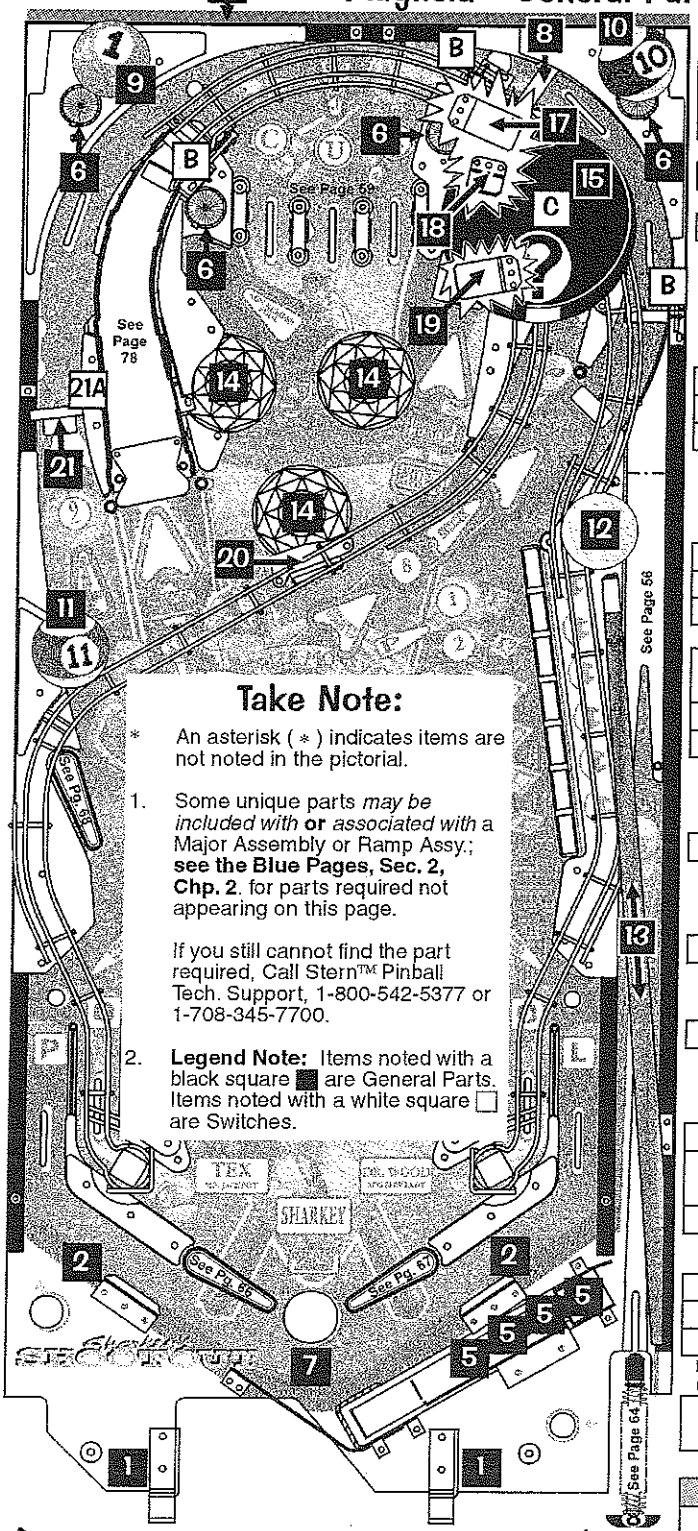


Take Note:

* An asterisk (*) indicates items are not shown on this page.

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. 60-62.
2. For Major Assemblies, Ramps and/or Under Troughs, **see the Blue Pages, Sec. 2, Chp. 2.**
3. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches or OPTO Boards, or Misc. PC Boards.

Playfield - General Parts & Switches (Above)



Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº
n/a *	P/F Screened w/ Inserts & Mylar Only	1	830-5100-72
	P/F Complete w/ Inserts & **ALL** Parts		505-6004-72-72
1	Playfield Hanger Bracket	2	535-8385-00

Item 1 is secured to the P/F by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)

2	Arch Retaining (Hold-Down) Brackets	2	535-8394-00

Item 2 is secured to the playfield by: #8 X 1/2" SHWH AB (Zc.) (Qty. 3/per) (234-5101-00)

3	Arch (Black Metal) w/Fork & Checks	1	535-8392-02

Item 3 is secured to the playfield by: #10-32 X 5/16" PH FL U/C MS STL Zinc (Qty. 2) (237-6013-00). ***Usage Note:*** 535-8392-**01** use with Game with a ***Shooter Plunger***; 535-8392-**00** use with Game with an ***Auto Launch Button***. When replacing transfer the Nelson Protect Strips 8-9/16" (Qty. 2) (545-5212-02) or order new. *(Note: Decals are not included with the above. See Playfield - Plastic, Decals & Mylar.)* ***Special Game Note:*** *This Game requires 535-8392-02 special designed arch with checks. For the "6 Checks" LED Light Board & Alternate Decals, see the IT Optional Header Kit Manual.*

4A	Instruction Card **(Regular)** Nº: 72	1	755-5172-00
4B	Coin Card (Double-Sided)	1	755-5087-01
4C	*OPTIONAL* Coin Card ('Blank')	0	755-5087-02

Note: *Use Item 4B* ***(Side 1: 1 Play 50¢ 3 Plays $1)*** *for Adj. 7, Game Pricing, USA 8 Setting; Use Item 4B* ***(Side 2: 1 Play 50¢)*** *for USA 3 Setting. Use Item 4C OPTIONAL* ***(Blank)*** *for Custom Settings* ***(not included** in USA Games or Foreign Games w/own Country Coin Card; Item 4C can be purchased, call your Distributor).* ***For Tournie Card Rules order 755-5172-01 available in IT Tournament Kit (Optional).***

5	1-1/16" Steel Balls	4	260-5000-00
6	Mini-Mars Light Cover (Blue)	4	550-5030-05
7	Plug-Cap (3/16") Black Plastic	1	545-5232-01

Note: *Use Item 7 (in the Spare Parts Bag) if the Center Post (@ Drain) is not desired.*

8	1-Way Gate Mounting Bracket	1	535-5269-06
	Wire Gate (for above)		535-8441-00
9	Pool Ball (1 - Yellow Solid) (Modified)	1	880-5041-00
10	Pool Ball (10 - Blue Stripe) (Modified)	1	880-5039-00

Item 9 is secured on Buty. (Plastic) -14 & Item 10 is secured on Buty. (Plastic) -15 by: (Ramp) Mounting Bracket (Qty. 1) (515-6508-00), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00), #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00) **and** 2-3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-15)

11	Pool Ball (11 - Red Stripe) (Modified)	1	880-5039-01

Item 11 is secured on Buty. (Plastic) -09 by: Mounting L-Bracket (Qty. 1) (535-8580-00), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00), #6-32 X 3/8" Cap Screw (Qty. 1) (237-5944-00), #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00) **and** 2-3/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-15)

12	Pool Ball (Cue) (Modified)	1	880-5040-00

Item 12 is secured on Buty. (Plastic) -17 by: (Ramp) Mounting Bracket (Qty. 1) (515-6508-00), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00), #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00) **and** 3-5/8" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-25)

13	Pool Cue Stick (Modified)	1	880-5023-00

Item 13 is secured on Buty. (Plastic) -17 by: #6-32 X 1" PPH TapTite (Qty. 1) (237-5827-00) **and** #6-32 X 1" PPH MS (Zinc) (Qty. 1) (237-5506-00) **also is secured on the Wood Rail by:** Mounting Bracket (Qty. 1) (535-8581-00) **and** #6 X 1-1/2" PPH (Zinc) (Qty. 2) (232-5007-00)

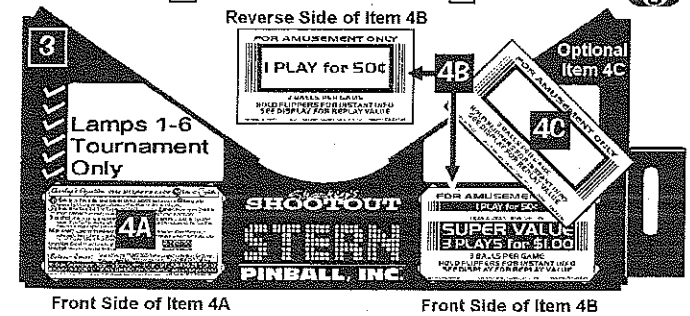
14	Turbo (Pop) Bumper Cap (Blue)	3	550-5057-05
15	Mystery Ball Cover	1	545-5897-01
	Value Dome (Inside Motor Cover)	1	545-5950-00
16	Back Panel Sharkey's (No Parts)	1	525-5565-00

Item 16 is secured by: #6 X 3/4" HWH AB (Zinc) (Qty. 5) (234-5003-00) **and** #6 X 1-1/4" PFH A (Zinc) (Qty. 5) (237-5804-00)

17	Snubber Bracket w/Pem Stud (Top Hole)	1	535-8678-00
18	Snubber Bracket (behind Super VUK Hole)	1	535-8679-00
19	Snubber Bracket (over Super VUK Hole)	1	535-8680-00

Items 17-19 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zinc (Qty. varies) (237-5976-05) **and** #8 X 1/2" SHWH AB (Zinc) (Qty. varies) (234-5101-00)

20	Target Backup Bracket (under Buty. -11)	1	535-8699-00
	Rubber Bumper (Grommet) (on above)		545-5105-00



Front Side of Item 4A
Reverse Side is IT Tournie Rules

Front Side of Item 4B

Nº	ABOVE SWITCHES PART NAME	QTY.	SPI PART Nº
21	Spinner Assembly	1	500-6421-00-72
ORDERING ABOVE (ITEM 21) ASSEMBLY PART Nº WILL INCLUDE:			
21A	**Micro Switch (1-1/4")**	**1**	**180-5010-04**
21B*	Switch Body Protect Plate	1	535-6539-00
21C*	Diode, 1N4001	1	112-5001-00
21D*	#2-56 X 1/2" HWH Self Unc #4HD TR3	1	237-5937-02
21E*	Spinner Bracket (Light & Sign Mount)	1	535-8684-00
21F*	Spinner Target Sub-Assy, Narrow	1	515-7088-00
21G*	Decals (Front & Back)	1 ea.	820-6267-01, -02

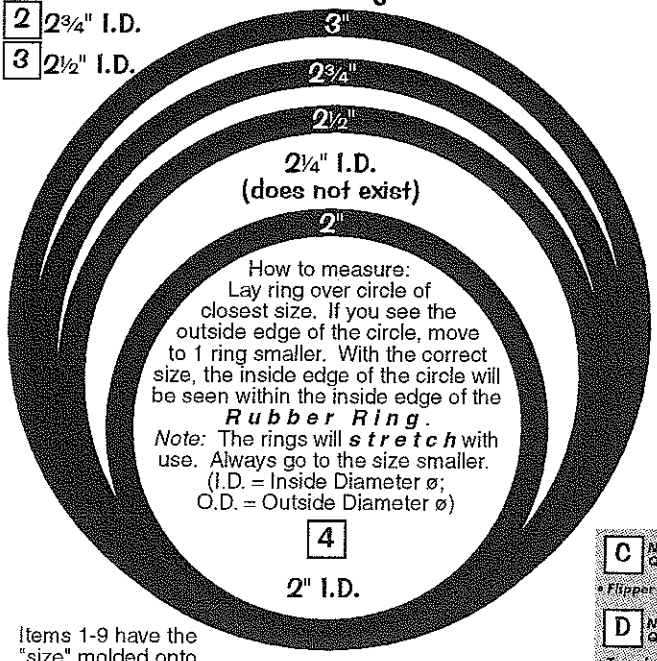
Item 21 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2) (234-5101-00)

B	Micro Switch (on Ramps: 1-Way Gates)	3	180-5087-00

Nº	MISC. PCB PART NAME	QTY.	SPI PART Nº
C	4-Pos. OPTO Board (inside Mystery Ball)	1	520-5194-00

Playfield - Rubber Parts (Rings Actual Size) †

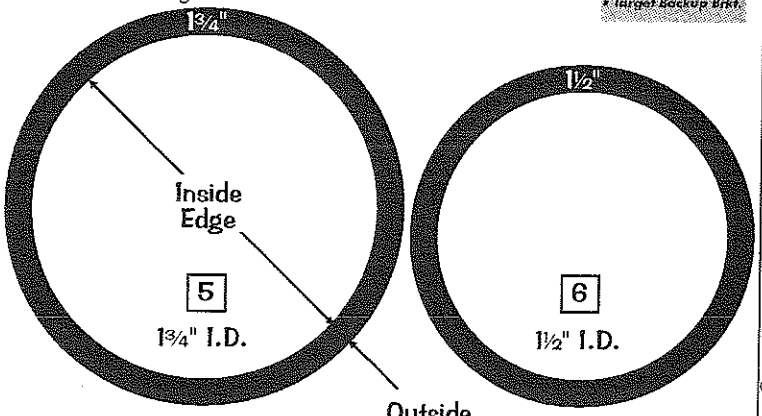
1 3" I.D.
2 2¾" I.D.
3 2½" I.D.

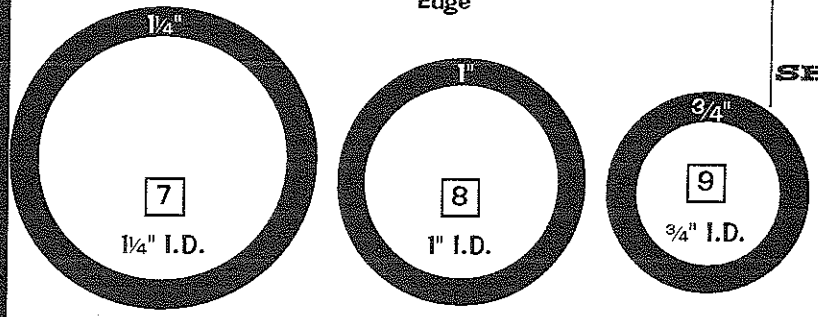


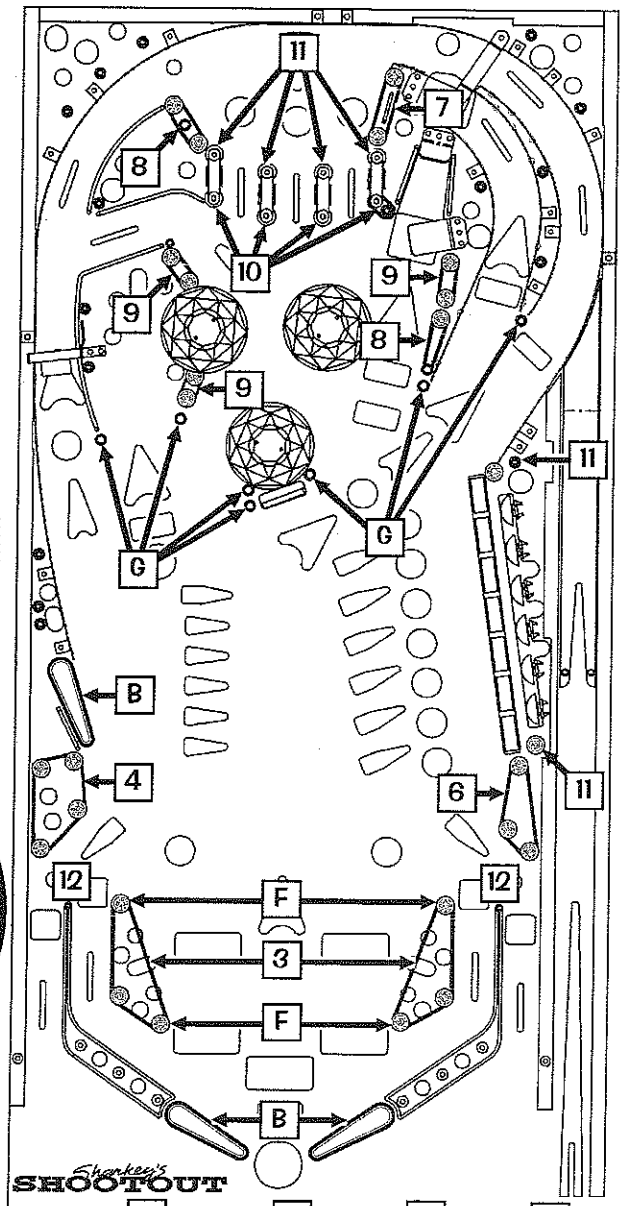
Items 1-9 have the "size" molded onto the Rubber Ring.

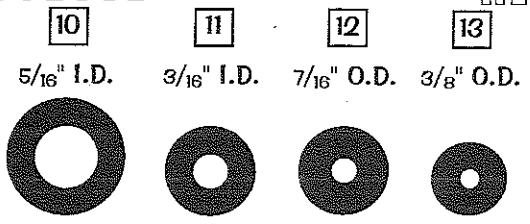
C Not Shown: Qty. 3
* Flipper Assemblies

D Not Shown: Qty. 3
* Trough Up-Kicker
* SVUR
* Target Backup Brkt.





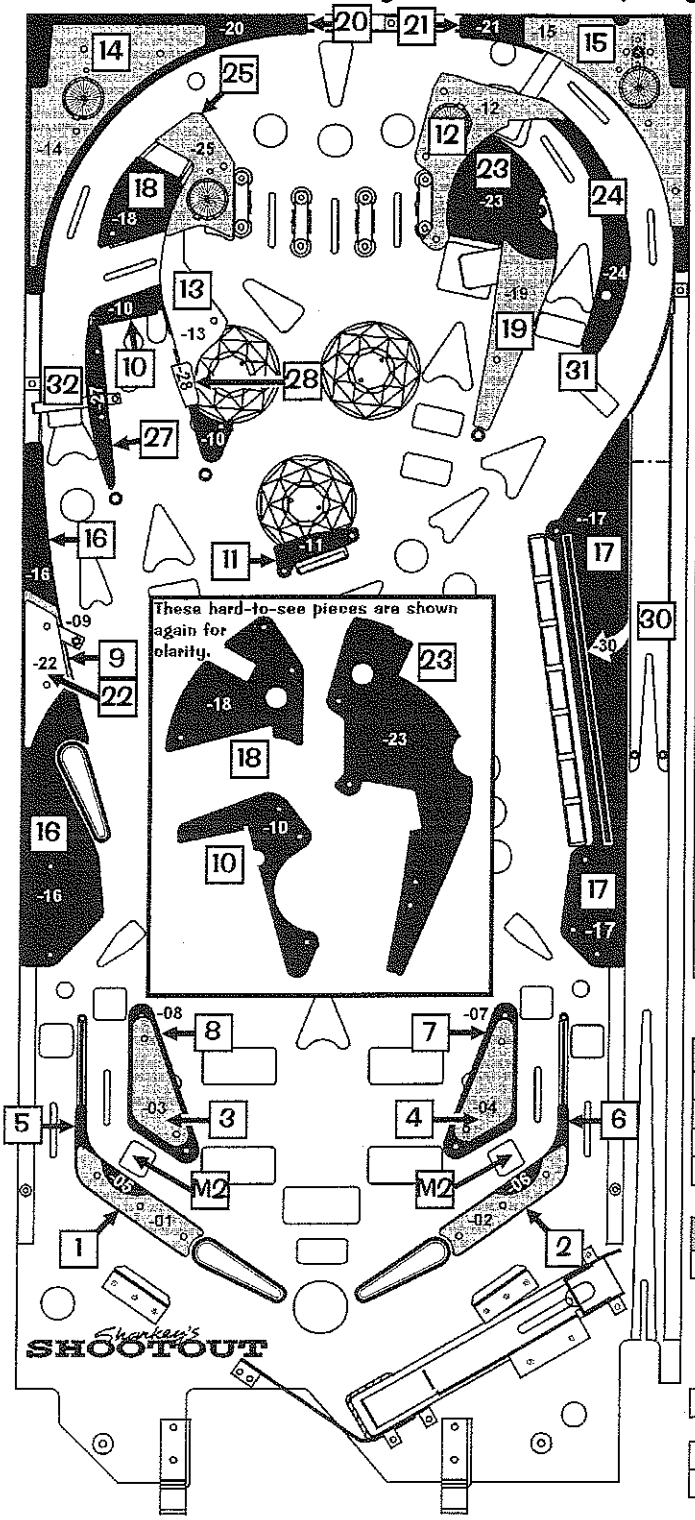




Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº
A	Small Flipper Rubber Ring	0	545-5207-00
B	Large Flipper Black Rubber Ring	3	545-5277-00
C*	Rubber Deflector Pad (Bumper)	3	545-5428-00
D*	Rubber Bumper (Grommet)	3	545-5105-00
E	Bumper Post Rubber	0	545-5009-00
F	Post Rubber (Sleeve Short)	4	545-5151-00
G	Post Black Rubber (Sleeve Tall)	8	545-5308-00
1	3" I.D. BLK Rubber Ring	0	545-5348-10
2	2¾" I.D. Black Rubber Ring	0	545-5348-20
3	2½" I.D. Black Rubber Ring	2	545-5348-09

Nº	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART Nº
4	2" I.D. Black Rubber Ring	1	545-5348-08
5	1¾" I.D. Black Rubber Ring	0	545-5348-21
6	1½" I.D. Black Rubber Ring	1	545-5348-07
7	1¼" I.D. Black Rubber Ring	1	545-5348-06
8	1" I.D. Black Rubber Ring	2	545-5348-05
9	¾" I.D. Black Rubber Ring	3	545-5348-04
10	5/16" I.D. Black Rubber Ring	4	545-5348-02
11	3/16" I.D. Black Rubber Ring	6	545-5348-01
12	7/16" O.D. Black Rubber Ring	2	545-5348-17
13	3/8" O.D. Black Rubber Ring	0	545-5348-19
14*	O-Ring 11/32" X 7/32" X 1/16"	4	545-5850-00

Playfield - Plastic (Butyrate), Decals and Mylar



Nº	PLASTIC (BUTY.) PART NAME	QTY.	SPI PART Nº
Attention: Individual Pieces may not be available.			830-5974-XX
1	Left Return (Upper) (above -05)	1	830-5974-01
2	Right Return (Upper) (above -06)	1	830-5974-02
3	Left Slingshot (Upper) (above -08)	1	830-5974-03
4	Right Slingshot (Upper) (above -07)	1	830-5974-04
5	Left Return (Lower) (below -01)	1	830-5974-05
6	Right Return (Lower) (below -02)	1	830-5974-06
7	Right Slingshot (Lower) (below -04)	1	830-5974-07
8	Left Slingshot (Lower) (below -03)	1	830-5974-08
9	Left Side (Middle) (above -16, below -22)	1	830-5974-09
10	Right of Ramp (Lower) (below -13)	1	830-5974-10
11	Lower (Pop) Bumper	1	830-5974-11
12	Left of Mystery Ball (Upper) (above -23)	1	830-5974-12
13	Right of Ramp (Upper) (above -10 & -18)	1	830-5974-13
14	Top Left Corner (Upper) (above -20)	1	830-5974-14
15	Top Right Corner (Upper) (above -21)	1	830-5974-15
16	Left Side (Lower) (below -09 & -22)	1	830-5974-16
17	Right Side (Lower) (below -30)	1	830-5974-17
18	Under Ramp (Lower) (below -25)	1	830-5974-18
19	Front of Mystery Ball (Upr.) (above -23)	1	830-5974-19
20	Top Left Corner (Lower) (below -14)	1	830-5974-20
21	Top Right Corner (Lower) (below -15)	1	830-5974-21
22	Left Side (Upper) (above -09 & -16)	1	830-5974-22
23	Below Myst. Ball (Lwr.) (below -19 & -12)	1	830-5974-23
24	Right of Mystery Ball	1	830-5974-24
25	Under Ramp (Mid.) (below -28, above -18)	1	830-5974-25
26*	Key Chain	1	830-5974-26
27	Left of Ramp	1	830-5974-27
28	On Ramp (Upper)	1	830-5974-28
29*	Backpanel	1	830-5974-29
30	Right Side (Perpendicular) (above -17)	1	830-5974-30
31	8-Ball Sign (over Right Orbit)	1	830-5974-31
32	9-Ball Sign (over Left Orbit, Spinner)	1	830-5974-32

Nº	MYLAR PART NAME	QTY.	SPI PART Nº
M1*	Clear Mylar - Playfield (Sharkey's...)	1	820-5880-00
M2	Clear Mylar - Square Ball Drop	2	820-5815-00
M3*	Clear Mylar - Slingshots	2	820-5821-00
M4*	Black Mylar - Cover Discs (in Cabinet)	2	820-5041-00

Nº	GAME DECAL PART NAME	QTY.	SPI PART Nº
D1*	Game Nº 72 Screened Decal Sheet Set		820-6267-XX

Note: Individual pieces may not available, *thus the entire sheet set must be ordered.*
-01 (Spinner F) **-02** (Spinner B) **-03** (? Ball Mid) **-04** (? Ball L) **-05** (? Ball R) **-06** (Bot Arch L) **-07** (Bot Arch R) **-08** (Bot Arch C) **-09** (Portals) **-10** (Install 4 Balls) **-11** (Up Post) **-12** (Bot Arch Shooter) **-13** (Flipper Bat L) **-14** (Flipper Bat R) **-15** (D/T 1 Ball) **-16** (D/T 2 Ball) **-17** (D/T 3 Ball) **-18** (D/T 4 Ball) **-19** (D/T 5 Ball) **-20** (D/T 6 Ball) **-21** (D/T 7 Ball) **-22** (D/T 8 Ball) **-23** (Light Strip) **-24** (Coin Door F) *F=Front B=Back L=Left R=Right C=Center*

D2*	Mystery Ball Screened Decal Sheet Set	820-6268-XX

Note: Individual pieces are not available, *the entire sheet set must be ordered.*

D3*	Diode Terminal Strip Desc. Decal (A-K)	820-6221-72
D4*	Game Specific Backbox Fuse Locations	820-6152-72

Nº	GENERIC DECAL PART NAME	QTY.	SPI PART Nº

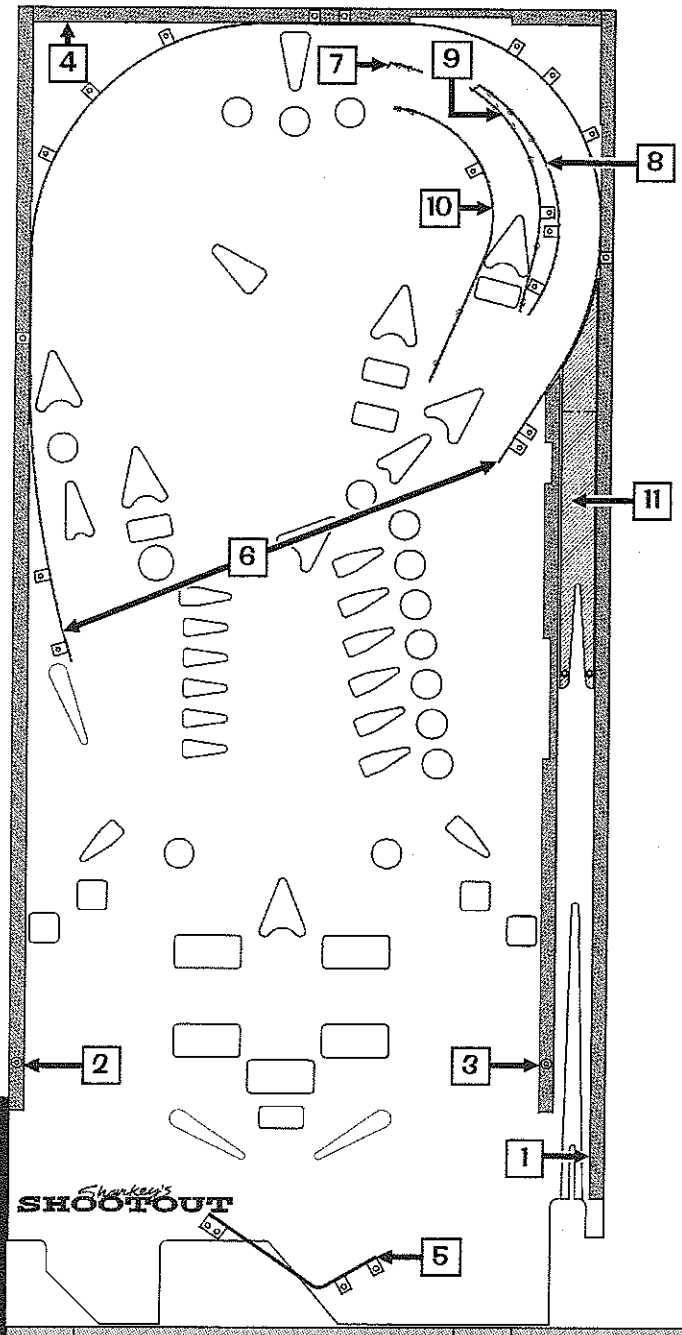
Power (820-6223-00)
Generic Backbox Fuse Loc. (820-6152-00)
Canadian UL Listing Label (820-6141-01)
Power Box Decal USA/Foreign (UL) (820-6123-03)
High Voltage Label (UL) (820-6082-01)
Protective Earth (820-6224-00)
Fuse Label (UL) (820-6143-00)
Shock Hazard Label (UL) (820-6263-00)
Caution Hot Surface (820-6266-00)
Suitable ...Use... (UL) (820-6001-01)

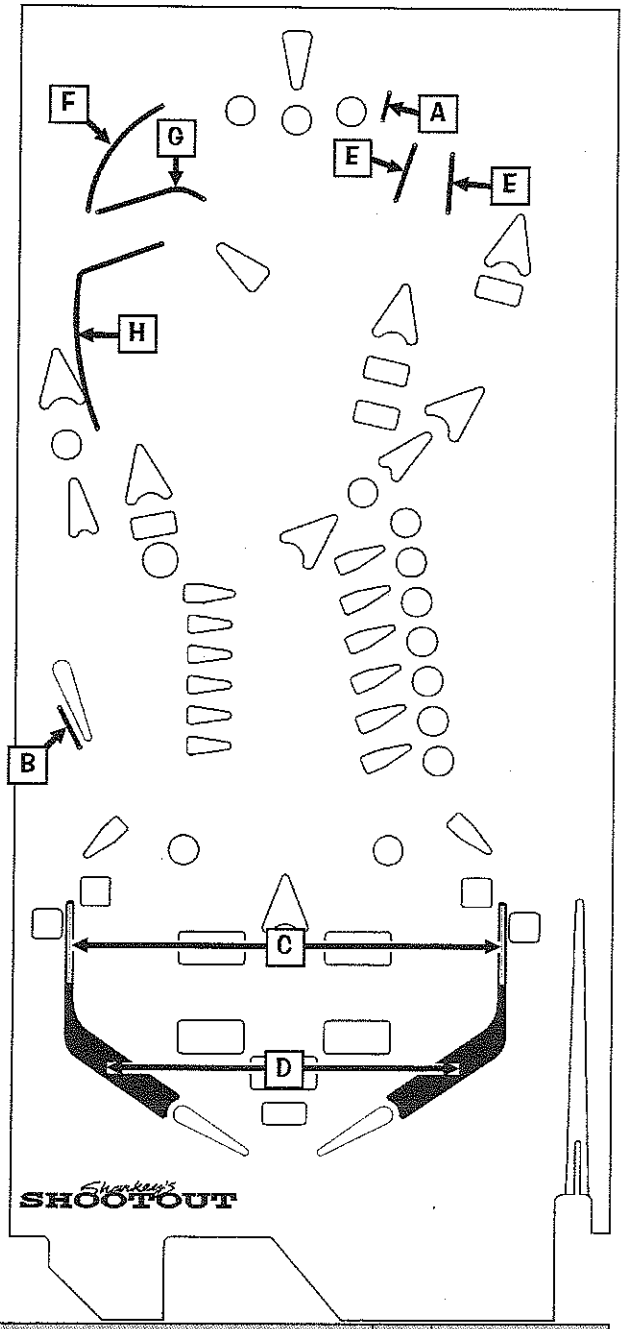
Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.

1. To order the entire Plastic Sheet Set (Screened), use the Part Nº with the "-XX" ending. For individual pieces replace the "-XX" with appropriate last 2-Digit Nº.

Playfield - Rails and Ball Guides †





№	WOOD/METAL RAIL PART NAME	QTY.	SPI PART №
1	Wood Rail (Right Side)	1	525-5566-00
2	Wood Rail (Left Side)	1	525-5567-00
3	Wood Rail (Inside Shooter Lane)	1	525-5568-00
4	Wood Rail (Rear)	1	525-5569-00

Items 1-4 are secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 5/per) (237-5804-00)

5	Metal Rail (Center Drain Under Arch)	1	535-8393-00

Item 5 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)

6	Metal Rail #1 (Full Orbit Loop)	1	535-8669-00

Item 6 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 10) (234-5101-00) **and** #6 X 1/2" PTH A (Zinc) (Qty. 4) (237-5809-00)

7	Metal Rail #2 (Small @ Top)	1	535-8670-00
8	Metal Rail #3 (Rt. P/F Right)	1	535-8671-00
9	Metal Rail #4 (Rt. P/F Middle)	1	535-8672-00
10	Metal Rail #5 (Rt. P/F Left)	1	535-8673-00

Items 7-10 are secured by: #8 X 1/2" SHWH AB (Zinc) (Item 7=0; #8=2; #9=1; #10=1) (234-5101-00), #8 Washer .17" ID X 1/2" OD X 1/32" (Qty. Item 7=1; #8=3; #9=5; #10=4) (242-5015-00) **and** #8-32 Nylon Stop Nut (Item 7=1; #8=3; #9=5; #10=4) (240-5102-00)

№	WOOD/METAL RAIL PART NAME	QTY.	SPI PART №
11	Metal Rail (Shooter Lane Ramp)	1	535-8677-00

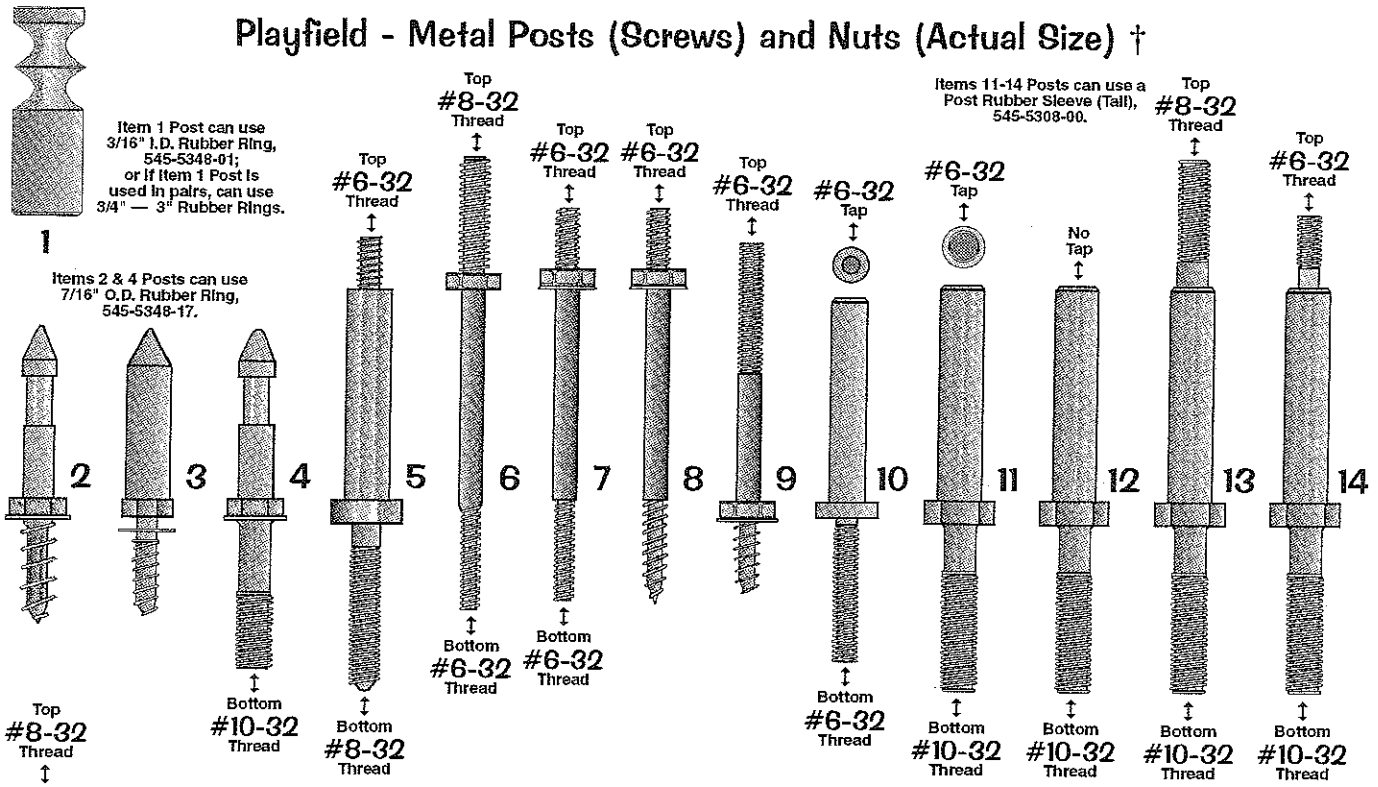
Item 11 is secured by: 9/16" X 5/16" X .144" ID Spacer Tap (Qty. 2) (254-5014-04), #6 Washer (Qty. 2) (242-5001-00), #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00) **and** #4 X 1/2" PFH Zinc (Qty. 2) (237-5840-00)

№	WIRE FORM PART NAME	QTY.	SPI PART №
A	Wire Form - 1"	1	535-5300-05
B	Wire Form - 2"	1	535-5300-10
C	Wire Form (over Item D)	2	535-5642-00

№	BALL GUIDE RAIL PART NAME	QTY.	SPI PART №
D	Ball Guide Rail (Plastic) (Return Lane)	2	550-5037-01
E	Ball Guide Rail - 2"	2	535-5356-01
F	Ball Guide Rail (Left Orbit Top)	1	535-8674-00
G	Ball Guide Rail (Sneak-In Top)	1	535-8675-00
H	Ball Guide Rail (Left Orbit Bottom)	1	535-8676-00

† Items with Ø Qty. are not used in this game. Size and/or quantities may change during production.

Playfield - Metal Posts (Screws) and Nuts (Actual Size) †



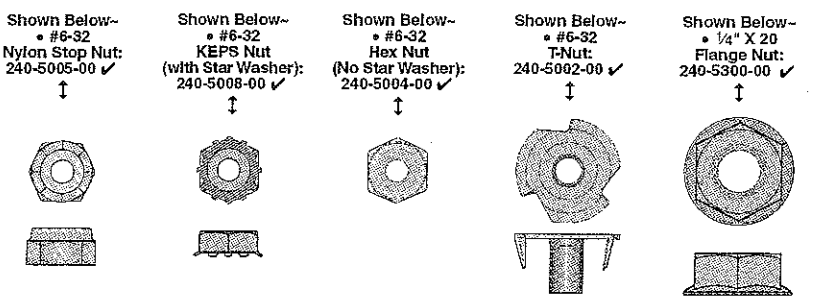
Item 16 is typically used to hold Hex Spacers onto the Playfield Top.

Item 17 is typically used to hold the bottom Cabinet Speaker (used with #6-32 Nylon Stop Nut, 240-5005-00).

Item 18 is typically used to hold Item 15 (515-5939-00) in Turbo Bumper Assy., 515-6459-04.

Note: The "Fins" keep the screw from turning inside the wood hole.

Nut Note: All nuts shown with a " ✔ " are used in this game. The quantities (not specified) vary. The remaining items listed are not used in this game and are noted for reference only (used in prior games).



Shown Below~
• #6-32 Nylon Stop Nut: 240-5005-00 ✔

Top & Side Views

Nylon Stop Nuts *Not Shown:*

- #6-32 (w/ 1/4" Hex Body): 240-5010-00 ✔
- #8-32: 240-5102-00 ✔
- #10-32: 240-5203-00 ✔
- #10-24: 240-5206-00 ✔
- #4-40: 240-5303-00 ✔
- #4-40 (18/8 Stainless): 240-5303-01
- 5/16"-18: 240-5316-00

Shown Below~
• #6-32 KEPS Nut (with Star Washer): 240-5008-00 ✔

Bottom & Side Views

KEPS Nuts *Not Shown:*

- #6-32 (w/ 1/4" Hex Body): 240-5011-00
- #8-32: 240-5104-00 ✔
- #10-32: 240-5208-00 ✔
- #10-24: 240-5207-00 ✔
- #4-40: 240-5318-00

Shown Below~
• #6-32 Hex Nut (No Star Washer): 240-5004-00 ✔

Top View

Hex Nuts *Not Shown:*

- #8-32: 240-5103-00
- #10-32: 240-5201-00
- #10-24: 240-5202-00 ✔
- #10-32 X 3/8": 240-5209-00
- 3/4-16: 240-5315-00 ✔
- #2-56: 240-5301-00 ✔
- 7/8"-14: 240-5317-00

Shown Below~
• #6-32 T-Nut: 240-5002-00 ✔

Bottom & Side Views

T-Nuts *Not Shown:*

- #6-32 (w/Side Cut Off): 240-5002-01
- #8-32: 240-5101-00 ✔
- #10-32 (Black Oxide): 240-5007-00
- #10-32 (w/Side Cut Off): 240-5205-00
- #10-24: 240-5200-00

Shown Below~
• 1/4" X 20 Flange Nut: 240-5300-00 ✔

Top & Side Views

Miscellaneous Nuts *Not Shown:*

- Plastic Pal Nut (on Flipper Buttons): 240-5003-00
- Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✔
- #6-32 Wing Nut: 240-5001-00
- #8-32 Wing Nut: 240-5100-00
- 1/4"-20 Wing Nut: 240-5302-00
- 1/4"-20 Toggle Wing: 240-5324-00

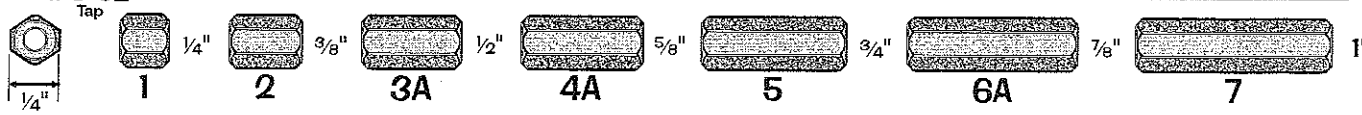
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

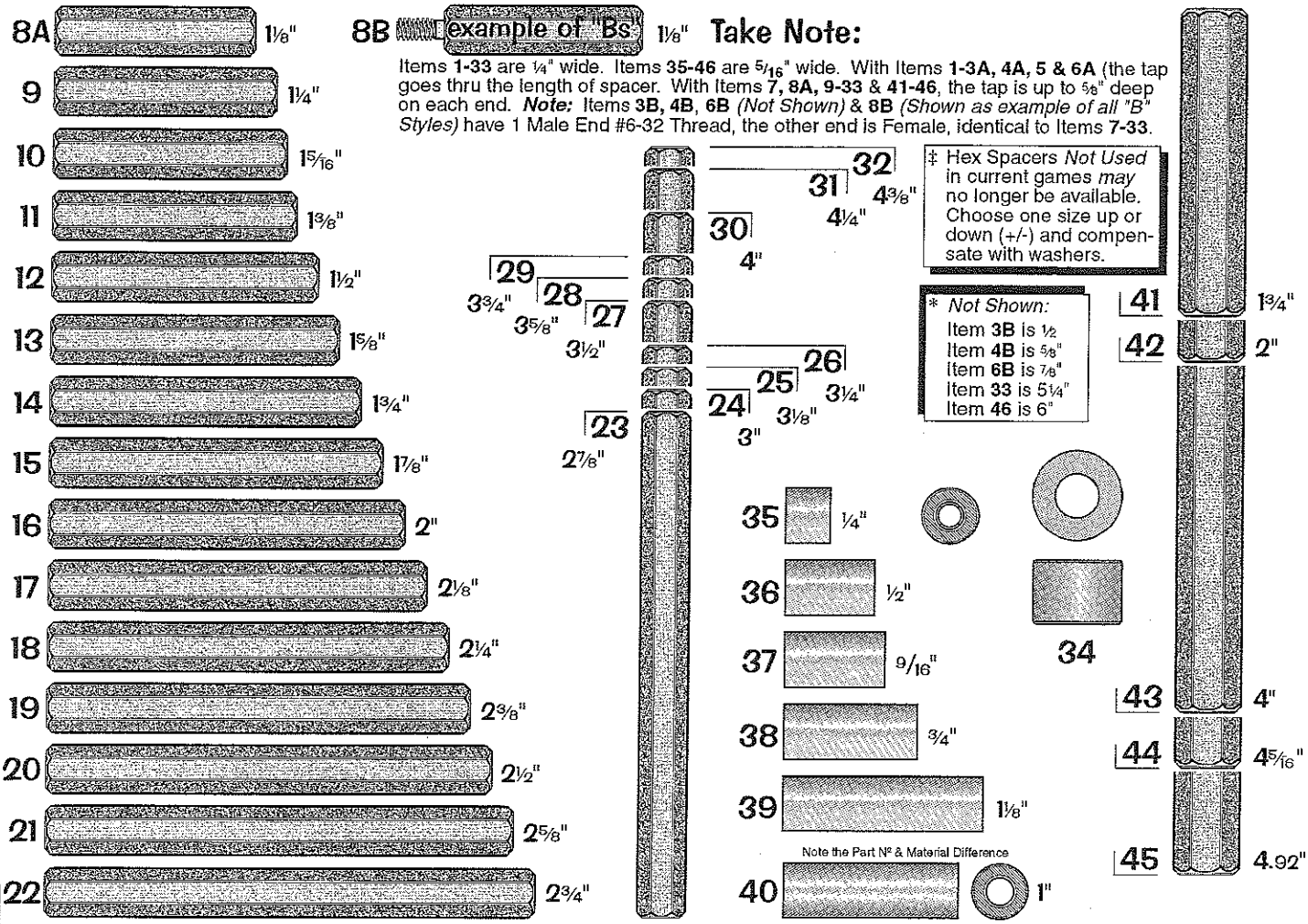
Nº	METAL POST NAME	QTY.	SPI PART Nº	Nº	METAL POST NAME	QTY.	SPI PART Nº
1	Stand-Off Double Groove Post 1-1/16"	0	530-5102-01	10	Post #6-32 Tap / #6-32 Bottom	0	530-5127-00
2	Mini-Post Wood Screw	2	530-5004-00	11	Post Hex Base #6-32 Tap/#10-32 Bot.	3	530-5332-01
3	Mini-Post Wood Screw (no cut-away)	3	530-5004-01	12	Post Hex Base (No Tap)/#10-32 Bot.	4	530-5332-00
4	Mini-Post Mach. Screw / #10-32 Bot.	2	530-5005-00	13	Post Hex Base #8-32 Top/#10-32 Bot.	0	530-5332-02
5	Post Fasten #6-32 Top / #8-32 Bot.	0	530-5007-00	14	Post Hex Base #6-32 Top/#10-32 Bot.	0	530-5332-03
6	Post Fasten #8-32 Top / #6-32 Bot.	2	530-5008-00	15	Playfield Support #8-32 Top/Bottom	0	530-5285-00
7	Post Fasten #6-32 Top / #6-32 Bot.	35	530-5012-02	16	#6-32 X 3/4" Fin Shank Screw	0	237-5921-02
8	Post Fstn. #6-32 Top / Wood Scr. Bot.	1	530-5010-02	17	#6-32 X 1-1/4" Fin Shank Screw	4	237-5883-00
9	Post #6-32 Top / Wood Screw Bottom	0	530-5263-01	18	#6-32 X 1-3/16" Spirol Fin Shank Scr.	9	237-5957-00

Playfield - Metal Spacers (Actual Size) †

A ***Standard USA 9 Inch Ruler*** is provided on the back cover.

Hex Spacers: #6-32 Tap





Take Note:

Items **1-33** are ¼" wide. Items **35-46** are 5/16" wide. With Items **1-3A, 4A, 5 & 6A** (the tap goes thru the length of spacer. With Items **7, 8A, 9-33** & **41-46**, the tap is up to ⅝" deep on each end. ***Note:*** Items **3B, 4B, 6B** *(Not Shown)* & **8B** *(Shown as example of all "B" Styles)* have 1 Male End #6-32 Thread, the other end is Female, identical to Items **7-33**.

‡ Hex Spacers *Not Used* in current games *may* no longer be available. Choose one size up or down (+/-) and compensate with washers.

* *Not Shown:*
Item **3B** is ½
Item **4B** is ⅝
Item **6B** is ⅞
Item **33** is 5¼"
Item **46** is 6"

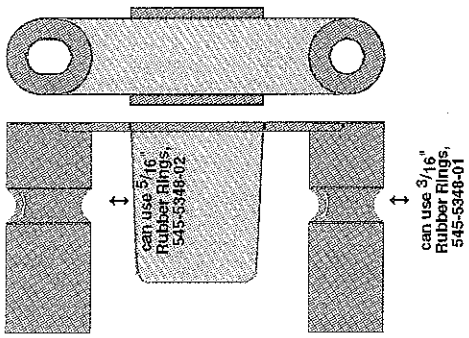
Note the Part Nº & Material Difference

Nº	METAL SPACER NAME	QTY.	SPI PART Nº	Nº	METAL SPACER NAME	QTY.	SPI PART Nº
1	¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-00	22	2¾" X ¼" Hex Spacer #6-32 Tap	3	254-5008-15
2	⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-12	23	2⅞" X ¼" Hex Spacer #6-32 Tap	0	254-5008-31
3A	½" X ¼" Hex Spacer #6-32 Tap	10	254-5008-03	24	3" X ¼" Hex Spacer #6-32 Tap	0	254-5008-14
3B	Same as 3A but with Male End #6-32	2	254-5024-03	25	3⅛" X ¼" Hex Spacer #6-32 Tap	0	254-5008-19
4A	⅝" X ¼" Hex Spacer #6-32 Tap	2	254-5008-02	26	3¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-26
4B*	Same as 4A but with Male End #6-32	0	254-5024-02	27	3½" X ¼" Hex Spacer #6-32 Tap	0	254-5008-27
5	¾" X ¼" Hex Spacer #6-32 Tap	17	254-5008-04	28	3⅝" X ¼" Hex Spacer #6-32 Tap	1	254-5008-25
6A	⅞" X ¼" Hex Spacer #6-32 Tap	2	254-5008-05	29	3¾" X ¼" Hex Spacer #6-32 Tap	0	254-5008-36
6B*	Same as 6A but with Male End #6-32	1	254-5024-05	30	4" X ¼" Hex Spacer #6-32 Tap	0	254-5008-21
7	1" X ¼" Hex Spacer #6-32 Tap	2	254-5008-06	31	4¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-30
8A	1⅛" X ¼" Hex Spacer #6-32 Tap	0	254-5008-17	32	4⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-29
8B	Same as 8A but with Male End #6-32	0	254-5024-17	33*	5¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-35
9	1¼" X ¼" Hex Spacer #6-32 Tap	3	254-5008-11	34	⅜" X ½" Spacer (Used with Backbox)	2	530-5099-00
10	1 5/16" X ¼" Hex Spacer #6-32 Tap	0	254-5008-34	35	¼" X 5/16" X .144" I.D. Spacer Tap	1	254-5014-03
11 ‡	1⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-33	36	½" X 5/16" X .144" I.D. Spacer Tap	3	254-5014-00
12	1½" X ¼" Hex Spacer #6-32 Tap	6	254-5008-09	37	9/16" X 5/16" X .144" I.D. Spacer Tap	2	254-5014-04
13 ‡	1⅝" X ¼" Hex Spacer #6-32 Tap	0	254-5008-13	38	¾" X 5/16" X .144" I.D. Spacer Tap	0	254-5014-01
14	1¾" X ¼" Hex Spacer #6-32 Tap	0	254-5008-10	39	1⅛" X 5/16" X .144" I.D. Spacer Tap	0	254-5014-02
15 ‡	1⅞" X ¼" Hex Spacer #6-32 Tap	0	254-5008-20	40	1" X 5/16" X .144" I.D. Spacer Tap	0	254-5001-00
16	2" X ¼" Hex Spacer #6-32 Tap	0	254-5008-07	41	1¾" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-06
17	2⅛" X ¼" Hex Spacer #6-32 Tap	0	254-5008-32	42	2" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-07
18	2¼" X ¼" Hex Spacer #6-32 Tap	0	254-5008-18	43	4" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-03
19	2⅜" X ¼" Hex Spacer #6-32 Tap	0	254-5008-28	44	4 5/16" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-00
20	2½" X ¼" Hex Spacer #6-32 Tap	0	254-5008-16	45	4.92" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-04
21	2⅝" X ¼" Hex Spacer #6-32 Tap	0	254-5008-08	46*	6" X 5/16" Hex Spacer #6-32 Tap	0	254-5018-02

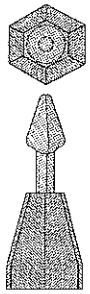
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

Playfield - Plastic Posts and Spacers (Actual Size) †

1** Various Colors



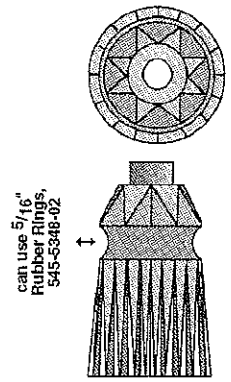
2** Various Colors



3** Limited Colors



4** Various Colors



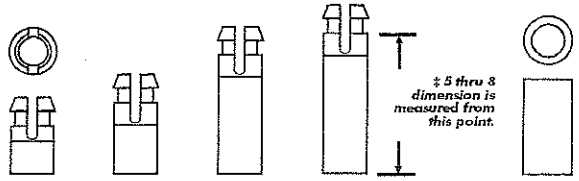
Items 3-4 Posts used in pairs can use 3/4" through 3" Rubber Rings, (See Rubber Parts for Part Nºs).

Take Note:

PLASTIC PART COLOR CHART					
Nº	Color	Nº	Color	Nº	Color
-00	Black	-06	Yellow	-12	Fluor. Blue
-01	Clear	-07	Orange	-13	Teal Green
-02	Red	-08	White	-14	Gray
-03	Amber	-09	Purple	-15	Luminescent
-04	Green	-10	Fluor. Orange	-16	Gold
-05	Blue	-11	Fluor. Green		

** Items **1, 2 & 4** come in various colors (may not be available in every color). Item **3** is currently only available in the color stated in this game manual (other colors used in prior games may no longer be available). The "-XX" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color desired. *Some colors may no longer be available for desired item.*

5 ‡ 6 ‡ 7 ‡ 8 ‡ 9



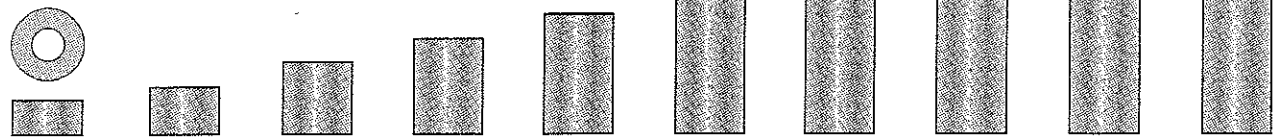
¼" ⅜" ⅝" ¾" ½"

‡ Items **5** through **8** (Board Spacers) dimensions are measured from bottom to just under cut-away (see pictorial with Item 8 above).

10 11 12 13 14 15 16 17 18 19

Take Note:

If any one of Items **10-19** Spacers is not available in the size required, order the smaller sized spacers required to stack sizes together until appropriate size is achieved (e.g. If 1⅛" is needed but unavailable, order a ½" + ⅝" & stack to = 1⅛").



3/16" ¼" ⅜" ½" ⅝" ¾" 1" 1⅛" 1¼" 1½"

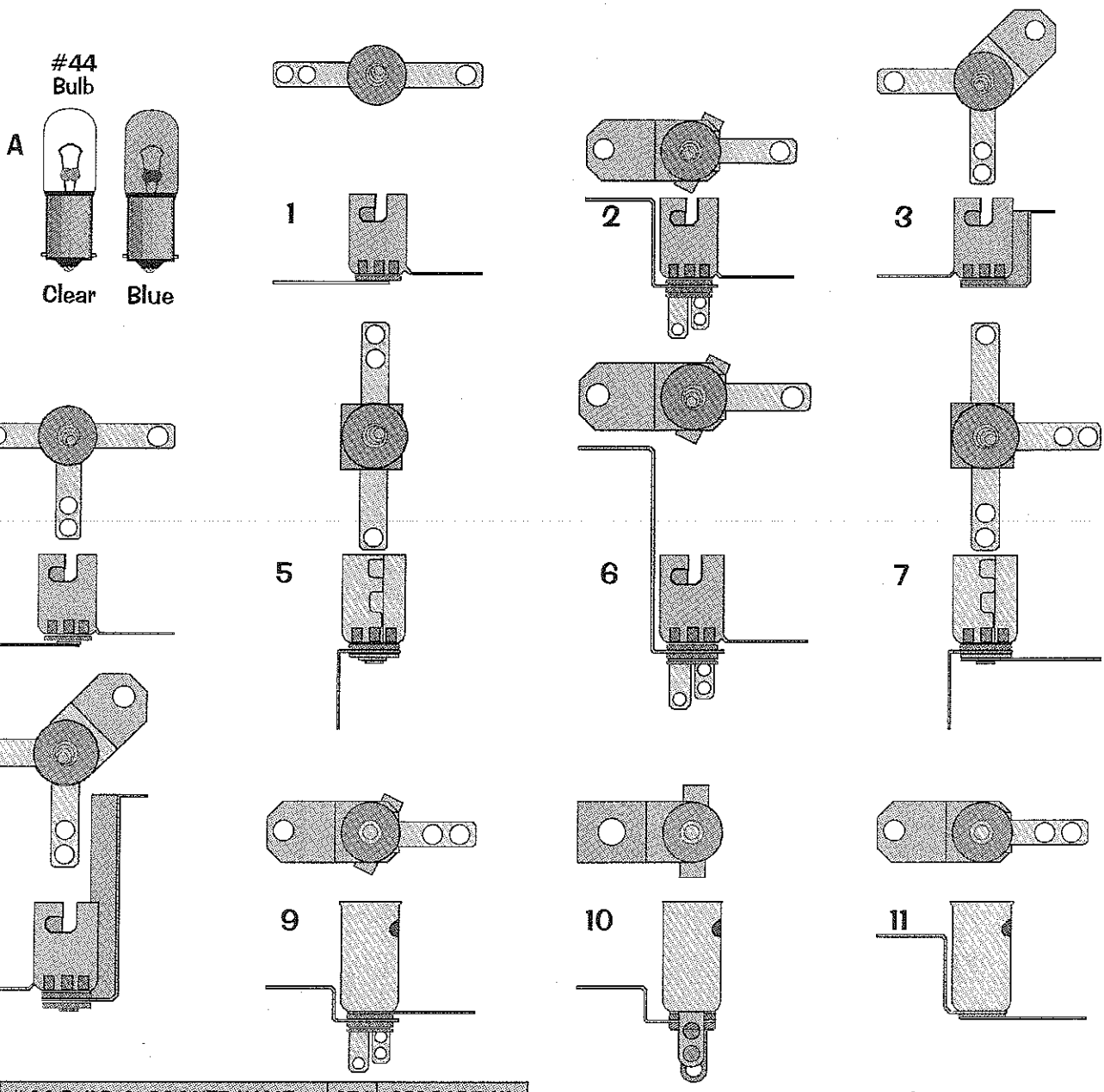
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
1**	Top Lane Mini-Light Hood (Blue)	4	550-5061-05
	Item 1 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) **and** Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00)		
2**	Mini-Jewel Post Clear	0	550-5052-01
	Item 2 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
3**	1 1/16" Single Groove Post (Black)	43	550-5059-00
4**	*Single* Groove Jewel Post (--)	0	550-5034-XX
	Items 3 & 4 typically secured by: Post Fastening Screw #6-32 Top / #6-32 Bottom (Qty. 1/per) (530-5012-02, Item 7 Page 57) ***and may use*** Washer 9/64" X 5/16" OD X 1/32" (Qty. 1/per) (242-5017-00) **with a** #6-32 Nylon Stop Nut (Qty. 1/per) (240-5005-00).		
5 ‡	¼" Slf. Rtn. Spacer White	0	254-5007-02
6 ‡	⅜" Slf. Rtn. Spacer White	4	254-5007-01
7 ‡	⅝" Slf. Rtn. Spacer White	0	254-5007-00
8 ‡	¾" Slf. Rtn. Spacer White	0	254-5007-03

Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
9	½" X ¼" Spacer White (Narrow)	0	254-5000-03
10	3/16" X ⅜" Spacer Gray (4 for Dot Display)	4	254-5000-18
11	¼" X ⅜" Spacer Gray	2	254-5000-02
12	⅜" X ⅜" Spacer Gray	3	254-5000-12
13	½" X ⅜" Spacer Gray	0	254-5000-01
14	⅝" X ⅜" Spacer Gray	0	254-5000-14
15	¾" X ⅜" Spacer Gray	8	254-5000-07
16	1" X ⅜" Spacer Gray/Black	1	254-5000-04
17	1⅛" X ⅜" Spacer Gray	0	254-5000-06
18	1¼" X ⅜" Spacer Gray	0	254-5000-05
19	1½" X ⅜" Spacer Gray	0	254-5000-08

Items 3, 4 & 16 typically secured by: Items 6, 7 & 8 Post Fasten Screws, see Page 57.
Items 10-19 typically secured by: #6 PPH Screw 1/2" Longer than spacer size.

† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

Playfield - Small Bayonet Type Bulbs and Sockets (Actual Size) †



Nº	#44 BULB & SOCKET NAME	QTY.	SPI PART Nº
A	#44 Bulb (Clear)	37	165-5000-44
	#44 Bulb (Blue)	10	165-5053-05
1	2-Lug Staple Down Socket	4	077-5000-00
2	3-Lug Stand-Up Short Socket	0	077-5008-00
3	2-Lug Stand-Up Short Socket	3	077-5002-00
4	3-Lug Staple Down Socket	0	077-5001-00
5	2-Lug Laydown Socket	0	077-5003-00
6	3-Lug Stand-Up Long Socket	0	077-5009-00
7	3-Lug Laydown Socket (3 Lugs Flat)	1	077-5006-00
8	2-Lug Stand-Up Long Socket	0	077-5005-00
9	3-Lug Stand-Up Long Shell Socket	0	077-5013-00
10	2-Lug Stand-Up Lg. Shell Socket (GIs)	39	077-5031-00
11	1-Lug Stand-Up Long Shell Socket	0	077-5012-00
12	3-Lug Laydown Socket (2 Lugs Bent)	0	077-5032-00

Nº	#455 BULB	QTY.	SPI PART Nº
B	#455 Twinkle Bulb	0	165-5003-00

Take Note:

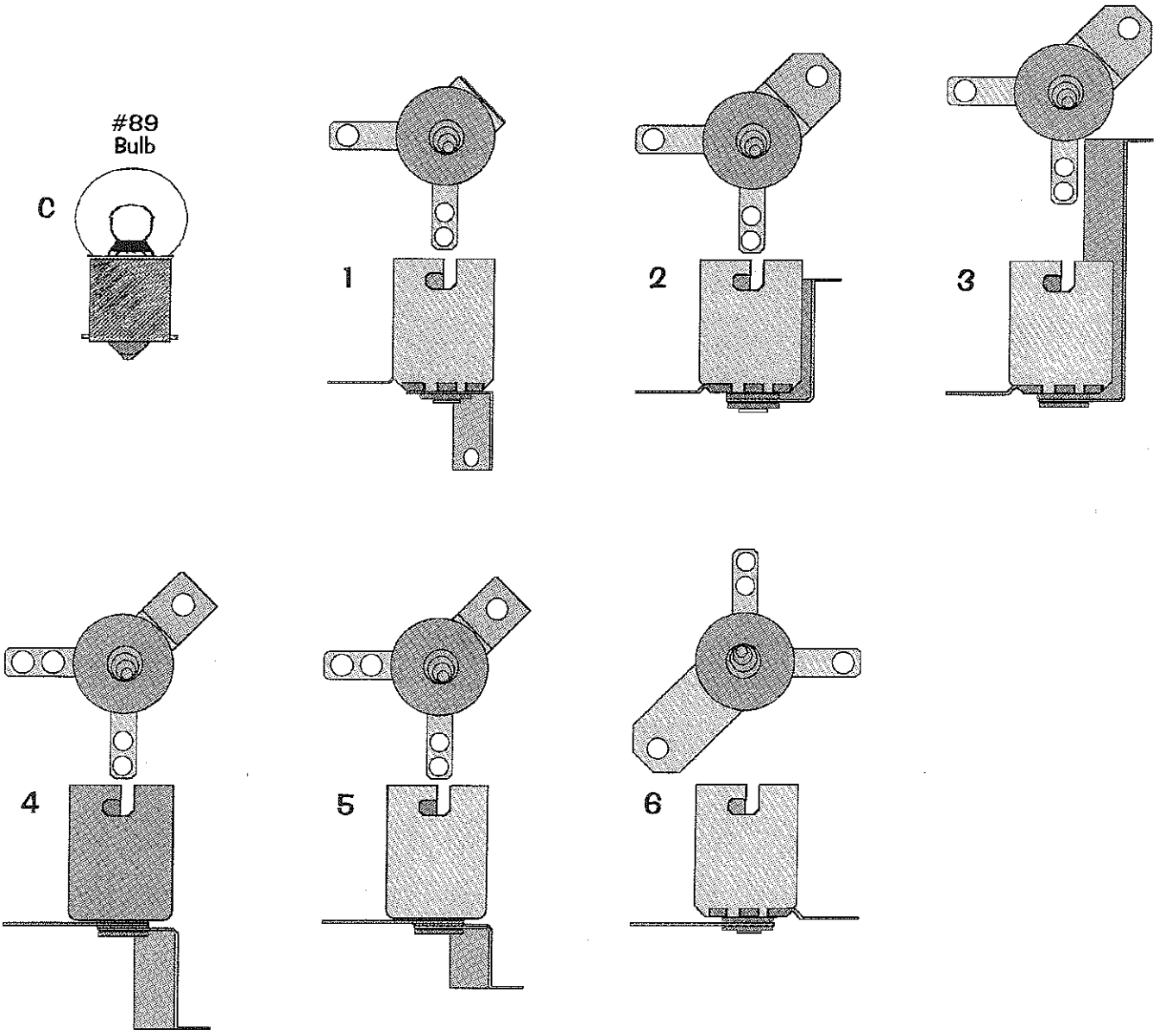
Item B Bulb (#455) is normally used in conjunction with Item **11** Socket, but ***can*** be used with Items **1-12** Sockets on this page.

Note: Always replace with same type bulb in original application.

#455
Bulb
B

† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

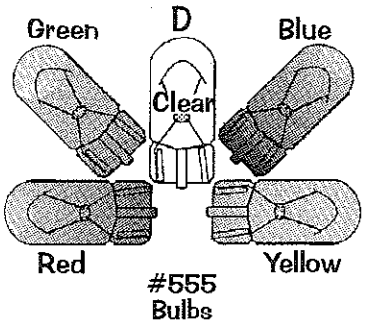
Playfield - Large Bayonet Type Bulb and Sockets (Actual Size) †

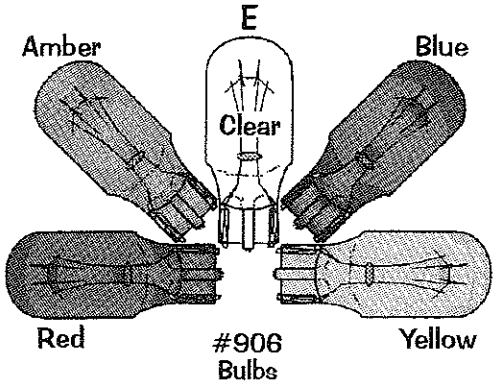


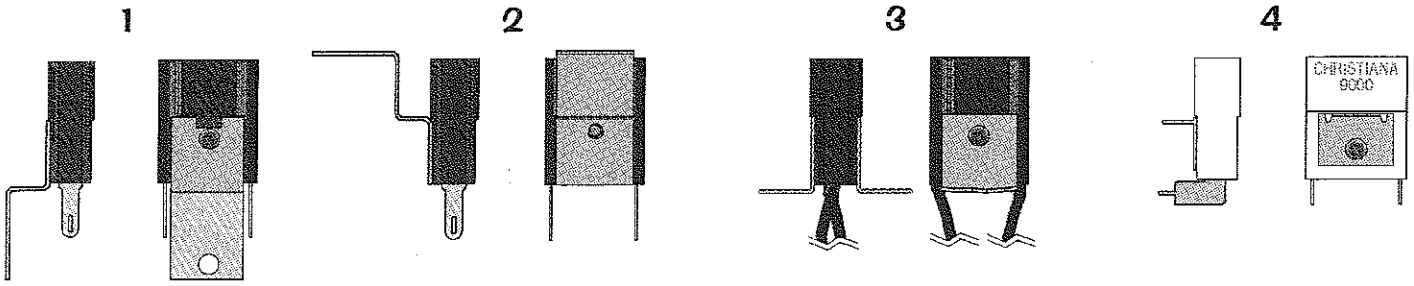
Nº	#89 BULB & SOCKET NAME	QTY.	SPI PART Nº
C	#89 Bulb	7	165-5000-89
1	Laydown Standard Socket	6	077-5100-00
2	2-Lug Stand-Up Short Socket	0	077-5101-00
3	2-Lug Stand-Up Long Socket	0	077-5102-00
4	Stand-Up Socket Rev. Short	1	077-5103-00
5	2-Lug Stand-Up Small Socket	0	077-5106-00
6	Straight Leg Socket	0	077-5107-00

† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

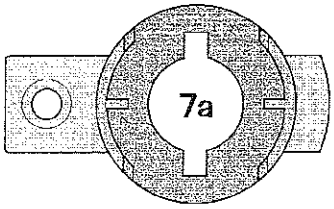
Playfield - Wedge Base Bulbs and Sockets (Actual Size) †





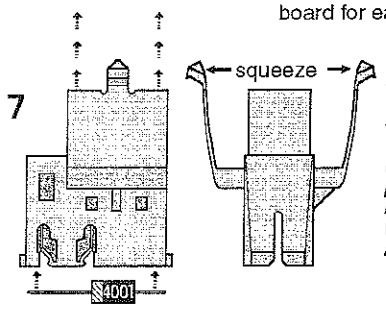


7a/7b Top View (7b Side View is Not Shown)



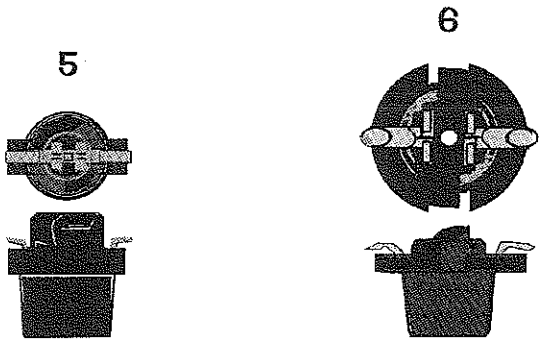
Take Special Note

Item 7 is an **IDC** (Insulation Displacement Connection) Style Socket. This style is solderless, and has a built-in diode. This socket is secured to the playfield or component by Items **7a** and **7b** Snap-On Socket Brackets, or *may* also be snapped into **Item 7c** Socket Mounting Board. Just squeeze the "side arms" of the socket together and pull away from the bracket or mounting board for easy Bulb replacement.



Note: Item 7c Socket Mounting Board is used only when sockets are positioned too close together (typically is a clear plastic piece; If used in this game, Item 7c will show the quantity and the Part Nº.).

This Socket is equipped with a *built-in* Diode, 1N4003, (112-5013-00). However, replacement can be made with Diode, 1N4001, (112-5003-00).



Take Note:

* An asterisk (*) indicates items are not shown on this page.

1. Item **3** Socket has 2 Wires attached are approximately 12" ea.
2. Item **4** Socket **was** used on PC Light Boards to position bulbs horizontally; Item **4** Socket is secured by soldering into place.
3. Item **5** Socket **was** used on PC Light Boards to position bulbs vertically; Item **5** Socket is secured by "twisting" into place.
4. Item **E** Bulb (#906) is normally used in conjunction with Item **6** Socket, but ***can*** be used with Items **1, 2, 4** or **7**.

Note: Always replace with same type bulb in original application.

5. See the start of this chapter for Fluor. Bulb & Assoc. Parts.

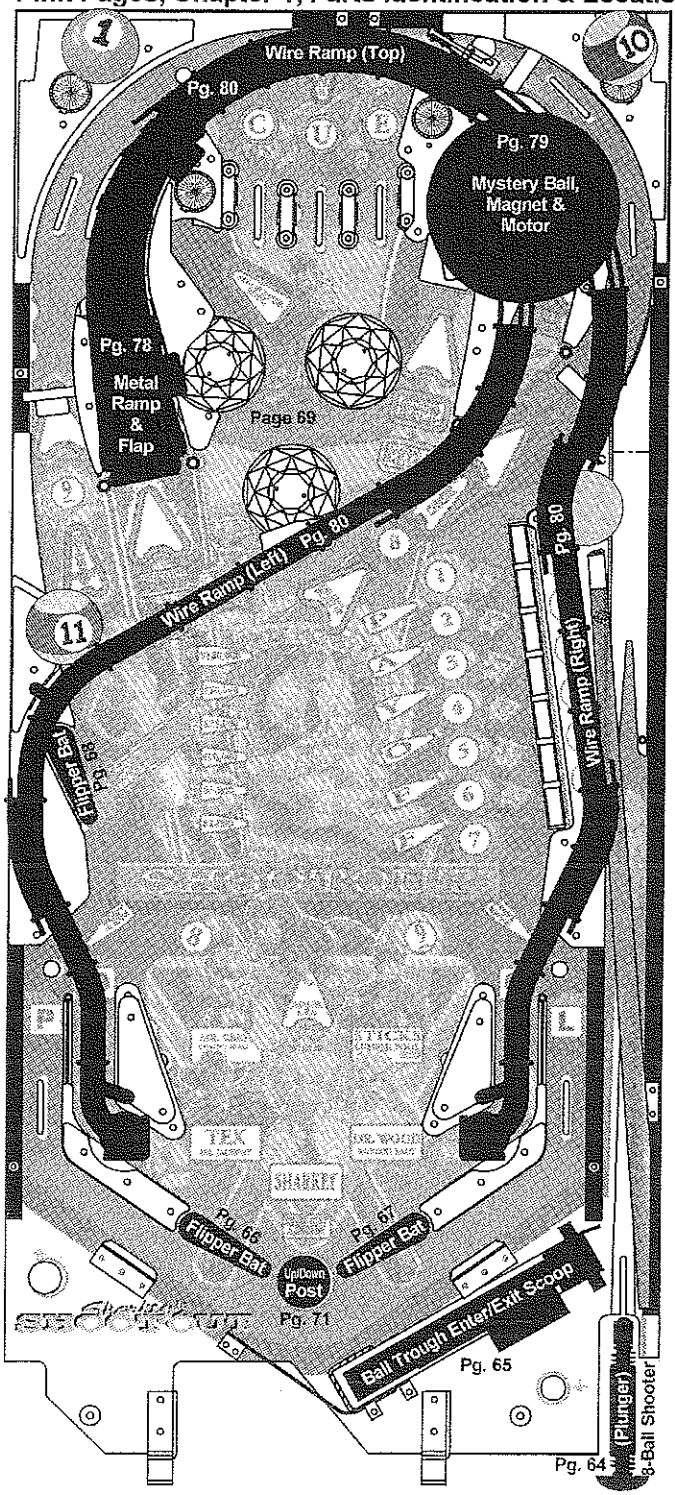
Nº	WEDGE BULB & SOCKET NAME	QTY.	SPI PART Nº
D	#555 Wedge Base Bulb (Clear)	57	165-5002-00
	#555 Wedge Base Bulb (Red)	1	165-5054-02
	#555 Wedge Base Bulb (Green)	1	165-5054-04
	#555 Wedge Base Bulb (Blue)	0	165-5054-05
	#555 Wedge Base Bulb (Yellow)	1	165-5054-06
1	Laydown #555 Wedge Base Socket	0	077-5026-01
2	#555 Wedge Base Offset Socket	7	077-5029-00
3	#555 W.B. Socket (for Pop Bumper)	3	077-5206-00
4	#555 W.B. Socket (Solder Type)	0	077-5207-00
5	#555 Wedge Base Socket (Twist)	0	077-5007-00
6	#906 Wedge Base Socket (Twist)	0	077-5016-00
7	#555 IDC Snap-On Socket	54	077-5216-00
7a	5/16" Ht. Snap-On Socket Bracket	54	545-5760-18
7b *	19/32" Ht. Snap-On Socket Bracket	0	545-5760-19
7c *	Clear Plastic (Bulb) Socket Mtg. Bd.	0	Not Used
E	#906 Wedge Base Bulb (Clear)	4	165-5004-00
	#906 Wedge Base Bulb (Red)	0	165-5004-02
	#906 Wedge Base Bulb (Amber)	0	165-5004-03
	#906 Wedge Base Bulb (Blue)	0	165-5004-05
	#906 Wedge Base Bulb (Yellow)	0	165-5004-06

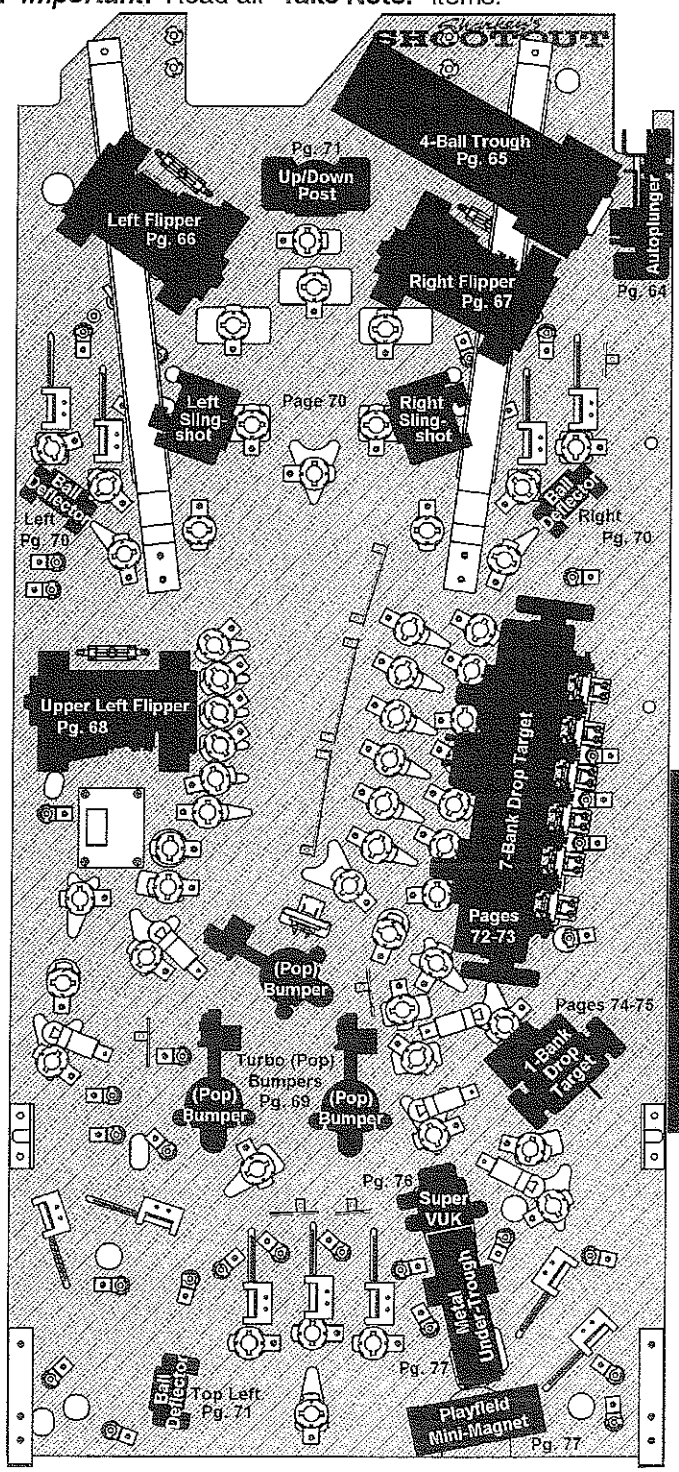
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

Drawings for Major Assemblies & Ramps (The Blue Pages)

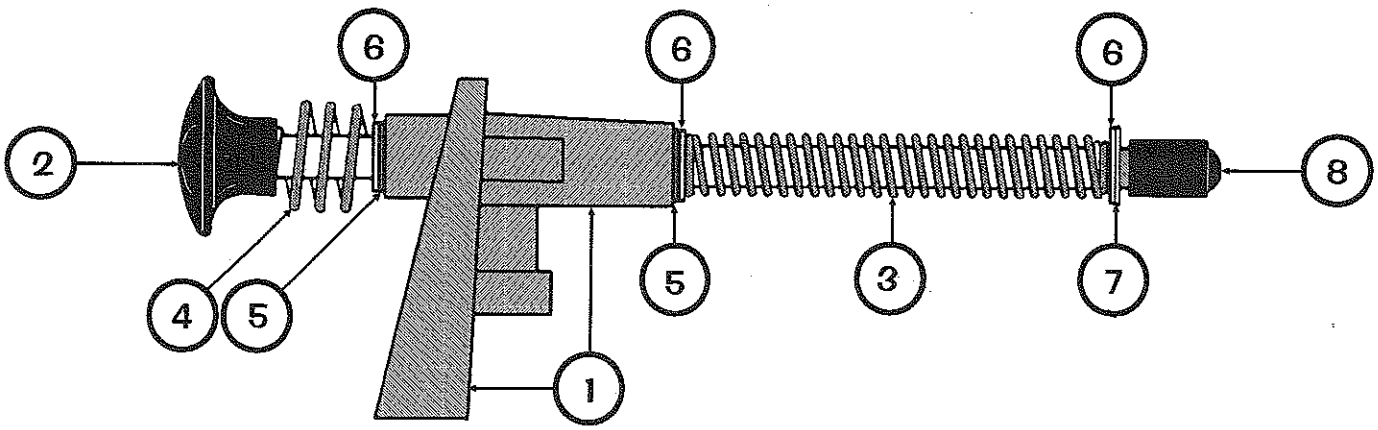
Overview

Drawings are provided for the Major Assemblies in this game with individual parts of each assembly numbered. Items noted with a white circle ○ are mounted above the playfield; items noted with a black circle ● are mounted below. All numbered parts describe the **NAME, QUANTITY & PART Nº. ASSOCIATED PARTS** (AP-) are noted and/or viewed with the associated Major Assembly. ***Below*** are drawings of the Playfield (*Above & Below*) with the Part Name & Page Number of Assemblies in this Chapter. ***Parts not listed in this chapter*** are detailed in the **Pink Pages, Chapter 1, Parts Identification & Location.** ***Important:*** Read all "**Take Note:**" items.





8-Ball Shooter (Plunger) Assembly, 500-6146-50-04 (Items 1-8)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Housing (Shooter Assembly)	1	535-5067-02
2	Rod Assembly (w/8-Ball Knob)	1	515-6557-50
3	Comp. Spring (Green, .035" ø)	1	266-5001-04
4	Compression Spring (Short Plunger)	1	266-5010-00
5	Bushing, 3/8" I.D. (Oilite)	2	280-5010-00
6	Washer, 3/8" I.D. X 5/8" O.D. X 1/16"	3	242-5014-00
7	Retaining Ring, 3/8" ø Shaft	1	270-5012-00
8	Plunger Tip (Black 50 Duro)	1	545-5276-00

Ball Shooter (Plunger) Assembly (500-6146-50-04) is secured to the Cabinet by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (234-5003-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00)

Autoplunger Coil Assembly, 500-6092-02 (Items 1-6) with Autoplunger Arm Weld Assembly, 500-6091-00 (Items 7-9)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº

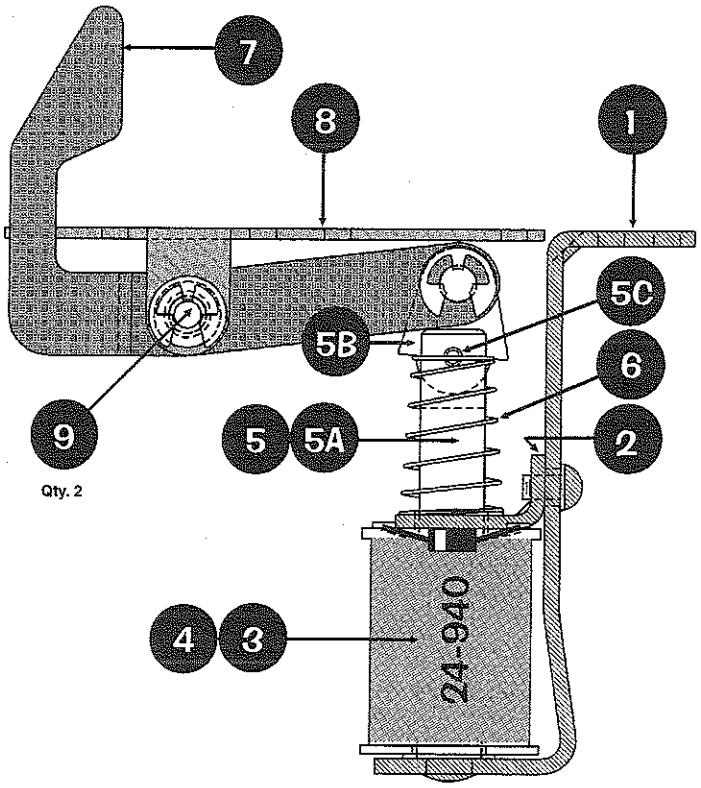
Autoplunger Coil Assembly, 500-6092-02 (Items 1-6)

1	Autoplunger Coil Bracket Assembly	1	515-6527-00
2	Coil Retainer Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
3	Coil, 24-940	1	090-5036-00T
	ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	515-5338-00
	ORDERING ABOVE (ITEM 5) SUB-ASSY PART Nº WILL INCLUDE:		
5A	Plunger 2"	1	530-5025-01
5B	Plunger Link	1	545-5293-00
5C	Roll Pin, 1/8" ø X 5/8" Lg.	1	251-5008-00
	Item 5B is secured to Item 7 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
6	Compression Return Spring	1	266-5020-00

Autoplunger Arm Weld Assy., 500-6091-00 (Items 7-9)

7	Arm Weld Assembly	1	515-6526-00
	Item 7 is secured to Item 8 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
8	Autoplunger Fulcrum	1	535-7697-00
9	Nyliner, 1/4" (Thomson #4l1-FF)	2	545-5423-00

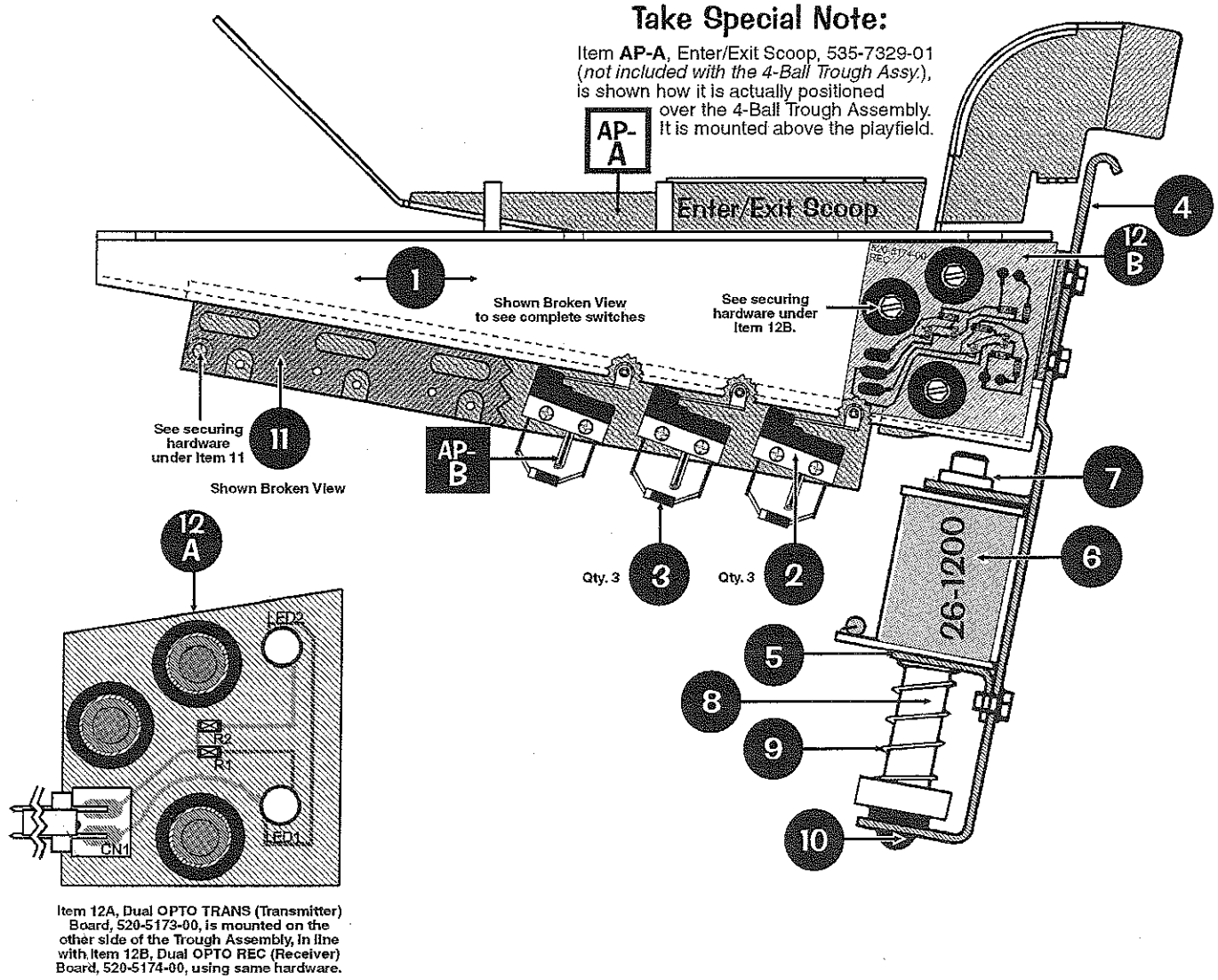
Autoplunger Arm Weld Assembly (500-6091-00) and Autoplunger Coil Assembly (500-6092-02) are secured under the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 9) (234-5101-00)



4-Ball Trough Assembly, 500-6318-24 (Items 1-12B)
and Associated Part: Ball Trough Enter/Exit Scoop, 535-7329-01 (Item AP-A)

Take Special Note:

Item **AP-A**, Enter/Exit Scoop, 535-7329-01 (*not included with the 4-Ball Trough Assy.*), is shown how it is actually positioned over the 4-Ball Trough Assembly. It is mounted above the playfield.



Item 12A, Dual OPTO TRANS (Transmitter) Board, 520-5173-00, is mounted on the other side of the Trough Assembly, in line with Item 12B, Dual OPTO REC (Receiver) Board, 520-5174-00, using same hardware.

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01
2	Micro-Switch (Roller Actuator, Lite-Force)	3	180-5119-02
	Item 2 is secured to Item 1 by: #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 1/per) (237-5937-02)		
3	Switch Diode, 1N4001	3	112-5001-00
4	Coil Mounting Bracket	1	535-7330-01
	Item 4 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 4) (237-5975-00)		
5	Coil Retaining Bracket	1	535-5203-03
	Item 5 is secured to Item 4 by: #8-32 X 1/4" HWH MS (Serr) Zinc (Qty. 2) (237-5964-01)		
6	Coil, 26-1200	1	090-5044-00T
	ORDERING ABOVE (ITEM 6) COIL PART № WILL INCLUDE:		
	Diode, 1N4004 (positioned at top)	1	112-5003-00
7	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
8	Plunger Assembly	1	515-5941-01
9	Compression Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
11	Trough Ball Guide Plate	1	535-7801-00
	Item 11 is secured to Item 1 by: 1/4" X 5/16" X .144" I.D. Spacer Tap. (Qty. 1) (254-5014-03) **and** #2-56 X 1/2" HWH (Ser) UNS #4HD TR3 BO (Qty. 4) (237-5937-02)		
12A	Dual OPTO Transmitter (TRANS) Bd.	1	520-5173-00
12B	Dual OPTO Receiver (REC) Board	1	520-5174-00
	Items 12A & 12B are secured to Item 1 by: OPTO PCB Tube Spacer (Brass) (Qty. 3/per) (530-5308-02), OPTO PCB Rubber Grommet (Qty. 3/per) (545-5518-00) **and** #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04)		
	4-Ball Trough Assembly (500-6318-24) is secured below the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)		

ASSOCIATED PARTS **ARE NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-A	Ball Trough Enter / Exit Scoop	1	535-7329-01
	Item AP-A secured to the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00).		
AP-B	Heat Shrink Tubing 1/8" ø PUI-24	3"	605-5006-00
n/a*	Steel Balls (1-1/16" ø)	4	260-5000-00

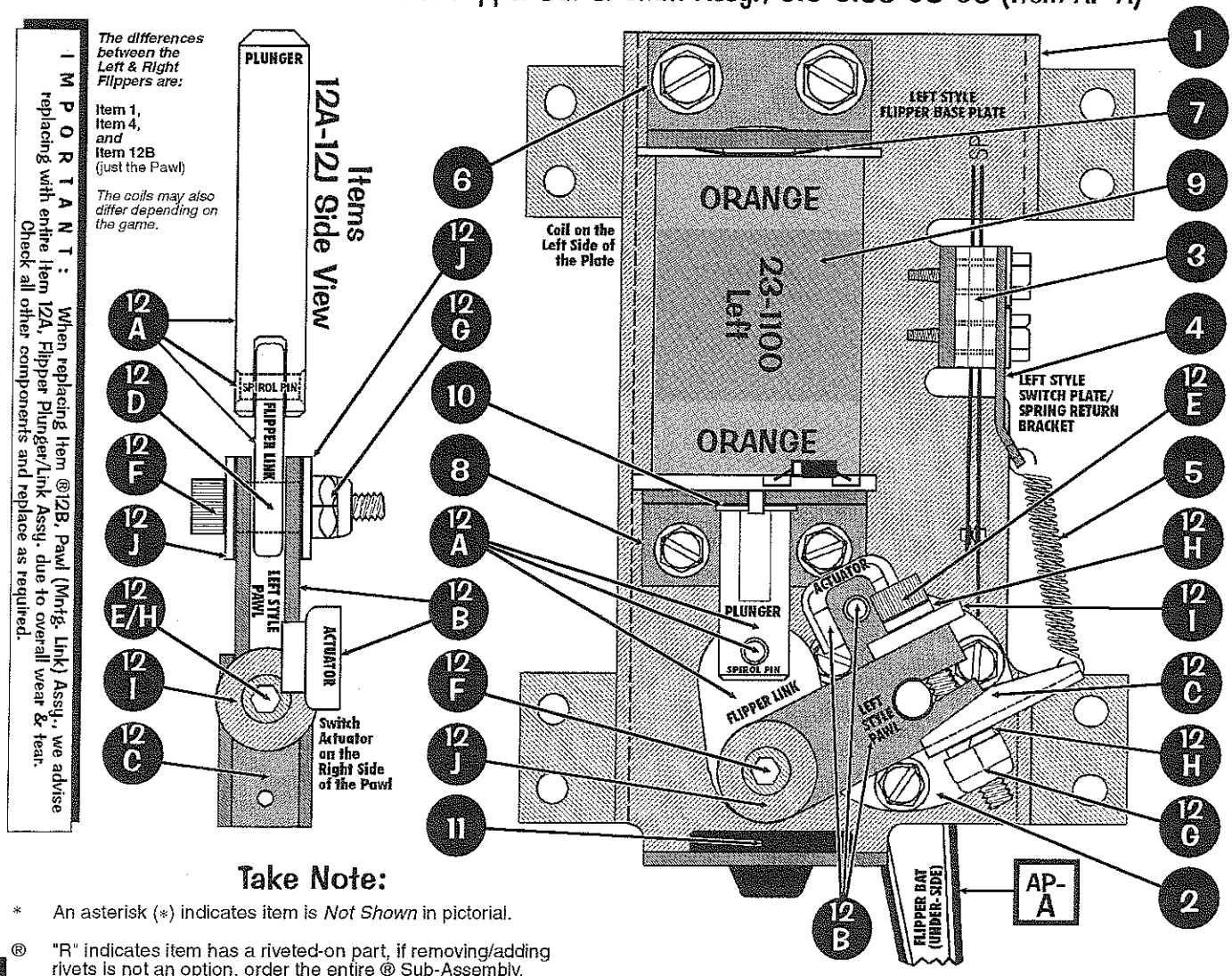
Flipper (Left) Assembly, 500-5944-14 (Items 1-12)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)

IMPORTANT: When replacing Item ®12B, Pawl (Mntg. Link) Assy., due to overall wear & tear, replacing with entire Item 12A, Flipper Plunger/Link Assy. is advised. Check all other components and replace as required.

The differences between the Left & Right Flippers are:

Item 1,
Item 4,
and
Item 12B
(just the Pawl)

The coils may also differ depending on the game.



Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

® "R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate Kit (Left)	1	515-6617-01
ORDERING ABOVE (ITEM 1) KIT (LEFT) PART Nº WILL INCLUDE:			
	Note: Flipper Base Plate (Left) comes threaded with all securing hardware (Thread Forming Screws) as listed under each of the Items which will get secured to it (Items **2**, **3**, **6** & **8**).		
2	Flipper Bat Bushing	1	545-5594-00
Item 2 Is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)			
3	Power (End of Stroke) Switch	1	180-5149-00
Item 3 Is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)			
4	Switch Plate/Spring Return Lt. Brkt.	1	535-7354-01
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
Item 6 Is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)			
7	Spring Washer	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
Item 8 Is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)			
9	Coil, 23-1100 (ORG) (Left)	1	090-5030-00T
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00

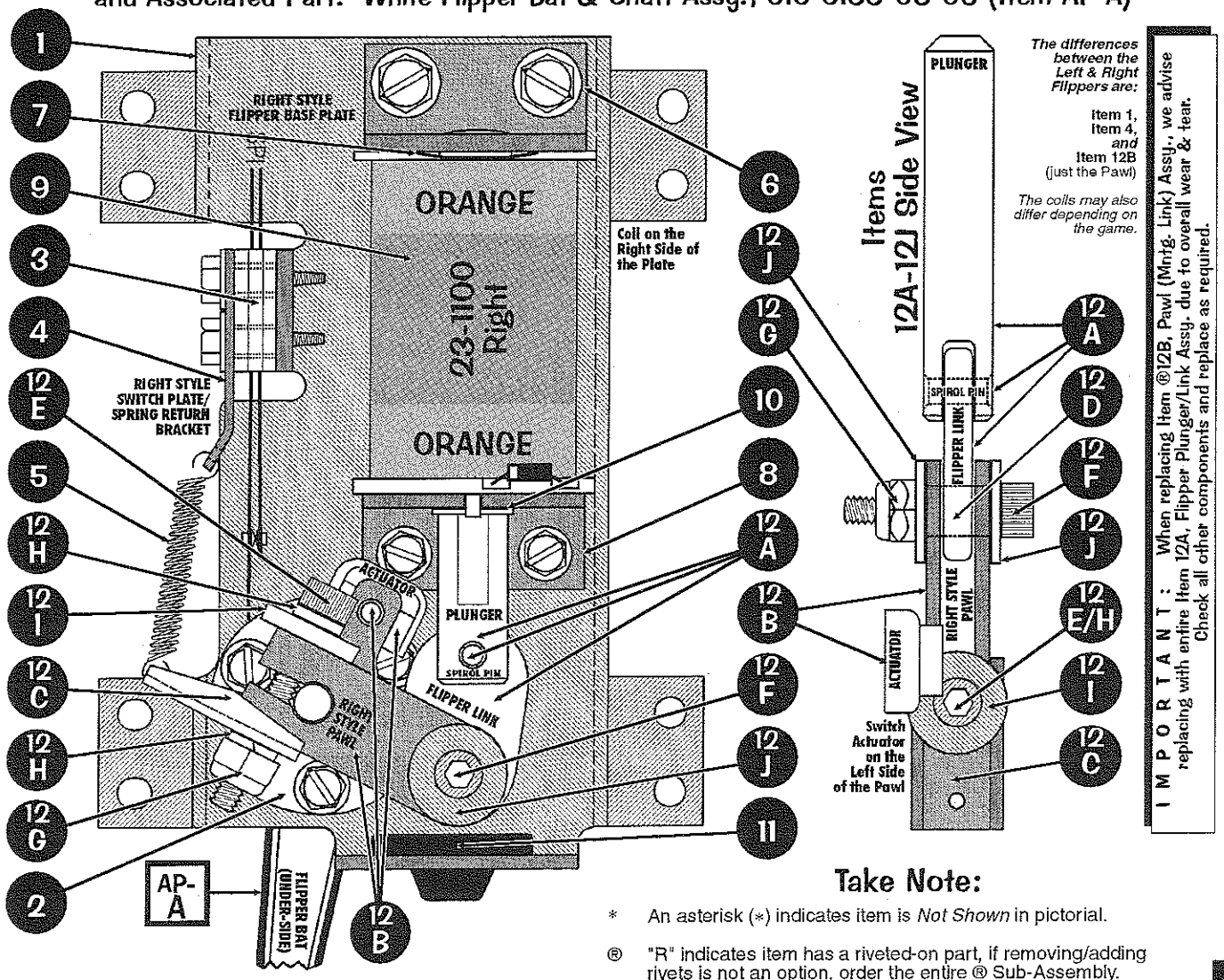
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Plunger, Link & Pawl (Left) Sub-Assy.	1	515-6518-01
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	**1**	**515-6304-01**
includes:	*Plunger, "Flipper" Link*	*1*	*545-5611-00*
includes:	*Spirol Pin ø 5/32" X 3/4" Lg.*	*1*	*251-5015-02*
includes:	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
®12B	**Pawl (Mntg. Link) (Left) Sub-Assy.**	**1**	**515-6305-01**
includes:	*Pawl (Mounting Link) (Left) Plain*	*1*	*535-7271-01*
includes:	*Switch Actuator*	*1*	*545-5612-00*
includes:	*Rivet, 1/8" ø X 1/4" Lg.*	*1*	*249-5003-00*
12C	**Return Bracket**	**1**	**535-7353-00**
12D	Flipper Link Bushing (Metal, Ext.) (.385" Lg. X .192" ID X .312" OD)	1	530-5139-01
12E	#10-32 X 1-1/4" Lg. Socket Head	1	237-5950-01
12F	#10-32 X 7/8" Lg. Socket Head	1	237-5966-00
12G	#10-32 Nylon Stop Nut	2	240-5203-00
12H	#10 Split Lock Washer	2	244-5003-00
12I	Washer .203" ID X .63" OD X .105" Thk W/cut	1	242-5039-01
12J	Washer .203" ID X .63" OD X .062" Thk	2	242-5038-00

Flipper (Left) Assembly (500-5944-14) Is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)

ASSOCIATED PARTS **ARE NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	White Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-08-06
	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Flipper (Right) Assembly, 500-5944-04 (Items 1-12)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)



Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

® "R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate Kit (Right)	1	515-6617-00
ORDERING ABOVE (ITEM 1) KIT (RIGHT) PART Nº WILL INCLUDE:			
Note:	Flipper Base Plate (Right) comes threaded with all securing hardware (Thread Forming Screws) as listed under each of the Items which will get secured to it (Items **2**, **3**, **6** & **8**).		
2	Flipper Bat Bushing	1	545-5594-00
Item 2 is secured to item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)			
3	Power (End of Stroke) Switch	1	180-5149-00
Item 3 is secured to item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)			
4	Switch Plate/Spring Return Rt. Brkt.	1	535-7354-00
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
Item 6 is secured to item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)			
7	Spring Washer	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
Item 8 is secured to item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)			
9	Coil, 23-1100 (ORG) (Right)	1	090-5030-00T
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00

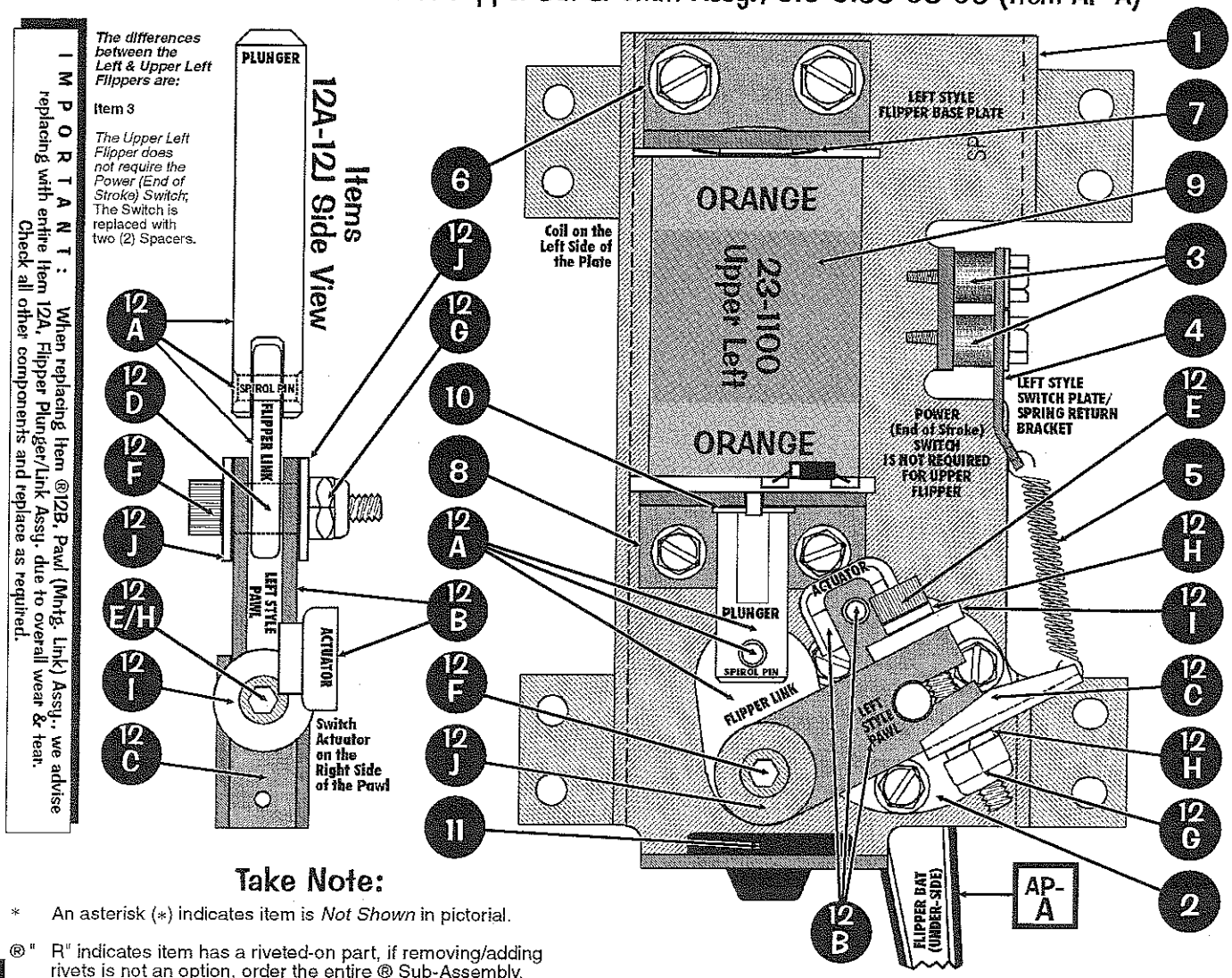
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Plunger, Link & Pawl (Rt.) Sub-Assy.	1	515-6518-00
ORDERING ABOVE (ITEM 12) SUB-ASSY PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	**1**	**515-6304-01**
Includes:	*Plunger "Flipper" Link*	*1*	*545-5611-00*
Includes:	*Spirol Pin ø 5/32" X 3/4" Lg.*	*1*	*251-5015-02*
Includes:	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
®12B	**Pawl (Mntg. Link) (Rt.) Sub-Assy.**	**1**	**515-6305-00**
Includes:	*Pawl (Mounting Link) (Rt.) Plain*	*1*	*535-7271-00*
Includes:	*Switch Actuator*	*1*	*545-5612-00*
Includes:	*Rivet, 1/8" ø X 1/4" Lg.*	*1*	*249-5003-00*
12C	**Return Bracket**	**1**	**535-7353-00**
12D	Flipper Link Bushing (Metal, Ext.) (.385" Lg. X .192" ID X .312" OD)	1	530-5139-01
12E	#10-32 X 1-1/4" Lg. Socket Head	1	237-5950-01
12F	#10-32 X 7/8" Lg. Socket Head	1	237-5966-00
12G	#10-32 Nylon Stop Nut	2	240-5203-00
12H	#10 Split Lock Washer	2	244-5003-00
12I	Washer .203" ID X .63" OD X .105" Thk W/cut	1	242-5039-01
12J	Washer .203" ID X .63" OD X .062" Thk	2	242-5038-00

Flipper (Right) Assembly (500-5944-04) is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)

ASSOCIATED PARTS **ARE NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	White Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-08-06
	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Flipper (Upper Left) Assembly, 500-5944-34 (Items 1-12)
and Associated Part: White Flipper Bat & Shaft Assy., 515-5133-08-06 (Item AP-A)



Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

®" R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Flipper Base Plate Kit (Left)	1	515-6617-01
ORDERING ABOVE (ITEM 1) KIT (LEFT) PART Nº WILL INCLUDE:			
	Note: Flipper Base Plate (Left) comes threaded with all securing hardware (Thread Forming Screws) as listed under each of the Items which will get secured to it (Items **2**, **3**, **6** & **8**).		
2	Flipper Bat Bushing	1	545-5594-00
Item 2 is secured to Item 1 by: #6-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 3) (237-5976-02)			
3	1/4" X 3/8" Spacer Gray	2	254-5000-02
Item 3 is secured to Item 1 by: #6-32 X 5/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5976-04)			
4	Switch Plate/Spring Return Lt. Brkt.	1	535-7354-01
5	Flipper Return Spring	1	265-5035-00
6	Coil Stop Bracket Sub-Assembly	1	515-6308-01
Item 6 is secured to Item 1 by: #10-32 X 3/8" SHWH Swage (Serr) Zinc (Qty. 2) (237-5985-00) **and** #10 Split Lock Washer (Qty. 2) (244-5003-00)			
7	Spring Washer	1	269-5002-00
8	Coil Support Bracket	1	535-7356-00
Item 8 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Ser.) Zc. (Qty. 2) (237-5975-00)			
9	Coil, 23-1100	1	090-5030-00T
ORDERING ABOVE (ITEM 9) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
10	Coil Sleeve	1	545-5388-00
11	Deflector Pad (Bumper)	1	545-5428-00

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Plunger, Link & Pawl (Left) Sub-Assy.	1	515-6518-01
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	1	**515-6304-01**
includes:	*Plunger "Flipper" Link*	*1*	*545-5611-00*
includes:	*Spirol Pin ø 5/32" X 3/4" Lg.*	*1*	*251-5015-02*
includes:	*Flipper Plunger with "Flat"*	*1*	*530-5349-01*
®12B	**Pawl (Mntg. Link) (Left) Sub-Assy.**	1	**515-6305-01**
includes:	*Pawl (Mounting Link) (Left) Plain*	*1*	*535-7271-01*
includes:	*Switch Actuator*	*1*	*545-5612-00*
includes:	*Rivet, 1/8" ø X 1/4" Lg.*	*1*	*249-5003-00*
12C	**Return Bracket**	1	**535-7353-00**
12D	Flipper Link Bushing (Metal, Ext.) (.385" Lg. X .192" ID X .312" OD)	1	530-5139-01
12E	#10-32 X 1-1/4" Lg. Socket Head	1	237-5950-01
12F	#10-32 X 7/8" Lg. Socket Head	1	237-5966-00
12G	#10-32 Nylon Stop Nut	2	240-5203-00
12H	#10 Split Lock Washer	2	244-5003-00
12I	Washer .203" ID X .63" OD X .105" Thk W/cut	1	242-5039-01
12J	Washer .203" ID X .69" OD X .062" Thk	2	242-5038-00

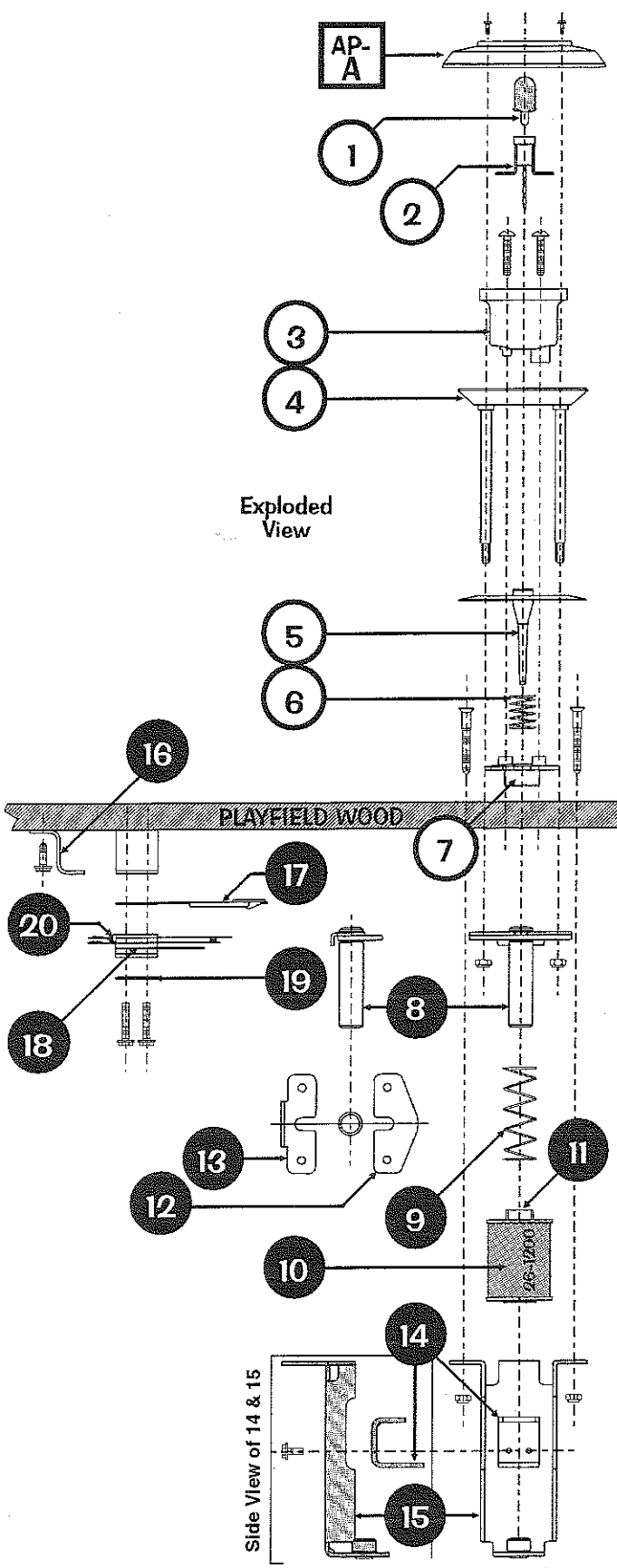
Flipper (Upper Left) Assembly (500-5944-34) Is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)

ASSOCIATED PARTS **ARE NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

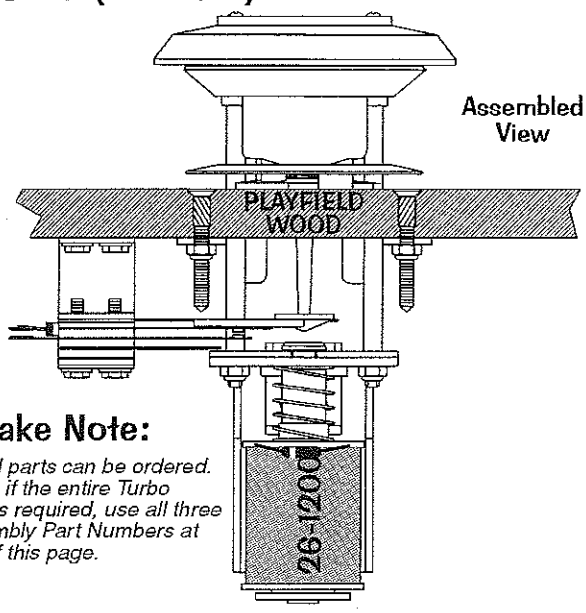
Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	White Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-08-06
	Large Flipper **BLACK** Rubber Ring	1	545-5277-00

Turbo (Pop) Bumper Top Assy., 515-6459-01 (Qty. 3) (Items 1-7), Turbo (Pop) Bumper Bottom Assy., 515-6459-04 (Qty. 3) (Items 8-15), Turbo (Pop) Bumper Switch Assy., 515-6459-03 (Qty. 3) (Items 16-20)

and Associated Part(s): See Table Below (Item AP-A)



Exploded View



Assembled View

Take Note:

Individual parts can be ordered. However, if the entire Turbo Bumper is required, use all three (3) Assembly Part Numbers at the top of this page.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
Turbo Bumper Top Assy., 515-6459-01 (Items 1-7)			
1	#555 Wedge Base Bulb	1	165-5002-00
2	#555 Wedge Base Socket	1	077-5206-00
3	Bumper Body	1	545-5197-00
Item 3 is secured by: #5 X 7/8" PRH AB (Zinc) (Qty. 2) (237-5826-00)			
4	Ring Assembly	1	515-5085-00
Item 4 is secured by: #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
5	Bumper Skirt	1	545-5607-00
6	Bumper Skirt Compression Spring	1	266-5048-00
7	Bumper Base	1	545-5195-00
Turbo Bumper Bottom Assy., 515-6459-04 (Items 8-15)			
8	Plunger	1	530-5348-00
9	Coil Compression Spring	1	266-5047-00
10	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 10) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
11	Coil Sleeve	1	545-5031-00
12	Fiber Yoke	1	545-5609-00
13	Metal Yoke	1	535-7346-00
14	Metal Yoke Stop	1	535-7347-00
Item 14 is secured by: #6-32 X 1/4" HWH Swage (Serr.) Zinc (Qty. 2) (237-5976-01)			
15	Coil Bracket Welded Assembly	1	515-5939-00
Item 15 is secured by: #6-32 X 1-3/16" Spiral Fin Shank (Qty. 3) (237-5957-00) **and** #6-32 Nylon Stop Nut (Qty. 3) (240-5005-00)			
Turbo Bumper Switch Assy., 515-6459-03 (Items 16-20)			
16	Switch Bracket	1	535-7342-00
Item 16 is secured by: #8 X 1/2" SHWH AB (Zinc) (Qty. 2) (234-5101-00)			
17	Spoon Switch Actuator	1	545-5610-01
18	Turbo Bumper Stack (Blade) Switch	1	180-5015-03
19	Switch Body Protect Plate	1	535-7344-00
Items 18 & 19 are secured by: #6-32 X 3/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5976-05)			
20	Switch Diode, 1N4001	1	112-5001-00

The Top & Bottom Assemblies are secured together by hardware included in assemblies.

ASSOCIATED PART **IS NOT INCLUDED** WITH THE ABOVE ASSEMBLY.

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	Turbo (Pop) Bumper Cap (Blue)	3	550-5057-05

Item AP-A is secured to Item 4 by: #4 X 3/4" PRH (Zinc) T-25 (Qty. 2/per) (237-5873-00)

Slingshot (Left & Right) Assemblies, 500-5849-00 (Qty. 2) (Items 1-10)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Slingshot Bracket Assembly	1	515-5339-01
ORDERING ABOVE (ITEM 1) SUB-ASSY PART Nº WILL INCLUDE:			
1A	Slingshot Bracket	1	535-5919-01
1B	Hinge Stud	1	530-5034-01
1C	Armature Stop	1	530-5017-01
1D	Shading Ring	1	530-5307-00
2	Coil Retaining Bracket	1	535-5203-03

Item 2 is secured to Item 1A by: #8-32 X 3/8" PPH MS (Sems) (Qty. 2) (232-5301-00)

3	Coil, 23-800	1	090-5001-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve	1	545-5031-00
5	Plunger & Link Assembly	1	515-5338-00
ORDERING ABOVE (ITEM 5) SUB-ASSY PART Nº WILL INCLUDE:			
5A	Plunger 2" Lg.	1	530-5025-01
5B	Plunger Link	1	545-5293-00
5C	Roll Pin 1/8" ø x 5/8" Lg.	1	251-5008-00

Item 5B is secured to Item 10A by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

6	Compression Spring	1	266-5020-00
7	Slingshot Stack (Blade) Switch	2	180-5054-00
8	Switch Body Protect Plate	2	535-5045-00

Items 7 & 8 are secured to Item 1A by: #6-32 X 5/8" HWH Swage (Qty. 4) (237-5976-04)

9	Switch Diode, 1N4001	2	112-5001-00
10®	Riveted Arm & Tip Assembly	1	515-5340-01
ORDERING ABOVE ® RIVETED ASSY. PART Nº WILL INCLUDE:			
10A	Arm	1	515-5341-01
10B	Kicker Tip	1	545-5216-01
10C	Rivet, 1/8" ø x 1/4" Lg.	1	249-5003-00

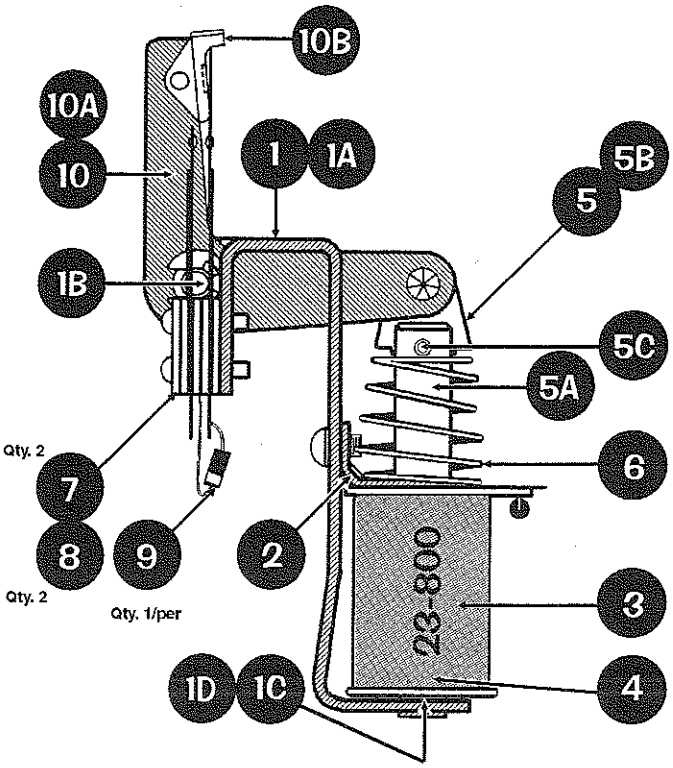
Item 10A is secured to Item 1A by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)

Slingshot Assemblies (500-5849-00) are secured below the playfield by:
#8 X 1/2" SHWH AB (Zinc) (Qty. 3/per) (234-5101-00)

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

® "R" indicates item has a riveted-on part, if removing/adding rivets is not an option, order the entire ® Sub-Assembly.



Ball Deflector (over Lt. & Rt. Outlanes) Assy., 500-5788-02 (Qty. 2) (Items 1-8)

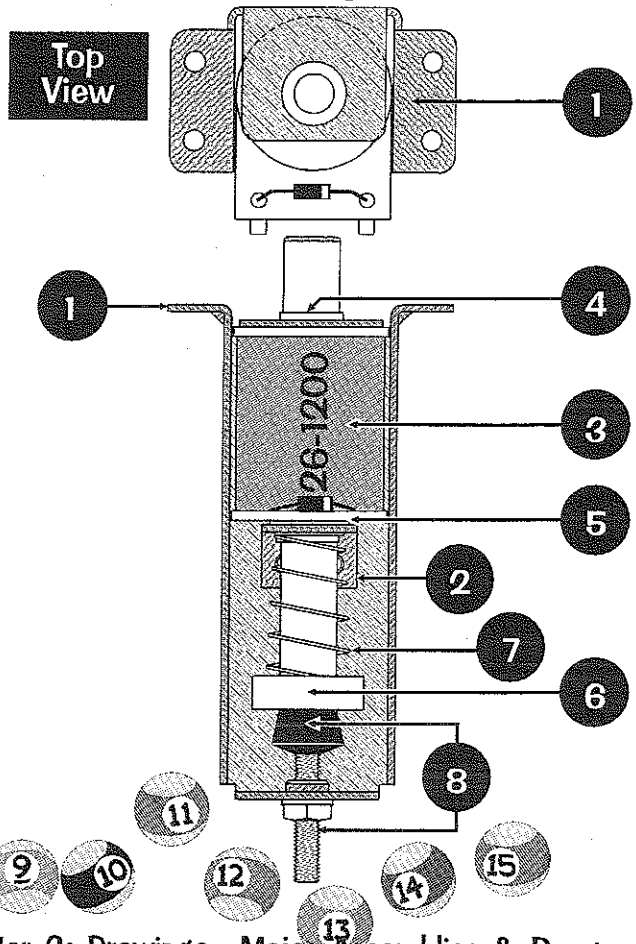
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
2	Coil Retaining Bracket	1	535-5203-03

Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)

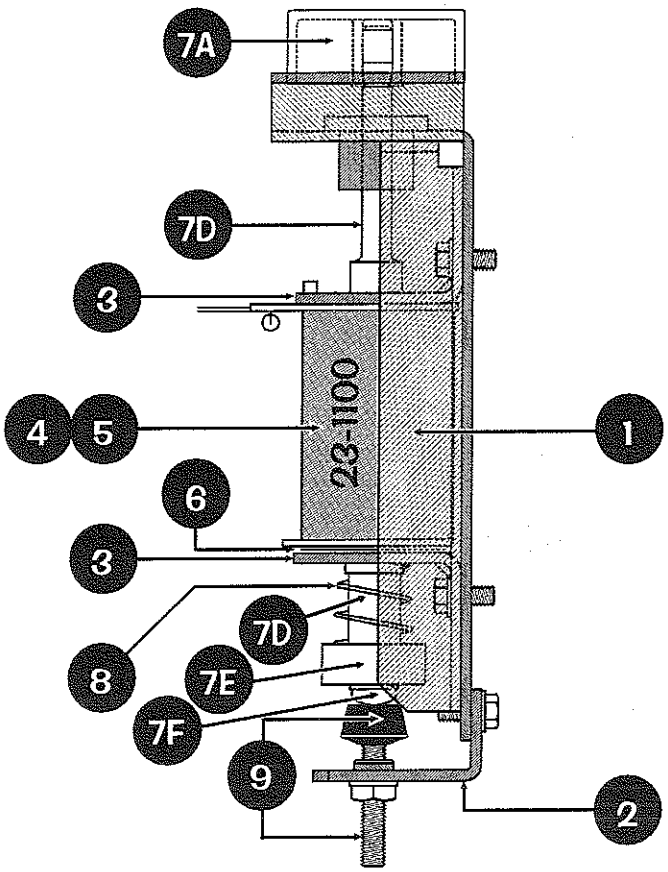
3	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Solid Plunger Assembly	1	515-6858-00
7	Compression (Relay) Spring	1	266-5022-01
8	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00

Item 8 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)

Ball Deflector Assembly (500-5788-02) is secured under the playfield by:
#8-32 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)



Up/Down Post Assembly, 500-6293-00 (Items 1-9)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Up/Down Post Coil Mounting Bracket	1	515-6840-00
2	Adjustment Spindle Stop Bracket	1	535-8303-00
3	Coil Retaining Bracket	2	535-7356-00

Items 2 & 3 are secured by: #8-32 X 3/8" Swage (Serr) Zinc (Qty. 2/per) (237-5975-00)

4	Coil, 23-1100 (ORG)	1	090-5030-00T
ORDERING ABOVE (ITEM 4) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
5	Coil Sleeve (with extension)	1	545-5847-00
6	Spring Washer, 17/32" ID X 3/4" X 1"	1	269-5002-00
7	Plunger & Shaft Assembly	1	515-6844-00
ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:			
7A	Ball Bumper Plastic (Top) Red	1	550-5029-02
7B*	Roll Pin, 3/32" ø X 1/2" Long	1	251-5002-00
7C*	Retaining Ring, 1/4" ø Shaft	1	270-5002-00
7D	Plunger & Shaft Sub-Assembly	1	515-6841-00
7E	Plunger Head	1	530-5511-00
7F	#10-32 X 3/8" PPH MS (Sems) Zinc	1	232-5401-00
8	Compression (Relay) Spring	1	266-5022-01
9	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00

Item 9 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)

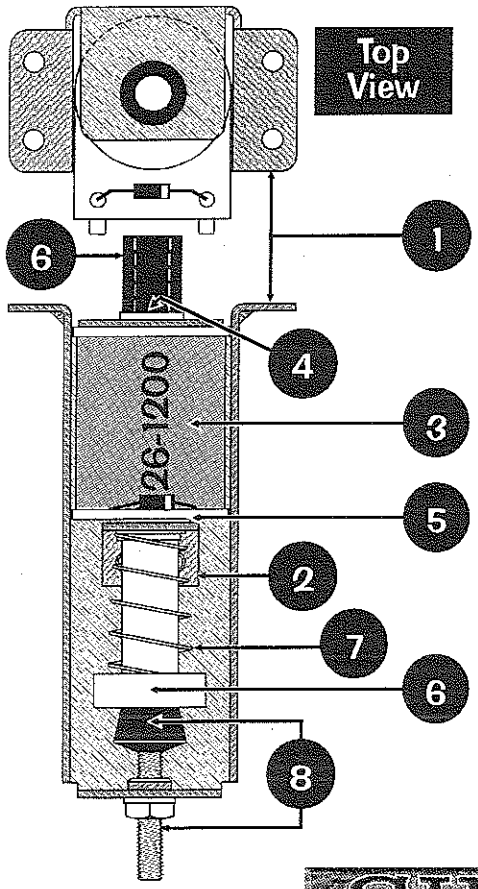
Up/Down Post Assembly (500-6293-00) is secured under the playfield by:
#8-32 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)

Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

1. Item **7D**, part of Item **7**, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.

Ball Deflector (in Top Left Orbit) Assembly, 500-6433-00-72 (Items 1-8)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
2	Coil Retaining Bracket	1	535-5203-03

Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)

3	Coil, 26-1200	1	090-5044-00T
ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
4	Coil Sleeve (Short) (Formost #10-7077)	1	545-5076-01
5	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
6	Solid Plunger Assy. (Tapered Top)	1	515-7089-00
	Post Black Rubber (Sleeve Tall)		545-5308-00
7	Compression (Relay) Spring	1	266-5022-01
8	#10-32 Adj. Spindle Stop w/Rubber Tip	1	280-5014-00

Item 8 is secured by: #10-32 Keps Nut (Qty. 1) (240-5208-00)

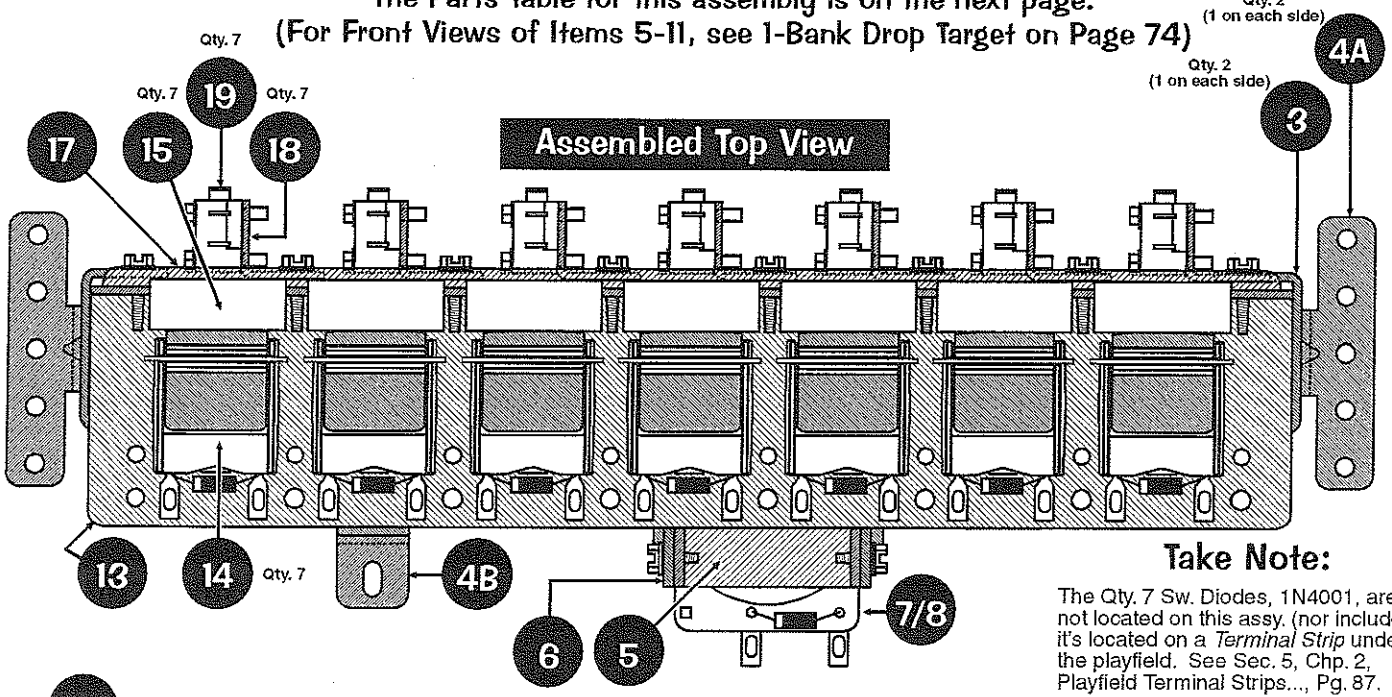
Ball Deflector Assembly (500-6433-00-72) is secured under the playfield by:
#8-32 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)

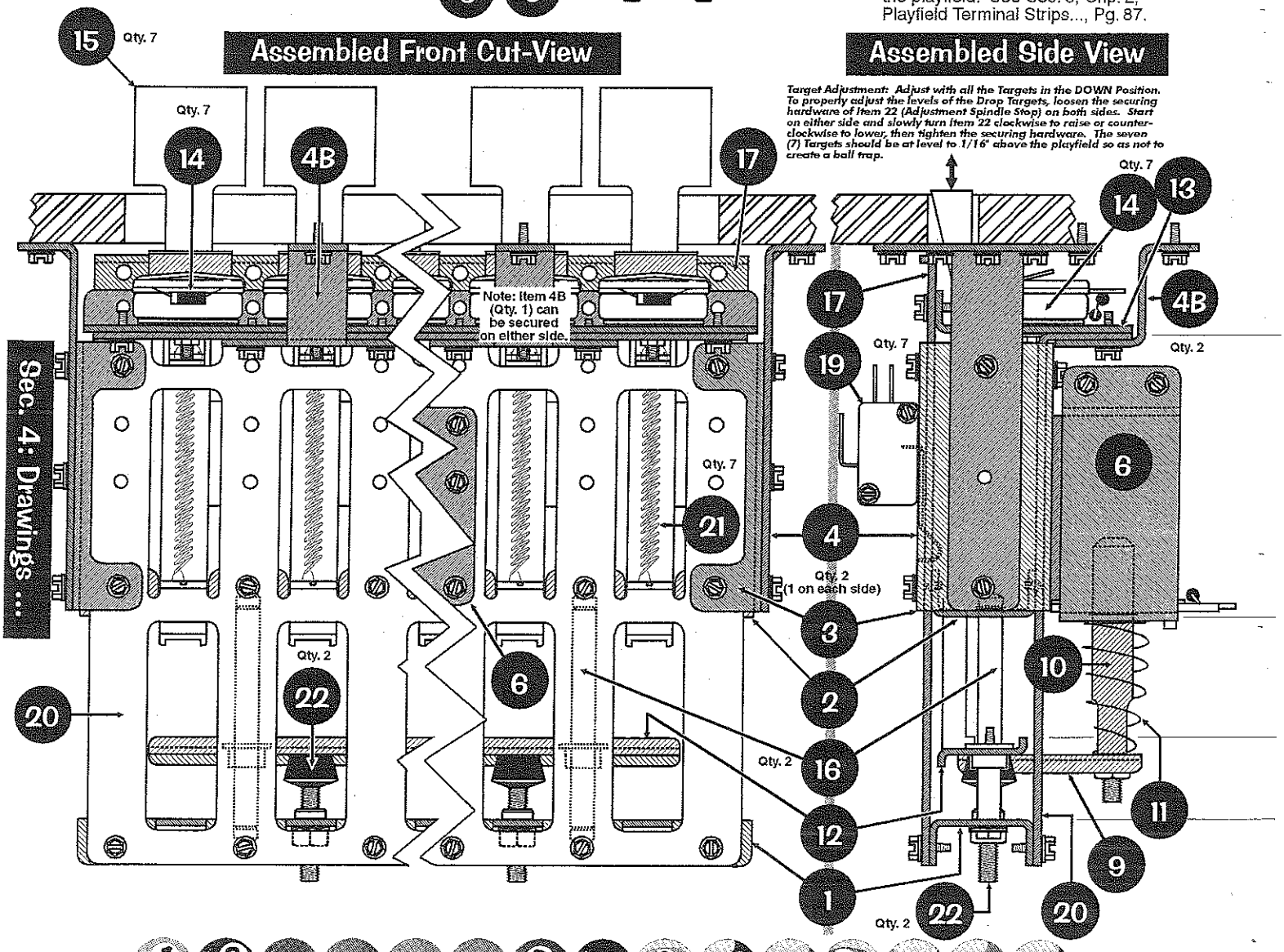
Usage Note: This Ball Deflector Assembly, 500-6433-00-72, is similiar to the Ball Deflector Assembly, 500-5788-02. The only difference is Item 6.

7-Bank Drop Target Assembly, 500-6345-07 (Items 1-22)

The Parts Table for this assembly is on the next page.

(For Front Views of Items 5-11, see 1-Bank Drop Target on Page 74)





7-Bank Drop Target Assembly, 500-6345-07 (Items 1-22)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Guide Brkt. (7-Bank) *with Pem Nuts*	1	515-6904-**07**
2	Guide Brkt. (7-Bank) *without Pem Nuts*	1	535-8408-**07**
3	Mounting Plate Housing Side	2	535-8415-00
4A	Mounting Bracket Side (Long Feet)	1	535-8416-00
4B	Mounting Bracket Front	2	535-8700-00
5	Coil Housing Stop Bracket Sub-Assy.	1	515-6905-00
6	Coil Housing Bracket	1	535-8411-00
7	Coil, 23-1100	1	090-5030-00T
ORDERING ABOVE (ITEM 7) COIL PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
8	Coil Sleeve	1	545-5709-00
9	Plunger Lift Bracket	1	535-8413-00

Item 9 is secured under Item 12: #10-32 X 3/8" SHWH (Ser) Swage (Qty. 2) (237-5985-00)

10	Drive Coil Plunger	1	530-5522-00

Item 10 is secured under Item 9: #10-32 Nylon Stop Nut (Qty. 1) (240-5203-00) **and over Item 9:** #10 Lock Washer (Qty. 1) (246-5002-00)

11	Compression Spring	1	266-5020-00
12	Reset/Stop Bracket Assy. (7-Bank)	1	515-6903-**07**
13	Trip Coil Mounting Bracket (7-Bank)	1	535-8410-**07**

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
14	Trip Coil, 32-1250 (Mini, YEL) Assy.	7	515-6916-01
ORDERING ABOVE (ITEM 14) COIL ASSY PART Nº WILL INCLUDE:			
—	Diode, 1N4004 (positioned at top) Coil riveted onto Weldment Bracket	1	112-5003-00

Item 14 is secured onto Item 13 by: #8-32 Nylon Stop Nut (Qty. 1/per) (240-5102-00), Nylon Washer .171" ID X .625" OD X .062" (Qty. 1/per) (242-5063-00) **and** #8 Washer (Qty. 1/per) (242-5005-00)

15	Drop Target White (Rollover)	7	545-5533-01

HOW TO REMOVE DROP TARGET: See Inside Cover

16	Drop Target Guide Shaft	2	530-5521-00

Item 16 is secured to Items 1 & 2 by: Retaining Ring, 1/4" ø (Qty. 2/per) (270-5002-00)

17	Switch Support Bracket (7-Bank)	1	535-8407-**07**
18	Switch Bracket	7	535-8414-00
19	Switch (D/T)	7	180-5158-00

Item 19 is secured to Item 18 by: #4-40 X 5/8" HWH MS (Ser) Zc (Qty. 2/per) (237-5945-00)

20	Spring Support Bracket (7-Bank)	1	535-8420-**07**
21	Spring (D/T Reset)	7	265-5003-00
22	#10-32 Adj. Spindle Stop w/Rubber Tip	2	280-5014-00

Item 22 is secured by: #10-32 Keps Nut (Qty. 1/per) (240-5208-00)

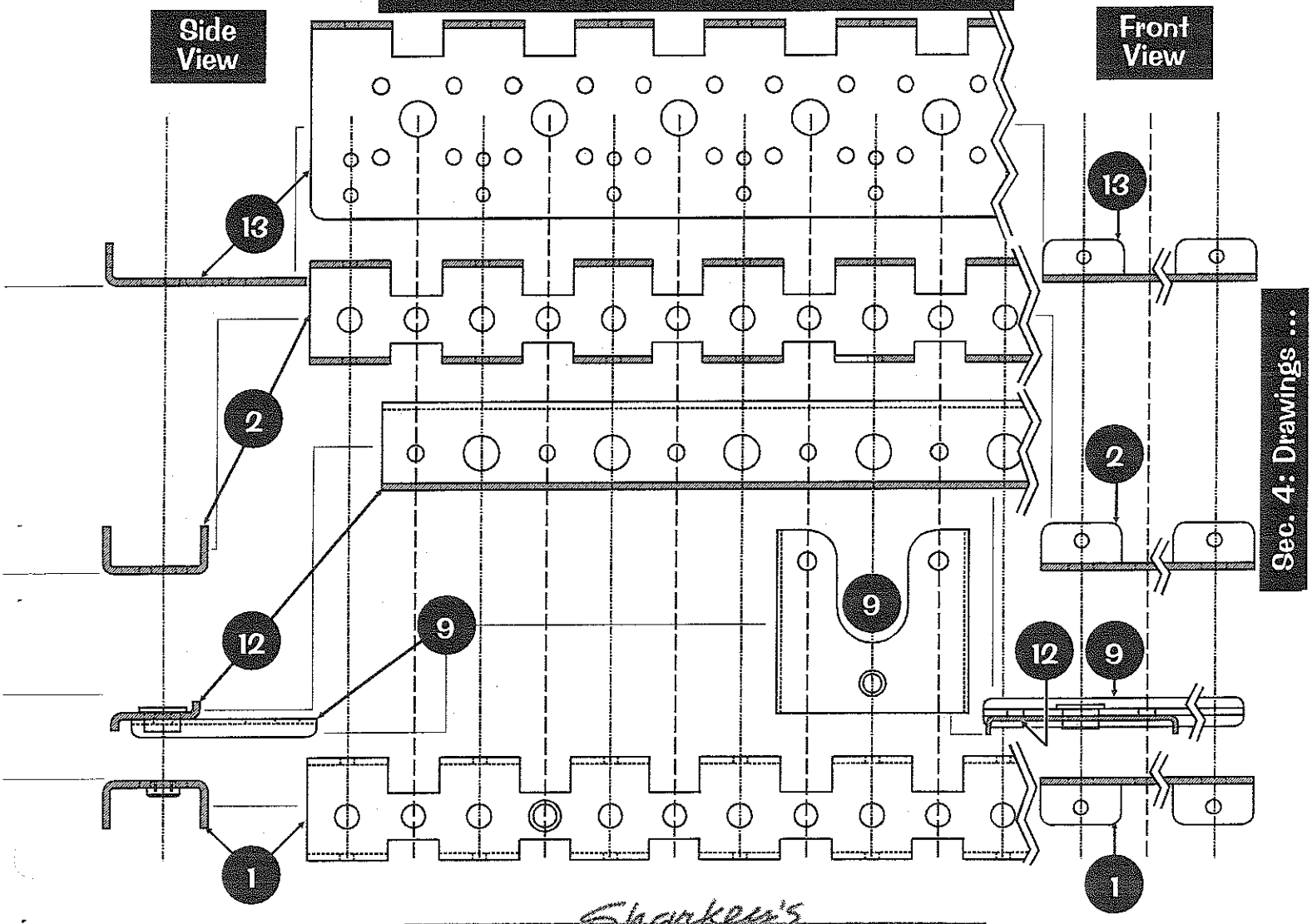
Items 1-6, 13, 17, 18 & 20 are secured by: #8-32 X 3/8" HWH MS Type C (237-5903-00)
Item 1 = 4 Item 2 = 2 Item 3 = 8 Item 4A = 4 Item 4B = 2 Item 5 = 4 Item 6 = 3
Item 13 = 6 Item 17 = 6 Item 18 = 14 *(Qty. Total = 53)*

7-Bank Drop Target Assembly (500-6345-07) is secured under the playfield through Items 4A/4B by: #8-32 X 1/2" SHWH AB (Zinc) (Qty. 12) (234-5101-00)

Take Note:

Top & Side Views are "cut" to fit page & are on same the horizontal line with the Assembled Side View on the previous page.)

Individual Views of Hard-To-See Items



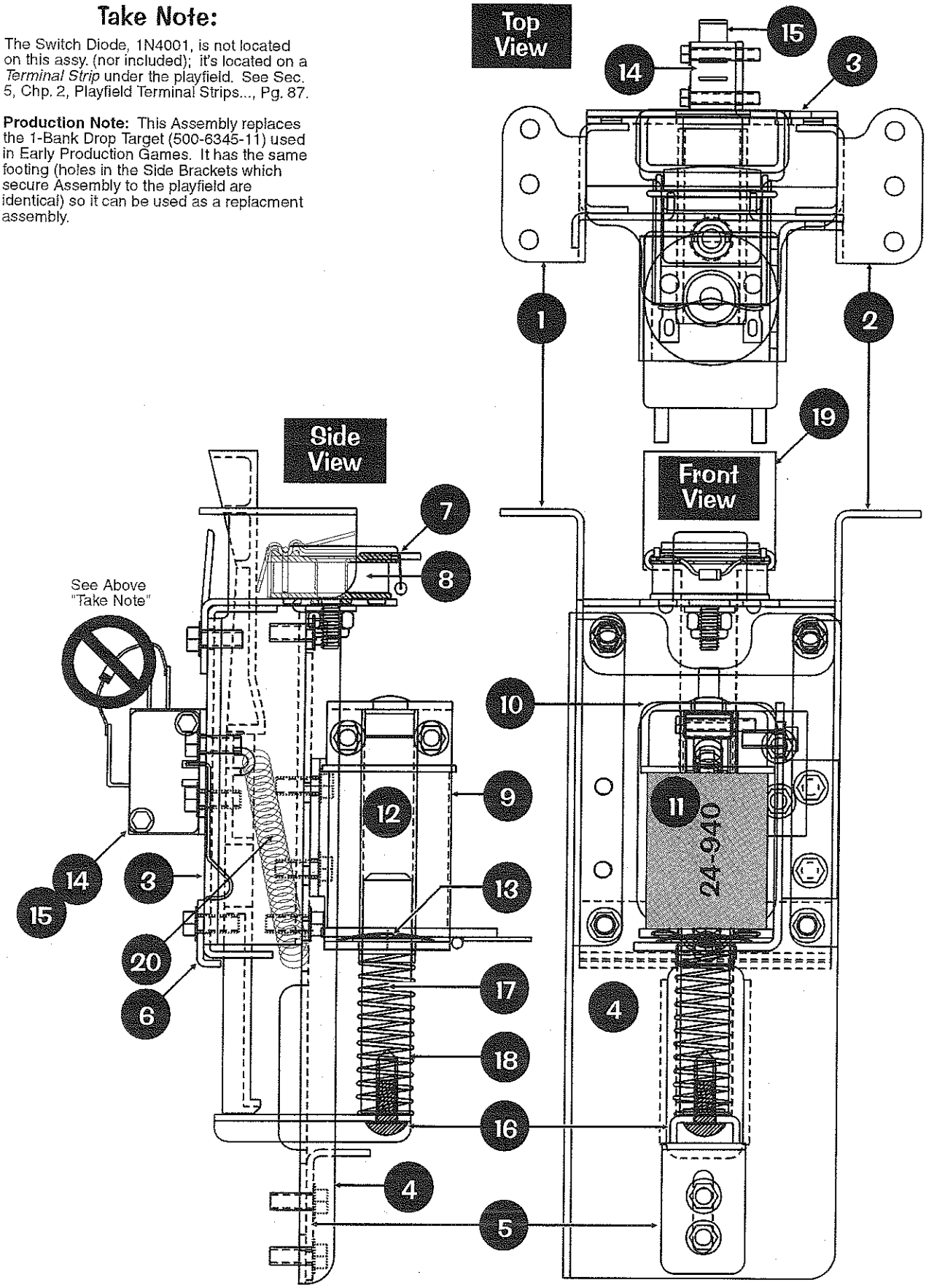
New 1-Bank Drop Target Assembly, 500-6440-01 (Items 1-20)

The Parts Table for this assembly is on the next page.

Take Note:

The Switch Diode, 1N4001, is not located on this assy. (nor included); it's located on a *Terminal Strip* under the playfield. See Sec. 5, Chp. 2, Playfield Terminal Strips..., Pg. 87.

Production Note: This Assembly replaces the 1-Bank Drop Target (500-6345-11) used in Early Production Games. It has the same footing (holes in the Side Brackets which secure Assembly to the playfield are identical) so it can be used as a replacment assembly.



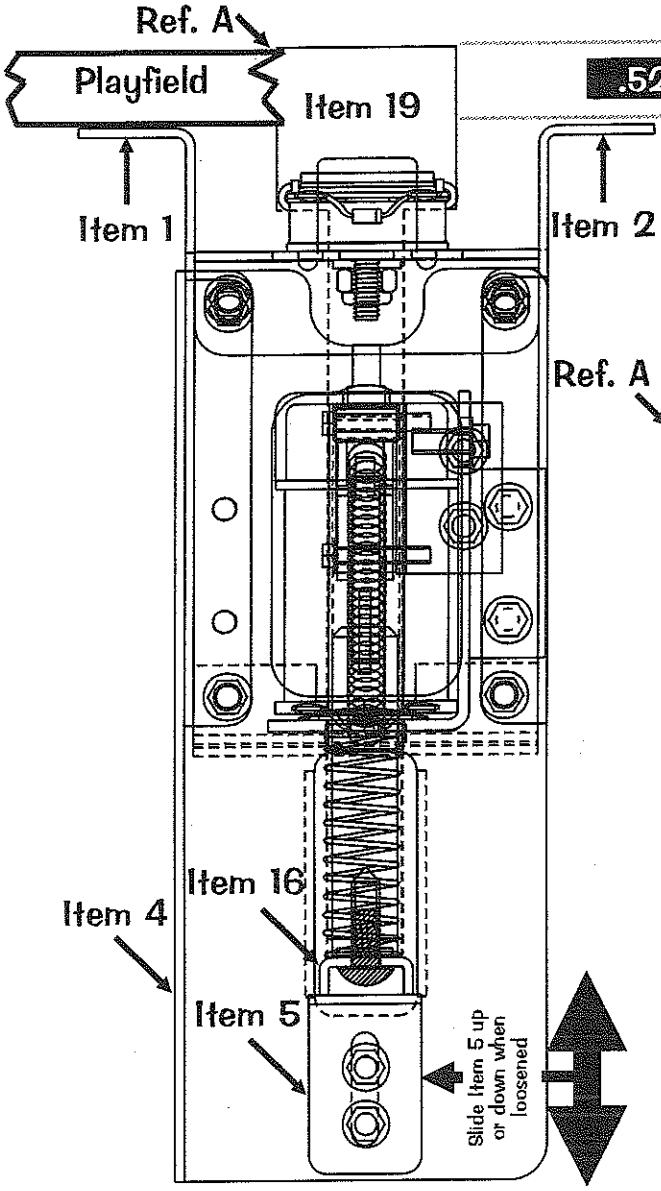
New 1-Bank Drop Target Assembly, 500-6440-01 (Items 1-20) Continued

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bracket Drop Target (Left Side)	1	535-8746-00
2	Bracket Drop Target (Right Side)	1	535-8746-01
3	Back Plate (1-Bank Drop Target)	1	535-7713-00
4	Bracket, Support (1-Bank D/T)	1	535-7712-00
5	Bracket, Height Adjustment	1	535-7709-00
6	Bracket, Target Retainer (1-Bank D/T)	1	535-7728-00
7	Bracket, Trip Coil Mounting	1	535-8745-00
8	Coil, 32-1250 (Mini, **YEL**) Assembly	1	515-6916-01
	Item 8 is secured to Item 7: #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00) **and** #8 Washer (Qty. 1) (242-5005-00). *To order Items 7 & 8 assembled with securing hardware, use SPI Nº: 515-7113-00.*		
9	Bracket, Coil Housing	1	535-7707-00
10	Bracket Cap, Coil Housing	1	515-6533-00
11	Coil, 24-940	1	090-5036-00B
	ORDERING ABOVE (ITEM 11) COIL PART Nº WILL INCLUDE:		
	Diode, 1N4004 (positioned at bottom)	1	112-5003-00

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Coil Sleeve	1	545-5709-00
13	Spring Washer	1	269-5002-00
	To order Items 9-13 assembled with securing hardware, use SPI Nº: 515-6535-01.		
14	Bracket, Switch (1-Bank D/T)	1	535-7710-00
15	Switch (D/T)	1	180-5158-00
	Item 15 is secured to Item 14 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)		
16	Bracket, Target Lift (1-Bank D/T)	1	535-7706-01
17	Plunger (Drive Coil)	1	530-5410-00
	Item 17 is secured to Item 16 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)		
18	Spring Return (Plunger Compression)	1	266-5020-00
19	Drop Target White (Rollover Target)	1	545-5533-01
20	Spring, Target Reset	1	265-5003-00

Items 1-3, 5, 9-10 are secured by: #8-32 X 3/8" HWH Swage (Qty. 16) (237-5975-00)

1-Bank Drop Target Assembly (500-6440-01) is secured under the playfield through Items 4 by: #8-32 X 1/2" SHWH AB (Zinc) (Qty. 6) (234-5101-00)



Target Height Adjustment Procedure:

1. Adjust the height of the top of ***Item 19*** (Rollover Target) at .52" (+/- .01"), relative to ***Items 1 & 2*** (Left & Right Side Brackets), as shown left. *Adjustment should be made with **Item 19** (...Target) in the **DOWN POSITION**.*

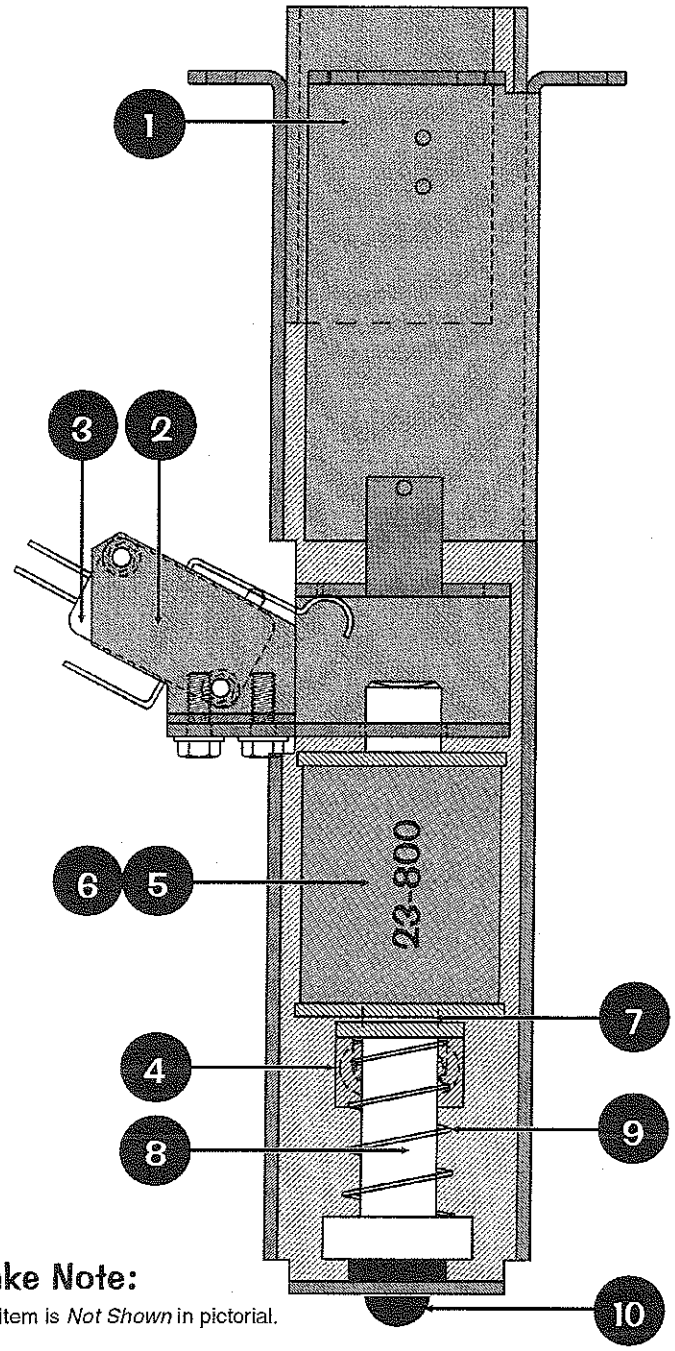
Keep in Mind: This adjustment procedure should have the **TOP SIDE** of ***Item 19*** (...Target) *"flush to slightly above"* the *playfield surface* after reinstalling to the underside of the Playfield. This will ensure a **BALL TRAP** is not created where the ball can rest in the target hole above the playfield.

2. Loosen the **securing hardware** for ***Item 5*** (Height Adjustment Plate) attached to ***Item 4*** (Support Bracket). ***Hint:*** *After loosening the screws, hand-tighten just enough so the* Adjustment Plate only moves with your touch.

3. Slide ***Item 5*** (Height Adj. Plate) either **UP** or **DOWN** causing ***Item 16*** (Target Lift Bracket) to raise or lower ***Item 19*** (...Target) to desired height.

4. Tighten the **securing hardware** for ***Item 5*** (Height Adj. Plate) enough so the plate will not move. *Do Not Over Tighten.*

Super VUK (Vertical Up-Kicker) Assembly, 500-6184-05 (Items 1-10)



Take Note:

* An asterisk (*) indicates item is *Not Shown* in pictorial.

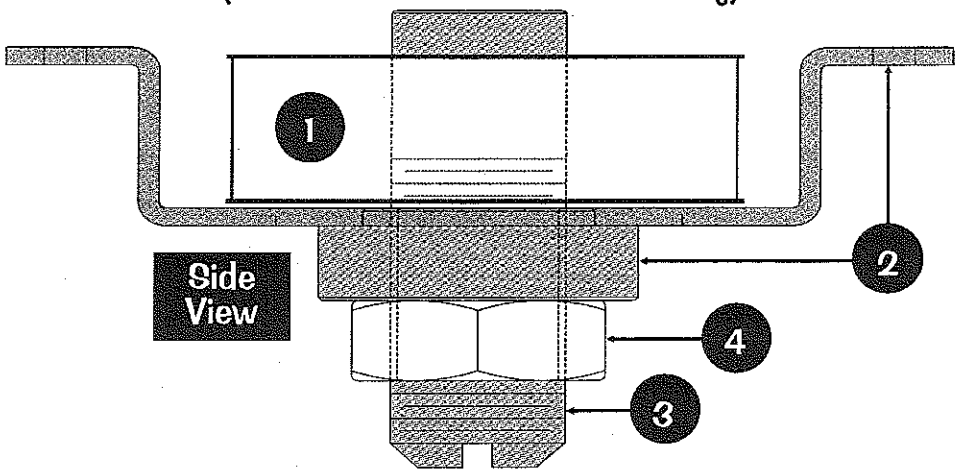
1. Note: The Switch Diode, 1N4001, is not located on this assembly (nor included); it's located on a *Terminal Strip* under the playfield. See Section 5, Chapter 2, Playfield Terminal Strips..., Page 87.

2. SPI Nº 500-6184-04 & 500-6184-05 (-05 used in this game) are identical except for the Coils: **-04 = Coil 24-940** and **-05 = Coil 23-800**

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	SVUK Mounting Weldment Bracket	1	515-6744-04
2	Super VUK Switch Bracket	1	535-8144-01
	Item 2 secured to Item 1 by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 2) (237-5976-02)		
3	Micro-Switch	1	180-5052-00
	Item 3 secured to Item 2 by: #4-40 X 5/8" MS (Serr) Zinc (Qty. 2) (237-5945-00)		
4	Coil Retaining Bracket	1	535-5203-03
	Item 4 secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
5	Coil, 23-800	1	090-5001-00T
—	ORDERING ABOVE ITEM 5) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1	112-5003-00
6	Coil Sleeve	1	545-5076-01
7	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
8	Plunger Assembly	1	515-5941-01
9	Compression (Relay) Spring	1	266-5020-00
10	Rubber Bumper (Grommet)	1	545-5105-00

Super VUK Assembly, 500-6184-05, is secured under the playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)

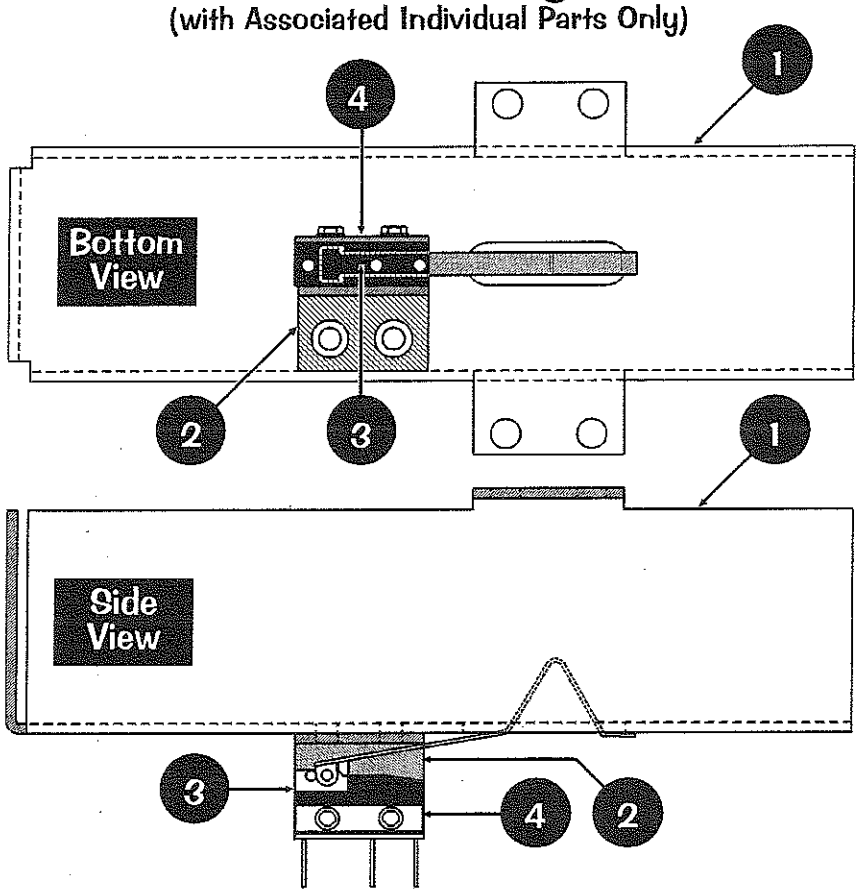
Playfield Mini-Magnet (24-780)
(with Associated Individual Parts Only)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Magnet, 24-780	1	090-5061-00	3	Threaded Core Plug	1	530-5320-00
2	Threaded Core Weld Assembly	1	515-6141-01	4	3/4" - 16 Hex Nut	1	240-5315-00

Item 2 is secured to the Playfield by: #8 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)

Metal Under-Trough
(with Associated Individual Parts Only)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº	Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Metal Under-Trough (Plain No Parts)	1	535-8681-00	4	Switch Body Protect Plate	1	535-6539-00
Item 1 is secured under the playfield by: #8-32 X 1/2" SHWH AB (Zinc) (Qty. 4) (234-5101-00)				**Items 3 & 4 are secured to item 2 by:** #2-56 X 1/2" HWH Ser UNS #4HD TR3 BO (Qty. 2) (237-5937-02)			
2	Micro Switch Bracket	1	535-7319-05	5*	Diode, 1N4001	1	112-5001-00
Item 2 is secured by: Rivet, 1/8" ø X 5/32" Lg. (Qty. 2) (249-5009-00)							
3	Micro Switch (High-Form)	1	180-5057-00				

Metal Ramp & Flap
(with Associated Individual Parts Only)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Riveted Metal Ramp Sub-Assembly	1	515-7096-00R-72
ORDERING ABOVE ® RIVETED ASSY PART Nº WILL INCLUDE:			
1A	Metal Ramp (No Parts)	1	515-6918-00
1B	Ramp Flap	1	535-8429-00
1C*	Rivet, 1/8" ø X 3/16" Lg. (for 1B)	2	249-5001-00
1D*	#6 Riveting Lock Washer (for 1B)	2	246-5000-00

Item 1B is secured to the Playfield by: #4 X 5/8" PFH Black (Qty. 2) (237-5833-00)

2	Gate (Roll-Under 1-1/2" Gold) Assy.	1	515-6490-06
ORDERING ABOVE (ITEM 2) SUB-ASSY PART Nº WILL INCLUDE:			
2A	Gate Bracket (Gold)	1	535-8529-00
2B	Wire Form (Gold) (on above item)	1	535-8530-00
2C	Micro Switch (for Roll-Under Gate)	1	180-5087-00
2D	Switch Body Protect Plate	1	535-6539-00
2E*	Diode, 1N4001	1	112-5001-00
2F*	#2-56 X 1/2" HWH Ser UNS #4HD TF3 BO	2	237-5937-02

Item 2 is secured to Item 1 by: #6 X 1/2" HWH Swage Ser (Zinc) (Qty. 2) (237-5976-03)

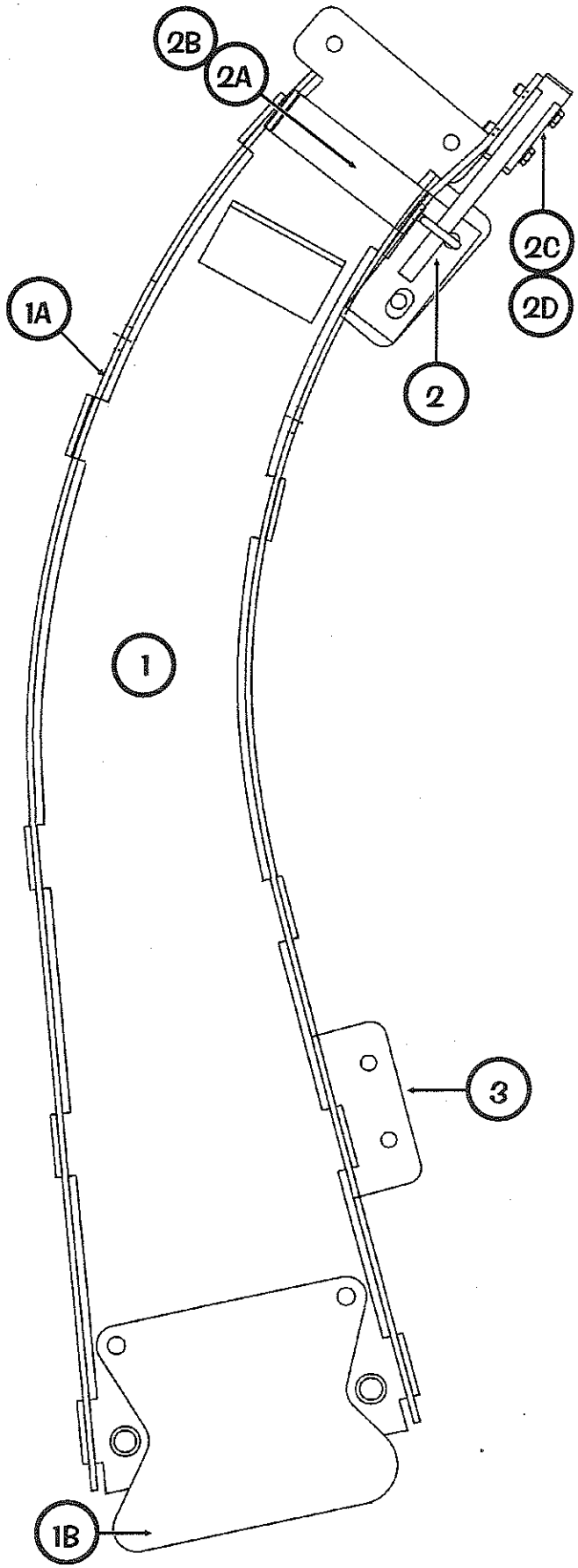
3	Plastic (Buty.) Piece -28	1	830-5974-28

Item 3 is secured to Item 1 by: #6 X 1/2" HWH Swage Ser (Zinc) (Qty. 2) (237-5976-03) **and** 1" X 1/4" Hex Spacer #6-32 Tap (Qty. 1) (254-5008-06)

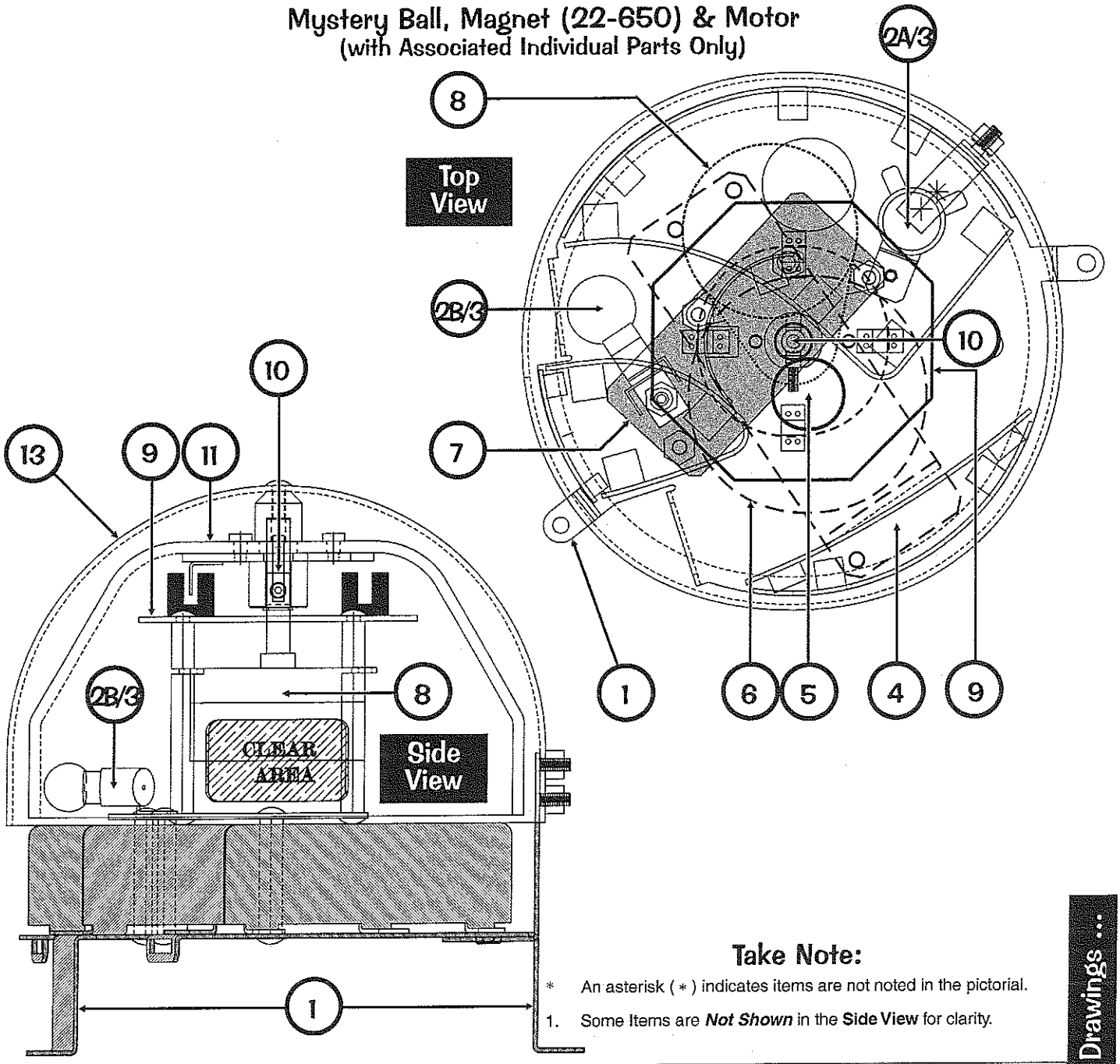
Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.

® "R" indicates item has a riveted-on part(s), if removing/adding rivets is not an option, order the entire ® Sub-Assembly. ***Please Note:*** If the ® Sub-Assembly **is not** available, call Technical Support.



Mystery Ball, Magnet (22-650) & Motor
(with Associated Individual Parts Only)



Take Note:

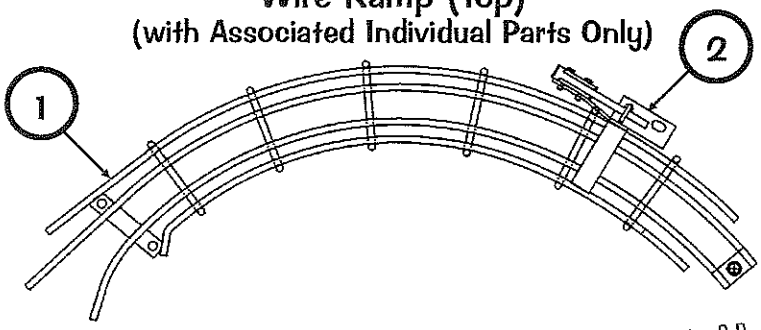
* An asterisk (*) indicates items are not noted in the pictorial.

1. Some Items are ***Not Shown*** in the **Side View** for clarity.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mystery Ball Platform Weldment	1	515-7092-00
	Item 1 is secured to Posts on P/F by: #6-32 Elastic Stop Nut (Qty. 2) (240-5005-00)		
2A	Stand-Up Socket Rev. Short	1	077-5103-00
	Item 2A is secured by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 1) (237-5976-02)		
2B	Laydown Standard Socket	1	077-5100-00
	Item 2B is secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00)		
3	#89 Bulb	2	165-5000-89
4	Threaded Core Mounting Bracket	1	535-8686-00
	Item 4 is secured by: #8-32 X 1/2" HWH Swage (Serr) Zinc (Qty. 3) (237-5975-01)		
5	Threaded Core Plug	1	530-5560-00
	Item 5 is secured by: #8-32 X 3/8" Socket Head Cap Screw (Zinc) (Qty. 1) (237-5897-00)		
6	Magnet, 22-650	1	090-5042-01
7	Motor Mounting Bracket	1	535-8690-00
	Item 7 is secured by: #6-32 X 1/4" PFH MS (Zinc) (Qty. 2) (237-5853-00), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 5) (232-5201-00), 1-1/2" X 1/4" Hex Spacer #6-32 Tap (Qty. 2) (254-5008-09) **and** 1-1/4" X 1/4" Hex Spacer #6-32 Tap (Qty. 3) (254-5008-11)		
8	Motor Assembly (Includes cable)	1	515-7095-00-72
	Item 8 is secured by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
	Order Model-E Motor (24v AC 50/60Hz 3W 20 RPM CW) with no cable use SPI PN: **041-5076-00.**		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
9	Motor 4-Pos. OPTO PC Board	1	520-5194-00
	Item 9 is secured by: 1/2" X 1/4" Hex Spcr. #6-32 Tap (1 Male-End) (Qty. 2) (254-5024-03) **and** #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00)		
10	Cam Plate & Hub Sub-Assy.	1	515-7094-00
	Item 10 is secured by: #8-32 X 1/4" Set Screw (Qty. 2) (237-5908-00) **and** Washer 1/4" X 7/16" OD X 1/32" (Qty. 1) (242-5012-00)		
11	Value Dome (Inside Motor Cover)	1	545-5950-00
	Item 11 is secured by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 2) (237-5976-02)		
12*	OPTO Shield (Fiche Paper)	1	545-5955-00
	Item 12 is secured by: #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00) *under Item 9 Securing Hardware Spacers.*		
13	Mystery Ball Cover (Outside Shell)	1	545-5897-01
	Item 13 is secured by: Stabilizer Bushing (Qty. 1) (530-5561-00), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00), #6 Washer (Qty. 2) (242-5001-00), #6-32 Nylon Stop Nut (Qty. 2) (240-5010-00)		
14*	Decal Set for Mystery Ball Labels	1	820-6268-XX
	The Mystery Ball also has 3 Decals on the Outside (820-6267-03 ?-Ball Mid, 820-6267-04 ?-Ball Left & 820-6267-05 ?-Ball Right) which may not be available as separate pieces. Order the entire Decal Sheet Set of 820-6267-XX.		

Wire Ramp (Top)
(with Associated Individual Parts Only)



Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Wire Ramp (Top)	1	535-8431-00

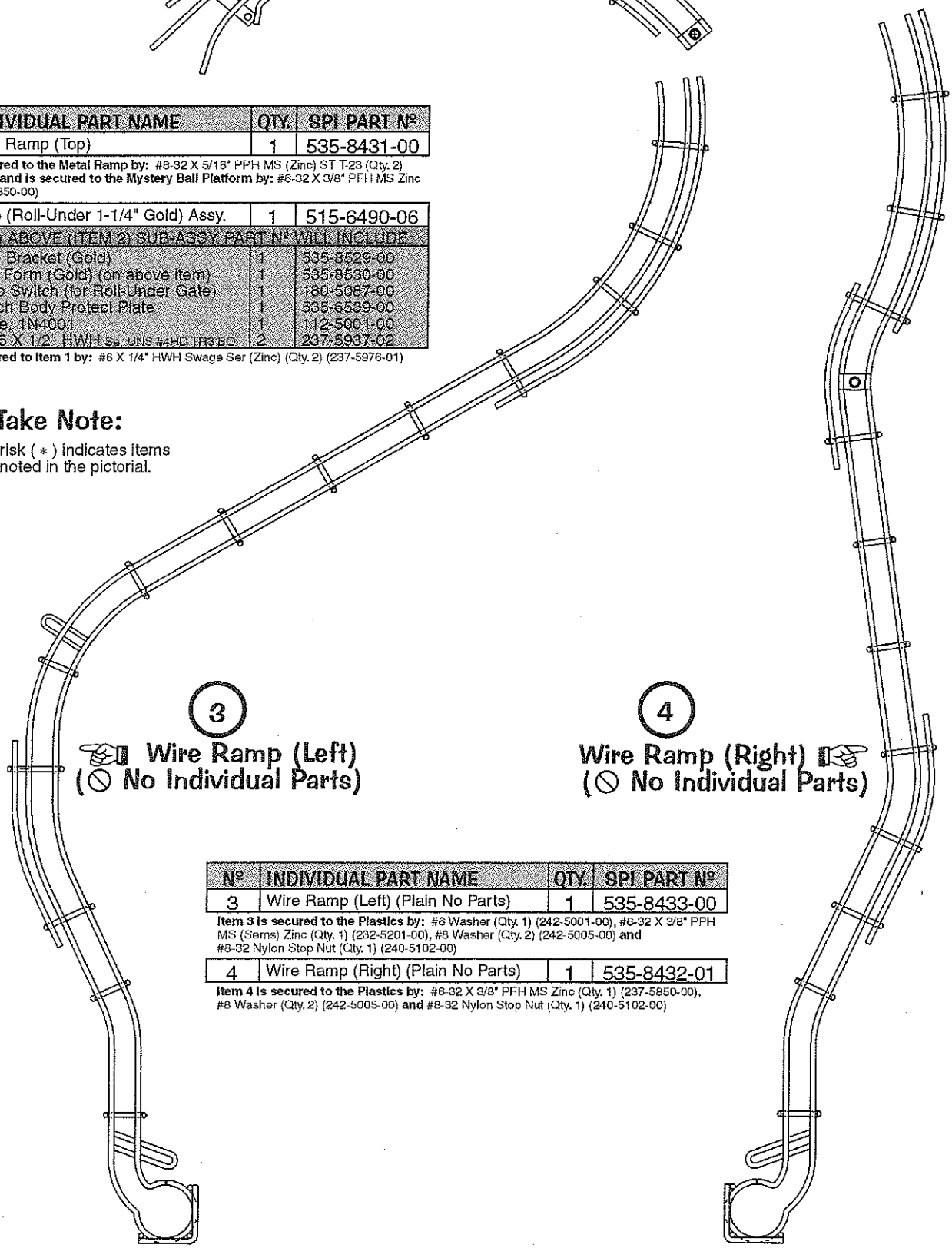
Item 1 is secured to the Metal Ramp by: #6-32 X 5/16" PPH MS (Zinc) ST T-23 (Qty. 2) (237-5808-00) **and is secured to the Mystery Ball Platform by:** #6-32 X 3/8" PFH MS Zinc (Qty. 1) (237-5850-00)

2	Gate (Roll-Under 1-1/4" Gold) Assy.	1	515-6490-06
ORDERING ABOVE (ITEM 2) SUB-ASSY PART Nº WILL INCLUDE:			
2A*	Gate Bracket (Gold)	1	535-8529-00
2B*	Wire Form (Gold) (on above item)	1	535-8530-00
2C*	Micro Switch (for Roll-Under Gate)	1	180-5087-00
2D*	Switch Body Protect Plate	1	535-6539-00
2E*	Diode, 1N4001	1	112-5001-00
2F*	#2-56 X 1/2" HWH Self UNS #4HD TR3 BO	2	237-5937-02

Item 2 is secured to Item 1 by: #6 X 1/4" HWH Swage Ser (Zinc) (Qty. 2) (237-5976-01)

Take Note:

* An asterisk (*) indicates items are not noted in the pictorial.



3

Wire Ramp (Left)
(⊘ No Individual Parts)

4

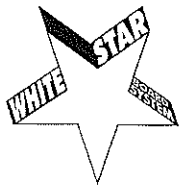
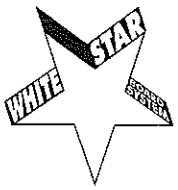
Wire Ramp (Right)
(⊘ No Individual Parts)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
3	Wire Ramp (Left) (Plain No Parts)	1	535-8433-00

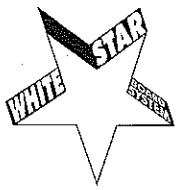
Item 3 is secured to the Plastics by: #6 Washer (Qty. 1) (242-5001-00), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00), #8 Washer (Qty. 2) (242-5005-00) **and** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)

4	Wire Ramp (Right) (Plain No Parts)	1	535-8432-01

Item 4 is secured to the Plastics by: #6-32 X 3/8" PFH MS Zinc (Qty. 1) (237-5850-00), #8 Washer (Qty. 2) (242-5005-00) **and** #8-32 Nylon Stop Nut (Qty. 1) (240-5102-00)

Section 5
Schematics & Troubleshooting
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Visit www.SternPinball.com/schematics.htm for the latest 11" X 17" Schematics (or "Split 8-1/2" X 11") for the **Display Power Supply, Display Controller, I/O Power Driver & CPU/Sound Boards** (White Star™ System Only). Along with the schematics you'll find the component layout and theory of operation. Keep visiting as these files are continuously improved with more "search" links in the documents. The files are in PDF Format (Adobe® Reader required). They may be slow to open in the website only, but once on your harddrive they'll open fast. Inside the schematics you can utilize internal links where addresses may direct you to another sheet in the schematic set (further instructions within documents). To "download" once open, in your browser click "File" "Send" "Page by eMail". It will be sent to your eMail Address, where there you can save the file to your hardrive.



Use the below ***Coils Detailed Chart Table*** in conjunction with Sec. 5, Chp. 1, Backbox I/O Power Driver Board Detailed Wiring Diagram (I/O Board Connectors J6, J7, J8 & J9) and Backbox Board Layout Wiring Diagram:

COILS DETAILED CHART TABLE

High Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#1	TROUGH UP-KICKER	Q1	I/O Pwr. Drvr.	BRN-BLK	J8-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#2	AUTO LAUNCH	Q2	I/O Pwr. Drvr.	BRN-RED	J8-P3	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#3	SUPER VUK	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00T
#4	SINGLE DROP TRGT (TRIP)	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	32-1250 515-6916-01
#5	7-BANK DROP TARGET (RESET)	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#6	SINGLE DROP TARGET (RESET)	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00T
#7	FLASH: SVUK, R. ORBIT X2	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#8	FLASH: JACKPOT X3	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

High Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#9	LEFT TURBO BUMPER	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	RIGHT TURBO BUMPER	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	BOTTOM TURBO BUMPER	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	TOP ORBIT MAGNET	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	VIO-YEL	J10-P3	50v DC	24-780 090-5061-00
#13	MYSTERY BALL MAGNET	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	VIO-YEL	J10-P3	50v DC	22-650 090-5042-01
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	23-1100 090-5030-00T

D iode O n T erminal S trip (if noted)

Low Current Coils Group 1		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn or Bulb Type
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	BALL DEFLECTOR	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#20	MTR DRV RELAY BD	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	BRN	J7-P1	20v DC	Relay Bd. 520-5010-00
#21	FLASH: LEFT CORNER X2	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#22	FLASH: RIGHT ORBIT X1	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#23	FLASH: MYSTERY BALL X2	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 031-5000-00

Low Current Coils Group 2		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA/Turn
#25	7-BANK DROP TRGT (1) (TRIP)	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	BRN	J7-P1	20v DC	32-1250 515-6916-01
#26	7-BANK DROP TRGT (2) (TRIP)	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	BRN	J7-P1	20v DC	32-1250 515-6916-01
#27	7-BANK DROP TRGT (3) (TRIP)	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	BRN	J7-P1	20v DC	32-1250 515-6916-01
#28	7-BANK DROP TRGT (4) (TRIP)	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	BRN	J7-P1	20v DC	32-1250 515-6916-01
#29	7-BANK DROP TRGT (5) (TRIP)	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	BRN	J7-P1	20v DC	32-1250 515-6916-01
#30	7-BANK DROP TRGT (6) (TRIP)	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	BRN	J7-P1	20v DC	32-1250 515-6916-01
#31	7-BANK DROP TRGT (7) (TRIP)	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	BRN	J7-P1	20v DC	32-1250 515-6916-01
#32	FLASH: 9 BALL X1	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89

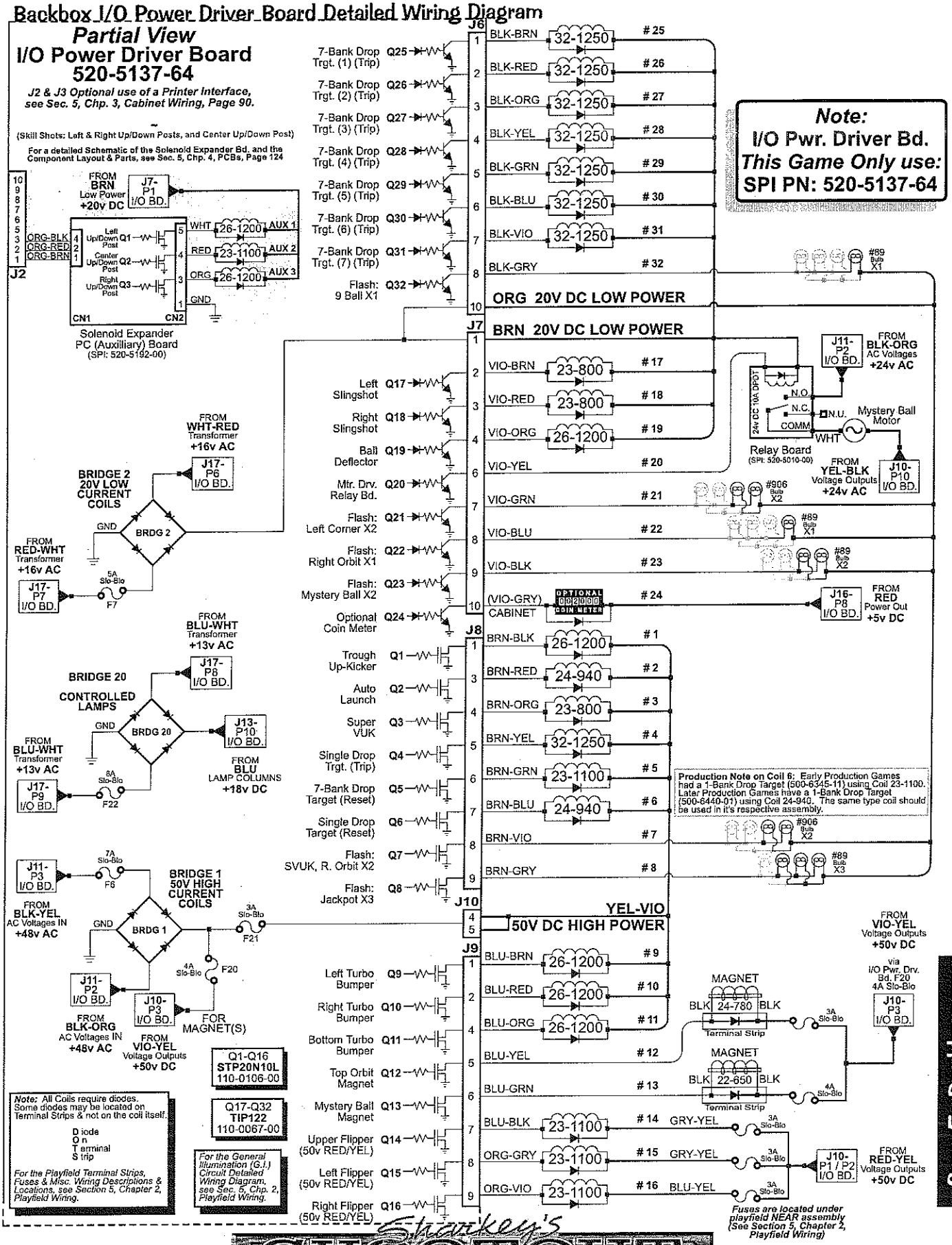
Note: In Test Flash Lamps Menu ("Flash Toon"), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game: #7-#8, #21-#22 & #32)

Auxiliary (Low Current Coils)		Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil GA-Turn
AUX 1: LEFT UP/DOWN POST		Q1	Sol. Expander (Aux. Board)	WHT	CN2-P5	BRN	J7-P1	20v DC	26-1200 090-5044-00T
AUX 2: CENTER UP/DOWN POST		Q2	Sol. Expander (Aux. Board)	RED	CN2-P4	BRN	J7-P1	20v DC	23-1100 090-5030-00T
AUX 3: RIGHT UP/DOWN POST		Q3	Sol. Expander (Aux. Board)	ORG	CN2-P3	BRN	J7-P1	20v DC	26-1200 090-5044-00T

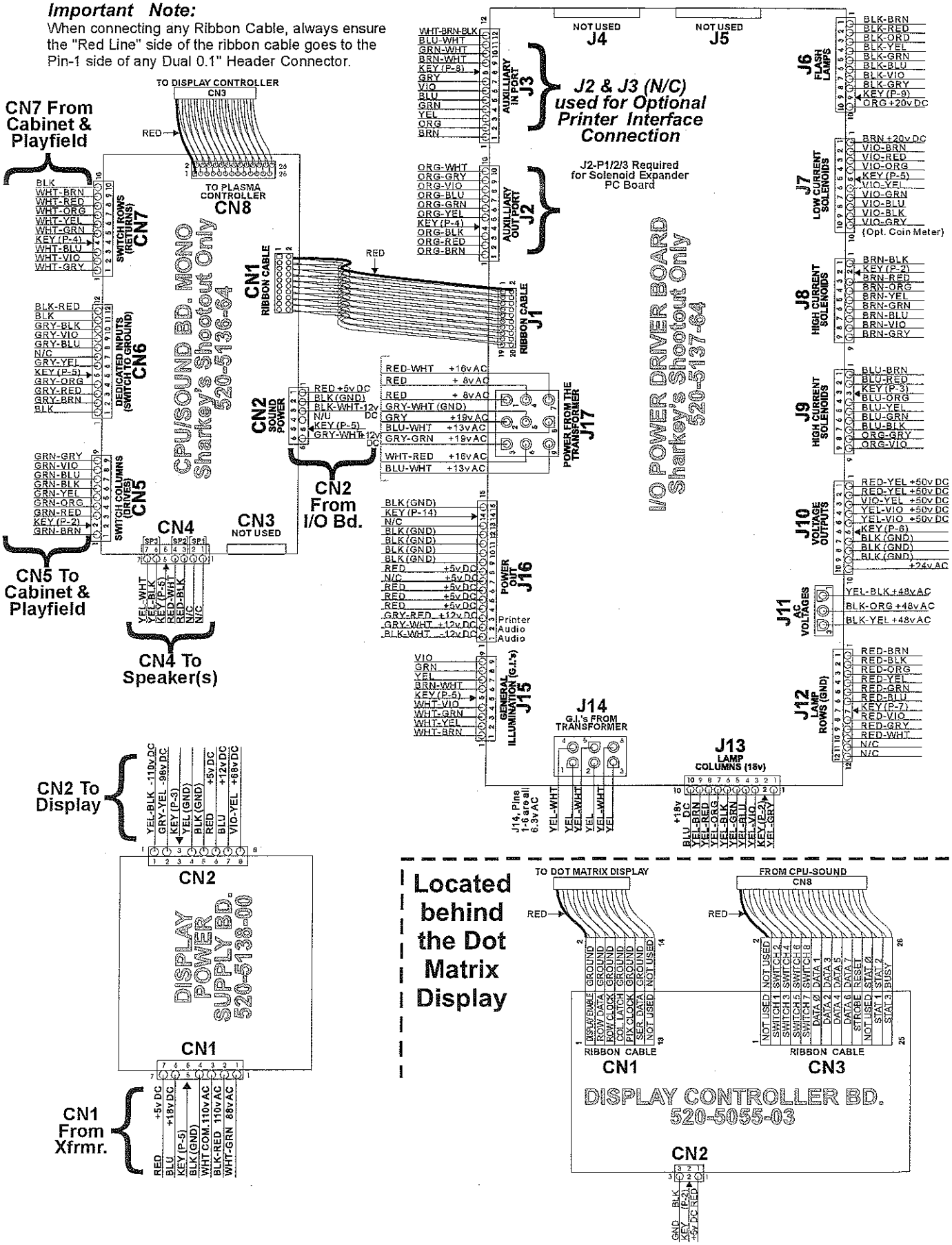


Backbox Wiring

Backbox I/O Power Driver Board Detailed Wiring Diagram

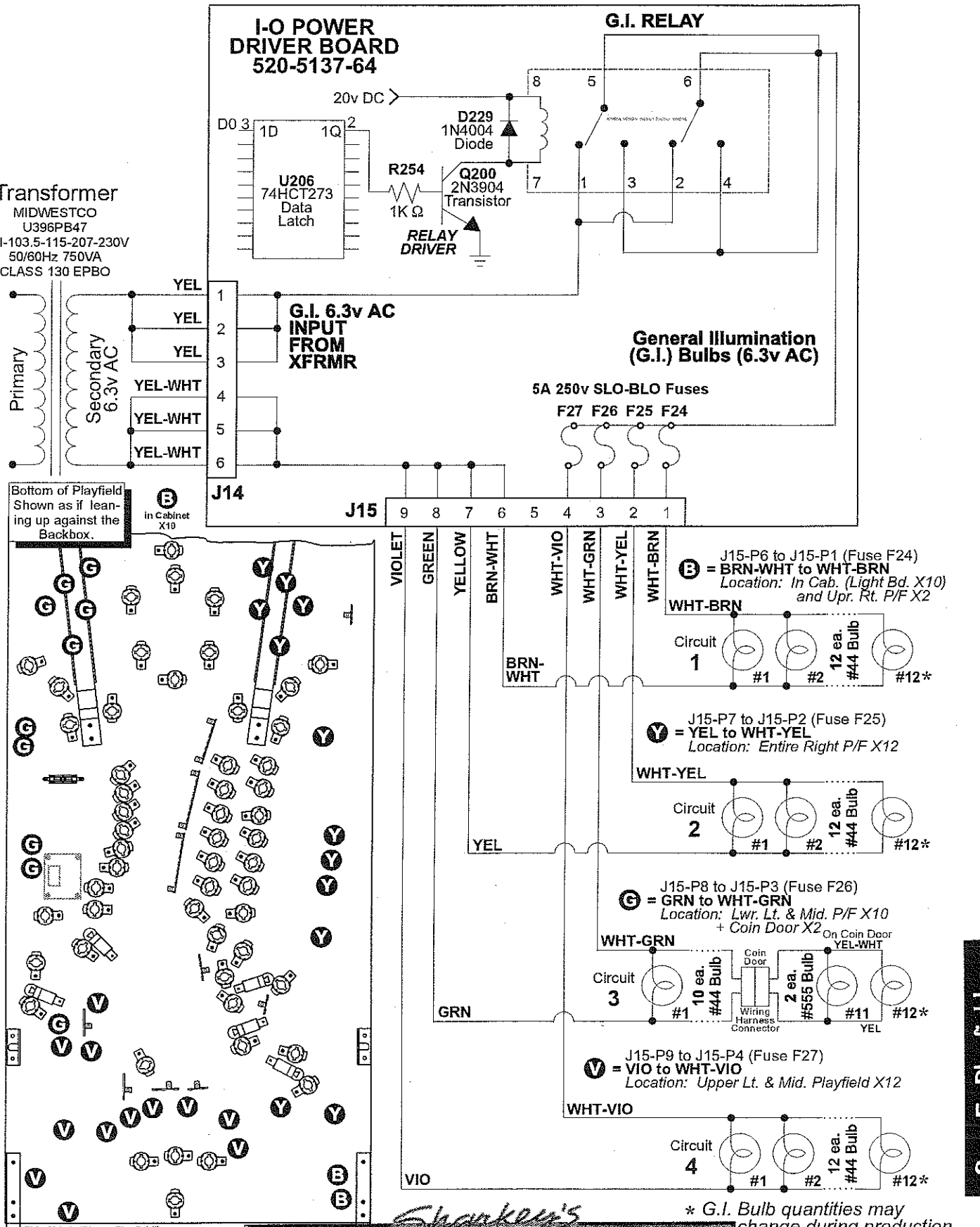


Important Note:
When connecting any Ribbon Cable, always ensure the "Red Line" side of the ribbon cable goes to the Pin-1 side of any Dual 0.1" Header Connector.



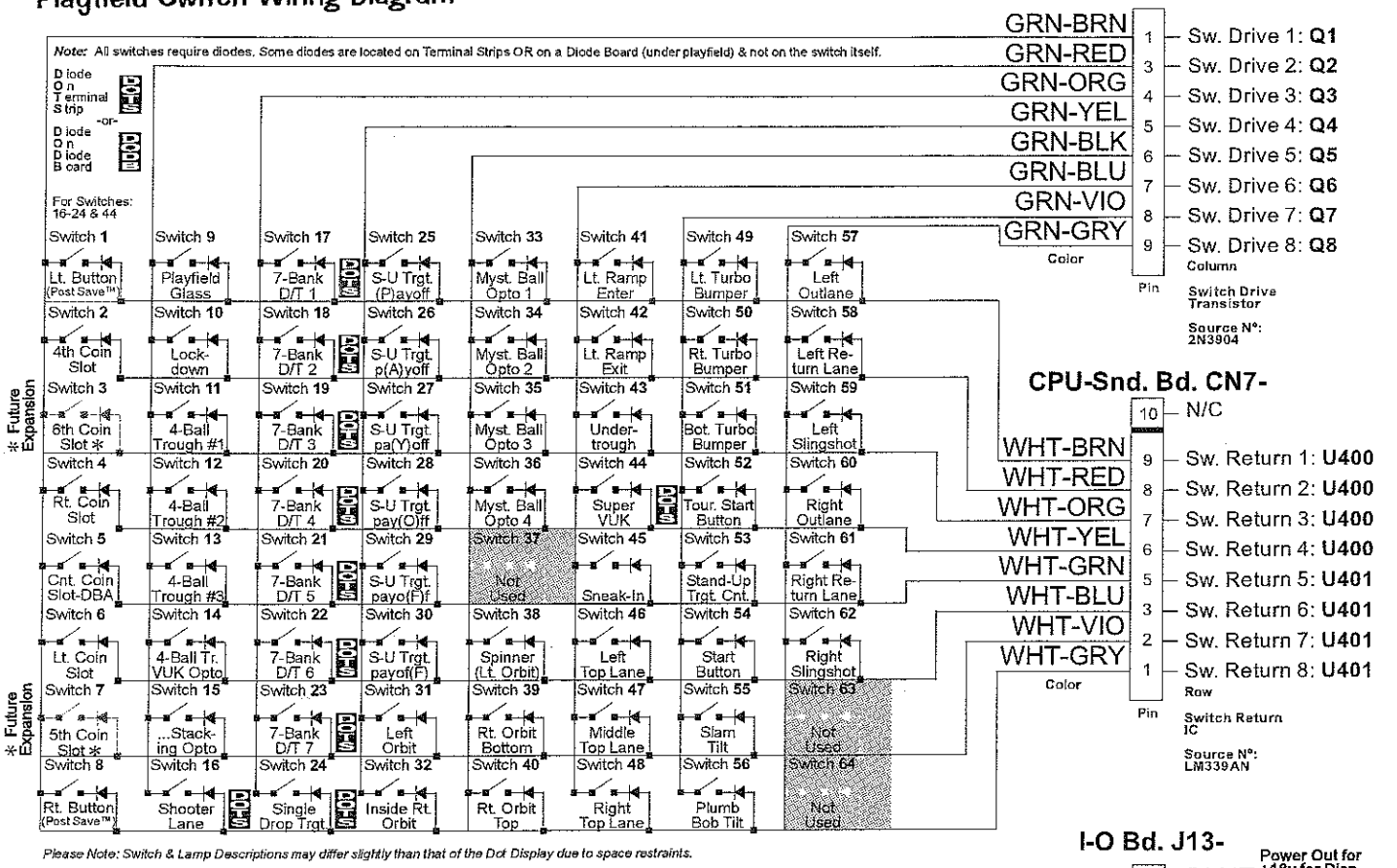
Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



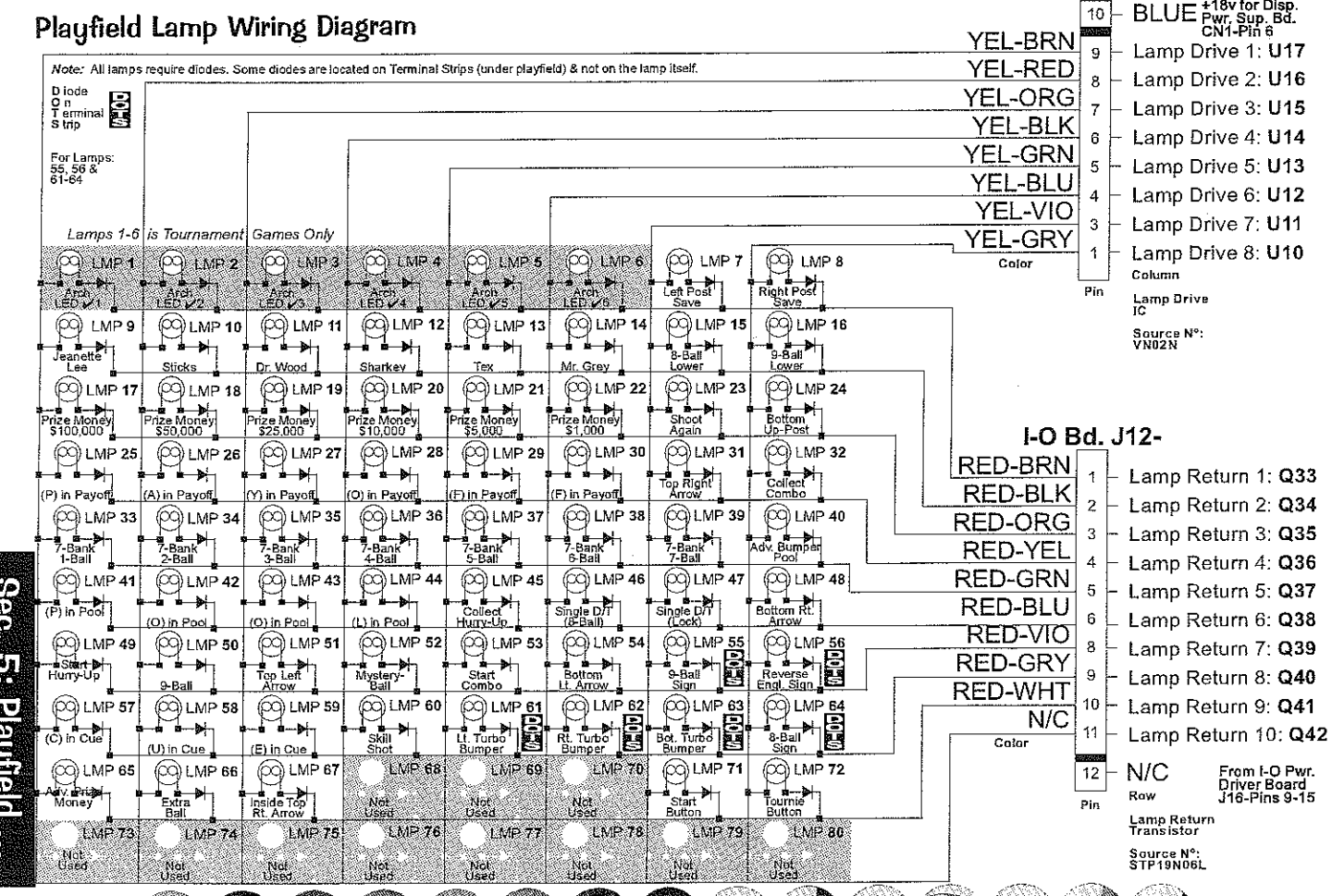
* G.I. Bulb quantities may change during production.

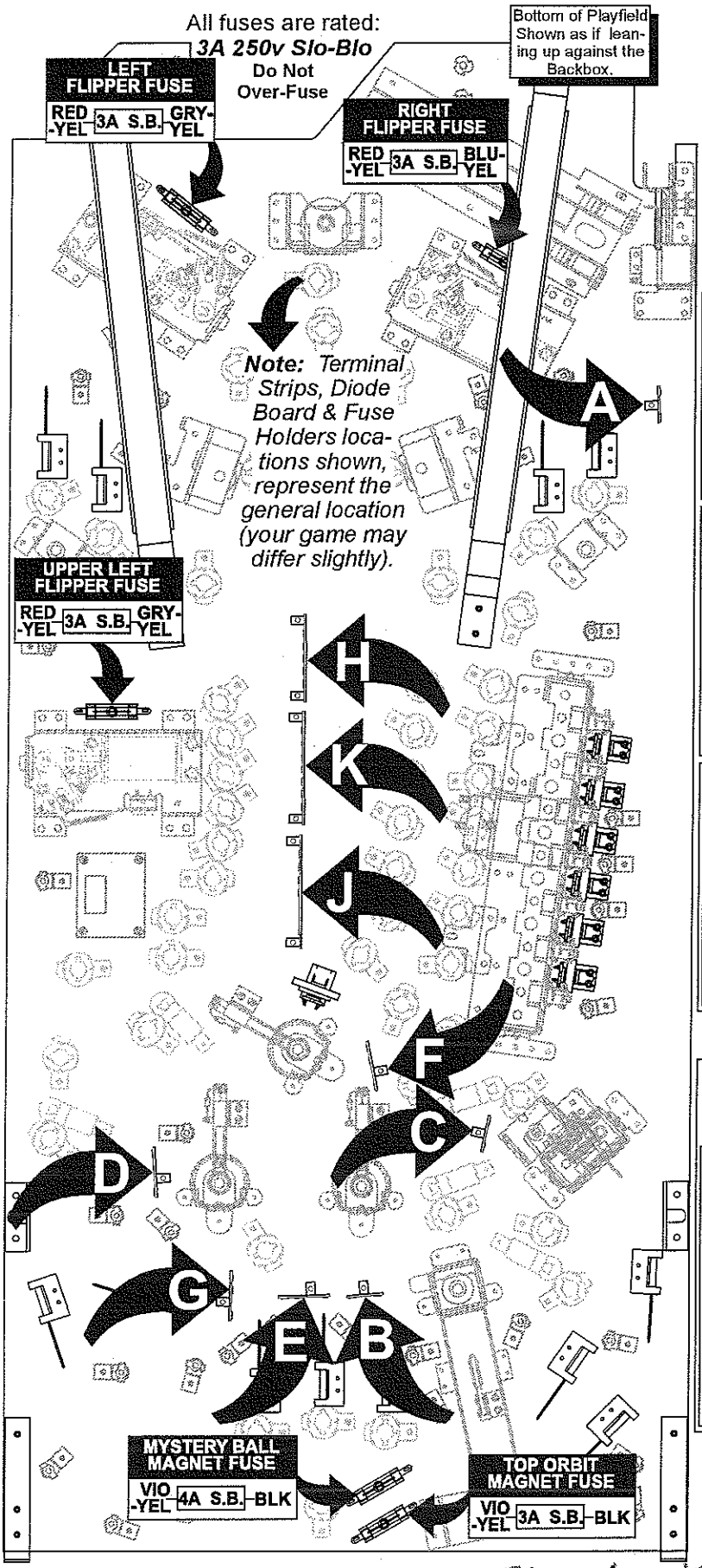
Playfield Switch Wiring Diagram



Please Note: Switch & Lamp Descriptions may differ slightly than that of the Dot Display due to space restraints.

Playfield Lamp Wiring Diagram





Explanation:
All switches, lamps, coils require diodes. The diodes not physically located on the switch, lamp or coil are located on Terminal Strips or Diode Bd. under the playfield. The Switch & Lamp Matrix Grids also note which switch or lamp has a diode on a Terminal Strip (noted by **"DOTS"** meaning: "Diode on Terminal Strip") or Diode Board (noted by **"DODB"** meaning: "Diode on Diode Board").
Note: This game there is no Diode Board used.

A Sharkey's Terminal Strip: Switch 16 Shooter Lane

Switch 16	WHT-GRY
	ORG-GRY to GRN-RED

B Sharkey's Terminal Strip: Switch 44 Super VUK

Switch 44	WHT-YEL
	ORG-YEL to GRN-BLU

C Sharkey's Terminal Strip: Lamp 64 8-Ball Sign

Lamp 64	ORG-GRY to YEL-GRY
	RED-GRY

D Sharkey's Terminal Strip: Lamp 61 Left Turbo (Pop) Bumper

Lamp 61	RED-GRY
	BLK
	YEL-GRN BLK

E Sharkey's Terminal Strip: Lamp 62 Right Turbo (Pop) Bumper

Lamp 62	YEL-BLU BLK
	BLK
	RED-GRY

F Sharkey's Terminal Strip: Lamp 63 Bottom Turbo (Pop) Bumper

Lamp 63	RED-GRY
	BLK
	YEL-VIO BLK

G Sharkey's Terminal Strip: Lamps 55-56 9-Ball Sign & Rvrs. English

Lamp 55	ORG-VIO to YEL-VIO
Lamp 56	RED-VIO
	ORG-GRY to YEL-GRY

H Sharkey's Terminal Strip: Switches 23-24 7-Bank D/T 7 (Bot) and 1-Bank D/T

Sw. 24	ORG-GRY to GRN-ORG
	WHT-GRY
Sw. 23	ORG-VIO to GRN-ORG
	WHT-VIO

I Label I Not Required

J Sharkey's Terminal Strip: Switches 17-19 7-Bank D/T 1 (Top), 2 & 3

Sw. 19	ORG to GRN-ORG
	WHT-ORG
Sw. 18	ORG-RED to GRN-ORG
	WHT-RED
Sw. 17	ORG-BRN to GRN-ORG
	WHT-BRN

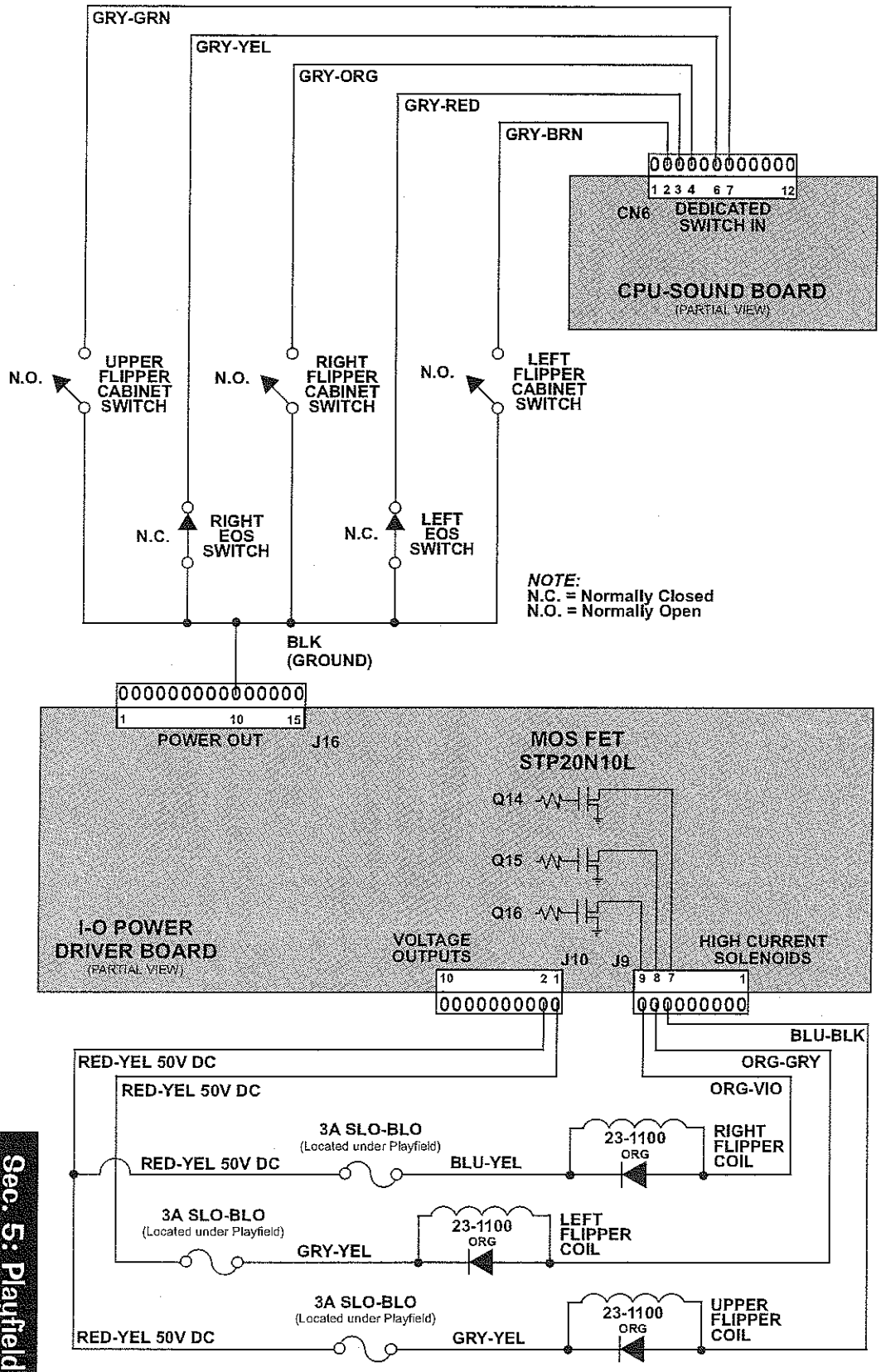
K Sharkey's Terminal Strip: Switches 20-22 7-Bank D/T 4, 5 & 6

Sw. 22	ORG-BLU to GRN-ORG
	WHT-BLU
Sw. 21	ORG-GRN to GRN-ORG
	WHT-GRN
Sw. 20	ORG-YEL to GRN-ORG
	WHT-YEL

See the Pink Pages, Playfield - General Parts (Below) (Page 52) for Terminal Strips, Diodes, Fuses and Fuse Holders Part N°s.

3-Flipper Circuit Wiring Diagram

The **White Star Board System**™ has allowed us to *simplify* the *Flipper Circuit* to the point where we have *eliminated the Flipper Board* all together. The *Flipper Circuit* is now configured the same as any other Solenoid Drive Circuit.



Technical Overview

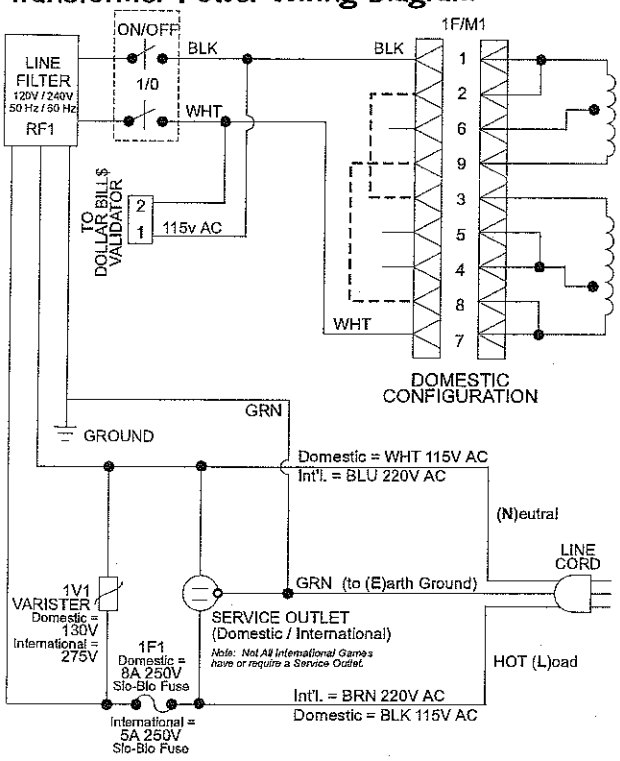
Our ***Flipper System*** uses one supply voltage (50v DC) for both ***kick*** & ***hold***. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 40*msec* pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet Switch closure *(the player holding the button in)* it will continue to pulse the flipper drive transistor 1*msec* every 12*msecs* for the duration of the hold cycle.

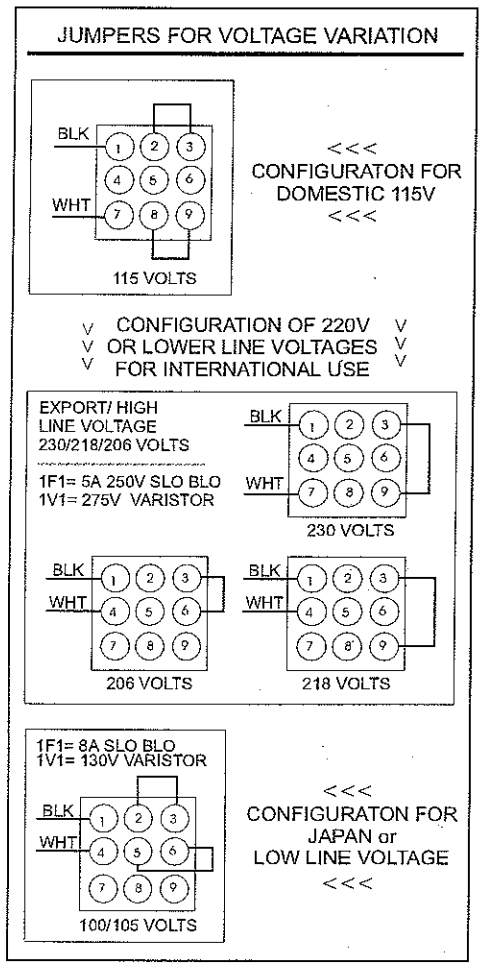
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect a switch closure if the flipper bat is forced back by a high velocity shot or rebound on the playfield and will apply another 40*msec* pulse of 50v DC to the coil.

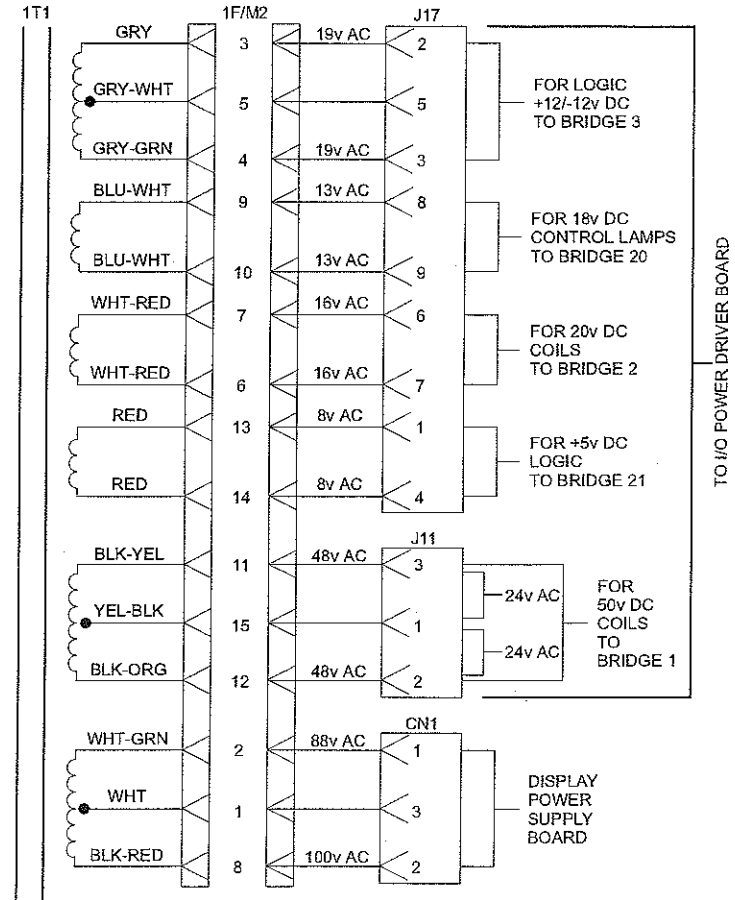
Note: *If an Upper Flipper is used, the Flipper Button on the side of the Upper Flipper will have a* ***"Double-Stacked" E.O.S. Switch****. This allows the player to push the Flipper Button half-way down to energize only the Lower Flipper; pushing the Flipper Button all the way down will energize both the Lower & Upper Flippers.*

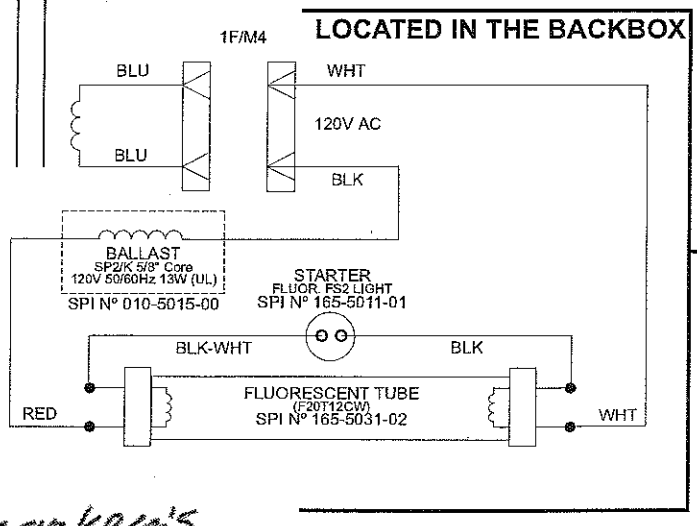
Cabinet Wiring

Transformer Power Wiring Diagram

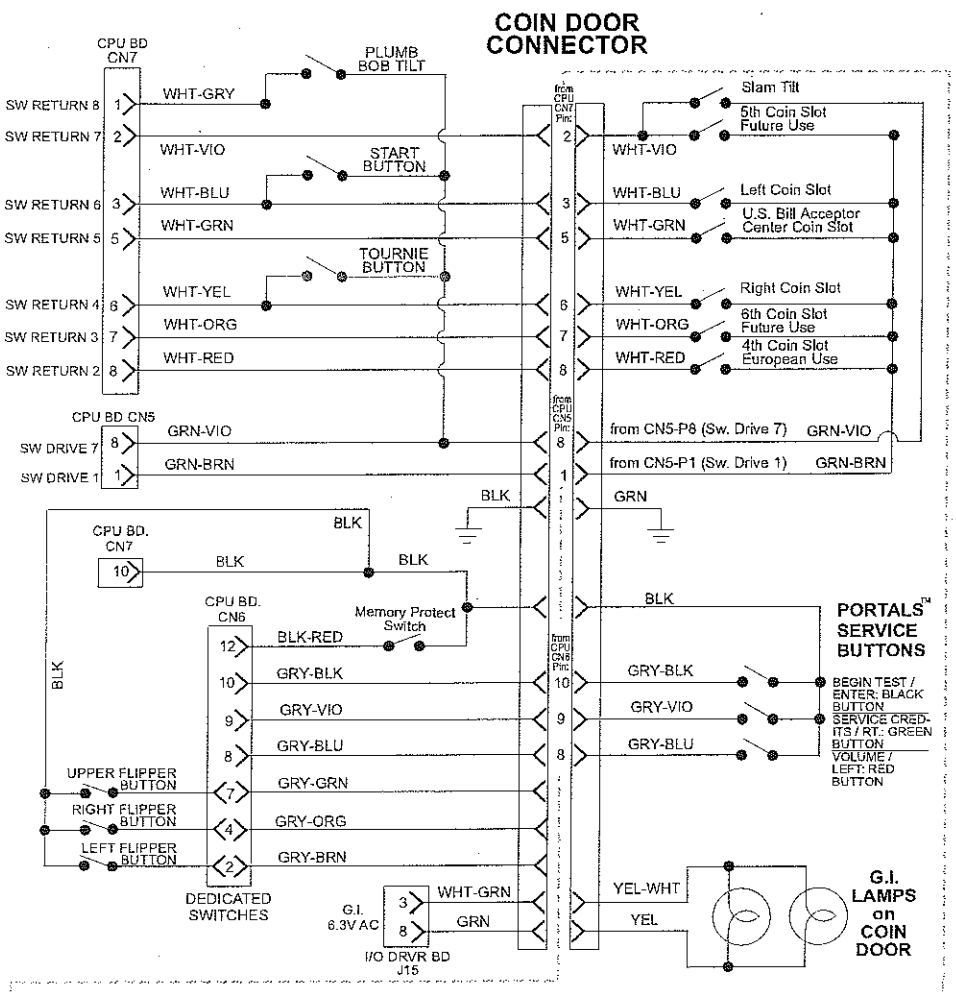


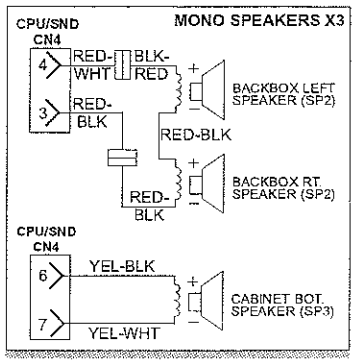


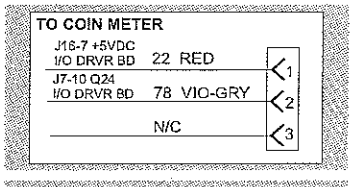


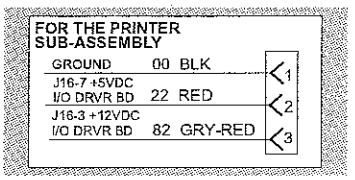


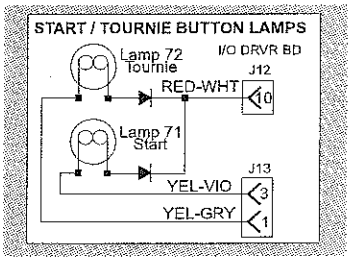
Cabinet / Coin Door Wiring Diagram



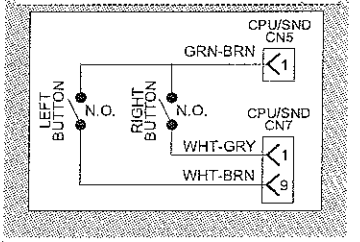


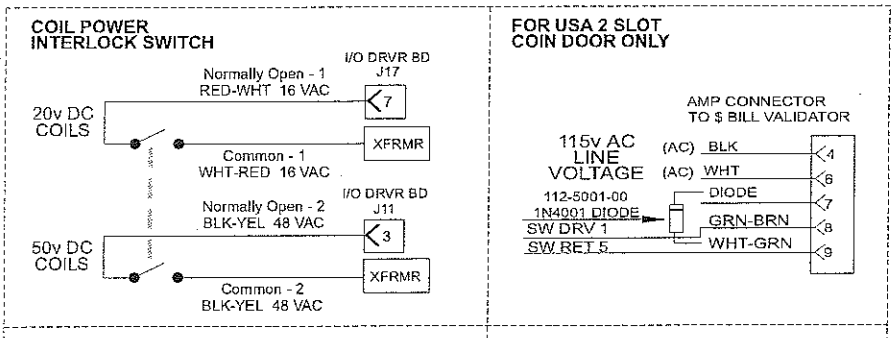






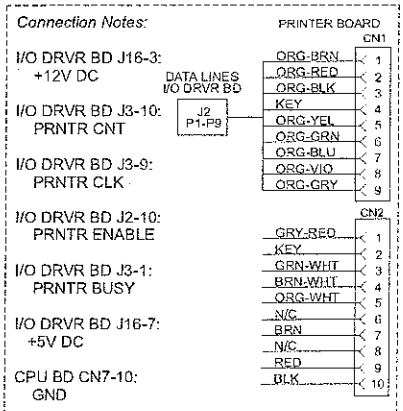
This game uses two Extra Cabinet Buttons for the Post Save™ Feature. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both Buttons (pushed together) operate the Center Up/Down Post. Both Buttons are located under the Flipper Buttons.





PRINTER INTERFACE OPTIONAL

Cable Wiring Harness SPI Part N°:
036-5408-00
RS-232 Printer Interface Board SPI Part N°:
520-5069-00

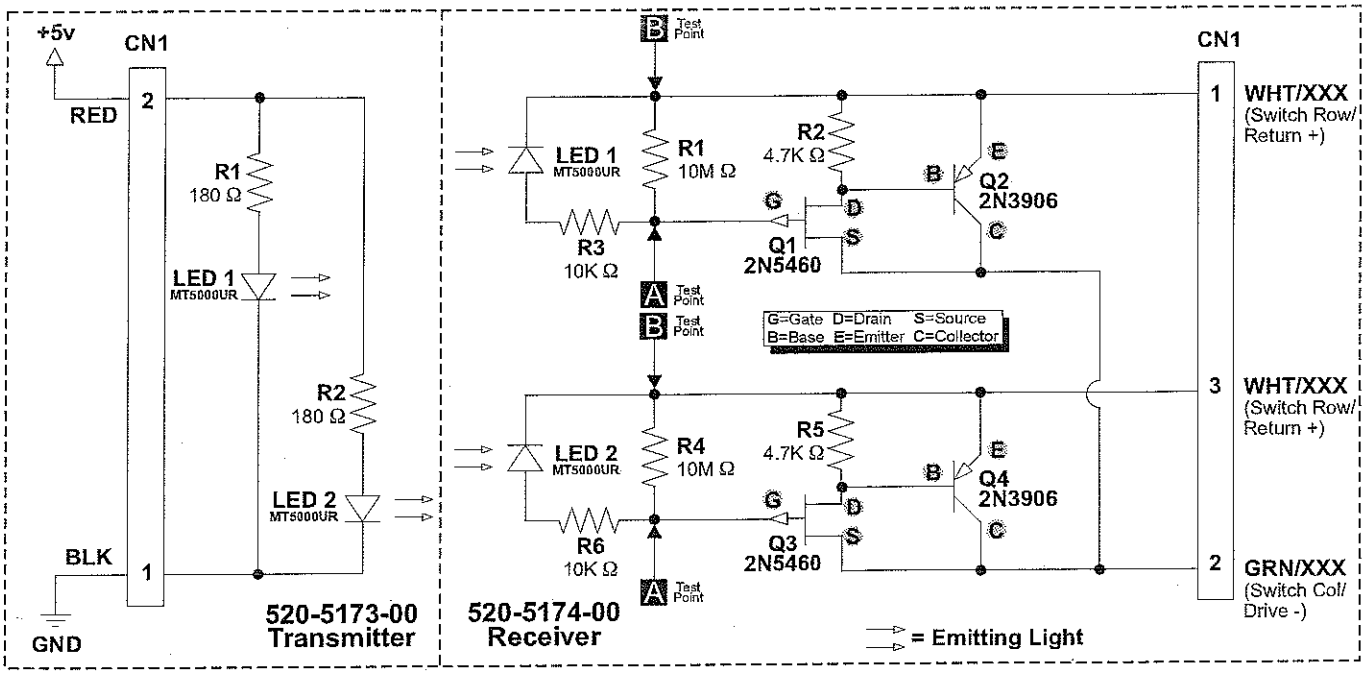


COIN DOOR

Printed Circuit Boards (PCBs)

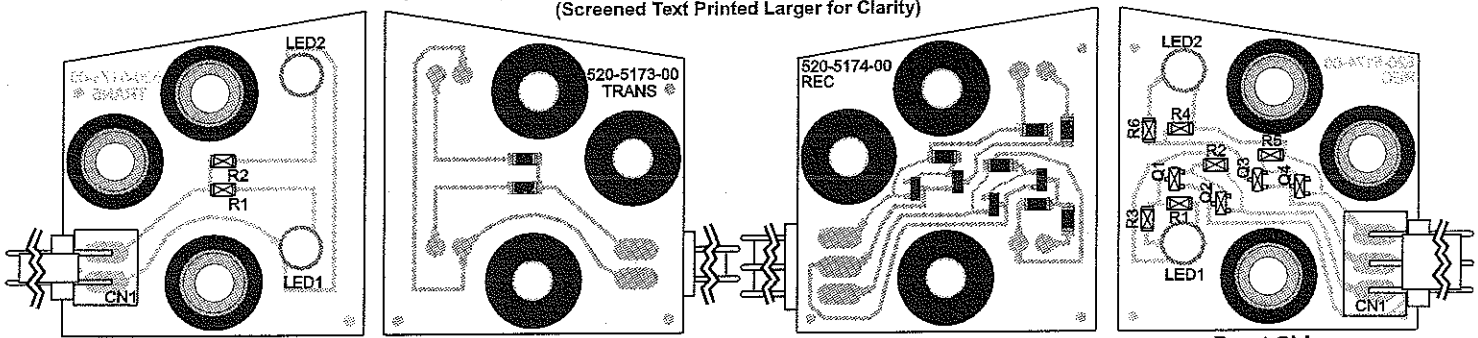
Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic

As light from the **Transmitter LED1** falls on the **Receiver LED1**, it generates a Positive Bias Voltage (0.7v to 1.5v) which is applied to the **Gate** (**G**) of **Q1 (Fet 2N5460)** turning **Q1** off. When **Q1** is held off, no current flows through **Q2**'s **(2N3906) Base** (**B**). With no *base current*, **Q2** is off and acts as an *OPEN SWITCH*. When the light is interrupted (*BLOCKED*) **R1** (Rec. Bd.) bleeds the gate voltage off of **Q1** allowing it to conduct, switching **Q2** on, which acts as a *CLOSED SWITCH*. The **LED2 (Trans/Rec) Circuit** operates identical as the **LED1 Circuit**.



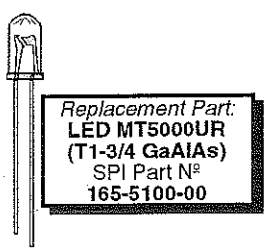
Trough Up-Kicker Dual OPTO Boards Component Layout & Parts

520-5173-00 (TRANS) — Boards Actual Size (Screened Text Printed Larger for Clarity) — 520-5174-00 (REC)



Front Side (LEDs & 2-Pin Connector) | Back Side (Solder / SMDs) | Back Side (Solder / SMDs) | Front Side (LEDs & 3-Pin Connector)

ITEM	QTY	PART NUMBER	REF-DESIGNATOR
A	**1**	**515-0173-00**	**Dual-OPTO Trans. Bd. Assy.**
—	**1**	**520-5173-00**	**Dual-OPTO Trans. Bd.**
1	2	165-5100-00	LED1, LED2
2	2	121-5067-00	R1, R2
3	1	045-5111-02	CN1
4	3	545-5518-00	n/a
5	3	530-5308-02	n/a
B	**1**	**515-0174-00**	**Dual-OPTO Rec. Bd. Assy.**
—	**1**	**520-5174-00**	**Dual-OPTO Rec. Bd.**
1	2	165-5100-00	LED 1, LED 2
2	2	121-5082-00	R1, R4
3	2	121-5083-00	R2, R5
4	2	121-5011-00	R3, R6
5	2	110-5006-00	Q1, Q3
6	2	110-0086-00	Q2, Q4
7	1	045-5111-03	CN1
8	3	545-5518-00	n/a
9	3	530-5308-02	n/a



Replacement Part:
LED MT5000UR
(T1-3/4 GaAlAs)
SPI Part Nº
165-5100-00

DESCRIPTION

PCB Assy. (with all **Items 1-5**)
PCB Assy. (with **Items 1-3** only)
LED MT5000UR (Ultra Bright Red)
180 Ω 1/8W Chip Res. (CRCW)
2X, .156" Rt. Angle (26-60-5020) Conn.
OPTO PCB Rubber Grommet
OPTO PCB Brass Tube Spacer
PCB Assy. (with all **Items 1-9**)
PCB Assy. (with **Items 1-7** only)
LED MT5000UR (Ultra Bright Red)
10M Ω 1/8W Chip Res. (CRCW)
4.7K Ω 1/8W Chip Res. (CRCW)
10K Ω 1/8W Chip Res. (CRCW)
2N5460, Transistor (P-FET SOT-23)
2N3906, Transistor
3X, .156" Rt. Angle (26-60-5030) Conn.
OPTO PCB Rubber Grommet
OPTO PCB Brass Tube Spacer

OPTO Troubleshooting

1. Volt Meter Test (indicates normal operating condition):

A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN.* Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previos page, 520-5174-00 Receiver Side). It should read approximately 0.8 - 1.2v DC. The **LED2 Circuit** operates the same.

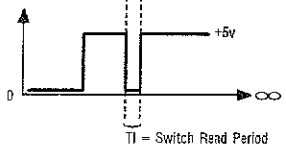
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED.* Place meter leads across points **A** and **B** on the **LED1 Circuit** (Refer to Schematic Drawing on previous page, 520-5174-00 Receiver Side). It should read approximately 0.0 - 0.1v DC. The **LED2 Circuit** operates the same.

2. Oscilloscope Test (indicates normal operating condition):

Fig. A



Fig. B



A. **OPEN OPTO** (Light Falling on LED) = *SWITCH OPEN.* Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **STEADY +5v** as shown in **Fig. A**, Wave Form Diagram.

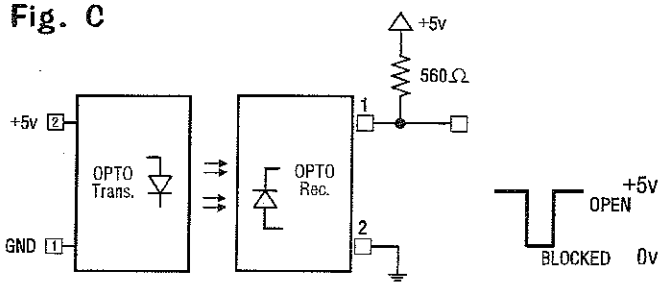
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED.* Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

3. Bench Test (See Fig. C):

Please Note: To perform this test you must use a spare 560Ω Pull-Up Resistor, SPI Nº: 121-5047-00

Disconnect the OPTO Transmitter / Receiver Board from the circuit. Connect one side of a 560Ω Pull-Up Resistor to **Pin-1** of the OPTO Receiver Bd. and the other side of the resistor to a 5v DC source. Connect **Pin-2** to GND. Connect a +5v DC source to **Pin-1** of the Transmitter & GND to **Pin-2**. Align with the Receiver OPTO approx. 3" distance. Using your Volt-Meter or an Oscilloscope, monitor **Pin-1** while *BLOCKING* and *UNBLOCKING* the ***BEAM*** from the Trans. The output will be approx. +5v DC when the ***BEAM IS NOT BLOCKED*** and approx. 0v when the ***BEAM IS BLOCKED.***

Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

When a working **OPTO** is installed and connected in a game, the transmitter should light (LED1 lower & LED2 upper) when the power is switched on. With the playfield in Service Position #1 (playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets) and the game on, the LED lights should show up as a **BRIGHT RED RINGS** through the back of the Receiver Board around the **Receivers LED1 & LED2** (See **Fig. 1**). Testing only **LED1:** With the game in ***Switch Test Mode***, lifting the Trough Plunger with a fingertip should block the **BEAM** and cause the Switch Position to trigger (See **Fig. 2**). View **Fig. 2a** & **2b** (on the next page) for a sectional view of the Light Path (note alignment) and what happens as a ball breaks the light beam.

Fig. 1

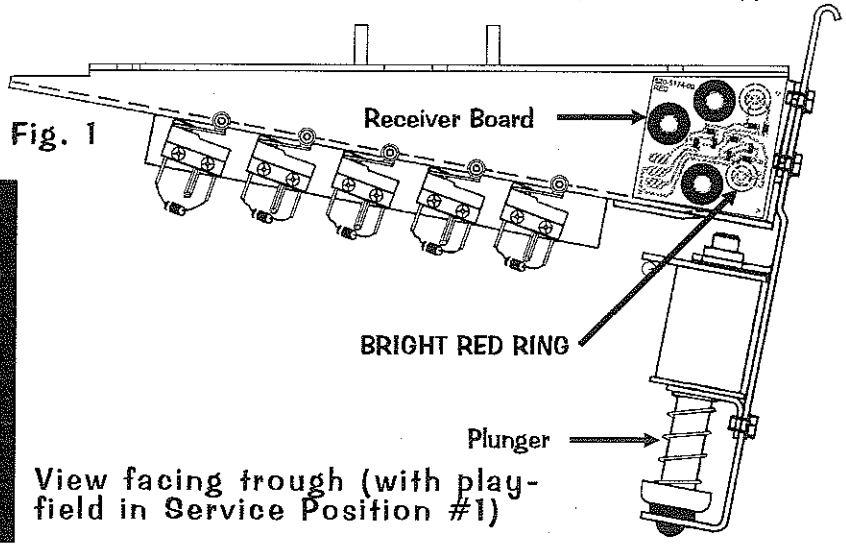
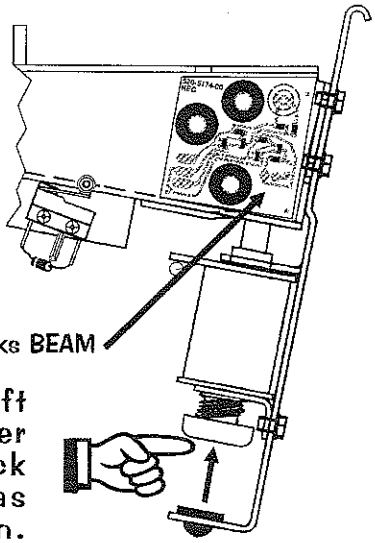
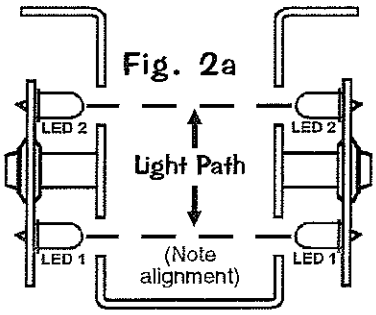


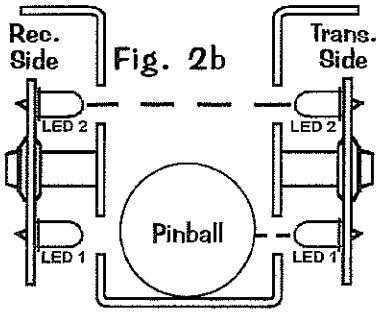
Fig. 2





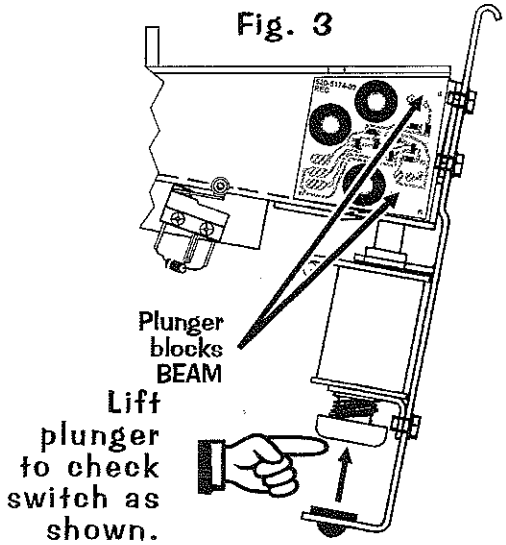
Sectional view from right (Fig. 2a & 2b)

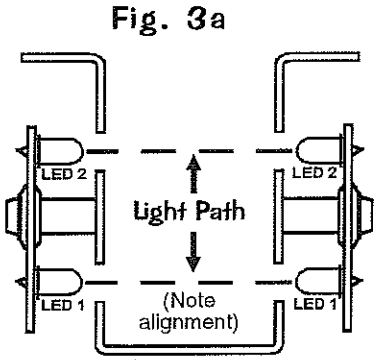


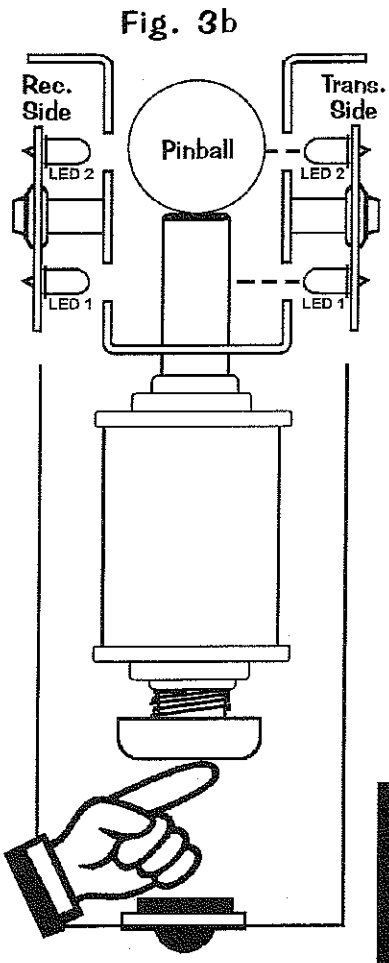


Trough Dual OPTO Boards Alignment / Test for LED2

When a working **OPTO** is installed and connected in a game, the transmitter should light (LED1 lower & LED2 upper) when the power is switched on. With the playfield in Service Position #1 (playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets) and the game on, the LED lights should show up as a **BRIGHT RED RINGS** through the back of the Receiver Board around the **Receivers LED1 & LED2** (See **Fig. 1, previous page**). Testing only **LED2:** *TO PERFORM THIS TEST, A PINBALL MUST BE IN THE BALL TROUGH.* With the game in ***Switch Test Mode***, lifting the Trough Plunger with a finger tip should block the **BEAM** on LED2 and cause the Switch Position to trigger (See **Fig. 3**). View **Fig. 3a** & **3b** for a sectional view of the Light Path (note alignment) and what happens as a "double-stacked" ball scenario breaks the light beam.







I M P O R T A N T

If replacement of ***LED*** *is required, insure that is* ***mounted correctly before and after soldering*** *(See* ***Fig. 4a / 4b****).*

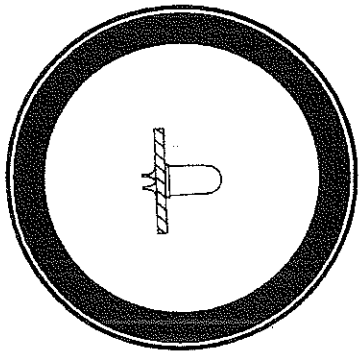


Fig. 4a
Correct Position

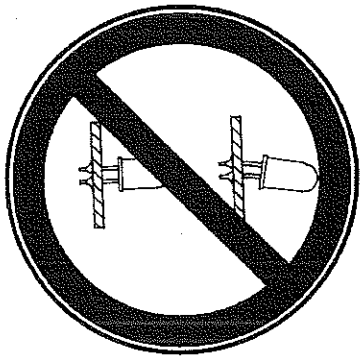
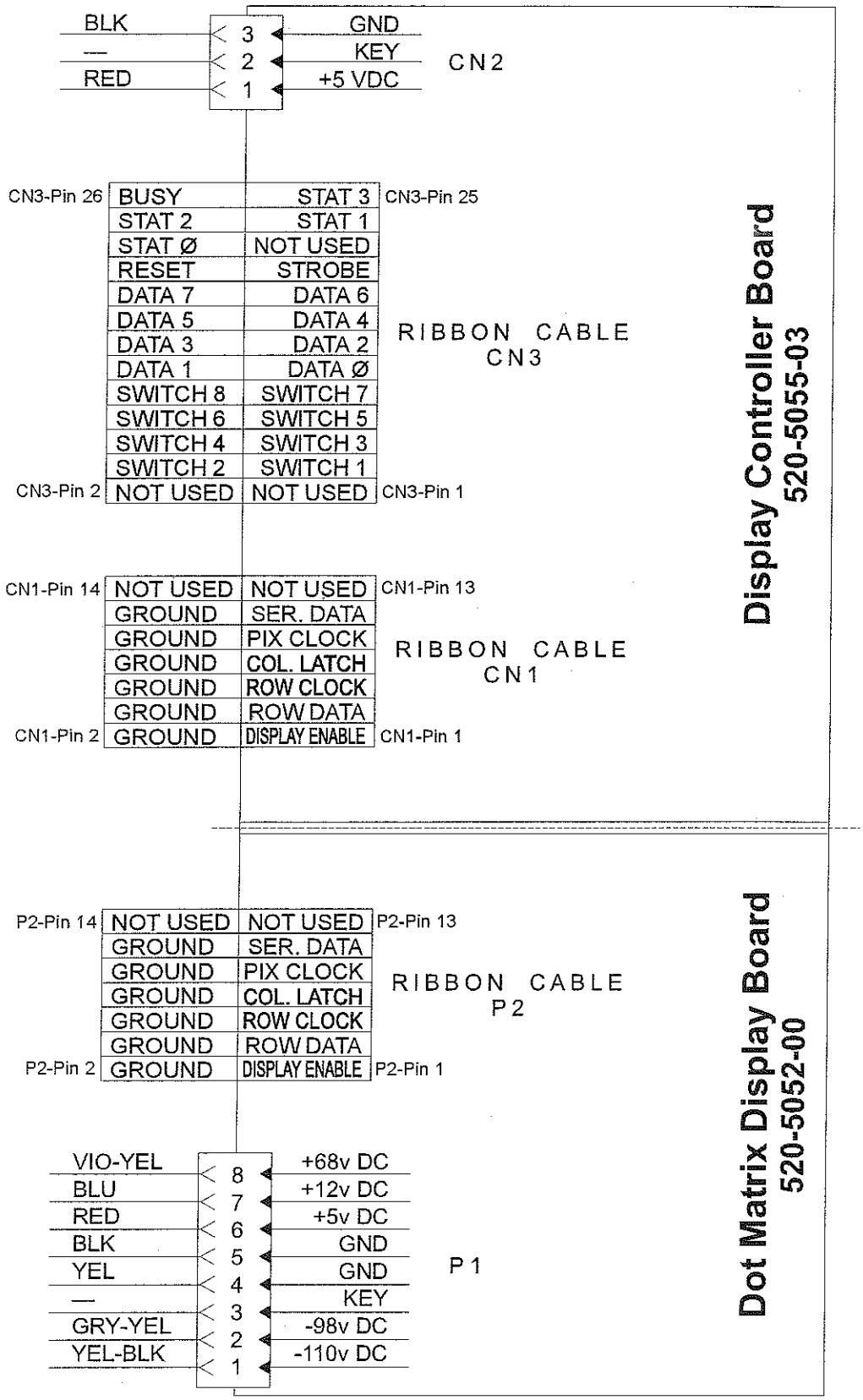
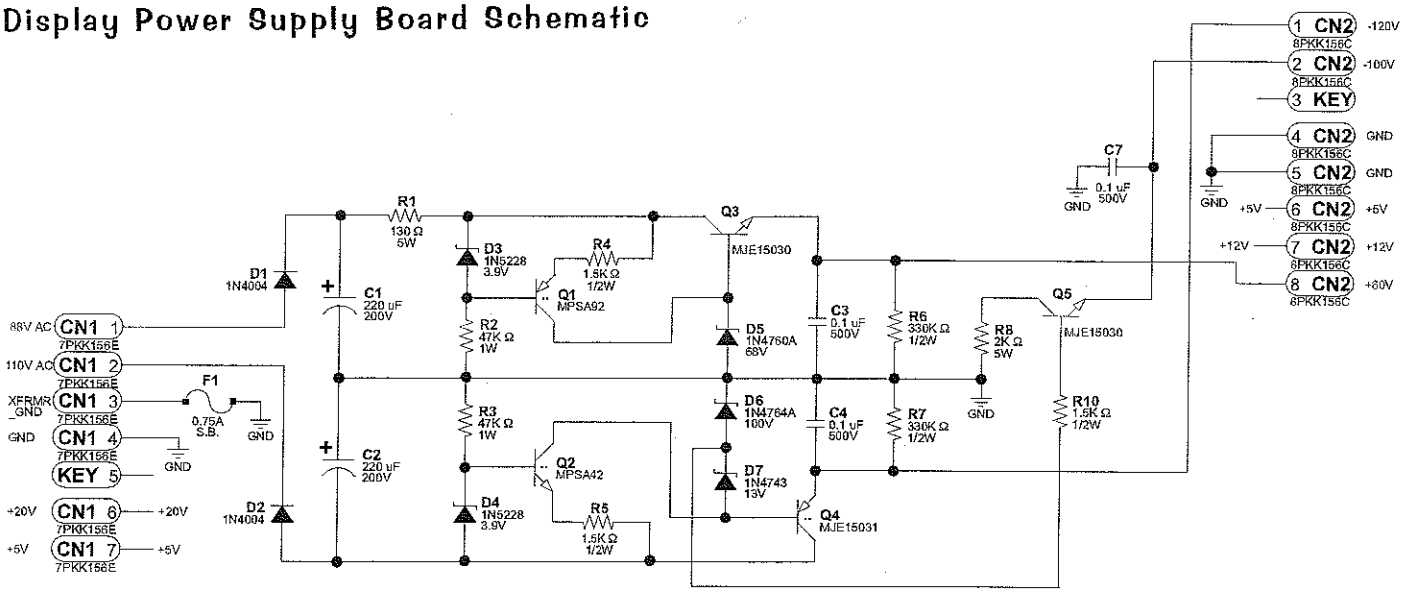


Fig. 4b
Incorrect Position

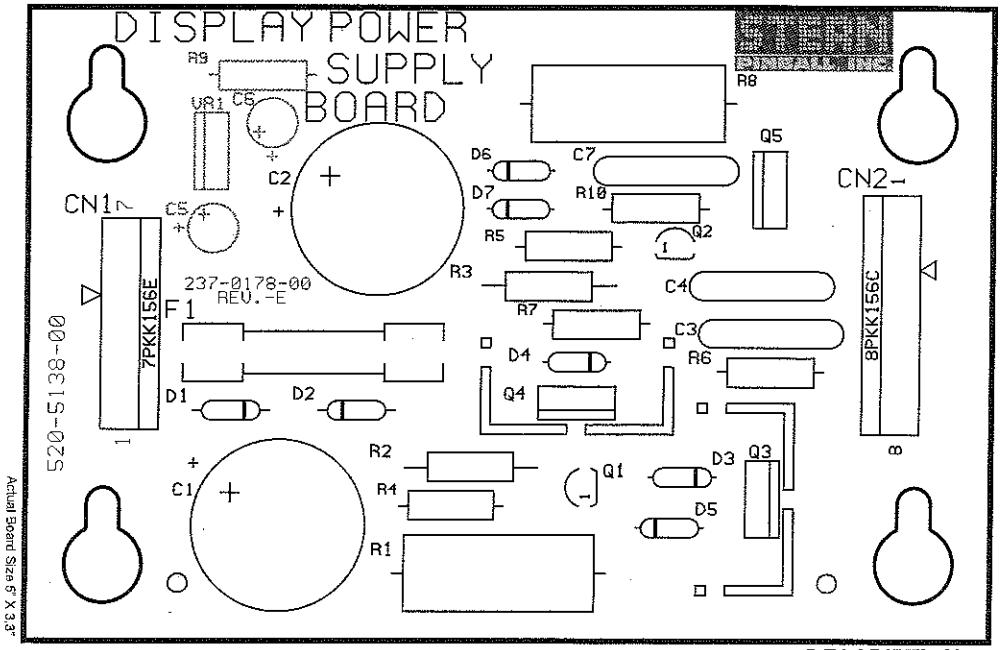
Dot Matrix Display/Display Controller Bd. Combined Display Connections



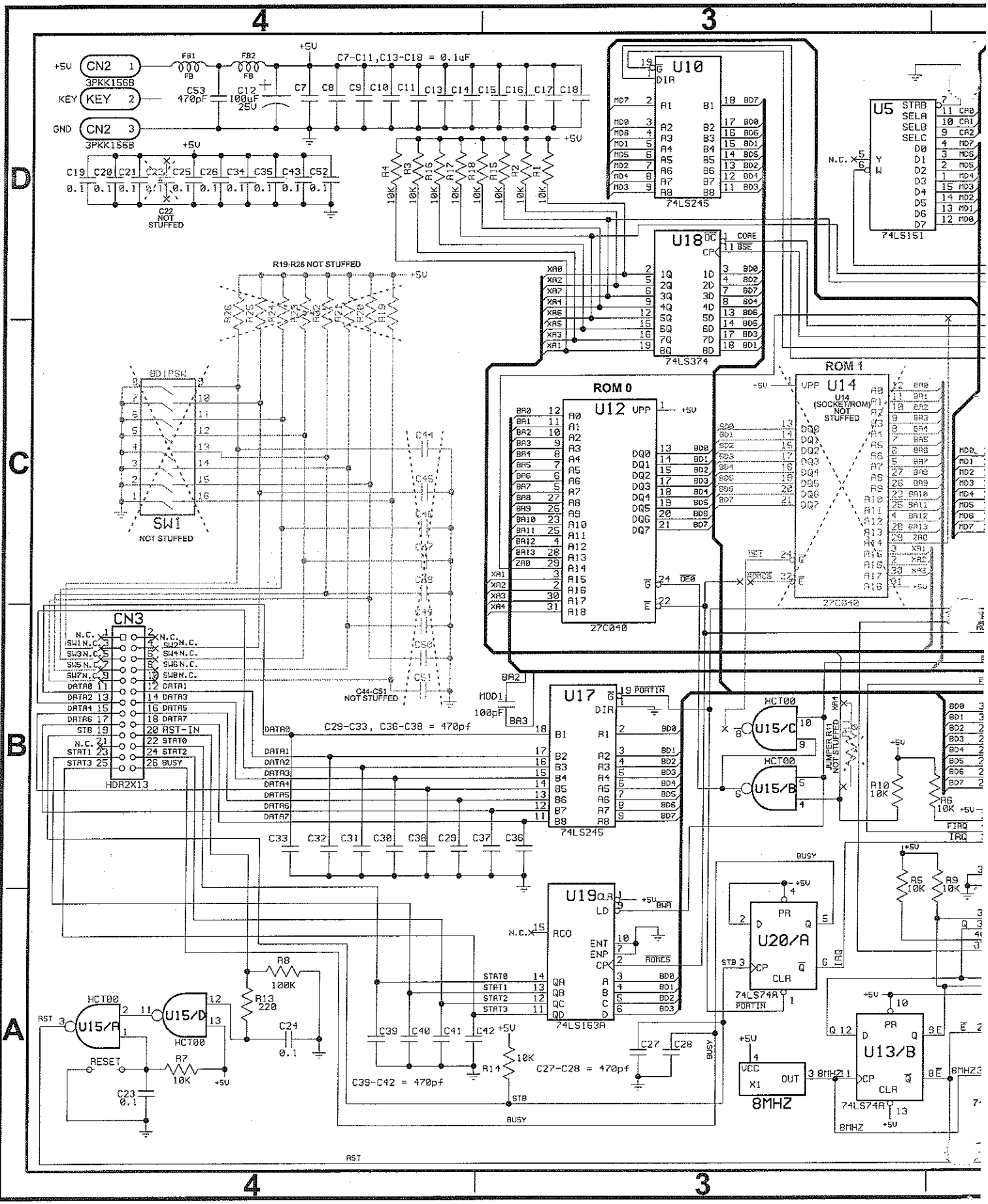
Display Power Supply Board Schematic

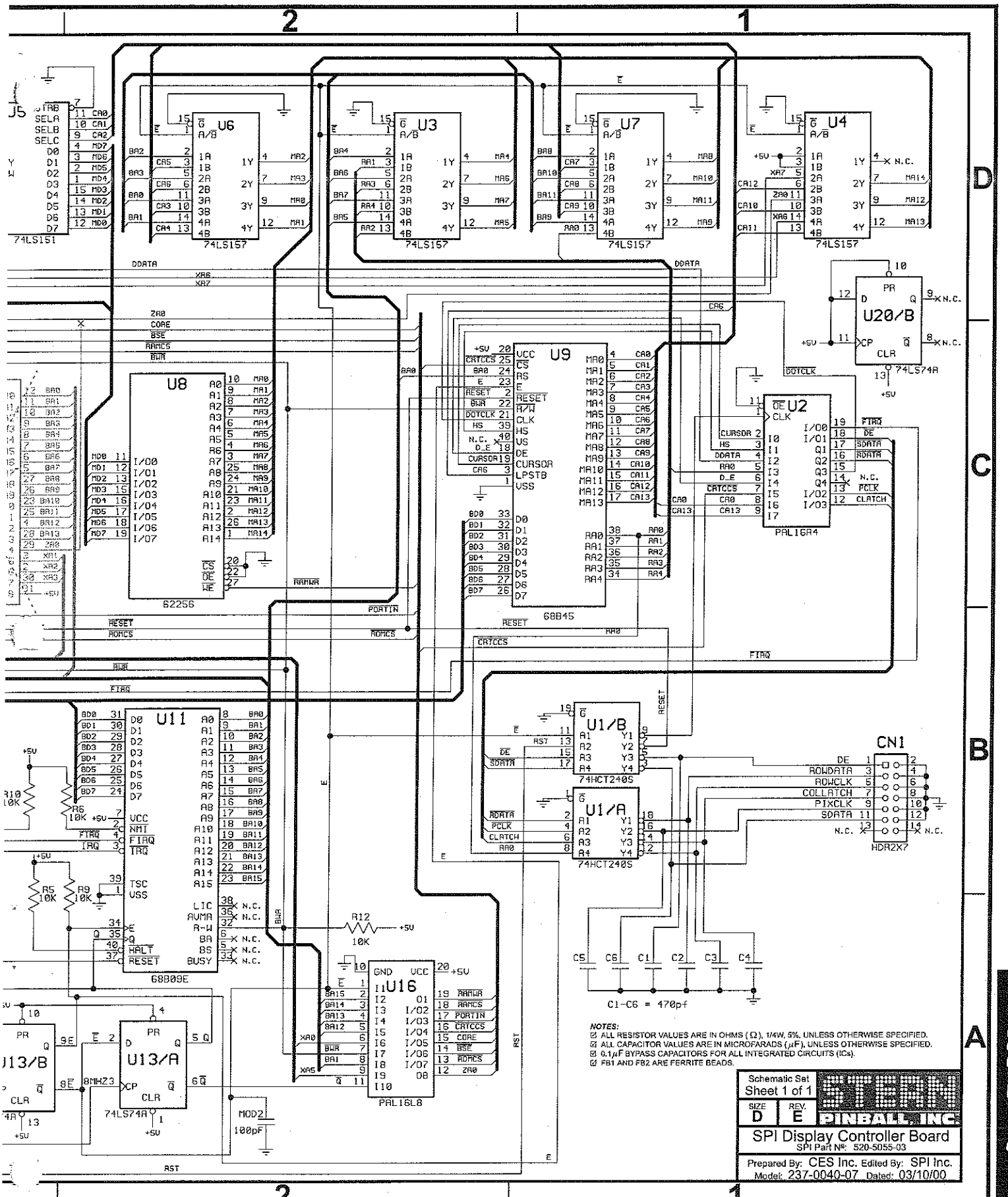


Display Power Supply Board Component Layout & Parts

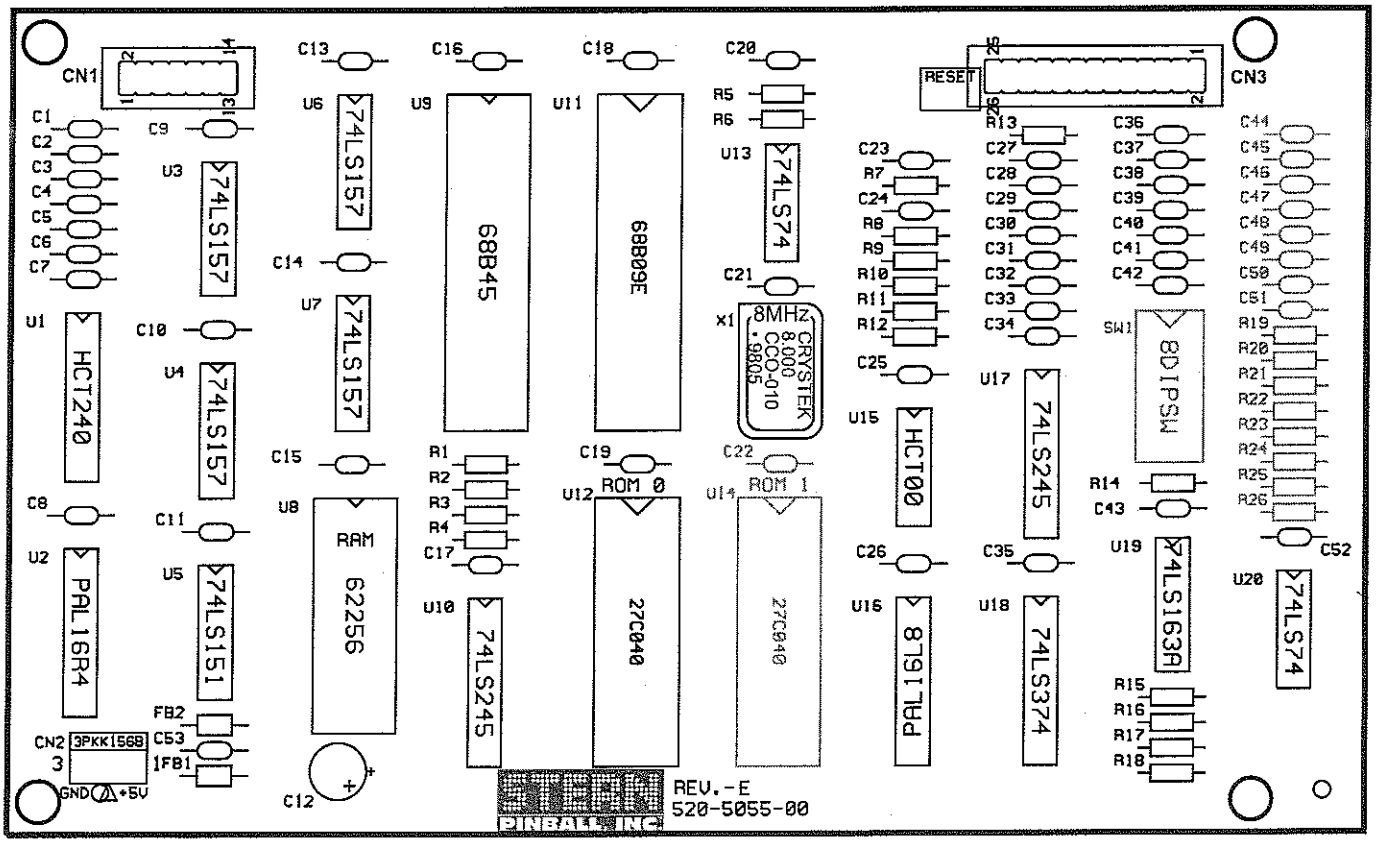


ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5138-00**	**Display Power Supply Board**	**Complete PCB Assembly**
1	1	200-5000-17	F1	3/4A (0.75A) S.B. Fuse
2	2	535-5000-11	Q3, Q4	Heatsinks - AAVID #563002
3	2	125-5044-00	C1, C2	220uF, 200v, Radial Lytic Cap.
4	3	121-5038-00	R4, R5, R10	1.5K Ω 1/2W Res. (R9: NS)
5	2	121-5059-00	R6, R7	330K Ω 1/2W Res.
6	2	121-5060-00	R2, R3	47K Ω 1W Res.
7	1	121-5061-00	R1	130 Ω 5W Res.
8	1	121-5062-00	R8	2K Ω 5W Res.
9	2	112-0053-00	D3, D4	1N5228, 3.9v, Diode
10	1	112-0062-00	D5	1N4760A, 68v, Diode
11	1	112-0049-00A	D6	1N4764A, 100v, Diode
12	1	112-0061-00	D7	1N4743, 13v, Diode
13	1	110-0100-00	Q1	MPSA92, Transistor
14	1	110-0082-00	Q2	MPSA42, Transistor
15	3	125-5035-00	C3, C4, C7	0.1uF, 500v, Ceramic Disk Cap.
16	1	110-0103-00	Q4	MJE15031, Transistor
17	2	110-0101-00	Q3, Q5	MJE15030, Transistor
18	0	125-5003-00	C5, C6	22uF, 35v, Rad Lytic Cap (C5, C6: NS)
19	0	123-5003-00	VR1	7812CT (VR1: NS)
20	1	045-5015-08	CN2	8PKK156 (PIN3=KEY)
21	2	112-5003-00	D1, D2	1N4004, Diode
22	1	045-5015-07	CN1	7PKK156E (PIN5=KEY)
23	2	240-5008-00	Q3, Q4	6/32 KEPS Nut
24	2	237-5501-00	Q3, Q4	6/32 X 3/8" PPH Screw
25	2	205-0004-00	F1	Fuse Clips


4
3
D
C
B
A
CN2
3PKK156B
KEY
GND
FB1
FB2
C53 470pF
C12 100uF 25V
C7-C11,C13-C18 = 0.1uF
C19 C20 C21 C22 C25 C26 C34 C35 C43 C52
0.1
C22 NOT STUFFED
R19-R26 NOT STUFFED
SW1
NOT STUFFED
U10
74LS245
U18
74LS374
U5
74LS151
ROM 0
U12
27C040
ROM 1
U14
(SOCKET/ROM) NOT STUFFED
27C040
CN3
HDR2X13
C44-C51 NOT STUFFED
C29-C33, C36-C38 = 470pf
U17
74LS245
U19
74LS163A
C33 C32 C31 C30 C38 C29 C37 C36
C39-C42 = 470pf
C27-C28 = 470pf
U15/A
U15/B
U15/C
U15/D
HCT00
R8 100K
R13 220
C24 0.1
R7 10K
C23 0.1
RESET
RST
R14 10K
U20/A
74LS74A
U13/B
74LS74A
8MHZ
R5 10K
R9 10K
R10 10K
R6 10K
JUMPER R11 NOT STUFFED
BUSY
STB
IRQ
FIRQ


U6
74LS157
U3
74LS157
U7
74LS157
U4
74LS157
U8
62256
U9
68B45
U11
68B09E
U16
PAL16L8
U20/B
74LS74A
U2
PAL16R4
U1/B
74HCT240S
U1/A
74HCT240S
U13/A
74LS74A
CN1
HDR2X7
C1-C6 = 470pf
NOTES:
ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
FB1 AND FB2 ARE FERRITE BEADS.
Schematic Set
Sheet 1 of 1
SIZE D
REV. E
PINBALL INC
SPI Display Controller Board
SPI Part №: 520-5055-03
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0040-07 Dated: 03/10/00

Display Controller Board Component Layout & Parts



Actual Board Size 8.05" X 4.9"

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5055-03**	**Display Controller Board (FCC FEB98) Rev. E**	**Complete PCB Assembly**
1	1	077-5217-00	U12 (U4 - Not Stuffed)	32-Pin, IC Dip Socket
2	1	100-0397-00	U8	32K X 8 Static RAM (62256L-10PC)
3	1	100-0189-01	U11	68B09E
4	1	100-0233-00	U9	68B45
5	1	100-0351-00	U15	74HCT00
6	1	100-5001-00	U1	74HCT240
7	1	100-5000-00	U5	74LS151
8	4	100-0046-00	U3, U4, U6, U7	74LS157
9	1	100-0049-00	U19	74LS163A
10	2	100-0058-00	U7, U10	74LS245
11	1	100-0064-00	U18	74LS374
12	2	100-0037-00	U13, U20	74LS74
13	1	965-0107-00	**U16 - ORANGE DOT** (Note the type of PAL)	PAL16L8 (15CN), (Programmed) **- ORANGE DOT**
14	1	965-0108-00	**U2 - ORANGE DOT** (Note the type of PAL)	PAL16R4 (25CN), (Programmed) **- ORANGE DOT**
15	23	125-5031-00	C7>C11, C13>C26, C34, C35, C43, C52	.1 uF, (104), Axial Cer. Cap
16	1	121-5051-00	R8	100K Ω 1/4W C.F. Res. 5%
17	15	121-5011-00	R1>R7, R9, R10, R12, R14>R18	10K Ω 1/4W Res. 5%
18	1	121-5014-00	R13	220 Ω 1/4W C.F. Res. 5%
19	0	n/a	(R19>R26 Not Stuffed)	
20	14	125-5028-00	C1>C6, C27>C33, C36>C42, C53 (C44>C51 N S)	470pF, (471), Axl. Cap
21	2	n/a	FB1, FB2	Ferrite Bead (2743001182)
22	1	125-5015-00	C12	100uF, 25v, Cap. (Radial Elec.)
23	1	045-5015-26	CN3	13-Pin, Dual Row .1" HDR Conn.
24	1	045-5015-03	CN2	3-Pin, KK-156 Conn. (540445-3)
25	1	045-5015-02	CN1	7-Pin, Dual Row .1" Hdr. Conn.
26	1	140-0013-00	X1	8Mhz Clock Oscillator
27	0	Not Used	(SW1 Not Stuffed)	(SW1)
28	1	(See Pg. DR. ❸ Table)	U12 (ROM 0) (U14 ROM 1 Not Stuffed)	4MB ROM
29	1	n/a	U1 (@ Pins 9 & 10)	100PF. Cap.

I/O Power Driver Board Theory of Operation

5v Supply:
An AC voltage of approximately 9v comes into the board at [**J17-**(1-4)] this AC voltage is then *full-wave rectified* by bridge **BRDG 21** and filtered by Capacitor **C203**. The resulting voltage is 11v DC which is inserted into a linear voltage regulator for the output of 5v DC. This 5v regulated voltage can be adjusted by potentiometer **R116** the voltage should be set to 5.00v. Besides powering the I/O Board the regulated 5 volts supplies power to the CPU / Sound Board, Gas Plasma (Dot Matrix) Display and Plasma (Display) Controller Board. Power for these devices comes off the I/O Board on [**J16**-(4-8)].

+5v, +20v, +50v, +18v, & +12v LED Indicators:
These DC voltages are derived on the I/O Board by rectification and filtering. Each has a **LED** indicating that power is being supplied to each of these voltage sources. The **-12v** supply comes from the same transformer winding as the **+12v** thus it does not have a **LED** indicator.

*** **Note** that the +50v & +20v power sources are turned off by the Interlock Switches when the Coin Door is OPEN.*

LED	SUPPLY VOLTAGE
L2	+5
L200	+20v
L201	+50v
L202	+18v
L203	+12v

Reset Circuitry:
The I/O will reset in three (3) cases:

1. The CPU is in reset. The CPU's reset signal is fed into the I/O through connector **J1** and forces the I/O into reset.
2. The 5v supply has fallen below 4.75v.
3. The watchdog is not being fed by the scanning of the light matrix. More specifically **Pin-19** of **U6** must be toggling once every ***50ms*** to prevent the watchdog from resetting. The scanning of the light matrix is controlled by the CPU through **J1**.

LED L204 shows the reset state of the I/O Board. If this **LED** is not lit either the 5v DC is below 4.75v or the CPU/Sound Board is holding the I/O in reset. If the **LED** is flashing this means that the watchdog is not being feed by the CPU/Sound Board and the I/O is oscillating into and out of reset. If the **LED** is continuously on the board is out of reset and communication from the CPU to the lamp matrix is confirmed. Testpoint Blanking is the actual reset signal on the I/O Board. A low voltage indicates that it is in reset this will turn off all Solenoid (Coil) Drivers, Flash Lamps, Lamp Matrix Drivers, Auxiliary Outputs and Flipper Outputs. A high voltage indicates that it is out of reset and normal operation can take place.

Address Decoding:
All Address decoding is done by two **74LS138** (3 of 8 decoder). Both of these must be in operation for the I/O Board to function properly.

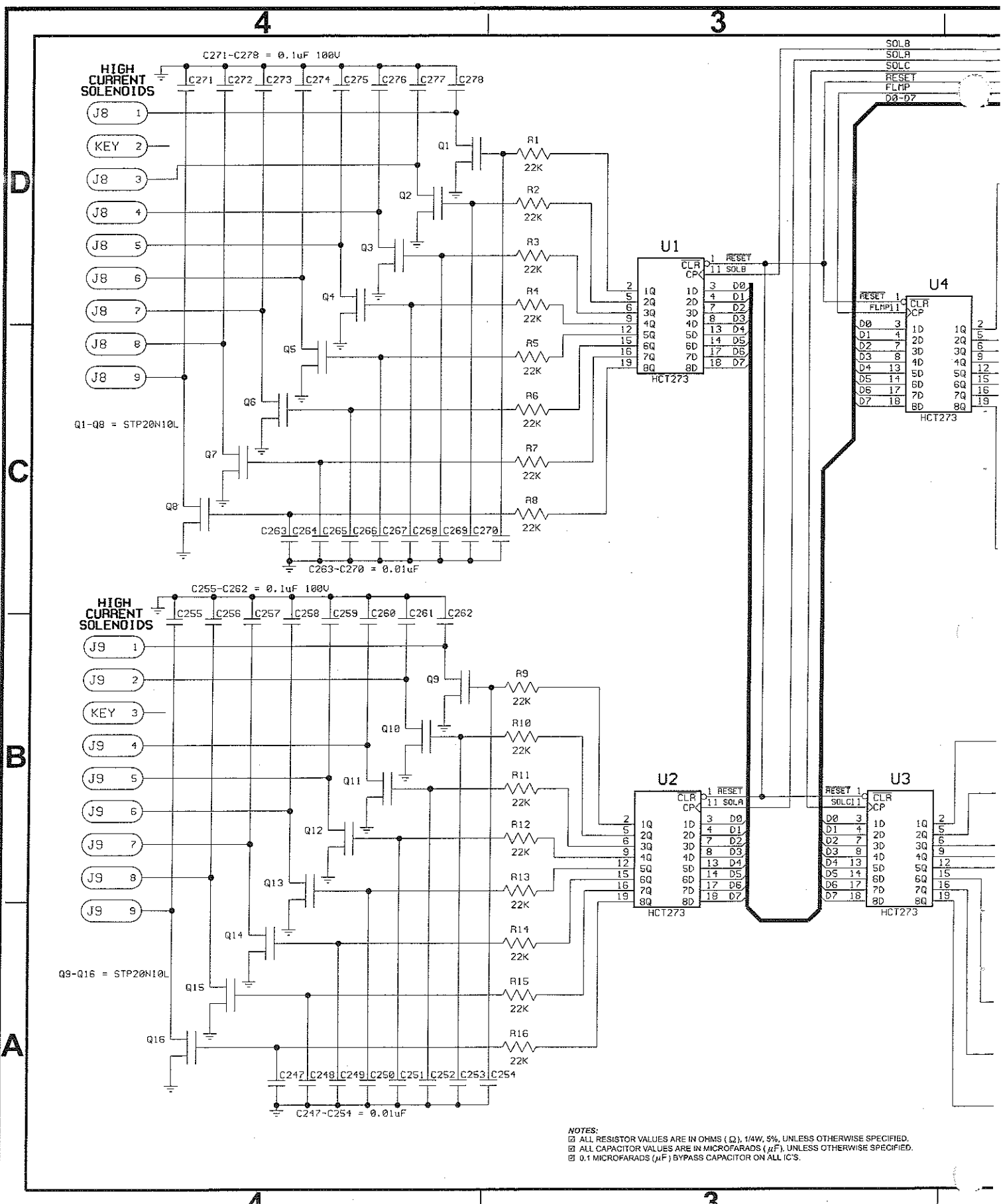
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test point **FET TPL1** and then the other to the corresponding gate resistor **R1-R16** (see *Note 1*). This will apply 3.4v to the gate of the **MOSFET Transistor** thus switching it on. **J7** & **J6** each are a bank of 8 low side driver for driving lamps or other lower current solenoids (coils). They use a Bipolar Power Transistor **TIP122** which can also be tested by using **TEST POINT TIP TPL3** and the corresponding resistors **R17-R32*** *(see Note 1).*

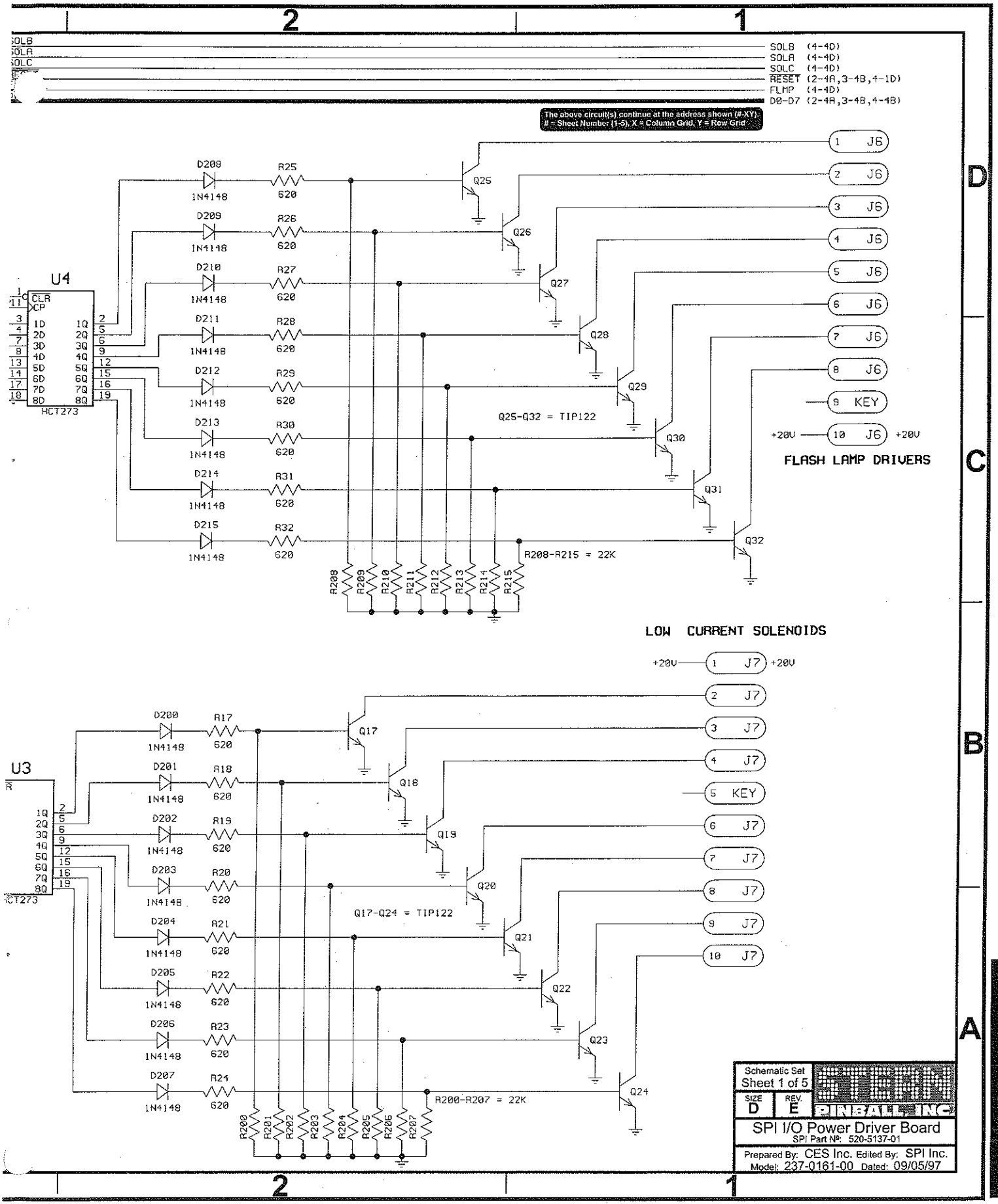
***Note 1** * Clip on the resistor side with the white stripe. ** R1 controls Q1 and R2 controls Q etc...*

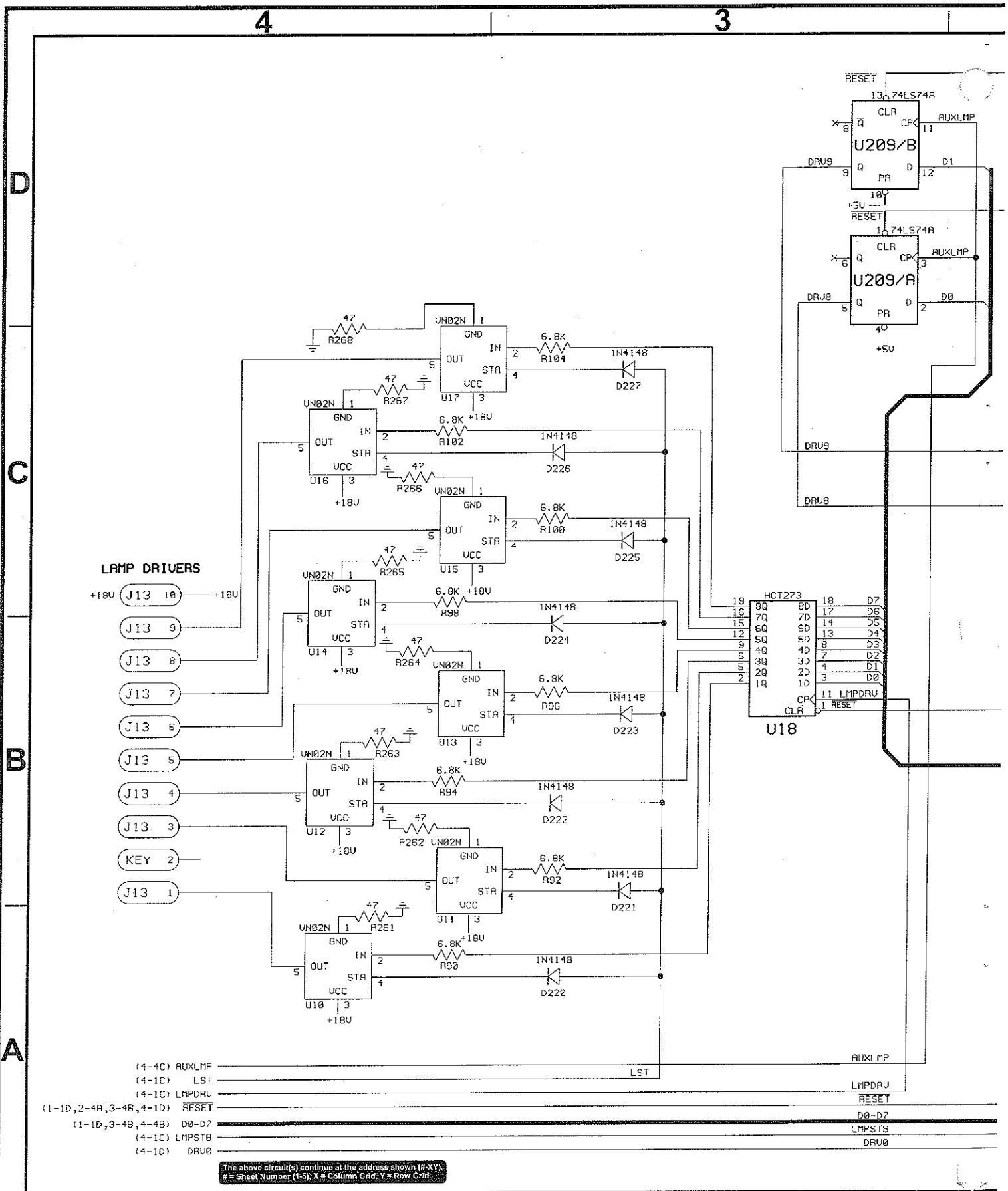
Auxiliary In & Out:
J2-8 CMOS Outputs sometimes used for a printer interface.
J3-8 CMOS Inputs general purpose inputs.

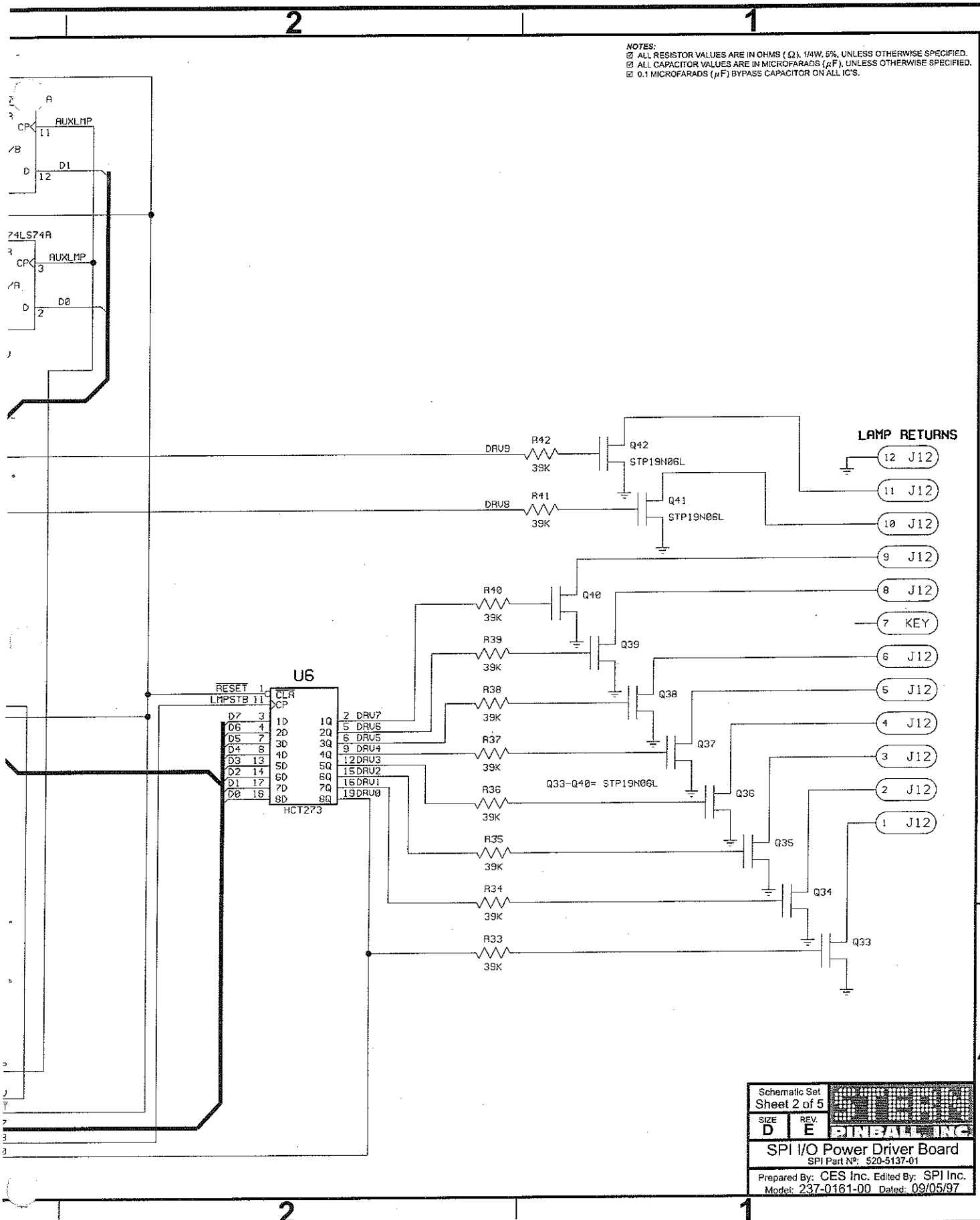
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the I/O from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status indicators are logically 'OR'ed together and fed back to the CPU/Sound Board. The status can identify open loads (for example open lamp filaments or intermittent connections) and short circuits. These drivers are also short-circuit protected.

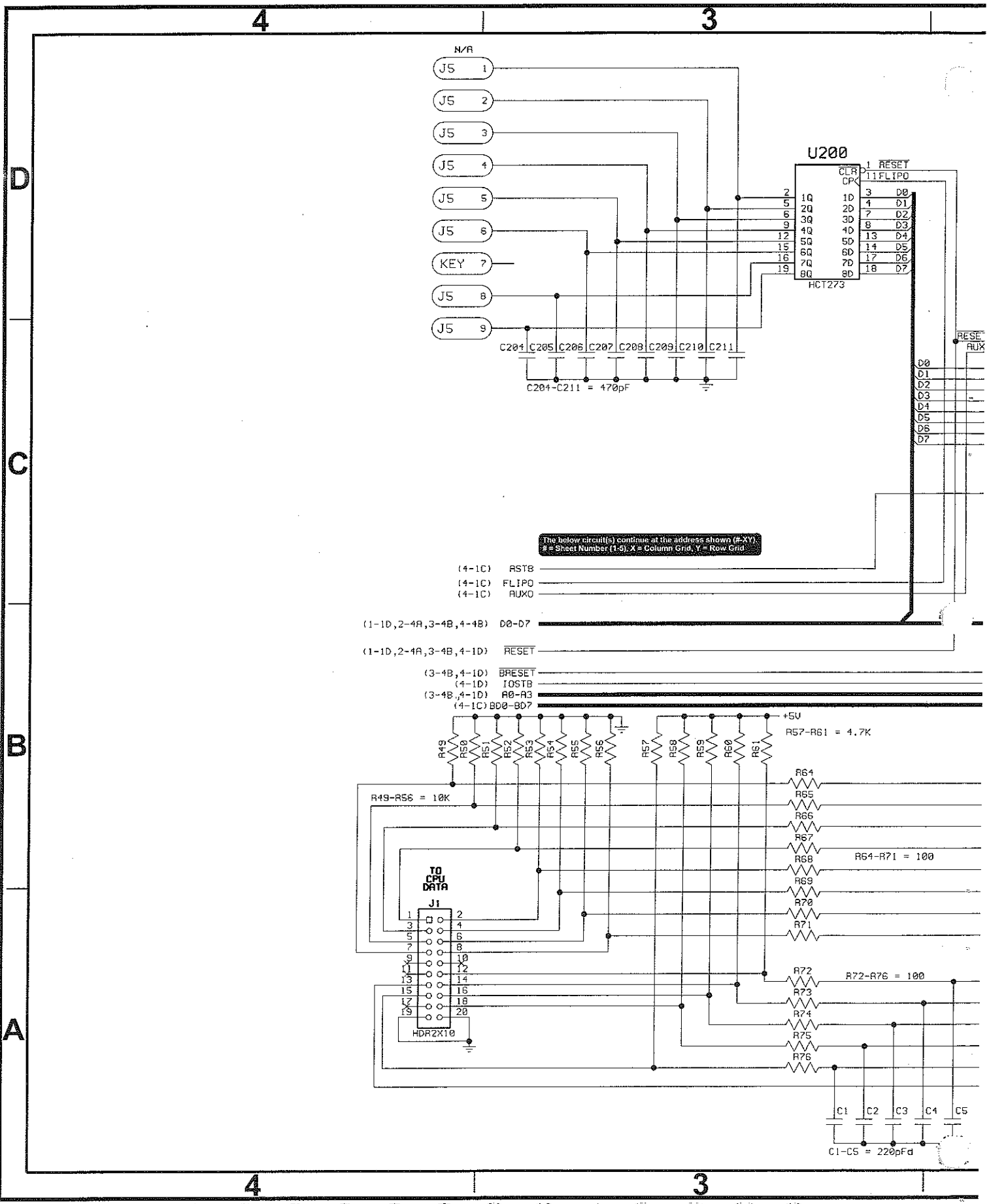
General Illumination (G.I.) Lights:
J15 has 6v AC switched on & off by a relay on the I/O Board. The relay is controlled by **Q200** which supplies power to the 24v coil winding to activate the relay. There are 4 taps on **J15** each fused at 5A for this 6v AC source.


4
3
D
C
B
A
HIGH CURRENT SOLENOIDS
C271-C278 = 0.1uF 100V
C271 C272 C273 C274 C275 C276 C277 C278
J8 1
KEY 2
J8 3
J8 4
J8 5
J8 6
J8 7
J8 8
J8 9
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8
Q1-Q8 = STP20N10L
R1 R2 R3 R4 R5 R6 R7 R8
22K
C263 C264 C265 C266 C267 C268 C269 C270
C263-C270 = 0.01uF
U1
HCT273
SOLB
SOLA
SOLC
RESET
FLMP
D0-D7
U4
HCT273
HIGH CURRENT SOLENOIDS
C255-C262 = 0.1uF 100V
C255 C256 C257 C258 C259 C260 C261 C262
J9 1
J9 2
KEY 3
J9 4
J9 5
J9 6
J9 7
J9 8
J9 9
Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16
Q9-Q16 = STP20N10L
R9 R10 R11 R12 R13 R14 R15 R16
22K
C247 C248 C249 C250 C251 C252 C253 C254
C247-C254 = 0.01uF
U2
HCT273
U3
HCT273
NOTES:
ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

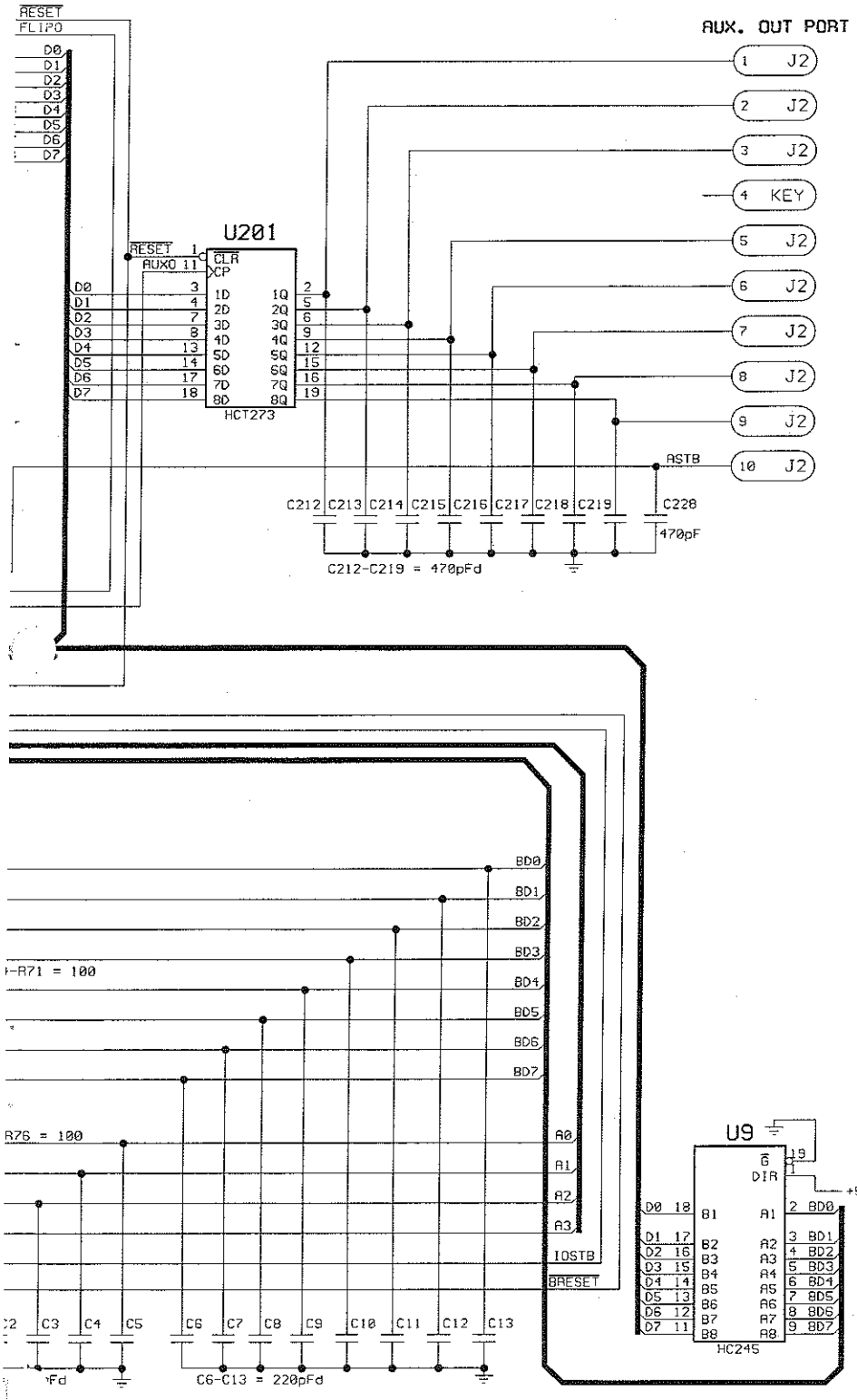

SOLB (4-4D)
SOLA (4-4D)
SOLC (4-4D)
RESET (2-4A,3-4B,4-1D)
FLMP (4-4D)
D0-D7 (2-4A,3-4B,4-4B)
The above circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
U4
HCT273
D208 R25 Q25 J6 1
D209 R26 Q26 J6 2
D210 R27 Q27 J6 3
D211 R28 Q28 J6 4
D212 R29 Q29 J6 5
D213 R30 Q30 J6 6
D214 R31 Q31 J6 7
D215 R32 Q32 J6 8
KEY 9
+20V J6 10 +20V
1N4148
620
Q25-Q32 = TIP122
R208-R215 = 22K
R208 R209 R210 R211 R212 R213 R214 R215
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
+20V J7 1 +20V
U3
HCT273
D200 R17 Q17 J7 2
D201 R18 Q18 J7 3
D202 R19 Q19 J7 4
D203 R20 Q20 KEY 5
D204 R21 Q21 J7 6
D205 R22 Q22 J7 7
D206 R23 Q23 J7 8
D207 R24 Q24 J7 9
J7 10
Q17-Q24 = TIP122
R200-R207 = 22K
R200 R201 R202 R203 R204 R205 R206 R207
Schematic Set Sheet 1 of 5
SIZE D
REV. E
PINBALL INC
SPI I/O Power Driver Board
SPI Part №: 520-5137-01
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


LAMP DRIVERS
+18V
J13 10
J13 9
J13 8
J13 7
J13 6
J13 5
J13 4
J13 3
KEY 2
J13 1
UN02N
GND
IN
OUT
STA
VCC
U17
U16
U15
U14
U13
U12
U11
U10
47
R268
R267
R266
R265
R264
R263
R262
R261
6.8K
R104
R102
R100
R98
R96
R94
R92
R90
1N4148
D227
D226
D225
D224
D223
D222
D221
D220
RESET
74LS74A
U209/B
U209/A
CLR
CP
PR
AUXLMP
DRV9
DRV8
D1
D0
+5V
HCT273
U18
LMPDRV
D7
D6
D5
D4
D3
D2
D1
D0
(4-4C) AUXLMP
(4-1C) LST
(4-1C) LMPDRV
(1-1D,2-4A,3-4B,4-1D) RESET
(1-1D,3-4B,4-4B) D0-D7
(4-1C) LMPSTB
(4-1D) DRV0
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid

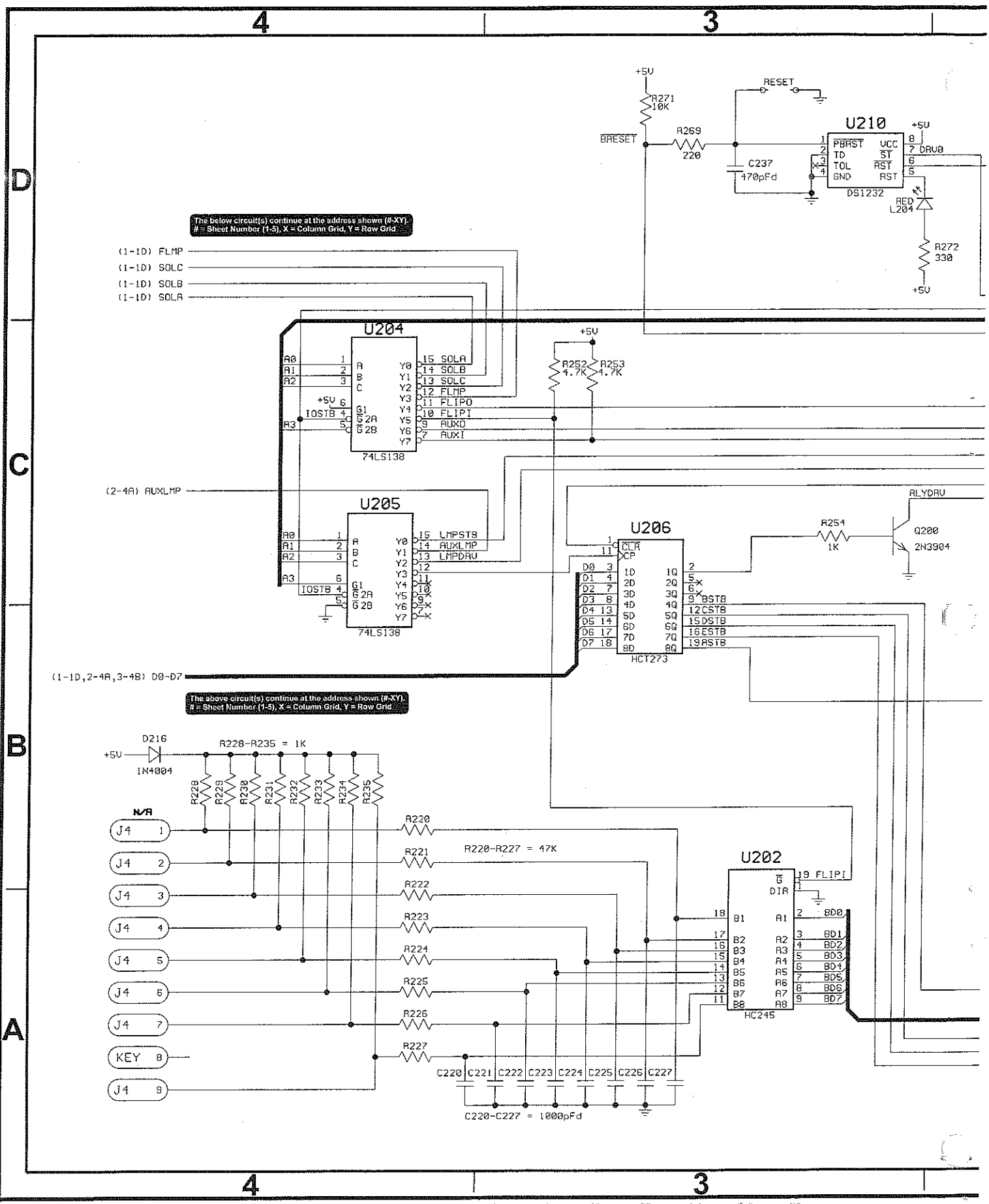

NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.
74LS74A
AUXLMP
D1
D0
U6
RESET
LMPSTB
HCT273
DRV9
DRV8
R42
R41
R40
R39
R38
R37
R36
R35
R34
R33
39K
Q42
Q41
Q40
Q39
Q38
Q37
Q36
Q35
Q34
Q33
STP19N06L
Q33-Q40= STP19N06L
LAMP RETURNS
12 J12
11 J12
10 J12
9 J12
8 J12
7 KEY
6 J12
5 J12
4 J12
3 J12
2 J12
1 J12
Schematic Set
Sheet 2 of 5
SIZE D
REV. E
PINBALL, INC.
SPI I/O Power Driver Board
SPI Part Nº: 520-5137-01
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


4
3
D
C
B
A
N/A
J5 1
J5 2
J5 3
J5 4
J5 5
J5 6
KEY 7
J5 8
J5 9
U200
HCT273
C204 C205 C206 C207 C208 C209 C210 C211
C204-C211 = 470pF
RESET
FLIPO
AUXO
D0
D1
D2
D3
D4
D5
D6
D7
The below circuit(s) continue at the address shown (#-XY)
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(4-1C) ASTB
(4-1C) FLIPO
(4-1C) AUXO
(1-1D,2-4A,3-4B,4-4B) D0-D7
(1-1D,2-4A,3-4B,4-1D) RESET
(3-4B,4-1D) BRESET
(4-1D) IOSTB
(3-4B,4-1D) A0-A3
(4-1C) BD0-BD7
+5V
R57-R61 = 4.7K
R49-R56 = 10K
R64-R71 = 100
R72-R76 = 100
TO CPU DATA
J1
HDR2X10
C1 C2 C3 C4 C5
C1-C5 = 220pFd

NOTES:
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Schematic Set	Sheet 3 of 5
SIZE	D
REV.	E
	PINBALL INC
SPI I/O Power Driver Board	
SPI Part №:	520-5137-01
Prepared By:	CES Inc. Edited By: SPI Inc.
Model:	237-0161-00 Dated: 09/05/97


4
3
D
C
B
A
+5V
R271
10K
RESET
BRESET
R269
220
U210
PBRST
TD
TOL
GND
VCC
ST
RST
DRV0
DS1232
C237
470pFd
RED
L204
R272
330
The below circuit(s) continue at the address shown (#-XY)
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
(1-1D) FLMP
(1-1D) SOLC
(1-1D) SOLB
(1-1D) SOLA
U204
A0
A1
A2
A3
IOSTB
G1
G2A
G2B
Y0 SOLA
Y1 SOLB
Y2 SOLC
Y3 FLMP
Y4 FLIPO
Y5 FLIPI
Y6 AUXO
Y7 AUXI
74LS138
R252
4.7K
R253
4.7K
(2-4A) AUXLMP
U205
Y0 LMPSTB
Y1 AUXLMP
Y2 LMPDRV
74LS138
U206
CLR
CP
D0
D1
D2
D3
D4
D5
D6
D7
1D
2D
3D
4D
5D
6D
7D
8D
1Q
2Q
3Q
4Q
5Q
6Q
7Q
8Q
BSTB
CSTB
DSTB
ESTB
ASTB
HCT273
R254
1K
Q200
2N3904
RLYDRV
(1-1D,2-4A,3-4B) D0-D7
The above circuit(s) continue at the address shown (#-XY)
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
D216
1N4004
+5V
R228-R235 = 1K
R228
R229
R230
R231
R232
R233
R234
R235
N/A
J4 1
J4 2
J4 3
J4 4
J4 5
J4 6
J4 7
KEY 8
J4 9
R220
R221
R222
R223
R224
R225
R226
R227
R220-R227 = 47K
U202
G
DIR
FLIPI
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
HC245
C220
C221
C222
C223
C224
C225
C226
C227
C220-C227 = 1000pFd

DATE	DESCRIPTION OF CHANGES / REVISIONS	REQ.	BY.
02-13-95	DELETE "-12V" NET FROM POSITIVE PIN OF C29. ADD "GND" NET TO POSITIVE PIN OF C29. MERGE UNNAMED NET FROM NEGATIVE PIN OF C29 WITH "-12V" NET.	BK	JHS
05-25-99	CUT PIN-3 TO GND ON U210 (4-3D)		

NOTES:
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☒ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☒ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

TOURNAMENT I/O BOARD (520-5137-64) REVISIONS AFFECT SHEETS 4 & 5 ONLY. ON THIS SHEET 4 OF 5, R245-R251 REMOVED. CUT TRACE AT 2 PLACES (4-1A, 4-1B) & ADDED JUMPER FROM J3 PIN-12.

+5U, R270 4.7K, UCC, ST, IST, AST, DRV0, RESET, BLANKING, RED L204, R272 330

RESET (1-1D,2-4A,3-4B,4-1D)
DRV0 (2-4A)
IOSTB (3-4B)
A0-A3 (3-4B)
BRESET (3-4B)

The above circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

The below circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid

FLIP0 (3-4C)
AUX0 (3-4C)
LMPSTB (2-4A)
LMPDRV (2-4A)
RLYDRV (5-4C)
ASTB (3-4C)
BD0-BD7 (3-4B)
LST (2-4A)

RLYDRV, Q200 2N3904

+5U, R256 4.7K, LST, D228 1N4148, R255 10K, C236 470pF, cut trace

U203 HC245: AUXI, G, DIR, BD0-BD7, A1-A8, B1-B8

R236-R243 = 39K

R245-R251 = 1K, D217 1N4004, +5U

AUX. IN PORT: 1 J3, 2 J3, 3 J3, 4 J3, 5 J3, 6 J3, 7 J3, 8 KEY, 9 J3, 10 J3, 11 J3, 12 J3

C229 C230 C231 C232 C233 C234 C235

C228-C235 = 470pFd

cut trace

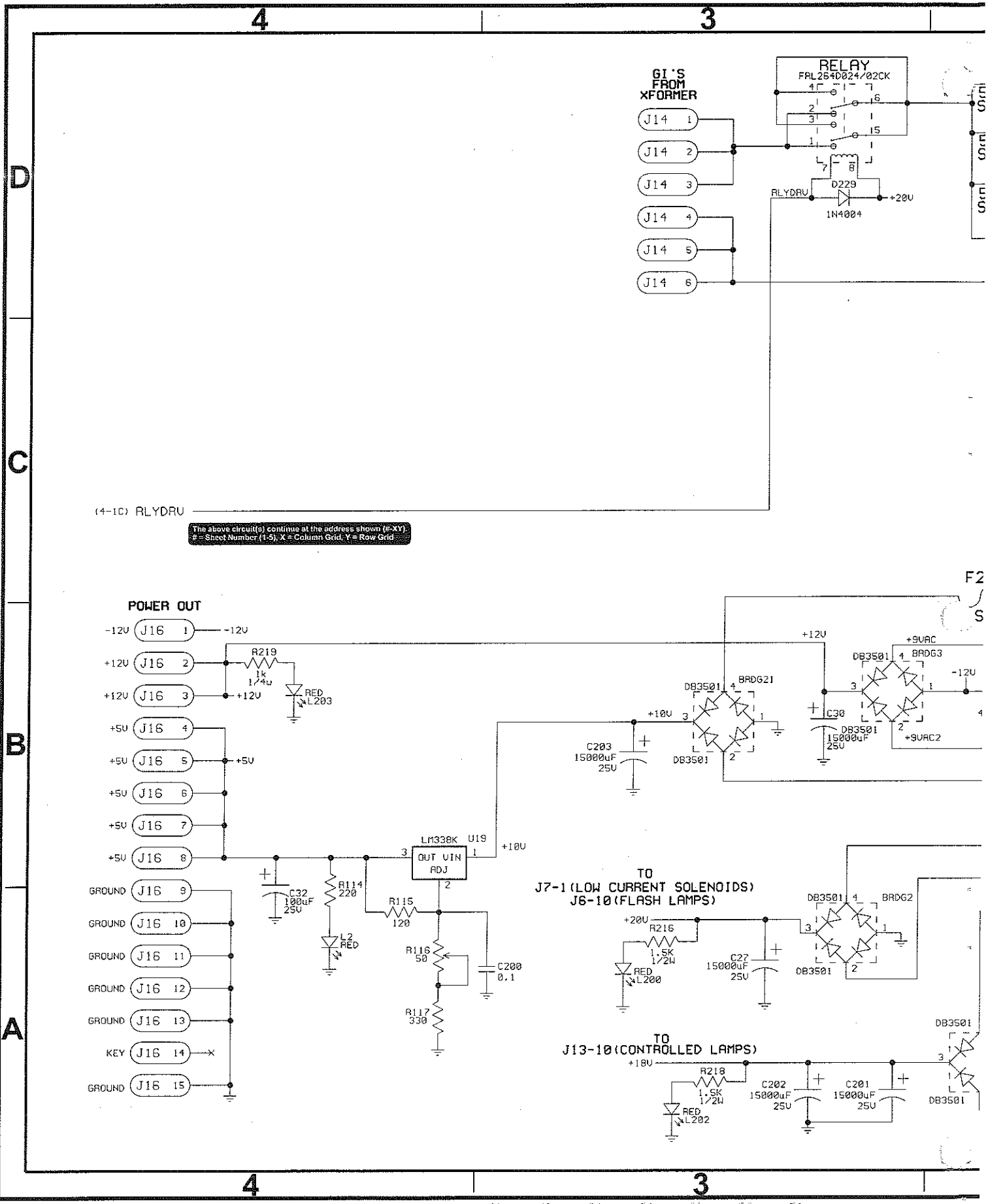
C243 C244 C245 C246

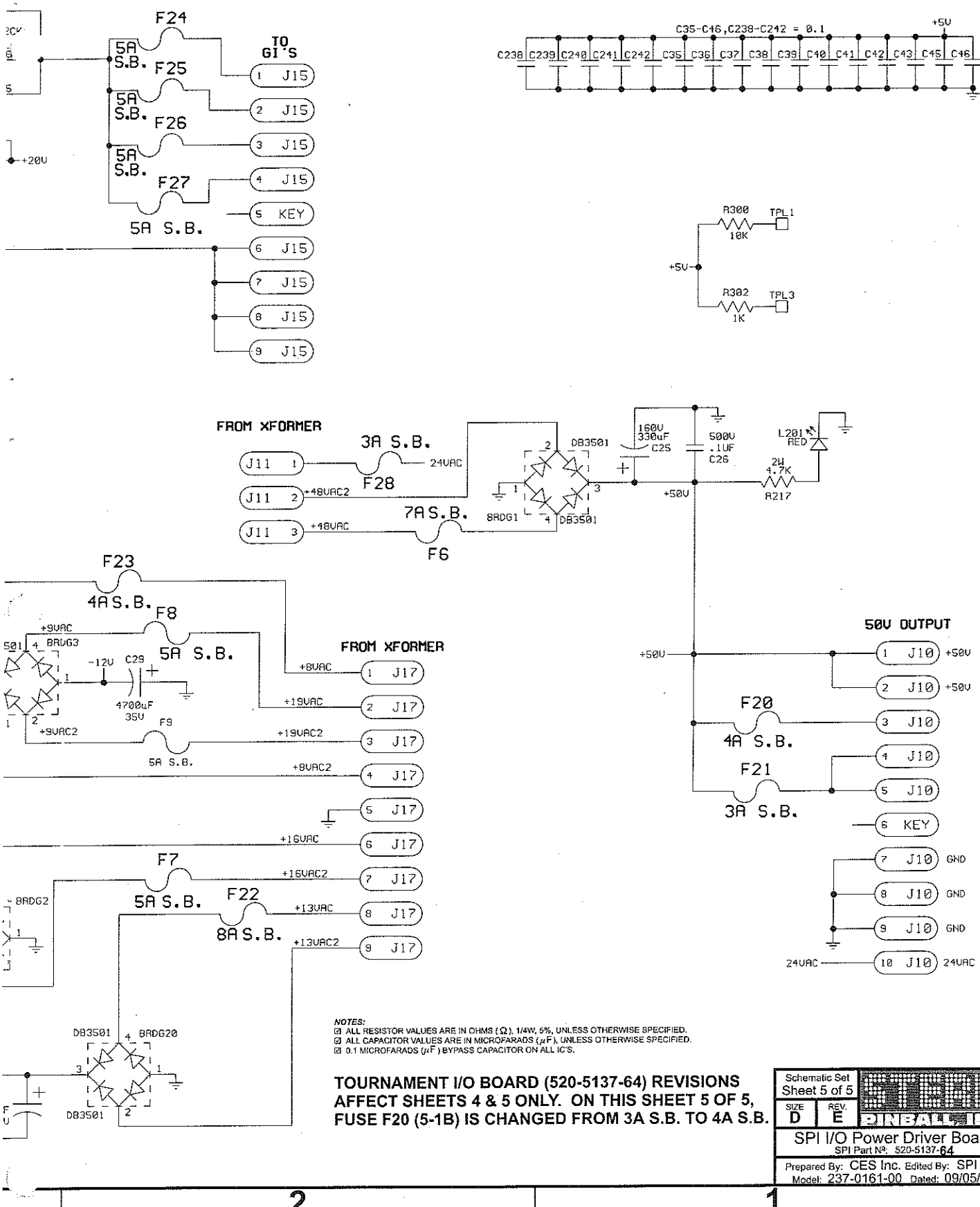
C243-C246 = 470pFd

Non-Text Document

Schematic Set	Sheet 4 of 5
SIZE	D
REV.	E

SPI I/O Power Driver Board
SPI Part №: 520-5137-64
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


GI'S FROM XFORMER
J14 1
J14 2
J14 3
J14 4
J14 5
J14 6
RELAY
FRL264D024/02CK
D229
RLYDRV
+20V
1N4004
(4-1C) RLYDRV
The above circuit(s) continue at the address shown (#-XY)
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
POWER OUT
-12V J16 1
+12V J16 2
+12V J16 3
+5V J16 4
+5V J16 5
+5V J16 6
+5V J16 7
+5V J16 8
GROUND J16 9
GROUND J16 10
GROUND J16 11
GROUND J16 12
GROUND J16 13
KEY J16 14
GROUND J16 15
R219
1k
1/4w
RED
L203
LM338K U19
OUT VIN
ADJ
+10V
C32
100uF
25V
R114
220
L2
RED
R115
120
R116
50
R117
330
C200
0.1
C203
15000uF
25V
DB3501
BRDG21
+12V
+9VAC
BRDG3
C30
+9VAC2
TO
J7-1(LOW CURRENT SOLENOIDS)
J6-10(FLASH LAMPS)
+20V
R216
1.5K
1/2W
RED
L200
C27
15000uF
25V
BRDG2
TO
J13-10(CONTROLLED LAMPS)
+18V
R218
1.5K
1/2W
RED
L202
C202
15000uF
25V
C201
15000uF
25V

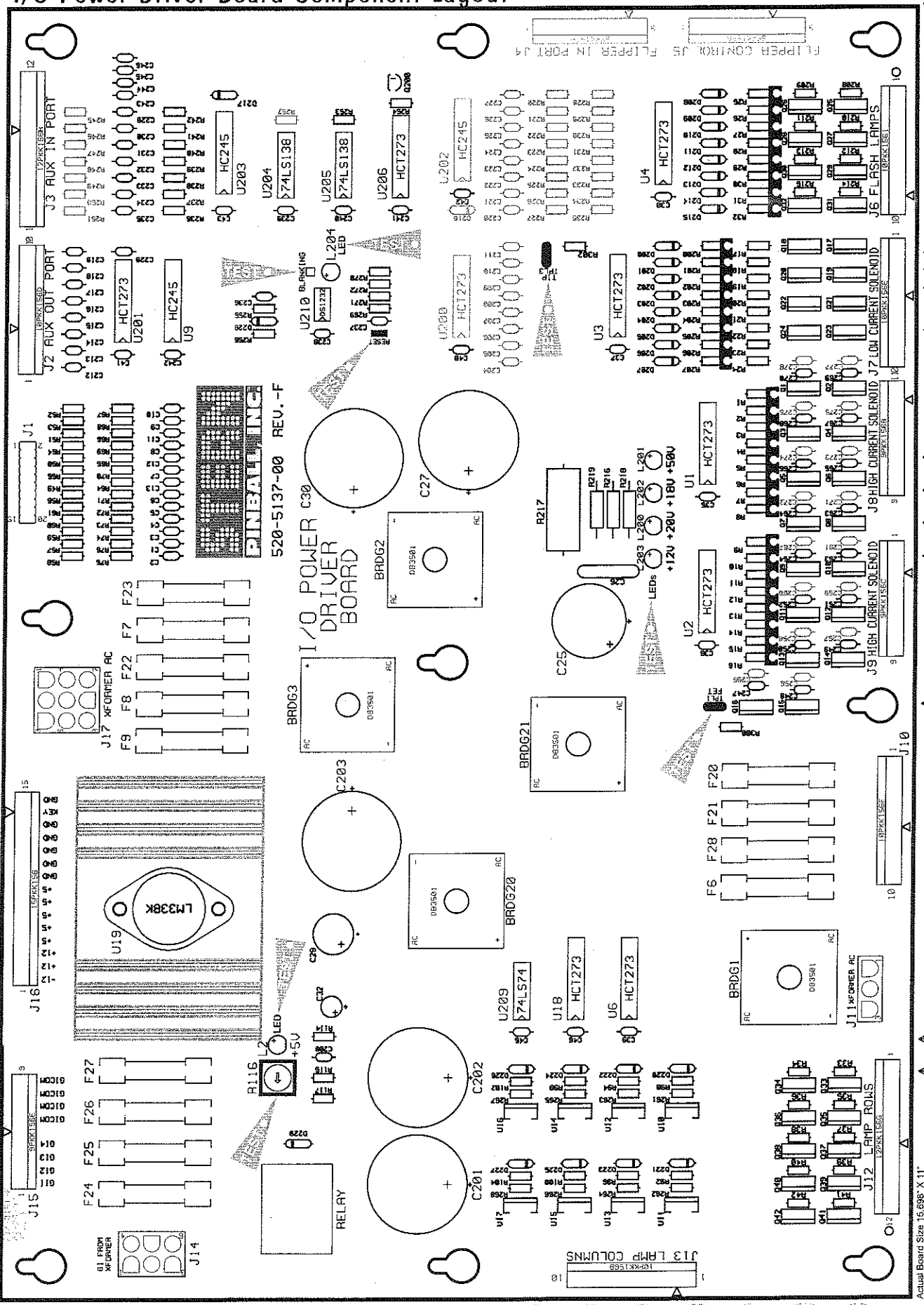


NOTES:
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

TOURNAMENT I/O BOARD (520-5137-64) REVISIONS AFFECT SHEETS 4 & 5 ONLY. ON THIS SHEET 5 OF 5, FUSE F20 (5-1B) IS CHANGED FROM 3A S.B. TO 4A S.B.

Schematic Set Sheet 5 of 5	
SIZE D	REV. E
PINBALL INC.	
SPI I/O Power Driver Board	
SPI Part №: 520-5137-64	
Prepared By: CES Inc. Edited By: SPI Inc.	
Model: 237-0161-00 Dated: 09/05/97	

I/O Power Driver Board Component Layout



I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5137-64**	**I/O Power Driver Board (IT Modified, See Note Below)**	**Complete PCB Assembly**
1	0	125-5027-00	C255>C262, C271>C278 Not Stuffed	0.1uF, (104), 100v, Cap.
2	22	125-5028-00	C212>C219, C228>C237, C243>C246 (C204-C211 NS)	470pF, (471), Axial Cap.
3	16	125-5029-00	C247>C254, C263>C270	0.01uF, (103), 100v Cap.
4	13	125-5030-00	C7 C8 C9 C10 C11 C12 C13 C1 C2 C3 C4 C5 C6	220pF, (221), Cap.
5	0	n/a	(C220>C227 NS)	
6	17	125-5031-00	C35>C43, C45, C46, C200, C238>C242	0.1uF, (104), Cap.
7	16	110-0106-00	Q1>Q16	20N10L STP, Transistor
8	32	121-5042-00	R1>R16, R200>R215	22K Ω 1/4W Res.
9	16	121-5003-00	R17>R32	620 Ω 1/4W Res.
10	17	121-5045-00	R33>R42, R236>R242	39K Ω 1/4W Res.
11	13	121-5007-00	R64>R76	100 Ω 1/4W Res.
12	8	121-5029-00	R90, R92, R94, R96, R98, R100, R102, R104	6.8K Ω 1/4W Res.
13	1	121-5030-00	R115	120 Ω 1/4W Res.
14	0	n/a	R220>R227	
15	2	121-5009-00	(R228>R235 NS) (*R245>R251 removed), R254, R302	1K Ω 1/4W Res.
16	8	121-5032-00	R261>R268	47K Ω 1/4W Res.
17	2	121-5033-00	R114, R269	220 Ω 1/4W Res.
18	8	121-5021-00	R49, R57>R61, R252, R253, R256, R270	4.7K Ω 1/4W Res.
19	11	121-5011-00	R50>R56, R255, R271, R300 (R252 NS)	10K Ω 1/4W Res.
20	2	121-5036-00	R117, R272	330 Ω 1/4W Res.
21	8	100-5012-00	U1>U4, U6, U18, U201, U206 (U200: NS)	74HCT273
22	1	n/a	RESET	n/a
23	1	121-5009-00	R219	1K Ω 1/4W Res.
24	2	121-5038-00	R216, R218	1.5K Ω 1/2W Res.
25	7	200-5000-01	F7>F9, F24>F27	5A 250v S.B. Fuse
26	1	200-5000-03	F6	7A 250v S.B. Fuse
27	2	200-5000-06	F23, **F20 (changed from 3A to 4A)**	4A 250v S.B. Fuse
28	1	200-5000-05	F22	8A 250v S.B. Fuse
29	2	200-5000-08	F21, F28	3A 250v S.B. Fuse
30	1	045-5013-00	J15	9PKK156 (PIN 5=KEY)
31	1	045-5016-00	J16	15PKK156
32	1	100-5023-00	U210	DS1232
33	1	110-0069-00	Q200	2N3904, Transistor.
34	1	125-5032-00	C32	100uF, 25v, Radial Lytic Cap.
35	1	045-5015-01	J1	20-Pin, 0.1 Dual Row Header
36	1	100-0338-00	U203 (U202: NS)	74HC245
37	10	110-0088-00	Q33>Q42	19N06L STP, Transistor
38	6	165-5099-00	**L2, L200>L204**	**LED T1-3/4 DIFFUSER LED**
39	1	045-5014-01	J2	10PKK156 (PIN 4=KEY)
40	1	121-5039-00	R116	50 Ω Pot
41	16	110-0067-00	Q17>Q32	TIP122
42	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
43	1	110-0058-00	U9	74LS245
44	1	125-5034-00	C29	4700uF, 35v, Radial Lytic Cap.
45	1	190-5002-00	RELAY	FRL264D024/02CK Relay
46	0	n/a	J5	(J5: NS)
47	1	100-0037-00	U209	74LS74
48	0	n/a	J4	(J4: NS)
49	2	100-0148-00	U204, U205	74LS138
50	1	125-5035-00	C26	.1UF, 500v, Ceramic Disk Cap.
51	1	100-0356-00	U19	LM338K
52	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
53	5	125-5036-00	C27, C30, C201>C203	15000uF, 25v, Radial Lytic Cap.
54	25	112-0054-00	D200>D215, D220>D227	1N4148, Diode
55	2	112-5003-00	D217, D229 (D216: NS)	1N4004, Diode
56	2	n/a	TPL1, TPL3	*Test Point Wire (24ga.) Loops*
57	1	045-5014-01	J7	10PKK156 (PIN 5=KEY)
58	1	045-5014-01	J6	10PKK156 (PIN 9=KEY)
59	8	110-0089-00	U10>U17	VN02N
60	1	045-0014-03	J11	10-84-4030 (3 PIN MOLEX)
61	1	045-5015-00	J12	12PKK156 (PIN 7=KEY)
62	1	045-0014-09	J17	10-84-4090 (9 PIN MOLEX)
63	1	n/a	BLANKING	*Test Point - Do Not Stuff*
64	1	121-5050-00	R217	4.7K Ω 2W Res. (SANDBAR)
65	1	045-5014-01	J13	10PKK156 (PIN 2=KEY)
66	1	045-0014-06	J14	10-84-4060 (6 PIN MOLEX)
67	1	045-5014-01	J10	10PKK156 (PIN 6=KEY)
68	1	045-5015-00	J3	12PKK156 (PIN 8=KEY)
69	1	045-5013-00	J9	9PKK156 (PIN 3=KEY)
70	1	045-5013-00	J8	9PKK156 (PIN 2=KEY)
71	26	205-0004-00	F6>F9, F20>F28	Fuse Clips
72	1	n/a	U19	Heatsink (5v Reg.)

***Please Note:**

The I/O Power Driver Board in this game (SPI №: 520-5137-64) has been modified to work with the Optional IT Tournament Equipment. This board is backward compatible with all White Star Board System Games (A13 thru current) with the exception of Golden Eye & Twister Pinballs (requires SPI №: 520-5137-01) which utilize a unique Magnet Controller Board. 520-5137-64 modifications from a 520-5137-01 board are summarized on Schematic Sheet 4 of 5, Right, Page 107.

Your Notes



CPU Section:

The CPU is a **68B09E** (**U209**) with up to 8 MBytes of CPU *Code Space* (**U210**). The CPU code is bank selected by the use of **U211** and each bank consists of 16 KBytes. **32 KBytes** of RAM (**U212**) is available to the CPU. The RAM is battery backed and has a write protected area. Battery back up is accomplished by 3-AA Cells which have a **TEST POINT VB** to check the battery voltage status. The write protected area consists of 512 Bytes used for storing game settings. This section of **RAM** can only be written to when the coin door is open. The Coin Door switch comes into the CPU on **CN6-12** and is fed into the address decoding **PAL U213**. When this memory protect signal is low writes to the protected **RAM** area are prohibited. Address decoding for the system is accomplished by one **PAL U213** and one 1-of-8 decoder **U214**.

A watchdog is used to monitor the CPU and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the CPU/Sound Board & I/O Board in reset. The watchdog must be fed at a rate of ***250ms*** or faster. The signal used to feed the watchdog comes from the EPROM Bank select signal used to load **U211**. The CPU has a timer interrupt used as a heartbeat for the system this signal comes from counter **U2**. The clock for this counter is the **CPU Q CLOCK**. Clearing the timer interrupt is done by reading the ***DIP Switch***. The timer interrupt can be observed at **TEST POINT FIRQ**. In normal operation "**FIRQ**" should be toggling at a rate of *976Hz*.

The I/O Interface **CN1** is buffered by two (2) **HC245** Chips. The CPU's reset line is buffered by **Q10** and fed over to the I/O through **CN1**. An I/O strobe signal is feed through **CN1-15** and is used to notify the I/O that a valid address is being sent.

Switches:

The Switch Matrix consists of eight (8) **2N3904** Transistors which pull one of 8 strobes 'low' to *activate* a Single Column of switches. The *Switch Return Signals* are fed into **CN7** [SWITCH ROWS] and are highly filtered and compared to a 2.5v *reference voltage*. The *Switch Return Voltage* must be below 2.5v to make a *Valid Switch Closure*. If *false switches* are appearing, check that none of the **2N3904** Transistors are permanently pulling the *strobe line low*. Only one strobe from **CN5** [SWITCH COLUMNS] should be *low at any time*. **CN6** [DEDICATED SWITCH IN] is a *Dedicated Bank of Input Switches*. Switches connected to **CN6** are connected to ground instead of a strobe and may be read at any time.

Plasma Interface:

The data path for communication to and from the Plasma Controller Board is 8 bits wide. There are separate *Input* and *Output Busses*. The *Input Bus* from the Plasma Controller to the CPU/Sound Board comes in on **CN8** [PLASMA CONTROL]-**Pins 3-10** and is fed into **U200** for input to the CPU's *Data Bus*. Data going out to the controller comes from the CPU's *Data Bus* through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma Controller comes in on **CN8-Pins 22-26** and is fed into **U202** for input to the CPU's *Data Bus*. Two control signals that go out to the Plasma Controller are **PRES** [PLASMA RESET] and **CN8-Pin 19** [**PSTB** - *Plasma Strobe*]. The Plasma Reset is software controllable through **U216/B** and also has a test point "Plasma Reset". The *Plasma Strobe Signal* to the controller is generated from **U216/A** and is *used to latch data* into the Plasma Controller.

Sound Section:

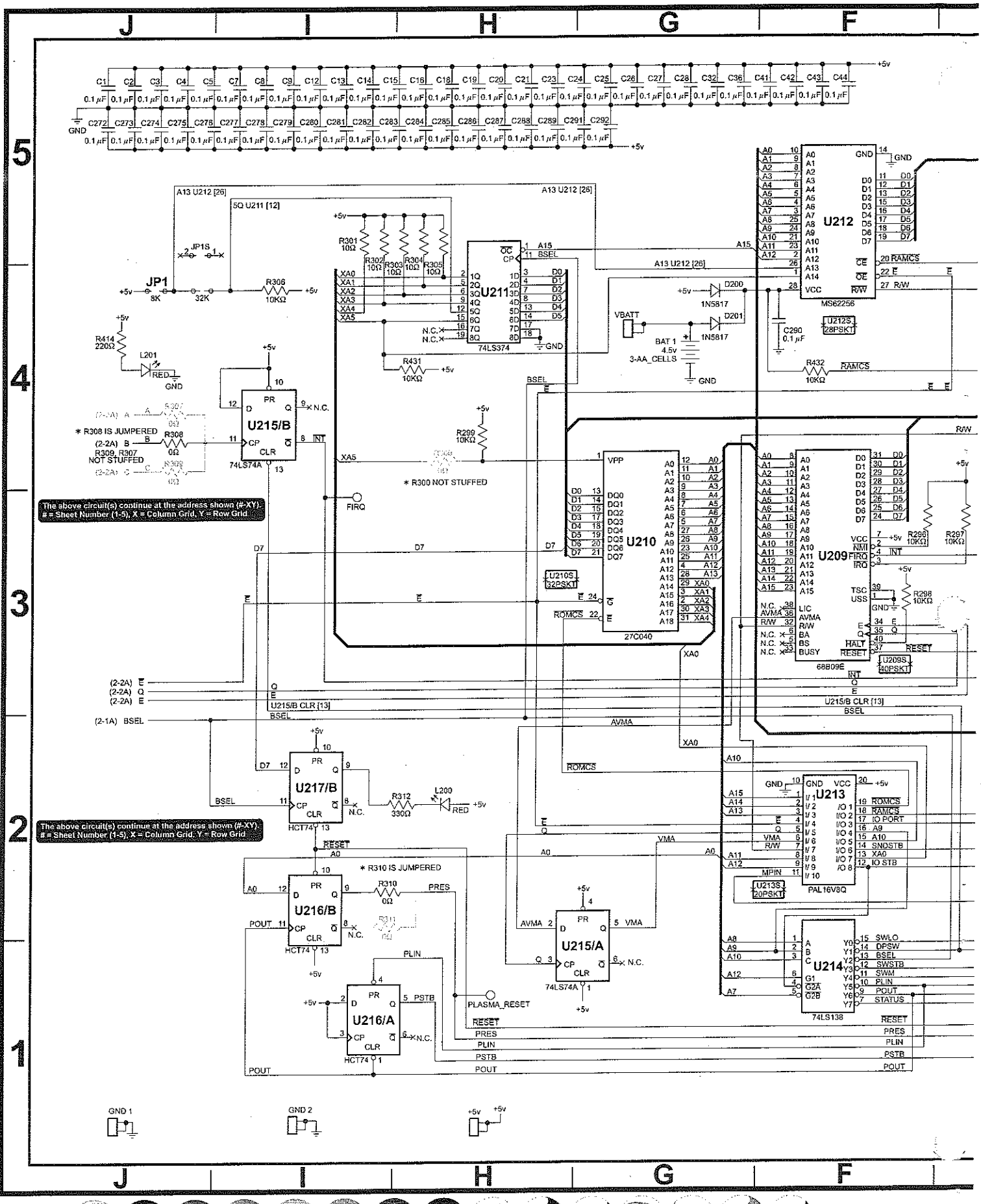
The audio section consists of a **BSMT SOUND CHIP U9** Sound (Voice) EPROMs (**U17 U21 U36 U37**) **68B09E U6** and Sound Code **EPROM U7**. The **BSMT** latches sound EPROM addresses in **U13** & **U12** for output to the Sound EPROMs. Sound Data from the EPROMs is read through **U19** to the **BSMT**. The EPROMs are bank selected by **U22**. When the **BSMT** has sound data to be played out to the speakers it loads 16 bits into a 16 bit shift register made up of **U24** & **U23**. The data stream from the shift register is serially shifted into a stereo 16 bit *Digital to Analog Converter* (**DAC**). When the system is operating properly the ws (word select) input of the **DAC** will be toggling. The ws input is used to latch the right and left channel sound data into the **DAC**. If the ws line is not oscillating no analog signal will come out of the **DAC**. The **DAC** outputs are a controlled current source. These outputs are converted to a voltage by an operational amplifier **U30** to form the analog signal. **TEST POINTS AOR** and **AOL** are the outputs of the operational amplifier. These outputs are then fed directly into three power amplifiers (**TDA2030A**) or optionally into an analog volume control chip **U35** for a potentiometer volume control. The analog section has its own +5v & -5v derived from **VR1** & **VR2**. These separate supply voltages are for the **DAC U26** Operational Amplifier **U30** and analog volume control **U35**.

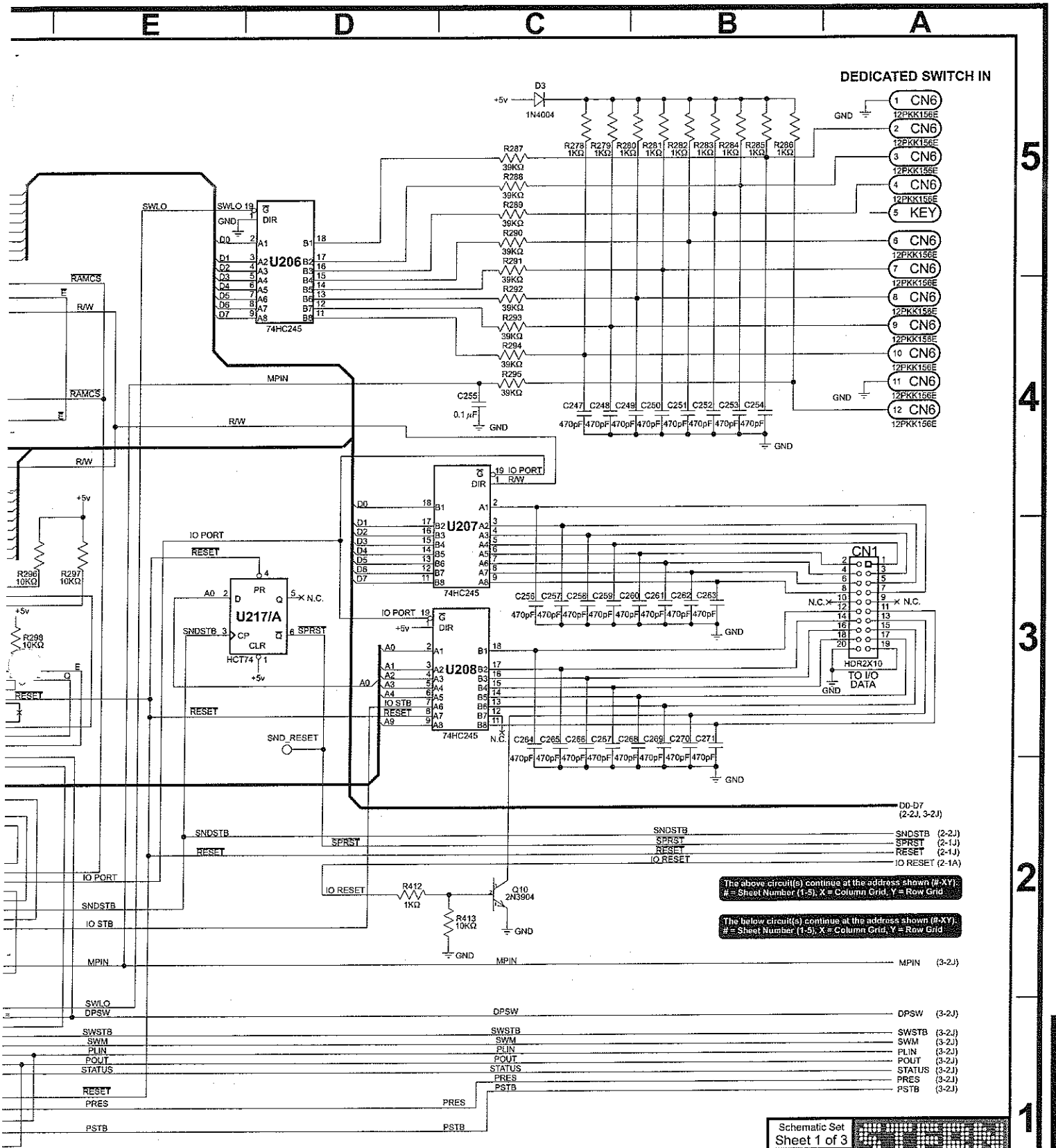
Sound calls are made from the **CPU's 68B09E U200** to the sound section by latching data into **U5**. The sound section's **CPU 68BO9E (U6)** reads in this data and handles the interfacing to the **BSMT**.

Other Test Points:

E & **Q** - The CPU signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by ***500 nsec***.
24Mhz - The oscillator used for the **BSMT** & derivation of **E** & **Q**.
SND-FIRQ - The sound sections CPU interupt.
6Mhz - This clock is generated internally on the **BSMT** and is used for shifting the data samples into th **DAC**.

W6 Jumper - This jumper must be installed for games that use **8MB** Sound EPROMs (**U17 U21 U36 U37**). For games which use **4MB** Sound EPROMs this jumper is not installed but will operate on boards with W6 installed.

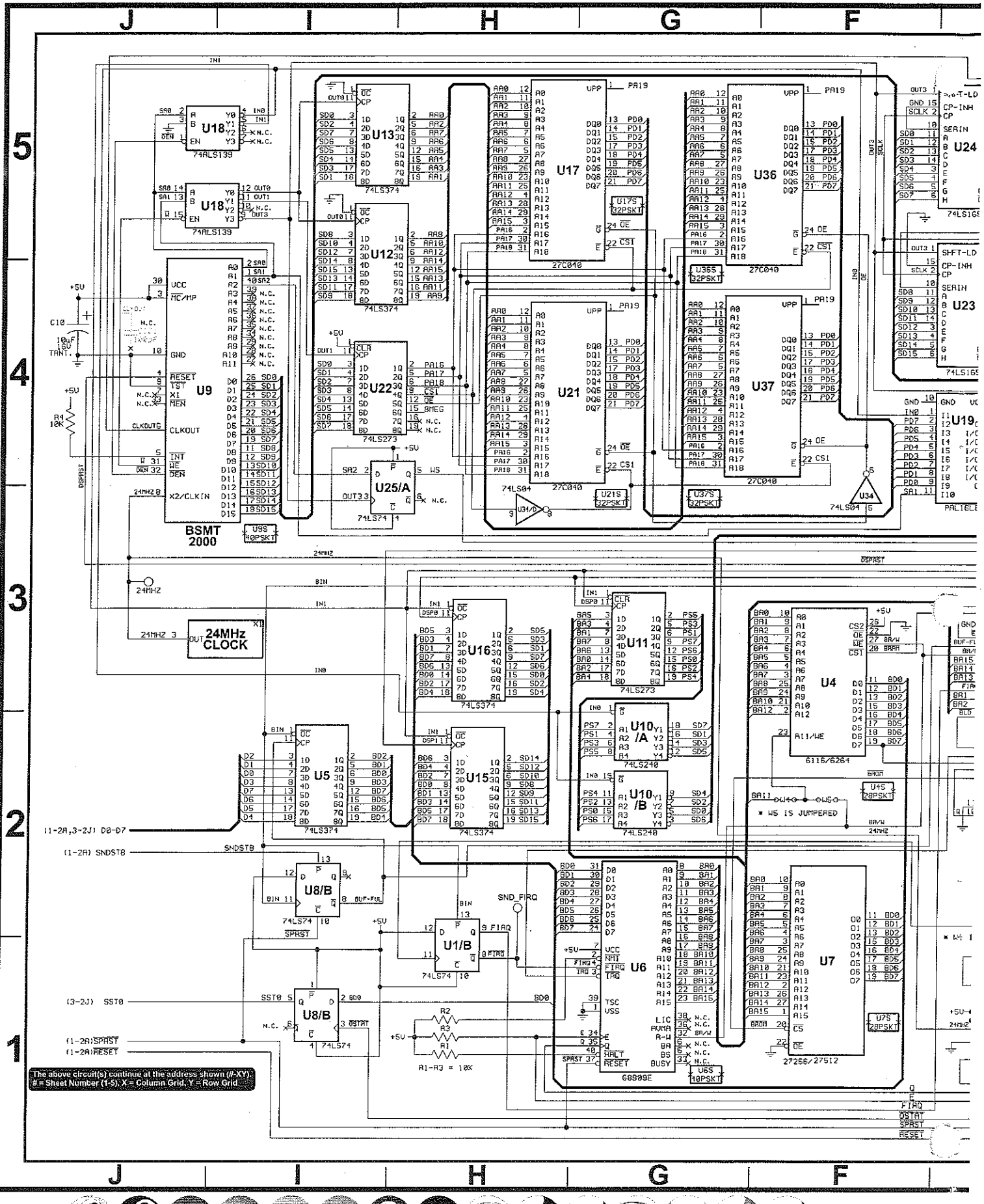

J
I
H
G
F
5
4
3
2
1
U212
U211
74LS374
U210
27C040
U209
68B09E
U213
PAL16V8Q
U214
74LS138
U215/B
74LS74A
U215/A
U216/B
U216/A
U217/B
HCT74
MS62256
1N5817
3-AA_CELLS
A13 U212 [26]
5Q U211 [12]
JP1
JP1S
R306
10KΩ
8K
32K
R301
R302
R303
R304
R305
R414
220Ω
L201
RED
R308 IS JUMPERED
R309, R307
NOT STUFFED
R300 NOT STUFFED
R299
R296
R297
R298
R431
R432
R312
330Ω
L200
R310 IS JUMPERED
R310
0Ω
C290
0.1 µF
U212S
28PSKT
U210S
32PSKT
U209S
40PSKT
U213S
20PSKT
RAMCS
ROMCS
IO PORT
IO STB
SNDSTB
SWLO
DPSW
BSEL
SWSTB
SWM
PLIN
PSTB
POUT
STATUS
RESET
PRES
PLASMA_RESET
FIRQ
VBATT
BAT 1
4.5v
GND
GND 1
GND 2
The above circuit(s) continue at the address shown (#-XY)
= Sheet Number (1-5), X = Column Grid, Y = Row Grid

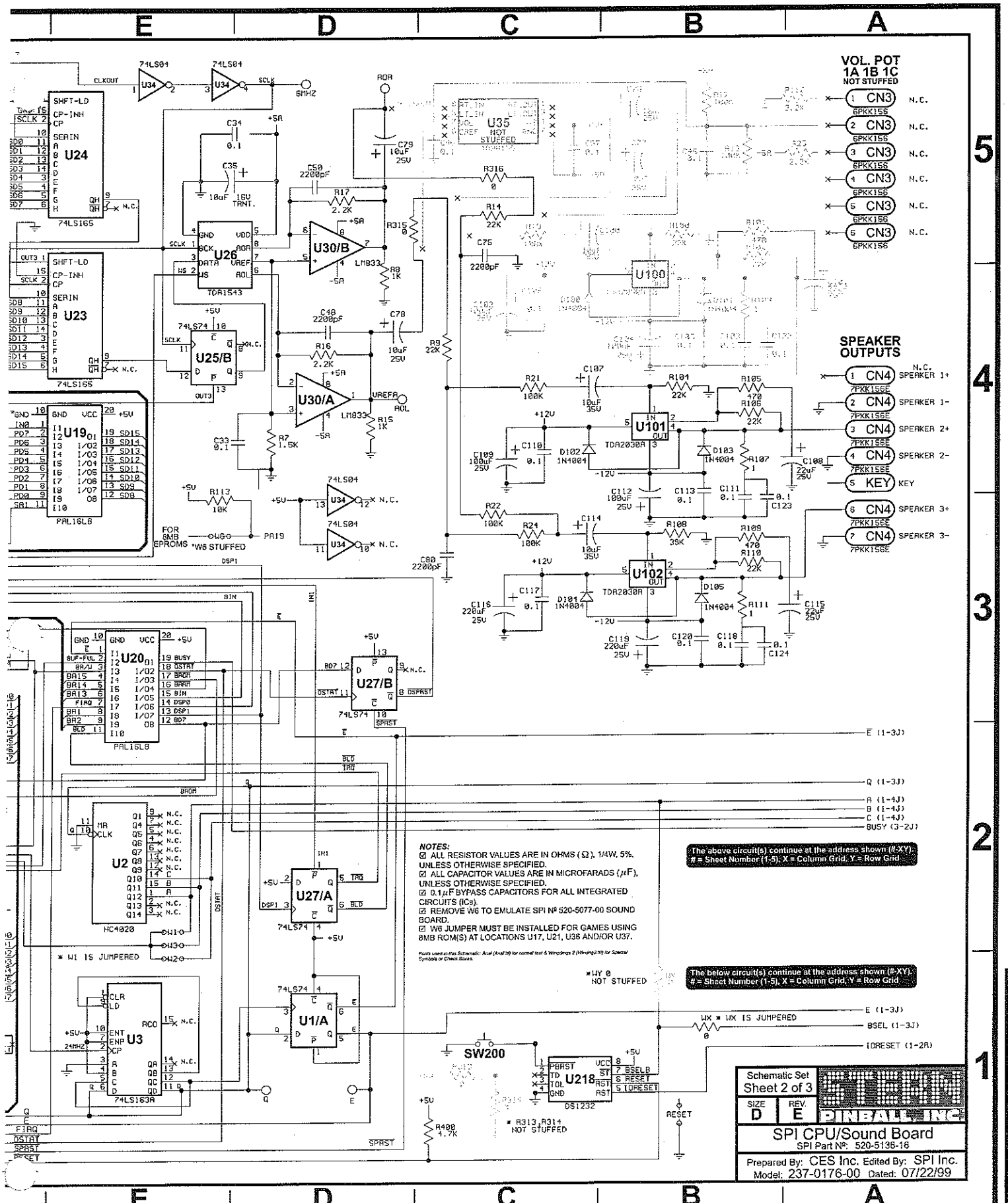


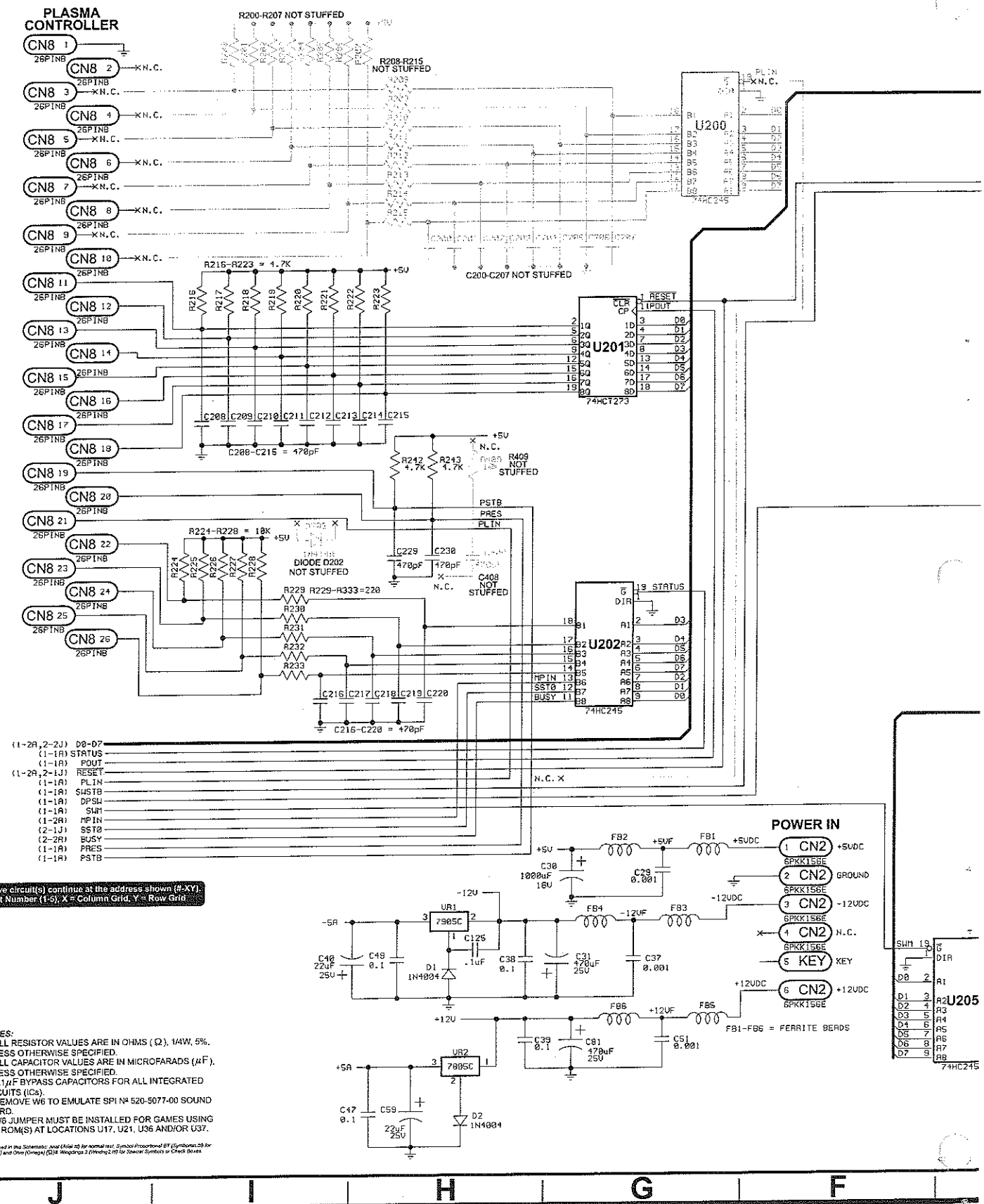
NOTES:
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
- ☑ REMOVE W6 TO EMULATE SPI № 520-5077-00 SOUND BOARD.
- ☑ W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8MB ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.

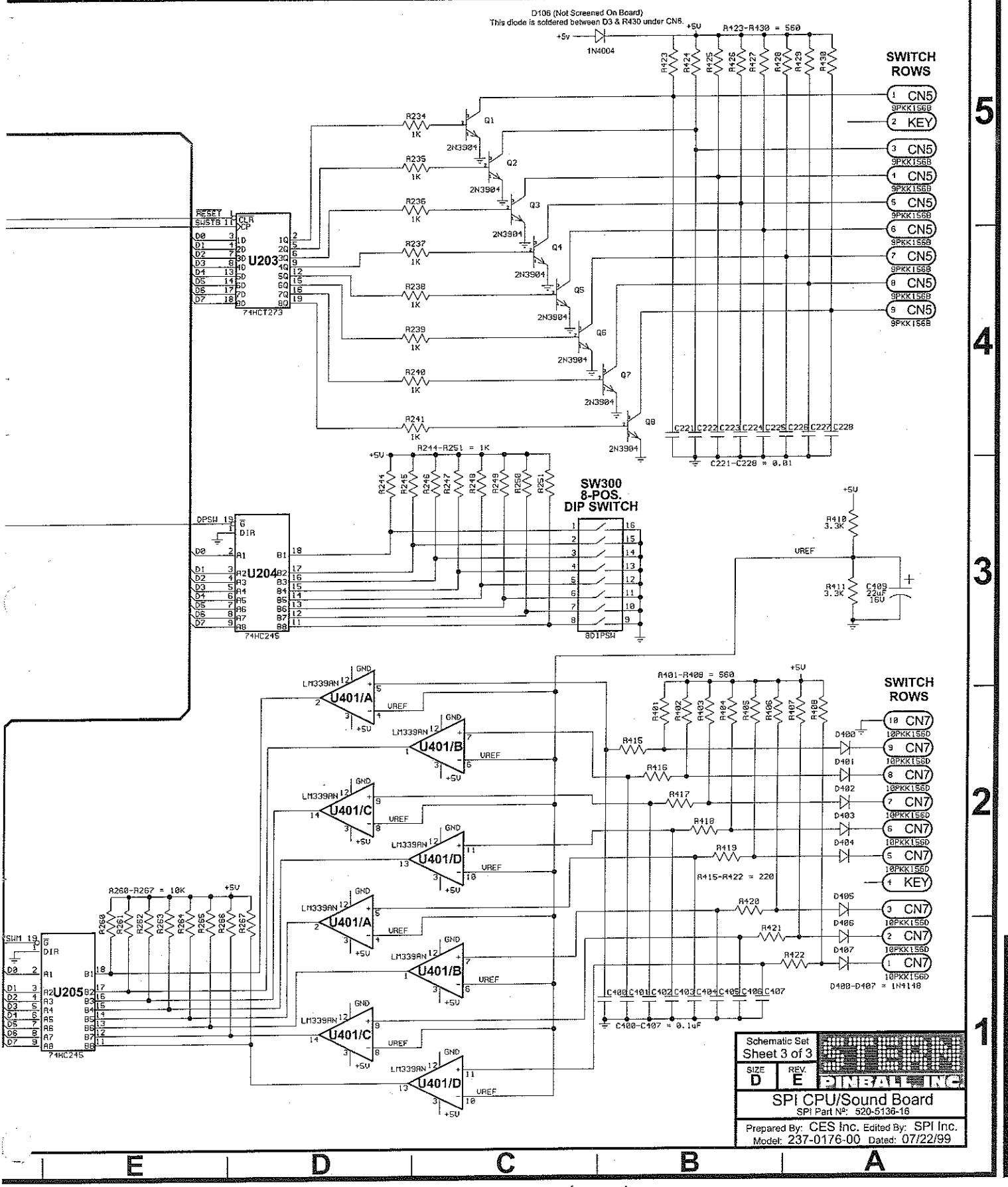
Fonts used in this Schematic: Arial (Arial.ttf) for normal text, Symbol Proportional BT (Symbprop.ttf) for Micro (μ) and Ohm (Omega)(Ω) & Wingdings 2 (Wingdng2.ttf) for Special Symbols or Check Boxes.

Schematic Set	Sheet 1 of 3
SIZE	D
REV.	E
	PINBALL INC.
SPI CPU/Sound Board	
SPI Part №: 520-5136-16	
Prepared By: CES Inc.	Edited By: SPI Inc.
Model: 237-0176-00	Dated: 07/22/99


BSMT 2000
24MHz CLOCK
U9
U17
U21
U36
U37
U13
U12
U22
U25/A
U16
U11
U15
U5
U10 /A
U10 /B
U8/B
U1/B
U6
U4
U7
U18
U24
U23
U19
U34
6116/6264
27256/27512
68B09E
74LS374
74LS273
74LS240
74LS139
74LS04
74LS74
27C040
* W5 IS JUMPERED
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid


VOL. POT
1A 1B 1C
NOT STUFFED
SPEAKER
OUTPUTS
U35
NOT
STUFFED
U100
U24
U23
U26
U30/B
U30/A
U25/B
U19
U20
U27/B
U27/A
U2
U3
U1/A
U101
U102
U218
SW200
NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
☑ REMOVE W6 TO EMULATE SPI Nº 520-5077-00 SOUND BOARD.
☑ W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8MB ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.
* W1 IS JUMPERED
* WX IS JUMPERED
* R313, R314 NOT STUFFED
The above circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid.
The below circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid.
Schematic Set
Sheet 2 of 3
SIZE D
REV. E
PINBALL INC
SPI CPU/Sound Board
SPI Part Nº: 520-5136-16
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0176-00 Dated: 07/22/99


PLASMA CONTROLLER
CN8 1 26PINB
CN8 2 26PINB N.C.
CN8 3 26PINB N.C.
CN8 4 26PINB N.C.
CN8 5 26PINB N.C.
CN8 6 26PINB N.C.
CN8 7 26PINB N.C.
CN8 8 26PINB N.C.
CN8 9 26PINB N.C.
CN8 10 26PINB N.C.
CN8 11 26PINB
CN8 12 26PINB
CN8 13 26PINB
CN8 14 26PINB
CN8 15 26PINB
CN8 16 26PINB
CN8 17 26PINB
CN8 18 26PINB
CN8 19 26PINB
CN8 20 26PINB
CN8 21 26PINB
CN8 22 26PINB
CN8 23 26PINB
CN8 24 26PINB
CN8 25 26PINB
CN8 26 26PINB
R200-R207 NOT STUFFED
R208-R215 NOT STUFFED
C200-C207 NOT STUFFED
U200
74AC245
PLIN
N.C.
R216-R223 = 4.7K
+5V
R215 R216 R217 R218 R219 R220 R221 R222 R223
U201
74HCT273
RESET
IPOUT
C208 C209 C210 C211 C212 C213 C214 C215
C208-C215 = 470pF
R242 4.7K
R243 4.7K
R409 NOT STUFFED
N.C.
PSTB
PRES
PLIN
R224-R228 = 10K
DIODE D202 NOT STUFFED
C229 470pF
C230 470pF
C408 NOT STUFFED
R229 R229-R333=220
R230
R231
R232
R233
U202
74HC245
STATUS
D3 D4 D5 D6 D7 D2 D1 D0
MPIN
SST0
BUSY
C216 C217 C218 C219 C220
C216-C220 = 470pF
(1-2A,2-2J) D0-D7
(1-1A) STATUS
(1-1A) POUT
(1-2A,2-1J) RESET
(1-1A) PLIN
(1-1A) SWSTB
(1-1A) DPSW
(1-1A) SWI
(1-2A) MPIN
(2-1J) SST0
(2-2A) BUSY
(1-1A) PRES
(1-1A) PSTB
N.C.
POWER IN
FB2 FB1
+5V
+5VDC
C30 1000uF 16V
C29 0.001
CN2 1 6PKK156E +5VDC
CN2 2 6PKK156E GROUND
CN2 3 6PKK156E -12VDC
CN2 4 6PKK156E N.C.
CN2 5 6PKK156E KEY
CN2 6 6PKK156E +12VDC
-12V
VR1 7905C
-5A
C125 .1uF
C40 22uF 25V
C49 0.1
D1 1N4004
C38 0.1
C31 470uF 25V
C37 0.001
FB4 FB3
-12VF
-12VDC
+12V
VR2 7805C
+5A
C39 0.1
C81 470uF 25V
C51 0.001
FB6 FB5
+12VF
+12VDC
FB1-FB6 = FERRITE BEADS
C47 0.1
C59 22uF 25V
D2 1N4004
SWM 19
U205
74HC245
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-9); X = Column Grid, Y = Row Grid
NOTES:
☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
☑ REMOVE W6 TO EMULATE SPI Nº 520-5077-00 SOUND BOARD.
☑ W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8M8 ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.
Fonts used in this Schematic: Arial (Arial nt) for normal text, Symbol Proportional BT (Symbol nt) for Ohms (Ω) and Omni (Omega) (Ω) (# Weights: 2 (Wedge) 2 nt) for Special Symbols or Check Boxes.



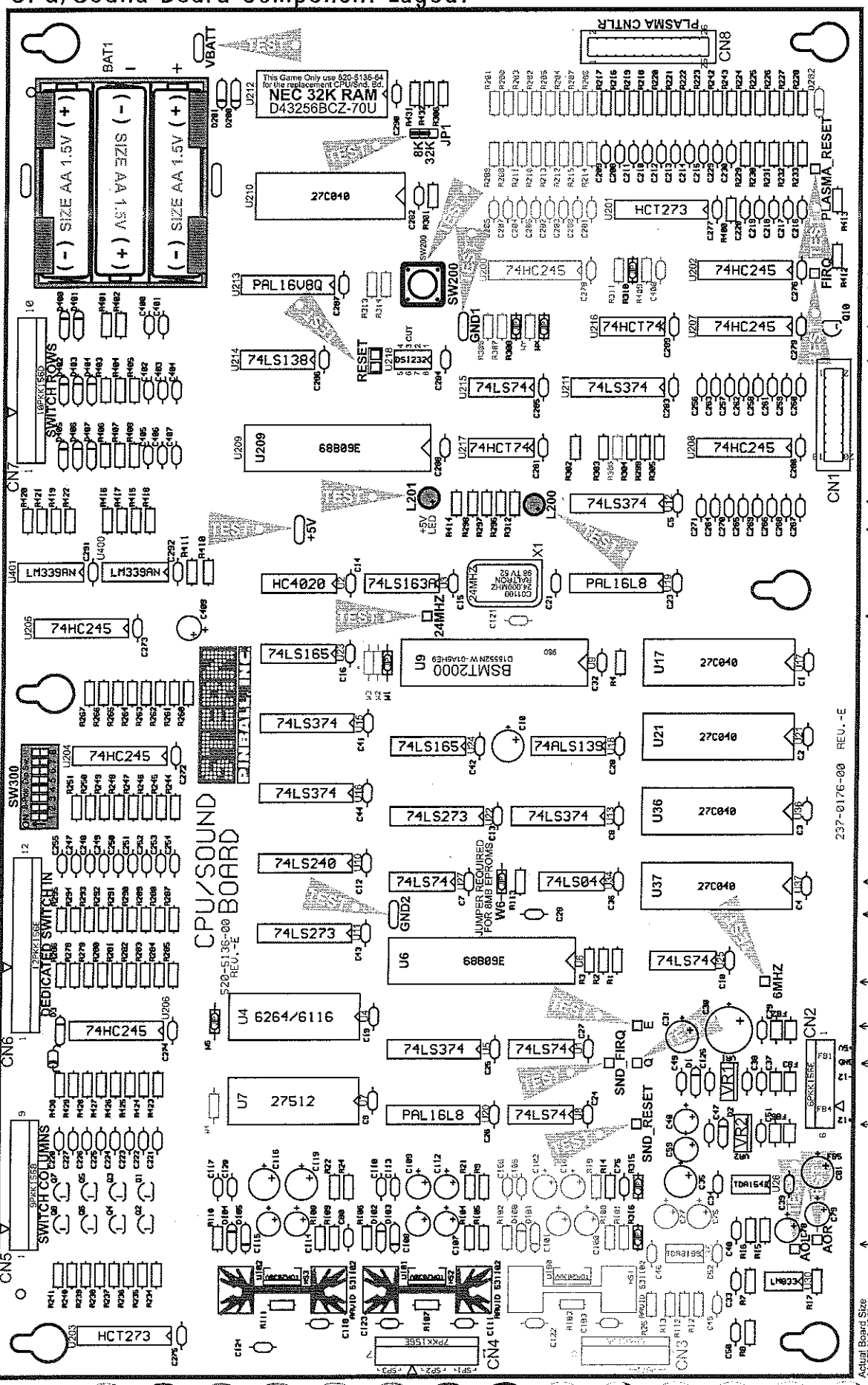
Schematic Set	Sheet 3 of 3
SIZE	D
REV.	E

PINBALL INC

SPI CPU/Sound Board
SPI Part №: 520-5136-16

Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0176-00 Dated: 07/22/99

CPU/Sound Board Component Layout



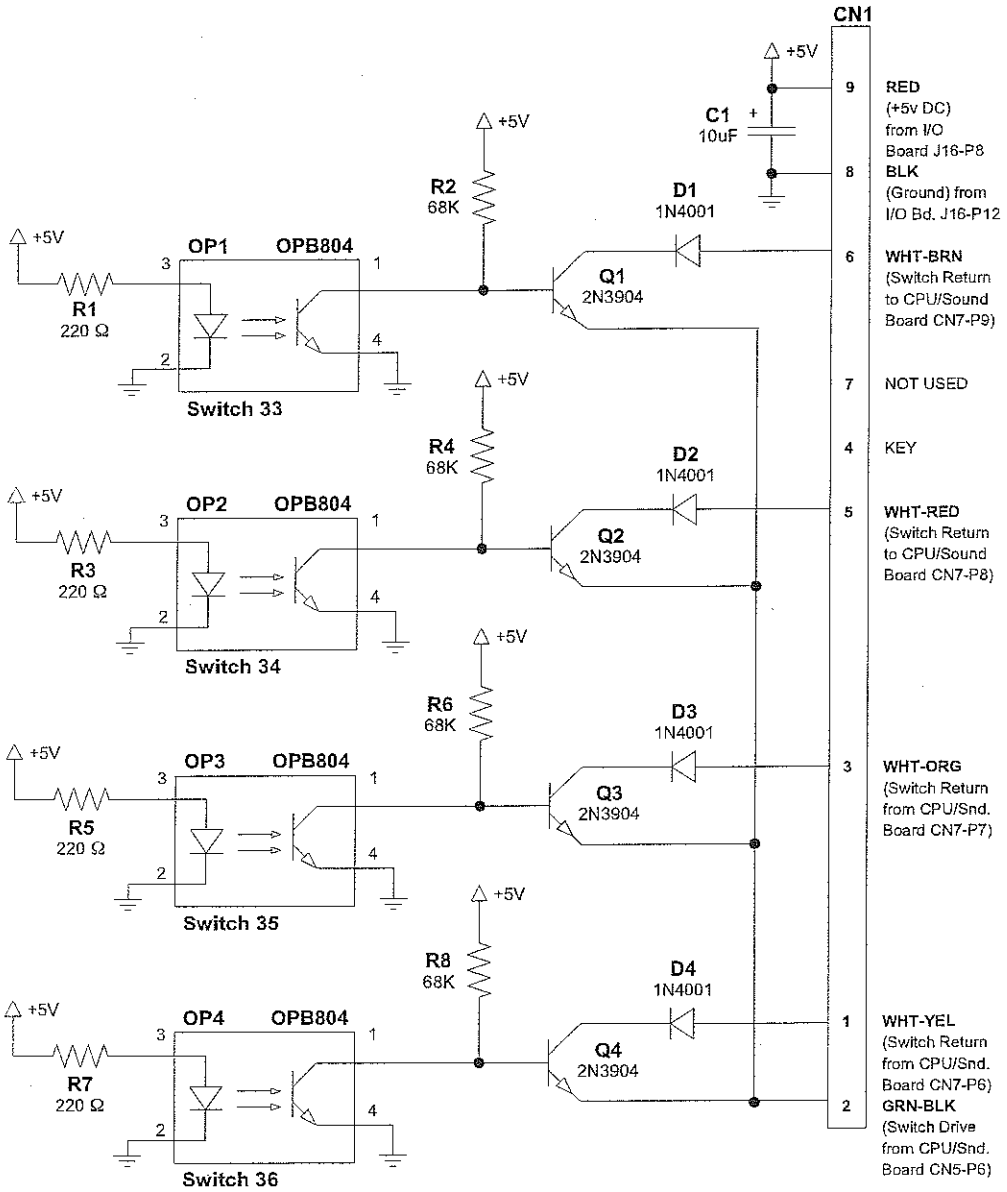
CPU/Sound Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5136-64**	**CPU/Sound Board Mono (FCC FEB98)**	**Complete PCB Assembly**
1	1	124-5001-00	VR2	LM7805CT +5v Regulator
2	5	121-5051-00	R12, R13, R21, R22, R24 (R19 NS)	100K Ω 1/4W Res.
3	2	121-5009-00	R103, R107, R111	1K Ω 1/4W Res.
4	38	121-5011-00	R1>R4, R113, R200>R207, R224>R228, R244>R251, R260>R267, R296>R299, R301>R306, R409, R413 (R103 R200>R207, R409, R413: NS)	10K Ω 1/4W Res.
5	5	121-5023-00	R9, R14, R104, R106, R110 (R100, R102 NS)	22K Ω 1/4W Res.
6	20	121-5009-00	R15, R8, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
7	4	121-5043-00	R16, R17, R25, R112	2.2K Ω 1/4W Res.
8	1	121-5018-00	R7	1.5K Ω 1/4W Res.
9	2	121-5046-00	R105, R109 (R101 NS)	470K Ω 1/4W Res.
10	9	121-5045-00	R108, R287>R294	39K Ω Res.
11	1	121-5036-00	R312	330 Ω 1/4W Res.
12	12	n/a	R300, R308>R311, R313>R316, WX, WY	0Ω *Jumper Wire (24ga.)*
13	15	121-5033-00	R229>R233, R414>R422 (R208>R215: NS)	220 Ω 1/4W Res.
14	11	121-5021-00	R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
15	16	121-5047-00	R401>R408, R423>R430	560 Ω 1/4W Res.
16	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
17	1	100-0049-00	U3	74LS163
18	1	(See Pg. **DR. ❸** Table)	U7	27512 EPROM
19	1	045-5015-07	CN4	7PKK156 (PIN5=KEY)
20	1	Not Used	RESET	
21	5	(See Pg. **DR. ❸** Table)	U17, U21, U36, U37, U210	27C040 EPROM
22	2	100-5008-00	U23, U24	74LS165
23	4	125-5017-00	C76>C79	10uF, 25v, Radial Lytic Cap.
24	4	125-5020-00	C40, C59, C108, C115 (C101: NS)	22uF, 25v, Radial Lytic Cap.
25	2	125-5017-00	C10,7 C114 (C102: NS)	10uF, 35v, Radial Lytic Cap.
26	2	125-5015-00	C109, C112 (C105, C104 NS)	100uF, 25v, Rad. Ltc. Cap.
27	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
28	0	100-5016-00	U35 NS	TDA1899
29	1	125-5037-00	C30	1000uF, 16v, Radial Lytic Cap.
30	1	100-0027-00	U34	74LS04
31	1	100-0043-00	U18	74ALS139
32	6	100-0064-00	U5, U12, U13, U15, U16, U211	74LS374
33	1	100-0249-00	U2	74HC4020
34	1	100-0149-00	U10	74LS240
35	6	n/a	W1, **W6 (W6 if using 8MB EPROMs)** (W2-W4 NS)	0Ω *Jumper Wire (24ga.)*
36	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
37	2	125-5017-00	C10, C35	10uF, 16v, Radial Tant. Cap.
38	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
39	1	045-5015-06	CN2	6PKK156 (PIN 5=KEY)
40	1	140-0011-00	X1	24Mhz
41	1	105-0116-00	U9	BSMT2000
42a	1	965-0136-00	**U19 - YELLOW DOT**	PAL16L8 (Programmed) - **YELLOW DOT**
42b	1	965-0137-00	**U20 - WHITE DOT**	PAL16L8 (Programmed) - **WHITE DOT**
42c	1	965-5023-00	**U213- GOLD DOT (THIS GAME ONLY)**	PAL16L8 (Programmed) - **GOLD DOT**
43	5	100-0037-00	U1, U8, U25, U27, U215	74LS74
44	3	125-5043-00	C29, C37, C51	0.001uF, (102), Cap.
45	79	125-5031-00	C1>C5, C7>C9, C12>C16, C18>C21, C23>C26, C28, C32>C34, C36, C38, C39, C41>C47, C49, C52, C102 C103, C105, C106, C110, C111, C113, C117, C118, C120, C122>C125, C255, C272>C292, C400>C407 (C102, C103, C105, C106: NS)	0.1uF, (104), Axial Cer. Cap.
46	1	125-5038-00	C121	100pF, (101), Cap.
47	4	125-5039-00	C48, C50, C75, C80	0.0022uF, (222), Cap.
48	44	125-5028-00	C208>C220, C229, C230, C247>C254, C256>C271 (C200>C207: NS)	470pF, (471), Cer. Cap.
49	8	125-5029-00	C221>C228 (C409: NS)	0.01uF, (103), 100v Cap.
50	1	045-5015-06	CN3	6PKK156
51	1	100-0375-00	U30	LM833
52	2	100-0022-00	U22 U11	74LS273
53	7	112-5003-00	D1>D3, D102>D105 (D100, D101: NS)	1N4004, Diode
54	2	112-5008-00	D200, D201	1N5817, Diode
55	8	112-0054-00	D400>D407 (D202: NS)	1N4148, Diode
56	1	124-5002-00	VR1	LM7905CT -5v Regulator
57	2	100-5016-20	U101, U102 (U100: NS)	TDA2030V
58	1	100-5018-00	U26	TDA1543
59	1	n/a	SW200	B3F4000
60	1	165-5099-00	**L200**	**LED T1-3/4 DIFFUSER LED**
61	1	165-5099-00	**L201**	**LED T1-3/4 DIFFUSER LED**
62	2	100-5015-00	U216, U217	HCT74
63	1	100-0148-00	U214	74LS138
64	1	**105-5001-00**	**U212 (THIS GAME ONLY)**	**NEC RAM 32K (D43256BCZ-70U)**
65	1	100-0189-01	U6, U209	68B09E
66	1	545-5685-00	BAT1 BATTERY HOLDER	3-AA CELLS 4.5v
67	1	045-5015-01	CN1	20-Pin, 0.1 HEADER
68	10	n/a	6MHZ AOR Q AOL 24MHZ	*Test Points* - NS
69	10	110-0069-00	Q1>Q10	2N3904, Transistor
70	1	045-5013-00	CN5	9PKK156 (PIN 2=KEY)
71	2	100-5012-00	U201, U203	74HCT273
72	6	100-0338-00	U202, U204>U208 (U200: NS)	74HC245
73	1	100-5023-00	U218	DS1232
74	1	045-5015-26	CN8	26-Pin, 0.1 HEADER
75	1	045-5014-01	CN7	10PKK156 (PIN 4=KEY)
76	4	n/a	VBATT +5v GND1, GND2	*Test Point Wire (24ga.) Loops*
77	1	045-5015-00	CN6	12PKK156 (PIN 5=KEY)
78	1	181-5002-00	SW300	8-Pin, Dip Switch
79	2	100-0377-00	U400, U401	LM339AN
80	1	105-0052-05	U4	6116 RAM
81	3	535-5000-10	U101, U102	AAVID 531102
82	3	077-5209-00	U6, U9, U209	40-Pin, IC Socket
83	5	077-5217-00	U17, U21, U36, U37, U210	32-Pin, IC Socket
84	3	077-5208-00	U4, U7, U212	28-Pin, IC Dip Socket
85	1	n/a	U1 (@ Pins 5 & 6)	100pF, Cap.

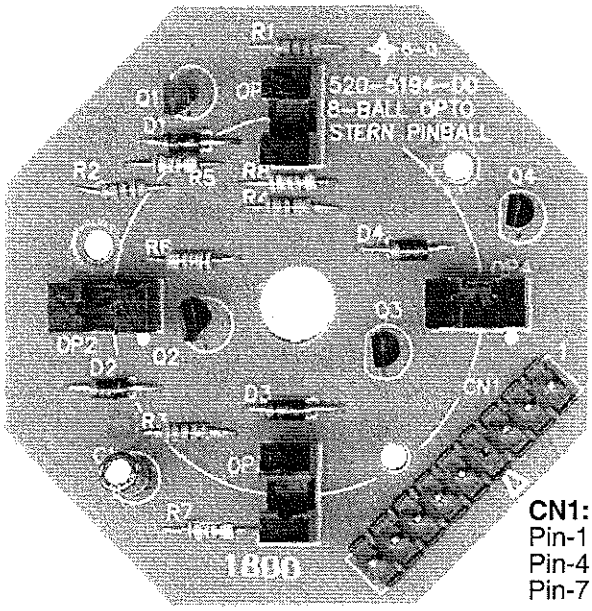
4-Position OPTO PC Board Theory of Operation & Schematic

The **OPTO Printed Circuit Board** (SPI Part №: 520-5194-00) used in the ***Mystery Ball Motor Assembly***, is an ordinary Photo-Interrupter designed to signal **Switches #33 (OP1)**, **#34 (OP2)**, **#35 (OP3)** and **#36 (OP4)** back to the **CPU/Sound Bd.** (Switch Matrix Grid). The slotted OPTO's (U-Shaped), locations **OP1**, **OP2**, **OP3** & **OP4**, contain a small infrared **LED** that beams light across the slot to an **NPN Phototransistor**. This causes the **Phototransistor** to *conduct* and *pulls down the voltage* at the base of **Q1-Q4** (2N3904 Transistors) to **.3v** *or less.* **Q1**, **Q2**, **Q3** and **Q4** (transistors) require the Base Emitter Drop Voltage (**.7v**) **plus** the Switch Drive Drop (**.1v**) to *conduct,* and since **.3v** *is less* than this **.8v**, **Q1-Q4** stay off when the *Switch Matrix Strobe* (on Pin-4 of CN1) polls them. If the Metal Flag Bracket (riveted on the CAM) of the Motor Shaft breaks the beam in the **OPTO Slot**, the **NPN Phototransistors** *stay off,* and the *base voltages* on the associated 2N3904 Transistor(s) are **pulled to .8v** during the *Switch Strobe* through the **68KΩ 1/4W Pull-Up Resistors** (this base voltage will be higher when the switch is not being polled). With the **.8v** applied to the bases, **Q1-Q4** conduct through **D1-D4**, respectively. These Diodes (1N4001) prevent certain kinds of *Matrix-Related leakages* which show up as "Phantom Switches" that completes the corners of a square in the Matrix with three (3) Real Activated Switches comprising the other three (3) corners.

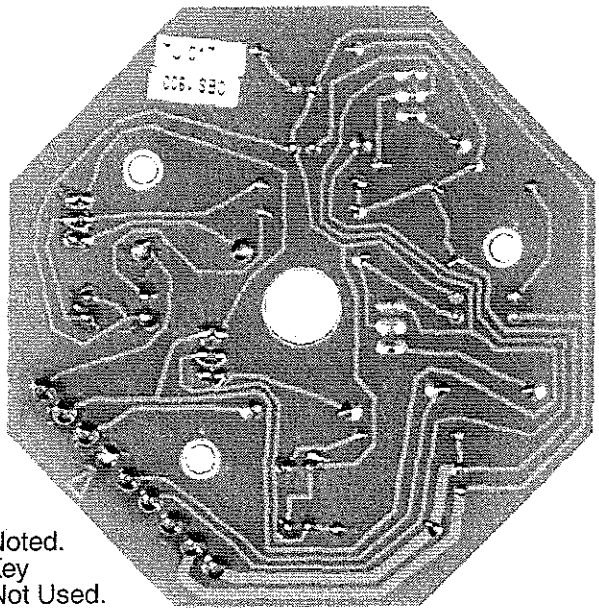
Note: With 8 Positions (signs) being utilized (with only 4 OPTO Positions), half of the software controlled motor stops use two (2) OPTO switch closures. More details are outlined in Sec. 3, Chapter 2, Go To Diagnostics Menu, Page 24, of this manual in the Sharkey's Shootout (Mystery Ball Test), Motor & OPTO Switch Test Procedure.



Component Side



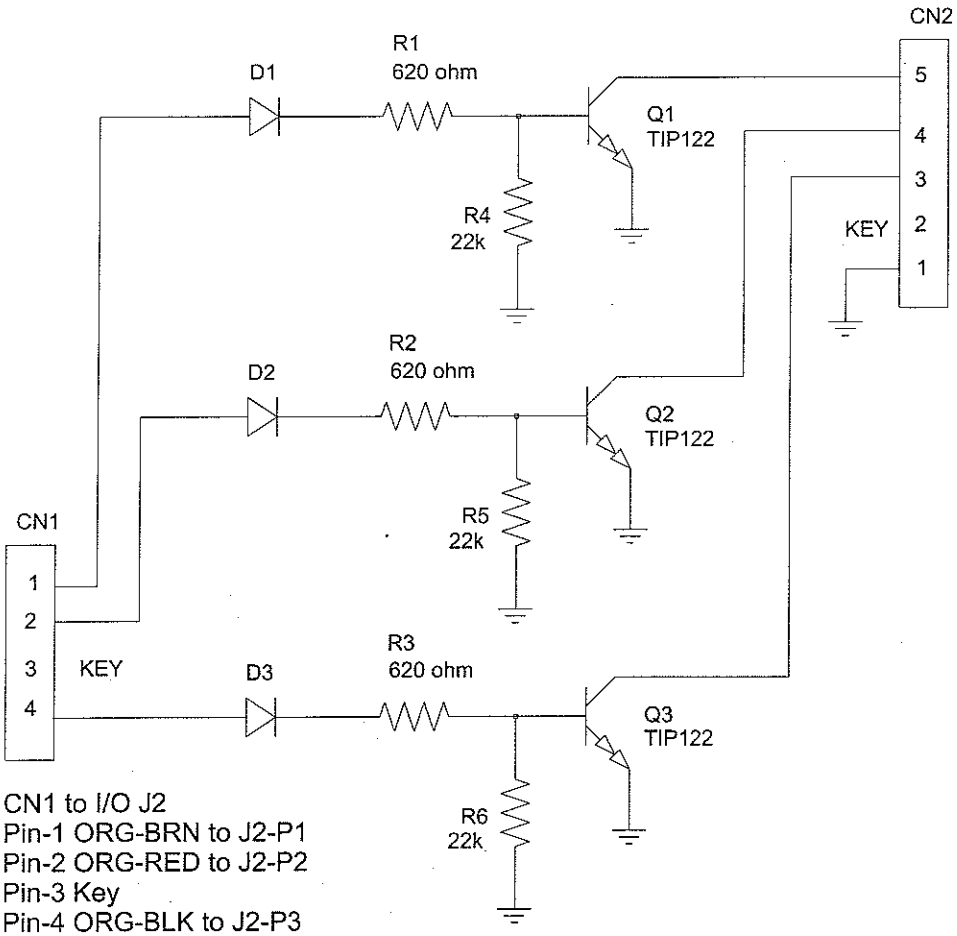
Solder Side



CN1:
Pin-1 is Noted.
Pin-4 = Key
Pin-7 is Not Used.

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	**520-5194-00**	—	**Complete PCB Assembly**
1	4	165-5036-00	OP1, OP2, OP3, OP4	Slotted OPTO OPB804 Rec/Trans
2	4	112-5001-00	D1, D2, D3, D4	1N4001, Diode
3	4	121-5014-00	R1, R3, R5, R7	220Ω 1/4W Resistor 5%
4	4	121-5035-00	R2, R4, R6, R8	68KΩ 1/4W Resistor 5%
5	1	125-5017-00	C1	10uf, 35v Radial Electrolytic Cap. (Panasonic ECE-A1VU100 (35v) or eqv.)
6	4	110-0069-00	Q1, Q2, Q3, Q4	2N3904, Transistor
7	1	045-5009-09	CN1	9x1 .156" Header ConnectorMotor

Solenoid Expander PC Board Schematic

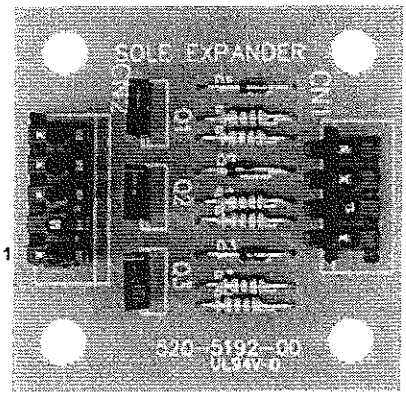


CN2 to Coils to I/O J7-P1 20v BRN

Pin-1 GND
Pin-2 Key
Pin-3 ORG
Right Up/Down Post (Aux. 3)
Pin-4 RED
Center Up/Down Post (Aux. 2)
Pin-5 WHT
Left Up/Down Post (Aux. 1)

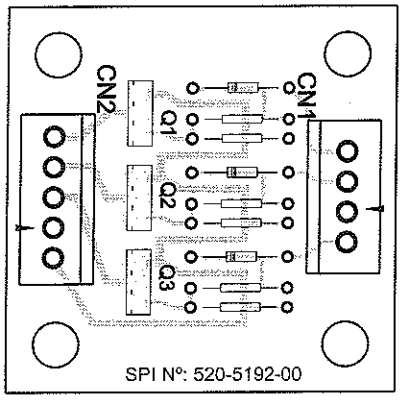
CN1 to I/O J2
Pin-1 ORG-BRN to J2-P1
Pin-2 ORG-RED to J2-P2
Pin-3 Key
Pin-4 ORG-BLK to J2-P3

Component Side

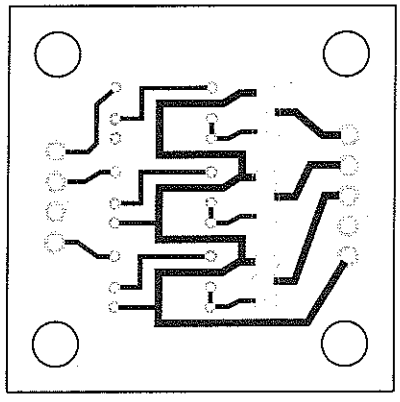


Solenoid Expander PC Board Component Layout & Parts

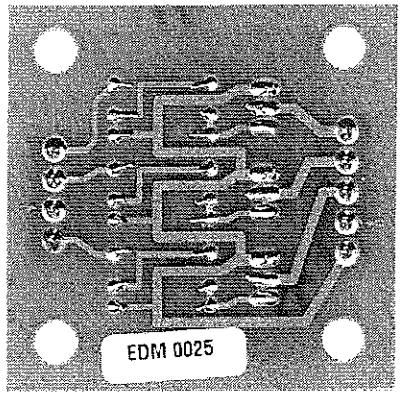
Component Side



Solder Side



Solder Side



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	520-5192-00	—	**Complete PCB Assembly**
1	1		CN1	Connector, 4X .156"
2	1		CN2	Connector, 5X .156"
3	3	112-5014-00	D1, D2, D3	1N914, Signal Diode
4	3	121-5003-00	R1, R2, R3	620Ω, 1/4W CF Resistor
5	3	121-5042-00	R4, R5, R6	22KΩ, 1/4W CF Resistor
6	3	110-0067-00	Q1, Q2, Q3	Tip122 (NPN Darl. Transistor)

Appendixes A through I

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- Appendix B, Semi-Conductors / I.C.'s / Relay Cross-Reference Table 128
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- Appendix C, Game Mfg. Date, Manual Part № & CPU Jumper Table 129
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  ...gives definitions or explanations of some pinball terms and acronyms.
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  ...keep track of your parts ordered through your distributor for this game.

APPENDIX A

Pinball Game Firmware Table

EPROM	Chip Size	Program Part №	USA Ver.	Bd. Loc.	Raw Part №
Laser War					
CPU	(256K)	965-0004-00		C5	960-5007-00
Sound (Old)	(256K)	965-0005-00		J5	960-5007-00
Sound (Old)	(256K)	965-0006-00		J6	960-5007-00
Sound (Old)	(256K)	965-0007-00		J7 9	60-5007-00
			- OR -		
Sound	(256K)	965-0008-00		7F	960-5007-00
Sound 1	(512K)	965-0009-00		6F	960-7001-02
Sound 2	(512K)	965-0010-00		4F 9	60-7001-02
Secret Service					
CPU	(256K)	965-0011-00	A-6	B5	960-5007-00
CPU	(256K)	965-0012-00	A-6	C5	960-5007-00
Voice 1	(512K)	965-0014-00		6F	960-7001-02
Voice 2	(512K)	965-0015-00		4F	960-7001-02
Sound	(256K)	965-0013-00		7F	960-5007-00
Torpedo Alley					
CPU	(256K)	965-0016-00	A02-1	B5	960-5007-00
CPU	(256K)	965-0017-00	A02-1	C5	960-5007-00
Voice 1	(512K)	965-0019-00		6F	960-7001-02
Voice 2	(512K)	965-0020-00		4F	960-7001-02
Sound	(256K)	965-0018-00		7F	960-5007-00
Time Machine					
CPU	(128K)	965-0021-00	A02-3	B5	960-5007-00
CPU	(256K)	965-0022-00	A02-3	C5	960-5007-00
Voice 1	(512K)	965-0024-00		6F	960-7001-02
Voice 2	(512K)	965-0025-00		4F	960-7001-02
Sound	(256K)	965-0023-00		7F	960-5007-00
Playboy 35th Anniversary					
CPU	(256K)	965-0046-00	A02-3	B5	960-5007-00
CPU	(256K)	965-0047-00	A02-3	C5	960-5007-00
Voice 1	(512K)	965-0049-00		6F	960-7001-02
Voice 2	(512K)	965-0050-00		4F	960-7001-02
Sound	(256K)	965-0048-00		7F	960-5007-00
ABC Monday Night Football					
CPU	(256K)	965-0031-00	A02-7	B5	960-5007-00
CPU	(256K)	965-0032-00	A02-7	C5	960-5007-00
Voice 1	(512K)	965-0034-00		6F	960-7001-02
Voice 2	(512K)	965-0035-00		4F	960-7001-02
Sound	(256K)	965-0033-00		7F	960-5007-00
Robocop					
CPU	(256K)	965-0036-00	A03-4	B5	960-5007-00
CPU	(256K)	965-0037-00	A03-4	C5	960-5007-00
Voice 1	(512K)	965-0039-00		6F	960-7001-02
Voice 2	(512K)	965-0040-00		4F	960-7001-02
Sound	(256K)	965-0038-00		7F	960-5007-00
Phantom of the Opera					
CPU	(256K)	965-0026-00	A03-2	B5	960-5007-00
CPU	(256K)	965-0027-00	A03-2	C5	960-5007-00
Voice 1	(512K)	965-0029-00		6F	960-7001-02
Voice 2	(512K)	965-0030-00		4F	960-7001-02
Sound	(256K)	965-0028-00		7F	960-5007-00
Back to the Future					
CPU	(256K)	965-0041-00	A02-0	B5	960-5007-00
CPU	(256K)	965-0042-00	A02-0	C5	960-5007-00
Voice 1	(512K)	965-0044-00		6F	960-7001-02
Voice 2	(512K)	965-0045-00		4F	960-7001-02
Sound	(256K)	965-0043-00		7F	960-5007-00
The Simpsons					
CPU	(256K)	965-0051-00	A02-7	B5	960-5007-00
CPU	(256K)	965-0052-00	A02-7	C5	960-5007-00
Voice 1	(512K)	965-0054-00		6F	960-7001-02
Voice 2	(512K)	965-0055-00		4F	960-7001-02
Sound	(256K)	965-0053-00		7F	960-5007-00
Checkpoint					
CPU	(256K)	965-0056-00	A1-7	B5	960-5007-00
CPU	(256K)	965-0134-00	A1-7	C5	960-5007-00
Voice 1	(1M)	965-0057-00		F7	960-5009-00
Voice 2	(1M)	965-0058-00		F5	960-5009-00
Sound	(256K)	965-0059-00		F4	960-5007-00
Display	(512K)	965-0060-00	CP80	U8	960-7001-02
Teenage Mutant Ninja Turtles					
CPU	(256K)	965-0061-00	A1.04	B5	960-5007-00
CPU	(256K)	965-0062-00	A1.04	C5	960-5007-00
Voice 1	(1M)	965-0063-00		F5/6	960-5009-00
Voice 2	(1M)	965-0064-00		F4/5	960-5009-00
Sound	(256K)	965-0065-00		F7	960-5007-00
Display	(512K)	965-0066-00	A1.04	U8	960-7001-02
Batman					
CPU	(128K)	965-0067-00	A1.06	B5	960-5006-00
CPU	(256K)	965-0135-00	A1.06	C5	960-5007-00
Voice 1	(2M)	965-0068-00		U17	960-5010-00
Voice 2	(1M)	965-0069-00		U21	960-5009-00
Sound	(256K)	965-0070-00		U7	960-5007-00
Display	(1M)	965-0071-00	A1.06	U8	960-5009-00
Star Trek 25th Anniversary					
CPU	(512K)	965-0072-00	A2.01	C5	960-7001-02
Voice 1	(2M)	965-0073-00		U17	960-5010-00
Voice 2	(2M)	965-0074-00		U21	960-5010-00
Sound	(256K)	965-0075-00		U7	960-5007-00
Display	(1M)	965-0076-00	A1.09	U8	960-5009-00
Hook					
CPU	(512K)	965-0077-00	A4.08	C5	960-7001-02
Voice 1	(2M)	965-0078-00		U17	960-5010-00
Voice 2	(2M)	965-0079-00		U21	960-5010-00
Sound	(256K)	965-0080-00		U7	960-5007-00
Display	(1M)	965-0081-00	A4.01	U8	960-5009-00

EPROM	Chip Size	Program Part №	USA Ver.	Bd. Loc.	Raw Part №
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.07	C5	960-7001-02
Voice 1	(2M)	965-0083-00		U17	960-5010-00
Voice 2	(2M)	965-0084-00		U21	960-5010-00
Sound	(256K)	965-0085-00		U7	960-5007-00
Display	(2M)	965-0086-00	A2.06	ROM 0	960-5010-00
Display	(2M)	965-0087-00	A2.06	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0087-04	A2.06	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Star Wars					
CPU	(512K)	965-0119-00	A1.03	C5	960-7001-02
Voice 0	(4M)	965-0132-00		U17	960-5015-00
Voice 1	(2M)	965-0133-00		U21	960-5010-00
Sound	(256K)	965-0131-00		U7	960-5007-00
Display	(2M)	965-0120-00	A1.04	ROM 0	960-5010-00
Display	(2M)	965-0121-00	A1.04	ROM 1	960-5010-00
	(Used on Display PCB 520-5055-00)				
			-OR-		
Display	(4M)	965-0122-00	A1.05	ROM 0	960-5015-00
	(Used on Display PCB 520-5055-01)				
Rocky & Bullwinkle & Friends					
CPU	(512K)	965-0138-00	A1.30	C5	960-7001-02
Voice 0	(4M)	965-0139-00		U17	960-5015-00
Voice 1	(2M)	965-0140-00		U21	960-5010-00
Sound	(256K)	965-0141-00		U7	960-5007-00
Display	(4M)	965-0142-00	A1.30	ROM 0	960-5015-00
Jurassic Park					
CPU	(512K)	965-0143-00	A5.13	C5	960-7001-02
Voice 0	(4M)	965-0144-00		U17	960-5015-00
Voice 1	(2M)	965-0145-00		U21	960-5010-00
Sound	(256K)	965-0146-00		U7	960-5007-00
Display	(4M)	965-0147-00	A5.10	ROM 0	960-5015-00
Last Action Hero					
CPU	(512K)	965-0148-00	A1.12	C5	960-7001-02
Voice 0	(4M)	965-0149-00		U17	960-5015-00
Voice 1	(2M)	965-0150-00		U21	960-5010-00
Sound	(256K)	965-0151-00		U7	960-5007-00
Display	(4M)	965-0152-00	A1.06	ROM 0	960-5015-00
Tales from the Crypt					
CPU	(512K)	965-0157-00	A3.03	C5	960-7001-02
Voice 0	(4M)	965-0158-00		U17	960-5015-00
Voice 1	(2M)	965-0159-00		U21	960-5010-00
Sound	(256K)	965-0160-00		U7	960-5007-00
Display	(4M)	965-0161-00	A3.01	ROM 0	960-5015-00
The Who's Tommy					
CPU	(512K)	965-0162-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0165-00		U17	960-5015-00
Voice 2	(4M)	965-0166-00		U21	960-5015-00
Voice 3	(4M)	965-0167-00		U36	960-5015-00
Voice 4	(4M)	965-0168-00		U37	960-5015-00
Sound	(512K)	965-0164-00		U7	960-7001-02
Display	(4M)	965-0163-00	A4.00	ROM 0	960-5015-00
WWF Royal Rumble					
CPU	(512K)	965-0169-00	A1.06	C5	960-7001-02
Voice 1	(4M)	965-0172-00		U17	960-5015-00
Voice 2	(4M)	965-0173-00		U21	960-5015-00
Voice 3	(4M)	965-0174-00		U36	960-5015-00
Sound	(512K)	965-0171-00		U7	960-7001-02
Display	(4M)	965-0170-00	A1.02	ROM 0	960-5015-00
Guns N' Roses					
CPU	(512K)	965-0175-00	A3.00	C5	960-7001-02
Voice 1	(4M)	965-0178-00		U17	960-5015-00
Voice 2	(4M)	965-0179-00		U21	960-5015-00
Voice 3	(4M)	965-0180-00		U36	960-5015-00
Voice 4	(4M)	965-0181-00		U37	960-5015-00
Sound	(512K)	965-0177-00		U7	960-7001-02
Display	(4M)	965-0176-00	A3.00	ROM 0	960-5015-00
Maverick *					
CPU	(512K)	965-0182-00	A4.04	C5	960-7001-02
Voice 1	(4M)	965-0186-00		U17	960-5015-00
Voice 2	(4M)	965-0187-00		U21	960-5015-00
Voice 3	(4M)	965-0187-01		U36	960-5015-00
Sound	(512K)	965-0185-00		U7	960-7001-02
Display*	(4M)	965-0183-00	A4.01	ROM 0	960-5015-00
Display*	(4M)	965-0184-00	A4.01	ROM 3	960-5015-00
Mary Shelley's Frankensteln *					
CPU	(512K)	965-0188-00	A1.03	C5	960-7001-02
Voice 1	(4M)	965-0192-00		U17	960-5015-00
Voice 2	(4M)	965-0193-00		U21	960-5015-00
Voice 3	(4M)	965-0194-00		U36	960-5015-00
Sound	(512K)	965-0191-00		U7	960-7001-02
Display*	(4M)	965-0189-00	A1.03	ROM 0	960-5015-00
Display*	(4M)	965-0190-00	A1.03	ROM 3	960-5015-00
Baywatch *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0195-00	A4.00	C5	960-7001-02
Voice 1	(4M)	965-0196-00		U17	960-5015-00
Voice 2	(4M)	965-0197-00		U21	960-5015-00
Sound	(512K)	965-0199-00		U7	960-7001-02
Display*	(4M)	965-0200-00	A4.00	ROM 0	960-5015-00
Display*	(4M)	965-0201-00	A4.00	ROM 3	960-5015-00
Batman Forever *	(CPU Board 520-5003-04)				
CPU	(512K)	965-0202-00	A3.02	C5	960-7001-02
Voice 1	(4M)	965-0203-00		U17	960-5015-00
Voice 2	(4M)	965-0204-00		U21	960-5015-00
Sound	(512K)	965-0205-00		U7	960-7001-02
Display*	(4M)	965-0206-00	A3.00	ROM 0	960-5015-00
Display*	(4M)	965-0207-00	A3.00	ROM 3	960-5015-00

* ***Note:*** *Display* ***EPROMS (4M)*** *for* ***Maverick*** *thru* ***Batman Forever*** *require an access time of* ***120 Nsec*** *or faster.*



APPENDIX A

Pinball Game Firmware (for White Star Board System) Table

ROM	Chip Size	Program Part №	USA Ver. & Check Sum	Bd. Loc.	Raw Part №
Apollo 13					
CPU / Sound Board:			**520-5136-00 (Stereo)**		
Game ROM	(1M)	965-0208-00	A5.01 I $09FF	U210	960-5009-00
Voice 1	(4M)	965-0209-00	U17	n/a (masked)	
Voice 2	(4M)	965-0210-00	U21	n/a (masked)	
Voice 3	(4M)	965-0211-00	U36	n/a (masked)	
Sound	(512K)	965-0212-00	U7		960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0213-00	A5.00 I $B92B	ROM 0	960-5015-01
Golden Eye					
CPU / Sound Board:			**520-5136-00 (Stereo)**		
Game ROM	(1M)	965-0214-42	A4.04 I $3FFF	U210	960-5009-00
Voice 1	(4M)	965-0215-42		U17	n/a (masked)
Voice 2	(4M)	965-0216-42		U21	n/a (masked)
Sound	(512K)	965-0217-42		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0218-42	A4.00 I $E6ED	ROM 0	960-5015-01
Twister					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0219-41	A4.05 I $E9FF	U210	960-5009-00
Voice 1	(4M)	965-0220-41		U17	960-5015-01
Voice 2	(4M)	965-0223-41		U21	960-5015-01
Sound	(512K)	965-0221-41		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0222-41	A4.01 I $FD01	ROM 0	960-5015-01
ID4: Independence Day					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0224-45	A2.02 I $9CFF	U210	960-5009-00
Voice 1	(4M)	965-0225-45		U17	960-5015-01
Voice 2	(4M)	965-0226-45		U21	960-5015-01
Sound	(512K)	965-0227-45		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0228-45	A2.00 I $ABF7	ROM 0	960-5015-01
Space Jam					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0229-43	A3.00 I $E6FF	U210	960-5009-00
Voice 1	(4M)	965-0230-43		U17	960-5015-01
Voice 2	(4M)	965-0231-43		U21	960-5015-01
Voice 3	(4M)	965-0232-43		U36	960-5015-01
Sound	(512K)	965-0233-43		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0234-43	A3.00 I $0057	ROM 0	960-5015-01
The Star Wars Trilogy - Special Edition (S.E.)					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0235-56	A4.03 I $5EFF	U210	960-5009-00
Voice 1	(4M)	965-0236-56		U17	960-5015-01
Voice 2	(4M)	965-0237-56		U21	960-5015-01
Sound	(512K)	965-0238-56		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0239-56	A4.00 I $8817	ROM 0	960-5015-01
The Lost World: Jurassic Park					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0240-53	A2.01 I $C2FF	U210	960-5009-00
Voice 1	(4M)	965-0241-53		U17	960-5015-01
Voice 2	(4M)	965-0242-53		U21	960-5015-01
Sound	(512K)	965-0243-53		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0244-53	A2.01 I $7F46	ROM 0	960-5015-01
The X-Files					
CPU / Sound Board:			**520-5136-10 (Mono)**		
Game ROM	(1M)	965-0245-46	A3.03 I $A2FF	U210	960-5009-00
Voice 1	(4M)	965-0246-46		U17	960-5015-01
Voice 2	(4M)	965-0247-46		U21	960-5015-01
Sound	(512K)	965-0248-46		U7	960-7001-02
Display Controller Bd.:			**520-5055-01**		
Display	(4M)	965-0249-46	A3.00 I $66D0	ROM 0	960-5015-01
Starship Troopers					
CPU / Sound Board:			**520-5136-15 (Mono FCC NOV97)**		
Game ROM	(1M)	965-0250-59	A2.00 I $85FF	U210	960-5009-00
Voice 1	(4M)	965-0251-59		U17	960-5015-01
Voice 2	(4M)	965-0252-59		U21	960-5015-01
Voice 3	(4M)	965-0255-59		U36	960-5015-01
Sound	(512K)	965-0253-59		U7	960-7001-02
Display Controller Bd.:			**520-5055-02 (FCC NOV97)**		
Display	(4M)	965-0254-59	A2.00 I $E77B	ROM 0	960-5015-01
Viper Night Drivin'					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Game ROM	(1M)	965-0266-35	A2.01 I $C5FF	U210	960-5009-00
Voice 1	(4M)	965-0267-35		U17	960-5015-01
Voice 2	(4M)	965-0268-35		U21	960-5015-01
Voice 3	(4M)	965-0269-35		U36	960-5015-01
Voice 4	(4M)	965-0270-35		U37	960-5015-01
Sound	(512K)	965-0271-35		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0272-35	A2.01 I $C17D	ROM 0	960-5015-01
Lost In Space					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Game ROM	(1M)	965-0282-60	A1.01 I $B2FF	U210	960-5009-00
Voice 1	(4M)	965-0283-60		U17	960-5015-01
Voice 2	(4M)	965-0284-60		U21	960-5015-01
Voice 3	(4M)	965-0285-60		U36	960-5015-01
Voice 4	(4M)	965-0286-60		U37	960-5015-01
Sound	(512K)	965-0287-60		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0288-60	A1.02 I $32AB	ROM 0	960-5015-01
Godzilla					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Game ROM	(1M)	965-0289-40	A2.05I $B1FF	U210	960-5009-00
Voice 1	(4M)	965-0290-40		U17	960-5015-01
Voice 2	(4M)	965-0291-40		U21	960-5015-01
Voice 3	(4M)	965-0292-40		U36	960-5015-01
Voice 4	(4M)	965-0293-40		U37	960-5015-01
Sound	(512K)	965-0294-40		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0295-40	A2.00 I $C929	ROM 0	960-5015-01
South Park					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Note: This game uses four (4) 8MB VOICE ROMS at U17, U21, U36 & U37 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0301-71	A1.03 I $58FF	U210	960-5009-00
Voice 1	(8M)	965-0302-71		U17	960-5016-00
Voice 2	(8M)	965-0303-71		U21	960-5016-00
Voice 3	(8M)	965-0304-71		U36	960-5016-00
Voice 4	(8M)	965-0305-71		U37	960-5016-00
Sound	(512K)	965-0306-71		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0307-71	A1.01 I $166F	ROM 0	960-5015-01
Harley-Davidson®					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Note: This game uses four (4) 8MB VOICE ROMS at U17, U21, U36 & U37 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0319-67	A1.03 I $3EFF	U210	960-5009-00
Voice 1	(8M)	965-0322-67		U17	960-5016-00
Voice 2	(8M)	965-0323-67		U21	960-5016-00
Voice 3	(8M)	965-0324-67		U36	960-5016-00
Voice 4	(4M)	965-0325-67		U37	960-5015-01
Sound	(512K)	965-0320-67		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0321-67	A1.04 I $FC7C	ROM 0	960-5015-01
Striker Xtreme					
CPU / Sound Board:			**520-5136-16 (Mono FCC FEB98)**		
Note: This game uses four (4) 8MB VOICE ROMS at U17, U21, U36 & U37 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0326-68	A1.02 I $E4FF	U210	960-5009-00
Voice 1	(8M)	965-0329-68		U17	960-5016-00
Voice 2	(8M)	965-0330-68		U21	960-5016-00
Voice 3	(8M)	965-0331-68		U36	960-5016-00
Voice 4	(8M)	965-0332-68		U37	960-5016-00
Sound	(512K)	965-0327-68		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0328-68	A1.03 I $1957	ROM 0	960-5015-01
Sharkey's Shootout					
CPU / Sound Board:			**520-5136-64 (Mono FCC FEB98 Rev. 8/00)**		
Note: This game uses four (3) 8MB VOICE ROMS at U17, U21 & U36 requiring a Jumper at Loc. W6. Refer to CPU/Snd. Bd. Schematic (2 of 3).					
Game ROM	(1M)	965-0333-72	A I $	U210	960-5009-00
Voice 1	(8M)	965-0336-72	**GAME CODE**	U17	960-5016-00
Voice 2	(8M)	965-0337-72	**IN**	U21	960-5016-00
Voice 3	(8M)	965-0338-72	**PRODUCTION**	U36	960-5016-00
Sound	(512K)	965-0334-72		U7	960-7001-02
Display Controller Bd.:			**520-5055-03 (FCC FEB98)**		
Display	(4M)	965-0335-72	A I $	ROM 0	960-5015-01

Game Revisions can be updated after the Production Run. This Table is accurate as of the printing of this manual. If any changes occurred, the next game manual will include the updated information. The version stated is USA. If there is a question of as to the latest Code Revision & Check Sum call our Technical Support Department, 1-800-542-5377 or 1-708-786-5466.



APPENDIX B

Semi-Conductors / Integrated Circuits (I.C.) / Relays Cross-Reference Table

Table №	Type	Source Number	STERN™ PINBALL	N T E®	E C G®	Radio Shack®	R C A®
	RECTIFICATION, BLOCKING, DAMPENING DIODES AND/OR LIGHT EMITTING DIODES (LEDs)						
1	Diode	1N4001	112-5001-00	NTE552	ECG552	- — - - — -	SK9000
	Diode	1N4004	112-5003-00	NTE116	ECG116	276-1103	SK3312
	Diode	1N5401	112-0056-00	NTE5801	ECG5801	276-1143	SK9004
	Diode	1N5404	112-5004-00	NTE5804	ECG5804	276-1144	SK9007
	Diode	T6A10L	112-5006-01	NTE5812	ECG5812	- — - - — -	- — - - — -
	Diode	FR302	112-5009-00	NTE588	ECG588	- — - - — -	SK5014
	Diode, Signal	1N914	112-5014-00	- — - - — -	- — - - — -	- — - - — -	- — - - — -
	LED	MT5000UR or (T1-3/4 GaAlAs)	165-5100-00	- — - - — -	- — - - — -	276-066B	- — - - — -
	ZENER DIODES						
2	Diode	1N4742A 12v	112-0061-00	NTE142A	ECG142A	276-563	SK12V
	Diode	1N4760B 68v	112-0062-00B	NTE5092A	ECG5092A	- — - - — -	SK68V
	Diode	1N4764A 100v	112-0049-00A	NTE5096A	ECG5096A	- — - - — -	SK100V
	Diode	1N5228 3.9v	112-0053-00	NTE5007A	ECG5007A	- — - - — -	SK3A9
	Diode	1N5234B 6.2v	112-0047-00B	NTE5013A	ECG5013A	276-561	SK6A2
	Diode	1N5379 110v	112-0072-00	NTE5157	ECG5157	- — - - — -	SK110X
	Diode	1N6267A 6.8v	112-5011-00	NTE4902	ECG4902	- — - - — -	- — - - — -
	Diode	1N4752A 33v	112-5010-00A	NTE147A	ECG147A	- — - - — -	SK33V
	Diode	1N4736 6.8v 1w	112-5007-00	NTE5071A	ECG5071A	- — - - — -	- — - - — -
	TRANSISTORS - TYPE FET, NPN, PNP AND/OR SCR						
3	FET Trans.	STP20N10L	110-0106-00	NTE2987	ECG2987	- — - - — -	- — - - — -
	FET Trans.	STP19N06L	110-0088-00	NTE2985	ECG2985	- — - - — -	- — - - — -
	FET Trans.	VN02N	110-0089-00	- — - - — -	- — - - — -	- — - - — -	- — - - — -
	NPN Trans.	2N4401	110-0073-00	NTE85	ECG85	276-2009	SK3124A
	NPN Trans.	2N6427	110-0070-00	NTE48	ECG48	- — - - — -	SK4906
	NPN Trans.	MJE340	110-0071-00	NTE157	ECG157	- — - - — -	SK3747
	NPN Trans.	MPSA42	110-0082-00	NTE287	ECG287	- — - - — -	SK3232
	NPN Trans.	2N3904	110-0069-00	NTE123AP	ECG123AP	276-2009	- — - - — -
	NPN Trans.	TIP122	110-0067-00	NTE261	ECG261	276-2068	SK3896
	NPN Trans.	MJE15030	110-0101-00	NTE375	ECG375	- — - - — -	SK9118
	PNP Trans.	2N5401	110-0078-00	NTE288	ECG288	- — - - — -	SK3434
	PNP Trans.	MJE15031	110-0103-00	NTE292	ECG292	- — - - — -	SK3441
	PNP Trans.	MJE350	110-0072-00	NTE374	ECG374	- — - - — -	SK9042
	PNP Trans.	MPSA92	110-0100-00	NTE288	ECG278	- — - - — -	SK3434
	PNP Trans.	TIP42	110-0068-00	NTE332	ECG332	- — - - — -	SK9236
	PNP Trans.	TIP32C	110-0081-00	NTE292	ECG292	- — - - — -	SK3441
	PNP Trans.	TIP36C	110-0077-00	NTE393	ECG393	- — - - — -	SK3961
	SCR Trans.	2N5060	110-0074-00	NTE5400	ECG5400	276-1067	SK3950
	SCR Trans.	SCR2800B	110-0083-00	NTE5461-8	ECG5461-8	- — - - — -	- — - - — -
	BRIDGE RECTIFIERS (BR)			**Comments:**			
4	BR (Present)	DB3501 or CM3501	112-5000-00	For White Star I/O Bds., BR = 35 Amp @ 100v P.I.V.			
	RELAYS			**Comments:**			
5	Relay	FRL-264 D024/02CK	190-5002-00	For PPB, Power Supply, & White Star I/O Boards, Relay = 24v DC 10 Amp DPDT			
	Relay	FRL-264 D006/04CV	190-5001-00	For CPU Boards, Relay = 6v DC 5 Amp 4 Pole DT			



APPENDIX C

Game Mfg. Date, Manual Part № & CPU Jumper Table†

Game Name	Game Mfg. Date and Manual PN№	CPU Ver.	EPROM Position	Jumpers Installed (*see Note)	Jumpers Removed (*see Note)
1. Laser War	MAY 87 780-5001-00	1 2	5C 5B, 5C	J4 J6a J7a J4 J5a J6a	J5 J6 J7b J5 J5b J6b
2. Secret Service	MAR 88 780-5002-00	2	5B, 5C	J4	J5
3. Torpedo Alley	AUG 88 780-5003-00	2	5B, 5C	J4	J5
4. Time Machine	DEC 88 780-5004-00	2	5B, 5C	J4	J5
5. Playboy 35th Anniversary	MAY 89 780-5005-00	2	5B, 5C	J4	J5
6. ABC Monday Night Football	SEP 89 780-5007-00	2	5B, 5C	J4	J5
7. Robocop	NOV 89 780-5006-00	2	5B, 5C	J4	J5
8. Phantom of the Opera	JAN 90 780-5008-00	2	5B, 5C	J4	J5
9. Back to the Future	JUN 90 780-5009-00	3	5B, 5C	J4	J5
10. The Simpsons	SEP 90 780-5012-00	3	5B, 5C	J4	J5
11. Checkpoint	FEB 91 780-5010-00	3	5B, 5C	J4	J5
12. Teenage Mutant Ninja Turtles	MAY 91 780-5017-00	3	5B, 5C	J4	J5
13. Batman	JUL 91 780-5011-00	3	5B, 5C	J4	J5
14. Star Trek 25th Anniversary	OCT 91 780-5014-00	3	5C	J5	J4
15. Hook	JAN 92 780-5019-00	3	5C	J5	J4
16. Lethal Weapon 3	JUN 92 780-5026-00	3	5C	J5	J4
17. Star Wars	OCT 92 780-5024-00	3	5C	J5	J4
18. Rocky & Bullwinkle & Friends	FEB 93 780-5022-00	3	5C	J5	J4
19. Jurassic Park	APR 93 780-5020-00	3	5C	J5	J4
20. Last Action Hero	AUG 93 780-5027-00	3	5C	J5	J4
21. Tales from the Crypt	NOV 93 780-5018-00	3	5C	J5	J4
22. The Who's Tommy	FEB 94 780-5028-00	3	5C	J5	J4
23. WWF Royal Rumble	MAY 94 780-5023-00	3	5C	J5	J4
24. Guns-N'-Roses	JUL 94 780-5029-00	3	5C	J5	J4
25. Maverick	SEP 94 780-5031-00	3	5C	J5	J4
26. Mary Shelley's Frankenstein	DEC 94 780-5036-00	3	5C	J5	J4
27. Baywatch	MAR 95 780-5033-00	3	5C	J5	J4
28. Batman Forever	JUL 95 780-5038-00	3	5C	J5	J4
29. Apollo 13 (A13)	NOV 95 780-5044-00	—	U210	n / a	n / a
30. Golden Eye	FEB 96 780-5042-00	—	U210	n / a	n / a
31. Twister	APR 96 780-5041-00	—	U210	n / a	n / a
32. ID4: Independence Day	JUL 96 780-5045-00	—	U210	n / a	n / a
33. Space Jam	OCT 96 780-5043-00	—	U210	n / a	n / a
34. The Star Wars Trilogy - S.E.	FEB 97 780-5056-00	—	U210	n / a	n / a
35. The Lost World: J.P.	JUN 97 780-5053-00	—	U210	n / a	n / a
36. The X-Files	AUG 97 780-5046-00	—	U210	n / a	n / a
37. Starship Troopers	NOV 97 780-5059-00	—	U210	n / a	n / a
38. Viper Night Drivin'	FEB 98 780-5035-00	—	U210	n / a	n / a
39. Lost In Space	JUN 98 780-5060-00	—	U210	n / a	n / a
40. Godzilla	SEP 98 780-5040-00	—	U210	n / a	n / a
41. South Park	JAN 99 780-5071-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
42. Harley-Davidson®	AUG 99 780-5067-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n / a
43. Striker Xtreme	MAR 00 780-5068-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
44. Sharkey's Shootout	OCT 00 780-5072-01	—	U17 U21 U36	W6 CPU/Snd.	n/a

† Additional Information for Installed / Removed Jumpers (List 1-28 only):

Board Combinations with **ROM** at Location **5C** (Game 1, Ver1) **Installed** J1b, J3, J4, J6a, **J7a** & J8 **Removed** J1a, J2, J5, J6 & **J7b**

Board Combinations w/ **ROM** at Locations **5B, 5C** (Game 1, Ver2) **Installed** J1b, J3, J4, **J5a, J6a, J7b** & J8 **Removed** J1a, J2, J5, **J5b, J6b,** & **J7a**

Board Combinations w/ **ROM** at Locations **5B, 5C** (Games 2-12, Ver2/3) **Installed** J1b, J3, **J4, J5b, J6b,** J7b & J8 **Removed** J1a, J2, **J5, J5a,** J6a & J7a

Board Combinations with **ROM** at Locations **5C** (Games 14-28, Ver3) **Installed** J1b, J3, **J5,** J5b, J6b, J7b & J8 **Removed** J1a, J2, **J4,** J5a, J6a & J7a

* Version 1 has a 2K RAM which is a 24-pin IC in Position 5D; Versions 2 & 3 have a 8K RAM which is a 28-PIN IC in Position 5D.

APPENDIX D

Board Type Table

Game Name	Flipper	Sound	Power Supply	Display X-Digit
Laser War	2-Flipper Board Not Required	*Initial:* 520-5002-00 *replaced with:* 520-5002-02 *520-5002-01 was not used.*	520-5000-00	Master: 520-5004-00 plus: 520-5005-00 (Qty. 2): 7 Digit Alpha/Numeric 520-5006-00 (Qty. 2): 7 Digit Numeric 520-5007-00 (Qty. 1): 4 Digit Numeric
Secret Service	3-Flipper Board Not Required	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
Torpedo Alley	3-Flipper Board Not Required	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
Time Machine	2-Flipper Board Not Required	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
Playboy 35th Anniversary	520-5033-00 2-Flipper (for 100 games)	520-5002-02	520-5000-00	520-5014-01 7 Digit Alpha/Numeric Combined
ABC Monday Night Football	520-5033-00 2-Flipper (for 100 games)	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
Robocop	520-5033-00 2-Flipper	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
Phantom of the Opera	520-5033-00 2-Flipper	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
Back to the Future	520-5033-00 2-Flipper	520-5002-02	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined
The Simpsons	520-5033-00 2-Flipper	520-5002-03	520-5000-00	520-5030-00 16 Digit Alpha/Numeric Combined

Game Name	Flipper	Sound	Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
Checkpoint	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16				
Teenage Mutant Ninja Turtles	520-5033-00 2-Flipper	520-5002-03	520-5047-00	520-5042-00 128 X 16				
Batman	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16				
Star Trek 25th Anniversary	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16				
Hook	520-5033-00 2-Flipper	520-5050-01	520-5047-00	520-5042-00 128 X 16				
Lethal Weapon 3	520-5033-00 2-Flipper	520-5050-01	520-5047-01	520-5052-00 128 X 32	520-5055-00			
Star Wars	520-5033-00 2-Flipper	520-5050-02	520-5047-01	520-5052-00 128 X 32	520-5055-00			
Rocky & Bull-winkle & Friends	520-5033-00 2-Flipper	520-5050-02	520-5047-01	520-5052-00 128 X 32	520-5055-00			
Jurassic Park	520-5076-00 3-Flipper	520-5050-02	520-5047-02	520-5052-00 128 X 32	520-5055-00			
Last Action Hero	520-5070-00 2-Flipper	520-5050-03	520-5047-02	520-5052-00 128 X 32	520-5055-00			
Tales from the Crypt	520-5076-00 3-Flipper	520-5050-03	520-5047-02	520-5052-00 128 X 32	520-5055-01			
The Who's Tommy	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01			
WWF Royal Rumble	520-5070 / 5080 -00 4-Flipper (2X2)	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01			
Guns N' Roses	520-5076-00 3-Flipper	520-5077-00	520-5047-02	520-5052-00 128 X 32	520-5055-01			
Maverick	520-5076-00 3-Flipper	520-5050-03	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5102-00 Single OPTO	520-5103-00 Single OPTO	Paddle Boat Wheel Enter
Mary Shelley's Frankenstein	520-5076-00 3-Flipper	520-5077-00	520-5047-03	520-5075-00 192 X 64	520-5092-01			
Baywatch	520-5070 / 5080 -00 4-Flipper (2X2)	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
Batman Forever	520-5076-00 3-Flipper	520-5126-02	520-5047-03	520-5075-00 192 X 64	520-5092-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker

Miscellaneous Boards (Lamp Boards & Relay Boards) not listed above can be found in each individual game manual.

GAMES HEREON USE THE WHITE STAR BOARD SYSTEM™ *(with the addition of the I/O Power Driver Board):*

Game Name	Flipper	I/O Power Driver	CPU/Sound Stereo	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application
Apollo 13	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5130-01, -04 & -05 Magnet Interface, 7-Segment Display & Light Bd. 520-5130-06 Magnet Driver Board 520-5130-02 Switch Membrane Board 520-5130-03				Relay Board 520-5010-00			
Golden Eye	520-5080-00 2-Flipper	520-5137-00	520-5136-00	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker
	Miscellaneous PC Boards:	Light Boards 520-5128-05 through -08		Mag. Processor X2 Driver Bd. 520-5143-00		Relay Board 520-5010-00			

Table continued on the next page.

APPENDIX D

Board Type Table

GAMES HEREON USE THE WHITE STAR BOARD SYSTEM™ *(with the deletion of the Flipper Board):*

Game Name	I/O Power Driver	CPU/Sound Mono	Disp. Power Supply	Dot Matrix Display	Display Controller	OPTO Transmitter	OPTO Receiver	OPTO Application	Misc OPTO & App.
Twister	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5145-01 through -07		Mag. Drv. Bd. 520-5143-00	Relay Board 520-5010-00				
Independence Day (ID4)	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Light Boards 520-5149-01 through -10		Servo Mtr. Bd. 520-5152-00		520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	Alien Head Enter	
Space Jam	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	2X 7-Segment Display Board 520-5153-00							
The Star Wars Trilogy - Special Ed.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
The Lost World: J.P.	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5162-00 2-Pos. Motor Sensor on Snagger Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Shaker Mtr. Bd. 520-5065-00						
The X-Files	520-5137-01	520-5136-10	520-5138-00	520-5052-00 128 X 32	520-5055-01	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on File Cab. Motor
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-00 Long Hop OPTO	File Cabinet Enter	
Starship Troopers	520-5137-01	520-5136-15	520-5138-00	520-5052-00 128 X 32	520-5055-02	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	4X 7-Segment Display Board 520-5166-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	L/R Orbit Lane Enter	
Viper Night Drivin'	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5124-00 Single OPTO	520-5125-00 Single OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00				520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Jump Ramp	
Lost In Space	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00							
Godzilla	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Shaker Mtr. Bd. 520-5065-00							
South Park	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	5-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:					520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Kenny Under Trough Enter	
Harley-Davidson®	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Shaker Mtr. Bd. 520-5065-00	Diode Board 520-5146-00		520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Motorcycle Enter	
Striker Xtreme	520-5137-01	520-5136-16	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5155-00 3-Pos. Motor Sensor on Goalie Motor
	Miscellaneous PC Boards:	DC Relay Bd. 520-5066-00	Relay Board 520-5010-00	Diode Board 520-5146-00	for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Goalie Under-Trough Enter	
Sharkey's Shootout	520-5137-64	520-5136-64	520-5138-00	520-5052-00 128 X 32	520-5055-03	520-5173-00 Dual OPTO	520-5174-00 Dual OPTO	4-Ball Trough over Up-Kicker	520-5194-00 4-Pos. Motor Sensor on ?-Ball Motor
	Miscellaneous PC Boards:	Relay Board 520-5010-00	Sol. Exp. Bd. 520-5192-00						

† ***Note:*** To order Game Specific CPU/Sound Board please specify Game Name.



APPENDIX E

Generic Coil Cross-Reference Guide † ‡

STANDARD COILS						FLIPPER COILS			
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GAUGE-TURNS	Res. (Ω)	COLOR	SPI PART Nº
20-400	1.0 Ω	090-5021-00	**24-940** †	5.5 Ω	090-5036-00T	**21-900** †	*not available*	RED	090-5020-10T
22-500	1.7 Ω	090-5017-00			090-5036-00B	**22-750**/30-2600 ‡	2.6 / 92.0 Ω	N/A	090-5011-00
22-600	2.2 Ω	090-5023-00	**25-1240**	9.3 Ω	090-5034-00	**22-900** †	3.4 Ω	YEL	090-5020-20T
23-700	3.1 Ω	090-5022-00	**26-1200** †	10.3 Ω	090-5044-00T	**22-1080** †	4.3 Ω	YEL/GRN	090-5032-00T
23-750	3.4 Ω	090-5019-00			090-5044-00B				090-5032-00B
23-800 †	3.6 Ω	090-5001-00T	**27-1300**	14.2 Ω	090-5003-00	**23-620**/30-2600 ‡	2.4 / 75.0 Ω	N/A	090-5006-00
		090-5001-00B	**27-1400**	14.7 Ω	090-5015-00	**23-700**/30-2600 ‡	3.0 / 83.5 Ω	N/A	090-5013-00
23-840	4.0 Ω	090-5005-00	**27-1500**	16.3 Ω	090-5004-00T	**23-800**/30-2600 ‡	2.8 / 90.5 Ω	N/A	090-5012-00
23-1200	7.1 Ω	090-5008-00			090-5004-00B	**23-900**	3.8 Ω	GRN	090-5020-30
23½-765	3.6 Ω	090-5037-03	**28-1050**	11.5 Ω	090-5046-00	**23-1100**	5.1 Ω	ORG	090-5030-00
24-900	5.0 Ω	090-5002-00	**29-2000**	33.6 Ω	090-5016-00	**24-1570**	9.5 Ω	N/A	090-5025-00
NOTE: Ohm values may vary +/- .03 Ω depending on meter calibration.						**25-1800**	13.8 Ω	BLU/GRN	090-5041-00

† Coil Part Nºs ending with a "T" signifies the Diode is on the top of the lug; ...ending with a "B" signifies the Diode is on the bottom of the lug.
‡ These coils are dual-wound. ***Also Note:*** All Coil Part Nºs listed ***Do Not Include*** Coil Sleeves (must be ordered separately).

MAGNET COILS w/12" leads			TRIP COILS (Miniature)						LUGLESS COILS	
GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)	SPI PART Nº	GA-TURNS	Res. (Ω)
22-650	4.3 Ω	090-5042-01	**29-1000**	15.2 Ω	090-5059-00	**33-1590**	59 Ω	515-6916-00	SPI PART Nº	
24-780	8 Ω	090-5061-00	**31-1500**	52.0 W	090-5054-00	**32-1250**	35 Ω	515-6916-**01**	**23-800**	3.6 Ω
			32-1800	50.2 Ω	090-5031-00	Note: 33-1590 WHT & 32-1250 YEL			090-5053-00	

Flipper Coil Table ‡ ††

GAME NAME	Nº of Flippers	LOWER FLIPPERS SPI Nº / GAUGE-TURNS / Color		UPPER FLIPPERS SPI Nº / GAUGE-TURNS / Color	
		LEFT	RIGHT	LEFT	RIGHT
Laser War ‡	2	090-5011-00 **22-750 / 30-2600**	SAME	Not Used	Not Used
Secret Service ‡	3	090-5006-00 **23-620 / 30-2600**	SAME	Not Used	090-5006-00 **23-620 / 30-2600**
Torpedo Alley ‡	3	090-5011-00 **22-750 / 30-2600**	090-5013-00 **23-700 / 30-2600**	Not Used	090-5012-00 **23-800 / 30-2600**
Time Machine ‡	2	090-5011-00 **22-750 / 30-2600**	SAME	Not Used	Not Used

‡ These coils are dual-wound.

Playboy 35th Anniversary ††	2	090-5020-02 **22-900 -YEL-**	SAME	Not Used	Not Used
ABC Monday Night Football ††	2	090-5020-02 **22-900 -YEL-**	SAME	Not Used	Not Used

†† A very small % of these games used a 090-5020-20 coil which used a proto-type Solid State Flipper System. The two types of coils both are 22-900 coils; the only difference being the addition of the 1N5404 Diode on the (-02) coils which was used in the Deger Design.

Robocop	2	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Phantom of the Opera	2	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Back to the Future	2	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
The Simpsons	2	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Checkpoint	2	090-5020-20 **22-900 -YEL-**	SAME	Not Used	Not Used
Teenage Mutant Ninja Turtles	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Batman	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Star Trek 25th Anniversary	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Hook	2	090-5030-00 **23-1100 -ORG-**	090-5020-30 **23-900 -GRN-**	Not Used	Not Used
Lethal Weapon 3	2	090-5030-00 **23-1100 -ORG-**	SAME	Not Used	Not Used

Table continued on the next page.

APPENDIX E

Flipper Coil Table †

GAME NAME	№ of Flippers	LOWER FLIPPERS SPI № / GAUGE-TURNS / Color		UPPER FLIPPERS SPI № / GAUGE-TURNS / Color	
		LEFT	RIGHT	LEFT	RIGHT
Star Wars	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Rocky & Bullwinkle & Friends	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Jurassic Park	3	090-5020-30 **23-900 -GRN-**	SAME	Not Used	090-5030-00 **23-1100 -ORG-**
Last Action Hero	2	090-5020-30 **23-900 -GRN-**	SAME	Not Used	Not Used
Tales from the Crypt	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5041-00 **25-1800 -BLU-GRN-**
The Who's Tommy	3	090-5020-30 **23-900 -GRN-**	SAME	090-5041-00 **25-1800 -BLU-GRN-**	Not Used
WWF Royal Rumble	4	090-5032-00 **22-1080 -YEL-GRN-**	SAME	090-5041-00 **25-1800 -BLU-GRN-**	SAME
Guns N' Roses	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	090-5030-00 **23-1100 -ORG-**	Not Used
Maverick	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5032-00 **22-1080 -YEL-GRN-**
Mary Shelley's Frankenstein	3	090-5030-00 **23-1100 -ORG-**	SAME	Not Used	090-5030-00 **23-1100 -ORG-**
Baywatch	4	090-5030-00 **23-1100 -ORG-**	090-5020-30 **23-900 -GRN-**	090-5025-00 **24-1570 -N/A-**	090-5030-00 **23-1100 -ORG-**
Batman Forever	3	090-5032-00 **22-1080 -YEL-GRN-**	090-5020-20 **22-900 -YEL-**	Not Used	090-5020-30 **23-900 -GRN-**
Apollo 13	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Golden Eye	2	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Twister	2	090-5020-20 **22-900 -YEL-**	090-5032-00 **22-1080 -YEL-GRN-**	Not Used	Not Used
ID4: Independence Day	3	090-5032-00 **22-1080 -YEL-GRN-**	SAME	Not Used	090-5020-30 **23-900 -GRN-**
Space Jam †	2	090-5032-00T **22-1080 -YEL-GRN-**	090-5020-20T **22-900 -YEL-**	Not Used	Not Used
The Star Wars Trilogy - Special Edition †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The Lost World: Jurassic Park †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
The X-Files †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
Starship Troopers †	3	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	090-5032-00T **22-1080 -YEL-GRN-**
Viper Night Drivin' †	2	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	Not Used
Lost In Space †	2	090-5030-00T **23-1100 -ORG-**	090-5032-00T **22-1080 -YEL-GRN-**	Not Used	Not Used
Godzilla †	2	090-5032-00T **22-1080 -YEL-GRN-**	SAME	Not Used	Not Used
South Park †	2	090-5030-00T **23-1100 -ORG-**	SAME	Not Used	Not Used
Harley-Davidson® †	2	090-5032-00T **22-1080 -YEL-GRN-**	090-5030-00T **23-1100 -ORG-**	Not Used	Not Used
Striker Xtreme †	3	090-5032-00T **22-1080 -YEL-GRN-**	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used
Sharkey's Shootout †	3	090-5030-00T **22-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used

† Coil Part №s ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side);
Coil Part №s ending with a "B" signifies the Diode is on the bottom of the lugs.

APPENDIX F

Motor Specification Table

The following table only list games that used motors.

Game Name	Function	Specifications	Part Nº
ABC Monday Night Football	Goal Post Up/Down Movement	Motor 24v A.C. 60 RPM CW	515-5222-00
Phantom of the Opera	Organ Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Checkpoint	Mag Wheel (in Backbox)	Motor D.C. (KEN)	041-5005-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Teenage Mutant Ninja Turtles	Spinning Pizza Ball Deflector	Gear Motor 24v A.C. 325 RPM CW	515-5397-00
Batman	Bar Target Up/Down Movement	Bowman Motor 24v 60Hz 3W 11 RPM CCW	515-5256-00
Star Trek 25th Anniversary	Swinging Target	Bowman Motor 24v 22½ RPM	515-5534-00
	Transporter F/X	Gear Motor 24v A.C. 3½ RPM	500-5421-00
	Cooling Fan (for Transporter F/X)	4½" Motor 12v	041-5014-00
Lethal Weapon 3	Spinning Light	Motor 2½ v A.C. 4000 RPM CCW	041-5017-00
Star Wars	Bar Target Up/Down Movement	Bowman Motor 24v 60hz 3W 11 RPM CCW	515-5256-00
	R2D2 Robot Left/Right Movement	Bowman Motor 24v A.C. 22½ RPM CW	515-5571-00
	Death Star Rotation	Bowman "G" Motor 24v A.C. 60Hz 6 RPM CW	515-5570-00
Rocky & Bullwinkle & Friends	Nell Log "Cutting Blade" Forward/Back Movement	Autotrol Model E Motor 24v 60hz 4W 3 RPM CCW	041-5023-00
Jurassic Park	T-Rex Left/Right Movement	Multi Motor 5v D.C.	041-5025-00
	T-Rex Up/Down Movement	Bowman Motor 24v 11 RPM CW	041-5026-00
	Shaker	Johnson Motor (Vibrator)	041-5002-00
Last Action Hero	Crane Left/Right Movement	Multi Products Motor 12v D.C. #3312 OSC	041-5027-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Tales from the Crypt	Tombstone Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The Who's Tommy	Mirror Up/Down Movement	Bowman Motor 24v A.C. 6 RPM CCW	515-5900-00
	Flipper Blinders	Servo Motor (94102)	041-5032-00
	Spinning Airplane Propellers	Motor D.C.	041-5033-00
WWF Royal Rumble	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Maverick, The Movie	Turning Paddle Wheel	Motor 24v A.C. 10 RPM	041-5036-00
Mary Shelley's Frankenstein	Creature Head Left/Right Movement	Servo Motor (94102)	041-5032-00
Batman Forever	Cannon Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
Apollo 13	Rocket Up/Down Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CCW	515-6383-00
	Moon Unit Rotational Orbit	Multi Products Motor 24v A.C. 50/60Hz 3W 6 RPM CCW	515-6487-00
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
Golden Eye	Satellite Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 6 RPM CW	515-6528-00

Table continued on the next page.

APPENDIX F

Motor Specification Table

The following table only list games that used motors.

Game Name	Function	Specifications	Part №
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. 50/60Hz 3W 325 RPM CCW	515-6347-00
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. 50/60Hz 3W 3600 RPM CW	515-6531-00
ID4: Independence Day	Alien Head Open/Close Movement	Servo Motor (94322)	041-5045-00
The Star Wars Trilogy - S.E.	X-Wing Left/Right Movement	Bowman Motor 24v A.C. 60Hz 3W 10 RPM CCW	515-6383-01
The Lost World: J.P.	Snagger & Center Link Lift Up/Down Movement	Multi Products Motor 20v D.C. 9 RPM Non-Directional	515-6715-03
	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW	041-5029-00
The X-Files	X-File Cabinet Lift Up/Down Movement	Multi Products Motor 20v D.C. 9 RPM CCW	041-5057-00
Starship Troopers	Warrior Bug Forward/Reverse Movement	Haydon Switch & Instrument, Inc. Stepper Motor, Series 36000: 1.4"ø (Non-Captive Shaft) HSI #36864-12 (Unipolar) / Travel per Step = .004 Step Angle = 15° / 12v D.C. / 4.6W	515-6794-00-59
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24v A.C. 50/60Hz 3W 325 RPM CCW	515-6347-00
Godzilla	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01**
Harley-Davidson®	Shaker	Johnson Motor (Vibrator) 10.5v D.C. 10 AMP 2950 RPM CW ‡	041-5029-**01**
	Motorcycle Lift Up/Down Movement	Autotrol 24v A.C. 6 RPM CW	041-5072-01
Striker Xtreme	Goalie Left to Right Movement	Multi #3590 12v D.C. 60 RPM	041-5075-00
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Model-E 24v A.C. 50/60Hz 3W 20 RPM CW	041-5076-00

No motors were used on the following games: Laser War, Secret Service, Torpedo Alley, Time Machine, Playboy 35th Anniversary, Robocop, Back to the Future, The Simpsons, Hook, Guns N' Roses, Baywatch, Space Jam, Viper Night Drivin', South Park.

‡ ***Please Note:*** *"-01" Shaker Motor is* ***Not Compatible*** *with old Shaker Motor 041-5029-**00** (Shaker Motor Assy. 515-5893-00). THIS NEW MOTOR CAN ONLY BE USED IN NEW SHAKER MOTOR ASSY. 515-5893-**01**.*



APPENDIX G

Part Number Prefix Classification Codes

I. Electrical Source, Energy & Signal Converters
- 010- Transformers
- 031- Speakers
- 090- Solenoids (Coils)

II. Conductors, Connectors & Insulators
- 034- Line Cords
- 036- Cable and Harness Assemblies
- 041- Motors
- 045- Connectors (All Types)
- 077- Lamp Sockets

III. Circuits & Circuit Elements
- 100- ICs
- 110- Transistors
- 112- Diodes
- 121- Resistors
- 123- Resistors (Variable & Adjustable)
- 124- Regulators & Bridge Rectifiers
- 125- CAPS
- 140- Crystals
- 165- Light Bulbs
- 180- Switches
- 190- Relays

IV. Bolts, Screws, Nuts & Washers
- 231- Bolts
- 232- Screws (Pan Head)
- 234- Screws (HWH)
- 237- Screws (Misc.)
- 240- Nuts (Misc.)
- 242- Washers (Flat, Round)
- 244- Washers (Split Lock)
- 246- Washers (Lockers, External Tooth)

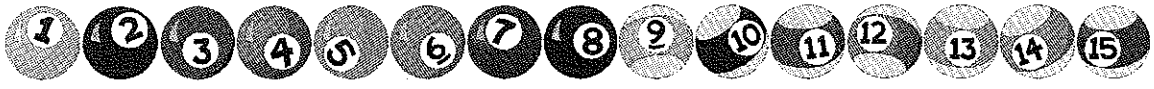
V. Mechanical Components
- 249- Rivets
- 251- Pins (Dowel)
- 254- Stand-Offs, Spacers and Shims
- 260- Steel Ball
- 265- Springs (Extension)
- 266- Springs (Compression)
- 269- Springs (Washers - Belleville, Wave)
- 280- Grommets and Bushing

VI. Handles, Locks, Catches & Latches, Keys & Hinges
- 355- Handles, Locks, Catches & Latches and Keys
- 390- Hinges

VII. Fabricated Parts (In-House Assemblies)
- 500- End Product (Systems and Models)
- 515- Sub-Assemblies
- 520- Printed Circuit Boards (PCBs)
- 522- Display Glass
- 525- Wood Parts
- 530- Screw Machined Parts
- 535- Fabricated Parts
- 545- Molded (Extruded) Plastic/Rubber Parts
- 550- Molded (Inserts)

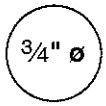
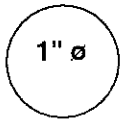
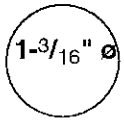
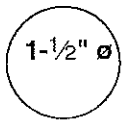
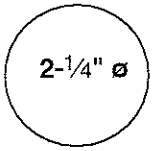
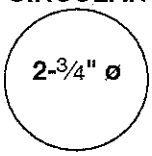
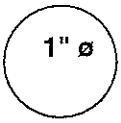
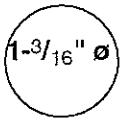
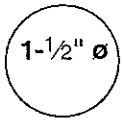
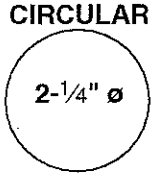
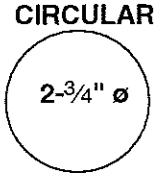
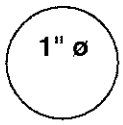
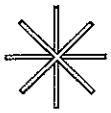
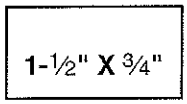
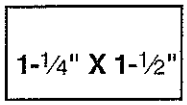
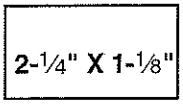
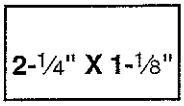
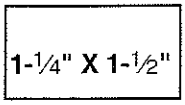
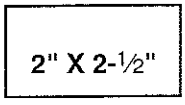
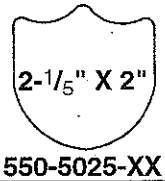
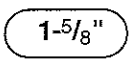
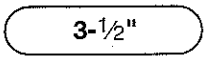
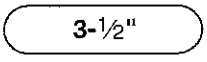
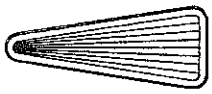
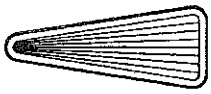
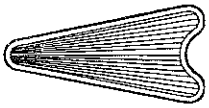
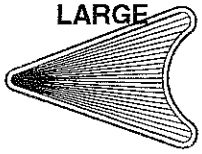
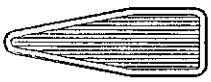
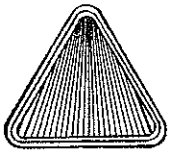
VIII. Bulk Materials
- 600- Braided Ground Wire
- 601- Stranded Wire
- 602- Ribbon Cable
- 605- Sleeving (Shrink Tubing)
- 626- Foam Rubber

IX. Miscellaneous
- 705- Packing & Shipping Items
- 820- Decals and Labels (Sets & Misc.)
- 830- Butyrate (Plastic Pieces)
- 900- Game Posters
- 960- EPROM (Raw Part)
- 965- EPROM (Programmed Part)



APPENDIX H

Playfield Inserts (Plastic Light Covers)

Patterns: STARBURST  STIPPLE 	STARBURST CIRCULAR  5/8" ø 550-5000-XX	STARBURST CIRCULAR  3/4" ø 550-5001-XX	STARBURST CIRCULAR  1" ø 550-5002-XX	STARBURST CIRCULAR  1-3/16" ø 550-5003-XX	STARBURST CIRCULAR  1-1/2" ø 550-5004-XX
STARBURST CIRCULAR  2-1/4" ø 550-5005-XX	STARBURST CIRCULAR  2-3/4" ø 550-5006-XX	PLAIN CIRCULAR  3/4" ø 550-5007-XX	PLAIN CIRCULAR  1" ø 550-5008-XX	PLAIN CIRCULAR  1-3/16" ø 550-5009-XX	PLAIN CIRCULAR  1-1/2" ø 550-5010-XX
PLAIN CIRCULAR  2-1/4" ø 550-5011-XX	PLAIN CIRCULAR  2-3/4" ø 550-5012-XX	STIPPLE CIRCULAR  1" ø 550-5048-XX	STIPPLE 1" SQUARE  1" 550-5019-XX	ROLLOVER BUTTON BASE  550-5026-XX	WHITE STAR *(only in white)*  545-5015-00
STIPPLE RECTANGULAR  1-1/2" X 3/4" 550-5018-XX	STIPPLE RECTANGULAR  1-1/4" X 1-1/2" 550-5051-XX	STARBURST RECTANGULAR  2-1/4" X 1-1/8" 550-5044-XX	PLAIN RECTANGULAR  2-1/4" X 1-1/8" 550-5049-XX	PLAIN RECTANGULAR  1-1/4" X 1-1/2" 550-5050-XX	PLAIN RECTANGULAR  2" X 2-1/2" 550-5063-XX
STARBURST MINI SHIELD  1" X 1" 550-5024-XX	STARBURST LARGE SHIELD  2-1/5" X 2" 550-5025-XX	MINI HOT DOG  1-5/8" 550-5020-XX	BEVEL HOT DOG  3-1/2" 550-5021-XX	PLAIN HOT DOG  3-1/2" 550-5022-XX	BANANA  550-5023-XX
STARBURST ARROW-SMALL  550-5013-XX	STARBURST ARROW-LARGE  550-5070-XX	STARBURST ARROW-HEAD SMALL  550-5014-XX	STARBURST ARROW-HEAD LARGE  550-5015-XX	STARBURST BULLET  550-5016-XX	STARBURST TRIANGLE  550-5017-XX

Note: The shapes and sizes shown above are not to scale. Some shapes may no longer be available in every color.

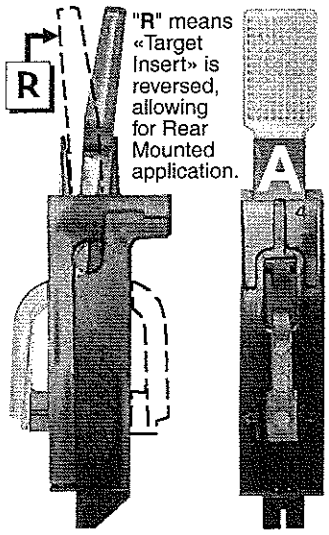
Instructions: Parts which may come in various colors (i.e. targets, some posts, playfield inserts, etc.) end in a 2-digit Nº which correspond to the color of that part. The "-XX" in Part Nºs which may come in various colors should be replaced with the desired 2-Digit Nº. corresponding to the color desired. *Not all colors may be available.*

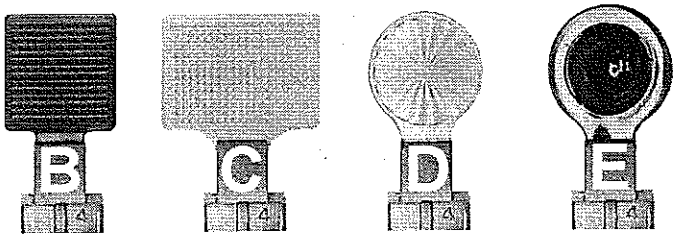
PLASTIC PART COLOR CHART

Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color
-00	Black or Solid Clear	-03	Amber	-06	Yellow	-09	Purple	-12	Fluor. Blue	-15	Luminescent
-01	Clear	-04	Green	-07	Orange	-10	Fluor. Orange	-13	Teal Green	-16	Gold
-02	Red	-05	Blue	-08	White	-11	Fluor. Green	-14	Gray	-17	Trans. Brown

APPENDIX I

Stand-Up Targets





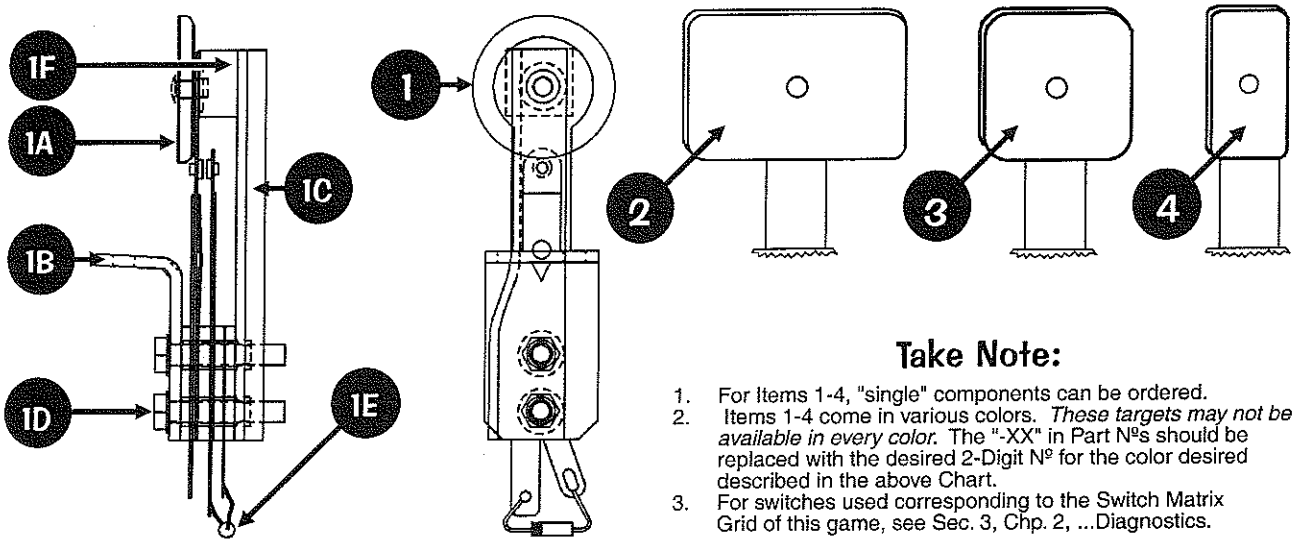
PLASTIC PART COLOR CHART	
Nº	Color
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold

Take Note:

1. For **Items A-E**, for the Target Assembly use the **"500-"** SPI Nº; For the Target Assy. with Rear Mount add **"R"** to **"500-"** SPI Nº; For just the «Target Insert» use the **"545-"** SPI Nº.
2. **Items A-E** come in various colors. *These targets may not be available in every color.* The **"-XX"** in should be replaced with the desired 2-Digit Nº for the color desired described in the Chart ➶. ***As of date of print, the following colors were used for Items A-E:***
   -01 Clear **(A, D)**; **-02** Red **(A, B, C, D, E)**; **-03** Amber **(D, E)**; **-04** Green **(A, B)**; **-05** Blue **(C)**; **-06** Yellow **(A, C)**, **-09** Purple **(B, D)**; **-11** Fluorescent Green **(A, B, D)**.
3. See Section 3, Chapter 2, Go To Diagnostics Menu, for switches used corresponding to the Switch Matrix Grid of this game.

Nº	STAND-UP TARGET NAME	SPI PART Nº
A	Modular Stand-Up Target Narrow Assy.	500-6138-XX
	Stand-Up Target Narrow (Insert)	545-6138-XX
B	Modular Stand-Up Target Square Assy.	500-6139-XX
	Stand-Up Target Square (Insert)	545-6139-XX
C	Modular Stand-Up Target Rectangle Assy.	500-6228-XX
	Stand-Up Target Rectangle (Insert)	545-6228-XX
D	Modular Stand-Up Target Round Assy.	500-6075-XX
	Stand-Up Target Round (Insert)	545-6075-XX
E	Mod. Stand-Up Target 1" Spherical Assy.	500-6189-XX
	Stand-Up Target 1" Spherical (Insert)	545-6189-XX

NOTE: To receive the Target Assy. with the « Target Insert » « **R**eversed » simply add a **"R"** at the end of the Part Nº. See Side View picture above to compare (dashed line shows target reversed).



Take Note:

1. For Items 1-4, "single" components can be ordered.
2. Items 1-4 come in various colors. *These targets may not be available in every color.* The "-XX" in Part Nºs should be replaced with the desired 2-Digit Nº for the color desired described in the above Chart.
3. For switches used corresponding to the Switch Matrix Grid of this game, see Sec. 3, Chp. 2, ...Diagnostics.

Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº
1	1" Round Stand-Up Target Assy.	500-5835-XX
ORDERING ABOVE (ITEM 1) ASSY. PART Nº WILL INCLUDE:		
1A‡	Switch & Target Assy. 1" Round	515-5966-XX
1B	Mounting Bracket	535-6896-00
1C	Switch Back Plate	535-6452-00
1D	6-32 X ¾ HWH Swage (Qty. 2)	237-5976-05
1E	Switch Diode, 1N4001	112-5001-00
1F	Foam Pad	626-5029-00

‡ Note: Item 1A, is a riveted Sub-Assy. which includes the following items for reference:
A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00),
A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— 1" Round Target (545-5456-XX).

2	1" X 1½" Stand-Up Rect. Target Assy.	500-5321-XX
ORDERING ABOVE (ITEM 2) ASSY. PART Nº WILL INCLUDE:		
2A‡	Sw. & Target Assy. 1" X 1½" Rect. Items 2B-F are identical to 1B-F	515-6027-XX Same as 1B-F

Item 2 Table Note continued in the next column.

Nº	STAND-UP (FLAT) TARGET NAME	SPI PART Nº

‡ Note: Item 2A, is a riveted Sub-Assy. which includes the following items for reference:
A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00),
A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Rectangular Target (545-5145-XX).

3	1" Sq. Stand-Up Target Assy.	500-5232-XX
ORDERING ABOVE (ITEM 3) ASSY. PART Nº WILL INCLUDE:		
3A‡	Sw. & Target Assy. 1" Square Items 3B-F are identical to 1B-F	515-5162-XX Same as 1B-F

‡ Note: Item 3A, is a riveted Sub-Assy. which includes the following items for reference:
A1— Stack Switch Radius End (180-5133-00), A2— Washer 5/16" (242-5017-00),
A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— 1" Square Target (545-5470-XX).

4	Narrow Stand-Up Target Assy.	500-5857-XX
ORDERING ABOVE (ITEM 4) ASSY. PART Nº WILL INCLUDE:		
4A‡	Sw. & Target Assy. Narrow Items 4B-F are identical to 1B-F	515-5967-XX Same as 1B-F

‡ Note: Item 4A, is a riveted Sub-Assy. which includes the following items for reference:
A1— Stack Switch Square End (180-5132-00), A2— Washer 5/16" (242-5017-00),
A3— Rivet 1/8" ø X 3/16" (249-5001-00) and A4— Narrow Target (545-5210-XX).

GLOSSARY OF TERMS

A Followed after a number means "Amp." or Ampage in an expression relating to an electrical object. (e.g. 8**A**).

AC (Acronym) **A**lternating **C**urrent.

Adj. (Abbreviation) Adjustment(s).

Assy. (Abbreviation) Assembly.

Au. (Abbreviation) Audit(s).

Bd. (Abbreviation) Board.

BOT (Abbreviation) Bottom.

Brkt. (Abbreviation) Bracket.

Bridge Rectifier A configuration of a diode that allows current to flow in one direction producing both positive and negative pulsating DC Voltages.

Color Coding See Appendix H or I, Plastic Part Color Chart or Section 4, Chapter 1, Playfield - Plastic Posts & Spacers.

Combination (Combo) [Shot] Any variable pinball shot(s) made successively.

Conn. (Abbreviation) Connector.

CMOS Short for COSMOS (Complementary Symmetry M.O.S.); Complementary Metal-Oxide Semi-Conductor.

CN (Abbreviation) Connector (e.g. **CN**5-P3).

CT (Abbreviation) Center.

DC (Abbreviation) Direct Current.

DT (Abbreviation) Drop Target(s).

DOTS (Acronym) **D**iode **O**n **T**erminal **S**trip.

EB (Abbreviation) Extra Ball.

Eject Playfield surface device to kick ball back into play; Saucer.

EPROM (Acronym) **E**rasable **P**rogrammable **R**ead **O**nly **M**emory. Can be erased using UV Light and re-programmed.

e.g. (Abbreviation) Latin- Exempli gratia. For Example.

EOS (Acronym) **E**nd-**O**f-**S**troke (i.e. Switch for flipper).

F (Abbreviation) Fuse (i.e. F23).

GA-Turn Gauge & Turn describing the windings on a coil (e.g. 23-800, 23 is the gauge of wire and 800 is the amount of windings.

G.I. (Abbreviation) General Illumination (Lamps).

HWH (Abbreviation) Hex Washer Head.

IC (Acronym) **I**ntegrated **C**ircuit (As in after 24-Pin IC).

ID or I.D. (Acronym) **I**nside **D**imension.

i.e. (Abbreviation) Latin- Id est. That is.

IO or I/O (Abbreviation) Input / Output (e.g. I/O Power Driver Bd.)

LT, Lt. or L. (Abbreviation) Left.

Laser Kick A coil/plunger used above the playfield to kick pinball back into play.

LED (Acronym) **L**ight **E**mitting **D**iode.

Loop [Shot] Continuously up a ramp and back to the flipper.

Lwr. (Abbreviation) Lower.

Orbit [Shot] From the left or right flipper around the back rail of the playfield back to the flipper.

MB (Abbreviation) Magnet Board.

M-BALL or MBALL (Abbreviation) Multiball™ More than 1 ball in game play.

MID (Abbreviation) Middle

Non-Reflexive See Reflexive.

No. or Nº or # (Abbreviation) Number

NPF (Acronym) **N**o **P**roblem **F**ound.

N.C. or NC (Abbreviation) Normally Closed.

N.O. or NO (Abbreviation) Normally Open.

NS (Abbreviation) Not Stuffed. (Use in Part Listings, Sec. 5)

OD or O.D. (Abbreviation) Outside Dimension.

P (Abbreviation) Pin (e.g. CN5-**P**3).

PCB (Acronym) **P**rinted **C**ircuit **B**oard

P/F (Abbreviation) Playfield.

PIA LED (Acronym) **P**eripheral **I**nterface **A**dapter **L**ight **E**mitting **D**iode.. This is a diagnostic LED on the CPU; it should not be lit during normal operation of a pinball game.

Plumb Bob Tilt Weight on Tilt Assembly.

PPH (Abbreviation) Phillips Pan Head.

Pop(s) Another term for Turbo Bumper(s).

PPB (Acronym) Playfield Power Board ("Popcorn-Popping Bd.").

PREV (Abbreviation) Previous.

PSB (Abbreviation) Power Supply Board

RAM (Acronym) **R**andom **A**ccess **M**emory. RAM **can** store input instructions and supply output information.

Reflexive/Non-Reflexive Reflexive—Solenoid Drive Transistor is enabled directly by a switch closure on the (Relating to CPU Boards) solenoid assembly (Ver. 1/2).
Non-Reflexive—Solenoid Drive Transistor is enabled by the CPU after reading a switch closure in the Switch Matrix (Ver. 3). Also note: All CPU Boards are backwards compatible (e.g. Jurassic Park/Ver. 3 to Time Machine/ Ver. 2). Swapping a Ver. 2 Board to a Ver. 3 is not possible due to the special solenoids section (i.e. Slingshots, Turbo Bumpers, etc.) changing from ***REFLEXIVE*** to ***NON-REFLEXIVE*** on Ver. 3 Boards.

Relay An automatic switch operated by current in a coil.

ROM (Acronym) **R**ead **O**nly **M**emory. ROM **cannot** store input instructions but can supply output information. ROM can be programmed only once.

RMA (Abbreviation) Return Merchandise Authorization Number

RT, Rt. or R. (Abbreviation) Right; ("**R**" at the end of Target Assy. Part Nº signifies Target Insert is **R**eversed.)

RO (Abbreviation) Rollover (switches).

Saucer See Eject.

Scoop A hole into the playfield. A metal scoop is in place to guide the ball into the kick-back under the playfield.

Slam Tilt A switch which closes when the game is slammed into or the Coin Door is slammed shut. Depending on adjustable settings, will cancel game in play when the number of closures required is achieved.

SMB (Abbreviation) Shaker Motor Board.

Solenoid A coil used for Electro Magnetic devices such as relays, flippers, slingshots, etc.

SSFB (Abbreviation) Solid State Flipper Board.

STEP Refers to the service switches on the coin door.

Sub-Assy. (Abbreviation) Sub-Assembly.

S-U or S/U (Abbreviation) Stand-Up (targets).

TM (Abbreviation) Trademark

Transfer [Shot] Maneuvering the ball in play from one flipper to the other. With flipper in the up position and the ball cradled by that flipper one would activate the flipper button in a quick repetitive manner to bounce the ball to the other side. Skilled players can rebound the ball off the slingshot.

Tri-Ball Three balls in play.

TTL (Abbreviation) Transistor-Transistor Logic

Upr. (Abbreviation) Upper.

V or v (Abbreviation) Volt(s).

Ver. (Abbreviation) Version.

VUK (Acronym) **V**ertical **U**p-**K**icker (Super or Standard).

X (Abbreviation) "Times" A multiplier; also used in dimensions.

X-Ball An undetermined number of ball(s) during game play.

Zener Diode A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.

"-00B" "B" at the end of Coil Part Numbers signifies that the diode is attached to the bottom of the lug.

"-00T" "T" at the end of Coil Part Numbers signifies that the diode is attached to the top of the lug (the side nearest the coil-winding).

Parts Order Checklist Notes

Date Ordered	Part №	Qty.	Description	Date Received



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DOT MATRIX DISPLAY BOARDS:	9 MONTHS

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Always Disconnect The Line Voltage Before Servicing. Some Parts May Still Hold Current When Unplugged.

Warning

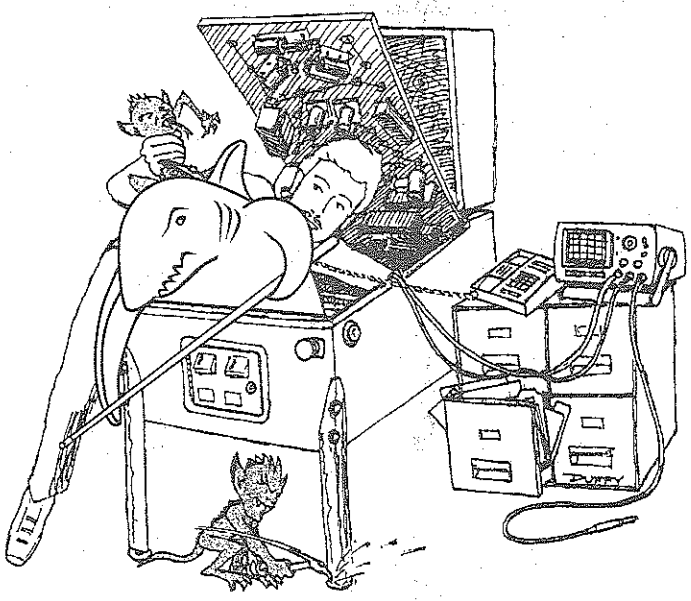
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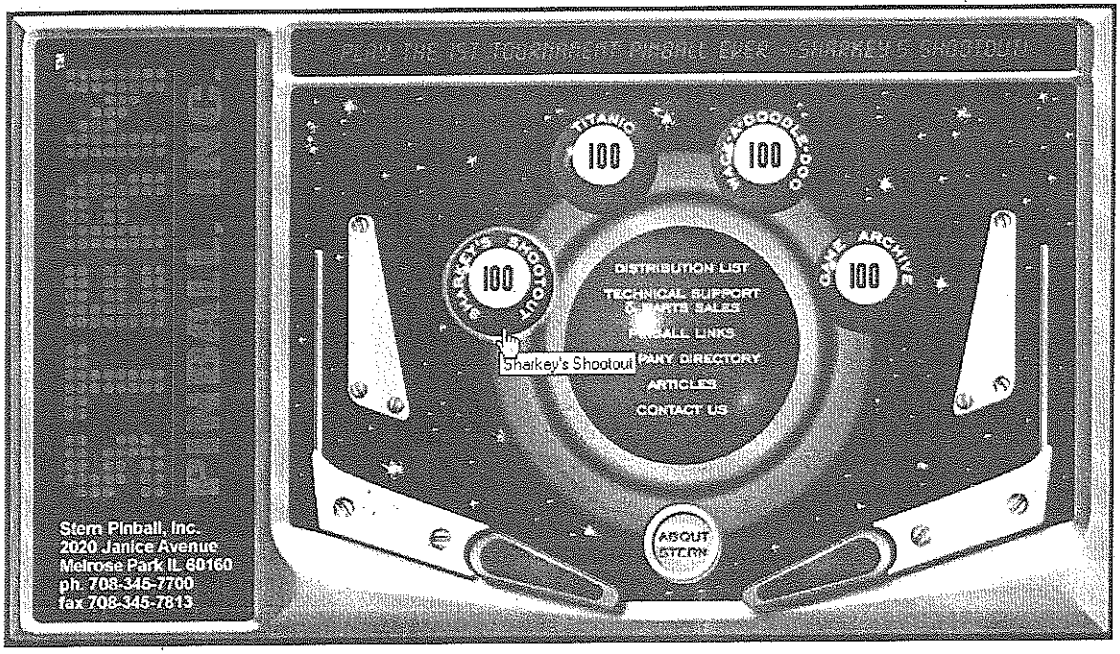
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ALTHOUGH EVERY EFFORT IS PUT INTO MAKING THIS MANUAL (AND ALL OTHER DOCUMENTS RELATING TO THIS PRODUCT) ACCURATE AND COMPLETE, PLAYFIELD COMPONENTS, FEATURES, RULES, PROGRAMMING

1/16"
1/8" 1/4" 1/2" 3/4"
Inch fractions defined:

Standard USA 9 Inch Ruler (From the top to the bottom edge is 11")