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

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

Alot of questions get answered here...

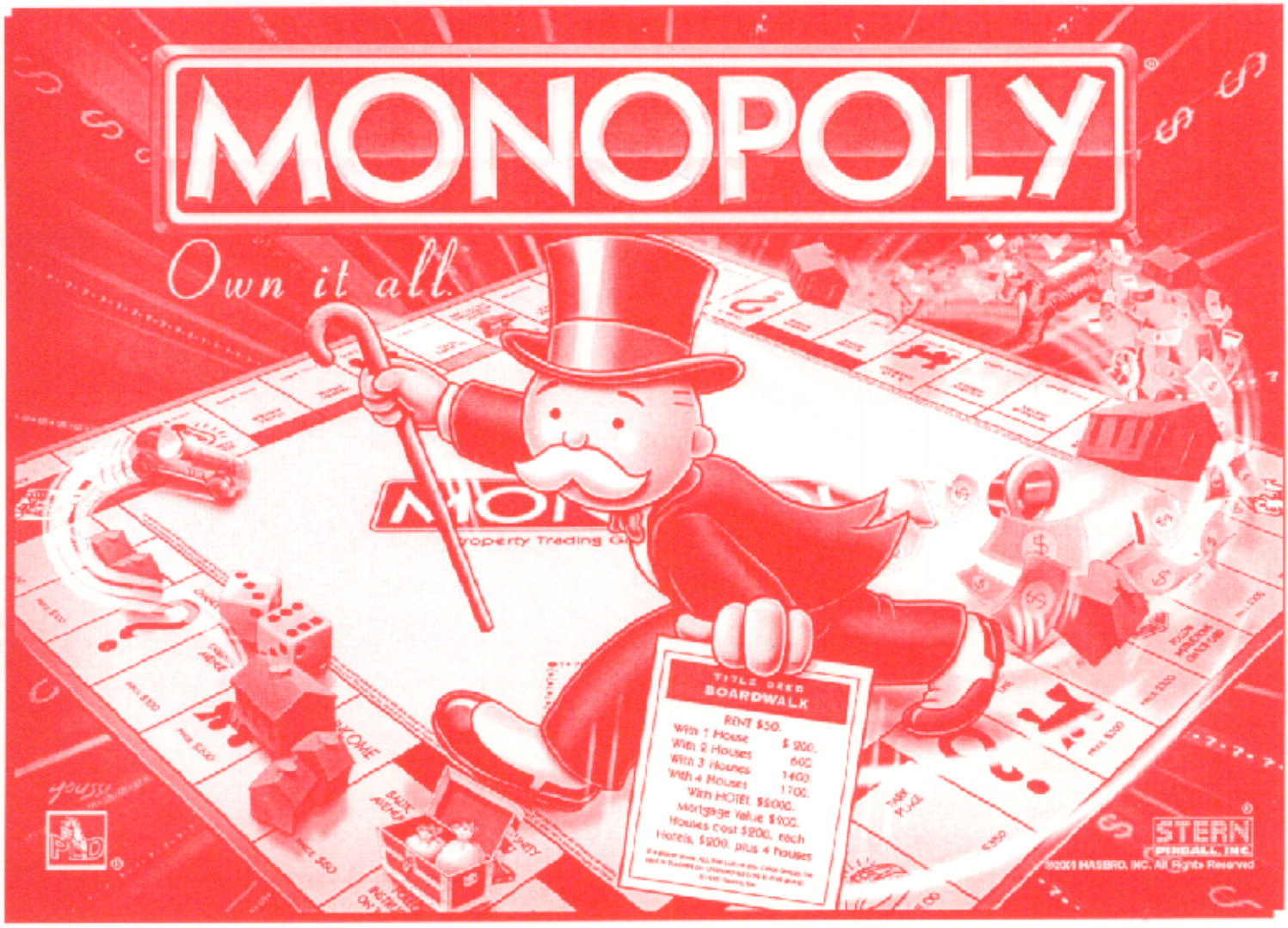
DR. DR. DR. DR.

NO YES END PREV QUIT

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

STERN PINBALL, INC.

http://www.SternPinball.com
2020 Janice Ave., Melrose Park, IL 60160



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SPI PN⁰:
780-5075-00

STERN
PINBALL, INC.

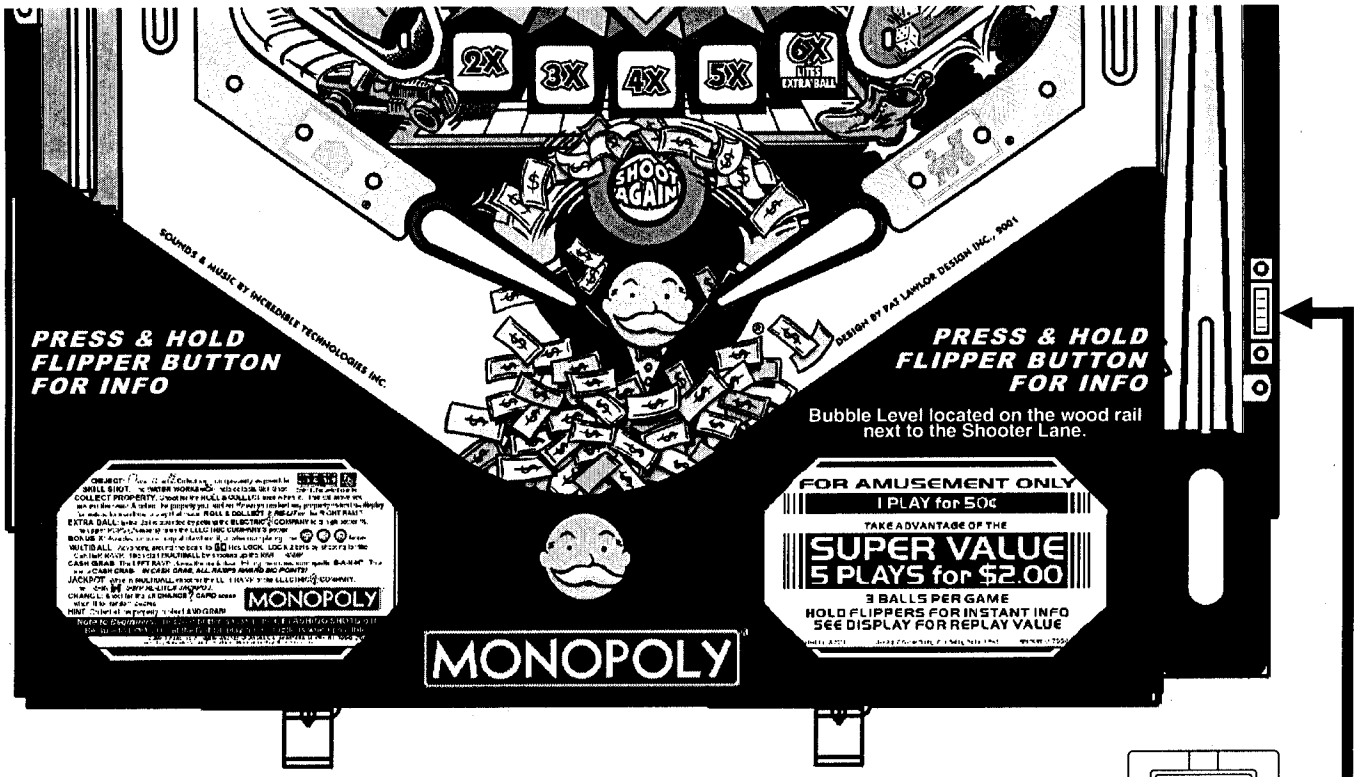
The Bubble Level is back!

This will ensure Game Pitch is 6.5° (recommended) for proper game play.

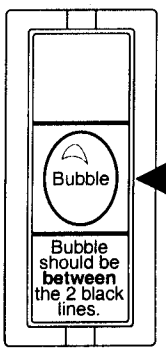
Leg Leveler Adjustment and use of the Bubble Level

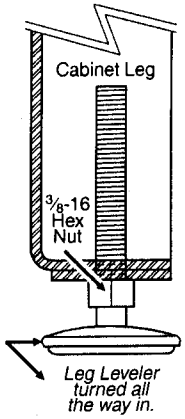
On a LEVEL FLOOR, this cabinet is designed to automatically have a 6.5° pitch without adjusting levelers.

Start adjustment with the leg levelers *turned all the way in.*



View the *bubble* in the level provided on the right side wood rail (see above).





Adjust the front or rear levelers as necessary to cause the bubble to float between the two (2) black lines.

Use a pinball to roll down the center of the playfield for side-to-side leveling.

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

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

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 (Option 1).

BEFORE TRANSPORTING



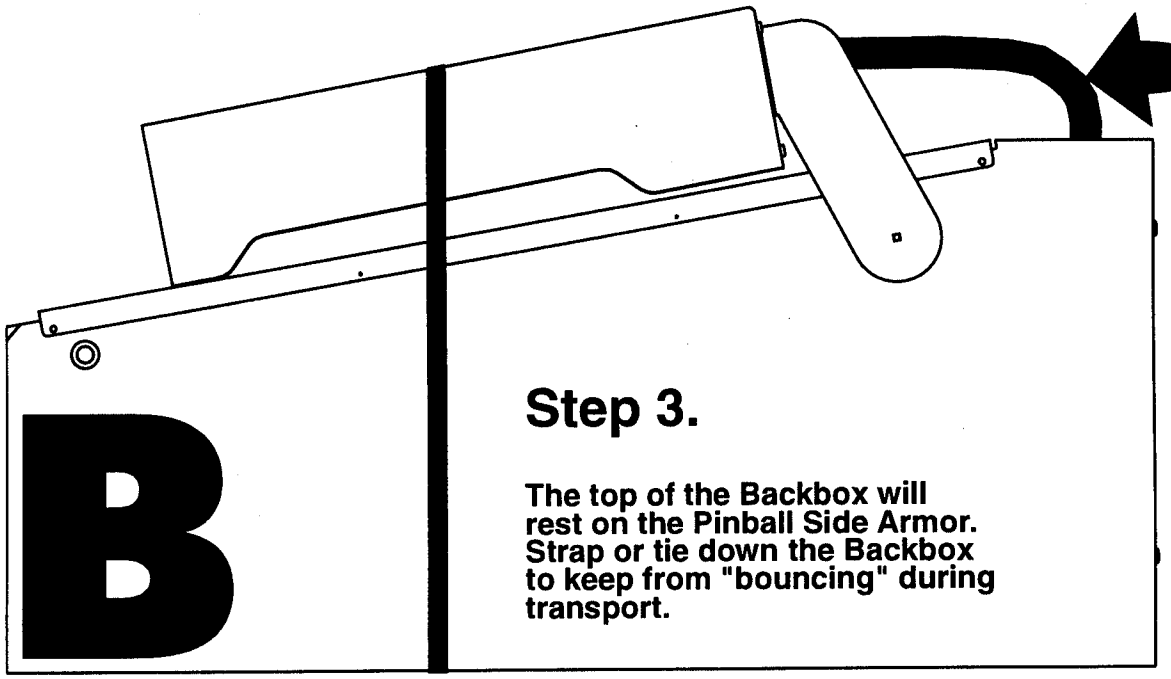
Step 2.

Carefully pull the Backbox forward into the "down" position.

Step 1.

Unlock the Roto-Lock (Counter-Clockwise)

A



Ensure Cables do not bind, pinch or are being pulled tight. Hand-Feed out with Backbox so Cables are not tight.

Step 3.

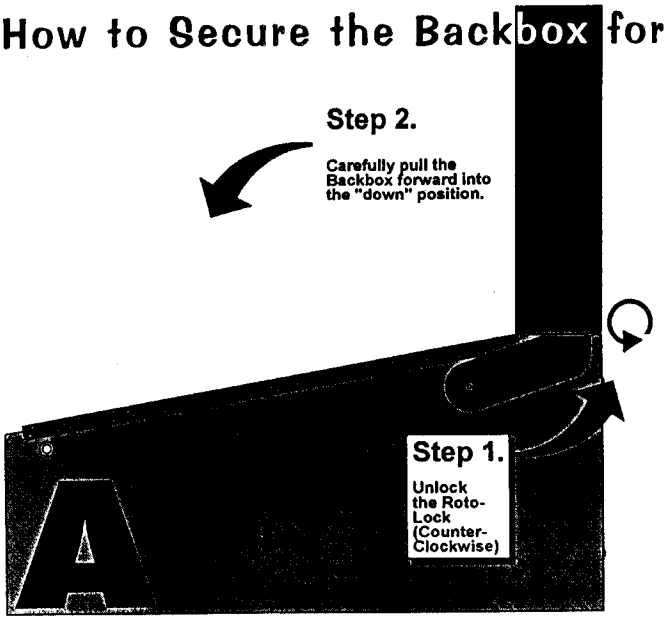
The top of the Backbox will rest on the Pinball Side Armor. Strap or tie down the Backbox to keep from "bouncing" during transport.

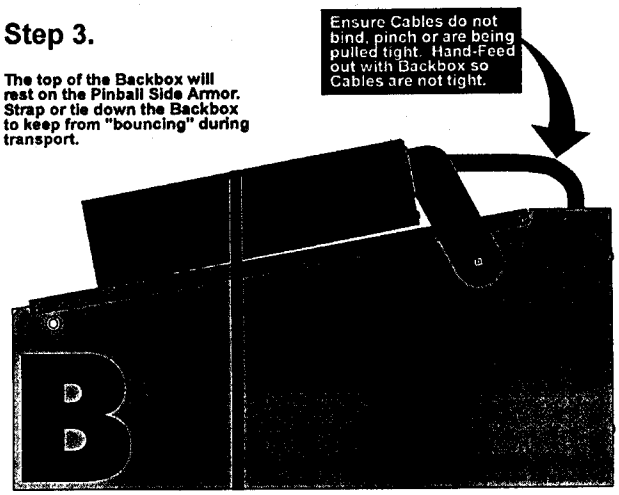
B

Stern Part №: 755-5085-02 © OCT 1999

How to Secure the Backbox for Transporting

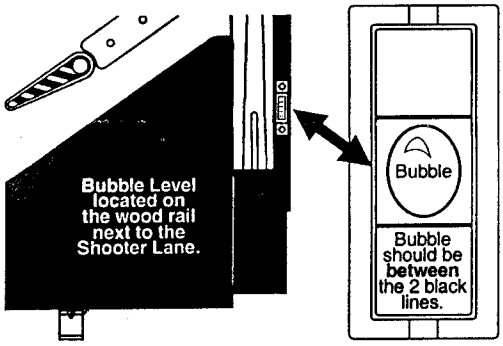
For more Backbox details & part numbers, see Section 4, hapter 1, Backbox Assembly, Pages 50-51.





Leg Leveler Adjustment

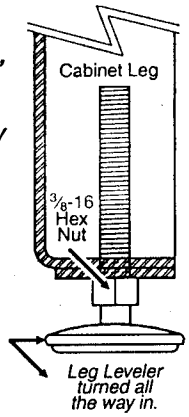
On a LEVEL FLOOR, this cabinet is designed to automatically have a 6.5° pitch without adjusting levelers.



Attach the four (4) Leg Assemblies to cabinet corners with the eight (8) leg bolts provided *(See Sec. 4, Chp. 1, Cabinet - General Parts & Switches, Page 52).*

Start adjustment with the leg levelers *turned all the way in.* **View** the *bubble* in the level provided on the right side wood rail. **Adjust** the front or rear levelers as necessary to cause the bubble to float between the two (2) black lines. **Use** a pinball to roll down the center of the playfield for side-to-side leveling.

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



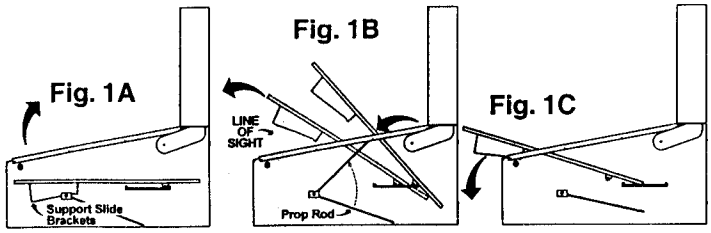
For custom adjustment greater than >6.5° can be acheived by turning out the rear leg leveler(s), however, ***it is not recommended.***

Easy Access Service System - 3 Positions

With the front molding & glass removed, carefully lift the playfield (take care when using the Bottom Arch to hoist).

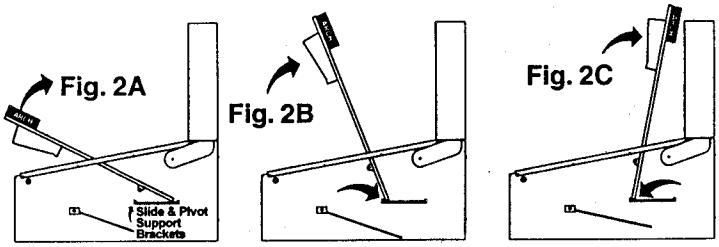
Positions 1 & 2

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)**.



The Bubble Level is back!
This will ensure Game Pitch is 6.5° (recommended) for proper game play.

Le niveau à bulle est de retour! Celui-ci garantira l'inclinaison de 6,5° recommandée pour jouer sur le "Game Pitch".

Die Wasserwaage ist wieder da! Sie gewährleistet eine empfohlene Spielfeldneigung von 6,5°, die für ein ordnungsgemäßes Spiel erforderlich ist.

Ritorna la livella a bolla! Questo assicura l'inclinazione a 6,5° (raccomandata) per assicurare condizioni corrette per il gioco.

¡Regresa el Nivel de Burbuja! Esto garantiza que el campo de juego del Game Pitch esté a 6.5° (lo recomendado) para jugar apropiadamente.

Leg Leveler Adjustment and use of the Bubble Level

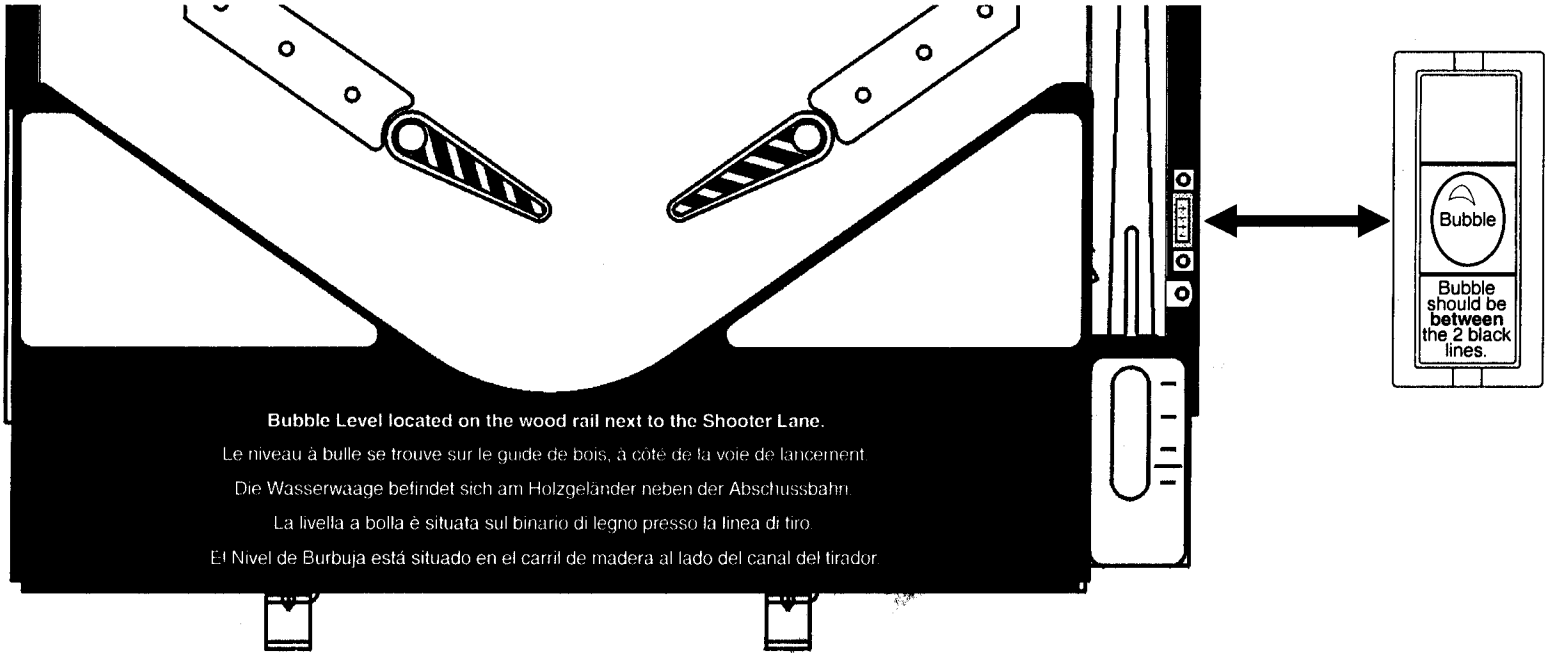
Réglage du niveau du pied et utilisation du niveau à bulle

Verstellen der Beine und Gebrauch der Wasserwaage

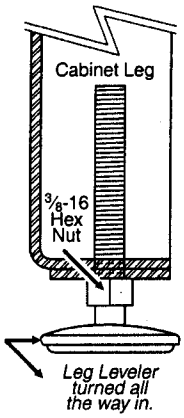
Regolazione dei livellatori delle gambe e uso della livella a bolla

Ajuste del nivelador de patas y uso del nivel de burbuja

Start adjustment with the leg levelers *turned all the way in.*
Commencer le réglage avec le mécanisme d'ajustement du pied entièrement à l'intérieur de celui-ci.
Beim Beginnen mit dem Verstellen müssen die Nivelliervorrichtungen an den Beinen ganz nach innen gedreht sein.
Iniziare la regolazione con i livellatori delle gambe girati completamente all'interno.
Comience el ajuste con los niveladores de patas metidos totalmente hacia dentro.



View the *bubble* in the level provided on the right side wood rail (see above).
Observer la bulle à l'intérieur du niveau situé sur le guide de bois, à droite (voir ci-dessus).
Visieren Sie die „Blase" in der Wasserwaage am rechten Holzgeländer an (siehe oben).
Osservare la "bolla" nella livella che si trova a destra del binario di legno (vedere più sopra).
Vea la *burbuja* en el nivel provisto en el carril de madera del lado derecho (vea arriba).



Adjust the front or rear leg levelers as necessary to cause the bubble to float between the 2 black lines.
Régler les dispositifs de mise à niveau à l'avant et à l'arrière de telle sorte que la bulle flotte entre les deux lignes.
Verstellen Sie bei Bedarf die vorderen oder hinteren Beine, so dass die Blase zwischen den beiden schwarzen Linien schwimmt.
Regolare i livellatori delle gambe anteriori o posteriori fino a che la bolla flotti tra le due linee nere.
Ajuste los niveladores de las patas delanteras o traseras según sea necesario para que la burbuja flote entre las dos líneas negras.

Use a pinball to roll down the center of the playfield for side-to-side leveling.
Faire rouler une balle vers le centre de l'aire de jeu pour niveler d'un côté à l'autre.
Lassen Sie einen Pinball in der Mitte des Spielfelds entlang rollen, um das Spielfeld seitlich zu nivellieren.
Usare un flipper per rotolare verso il basso al centro del campo di gioco per la livellazione lato a lato.
Use una bola que ruede hacia abajo por el centro del campo de juego para conseguir la nivelación de lado a lado.

SPI Part N°: 755-5085-04 ©OCT01
Stern Pinball, Inc. ©2001

Translation Order: French, German, Italian & Spanish
by Language Exchange, Inc. www.langx.com

▼ 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	3A 250v S.B.	50v DC	Magnet
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	**Not Used / Spare**

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)

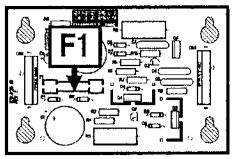
Playfield Fuses

LOC:	UNDER PLAYFIELD (near Flippers)		
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	Upr. Flipper (GRY-YEL⇆RED-YEL)

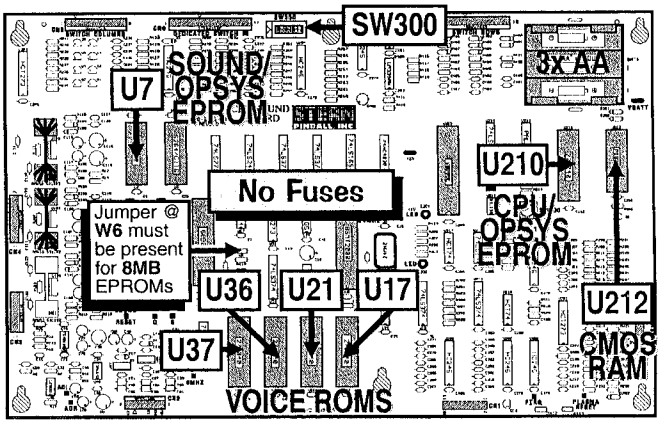
For other fuses, if any, locations & more information, see Page 95.

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

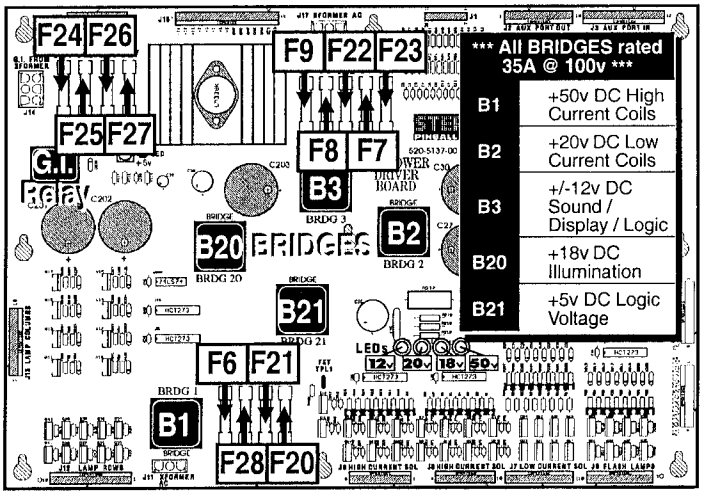
Display Power Supply Board



CPU / Sound Board

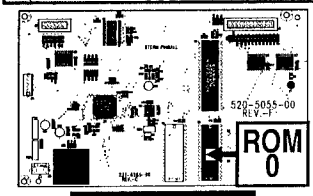


I/O Power Driver Board

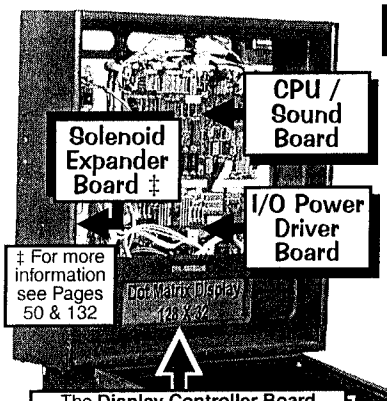


Display Controller Board

(Mounted behind the Dot Matrix Display)

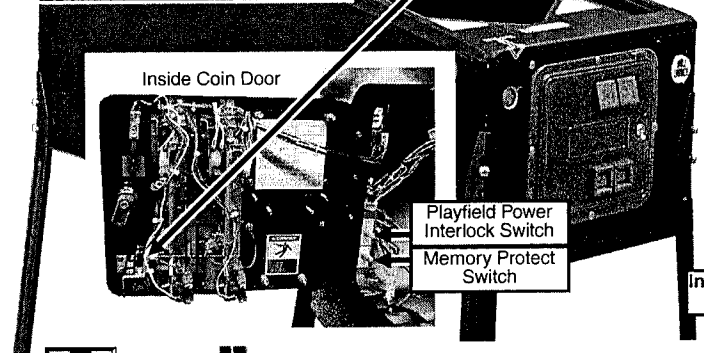


No Fuses

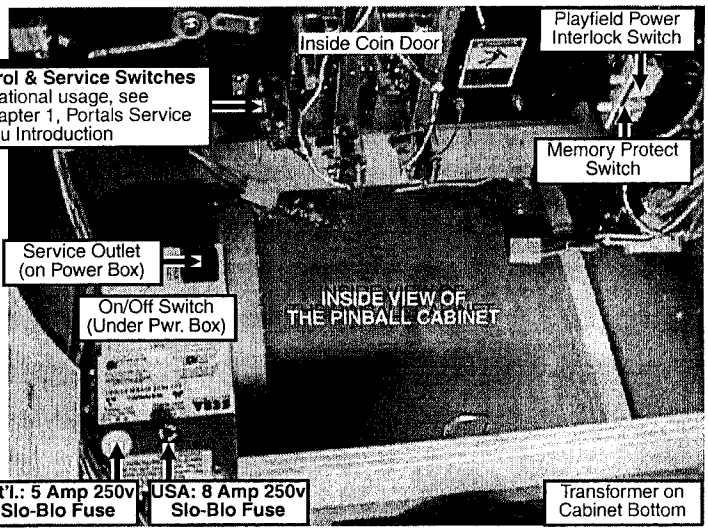


‡ For more information see Pages 50 & 132

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



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**).

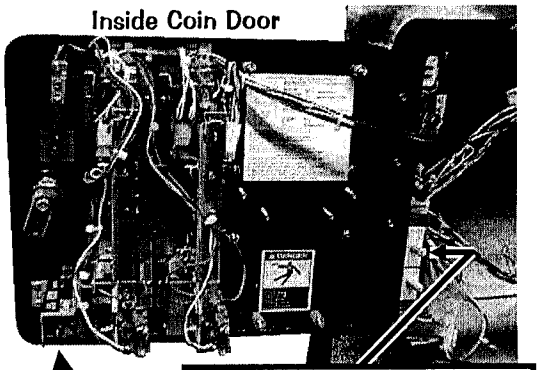
Step 1: Push down the **Black "BEGIN TEST" Button**. Looking at the Video Display you will momentarily see the introductory screen followed by the **MAIN MENU**.

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



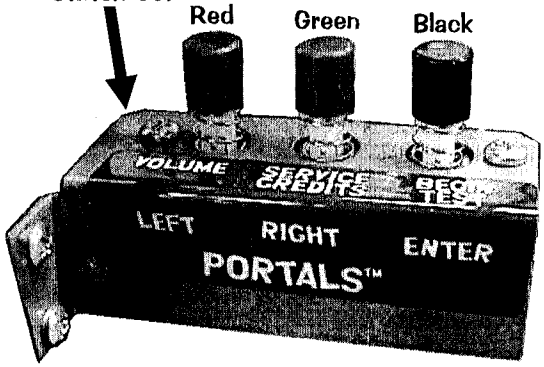
Step 3: Select or activate the *Icons* by pushing the **Black "ENTER" Button**.

Inside Coin Door



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

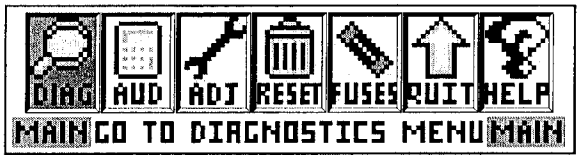
Portals™ Service Switch Set



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 microprocessor 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.

For proper operation of MONOPOLY® Pinball,



FOUR (4) PINBALLS MUST BE INSTALLED!

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.

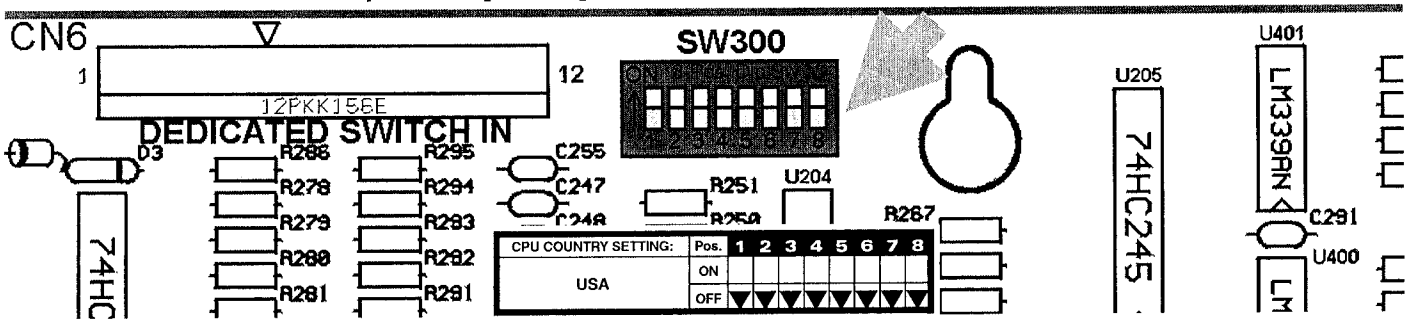
The *display flashes* "OPEN THE COIN DOOR"

— 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 (Right of CN6, Top Mid)



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
EURO	ON	▲	▲	▲	▲				
	OFF					▼	▼	▼	▼

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

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

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

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

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

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

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

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

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

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

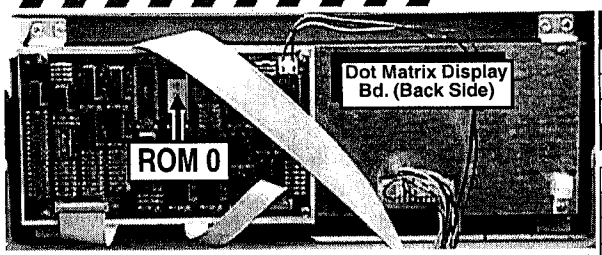
CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
SWEDEN	ON	▲	▲		▲				
	OFF			▼		▼	▼	▼	▼

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

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

CPU COUNTRY SETTING:	Pos.	1	2	3	4	5	6	7	8
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	965-0360-75
Sound EPROM	512K	CPU / Sound Bd.	U7	965-0361-75
Display EPROM	4MB	Display Cntlr. Bd.	ROM 0	965-0362-75
Display EPROM	N/C	Display Cntlr. Bd.	ROM 1	N/A
Voice ROM 1	8MB	CPU / Sound Bd.	U17	965-0363-75
Voice ROM 2	8MB	CPU / Sound Bd.	U21	965-0364-75
Voice ROM 3	8MB	CPU / Sound Bd.	U36	965-0365-75
Voice ROM 4	8MB	CPU / Sound Bd.	U37	965-0366-75

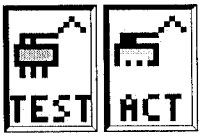
For Game, Sound & Voice ROM Locations see DR. ❶.



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

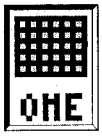
Diode On Terminal Strip:

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 (UK ONLY) on Cabinet side 1	CHANCE SCOOP On Assembly 9	LEFT TOP LANE (A) Under Playfield 17	RIGHT ORBIT Under Playfield 25	BANK OPTO 1 (L) On Assembly 33	LOWER BOTTOM POP On Assembly 41	UPPER LEFT POP On Assembly 49	LEFT OUTLANE Under Playfield 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	RAILROAD RAMP Above Playfield 10	MIDDLE TOP LANE (B) Under Playfield 18	ELECTRIC COMPANY On Assembly 26	BANK OPTO 2 On Assembly 34	LOWER RIGHT POP On Assembly 42	UPPER RIGHT POP 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 On Assembly 11	RIGHT TOP LANE (C) Under Playfield 19	DICE EJECT LANE Under Playfield 27	BANK OPTO 3 On Assembly 35	LOWER LEFT POP On Assembly 43	UPPER BOTTOM POP 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	LOCKUP 1 (TOP) Under Playfield 20	LEFT ORBIT Under Playfield 28	BANK OPTO 4 (R) On Assembly 36	100K STANDUP Under Playfield 44	DICE EJECT On Assembly 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	LOCKUP 2 Under Playfield 21	WATERWORKS EJECT On Assembly 29	NOT USED 37	SPINNER On Assembly 45	NOT USED 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	LOCKUP 3 (BOTTOM) Under Playfield 22	WWORKS MINI FLIPPER On Assembly 30	COP DROP TARGET DIOD 38	COP STANDUP X2 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	NOT USED 23	CENTER RAMP On Ramp Asm. 31	LEFT RAMP MID On Ramp Asm. 39	FREE PARKING Above Playfield 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) on Cabinet side 8	SHOOTER LANE Under Playfield 16	NOT USED 24	NOT USED 32	NOT USED 40	RIGHT RAMP On Ramp Asm. 48	PLUMB BOB TILT Inside Cabinet 56	NOT USED 64

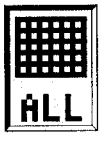
GND / IC U206 INPUTS	Ground BLK CN6-P1, -P11
1: U206 GRY-BRN CN6-P2	#1 LEFT FLIPPER BUTTON in Cabinet side DS-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) on Flipper Assy. DS-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON in Cabinet side DS-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) on Flipper Assy. DS-4
5: U206 GRY-GRN CN6-P7	#5 UPPER FLIPPER BUTTON *(Double-Stacked with DS-3)* 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



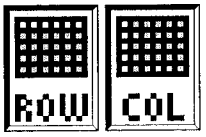
From the Diagnostics Menu GO TO LAMP MENU



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

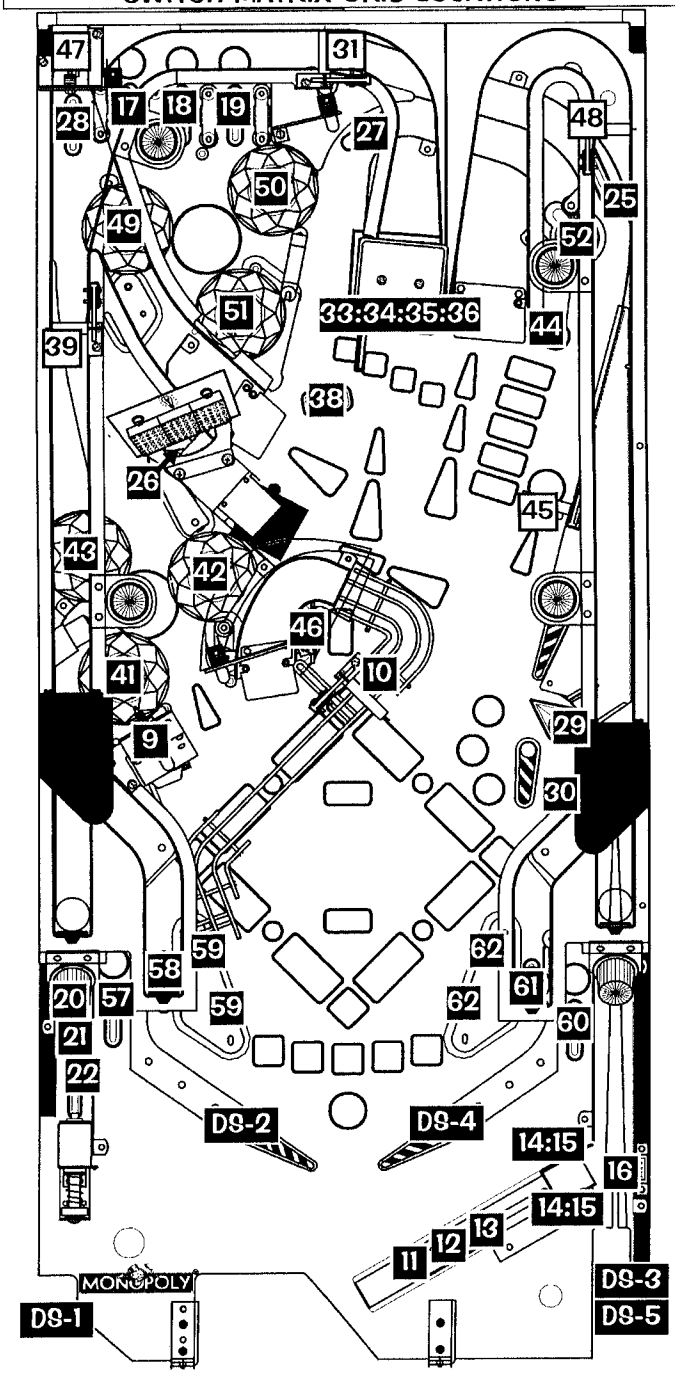
Diode On Terminal Strip:

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	LEFT OUTLANE #555 Bulb 1	BONUS 2X #555 Bulb 2	BONUS 3X #555 Bulb 3	BONUS 4X #555 Bulb 4	BONUS 5X #555 Bulb 5	BONUS 6X #555 Bulb 6	SHOOT AGAIN #555 Bulb 7	RIGHT OUTLANE #555 Bulb 8
2: Q34 RED-BLK J12-P2	GO #555 Bulb 9	MEDITER-RANEAN #555 Bulb 10	COMM CHEST #555 Bulb 11	BALTIC #555 Bulb 12	READING RR #555 Bulb 13	ORIENTAL #555 Bulb 14	VERMONT #555 Bulb 15	CONNECTI-CUT #555 Bulb 16
3: Q35 RED-ORG J12-P3	IN JAIL #555 Bulb 17	ST CHARLES #555 Bulb 18	STATES #555 Bulb 19	VIRGINIA #555 Bulb 20	PENN RR #555 Bulb 21	ST JAMES #555 Bulb 22	TENNESSEE #555 Bulb 23	NEW YORK #555 Bulb 24
4: Q36 RED-YEL J12-P4	FREE PARKING #555 Bulb 25	KENTUCKY #555 Bulb 26	INDIANA #555 Bulb 27	ILLINOIS #555 Bulb 28	B.O. RR #555 Bulb 29	ATLANTIC #555 Bulb 30	VENTNOR #555 Bulb 31	MARVIN GARDENS #555 Bulb 32
5: Q37 RED-GRN J12-P5	GO TO JAIL #555 Bulb 33	PACIFIC #555 Bulb 34	NORTH CAROLINA #555 Bulb 35	PENNSYL-VANIA #555 Bulb 36	SHORT LINE RR #555 Bulb 37	CHANCE #555 Bulb 38	PARK PLACE #555 Bulb 39	BOARDWALK #555 Bulb 40
6: Q38 RED-BLU J12-P6	LOWER BOTTOM POP #555 Bulb DIOD 41	LOWER LEFT POP #555 Bulb DIOD 42	RELIGHT JACKPOT #555 Bulb DIOD 43	RAILROAD LIT #555 Bulb DIOD 44	L BONUS X #555 Bulb 45	LOWER RIGHT POP #555 Bulb DIOD 46	COMM CHEST LIT #555 Bulb DIOD 47	FREE PARKING #555 Bulb DIOD 48
7: Q39 RED-VIO J12-P8	CHANCE LIT #555 Bulb DIOD 49	3000 WHEN FLASHING #555 Bulb 50	ROLL #555 Bulb 51	SUPER JACKPOT #555 Bulb 52	WATERWORKS 1X #555 Bulb 53	WATERWORKS 2X #555 Bulb 54	WATERWORKS 4X #555 Bulb 55	R BONUS X #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT TOP LANE (A) #555 Bulb 57	MIDDLE TOP LANE (B) #555 Bulb 58	RIGHT TOP LANE (C) #555 Bulb 59	UPPER LEFT POP #555 Bulb DIOD 60	UPPER RIGHT POP #555 Bulb DIOD 61	UPPER BOTTOM POP #555 Bulb DIOD 62	ROLL AND COLLECT #555 Bulb DIOD 63	EXTRA BALL #555 Bulb DIOD 64
9: Q41 RED-WHT J12-P10	BA(N)K #555 Bulb 65	BAN(K) #555 Bulb 66	LOCK #555 Bulb 67	COP #555 Bulb 68	BUILD #555 Bulb 69	JACKPOT #555 Bulb 70	(B)ANK #555 Bulb 71	B(A)NK #555 Bulb 72
10: Q42 RED J12-P11	MOVE 2 #555 Bulb 73	LITE ROLL #555 Bulb 74	MULTIBALL #555 Bulb 75	100,000 #555 Bulb 76	LITE SPINNER #555 Bulb 77	POWER UP #555 Bulb 78	WATER BONUS X #555 Bulb 79	ADVANCE TO GO #555 Bulb 80

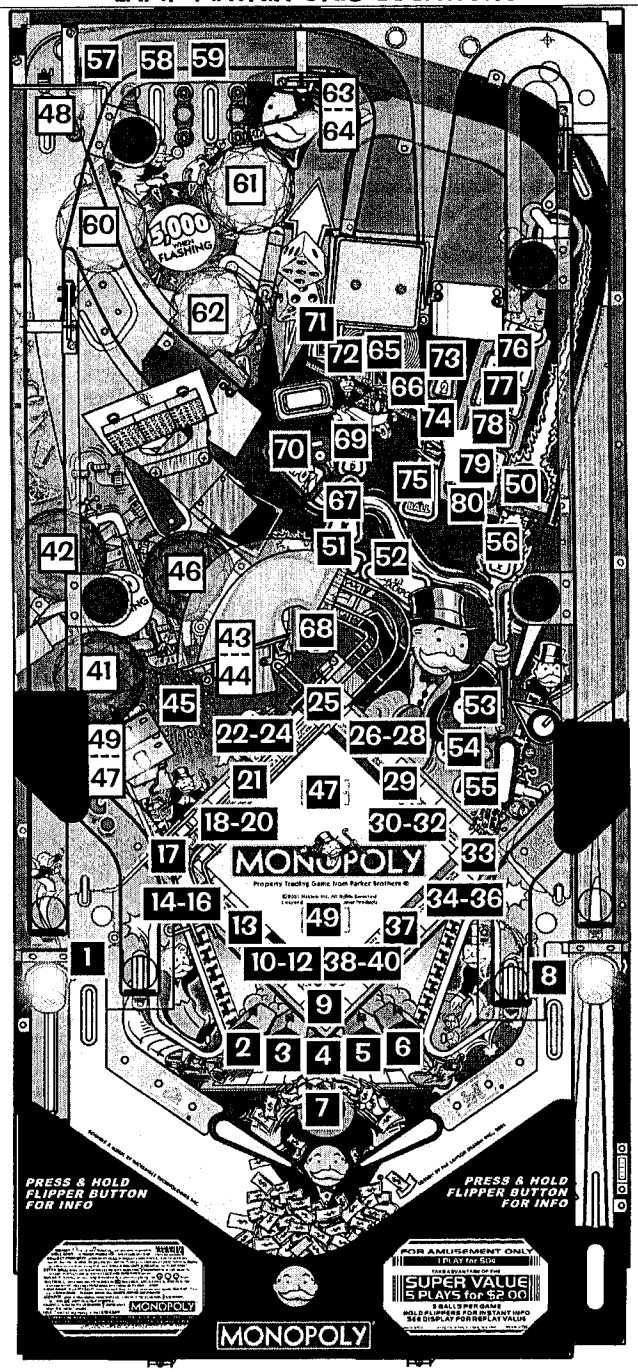




SWITCH MATRIX GRID LOCATIONS

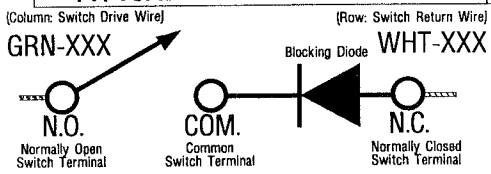


LAMP MATRIX GRID LOCATIONS

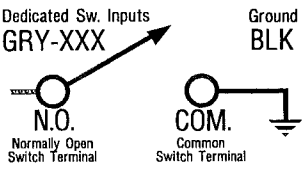


Legend Note: ☐ = Switches/Lamps mounted above P/F. ■ = Switches/Lamps mounted below the P/F. ▨ = ...mounted on Cabinet.

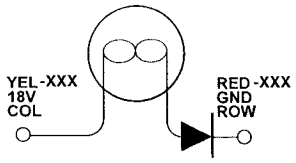
TYPICAL SWITCH SCHEMATIC



DEDICATED SWITCH SCHEMATIC



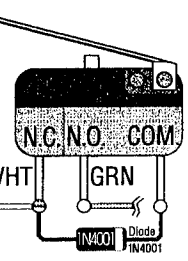
TYPICAL LAMP SCHEMATIC



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

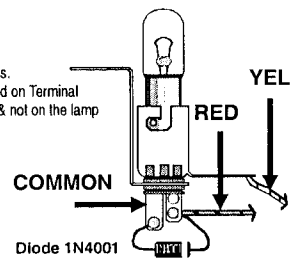
Diode On Terminal Strip

Diode On Diode Board



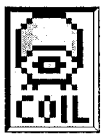
Note:
All Lamps require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the lamp itself.

Diode On Terminal Strip

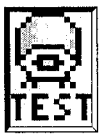




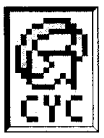
From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



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 Part #
#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	23-700 090-5022-00T
#3	LOWER LEFT POP	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#4	LOWER RIGHT POP	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#5	LOWER BOTTOM POP	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#6	BANK CLOSE	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#7	DROP TARGET RESET	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#8	LOCK KICKER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00B

	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) Part #
#9	UPPER LEFT POP	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	UPPER RIGHT POP	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	UPPER BOTTOM POP	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	CHANCE SCOOP	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00B
#13	BANK OPEN	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1500 090-5062-00
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T

	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, Bulb or Meter Part #
#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	FLASH RGT RAMP TOP	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#20	FLASH RGT RAMP MID (X2)	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#906 Bulb are ABOVE
#21	FLASH LEFT RAMP TOP (X2)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#22	FLASH LEFT RAMP MID (X2)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	ORG	J6-P10	20v DC	#89 Bulb are BELOW
#23	FLASH LEFT RAMP BOT	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

Diode On Terminal Strip (if noted)

	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) or Bulb Part #
#25	WATERWORKS MOTOR	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	BRN	J7-P1	20v DC	EX00159A 041-5083-00
#26	ELECTRIC COMPANY	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#27	MOTOR RELAY	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	BRN	J7-P1	20v DC	DC Relay 520-5066-00
#28	DICE EJECT	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#29	FLASH RGT RAMP BOT	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#30	LEFT RAMP DIVERTER	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	BRN	J7-P1	20v DC	32-1800 090-5031-00
#31	RIGHT RAMP DIVERTER	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	BRN	J7-P1	20v DC	32-1800 090-5031-00
#32	TOP LANE UP/DN POST	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	BRN	J7-P1	20v DC	26-1200 090-5044-00T

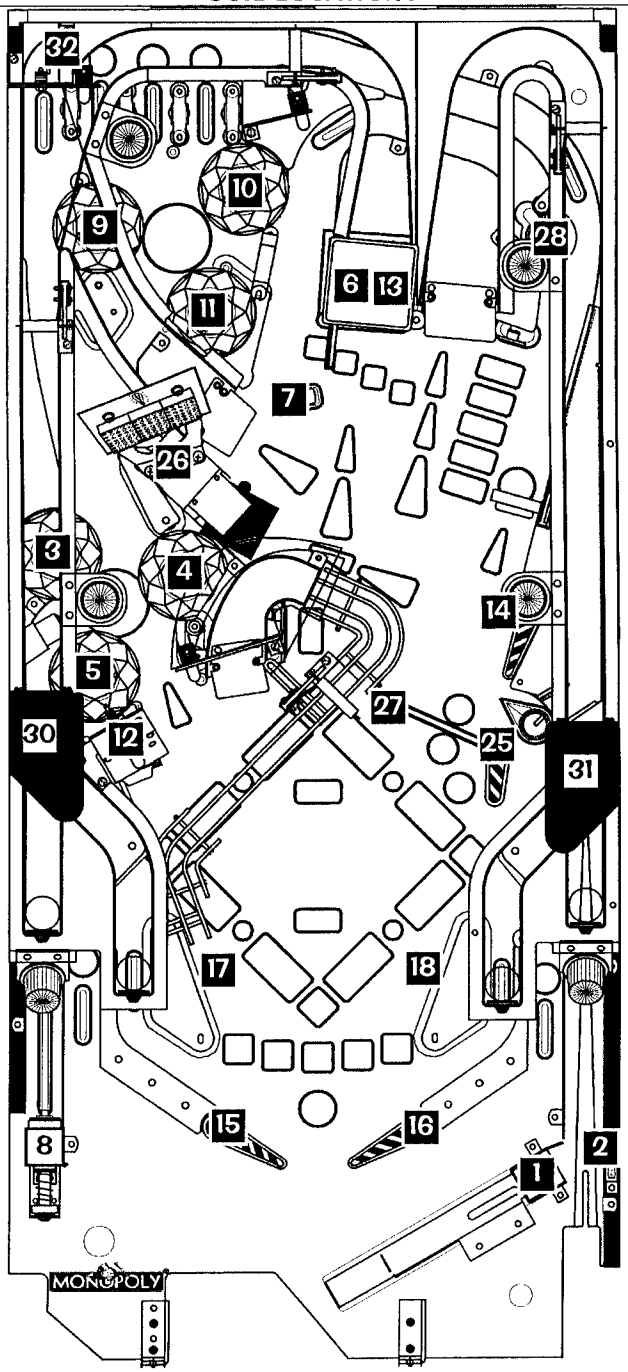
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game:)

Auxilliary (UK ONLY)	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) Part #
AUX 1: LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	J3-P11	BRN	J7-P1	20v DC	26-1200 090-5044-00T
AUX 2: CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	J3-P10	BRN	J7-P1	20v DC	23-1100 090-5030-00T
AUX 3: RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	J3-P9	BRN	J7-P1	20v DC	26-1200 090-5044-00T

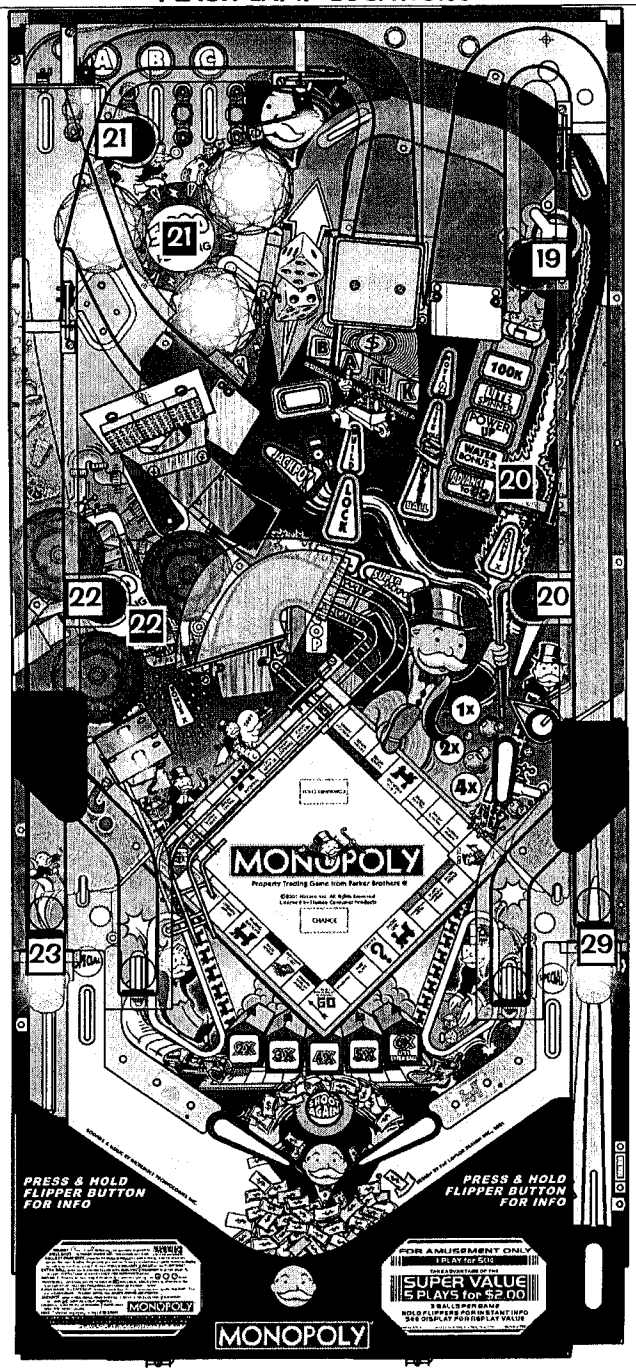




COIL LOCATIONS

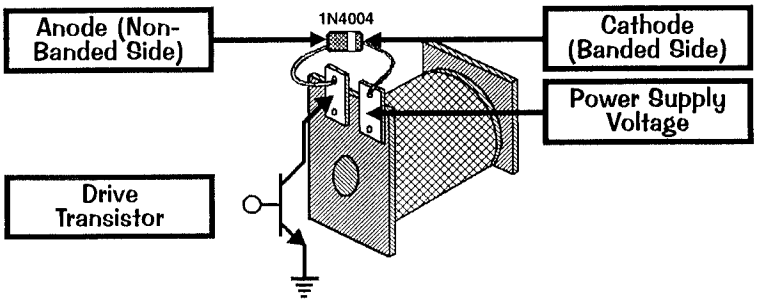


FLASH LAMP LOCATIONS



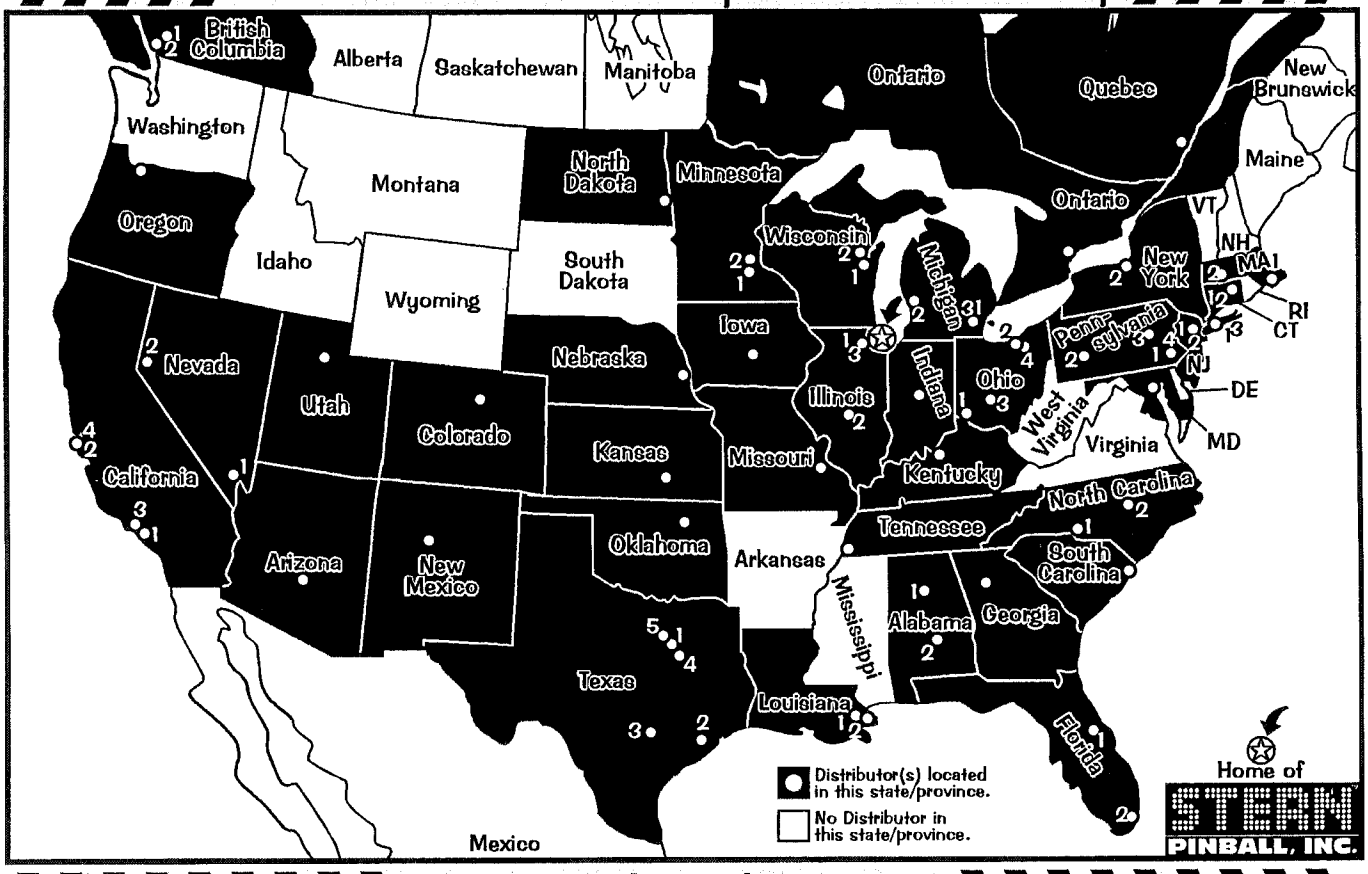
Legend Note: ☐ = Coils/Flashers mounted above P/F. ■ = Coils/Flashers mounted below the P/F. ▨ = ...mounted in/on Cabinet.

TYPICAL COIL WIRING

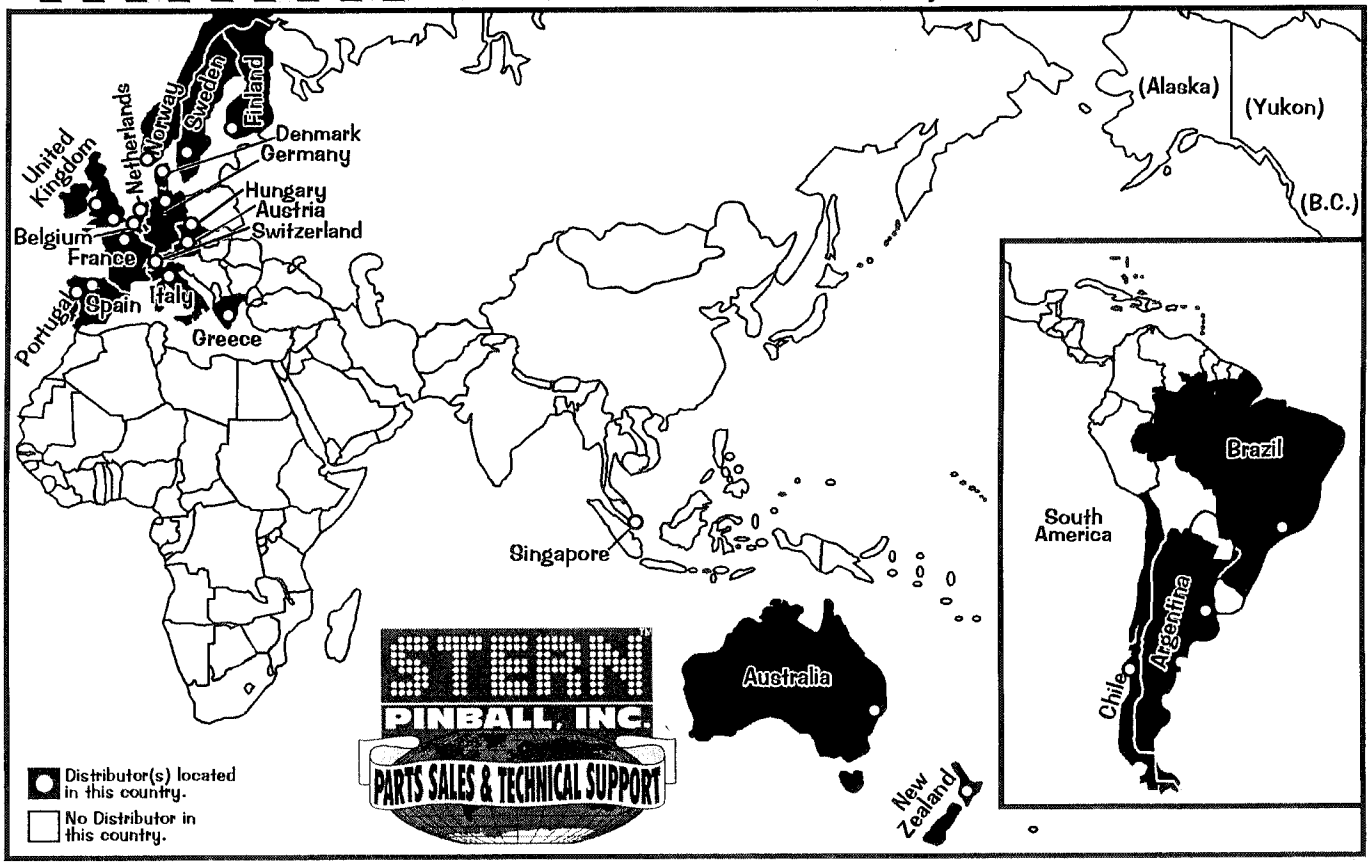


Note:
All Coils require diodes. Some diodes are located on Terminal Strips (under playfield) & not on the coil itself.
D iode
O n
T erminal
S trip

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 **1-708-786-5466**. Visit us at www.SternPinball.com for current Distributor Information & other pinball needs.



Domestic Pinball & Redemption Distributors Directory

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

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

ARIZONA
Mountain Coin
Phoenix
1-602-269-7596

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

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

TDM Distributing
Willimantic (2)
1-860-456-4231

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

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
1-316-263-6181

KENTUCKY
Atlas Distributing
Louisville
1-502-966-5266

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

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

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

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

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
Starburst Coin Mach.
Toronto
1-416-251-2122

OREGON
Dunis Distributing
Portland
1-503-234-5491

Specialty Coin Products
Portland
1-800-987-4946

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

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
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

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

CANADA

ONTARIO
Starburst Coin Mach.
Toronto
1-416-251-2122

Parts & Service Only:

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

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

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

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.

Note: *Distributors are subject to change. Visit us at* **www.SternPinball.com** *for current Distributor Information.*

International Distributors Directory

ARGENTINA
Universe Electronics
Buenos Aires
(54) 1865-4730

Electroport (Florencia)
Mar Del Plata
(54) 22-3495-5532

BRAZIL
DiverBras
São Paulo
(55) 11-6674-1000

AUSTRALIA
Amusement Mach. Dist.
Matraville
(61) 2-9316-6000

AUSTRIA
R. Rupp
Kaindorf
(43) 3-4528-6105

BELGIUM
Brabo
Antwerpen
(32) 3238-9970

BRAZIL
DiverBras
São Paulo
(55) 11-6674-1000

CHILE
Cuinsa
Santiago
(56) 2641-8520

DENMARK
Vendcomatic
(Oslo, Norway)
(47) 2291-8383

FINLAND
Pelika Ray-Oy
Espoo
(0) 3589-2904-5299

FRANCE
Avranches Automatic
Ducey
(33) 2-3389-6162

SFA
Paris
(33) 1-5326-8082

GERMANY
Nova Games
Hamburg
(49) 4053-8060

GREECE
Elcoin
Nikea
(30) 1492-9357

GREECE
Greece Coin
Athens
(30) 1577-7012

ITALY (RSM)
Tecnoplay S.A.
San Marino
(39) 549-900361

NEW ZEALAND
Amco Machine Supplies
Auckland
(64) 9846-7606

NORWAY
Vendcomatic
Oslo
(47) 2291-8383

PORTUGAL
Jacinto & Martins, Lda.
Amadora
(35) 12-1496-3744

SINGAPORE
Valibel Technologies
Singapore
(65) 748-8404

SPAIN
Commercial Cocomatic
Madrid
(34) 91-671-69-80

SWEDEN
Call for Information
or visit our website
www.SternPinball.com

SWITZERLAND
Novomat, A.G.
Harkingen
(41) 6-2388-8961

UNITED KINGDOM
Electrocoin
London, England
(44) 20-8965-2055

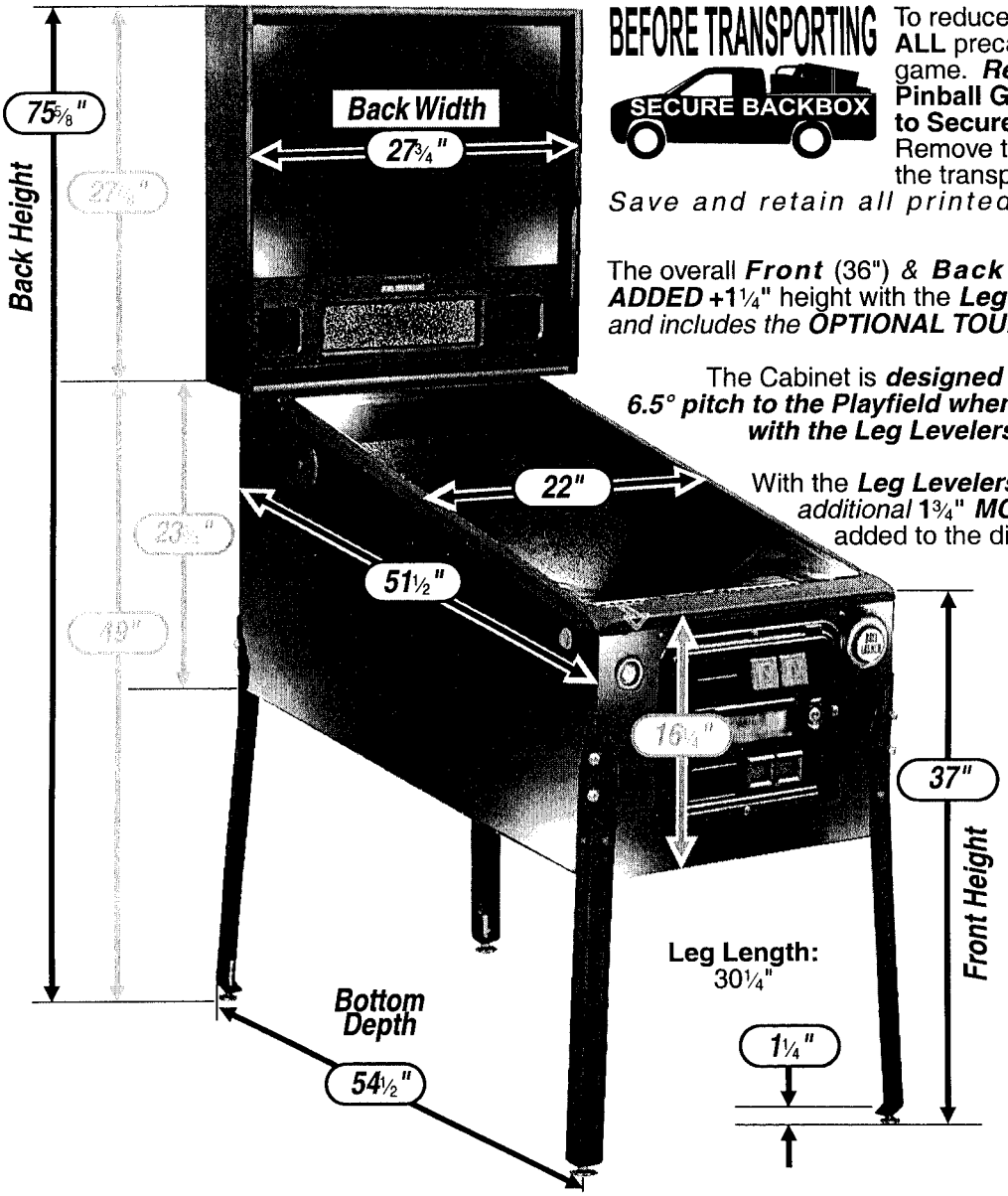
Electrocoin Aftersales
Cardiff, S. Wales
(44) 29-2034-3888

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 Fuse.) 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,* **Pinball Game Set-Up 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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See Sections 3 & 5, Table Of Contents, for details of that Section and it's Chapters.

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- ▶ Find-It-In-Front: Dr. Pinball Section Explained..... DR. ❷
- ▶ Diagnostic Aids ↳ CPU DIP Switch Settings ↳ ROM Summary Table..... DR. ❸
- ▶ Switch Matrix Grid & Dedicated Switches ↳ Lamp Matrix Grid ..... DR. ❹
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- ▶ Coils Detailed Chart Table ..... DR. ❻
- ▶ Coil & Flash Lamp Locations ↳ Typical Coil Wiring ..... DR. ❼
- ▶ Domestic Pinball & Redemption and International Distributors Maps..... DR. ❽
- ▶ Domestic Pinball & Redemption and International Distributors Directories ..... DR. ❾
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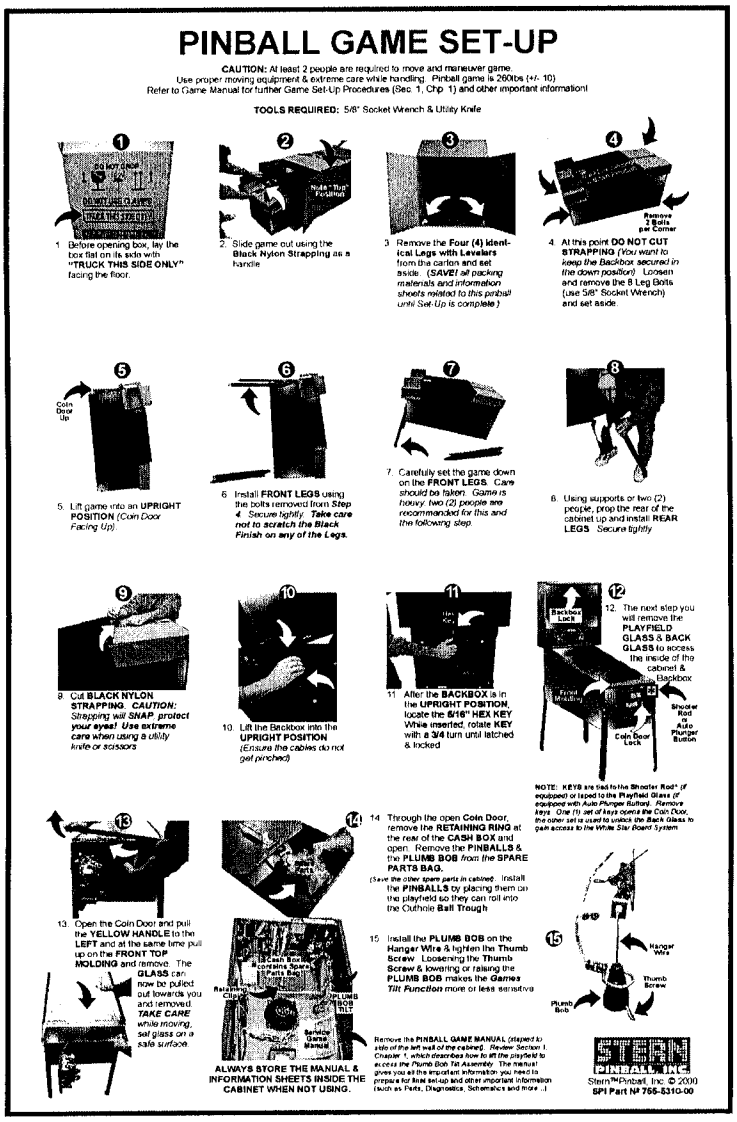
After Set-Up

Pinball Game Set-Up Procedures

...after reading the Pinball Game Set-Up Instruction Sheet (SPI Part Nº 755-5310-00) included with your New Pinball Game, continue with the below procedures:



With the Back Glass Removed:

1. 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.*

With the Playfield Glass Removed:

2. Make sure the proper amount of pinballs were installed *(Amount of balls are always specified on decal attached to the lock down assembly and top of Page* ***DR.*** ❸ *in the beginning of this manual).*

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

4. 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"** *on Page 4.*

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

6. Lower the playfield and ensure game is **level side-to-side** by adjusting Leg Levelers, if required. See the illustration **"Leg Leveler Adjustment"** *on Page 4.* 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.*

USE THE BUBBLE LEVEL ON THE WOOD RAIL (LOWER RIGHT) TO DETERMINE IF LEVEL IS ACHEIVED. BUBBLE SHOULD APPEAR BETWEEN THE 2 BLACK LINES. SEE PAGE 4 FOR AN ILLUSTRATION.

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

With the Coin Door Open:

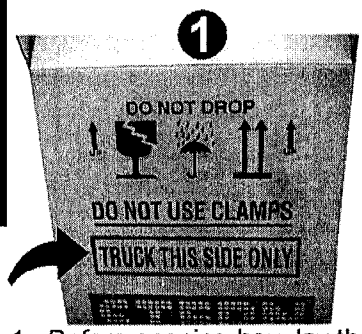
7. If desired, perform any self tests at this time. See **Section 3, Chapter 1, Portals™ Service Menu Introduction**, and **Chapter 2, Go To Diagnostics Menu**, for instructions on how to *enter "Begin Play Test"* and *"Game Specific"* to test components on the game.

8. 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.

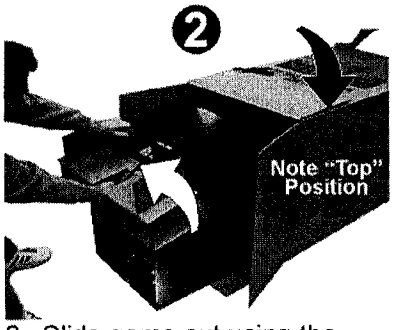
CE **Per CE:** "The appliance has to be placed in a horizontal position." "This appliance is not to be cleaned by a Water Jet."

Pinball Game Set-Up Future Reference

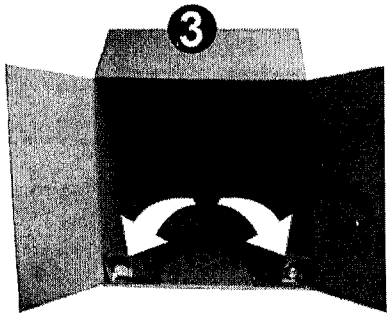
CAUTION: At least 2 people are required to move and maneuver game.
Use proper moving equipment & extreme care while handling. Pinball game is 260lbs (+/- 10).
Refer to Game Manual for further Game Set-Up Procedures (Sec. 1, Chp. 1) and other important information!
TOOLS REQUIRED: 5/8" Socket Wrench & Utility Knife



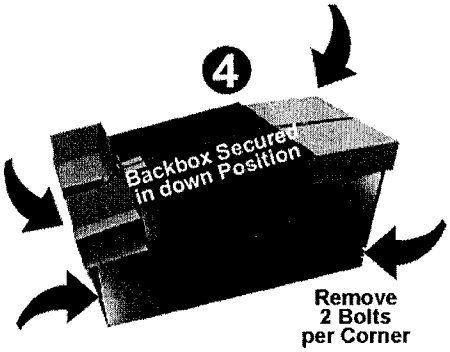
1. Before opening box, lay the box flat on its side with **"TRUCK THIS SIDE ONLY"** facing the floor.



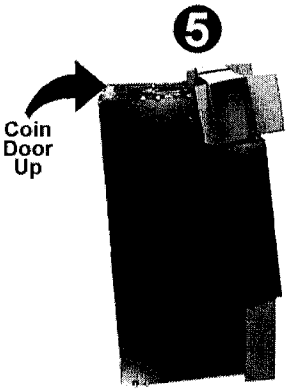
2. Slide game out using the **Black Nylon Strapping** as a handle.



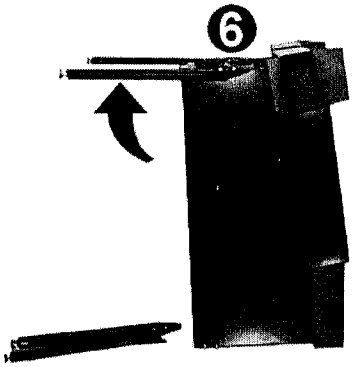
3. Remove the **Four (4) Identical Legs with Levelers** from the carton and set aside. (***SAVE!*** *all packing materials and information sheets related to this pinball until Set-Up is complete.)*



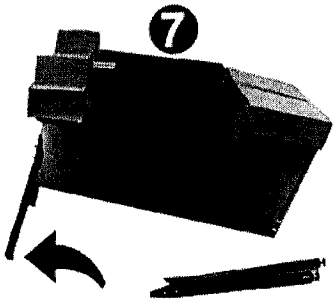
4. At this point **DO NOT CUT STRAPPING** *(You want to keep the Backbox secured in the down position).* Loosen and remove the 8 Leg Bolts (use 5/8" Socket Wrench) and set aside.



5. Lift game into an **UPRIGHT POSITION** *(Coin Door Facing Up).*



6. Install **FRONT LEGS** using the bolts removed from ***Step 4***. *Secure tightly.* ***Take care not to scratch the Black Finish on any of the Legs.***



7. Carefully set the game down on the **FRONT LEGS**. *Care should be taken...Game is heavy, two (2) people are recommended for this and the following step.*

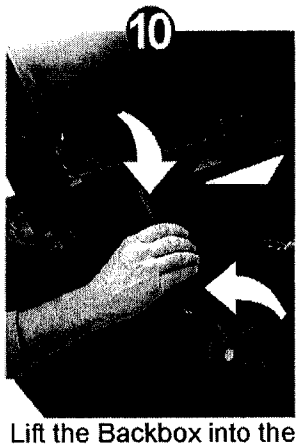


8. Using supports or two (2) people, prop the rear of the cabinet up and install **REAR LEGS**. *Secure tightly.*

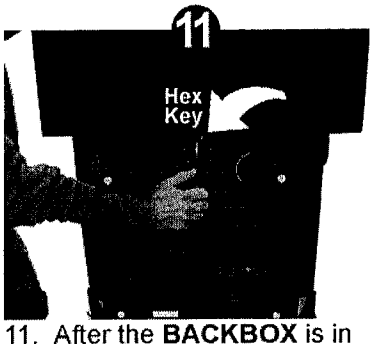


9. Cut **BLACK NYLON STRAPPING**. ***CAUTION:*** *Strapping will* ***SNAP, protect your eyes! Use extreme care*** *when using a utility knife or scissors.*

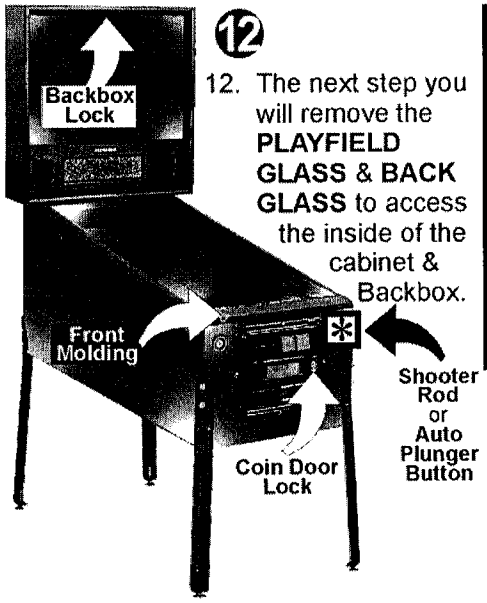
Pinball Game Set-Up Future Reference Continued



10. Lift the Backbox into the **UPRIGHT POSITION** *(Ensure the cables do not get pinched).*



11. After the **BACKBOX** is in the **UPRIGHT POSITION**, locate the **5/16" HEX KEY**. While inserted, rotate **KEY** with a **3/4** turn until latched & locked.

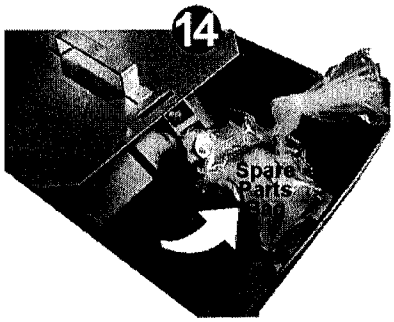


12. The next step you will remove the **PLAYFIELD GLASS** & **BACK GLASS** to access the inside of the cabinet & Backbox.

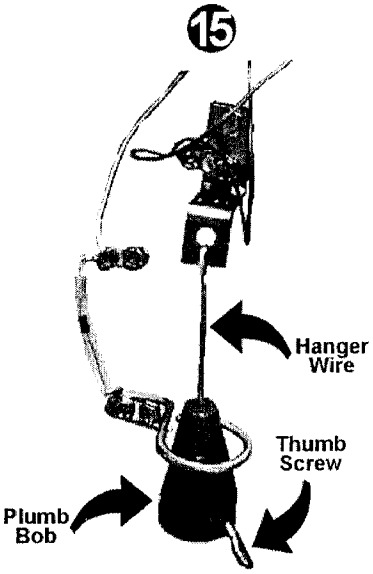
NOTE: KEYS are tied to the **Shooter Rod*** *(if equipped)* or taped to the **Playfield Glass** *(if equipped with Auto Plunger Button). Remove keys. One (1) set of keys opens the Coin Door, the other set is used to unlock the* ***Back Glass*** *to gain access to the White Star Board System.*



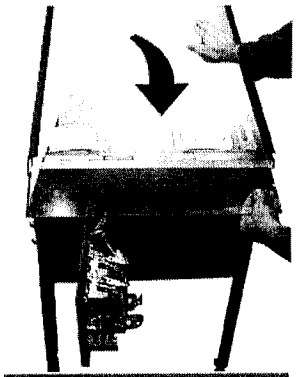
13. Open the Coin Door and pull the **YELLOW HANDLE** to the **LEFT** and at the same time pull up on the **FRONT TOP MOLDING** and remove. The **GLASS** can now be pulled out towards you and removed. ***TAKE CARE*** *while moving; set glass on a safe surface.*

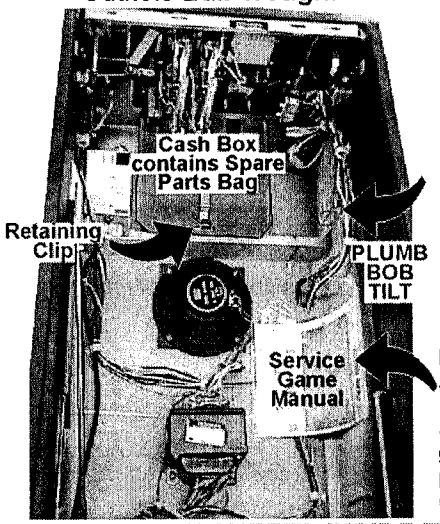


14. Through the open **Coin Door**, remove the **RETAINING RING** at the rear of the **CASH BOX** and open. Remove the **PINBALLS** & the **PLUMB BOB** *from the* **SPARE PARTS BAG.**
(Save the other spare parts in cabinet).
Install the **PINBALLS** by placing them on the playfield so they can roll into the Outhole **Ball Trough**.



15. Install the **PLUMB BOB** on the **Hanger Wire** & tighten the **Thumb Screw**. Loosening the **Thumb Screw** & lowering or raising the **PLUMB BOB** makes the ***Games Tilt Function*** more or less sensitive.





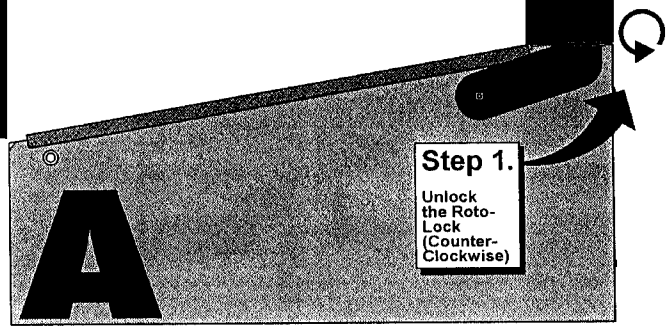
Remove the **PINBALL GAME MANUAL** *(stapled to side of the left wall of the cabinet). Review Section 1, Chapter 1, which describes how to lift the playfield to access the Plumb Bob Tilt Assembly.* The manual gives you all the important information you need to prepare for final set-up and other important information (such as Parts, Diagnostics, Schematics and more...).

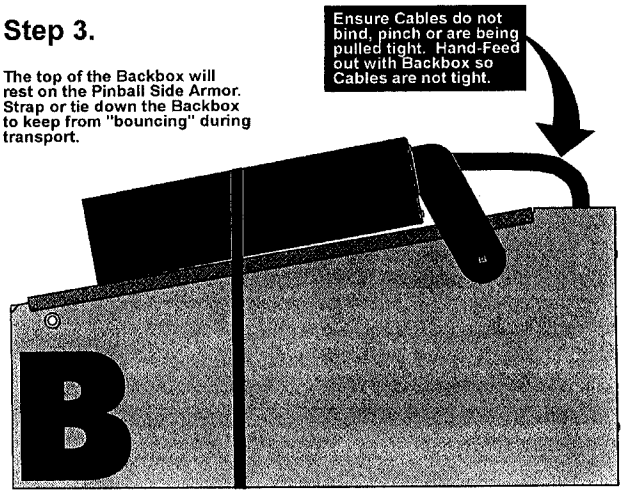
ALWAYS STORE THE MANUAL & INFORMATION SHEETS INSIDE THE CABINET WHEN NOT USING.

Stern™ Pinball, Inc. © 2000.

How to Secure the Backbox for Transporting

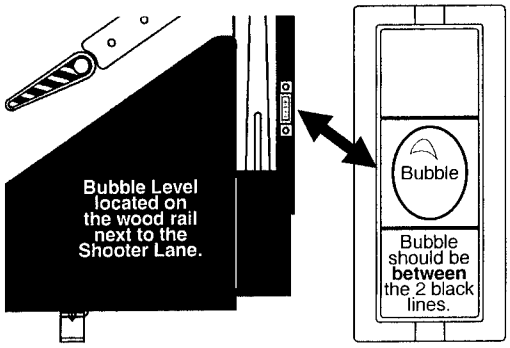
For more Backbox details & part numbers, see Section 4, hapter 1, Backbox Assembly, Pages 50-51.





Leg Leveler Adjustment

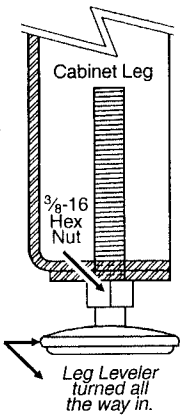
On a LEVEL FLOOR, this cabinet is designed to automatically have a 6.5° pitch without adjusting levelers.



Attach the four (4) Leg Assemblies to cabinet corners with the eight (8) leg bolts provided *(See Sec. 4, Chp. 1, Cabinet - General Parts & Switches, Page 52).*

Start adjustment with the leg levelers *turned all the way in.* **View** the *bubble* in the level provided on the right side wood rail. **Adjust** the front or rear levelers as necessary to cause the bubble to float between the two (2) black lines. **Use** a pinball to roll down the center of the playfield for side-to-side leveling.

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



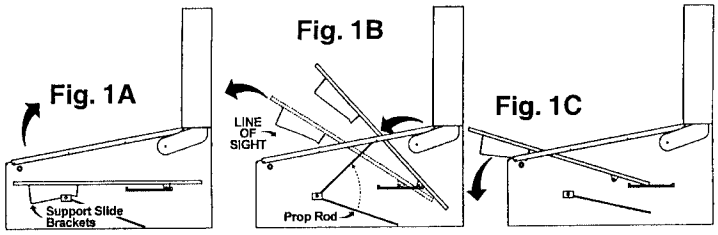
For custom adjustment greater than >6.5° can be acheived by turning out the rear leg leveler(s), however, ***it is not recommended.***

Easy Access Service System - 3 Positions

With the front molding & glass removed, carefully lift the playfield (take care when using the Bottom Arch to hoist).

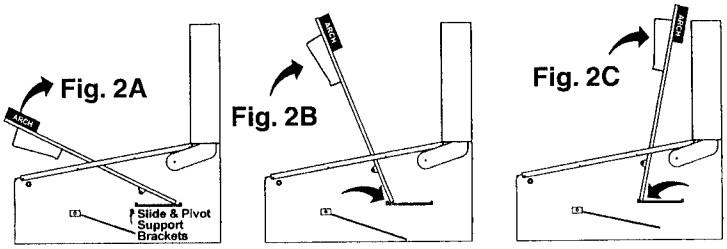
Positions 1 & 2

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).

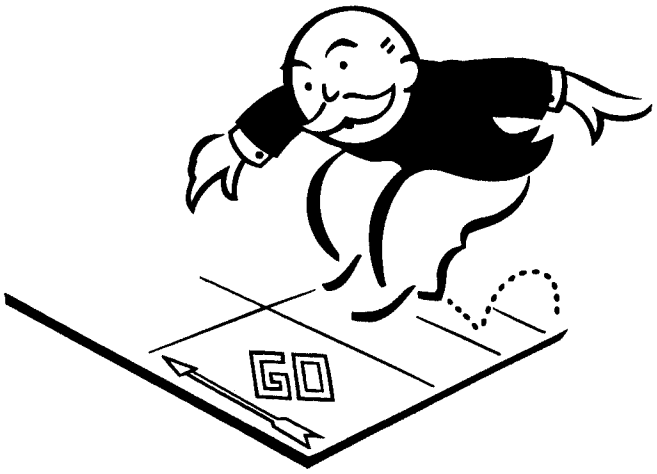
The display now indicates the player or # of players selected from the total depressions of the **Start Button**. The display indicates the ball in play, and a ball is served to the *Shooter Lane*. An introduction is shown followed by Skill Shot Graphics and/or instructions. Pressing the **Start Button** 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.



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 **Adj. 3, Replay Awards** (Default = **CREDIT**). 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, **Adj. 13, Tilt Warnings** (Default = **1**) or 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 = **8%**) 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 nor award anything. Changing this adjustment to **OFF** will **not display** the *"Match Animation"* nor award anything.

Entering Initials/Name

If player achieved a new high score in a game or acheived a special feature (if given) the player may enter 3 Initials. In **Adj. 32, High Score Initials** (Default = **3 Initials**) can also be changed to **10-Letter Name**. Use the **Flipper Buttons** to choose a 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: **Adj. 34, Custom Message** (Default = **ON**) can be displayed during the Attract Mode; enter letters in the same fashion.*

For more details with Adjustments, see Sec. 3, Chp. 4.

Continued Next Page.

Auto Percentaging

This game is equipped with Auto Percentaging, **Adjustment 1, Replays: Fixed/Auto** (Default = **12%**, adjustable). The *Replay Percent* is automatically adjusted or you can set a *Fixed Replay Score*. Four levels may be selected. Adjustments allow awarding of a "CREDIT" (or your setting) as each level is exceeded. This can be adjusted with, **Adj. 3, Replay Award** (Default = **Credit**). 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). You may choose to make a different "score-to-beat" adjustment; this is done by utilizing **Adj. 2, Replay Levels**. *For more details with Adjustments, see Section 3, Chapter 4, Go To Adjustments Menu.*

Instruction Card

Below is a **COPY** of the Game Instruction Card (SPI Nº: 755-5175-00 USA) which is included with every game. 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

MONOPOLY®

For more detailed game rules, visit our website @ www.SternPinball.com and click on the "MONOPOLY®" or "Game Archive" Pop Bumper Link.

FOLD HERE

OBJECT: *Own it all.* Collect as much property as possible.

STERN PINBALL INC. Design by Pat Lawlor Design Inc.

SKILL SHOT: The **WATER WORKS** hole collects Skill Shot.

COLLECT PROPERTY: Shoot for the **ROLL & COLLECT** area when lit. This will move you around the board & collect the property you land on. When you collect any property watch the display for instructions on how to play that mode. **ROLL & COLLECT** IS ***RE-LIT*** on the RIGHT RAMP.

EXTRA BALL: Extra Ball is awarded by getting the **ELECTRIC COMPANY** to a high power **%**. The upper POPS (Bumpers) raise the **ELECTRIC COMPANY'S** power.

BONUS X: Awarded on outer loop shots when lit, or when completing the Ⓐ Ⓑ Ⓖ lanes.

MULTIBALL: Advancing around the board to **GO** lites **LOCK**. **LOCK 2** balls by shooting for the CENTER RAMP. Then start **MULTIBALL** by shooting up the RIGHT RAMP.

CASH GRAB: The LEFT RAMP closes the bank door. Hitting the closed door spells "**B-A-N-K**". This starts **CASH GRAB**. ***IN CASH GRAB, ALL RAMPS AWARD BIG POINTS!***

JACKPOT: While in **MULTIBALL** shoot for the LEFT RAMP or the **ELECTRIC COMPANY**. The TRAIN RAMP ***RE-LITES JACKPOT.***

CHANCE: Shoot for the left **CHANCE ? CARD** scoop when lit for random awards.

HINT: Collect all the property to play **LAND GRAB**!

MONOPOLY®

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

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Portals™ Service Menu Introduction

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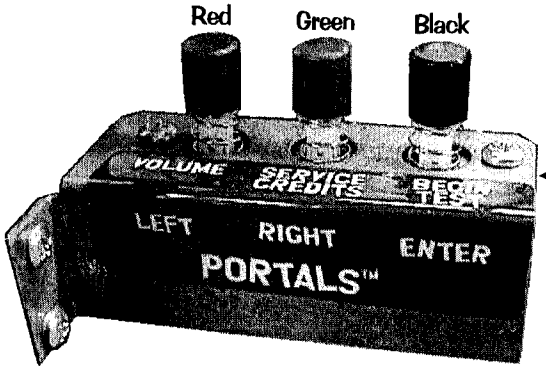
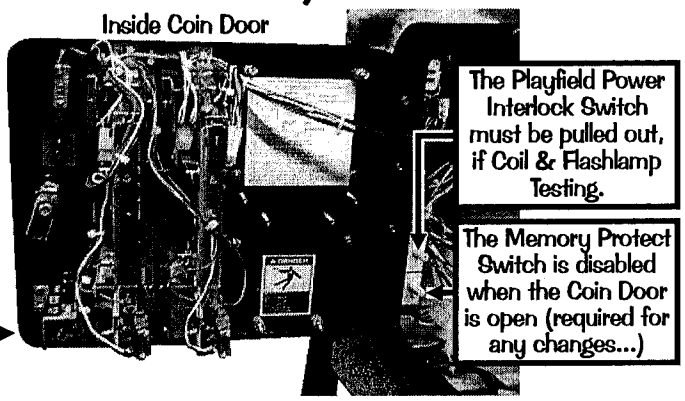
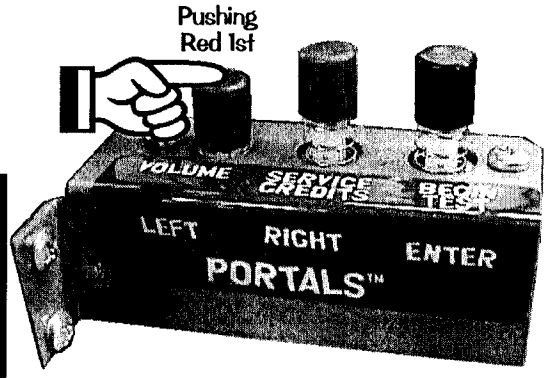
Service Switch Set (Red, Green & Black Buttons) Access & Use

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).*

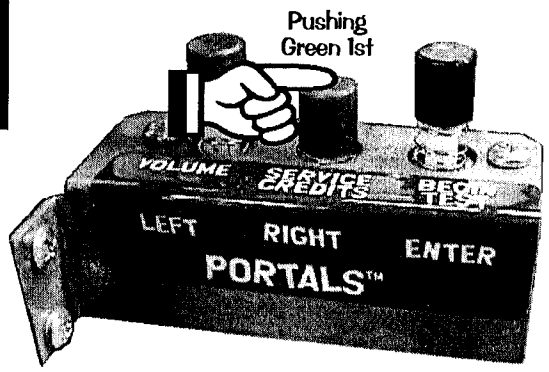


Function 1, Volume Menu

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.*

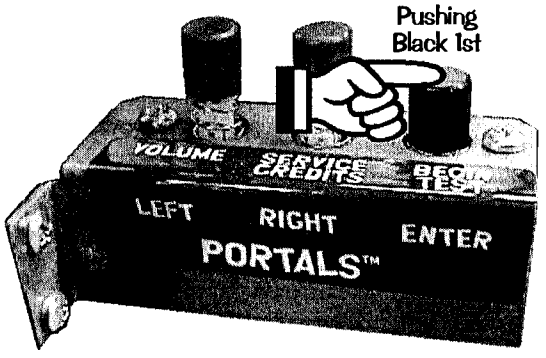
Set between **0** and **31**; **15** is the *Factory Default*. Once your adjustments are made, this menu will ***automatically exit*** a few seconds after the last button depression.



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**, (Default = **30**) determines this, 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.*

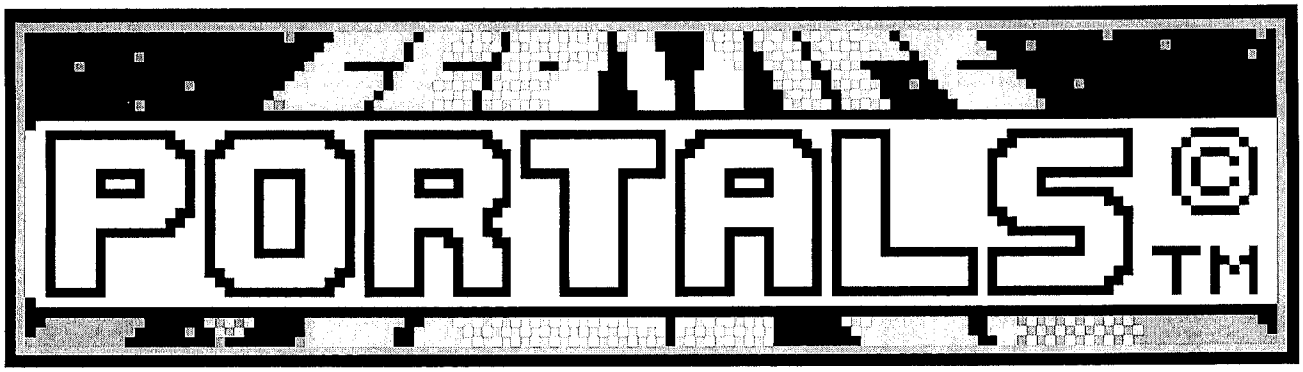
Please read *the remainder of this Chapter for more information on the **Portals™ Service Menu**. The remaining six (6) Chapters of this Section explains all **Icons & Menus** in detail. **Read! Read! Read!***

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

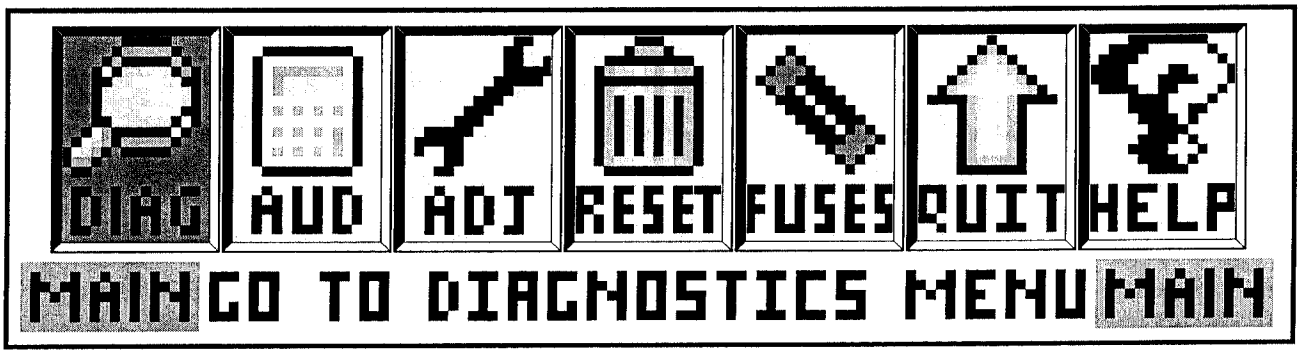
This section will cover all functions available in the **Portals™ Service Menu** in a *Step-By-Step* process. This section is divided into chapters which coincide with the **MAIN MENU**. The following pages in this chapter will instruct the operator on how to move through the menus. It's simple, easy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



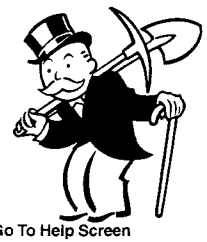
As the operator views the Menu Screen(s), the MORE MORE symbols indicates that there are more *Icons* to select in each direction. The *Icon* selected will blink. Pushing the **Black "ENTER" Button** (or **Start Button**) will select the *Icon* and the Menu Screen will change to the menu selected. Select 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.

Portals™ Service Menu Icon Tree for MONOPOLY Pinball Game





MAIN MENU

- DIAG → GO TO DIAGNOSTICS MENU
- AUD → GO TO AUDITS MENU
- ADJ → GO TO ADJUSTMENTS MENU
- RESET → GO TO RESET MENU
- FUSES → GO TO FUSE TABLE
  - GAME FUSES LISTING
  - Reference current Game Manual, Sec. 3, Chapter 6.
- QUIT → QUIT THIS SESSION
  - Exits back to Attract Mode
- HELP → GO TO HELP SCREEN

Go To Help Screen

HELP SCREEN

See the next page for "**Summary of Common Icons**" or reference Sec. 3, Chapter 7.

Go To Adjustments Menu

ADJUSTMENTS MENU

Reference current Game Manual, Sec. 3, Chapter 4.



- S.P.I. → S.P.I. ADJUSTMENTS
  - 1st Adjustment of Game Generic Group
- MON → MONOPOLY® ADJUSTMENTS
  - 1st Adjustment of Game Specific Group
- ABCD CUST MSG → CUSTOM MESSAGE
  - Direct Access to Adjustment 34, Custom Message
- STAR → FILM STAR RESET
  - REQUEST INSTALLED (Back to Attract Mode)

Go To Reset Menu

RESET MENU

Reference current Game Manual, Sec. 3, Chapter 5.



- COIN → RESET COIN AUDITS
  - REQUEST INSTALLED
- AUD → RESET GAME AUDITS
  - REQUEST INSTALLED
- FACT → FACTORY RESET
  - REQUEST INSTALLED (Back to Attract Mode)

Go To Audits Menu

AUDITS MENU

Reference current Game Manual, Sec. 3, Chapter 3.



- EARN → EARNINGS AUDITS
  - 1st Audit of Game Earnings Group
- S.P.I. → S.P.I. AUDITS
  - 1st Audit of Game Generic Group
- MON → MONOPOLY® AUDITS
  - 1st Audit of Game Specific Group
- PRNT → GO TO PRINTER MENU

Go To Audits Menu

PRINTER SUB-MENU

Reference current Game Manual, Sec. 3, Chapter 3.



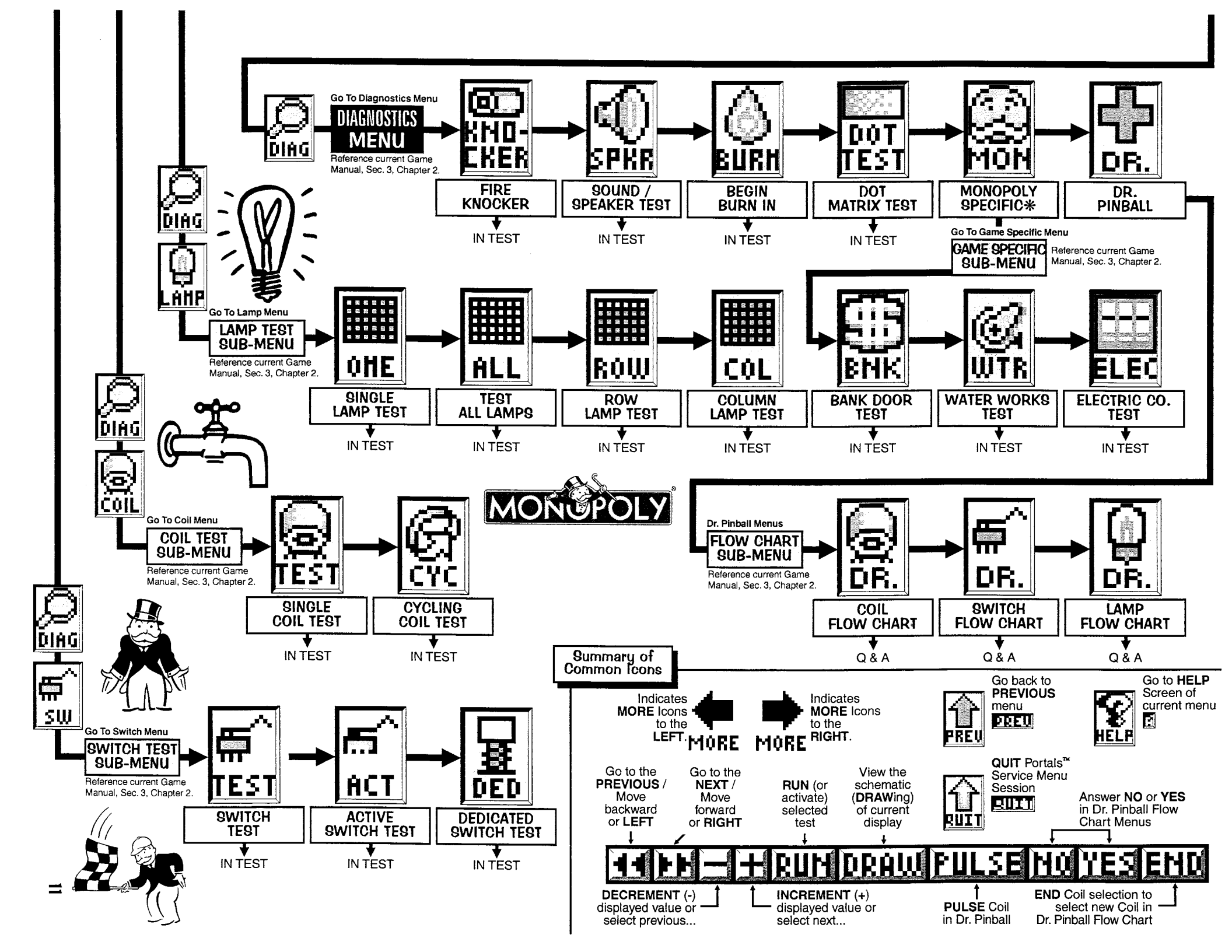
- QUIK → QUICK PRINTOUT
  - Special Equipment is required.
- ALL-SUM → FULL PRINTOUT
  - Special Equipment is required.
- RESET → RESET PRINTER
  - Nº of Copies Printed is reset.

Go To Diagnostics Menu

DIAGNOSTICS MENU

Reference current Game Manual, Sec. 3, Chapter 2.

- SW → GO TO SWITCH MENU
- COIL → GO TO COIL MENU
- LAMP → GO TO LAMP MENU
- FLASH → TEST FLASH LAMPS
  - IN TEST
- CLR → CLEAR BALL TROUGH
  - IN TEST
- TECH → TECHNICIAN ALERTS
  - PLAYFIELD STATUS
- SERV → SERVICE PHONE #
  - **1-800-KICKERS** *or if different country the local # provided*
- PLAY → BEGIN PLAY TEST
  - IN TEST


DIAG
Go To Diagnostics Menu
DIAGNOSTICS MENU
Reference current Game Manual, Sec. 3, Chapter 2.
KNO-CKER
SPKR
BURN
DOT TEST
MON
DR.
FIRE KNOCKER
SOUND / SPEAKER TEST
BEGIN BURN IN
DOT MATRIX TEST
MONOPOLY SPECIFIC*
DR. PINBALL
IN TEST
Go To Game Specific Menu
GAME SPECIFIC SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
LAMP
Go To Lamp Menu
LAMP TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
ONE
ALL
ROW
COL
BNK
WTR
ELEC
SINGLE LAMP TEST
TEST ALL LAMPS
ROW LAMP TEST
COLUMN LAMP TEST
BANK DOOR TEST
WATER WORKS TEST
ELECTRIC CO. TEST
COIL
Go To Coil Menu
COIL TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
TEST
CYC
SINGLE COIL TEST
CYCLING COIL TEST
MONOPOLY
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
SW
Go To Switch Menu
SWITCH TEST SUB-MENU
Reference current Game Manual, Sec. 3, Chapter 2.
TEST
ACT
DED
SWITCH TEST
ACTIVE SWITCH TEST
DEDICATED SWITCH TEST
IN TEST
Summary of Common Icons
Indicates MORE Icons to the LEFT.
MORE
Indicates MORE Icons to the RIGHT.
MORE
Go back to PREVIOUS menu
PREV
Go to HELP Screen of current menu
HELP
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
QUIT
Answer NO or YES in Dr. Pinball Flow Chart Menus
RUN
DRAW
PULSE
NO
YES
END
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.***



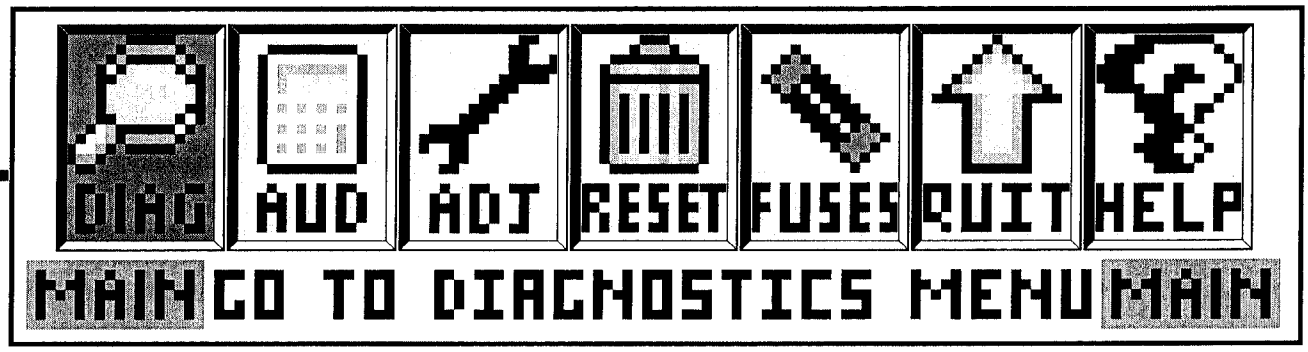


Selecting & activating the "QUIT" *Icon* from any display will exit the *Service Session.*

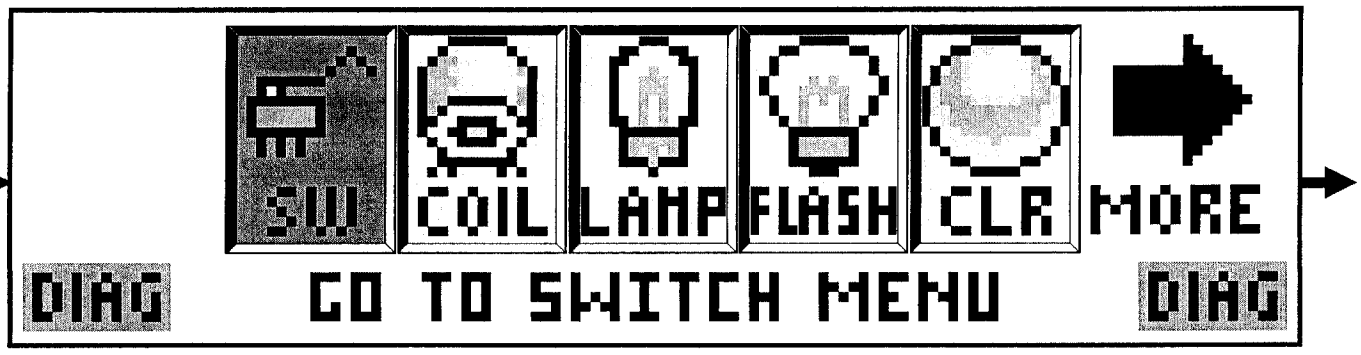


Selecting & activating the "HELP" *Icon* will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)

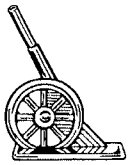
Example: From the **MAIN MENU**, use the **Red "LEFT"** or **Green "RIGHT" Buttons** to select the "DIAG" *Icon* (**GO TO DIAGNOSTICS MENU**).



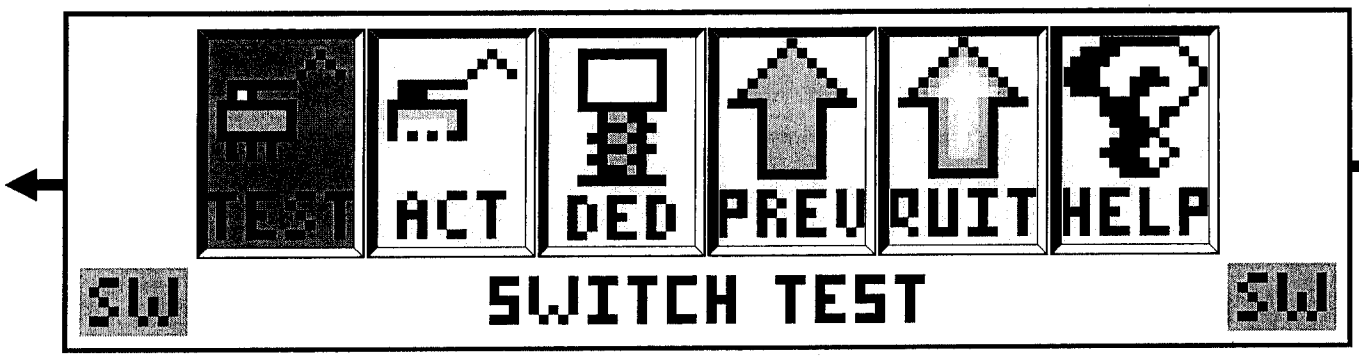
Press the **Black "ENTER" Button** to activate this **ICON**. This will bring up the **DIAGNOSTICS MENU**.



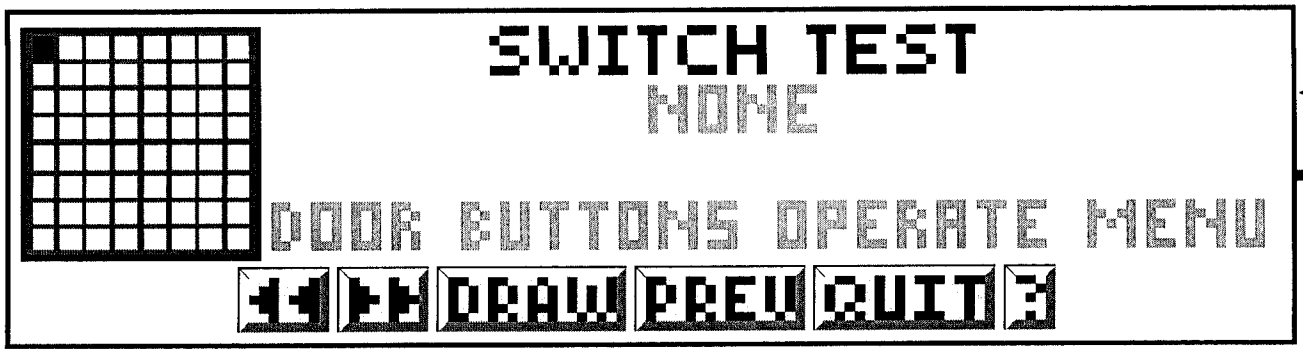
The **DIAGNOSTICS MENU** now appears with the "SW" *Icon* (**GO TO SWITCH MENU**) flashing. Press the **Black Button** to *activate* this icon. This will bring up the **SWITCH TEST MENU**.



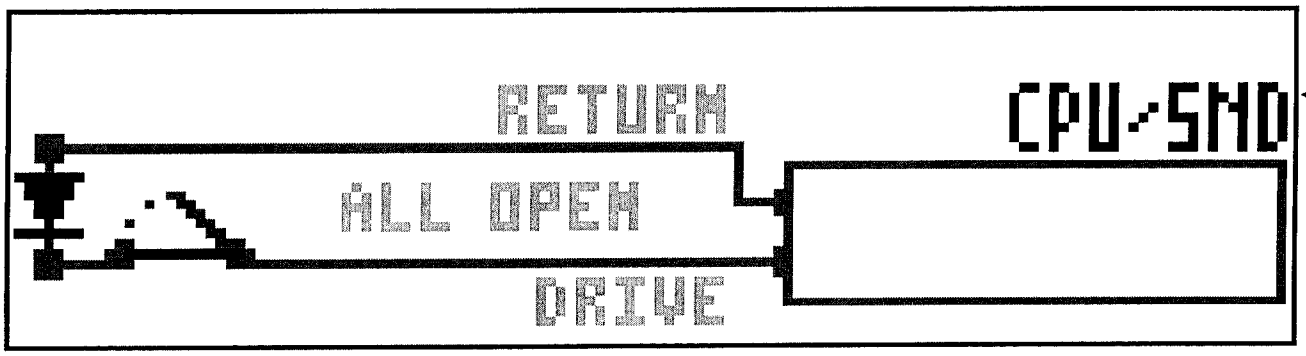
The **SWITCH TEST MENU** now appears with the "TEST" *Icon* (**SWITCH TEST**) flashing:
Press the **Black "ENTER" Button** to *activate* this icon. This will bring up the **Switch Test Display**.



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 either the **Red** or **Green Button** to select the "DRAW" *Mini-Icon*. Press the **Black Button** to *activate* this *Mini-Icon*; do so while the switch is momentarily closed. This will bring up the **Switch Schematic Display**. 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, and the "Pin-Outs" from the CPU/Sound Board. Activating the "DRAW" *Icon* when a switch is not closed, will give the generic switch schematic as shown below.



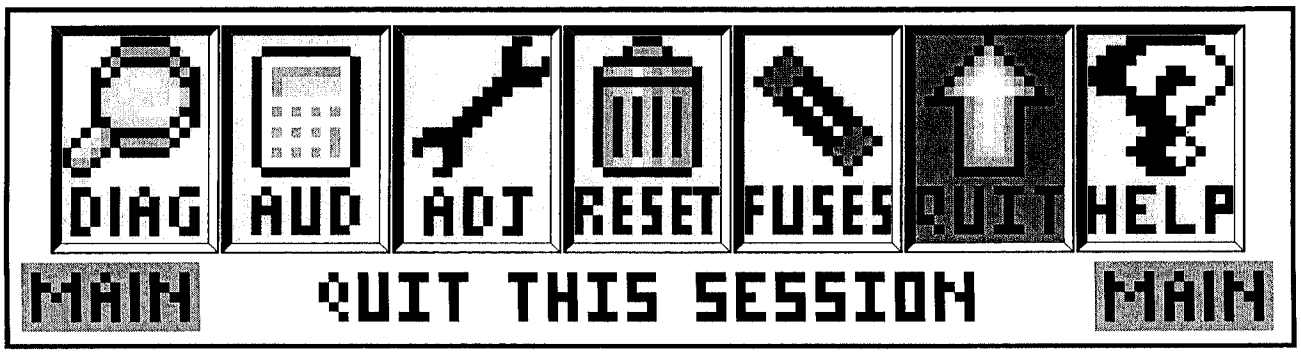
While in Switch or Active Switch Tests, the **Flipper & Start Buttons** are deactivated. Use the **Red "LEFT," Green "RIGHT"** and/or **Black "ENTER" Buttons** to select and activate the **"MINI-ICONS"** at the bottom of the display. In Switch Test, if the "Left Arrow" or "Right Arrow" *Mini-Icon* is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

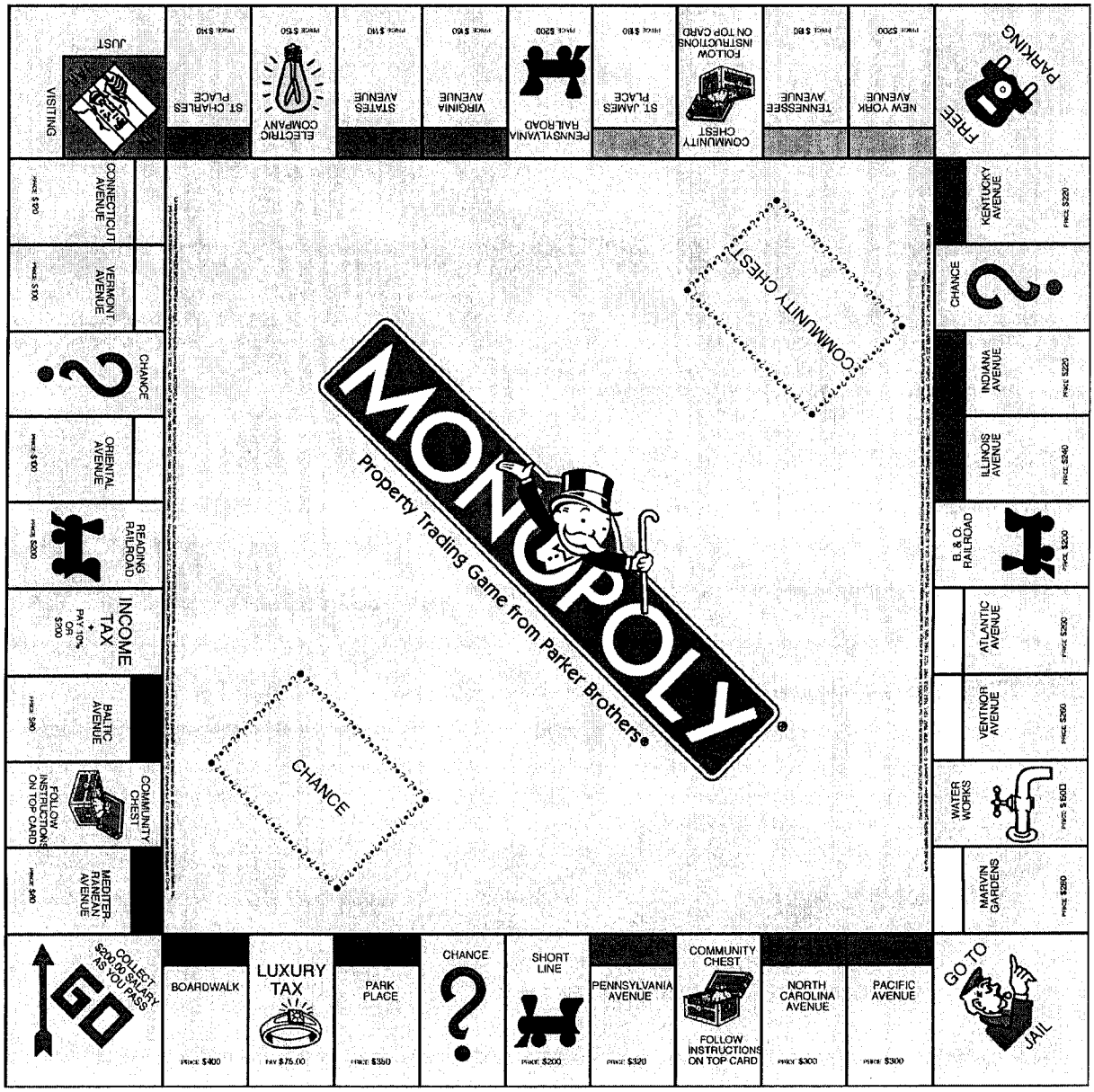
Exit out of the sub-menu by activating the big "PREV" *Mini-Icon* in the menu. This will bring up the **DIAGNOSTICS MENU**. The Switch Test Session is now complete. See the next page about exiting the **Portals™ Service Menu**.

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.



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(s)***.) 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*** & ***Monopoly Tests*** 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 and the "Pin-Outs" from the CPU/SOUND Board. When the switch is closed, the information if displayed momentarily. To view the schematic for the switch selected, press either the **Red** or **Green Button** to select the "DRAW" *Mini-Icon*. Press the **Black Button** to activate this *Mini-Icon*; do so while the switch is momentarily closed. To return to Switch Test, press the **Black Button** again.

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.

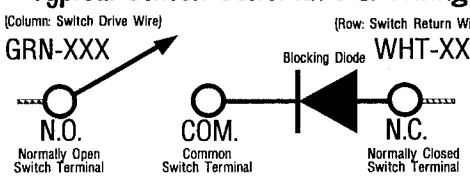
SWITCH MATRIX GRID & DEDICATED SWITCHES

Diode On Terminal Strip:

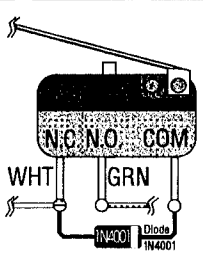
Row (Return) \ Column (Drive)	1: Q1 GRN-BRN CN5-P1	2: Q2 GRN-RED CN5-P3	3: Q3 GRN-ORG CN5-P4	4: Q4 GRN-YEL CN5-P5	5: Q5 GRN-BLK CN5-P6	6: Q6 GRN-BLU CN5-P7	7: Q7 GRN-VIO CN5-P8	8: Q8 GRN-GRY CN5-P9
1: U400 WHT-BRN CN7-P9	LEFT BUTTON (UK ONLY) On Cabinet side 1	CHANCE SCOOP On Assembly 9	LEFT TOP LANE (A) Under Playfield 17	RIGHT ORBIT 1 (L) Under Playfield 25	BANK OPTO 1 (L) On Assembly 33	LOWER BOTTOM POP On Assembly 41	UPPER LEFT POP On Assembly 49	LEFT OUTLANE Under Playfield 57
2: U400 WHT-RED CN7-P8	4TH COIN SLOT On Coin Door 2	RAILROAD RAMP Above Playfield 10	MIDDLE TOP LANE (B) Under Playfield 18	ELECTRIC COMPANY On Assembly 26	BANK OPTO 2 On Assembly 34	LOWER RIGHT POP On Assembly 42	UPPER RIGHT POP 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 On Assembly 11	RIGHT TOP LANE (C) Under Playfield 19	DICE EJECT LANE Under Playfield 27	BANK OPTO 3 On Assembly 35	LOWER LEFT POP On Assembly 43	UPPER BOTTOM POP 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	LOCKUP 1 (TOP) Under Playfield 20	LEFT ORBIT Under Playfield 28	BANK OPTO 4 (R) On Assembly 36	100K STANDUP Under Playfield 44	DICE EJECT On Assembly 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	LOCKUP 2 Under Playfield 21	WATERWORKS EJECT On Assembly 29	NOT USED 37	SPINNER On Assembly 45	NOT USED 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	LOCKUP 3 (BOTTOM) Under Playfield 22	WWORKS MINI FLIPPER On Assembly 30	COP DROP TARGET 38	COP STANDUP X2 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	NOT USED 23	CENTER RAMP On Ramp Asm. 31	LEFT RAMP MID On Ramp Asm. 39	FREE PARKING Above Playfield 47	SLAM TILT On Coin Door 55	NOT USED 63
8: U401 WHT-GRY CN7-P1	RIGHT BUTTON (UK ONLY) On Cabinet side 8	SHOOTER LANE Under Playfield 16	NOT USED 24	NOT USED 32	NOT USED 40	RIGHT RAMP On Ramp Asm. 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 D9-1
2: U206 GRY-RED CN6-P3	#2 LEFT FLIPPER E.O.S (End-of-Stroke) on Flipper Assy. D9-2
3: U206 GRY-ORG CN6-P4	#3 RIGHT FLIPPER BUTTON In Cabinet side D9-3
4: U206 GRY-YEL CN6-P6	#4 RIGHT FLIPPER E.O.S. (End-of-Stroke) on Flipper Assy. D9-4
5: U206 GRY-GRN CN6-P7	#5 UPPER FLIPPER BUTTON *(Double-Stacked with DS-3)* In Cabinet side D9-5
6: U206 GRY-BLU CN6-P8	#6 VOLUME (RED BUTTON) (In Test: LEFT) on Coin Door D9-6
7: U206 GRY-VIO CN6-P9	#7 SERV. CRED. (GREEN BUTTON) (In Test: RIGHT) on Coin Door D9-7
8: U206 GRY-BLK CN6-P10	#8 BEGIN TEST (BLACK BUTTON) (In Test: ENTER) on Coin Door D9-8

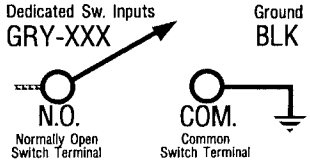
Typical Switch Schematic & Wiring



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



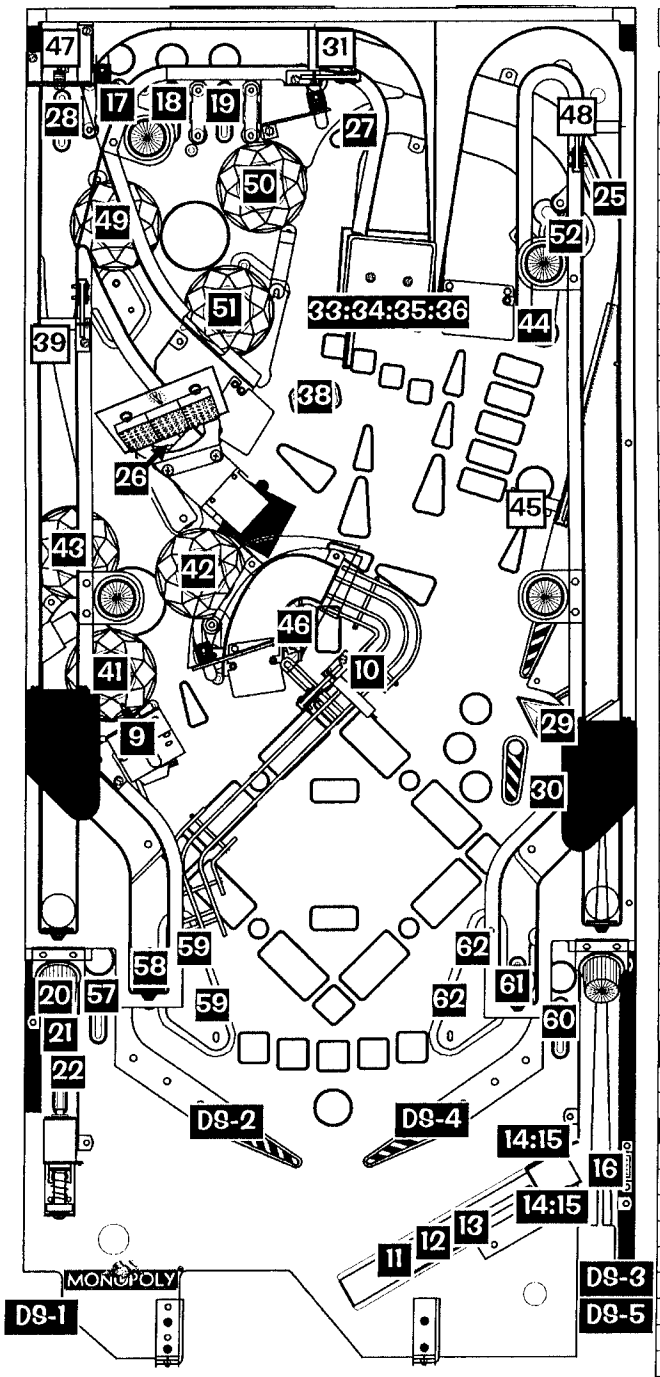
Dedicated Switch Schem.





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. 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	5, 7	LEFT BUTTON (UK ONLY)	180-5160-00
2	1	2	5	4TH COIN SLOT	180-5024-00
3	1	3	5, 6	*6TH COIN SLOT*	*(Future Use)*
4	1	4	5	RIGHT COIN SLOT	180-5024-00
5	1	5	5	CENTER COIN SLOT / DBA	
6	1	6	5	LEFT COIN SLOT	
7	1	7	5, 6	*5TH COIN SLOT*	*(Future Use)*
8	1	8	5, 7	RIGHT BUTTON (UK ONLY)	180-5160-00
9	2	1		CHANCE SCOOP	180-5183-00
10	2	2		RAILROAD RAMP Sw. on Gate	180-5087-00
11	2	3		4-BALL TROUGH #1	180-5119-02
12	2	4		4-BALL TROUGH #2	
13	2	5		4-BALL TROUGH #3	
14	2	6	1	4-BALL TROUGH VUK OPTO BOT TRANS: 515-5073-00 BOT REC: 515-5074-00	
15	2	7	1	4-BALL STACKING OPTO TOP TRANS: 515-5073-00 TOP REC: 515-5074-00	
16	2	8		SHOOTER LANE	180-5157-00
17	3	1	2, 3	LEFT TOP LANE (A) Switch w/ Rt. Brkt.	500-6227-02
18	3	2	2, 3	MIDDLE TOP LANE (B) Sw. w/ Rt. Brkt.	
19	3	3	2, 3	RIGHT TOP LANE (C) Sw. w/ Rt. Brkt.	
20	3	4		LOCKUP 1 (TOP) Sw. on Brkt. w/ 21 & 22	180-5178-00
21	3	5		LOCKUP 2 Switch on Brkt. with 20 & 22	180-5179-00
22	3	6		LOCKUP 3 (BOT) Sw. on Brkt. w/ 20 & 21	180-5180-00
23	3	7		NOT USED	
24	3	8		NOT USED	
25	4	1	2, 3	RIGHT ORBIT Switch w/ Rt. Brkt.	500-6227-02
26	4	2		ELECTRIC COMPANY	180-5186-00
27	4	3	2, 3	DICE EJECT LANE Switch w/ Rt. Brkt.	500-6227-02
28	4	4	2, 3	LEFT ORBIT Switch w/ Lt. Brkt.	500-6227-01
29	4	5		WATERWORKS EJECT	180-5187-00
30	4	6		WWORKS MINI FLIPPER	180-5119-00
31	4	7		CENTER RAMP Sw. on Gate	180-5087-00
32	4	8		NOT USED	
33	5	1		BANK OPTO 1 (L)	*Transmitter Bd* 520-5218-00 *Receiver Bd.* 520-5210-00
34	5	2		BANK OPTO 2	
35	5	3		BANK OPTO 3	
36	5	4		BANK OPTO 4 (R)	
37	5	5		NOT USED	
38	5	6	DOTS	COP DROP TARGET	180-5158-00
39	5	7		LEFT RAMP MID Sw. on Gate	180-5087-00
40	5	8		NOT USED	
41	6	1		LOWER BOTTOM POP	180-5015-03
42	6	2		LOWER RIGHT POP	
43	6	3		LOWER LEFT POP	
44	6	4	2	100K STANDUP	515-5162-06
45	6	5		SPINNER	180-5010-04
46	6	6	2	COP STANDUP X2	515-5162-06
47	6	7	2	FREE PARKING (STANDUP)	515-5967-06
48	6	8		RIGHT RAMP Sw. on Gate	180-5087-00
49	7	4		UPPER LEFT POP	180-5015-03
50	7	2		UPPER RIGHT POP	
51	7	3		UPPER BOTTOM POP	
52	7	4		DICE EJECT	180-5186-00
53	7	5		NOT USED	
54	7	6	4, 5	START BUTTON	180-5174-00
55	7	7	5	SLAM TILT On Coin Door	180-5022-00
56	7	8	5	PLUMB BOB TILT HANGER 535-5319-00 CONTACT 535-7563-01	
57	8	1	2, 3	LEFT OUTLANE Switch w/ Lt. Brkt.	500-6227-01
58	8	2	2, 3	LEFT RETURN LANE Switch w/ Rt. Brkt.	500-6227-02
59	8	3	2	LEFT SLINGSHOT Leaf Sw. X2	180-5054-00
60	8	4	2, 3	RIGHT OUTLANE Switch w/ Lt. Brkt.	500-6227-01
61	8	5	2, 3	RIGHT RETURN LANE Sw. w/ Lt. Brkt.	
62	8	6	2	RIGHT SLINGSHOT Leaf Sw. X2	180-5054-00
63	8	7		NOT USED	
64	8	8		NOT USED	

Legend Note:

□ = Switches mounted above playfield.

■ = Switches mounted below playfield.

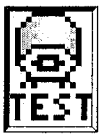
DS: *Dedicated Switches descriptions on previous page.*
DOTS: **D**iode **O**n **T**erminal **S**trip *or* **DODB**: **D**iode **O**n **D**iode **B**oard.

Note 1: Sw. 14 / Sw. 15 have both REC/TRANS on same board.
Note 2: For a detailed switch description, see Playfield - General Parts & Switches, Pages 54-55.
Note 3: Switch sold only with Bracket.
Note 4: Switch Only; for entire Button Assembly, see Cabinet - General Parts & Switches, Pages 52-53.
Note 5: Switch located in/on Cabinet.
Note 6: Future Use.
Note 7: UK Only.



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 Positions are Optional UK Only)*. 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**.

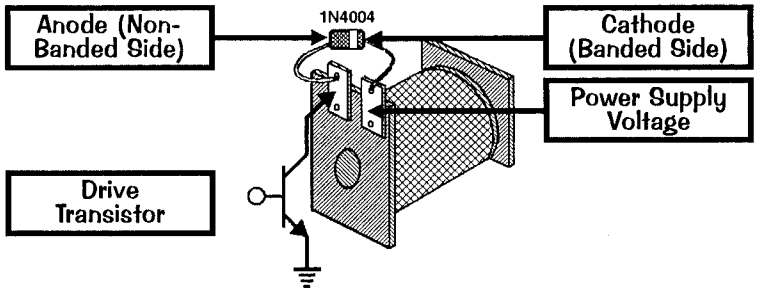
Coil & Flash Lamp Descriptions

#	Type	Coil / Flash Lamp Descriptions
1	Coil	TROUGH UP-KICKER (VUK) (26-1200)
2	Coil	AUTO LAUNCH (23-700)
3	Coil	LOWER LEFT POP (26-1200)
4	Coil	LOWER RIGHT POP (26-1200)
5	Coil	LOWER BOTTOM POP (26-1200)
6	Coil	BANK CLOSE (23-1100)
7	Coil	DROP TARGET RESET (24-940)
8	Coil	LOCK KICKER (23-800)
9	Coil	UPPER LEFT POP (26-1200)
10	Coil	UPPER RIGHT POP (26-1200)
11	Coil	UPPER BOTTOM POP (26-1200)
12	Coil	CHANCE SCOOP (23-800)
13	Coil	BANK OPEN (23-1100)
14	Coil	UPPER FLIPPER [50V RED/YEL] (23-1500)
15	Coil	LEFT FLIPPER [50V RED/YEL] (22-1080)
16	Coil	RIGHT FLIPPER [50V RED/YEL] (22-1080)

#	Type	Coil / Flash Lamp Descriptions
17	Coil	LEFT SLINGSHOT (23-800)
18	Coil	RIGHT SLINGSHOT (23-800)
19	Flash	FLASH RGT RAMP TOP (#906 Bulb)
20	Flash	FLASH RGT RAMP MID (X2) (#89/#906 Bulb)
21	Flash	FLASH LEFT RAMP TOP (X2) (#89/#906 Bulb)
22	Flash	FLASH LEFT RAMP MID (X2) (#89/#906 Bulb)
23	Flash	FLASH LEFT RAMP BOT (#906 Bulb)
24	Coil	(OPTIONAL COIN METER)
25	Coil	WATERWORKS MOTOR (EX00159A)
26	Coil	ELECTRIC COMPANY (23-800)
27	Coil	MOTOR RELAY (DC RELAY BD)
28	Coil	DICE EJECT (26-1200)
29	Flash	FLASH RGT RAMP BOT (#906 Bulb)
30	Coil	LEFT RAMP DIVERTER (32-1800)
31	Coil	RIGHT RAMP DIVERTER (32-1800)
32	Coil	TOP LANE UP/DN POST (26-1200)

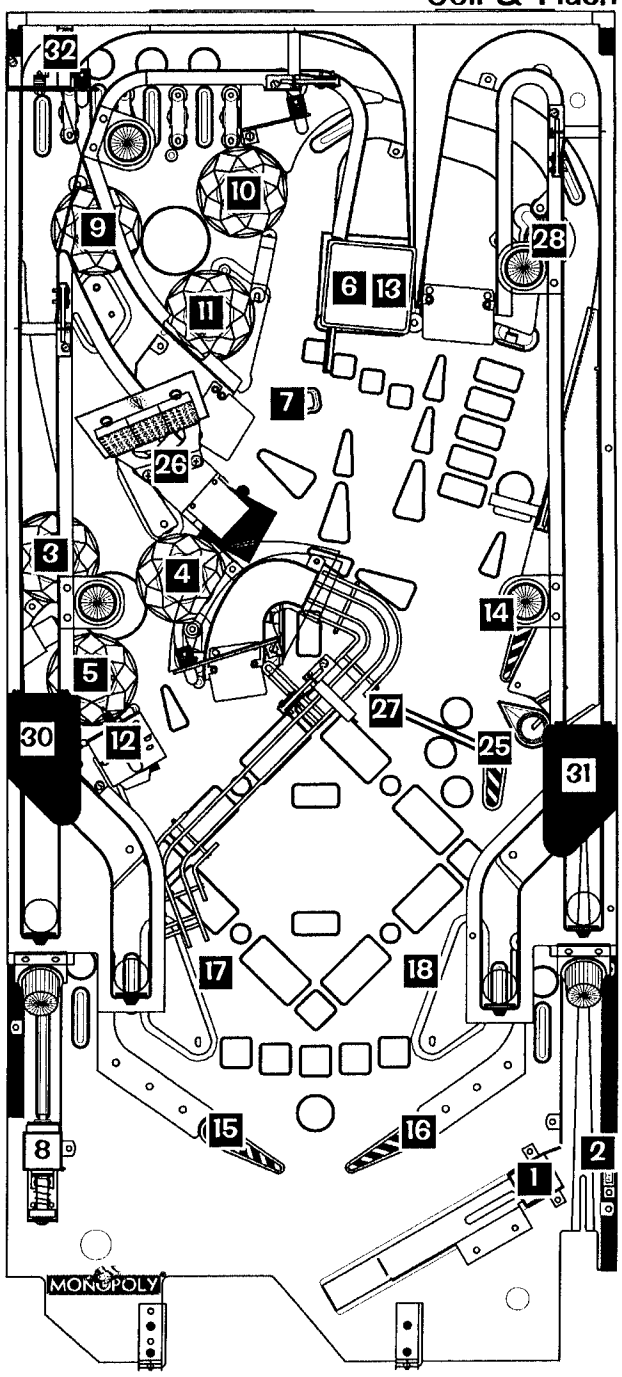
See the next three (3) pages for the **Coil & Flash Lamp Location Maps** (corresponds to above tables), **Coils Detailed Chart Table** & the **Backbox I/O Power Driver Board Detailed Wiring Diagram**.

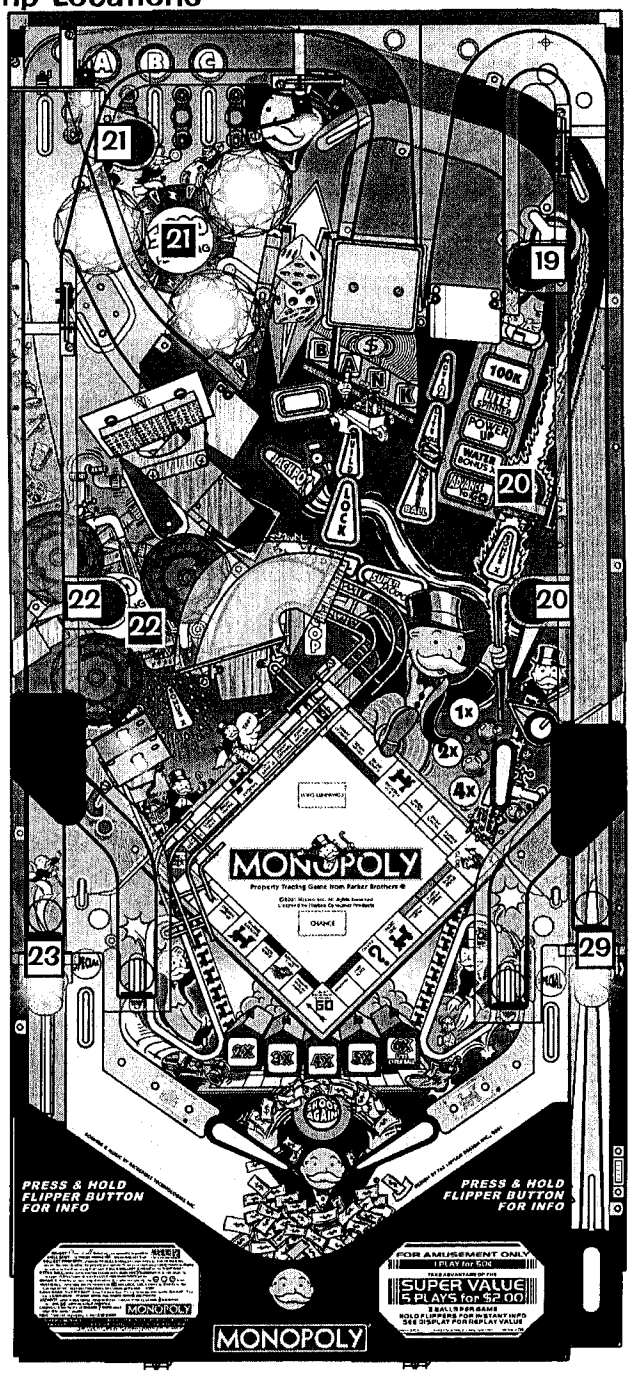
Typical Coil Wiring



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:

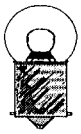
☐ = Coils and Flash Lamps mounted above playfield.

■ = Coils and Flash Lamps mounted below playfield.

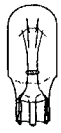
The following Coil is optional:

24

The following Bulb Types are used for Flash Lamps:



#89 Bulb
(Bayonet)
165-5000-89



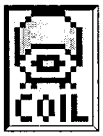
#906 Bulb
(Wedge Base)
165-5004-00

The following Coils are for **UK Only**:

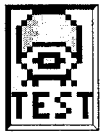
Aux. 1 Aux. 2 Aux. 3



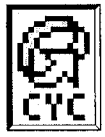
From the Main Menu in Portals™ GO TO DIAGNOSTICS MENU →



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 Part #
#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	23-700 090-5022-00T
#3	LOWER LEFT POP	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#4	LOWER RIGHT POP	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#5	LOWER BOTTOM POP	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#6	BANK CLOSE	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#7	DROP TARGET RESET	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#8	LOCK KICKER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00B

	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) Part #
#9	UPPER LEFT POP	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	UPPER RIGHT POP	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	UPPER BOTTOM POP	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	CHANCE SCOOP	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00B
#13	BANK OPEN	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1500 090-5062-00
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T

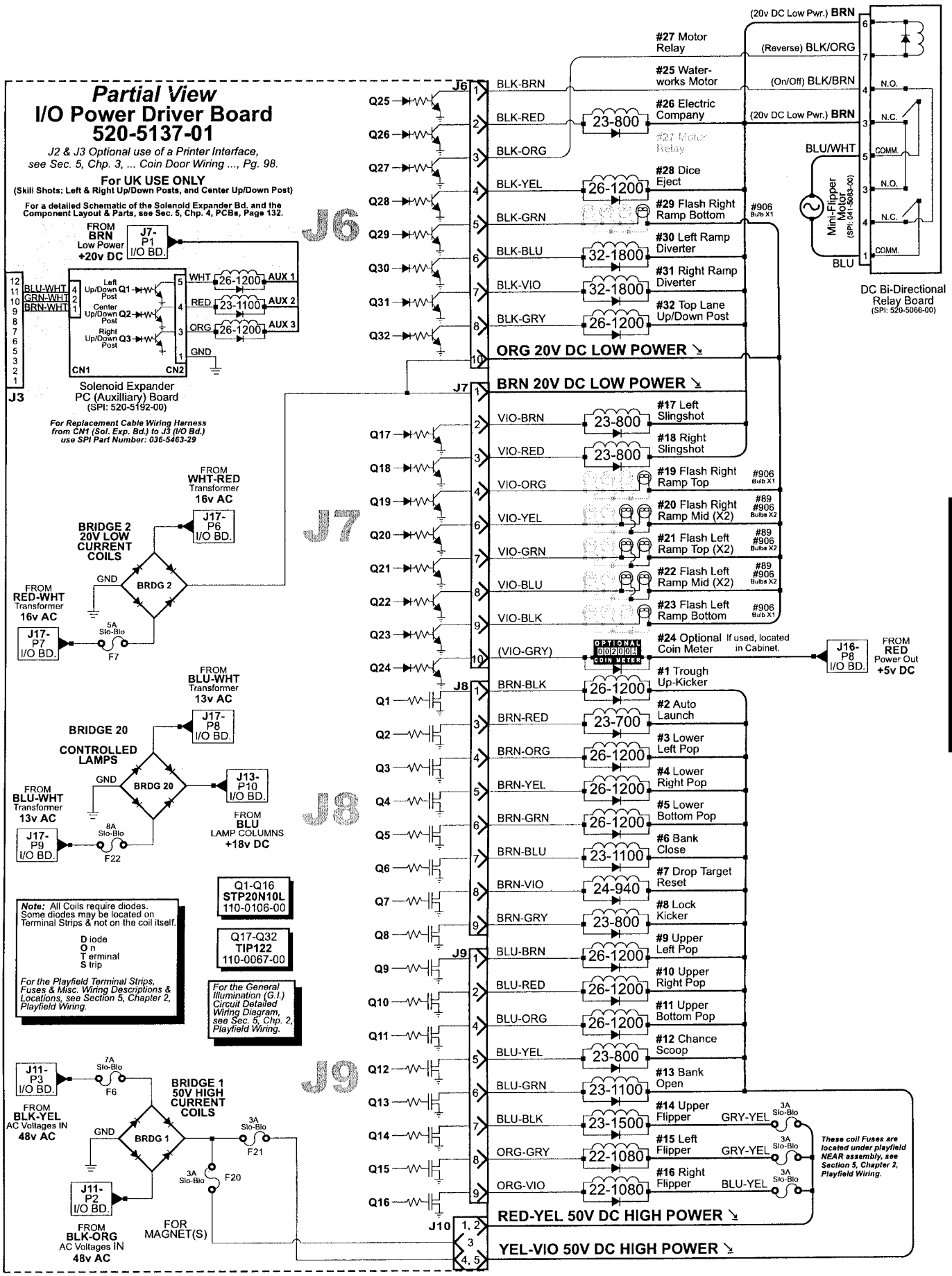
	Low Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil, Bulb or Meter Part #
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	FLASH RGT RAMP TOP	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#20	FLASH RGT RAMP MID (X2)	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#906 Bulb are ABOVE
#21	FLASH LEFT RAMP TOP (X2)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#22	FLASH LEFT RAMP MID (X2)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	ORG	J6-P10	20v DC	#89 Bulb are BELOW
#23	FLASH LEFT RAMP BOT	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

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

	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) or Bulb Part #
#25	WATERWORKS MOTOR	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	BRN	J7-P1	20v DC	EX00159A 041-5083-00
#26	ELECTRIC COMPANY	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#27	MOTOR RELAY	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	BRN	J7-P1	20v DC	DC Relay 520-5066-00
#28	DICE EJECT	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#29	FLASH RGT RAMP BOT	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#30	LEFT RAMP DIVERTER	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	BRN	J7-P1	20v DC	32-1800 090-5031-00
#31	RIGHT RAMP DIVERTER	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	BRN	J7-P1	20v DC	32-1800 090-5031-00
#32	TOP LANE UP/DN POST	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	BRN	J7-P1	20v DC	26-1200 090-5044-00T

Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game:)

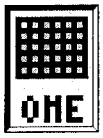
	Auxilliary (UK ONLY)	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil (GA-Turn) Part #
	AUX 1: LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	J3-P11	BRN	J7-P1	20v DC	26-1200 090-5044-00T
	AUX 2: CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	J3-P10	BRN	J7-P1	20v DC	23-1100 090-5030-00T
	AUX 3: RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	J3-P9	BRN	J7-P1	20v DC	26-1200 090-5044-00T


Partial View
I/O Power Driver Board
520-5137-01
J2 & J3 Optional use of a Printer Interface, see Sec. 5, Chp. 3, ... Coin Door Wiring ..., Pg. 98.
For UK USE ONLY
(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 132.
J6
J7
J8
J9
J10
J3
Solenoid Expander PC (Auxilliary) Board (SPI: 520-5192-00)
For Replacement Cable Wiring Harness from CN1 (Sol. Exp. Bd.) to J3 (I/O Bd.) use SPI Part Number: 036-5463-29
FROM BRN Low Power +20v DC
J7-P1 I/O BD.
BLU-WHT
GRN-WHT
BRN-WHT
Left Up/Down Post Q1
Center Up/Down Post Q2
Right Up/Down Post Q3
WHT 26-1200 AUX 1
RED 23-1100 AUX 2
ORG 26-1200 AUX 3
GND
CN1
CN2
FROM WHT-RED Transformer 16v AC
J17-P6 I/O BD.
BRIDGE 2 20V LOW CURRENT COILS
BRDG 2
GND
FROM RED-WHT Transformer 16v AC
J17-P7 I/O BD.
5A Slo-Blo
F7
FROM BLU-WHT Transformer 13v AC
J17-P8 I/O BD.
BRIDGE 20 CONTROLLED LAMPS
BRDG 20
GND
J13-P10 I/O BD.
FROM BLU-WHT Transformer 13v AC
J17-P9 I/O BD.
8A Slo-Blo
F22
FROM BLU LAMP COLUMNS +18v DC
Note: All Coils require diodes. Some diodes may be located on Terminal Strips & not on the coil itself.
Diode On Terminal Strip
For the Playfield Terminal Strips, Fuses & Misc. Wiring Descriptions & Locations, see Section 5, Chapter 2, Playfield Wiring.
Q1-Q16 STP20N10L 110-0106-00
Q17-Q32 TIP122 110-0067-00
For the General Illumination (G.I.) Circuit Detailed Wiring Diagram, see Sec. 5, Chp. 2, Playfield Wiring.
J11-P3 I/O BD.
7A Slo-Blo
F6
FROM BLK-YEL AC Voltages IN 48v AC
BRIDGE 1 50V HIGH CURRENT COILS
BRDG 1
GND
3A Slo-Blo
F21
3A Slo-Blo
F20
J11-P2 I/O BD.
FROM BLK-ORG AC Voltages IN 48v AC
FOR MAGNET(S)
BLK-BRN
BLK-RED
BLK-ORG
BLK-YEL
BLK-GRN
BLK-BLU
BLK-VIO
BLK-GRY
ORG 20V DC LOW POWER
BRN 20V DC LOW POWER
VIO-BRN
VIO-RED
VIO-ORG
VIO-YEL
VIO-GRN
VIO-BLU
VIO-BLK
(VIO-GRY)
BRN-BLK
BRN-RED
BRN-ORG
BRN-YEL
BRN-GRN
BRN-BLU
BRN-VIO
BRN-GRY
BLU-BRN
BLU-RED
BLU-ORG
BLU-YEL
BLU-GRN
BLU-BLK
ORG-GRY
ORG-VIO
RED-YEL 50V DC HIGH POWER
YEL-VIO 50V DC HIGH POWER
#27 Motor Relay
#25 Water-works Motor
#26 Electric Company
#28 Dice Eject
#29 Flash Right Ramp Bottom
#30 Left Ramp Diverter
#31 Right Ramp Diverter
#32 Top Lane Up/Down Post
#17 Left Slingshot
#18 Right Slingshot
#19 Flash Right Ramp Top
#20 Flash Right Ramp Mid (X2)
#21 Flash Left Ramp Top (X2)
#22 Flash Left Ramp Mid (X2)
#23 Flash Left Ramp Bottom
#24 Optional Coin Meter
If used, located in Cabinet.
#1 Trough Up-Kicker
#2 Auto Launch
#3 Lower Left Pop
#4 Lower Right Pop
#5 Lower Bottom Pop
#6 Bank Close
#7 Drop Target Reset
#8 Lock Kicker
#9 Upper Left Pop
#10 Upper Right Pop
#11 Upper Bottom Pop
#12 Chance Scoop
#13 Bank Open
#14 Upper Flipper
#15 Left Flipper
#16 Right Flipper
23-800
26-1200
32-1800
23-1100
24-940
23-700
23-1500
22-1080
#906 Bulb X1
#89 #906 Bulbs X2
(20v DC Low Pwr.) BRN
(Reverse) BLK/ORG
(On/Off) BLK/BRN
(20v DC Low Pwr.) BRN
BLU/WHT
BLU
Mini-Flipper Motor (SPI: 541-5083-00)
N.O.
N.C.
COMM.
DC Bi-Directional Relay Board (SPI: 520-5066-00)
FROM RED Power Out +5v DC
J16-P8 I/O BD.
GRY-YEL
BLU-YEL
These coil Fuses are located under playfield NEAR assembly, see Section 5, Chapter 2, Playfield Wiring.



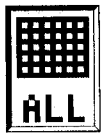
Go To Lamp Menu

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.



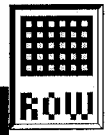
Single Lamp Test

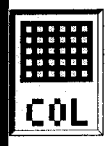
To initiate, from the **LAMP MENU**, select the "ONE" *Icon* with either **Red** or **Green Button** and press the **Black Button**. Select either the "-" or "+" *Icons*. Start with the "+" *Icon* to start the manual Lamp Test from Column 1, Row 1, Switch 1. Press the **Black Button** on the "+" *Icon*, 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	LEFT OUTLANE #555 Bulb 1	BONUS 2X #555 Bulb 2	BONUS 3X #555 Bulb 3	BONUS 4X #555 Bulb 4	BONUS 5X #555 Bulb 5	BONUS 6X #555 Bulb 6	SHOOT AGAIN #555 Bulb 7	RIGHT OUTLANE #555 Bulb 8
2: Q34 RED-BLK J12-P2	GO #555 Bulb 9	MEDITER-RANEAN #555 Bulb 10	COMM CHEST #555 Bulb 11	BALTIC #555 Bulb 12	READING RR #555 Bulb 13	ORIENTAL #555 Bulb 14	VERMONT #555 Bulb 15	CONNECTI-CUT #555 Bulb 16
3: Q35 RED-ORG J12-P3	IN JAIL #555 Bulb 17	ST CHARLES #555 Bulb 18	STATES #555 Bulb 19	VIRGINIA #555 Bulb 20	PENN RR #555 Bulb 21	ST JAMES #555 Bulb 22	TENNESSEE #555 Bulb 23	NEW YORK #555 Bulb 24
4: Q36 RED-YEL J12-P4	FREE PARKING #555 Bulb 25	KENTUCKY #555 Bulb 26	INDIANA #555 Bulb 27	ILLINOIS #555 Bulb 28	B.O. RR #555 Bulb 29	ATLANTIC #555 Bulb 30	VENTNOR #555 Bulb 31	MARVIN GARDENS #555 Bulb 32
5: Q37 RED-GRN J12-P5	GO TO JAIL #555 Bulb 33	PACIFIC #555 Bulb 34	NORTH CAROLINA #555 Bulb 35	PENNSYL-VANIA #555 Bulb 36	SHORT LINE RR #555 Bulb 37	CHANCE #555 Bulb 38	PARK PLACE #555 Bulb 39	BOARDWALK #555 Bulb 40
6: Q38 RED-BLU J12-P6	LOWER BOTTOM POP #555 Bulb 41	LOWER LEFT POP #555 Bulb 42	RELIGHT JACKPOT #555 Bulb 43	RAILROAD LIT #555 Bulb 44	L BONUS X #555 Bulb 45	LOWER RIGHT POP #555 Bulb 46	COMM CHEST LIT #555 Bulb 47	FREE PARKING #555 Bulb 48
7: Q39 RED-VIO J12-P8	CHANCE LIT #555 Bulb 49	3000 WHEN FLASHING #555 Bulb 50	ROLL #555 Bulb 51	SUPER JACKPOT #555 Bulb 52	WATERWORKS 1X #555 Bulb 53	WATERWORKS 2X #555 Bulb 54	WATERWORKS 4X #555 Bulb 55	R BONUS X #555 Bulb 56
8: Q40 RED-GRY J12-P9	LEFT TOP LANE (A) #555 Bulb 57	MIDDLE TOP LANE (B) #555 Bulb 58	RIGHT TOP LANE (C) #555 Bulb 59	UPPER LEFT POP #555 Bulb 60	UPPER RIGHT POP #555 Bulb 61	UPPER BOTTOM POP #555 Bulb 62	ROLL AND COLLECT #555 Bulb 63	EXTRA BALL #555 Bulb 64
9: Q41 RED-WHT J12-P10	BA(N)K #555 Bulb 65	BAN(K) #555 Bulb 66	LOCK #555 Bulb 67	COP #555 Bulb 68	BUILD #555 Bulb 69	JACKPOT #555 Bulb 70	(B)ANK #555 Bulb 71	B(A)NK #555 Bulb 72
10: Q42 RED J12-P11	MOVE 2 #555 Bulb 73	LITE ROLL #555 Bulb 74	MULTIBALL #555 Bulb 75	100,000 #555 Bulb 76	LITE SPINNER #555 Bulb 77	POWER UP #555 Bulb 78	WATER BONUS X #555 Bulb 79	ADVANCE TO GO #555 Bulb 80



Lamp Matrix Grid Locations

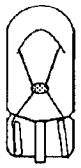
The lamp locations correspond with the Lamp Nº in the Lamp Matrix Grid on the previous page.

Legend Note:

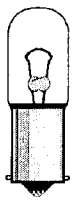
□ = Lamps mounted above playfield.

■ = Lamps mounted below playfield.

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

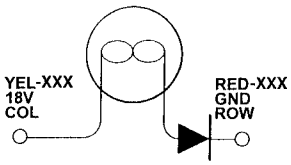


#555 Bulb (Wedge)
165-5002-00

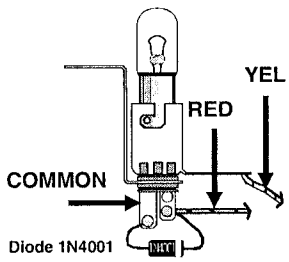


#44 Bulb (Bayonet)
165-5000-44

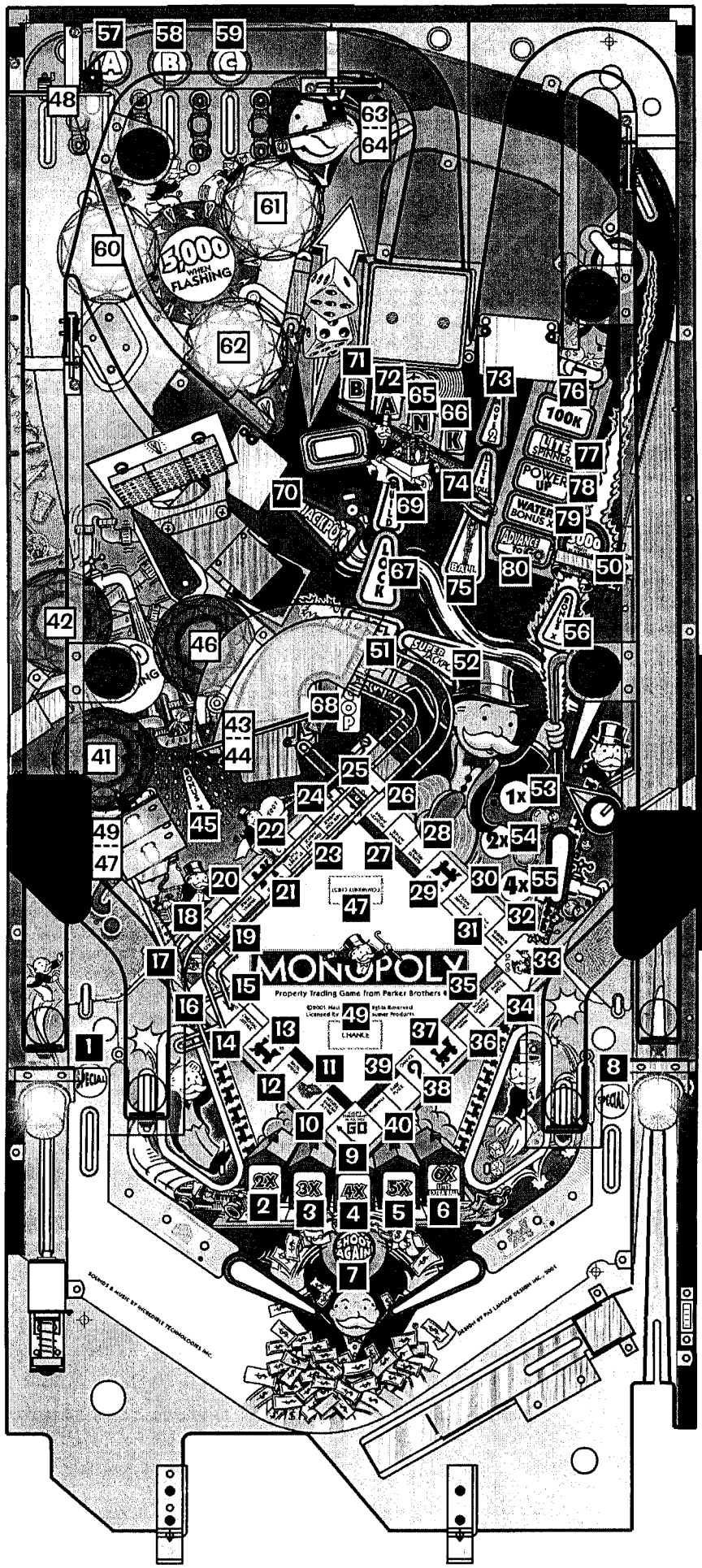
Typical Lamp Schematic



Typical Lamp Wiring



Note:
All Lamps require diodes. Some diodes are located on Terminal Strips (under the playfield) and not on the lamp itself. DOTS: Diode On Terminal Strip





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): **Q19-23** & **Q29**.

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 Alerts

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 *(In USA code the number is 1-800-KICKERS).*



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) 4 (U37)	Speech Pattern 1-3+

Note: For ROM Locations, see Page* DR. ❶. *For ROM Usage (Summary Table) see Page* DR. ❸ *in the "Find-It-In-Front: Dr. Pinball Section". Voice ROMs (U17, U21, U36 & U37) 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:

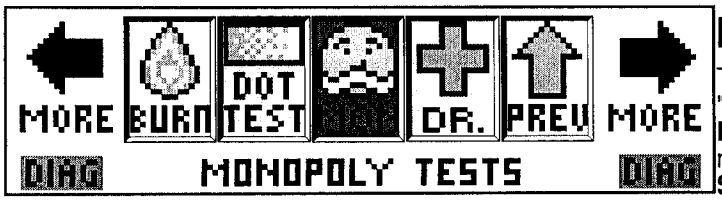
1. Illuminates 1 vertical column of dots, turning it off & illuminating the next column, until each column has been individually lit, while the other columns are off.
2. Illuminates 1 horizontal row of dots, turning it off & illuminating the next row, until each row has been individually lit, while the 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.

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.



Monopoly Tests

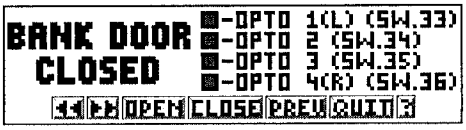
To initiate, from the **DIAGNOSTICS MENU**, select the "MON" *Icon* with either the **Red "LT"** or **Green "RT" Button** (the **FLIPPER Buttons** operates in the same manner) & press the **Black "ENTER" Button** (the **START Button** operates in the same manner).

This will bring up the **MONOPOLY TESTS MENU**. This Sub-Menu is used to test the operation of the **Bank Door (Open & Close) Coils & OPTO Switches** ("BNK" *Icon*), **Water Works Mini-Flipper & Water Works Motor Home Switch** ("WTR" *Icon*) & **Electric Company Sign Dot Test** ("ELEC" *Icon*). To initiate, from the **MONOPOLY TESTS MENU**, select one of the 3 *Icons* 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). After finishing the Test, select the "PREV" *Icon* to return to the Sub-Menu or select either of the ">>" *Icons* to slip between the 3 Testing Menus.

CAUTION: Beware of MOVING PARTS!

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

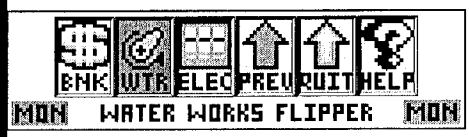




Bank Door Test



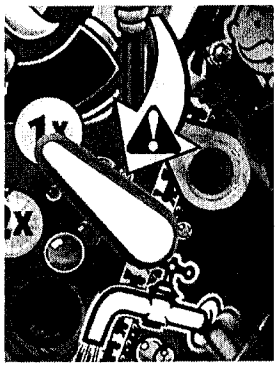
Selecting the"BNK" *Icon* will bring up the **BANK DOOR TEST MENU**. This test is provided to allow a method of testing the **Bank Close (Q6)**, **Bank Open (Q13)**, and the **Bank OPTO Switches (Sw. 33-36)**. Upon entering the test, the display will indicate the status of the Bank Door (the "CLOSE" *Mini-Icon* will be flashing). Select the "OPEN" *Mini-Icon* to ***OPEN*** the Bank Door (**Q13** will be energized), the display will indicate **BANK DOOR OPEN**; select the "CLOSE" *Mini-Icon* to ***CLOSE*** the Bank Door (**Q6** will be energized), the display will indicate **BANK DOOR CLOSED**. With *ball-in-hand*, roll a pinball into the Bank Door and watch the display. As the pinball breaks the OPTO beam at any of the 4 positions, the the solid ■ box will turn □.



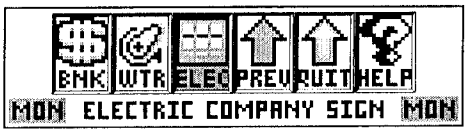


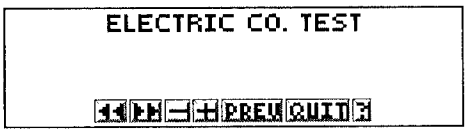


Water Works Flipper

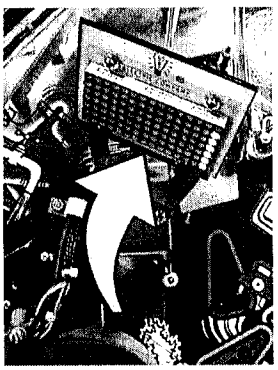


Selecting the"WTR" *Icon* will bring up the **WATER WORKS FLIPPER TEST MENU**. This test is provided to allow a method of testing the **Water Works Motor (Q25)** in conjunction with the **Motor Relay Board (Q27)** and the **Water Works Motor Home Switch (Sw. 40)**. Upon entering the test, the display will indicate the status of the Relay Board (either **OFF/Counterclockwise** or **ON/Clockwise**) and the **Motor Home Switch** (the "RUN" *Mini-Icon* will be flashing). Select the "REVERSE" *Mini-Icon* to change the direction of the Mini-Flipper (clockwise or counterclockwise); then select either the "RUN" or "PULSE" *Mini-Icons*. Activating the "RUN" *Mini-Icon* will cycle the motor continuously until another *Mini-Icon* is selected or the test is exited. Activating the "PULSE" *Mini-Icon* will pulse the motor about 270°. Watch the display, as the Mini-Flipper is rotating the **Home Switch (Sw. 40)** will be closed (the □ box will turn solid ■) once every complete rotation.





Electric Company Sign



Selecting the"ELEC" *Icon* will bring up the **ELECTRIC COMPANY SIGN TEST MENU**. This test is provided to allow a method of testing the triple 5X7 Dot Display on the **Electric Company Sign**. Upon entering the test, the display will indicate the status of the *Dot Display* which should be "off" or "blank" (the "+" *Mini-Icon* will be flashing). Select either the "-" or "+" *Mini-Icons* to step through all **six tests** *(as shown below)*. As each menu appears, the corresponding test is demonstrated on the **Electric Company Sign Dot Display**.

1. 

2. 

3. 

4. 

5. 

6. 

NOTE:
For more details of the PC Boards which are tested on this page, see Sec. 5, Chp. 4, Pages 130-133, Printed Circuit Boards (PCBs).

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

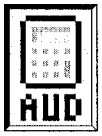
To initiate, from the **DR. PINBALL MENU**, select the Coil "DR." *Icon* with either the **Red** or **Green Button** and press the **Black Button**. This is the Coil Flow Chart. Follow the questions, answering by using the *Mini-Icons* in the display.

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.



MONOPOLY

Pinball Game Audit Table

What's the current Replay Score Level?

CPU version: ____.____

DISPLAY ver.: ____.____

LOCATION: _____

DATE: ____/____/____

AUDITOR: _____

Copy for Field Audit Tracking Performance *(Use blank boxes to fill-in Audit Information).*



01 thru 12

Total Paid Credits	Average Ball Time	Coins Thru Left Slot	Coins Thru Center Slot	Total Coins	Meter Clicks
01:	03:	05:	07:	09:	11:
Free Game Percentage	**Average Game Time**	**Coins Thru Right Slot**	**Coins Thru 4th Slot**	**Total Earnings**	**Software Meter**
02:	04:	06:	08:	10:	12:



13 thru 55

Total Replays	Total Free Plays	15M+ Scores	Center Drains	Proprietary (46)	Right Flipper Used
18:	25:	32:	39:		53:
Replay Percent	**Total Plays**	**Average Scores**	**Right Drains**	**Proprietary (47)**	**Proprietary (54)**
19:	26:	33:	40:		
Total Balls Played	**Total Specials**	**0 - 999K Scores**	**Service Credits**	**Slam Tilts**	**Proprietary (48)**	**Proprietary (55)**
13:	20:	27:	34:	41:		
Total Extra Balls	**Special Percent**	**1M - 1.9M Scores**	**Ball Search Started**	**Total Balls Saved**	**Proprietary (49)**
14:	21:	28:	35:	42:	
Extra Ball Percent	**Total Matches**	**2M - 4.9M Scores**	**Lost Ball Feeds**	**Proprietary (43)**	**Proprietary (50)**
15:	22:	29:	36:		
Replay 1 Awards	**High Score Awards**	**5M - 9.9M Scores**	**Lost Ball Game Starts**	**Proprietary (44)**	**Proprietary (51)**
16:	23:	30:	37:		
Replay 2+ Awards	**High Score Percent**	**10M - 14.9M Scores**	**Left Drains**	**Proprietary (45)**	**Left Flipper Used**
17:	24:	31:	38:		52:



56 thru 110

Cash Grab Award	Bonus X	Inlanes Completed	Card - WW Mult	Card - Bonus	Yellow - Overload
63:	72:	81:	90:	99:	108:
Waterworks Arrive	**Dice Rolls**	**Land Grab Start**	**Card - Bonus X**	**Card - Pay Each**	**Green - Millions**
64:	73:	82:	91:	100:	109:
Multiball Qualify	**Electric Co Power**	**Left Ramp**	**Land Grab Houses**	**Card - Upper Pops**	**Card - Quick MB**	**Dk Blu - EB/Special**
56:	65:	74:	83:	92:	101:	110:
Multiball Start	**MB Rematch Offer**	**Right Ramp**	**Card - Light Lock**	**Card - Lower Pops**	**Card - Cash Grab**
57:	66:	75:	84:	93:	102:
Quick MB Starts	**MB Rematch Given**	**Side Ramp**	**Card - EB Lit**	**Card - All Pops**	**Purple - Pops**
58:	67:	76:	85:	94:	103:
2+ MBall Starts	**Chance/Chest Cards**	**Free Parking**	**Card - Adv RR**	**Card - Adv Bank**	**Lt Blu - Token Race**
59:	68:	77:	86:	95:	104:
Jackpots	**Bank Hits**	**Left Orbit**	**Card - Special Lit**	**Card - Roll Lit**	**Magenta - Free Money**
60:	69:	78:	87:	96:	105:
Super Jackpots	**Banks Completed**	**Right Orbit**	**Card - Property**	**Card - MB Lit**	**Orange - Tax Refund**
61:	70:	79:	88:	97:	106:
Cash Grab Start	**Right Standups**	**Railroad Ramps**	**Card - Points**	**Card - 3 Spaces**	**Red - Board Chase**
62:	71:	80:	89:	98:	107:

Don't forget to fill-in the current Replay Score Level in the Box at the top of this page and current versions...

Comments:

Go To Audits Menu

Overview

The **Portals™Service Menu System** provides 110 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 •**MONOPOLY®Audits**, are the Game Play Specific Audits 56-110 (**//// Programming Use Only ////**); 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 - 999K SCORES	Provides the total number of games the Player's final score was between 0 and 999,990 points.
Au. 28	1M - 1.9M SCORES	Provides the total number of games the Player's final score was between 1,000,000 and 1,999,990 points.
Au. 29	2M - 4.9M SCORES	Provides the total number of games the Player's final score was between 2,000,000 and 4,999,990 points.
Au. 30	5M - 9.9M SCORES	Provides the total number of games the Player's final score was between 5,000,000 and 9,999,990 points.
Au. 31	10M - 14.9M SCORES	Provides the total number of games the Player's final score was between 10,000,000 and 14,999,990 points.
Au. 32	15M+ SCORES	Provides the total number of games the Player's final score was over 15,000,000 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).

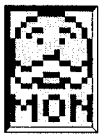


Monopoly Audits (56-110)

Programming Use Only

From the **AUDITS MENU**, select the "MON" *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. These Game Specific Audits are primarily used for programming. They provide the total number of times a feature was started, awarded, lit, played and/or completed. They also may indicate the total number of Switch Closures during certain modes or features. Multiple variations of switch closures (see Diagnostics) are used to determine the lighting and/or completion of the feature stated.

Au. Nº	Audit Name	Au. Nº	Audit Name
Au. 56	Multiball Qualify	Au. 77	Free Parking
Au. 57	Multiball Start	Au. 78	Left Orbit
Au. 58	Quick MB Starts	Au. 79	Right Orbit
Au. 59	2+ MBall Starts	Au. 80	Railroad Ramps
Au. 60	Jackpots	Au. 81	Inlanes Completed
Au. 61	Super Jackpots	Au. 82	Land Grab Start
Au. 62	Cash Grab Start	Au. 83	Land Grab Houses
Au. 63	Cash Grab Award	Au. 84	Card - Light Lock
Au. 64	Waterworks Arrive	Au. 85	Card - EB Lit
Au. 65	Electric Co Power	Au. 86	Card - Adv RR
Au. 66	MB Rematch Offer	Au. 87	Card - Special Lit
Au. 67	MB Rematch Given	Au. 88	Card - Property
Au. 68	Chance/Chest Cards	Au. 89	Card - Points
Au. 69	Bank Hits	Au. 90	Card - WW Mult
Au. 70	Banks Completed	Au. 91	Card - Bonus X
Au. 71	Right Standups	Au. 92	Card - Upper Pops
Au. 72	Bonus X	Au. 93	Card - Lower Pops
Au. 73	Dice Rolls	Au. 94	Card - All Pops
Au. 74	Left Ramp	Au. 95	Card - Adv Bank
Au. 75	Right Ramp	Au. 96	Card - Roll Lit
Au. 76	Side Ramp	Au. 97	Card - MB Lit



MONOPOLY® Audits Continued. ///Programming Use Only///

Audit Name	Au. Nº	Audit Name
Au. 98 Card - 3 Spaces	Au. 105	Magenta - Free Money
Au. 99 Card - Bonus	Au. 106	Orange - Tax Refund
Au. 100 Card - Pay Each	Au. 107	Red - Board Chase
Au. 101 Card - Quick MB	Au. 108	Yellow - Overload
Au. 102 Card - Cash Grab	Au. 109	Green - Millions
Au. 103 Purple - Pops	Au. 110	Dk Blu - EB/Special
Au. 104 Lt Blu - Token Race		





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 & a Lap Top PC is required. All game audits (Earnings, S.P.I. & Game Specific) can be retrieved.



Reset Printer (Nº 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 "Nº 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).

MONOPOLY

Pinball Game Adjustment Table

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 ‡	...12%...*		23	DEFAULT HIGH SCORE #3	22,000,000	
2	REPLAY LEVELS ‡	1 ...		24	DEFAULT HIGH SCORE #4	20,500,000	
3	REPLAY AWARD	CREDIT		25	DEFAULT HIGH SCORE #5	18,000,000	
4	FREE GAME LIMIT	05		26	DEFAULT HIGH SCORE #6	16,500,000	
5	EXTRA BALL LIMIT	03		27	DEFAULT HIGH SCORE #7	12,000,000	
6	GAME DIFFICULTY ‡	MODERATE		28	DEFAULT HIGH SCORE #8	10,500,000	
7	GAME PRICING ‡	USA5		29	DEFAULT HIGH SCORE #9	8,000,000	
8	RESET COIN AUDITS	NO		30	DEFAULT HIGH SCORE #10	6,500,000	
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	8%*		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	LOW	
16	ALLOW HIGH SCORES	YES		38	GAME RESTART	YES	
17	HIGH SCORE #1 AWARDS	01		39	EXTRA BALL PERCENTAGE	20%*	
18	HIGH SCORE #2 AWARDS	01		40	BILL VALIDATOR	NO	
19	HIGH SCORE #3 AWARDS	01		41	TOURNAMENT MODE	NONE	
20	HIGH SCORE #4 AWARDS	00		42	UK COIN MECH. TYPE	CURRENT:	
21	DEFAULT HIGH SCORE #1	30,000,000		43	BKGRND MUSIC VOLUME	01	
22	DEFAULT HIGH SCORE #2	26,000,000		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.

*Adj. 42 & 48 are utilized only for the UK, with UK Dip Switch Option Setting 2 (See **DR. ❸**, in the front part of this manual.)*

* - ***may change.***

MONOPOLY® Adjustments 46-63

	Adjustment Name	USA Default	Your Setting		Adjustment Name	USA Default	Your Setting
46	EXTRA BALL MEMORY	NO		55	ELECTRIC CO DIFF	MODERATE	
47	SPECIAL MEMORY	YES		56	B-A-N-K LETTERS	01	
48	UK POST SAVE ENABLED	NO		57	CHASE BALL	YES	
49	FREEZE TIME	OFF		58	POP HITS TO MOVE TOKEN	05	
50	BANK DIFFICULTY	MODERATE		59	ADV BANK AT NEW BALL	YES	
51	REMATCH DIFFICULTY	MODERATE		60	RIGHT STANDUP SPOTS	03	
52	BONUS X DIFFICULTY	MODERATE		61	CHANCE VUK STRENGTH	MODERATE	
53	DISABLE BANK	NO		62	START AT 1500 PTS	YES	
54	TIMED PLUNGER	OFF		63	ELEC. EB AT %	30	

Go To Adjustments Menu

Overview

The **Portals™ Service Menu System** provides **63** 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**) • **MONOPOLY® Adjustments**, are the Game Play Specific Adjustments (**46-63**); 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 **12%**. 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. Adjustments which typically automatically get changed when changing this adjustment are Game Specific with adjustments values of **EXTRA EASY**, **EASY**, **MODERATE**, **HARD**, **EXTRA HARD**, **ON** or **OFF**. After changing this adjustment, make note of it in the Table on Page 34 (in pencil), and check all Game Specific adjustments, noting all changes in the "Your Setting" Column. *Performing a Factory Reset will revert all adjustments back to the defaults.*

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 **USA5** *(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

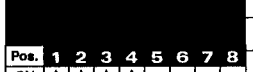
Coin Mechanisms					<<< Adjustments >>>							
LEFT	CENTER	RIGHT	4TH	*Plays/Coins*	LEFT Pulses	CENTER Pulses	RIGHT Pulses	4TH Pulses	Pulses /Credit	Pulses /Bonus	Pulses /2nd Bonus	Credit /1st Bonus
25¢	$1.00	25¢	N/U	1/25¢ 3/50¢	01	04	01	00	01	02	00	01
				1/25¢ 5/$1.00	01	04	01	00	01	04	00	01
				1/25¢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

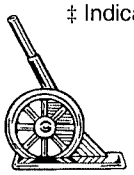
Standard Pricing Select Table

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					1 /50¢			
	USA 4					1 /50¢			
	USA 5 (Default)					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		
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ / OFF ▼ ▼▼▼▼▼	(Brazil †)	This country uses unique Tokens and/or Debit Cards *only* (pricing varies).							
		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
Pos. 1 2 3 4 5 6 7 8 / ON ▲ ▲ ▲ / OFF ▼ ▼▼▼▼▼	Germany 1	1 DM	2 DM	5 DM		1 /1 DM	6/'1 X 5 DM'		
	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 Normal Coin Slots 1-4 (Left, Center, Right & 4th). If an old style Coin Mech is used, see new adjustment to accomodate.	
SEE NOTES IN PRICING SCHEME	UK 6					3 /£2			

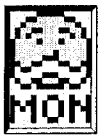
Notes: † Indicates Factory Default for that setting. ‡ Indicates a USA Dip Switch Setting (all positions in the "OFF" position).



	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 **8%**. 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, High Score 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 **01**. Adjusts the number of awards awarded for exceeding Level 2.
Adj. 19	HIGH SCORE #3 AWARDS	Set between **00 - 02**. Default is **01**. 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 **30,000,000**. 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 - 9,999,000,000** or **00** *(increments of 1M).* Default is **26,000,000**. 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** or **00** *(increments of 1M).* Default is **22,000,000**. 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 - 9,999,000,000** or **00** *(increments of 1M).* Default is **20,500,000**. Adjusts the desired ***High Score Level*** to which Level 4 may be achieved (not affected by **Adj. 31**).
Adj. 25 Adj. 30	DEFAULT HIGH SCORE #5- DEFAULT HIGH SCORE #10	Set between **1,000,000 - 9,999,000,000** or **00** *(increments of 1M).* Default is... *(see table on page 34).* Adjusts the desired ***High Score Level*** to which Level 5 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.

Adjustment Name		Adjustment Definition
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 "S.P.I." 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 **LOW**. 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%**. Default is **20%**. 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.***
Adj. 42	UK COIN MECH. TYPE	////////// **UK Only Dip Switch Set @ Option 2** ////////// 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 33). For more details on Factory Reset, review Section 3, Chapter 5, Go To Reset Menu.*



MONOPOLY® Adjustments (46-63)

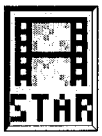
From the **ADJUSTMENTS MENU**, select the "MON" *Icon* with either **Red "LEFT"** or **Green "RIGHT" Button** and press the **Black "ENTER" Button**. Select and activate the "RIGHT ARROW" *Icon* to view the 1st adjustment in this group. Continue to select either of the "ARROW" *Icons* to view each adjustment 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 **YES** or **NO**. Default is **NO**. When set to **YES**, this feature bonus will be retained in memory from ball-to-ball for the same player. When set to **NO**, this feature will go out at the end of each ball.
Adj. 47	SPECIAL MEMORY	Set to **YES** or **NO**. Default is **YES**. When set to **YES**, this feature bonus will be retained in memory from ball-to-ball for the same player. When set to **NO**, this feature will go out at the end of each ball.
Adj. 48	UK POST SAVE ENABLED	**UK Only Dip Switch Set @ Option 2** Set to **YES** or **NO**. Default is **NO**, (UK Default is **YES**). When set to **YES** this feature is available when lit. Set to **NO** to disable this feature. (UK Games have Outlane & Center Post Save Devices which are accessed in a different way; Non-UK Games cannot adjust this setting.)
Adj. 49	FREEZE TIME (BALL SAVE)	Set to **OFF**, **0:01-0:15** or **AUTO**. Default is **OFF**. 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. 50	BANK DIFFICULTY	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature is started and played.
Adj. 51	REMATCH DIFFICULTY	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature is started and played.
Adj. 52	BONUS X DIFFICULTY	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature is started and played.
Adj. 53	DISABLE BANK	Set to **YES** or **NO**. Default is **NO**.
Adj. 54	TIMED PLUNGER	Set to **OFF** or **0:15 - 1:00**. Default is **OFF**. When set to **0:15** to **1:00**, the plunger will "Autoplunge" the ball (at the time set) when the ball is at the beginning of play, awaiting the skill shot by the player.
Adj. 55	ELECTRIC CO DIFF	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines how this Feature is started and played.
Adj. 56	B-A-N-K LETTERS	Set between **00 - 04**. Default is **01**. Determines how many letters are spotted at game start.
Adj. 57	CHASE BALL	Set to **YES** or **NO**. Default is **YES**. Determines if another ball is given in the game after a ball is trapped/missing & ball search did not find it.
Adj. 58	POPS HITS TO MOVE TOKEN	Set between **00 - 06**. Default is **05**. Determines how many pop switch closures are required for a move of 1 space on the game board.
Adj. 59	ADV BANK AT NEW BALL	Set to **YES** or **NO**. Default is **YES**.
Adj. 60	RIGHT STANDUP SPOTS	Set between **00 - 04**. Default is **03**. Determines how many lights (modes "completed") are lit at game start by the Right Standup Target.
Adj. 61	CHANCE VUK STRENGTH	Set to **EXEASY, EASY, MODERATE, HARD** or **EXHARD**. Default is **MODERATE**. Determines VUK strength.
Adj. 62	START AT 1500 PTS	Set to **YES** or **NO**. Default is **YES**.
Adj. 63	ELEC. EB AT %	Set between **20 - 80**. Default is **30**. Determines the percentage required to get to in *Electric Company Increase Power Mode.*



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.



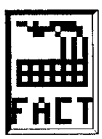
Film Star Reset (For the Home Setting)

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

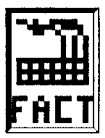
From the **RESET MENU**, select the "AUD" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All Game Audits (See **Fig. 2**) will be reset to Factory Settings. The display will indicate **REQUEST INSTALLED** and return to the **RESET MENU**. Game Audits can also be reset 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.

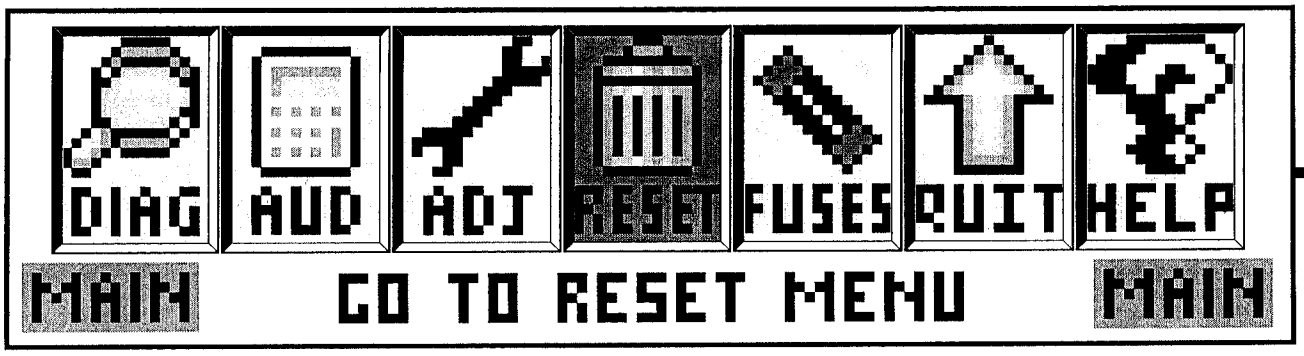


Factory Reset

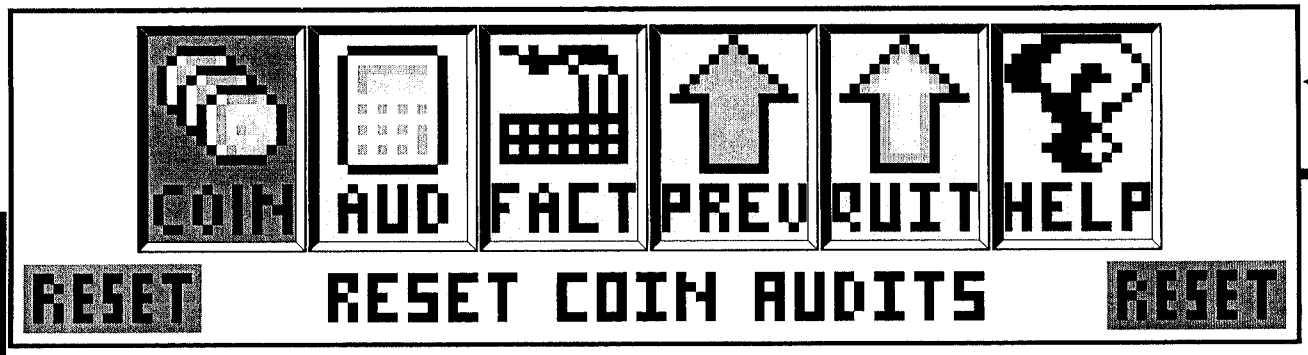
From the **RESET MENU**, select the "FACT" *Icon* with either **Red** or **Green Button** and press the **Black Button**. ⚠ All adjustments will be reset to *Factory Settings* (except for Proprietary Adjustments). The display will indicate **REQUEST INSTALLED** and exit the Service Session. See Chapter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

Overview

The **Portals™ Service Menu System** provides a current Fuse Table 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). For the complete Fuse List in the *Quick Reference Fuse Chart & Pictorials*, see the next page (identical to page **DR. ❶** in the front of this manual).



GO TO FUSE TABLE

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 "+" *Icon* to view the 1st fuse in this group. Continue to select either the "+" or "-" *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.



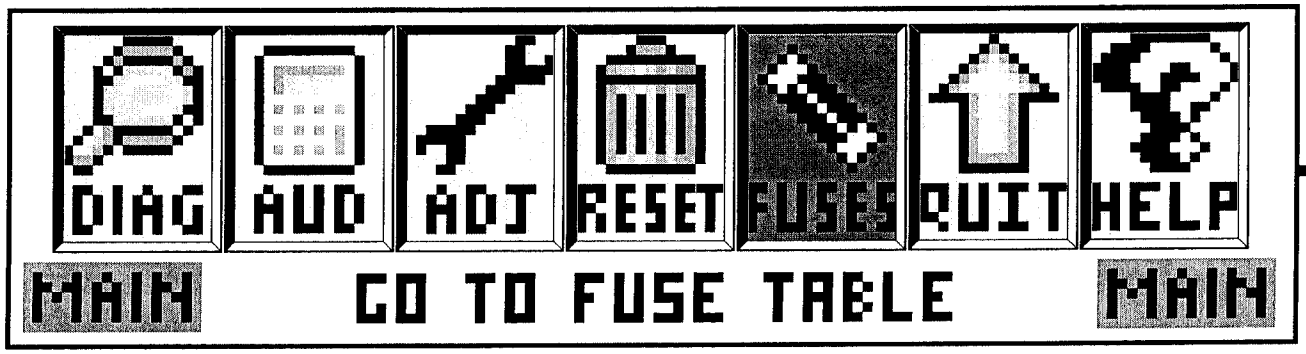
Selecting & activating the "HELP" *Icon* from any display will show a help screen. (An explanation of each *Mini-Icon* at that level will cycle continuously until any active button is pressed.)



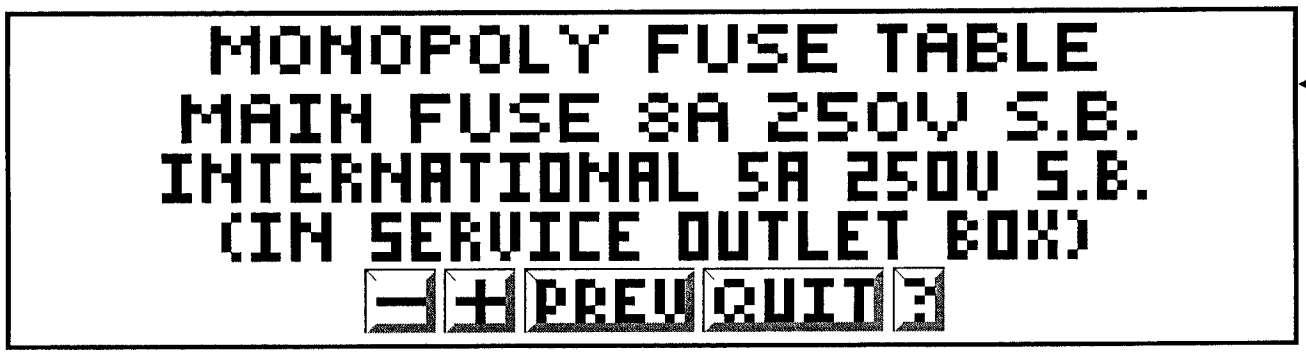
Selecting & activating the "+ " or "-" *Icons* selects the next or previous fuse in this group.

Example:

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



Press the **Black Button** to activate this **ICON**. This will bring up the **MONOPOLY FUSE TABLE**.





▼ 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

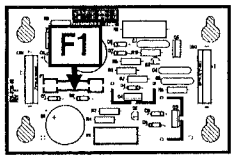
Backbox Fuses			
LOC:	**DISPLAY POWER SUPPLY (P.S.) BOARD**		
F1	¾A 250v S.B.	90v DC	High Voltage Display
LOC:	**I / O POWER DRIVER BOARD**		
F6	7A 250v S.B.	50v DC	Primary High Power Coils/Flippers
F7	5A 250v S.B.	20v DC	Low Power Coils
F8	5A 250v S.B.	12v DC	Logic Power
F9	5A 250v S.B.	12v DC	Logic Power
F20	3A 250v S.B.	50v DC	Magnet
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	**Not Used / Spare**
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)
Playfield Fuses			
LOC:	**UNDER PLAYFIELD (near Flippers)**		
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	Upr. Flipper (GRY-YEL⇆RED-YEL)

For other fuses, if any, locations & more information, see Page 95.

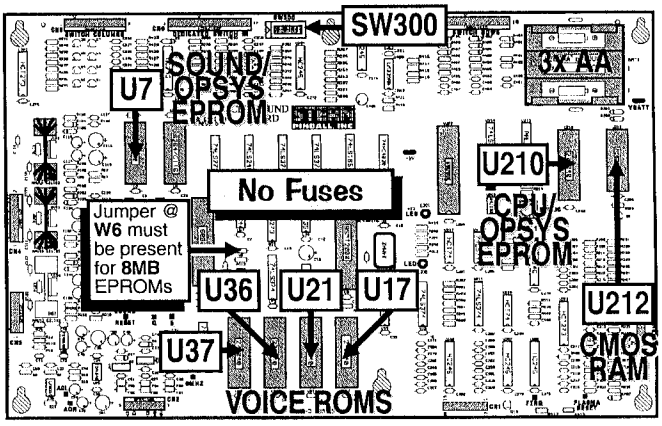
For Backbox & Cabinet General Parts, review Section 4, Chapter 1, Parts Identification & Location (The Pink Pages).
For Schematics and/or Component Parts on above Boards, review Section 5, Chapter 4, Printed Circuit Boards (The Yellow Pages).

Sec. 3: ... Fuse Table

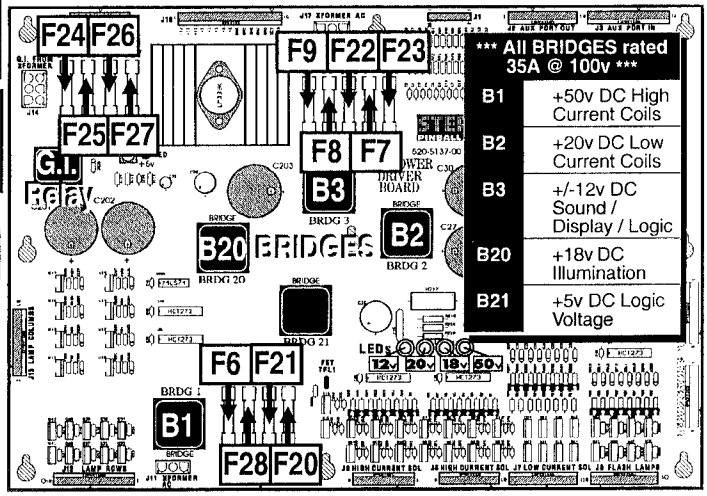
Display Power Supply Board



CPU / Sound Board



I/O Power Driver Board



Section 3, Chapter 6: Go To Fuse Table

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). Help Screens provide different information depending on where the "HELP" or "?" *Icons* are selected. Read all chapters in this section for a complete understanding of this pinball game. For more help, utilize the "Dr." *Icon* in the **DIAGNOSTICS MENU** (see the end of Chapter 2 in this section). The table on the next page was designed to provide solutions to some common problems frequently asked.



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 below screens appear and will continuously cycle until any **Button** is pressed bringing back the **MAIN MENU**.

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.

Help Screens from the MAIN MENU:

```
USE FLIPPER BUTTONS
(OR RED AND GREEN COIN
DOOR BUTTONS) TO CHANGE
THE SELECTED ICON.
```

```
PRESS START BUTTON
(OR ENTER) TO
ACTIVATE THE
SELECTED ICON.
```


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 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 TECH SUPPORT or visit our website at www.sternpinball.com.

PORTALS™ SERVICE MENU
PROBLEM/SOLUTION TABLE

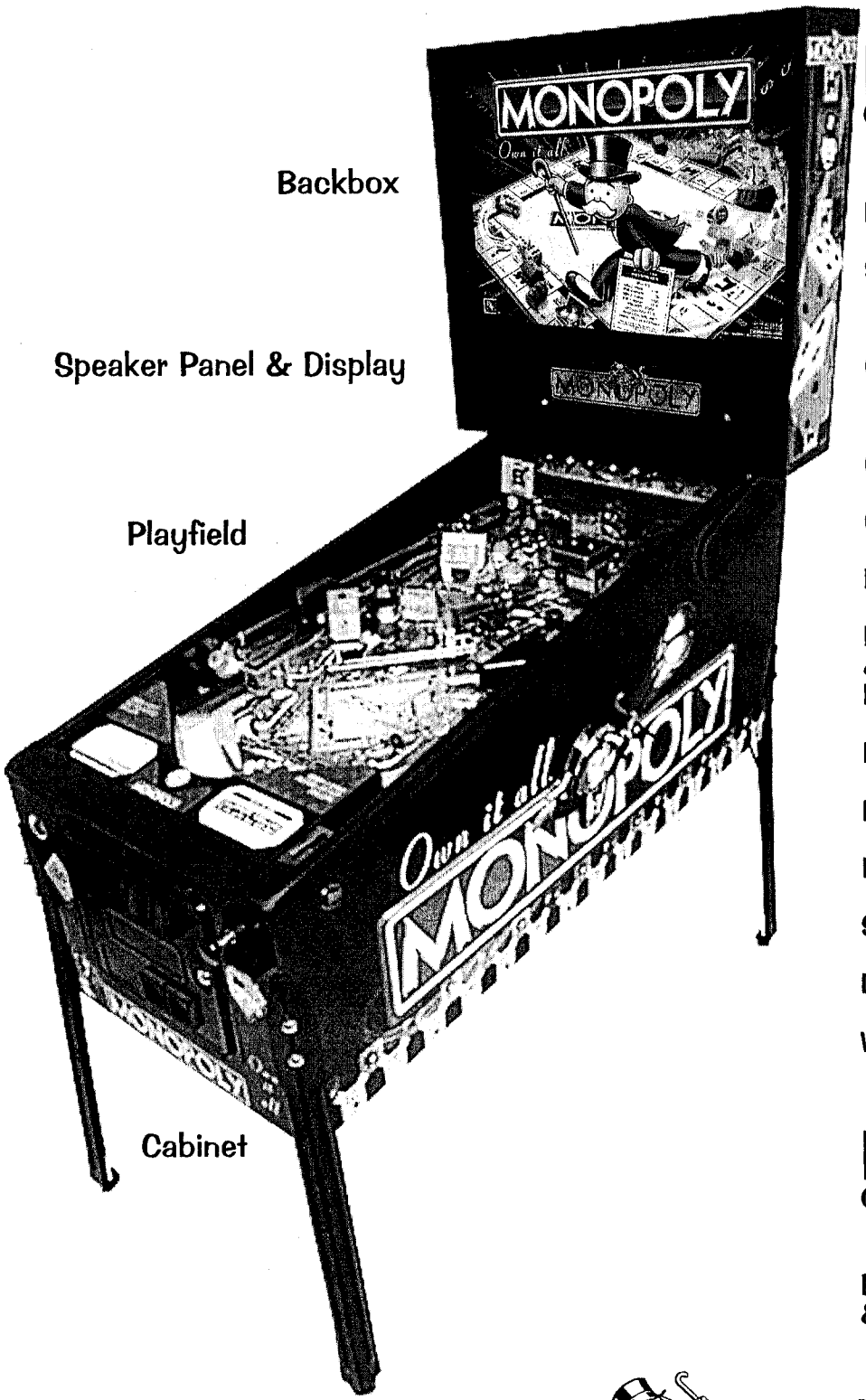
Use this table for a quick simple solution(s) guide. For more technical assistance view Section 5.

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 the end of Chapter 3).
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*is pulled out*** (see Chapter 1).
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.



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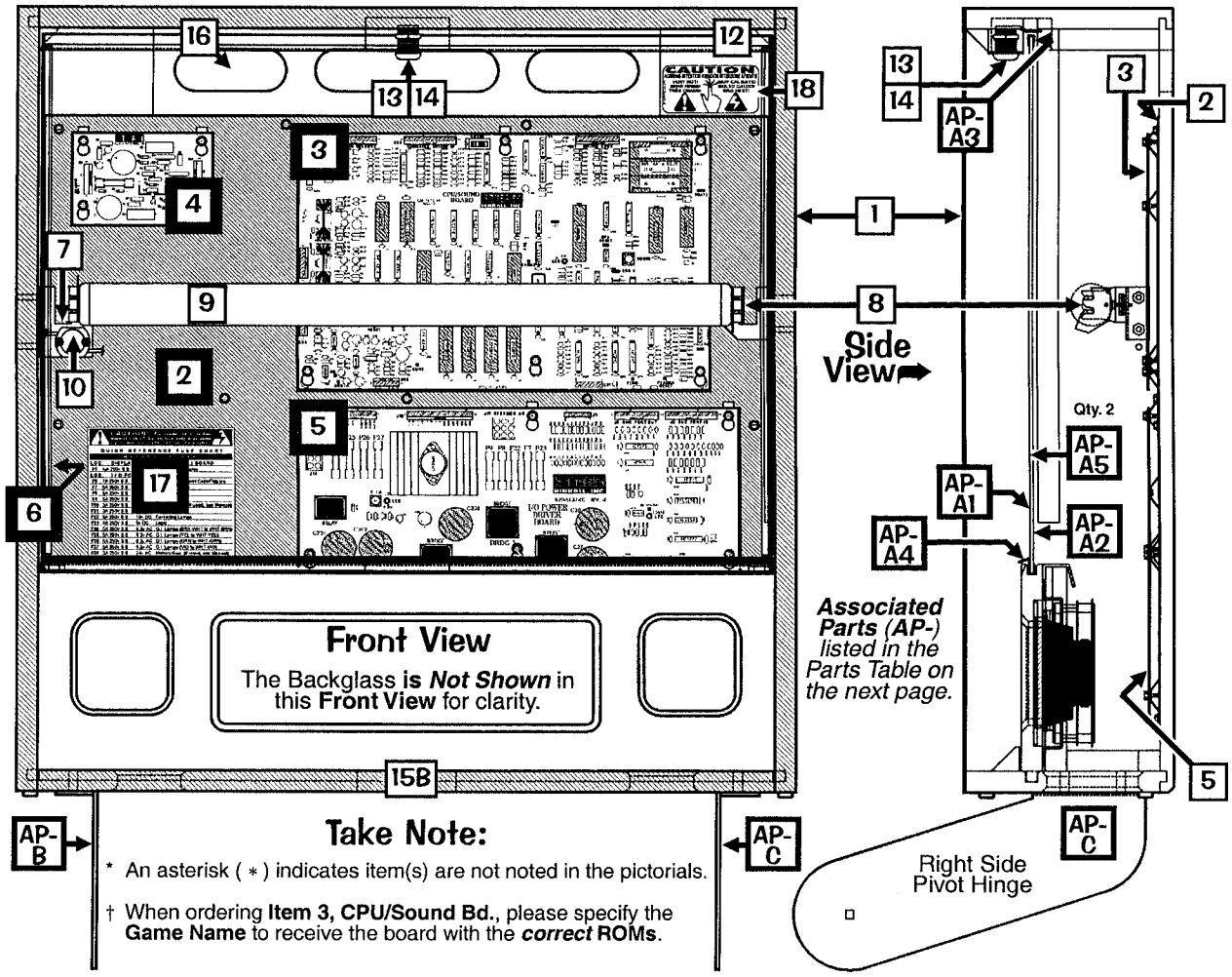
MONOPOLY Backbox Assembly, 505-6002-75-75 (Items 1-26)

Not sold as an assembly, order the individual part(s) actually required.



Take Note:

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

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

Sec. 4: Parts Id. ...

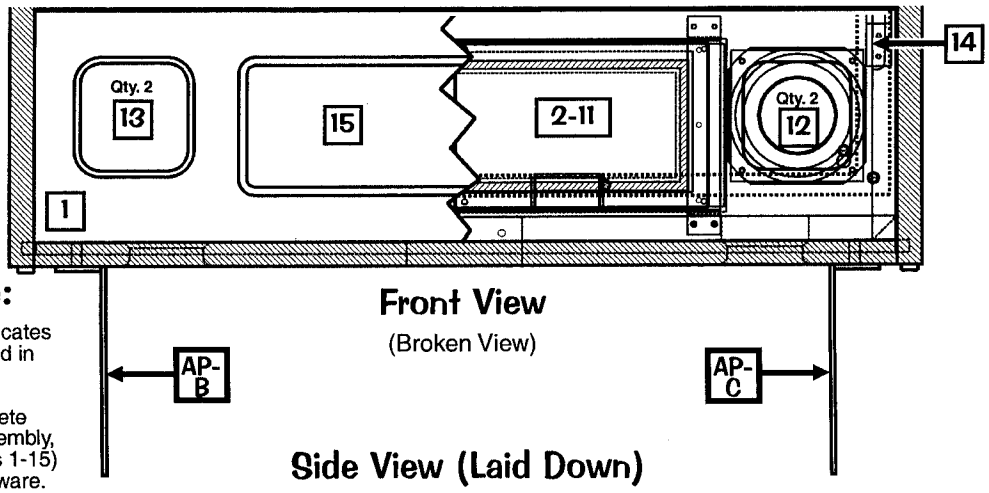
№	BACKBOX PART NAME	QTY.	SPI PART №
1	Backbox (MONOPOLY®)	1	525-5558-75
	Item 1 Note: Black Textured T-Molding is installed and cannot be ordered separately.		
2	PCB Metal Mounting Plate	1	535-5809-04
	Item 2 is secured to Item 1 by: #8 X 1/2" SHWH AB (Zinc) (Qty. 13) (234-5101-00) **and** #10 Washer 7/32" I.D. X .5" O.D. X 1/16" Thick (Qty. 4) (242-5003-00)		
3 †	CPU/Sound Board (Mono) FCC-FEB98	1	520-5136-16
4	Display Power Supply Board	1	520-5138-00
5	I/O Power Driver Board	1	520-5137-01
	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 (UK Only)	0	520-5192-00
	Item 6 is required for UK Games Only *to support the Left & Right Outlane Ball Deflectors & Center Up/Down Post Assemblies not supported in the Normal Coil Matrix of Q1-Q32.*		
7	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
	Ordering Note: If **500-6545-00** *is unavailable*, order the individual part(s) actually required.		
8	Fluorescent Light Bracket Assy. Right	1	515-6545-01
	ORDERING ABOVE (ITEM 8) SUB-ASSY. PART № WILL INCLUDE:		
8A	Fluorescent Light Bracket Right	1	535-7739-01
8B-8C	Identical to Items 7B-7C above.		See 6B-6C
	Items 7 & 8 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)		
	Ordering Note: If **500-6545-01** *is unavailable*, order the individual part(s) actually required.		
9	Fluorescent Tube (F20T12CW)	1	165-5031-02

№	BACKBOX PART NAME	QTY.	SPI PART №
10*	Ground Strap (5") (by Item 12)	1	600-5006-05
11	Starter - Fluorescent (FS2 Light)	1	165-5011-01
12	Ballast SP2/K 5/8" Core 120v 50/60 Hz 13W	1	010-5015-00
	Ballast Mounting Plate	1	535-8657-00
	Item 12 is secured to Item 1 by: #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5102-04)		
13	Lock Mounting Plate (2001)	1	535-8128-01
14	Camlock (Cam 440X) & Key	1	355-5018-02
	Items 13-14 are secured by: #8 X 5/8" TP Torx T20 (Qty. 4) (237-5947-00)		
15A	*#1 Roto Lock Male (on Cabinet)*	*1*	*355-5006-01*
15B	#1 Roto Lock Female (R2-0002-02)	1	355-5006-02
	Item 15B 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)		
16	Back Vent Grill 2-1/2" X 18"	1	545-5072-02
	Item 16 is secured by: Staple 5/16" (Qty. 24) (631-5000-00)		
17	Fuse Description Decal (Generic)	1	820-6152-00
	Fuse Description Decal (Specific)	1	820-6152-75
18	"CAUTION - VERY HOT" Decal	1	820-6266-00
19*	Fuse Label (UL)	1	820-6143-00
20*	Backbox Date Label	1	820-5091-00
21*	Ribbon Cable, 20-Pin (4")	1	036-5000-04
22*	Ribbon Cable, 26-Pin (40")	1	036-5001-40
23*	1/4" Clamp (Double)	3	040-5000-23
24*	1/2" Clamp (Single)	1	040-5000-06
25*	3/4" Clamp (Single)	2	040-5000-08
26*	1" Clamp (Single)	6	040-5000-09
	Items 23-26 are secured to Item 1 by: #8 X 1/2" SHWH AB (Zinc) (Qty. 13) (234-5101-00)		



MONOPOLY Speaker Panel Assy. for the Backbox, 515-6888-03 (Items 1-15) and Assoc. Parts: Backglass Assembly & Pivot Hinges (Left & Right) (Items AP-A - AP-C)

Not sold as an assembly, order the individual part(s) actually required.



Front View
(Broken View)

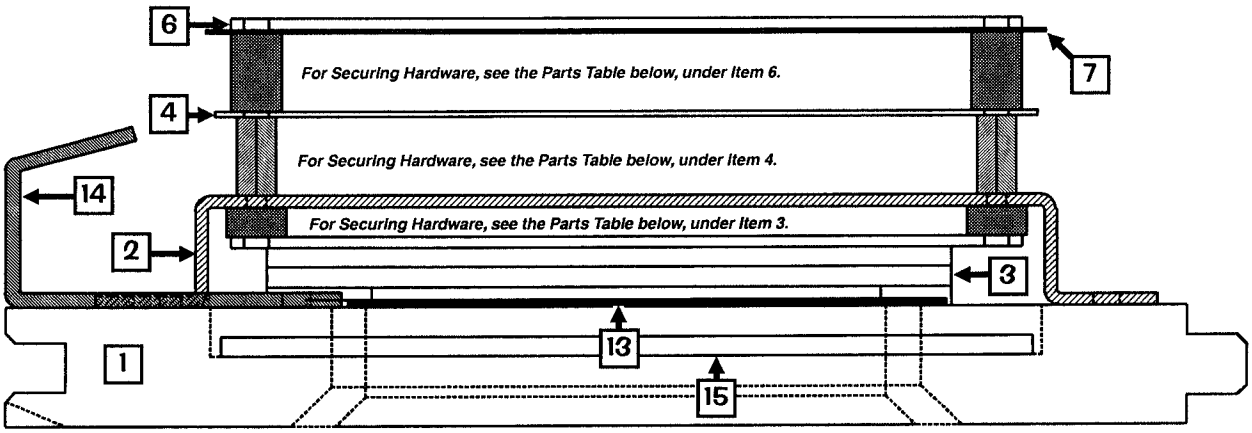
Take Note:

* An asterisk (*) indicates item(s) 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).



Nº	SPEAKER PANEL PART NAME	QTY.	SPI PART Nº
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 3/4" HWH AB (Zinc) (Qty. 4/per) (234-5103-00)		
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) (on Item 4)	1	040-5000-06
10*	Ribbon Cable, 14-Pin	1	036-5260-00
	***Item 10 Note:** The 14-Pin cable connects the Dot Matrix Disp. Bd. to the Disp. Controller Bd.*		
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
14	Speaker Panel Hook Bracket	2	535-7009-02
	Items 12, 13 & 14 are secured by: #8 X 3/4" HWH AB (Zinc) **(Items 12/13:** Qty. 4/per; **Item 14:** Qty. 2/per) (234-5103-00)		

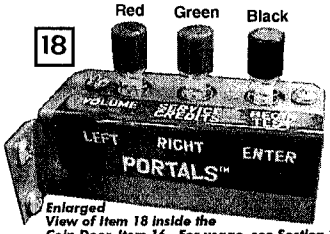
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
15	Plastic Shield (Display Cover)	1	545-5884-00
	Item 15 is secured to Item 2 by: #6 X 3/8" HWH AB (Zinc) (Qty. 8) (234-5000-00)		

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.

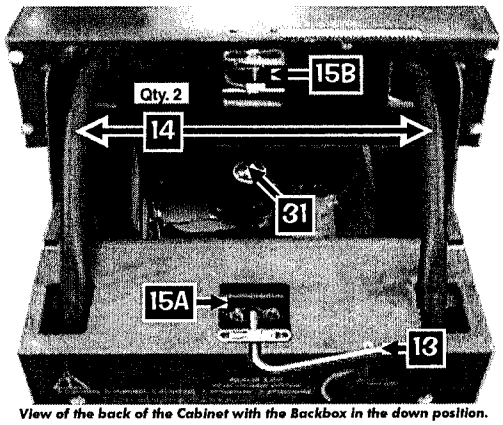
Nº	ASSOC. BACKBOX PART NAME	QTY.	SPI PART Nº
AP-A	Backglass Assembly (Game Nº 75)	1	*See Parts Below*
	ORDER ONLY INDIVIDUAL PART(S) NEEDED:		
AP-A1	Clear Backglass 25.906" X 19.187"	1	660-5038-02
AP-A2	MONOPOLY® Film Art (Game Nº 75)	1	830-5275-00
AP-A3	Top Plastic Channel - 26"	1	545-5018-15
AP-A4	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)	1/2	626-5005-00
	Note: AP-A6 secures AP-A5 to AP-A1		
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 □

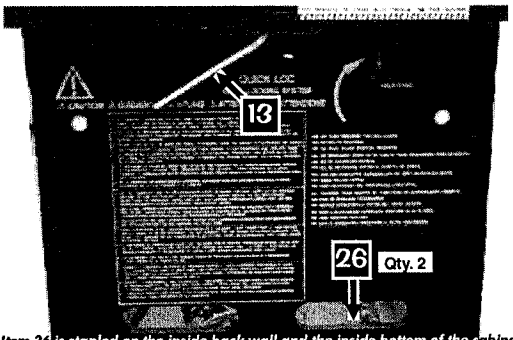


Enlarged View of Item 18 inside the Coin Door, Item 16. For usage, see Section 3, Chapter 1, Portals Service Menu Intro., Pg. 8

For Backbox Parts see the previous two pages.

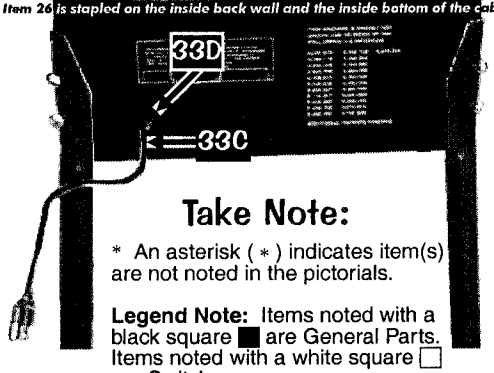


View of the back of the Cabinet with the Backbox in the down position.



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

View of the Coin Door Open, Item 16.



Item 33J (On/Off Switch) is located under the Cabinet (Front Right) directly below the Power Box. 33J

Take Note:

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

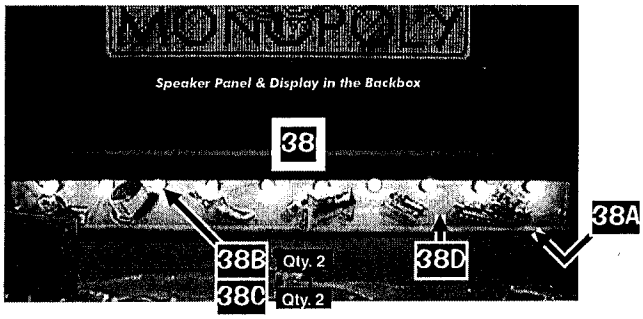
Legend Note: Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches.

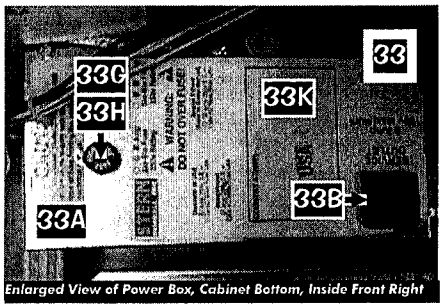
Sec. 4: Parts Id. ...

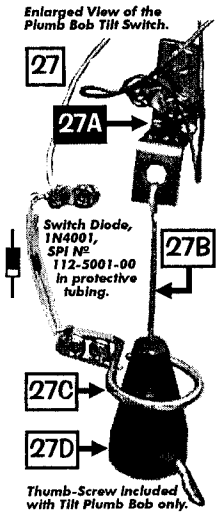
№	CABINET PART NAME	QTY.	SPI PART №
1	Game № 75 Screened Cabinet (Plain)	1	525-6000-75
2	Black Leg & Leveler Assembly	4	500-5921-50
	Item 2 is secured by: Leg Bolt Back Plate (535-5703-00) **and** Leg Bolt 3/8" X 16 X 2-1/2" Hex 5/8" Hd. (2/per) (231-5001-01) *To order just a Leg Leveler (3/8" - 16 X 3") use SPI №. 500-5017-00. A Leg "without" a Leg Leveler is not available.*		
3	Start Red Button Assy. ("Flipper" Style)	1	500-6090-02
	Item 3 includes the Switch.* FOR SWITCH ONLY *see Item 25 on the Next Page.		
4	Ball Shooter (Plunger) Assembly	1	500-6146-00-04
	Item 4 is secured by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 3/8" SHWH (Serr) Swage (Qty. 3) (237-5985-00) **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 66.**		
5	1" ø Round Red Button Lighted	0	Not Used
	Item 5 includes the Switch.* FOR SWITCH ONLY *see Item 25 on the Next Page.		
6	Flipper Red Button Assembly	2	500-5026-32
	Item 6 is secured by: Pal Nut for Flipper Button (Metal) (Qty. 2) (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 ONLY *see Items 23A/B on the Next Page.***		
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
	Above Item 11 is self-adhesive. It is located on Item 10. Sold in 12" Lengths only.		

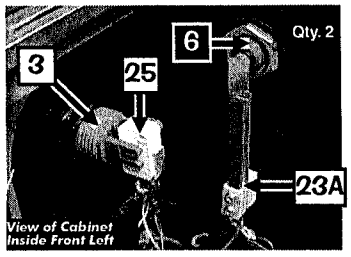
№	CABINET PART NAME	QTY.	SPI PART №
12*	P/F Glass (Tmprd.) 21" X 43" X 3/16"	1	660-5001-00
13	Hex Key Allen Wrench 5/16"	1	777-0001-00
14	Corrugated Tubing Black 1¼"ø X 2.6' Lg.	2	605-5008-00
	Above Item 14 covers the Cables Wiring Harnesses going into the Backbox from the Cab.		
15A	#1 Roto Lock Male	1	355-5006-01
15B	*#1 Roto Lock Female (on Backbox)*	*1*	*355-5006-02*
	Item 15A 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)		
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 №.*		
17	Coin Door Switch (USA)	2	180-5024-00
	Coin Door Switch (¥ Japan)	0	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 № 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)		

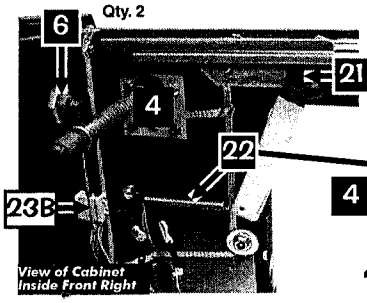
Parts Table & Views continue on the next page.

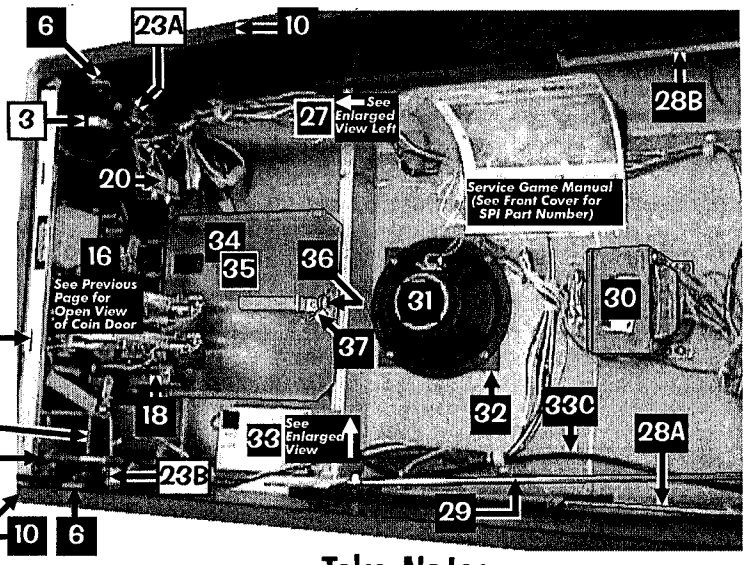












Take Note:

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

Legend Note: Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches.

Parts Table & Views continue on the previous page.

№	INDIVIDUAL 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. 2) (242-5003-00)		
22	Lockdown Spring (connected to handle)	1	265-5008-00
23A	Flipper Switch - **Self-Cleaning**	1	180-5160-00
23B	Flipper Sw. - **X2 Stack for Lwr./Upr. Flipper(s)**	1	180-5164-00
24*	Foam Strip (2 on 23A; 1 on 23B)	3	626-5042-00
25	Start Button (SWITCH ONLY)	1	180-5174-00
26	Grills 2-1/2" X 18" (on Back & Bottom)	2	545-5072-02
27	Cabinet Plumb Bob Tilt Switch	1	*See Parts Below*
	ORDER ONLY INDIVIDUAL PART(S) NEEDED:		
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	535-5990-00
28B	Slide & Pivot Support Bracket - Left	1	535-5989-00
	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 5.7v AC (with Ballast Winding)	1	010-5012-01
	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)		

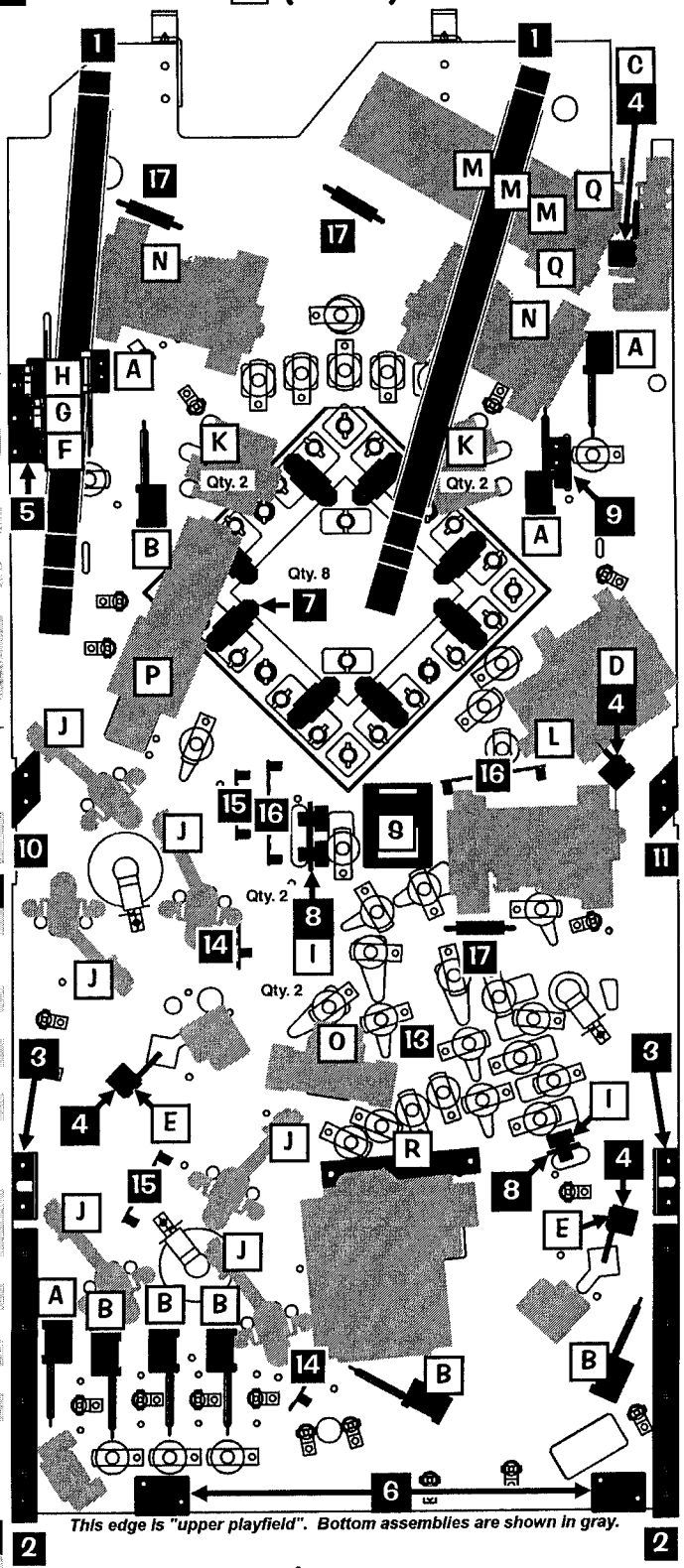
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
31	Speaker 8" ø Rd. 8010 4Ω	1	031-5007-00
32	Speaker Grill 7" X 7"	1	545-5072-03
	Items 31 & 32 are secured by: #6-32 X 1-1/4" Fin Shank Screw (Qty. 4) (237-5883-00) **and** #6-32 Keps Nut (Qty. 4) (240-5008-00)		
33	Power Input Box Sub-Assy.	1	515-5360-07
	ORDERING ABOVE (ITEM 33) SUB-ASSY. PART № WILL INCLUDE:		
33A	Power Box (Plain)	1	535-5932-00
33B	Service Outlet (for USA)	1	180-5008-01
33C	Line Cord 10' ROJ 3" Max.	1	034-5000-10
33D	Recessed Cup for Line Cord	1	545-5122-00
33E*	Line Filter	1	150-5000-00
33F*	Varistor TNR159211KM	1	150-5001-00
33G	Fuse 8 Amp 250v Slo-Blo (Domestic)	1	200-5000-05
33H	Fuse Holder	1	205-5001-00
33I*	On/Off Switch Bracket	1	535-8318-00
33J	On/Off Rocker Sw. (Arcolectric C1350AB)	1	180-5001-01
33K	Power Box Decal	1	820-6123-03
34	Cash Box Plastic Bottom	1	545-5090-00
35	Cash Box Cover (Validator)	1	535-5013-03
36	Cash Box Lock Bracket (wire)	1	535-7562-00
37	Large Hair-Pin Clip	1	535-7772-00
38	Cabinet Light Bd. Assy. MONOPOLY®	1	500-6413-75
	ORDERING ABOVE (ITEM 38) ASSEMBLY PART № WILL INCLUDE:		
38A	Cabinet Light Board Plain (Generic)	1	525-5570-00
38B	2-Lug Stand-Up Long Shell Socket	10	077-5031-00
38C	#44 Bulb Yellow (Small Bayonet Type)	10	165-5053-06
38D	Decal for Item 38A	1	820-6287-01
	Item 38B is secured to Item 38A by: #6 X 3/8" HWH AB Zinc (Qty. 1/per) (234-5000-00)		
	Item 38 is secured to the Cabinet by: #8-32 X 1½" HWH MS (Ser) Zinc (Qty. 2) (237-5946-00) **and** #8 Washer (Qty. 2) (242-5005-00)		
	Ordering Note: If **500-6413-75** *is unavailable*, order the individual part(s) actually required.		

Playfield - General Parts ■ & Switches □ (Below)

№	BELOW PLAYFIELD PART NAME	QTY.	SPI PART №
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 (Extended)	2	535-5988-01
	Item 2 is secured by: #4 X 1/2" PFH (Zinc) (Qty. 5/per) (237-5840-00)		
3	Pivot Pin Bracket Welded Assembly	2	500-5329-03
4	Switch Bracket **(Shooter Lane / Eject Holes)**	4	535-6173-00
	Item 4 is secured by: #6 X 1/2" HWH AB (Zinc) Red (Qty. 2/per) (234-5001-02)		
5	Sw. (3-Ball) Bracket **(Lock Ball Lane)**	1	535-8842-00
6	Mounting Bracket **(for Back Panel)**	2	535-8964-00
7	Light Cover Bracket	8	535-8965-00
	Item 7 is secured by: #8 X 3/8" HWH AB (Zinc) (Qty. 2/per) (234-5100-00)		
8	Switch Back Plate **(Stand-Up Target)**	3	535-6452-00
	Target (Stand-Up) Bracket	3	535-6896-00
9	Lane Divider Bracket	1	535-8972-00
10	Gate Bracket (Left) Assy. **(see next page)**	1	500-6514-00
11	Gate Bracket (Rt.) Assy. **(see next page)**	1	500-6515-00
	Items 5, 6 & 9-11 are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
12*	Insulation Fiche Paper **(under Iwr. Flips)**	2	545-5721-00
13	Diode Terminal Strip 2-Lug (810) Isolated	1	055-5203-00
14	Diode Terminal Strip 3-Lug (813) Isolated	2	055-5204-03
15	Diode Terminal Strip 5-Lug (824) Isolated	2	055-5204-05
16	Diode Terminal Strip 7-Lug Isolated	2	055-5204-07
	Items 13-16 are secured by: #6 X 3/8 HWH AB Zinc (Qty. 1-2/per) (234-5000-00). *Note: 1N4004 Diodes (112-5003-00) are used in all Diode applications. 1N4001 Diodes can be used for Switches and/or Lamps. See Sec. 5, Chp. 2, Playfield Diode Terminal Strip...*		
17	3A 250v Slo-Blo Fuse	3	200-5000-08
	Fuse Clip Holder (Socket)	3	205-5000-01
	Item 17 is secured by: #6 X 1/2" PPH AB (Qty. 1/per) (237-5805-00) *Note: Item 17, Fuse Clip Holder (Socket) 205-5000-01 is part of a set of 12 (205-5000-12). You can order them as individuals (...-01) or a set of 12 (...-12).*		
18*	#8 Solder Lug	7	055-5140-08
	Item 18 is secured by: #6 X 3/8" HWH AB (Zinc) Red (Qty. 1/per) (234-5000-00)		

№	BELOW SWITCHES PART NAME	QTY.	SPI PART №
A	Micro Sw. Roll-Over Left Brkt. Assy.	4	500-6227-01
B	Micro Sw. Roll-Over Right Brkt. Assy.	6	500-6227-02
	Items A & B are secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
C	Micro Switch **(at Shooter Lane)**	1	180-5157-00
D	Micro Switch **(Short Flat Actuator by Motor)**	1	180-5187-00
E	Micro Switch **(Long Flat Actuator by Ejects)**	2	180-5186-00
F	Micro Switch **(Straight Wire Actuator)**	1	180-5178-00
G	Micro Switch **(Small Bend Wire Actuator)**	1	180-5179-00
H	Micro Switch **(Large Bend Wire Actuator)**	1	180-5180-00
	Items C-H require a Switch Body Protect Plate (535-6539-00) which is secured by: #2-56 X 1/2" HWH Serr (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00).		
I	Switch & Target Assy. Square (Yel)	3	515-5162-06
	Item I is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00) ***For better views or entire assembly, see Appendix I, Page A14 (end of manual).***		
J	Micro Switch **(Bumpers)**	6	180-5015-03
K	Stack (Blade) Switch **(Slingshots)**	4	180-5054-00
L	Micro Switch **(Roller Actuator) (on Motor)**	1	180-5119-00
M	Micro Sw. **(Roller Actuator, Lite) (Ball Trough)**	3	180-5119-02
N	EOS Switch Flipper **(Lower Flippers)**	2	180-5149-00
0	Micro Switch **(Drop Target)**		180-5158-00
P	Micro Switch **(Scoop)**		180-5183-00
	*Note: For how Items J-P are secured or for a better view, see Sec. 4, Chp. 2, Drawings for Major Assemblies & Ramps, Item J, **Page 71**; Item K, **Page 72 (top)**; Item L, **Page 80**; Item M, **Page 67**; Item N, **Pages 68-69**; Item O, **Pages 76-76**; Item P, **Page 75**.*		

№	BELOW MISC. PCB PART NAME	QTY.	SPI PART №
Q	Dual OPTO TRANS Bd. **(on Ball Trough)**		520-5173-00
	Dual OPTO REC Board **(on Ball Trough)**		520-5174-00
R	4-Position OPTO (Receiver) PC Board	1	520-5210-00
	Item R is secured by: #6 X 7/8" HWH AB (Zinc) (Qty. 2) (234-5003-01) **and** 3/8" Slf. Rtn. Spacer White (Qty. 4) (254-5007-01)		
	*Note: For more details on Items Q & R and a break-down of parts, see Section 5, Chapter 4, Printed Circuit Boards, **Pages 99 & 130**. For how Item Q is secured or for a better view, see Sec. 4, Chp. 2, Drawings for Major Assemblies & Ramps, **Page 67**.*		
S	DC Relay (Bi-Directional) PC Board	1	520-5066-00
	Item s is secured by: #6 X 3/4" HWH AB (Zinc) (Qty. 4) (234-5003-00) **and** 3/8" Slf. Rtn. Spacer White (Qty. 4) (254-5007-01)		

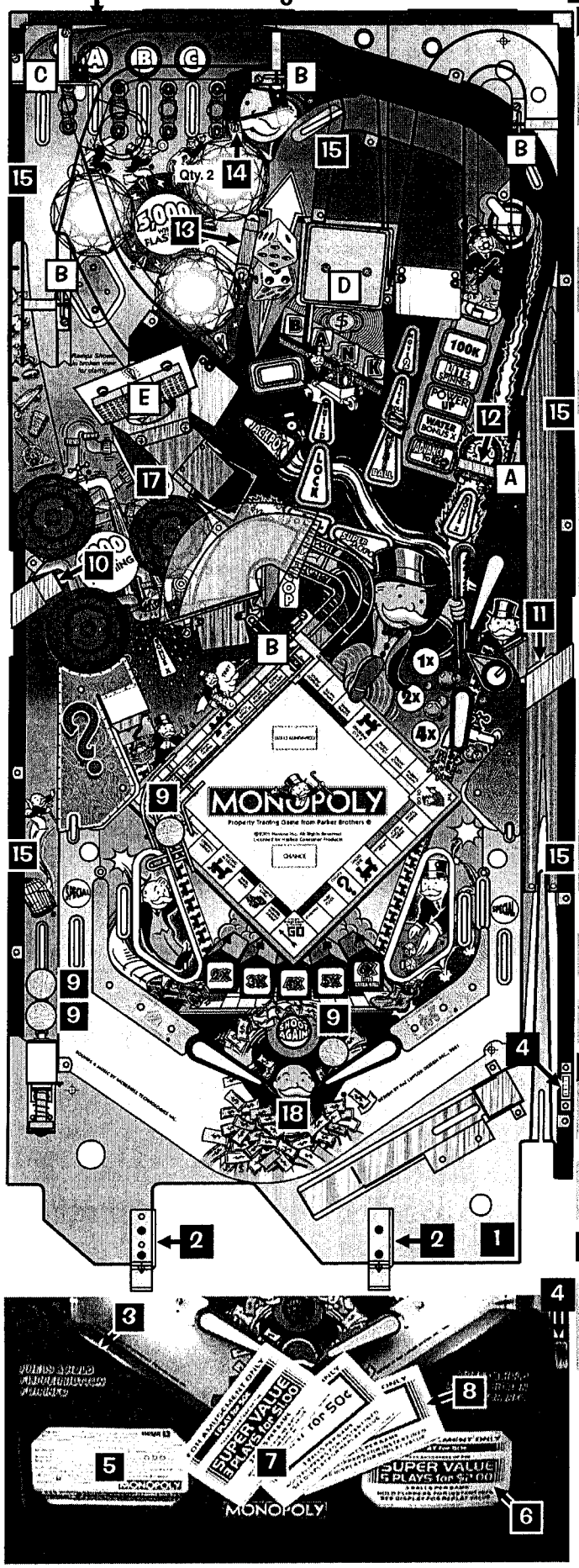


Take Note:

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

1. For Sockets & Bulbs (drawings & part numbers) see Pgs. 62-64.
2. Some items or parts *may be included with* **or** *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages, Sec. 4, Chp. 2.** for parts required not appearing on this page. If you still cannot find the part required, Call Stern™ Pinball Technical Support, 1-800-542-5377 or 1-708-345-7700.
3. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches, OPTO Boards, or Misc. PC Boards.

Playfield - General Parts ■ & Switches □ (Above)



№	ABOVE PLAYFIELD PART NAME	QTY.	SPI PART №
1	P/F Screened w/ Inserts & **NO** Parts	1	830-5100-75
	P/F Complete w/ Inserts & **ALL** Parts	1	505-6004-75-75
2	Playfield Hanger Bracket	2	535-8385-00
	Item 2 is secured to the P/F by: #8-32 X 7/8" HWH MS Zinc (Qty. 2/per) (237-5890-00)		
3	Bottom Arch (Black Plastic)	1	545-5995-00
	Item 3 is secured to the playfield by: Playfield Support Hex Post (double male threaded end #8-32 (Qty. 2) (530-5285-00) *[see **Page 59**, Item 15 for view]*, #8 Washer (Qty. 2) (242-5005-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00).		
	***Note:** For Decals, see Playfield - Plastics, Metal Covers, Mylar & Decals, **Page 57**.*		
4	Level Assembly	1	515-7214-00
	For Individual Items use : .882" 8MM Vial Mtg. Flange (545-6027-00) or Level Bracket (535-9010-00). **Flange secured by:** #6-32 X 1/4" PPH MS (no Sems) Zinc (Qty. 1) (237-5500-00) **and** #6-32 Keps Nut (Qty. 1) (240-5008-00) **and Bracket secured to the wood rail by:** #6 X 1/2" HWH AB Zinc Red (Qty. 2) 234-5001-02 (Qty. 2) (234-5001-02)		
5	Instruction Card (USA) №: 75	1	755-5175-00
	***Note:** Visit **www.sternpinball.com** for a PDF copy of the Game Instruction Card which will contain any translated instruction cards made for this game. Find Game Link or Archives.*		
6	Coin Card (1-Sided)	1	755-5087-05
	***Note:** Use Item 6 (**Side 1: 1 Play 50¢ - 5 Plays $2**) for Adj. 7, Game Pricing, USA 5 Setting.*		
7	Coin Card (2-Sided)	1	755-5087-01
	***Note:** Use Item 7 (**Side 1: 1 Play 50¢ - 3 Plays $1**) for Adj. 7, Game Pricing, USA 8 Setting; Use Item 5 (**Side 2: 1 Play 50¢**) for USA 3 Setting.*		
8	*OPTIONAL* Coin Card (1-Sided)	0	755-5087-02
	***Note:** Use Item 8 **OPTIONAL (Blank)** for Custom Settings (**NOT INCLUDED** in USA or Foreign Games w/own Country Coin Card; Item 8 is available, call your local Distributor).*		
9	Pinball (Steel) $1\frac{1}{16}$" ø	4	260-5000-00
10	Gate Bracket (Left) Assembly	1	500-6514-00
	Includes: Bracket LT (535-8976-00), LT Flap (535-8978-00) & Hinge Pin LT (535-8981-00)		
11	Gate Bracket (Right) Assemlby	1	500-6515-00
	Includes: Bracket RT (535-8977-00), RT Flap (535-8979-00) & Hinge Pin RT (535-8982-00)		
	Items 10 & 11 are secured under the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 2/per) (234-5101-00)		
12	Spinner Sub-Assembly	1	515-5553-00
	Spinner Bracket	1	535-8952-00
	Decal	2	820-5215-00
13	1-Way Gate Mounting Bracket (Small)	1	535-5269-03
	Wire Gate (for above)	1	535-5307-03
	Item 13 is secured by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00)		
14	Bracket, Sign Mounting (Short)	2	535-8912-00
	Item 14 is riveted to Screened Plastic -20 by: Rivet, 1/8" ø X 3/16" Lg. (Nickel) (Qty. 1/per) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 1/per) (246-5000-00) **and secured to Screen Plastic -13 by:** #8-32 Nylon Stop Nut (Qty. 1/per) (240-5102-00)		
15	Ramp Mounting Welded Bracket	5	515-6508-00
	Item 15 is secured by: #6 X 1/2" PTH A (Zinc) (Qty. 2/per) (237-5809-00)		
16	Back Panel Red Wood (No Parts)	1	525-5593-00
	Item 16 is secured by: See Mounting Brackets (Back Panel) on previous page.		
17	1/2" Clamp (Single) **(on Scr. Plastic -08)**	1	040-5000-06
18	Plug-Cap (3/16") Black Plastic	1	545-5232-01
	***Note:** Item 18 should plug hole if the Center Post (@ Drain) is Not Used.*		

№	ABOVE SWITCHES PART NAME	QTY.	SPI PART №
A	Micro Switch (Spinner)	1	180-5010-04
	Item A requires a Switch Body Protect Plate (535-6539-00) which is secured by: #2-56 X 1/2" HWH Serr (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00).		
B	Micro Switch (on Roll-Under Gates on Ramps)	4	180-5087-00
C	Switch & Target Assy. Narrow (Yellow)	1	515-5967-06
	***Note:** For how Item C is secured & for a better view or complete assembly, see Section 4, Chapter 2, Drawings for Major Assemblies & Ramps, **Pages 82-83**.*		

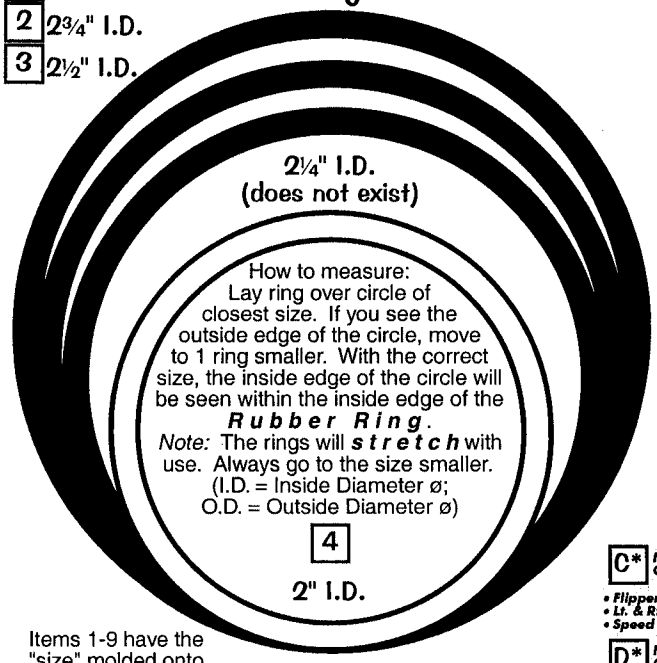
№	ABOVE MISC. PCB PART NAME	QTY.	SPI PART №
D	4-Position OPTO (Transmitter) PCB	1	520-5218-00
E	Dot Display (5X7) x3 PC Board	1	520-5197-00
	***Note:** For more details on Items D & E and a break-down of parts, see Sec. 5, Chapter 4, Printed Circuit Boards, **Pages 131 & 133**. For how Items D & E are secured or for a better view, see Section 4, Chapter 2, Drawings for Major Assemblies & Ramps, Item D, **Page 87**; Item E, **Page 79**.*		

Take Note:

1. Some items or parts *may be included with* **or** *associated with* a Major Assembly or Ramp Assembly; **see the Blue Pages, Sec. 4, Chp. 2.** for parts required not appearing on this page. If you still cannot find the part required, Call Stern™ Pinball Technical Support, 1-800-542-5377 or 1-708-345-7700.
2. **Legend Note:** Items noted with a black square ■ are General Parts. Items noted with a white square □ are Switches.

Playfield - Rubber Parts ☐ (Rings Actual Size) †

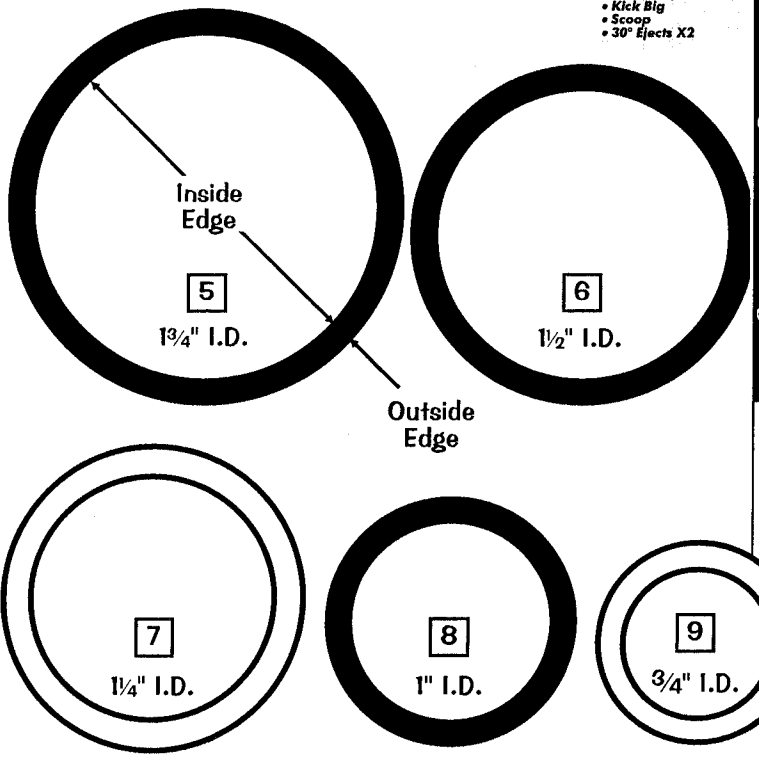
1 3" I.D.
2 2¾" I.D.
3 2½" I.D.

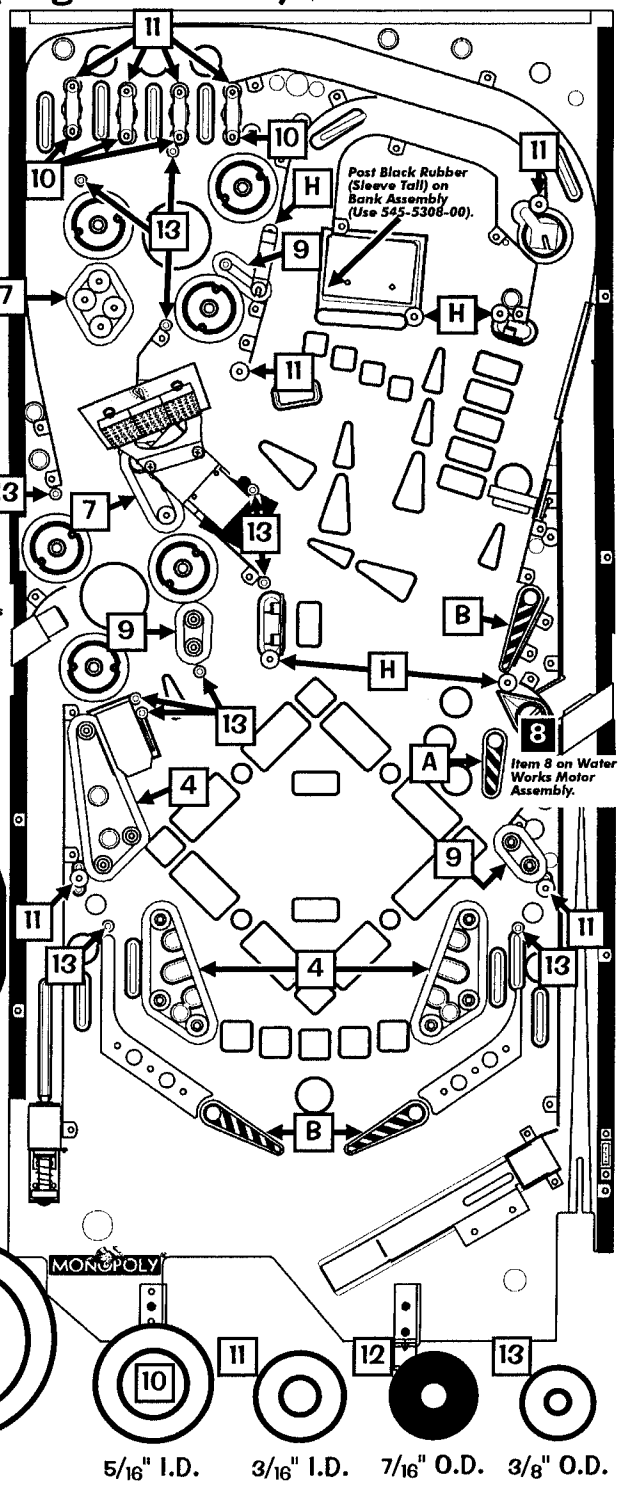


Items 1-9 have the "size" molded onto the Rubber Ring.

C* Not Shown: Qty. 8
- Flipper Assemblies
- Lt. & Rt. Plas. Ramps
- Speed Bump Ramp

D* Not Shown: Qty. 1 Per
- Trough Up-Kicker
- Kick Rig
- Scoop
- 30° Ejects X2





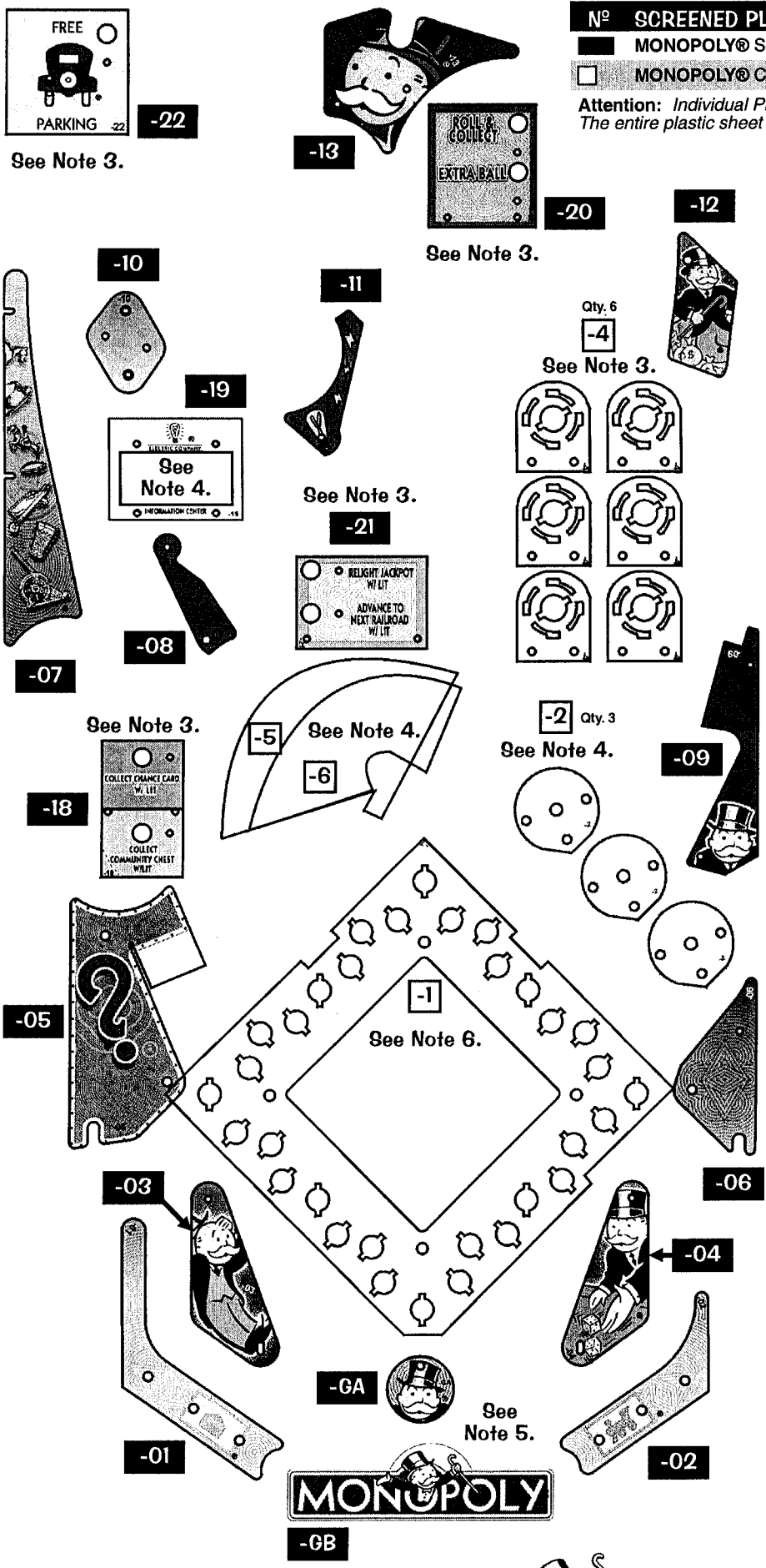
№	RUBBER PART NAME	QTY.	SPI PART №
A	Small Flipper **RED** Rubber Ring	1	545-5207-00
B	Large Flipper **RED** Rubber Ring	3	545-5277-00
C*	Deflector Pad (Bumper) **BLK** Rubber	8	545-5428-00
D*	Rubber Bumper (Grommet)	5	545-5105-00
E	Bumper Post Rubber	0	545-5009-00
F	Rubber Flange Bumper	0	545-5965-00
G	Post Rubber (Sleeve Short)	0	545-5151-00
H	Post **WHITE** Rubber (Sleeve Tall)	6	545-5308-08
1	3" I.D. BLACK Rubber Ring	0	545-5348-10
2	2¾" I.D. BLACK Rubber Ring	0	545-5348-20
3	2½" I.D. BLACK Rubber Ring	0	545-5348-09
4	2" I.D. **WHITE** Rubber Ring	3	545-5348-**58**
5	1¾" I.D. BLACK Rubber Ring	0	545-5348-21
6	1½" I.D. BLACK Rubber Ring	0	545-5348-07
7	1¼" I.D. **WHITE** Rubber Ring	2	545-5348-**56**
8	1" I.D. **BLACK** Rubber Ring	1	545-5348-05
9	¾" I.D. **WHITE** Rubber Ring	3	545-5348-**54**
10	5/16" I.D. **WHITE** Rubber Ring	4	545-5348-**52**
11	3/16" I.D. **WHITE** Rubber Ring	7	545-5348-**51**
12	7/16" O.D. BLACK Rubber Ring	0	545-5348-17
13	3/8" O.D. **WHITE** Rubber Ring	11	545-5348-**69**
14	O-Ring 11/32" X 7/32" X 1/16"	0	545-5850-00

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

Playfield - Plastics (Screened ■ & Clear □) & Decals (Not Shown)*

№	SCREENED PLASTIC PART NAME	SPI PART №
■	MONOPOLY® Screened Plastic Set	830-5985-XX
□	MONOPOLY® Clear Plastic Set	830-5987-XX

Attention: *Individual Pieces are not be available. The entire plastic sheet set must be ordered.*



Take Note:

1. To order the entire Plastic Sheet Set (Screened & Clear), use the above Part Number with the "-XX" ending.
2. **Legend Note:** Items noted with a black square ■ are Screened. Items noted with a white square □ are Clear.
3. The following Plastic Pieces require riveting, if replaced:
   -20 (Roll & Collect/Extra Ball), see **Page 55 (Item 14)** for brackets & securing hardware.
   -18 (Collect Chance...) & **-22** (Free Parking), see **Pages 82 & 83** for brackets & securing hardware.
   -4 (Clear: Flash Lamp Mounts) see **Pgs. 82-85** for securing hardware.
   -21 (Relight Jackpot...), see **Page 86** for brackets & securing hardware.
4. For bracket(s) and/or securing hardware:
   -2 (Clear Driven Wheel), see **Page 81**.
   -5/-6 (Clear Covers), see **Page 86.**
   -19 (Electric Company) see **Page 87**.
5. **-GA** (Key Fob) & **-GB** (Monopoly Logo) are provided for collecting and are not used in the game.
6. If Clear Piece **-1** (Lamp Board) requires replacement, ***mark the socket and corresponding hole with numbers as to not mix up the lamps.*** See **Pages 22-23** to verify lamps were put back in the correct order per the Lamp Matrix.

MONOPOLY® DECALS	SPI PART №
Game 75 Decal Set	820-6287-XX
Left, Center & Right Bottom Arch; Shooter Lane Bottom Arch; Coin Door Monopoly® Logo; "Install 4 Balls"; Portals...; "Bank"; Cop (Drop Target).	
Spinner Decal (Qty. 2)	820-5215-00
DTS **A-G** (under P/F)	820-6221-75
Miscellaneous *(Backbox, Cabinet & P/F):*	
Suitable ... Use (UL)	820-6001-01
High Voltage Label (UL)	820-6082-01
Power Box	820-6123-03
Can. UL Listing	820-6141-01
Fuse Label (UL)	820-6143-00
Gen. Backbox Fuse Loc.	820-6152-01
Power	820-6223-00
Protective Earth	820-6224-00
Shock Hazard Label (UL)	820-6263-00
"CAUTION - VERY HOT"	820-6266-00

OPTIONAL MYLAR	SPI PART №
Optional Clear Playfield Set *(Not Included with game)*	820-5094-00

Playfield - Rails ■, Wire Forms □, Ball Guides □ and Flat Metal Ramps ▒ †

№	WOOD RAIL PART NAME	QTY.	SPI PART №
1	Wood Rail Left	1	525-5594-00
2	Wood Rail Right	1	525-5595-00

Items 1 & 2 are secured by: #6 X 1-1/4" PFH A (Zinc) (Qty. 6/per) (237-5804-00)

№	METAL FLAT RAIL PART NAME	QTY.	SPI PART №
3	Metal Flat Rail (Shooter Lane Left, Lower)	1	535-8933-00
4	Metal Flat Rail (Behind Mini-Flipper)	1	535-8934-00
5	Metal Flat Rail (Shooter Lane Right)	1	535-8935-00
6	Metal Flat Rail (Shooter Ramp Left, Upper)	1	535-8936-00
7	Metal Flat Rail (2.6", Behind Upr. Flipper)	1	535-8937-00
8	Metal Flat Rail (Full Top Left to Right Orbit)	1	535-8939-00
9	Metal Flat Rail (Dice Eject Lane, Lower)	1	535-8940-00
10	Metal Flat Rail (Dice Eject Lane, Upper)	1	535-8942-00
11	Metal Flat Rail (Dice Eject Lane, Left)	1	535-8943-00
12	Metal Flat Rail (2.2", Upper Bot. Pop, Rt.)	1	535-8944-00
13	Metal Flat Rail (Upper Bottom Pop Left)	1	535-8945-00
14	Metal Flat Rail (Ball Lock Lane, Right)	1	535-8948-00
15	Metal Flat Rail (Ball Lock Lane, Left)	1	535-8949-00
16	Metal Flat Rail (Center Drain, under Arch)	1	535-8393-00

Items 3-16 are secured at Tabs by: #8 X 1/2" HWH AB (Zc.) (Qty. 1/per tab) (234-5101-00)

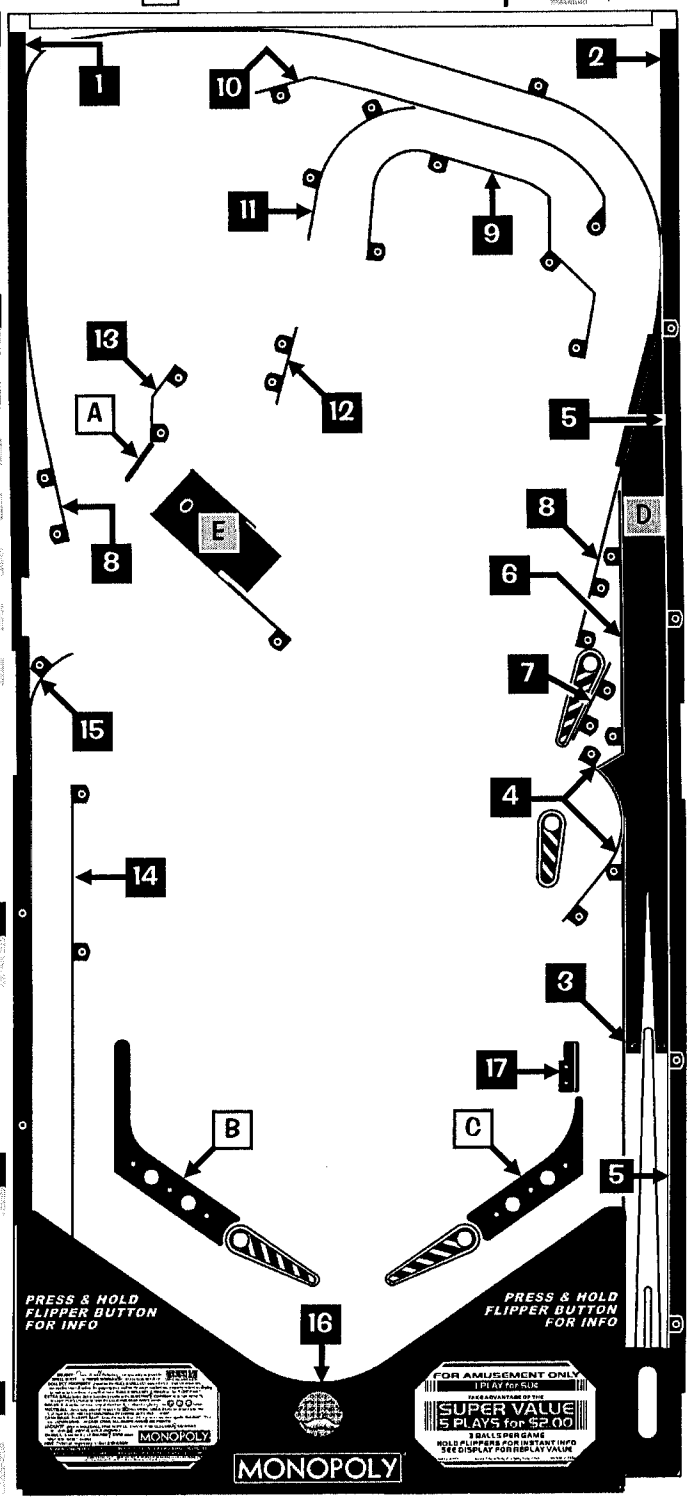
№	MISC. PART NAME	QTY.	SPI PART №
17	Lane Divider Bracket	1	535-8972-00

Item 17 is secured under the playfield by: #8 X 1/2" HWH AB (Zc.) (Qty. 2) (234-5101-00)

№	WIRE FORM PART NAME	QTY.	SPI PART №
A	Snubber Wire	1	535-5373-02

№	BALL GUIDE RAIL PART NAME	QTY.	SPI PART №
B	Ball Guide (Steel) Return Lane Left	1	535-8950-00
C	Ball Guide (Steel) Return Lane Right	1	535-8951-00

Items B & C are secured onto posts by: #6-32 Nylon Stop Nut (Qty. 3/per) (240-5005-00)



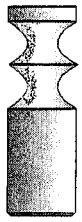
№	FLAT RAMPS PART NAME	QTY.	SPI PART №
D	Shooter Lane Ramp	1	535-8938-00

Item D is secured by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00) **and** #4 X 1/2" PFH (Zinc) (Qty. 2) (237-5840-00)

E	Speed Bump Metal Ramp Riv. Assy.	1	515-7202-00

Note on Item E: *For securing hardware and a break-down of parts on this item, see the Blue Pages, Sec. 4, Chp. 2, Drawings for Major Assemblies & Ramps, Page 87.*

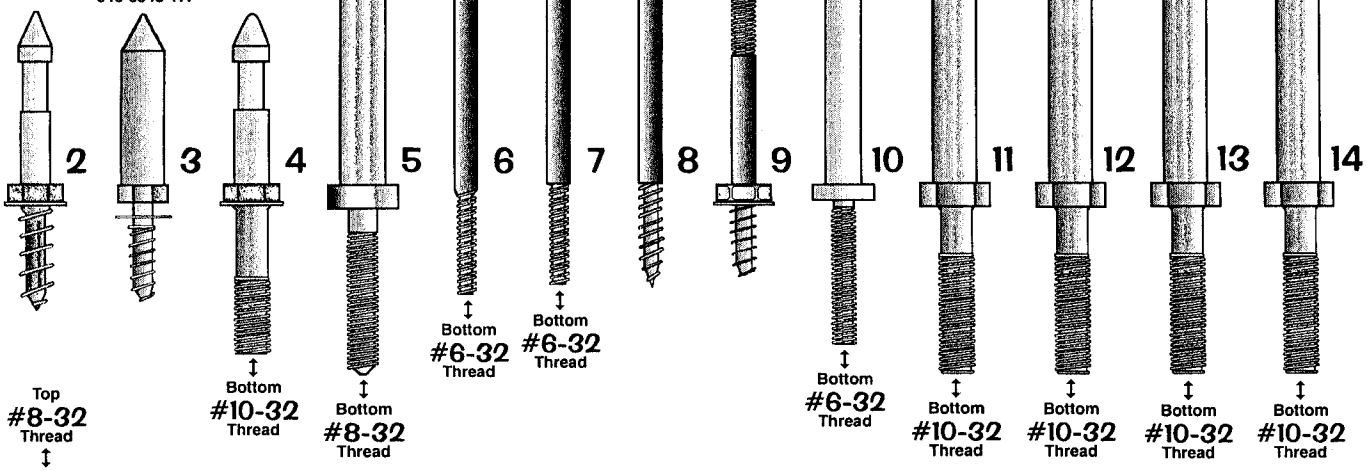
Playfield - Metal Posts (Screws) and Nuts (Actual Size) †

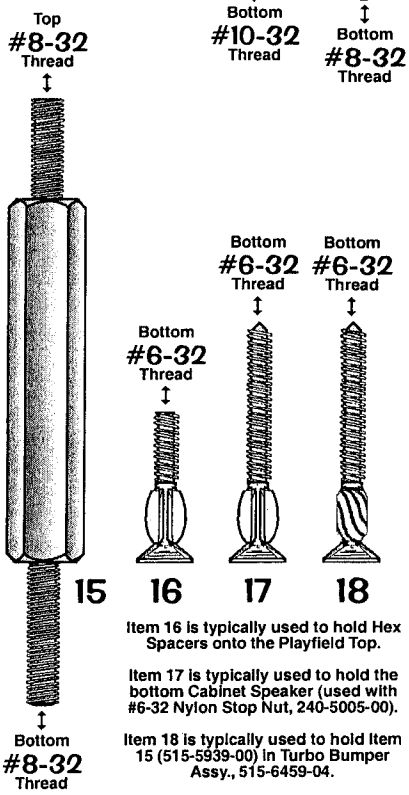


1

Item 1 Post can use 3/16" I.D. Rubber Ring, 545-5348-01; or if Item 1 Post is used in pairs, can use 3/4" — 3" Rubber Rings.

Items 2 & 4 Posts can use 7/16" O.D. Rubber Ring, 545-5348-17.





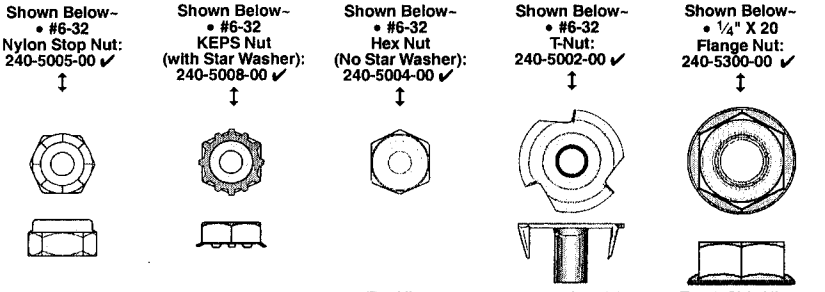
Item 16 is typically used to hold Hex Spacers onto the Playfield Top.

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:*

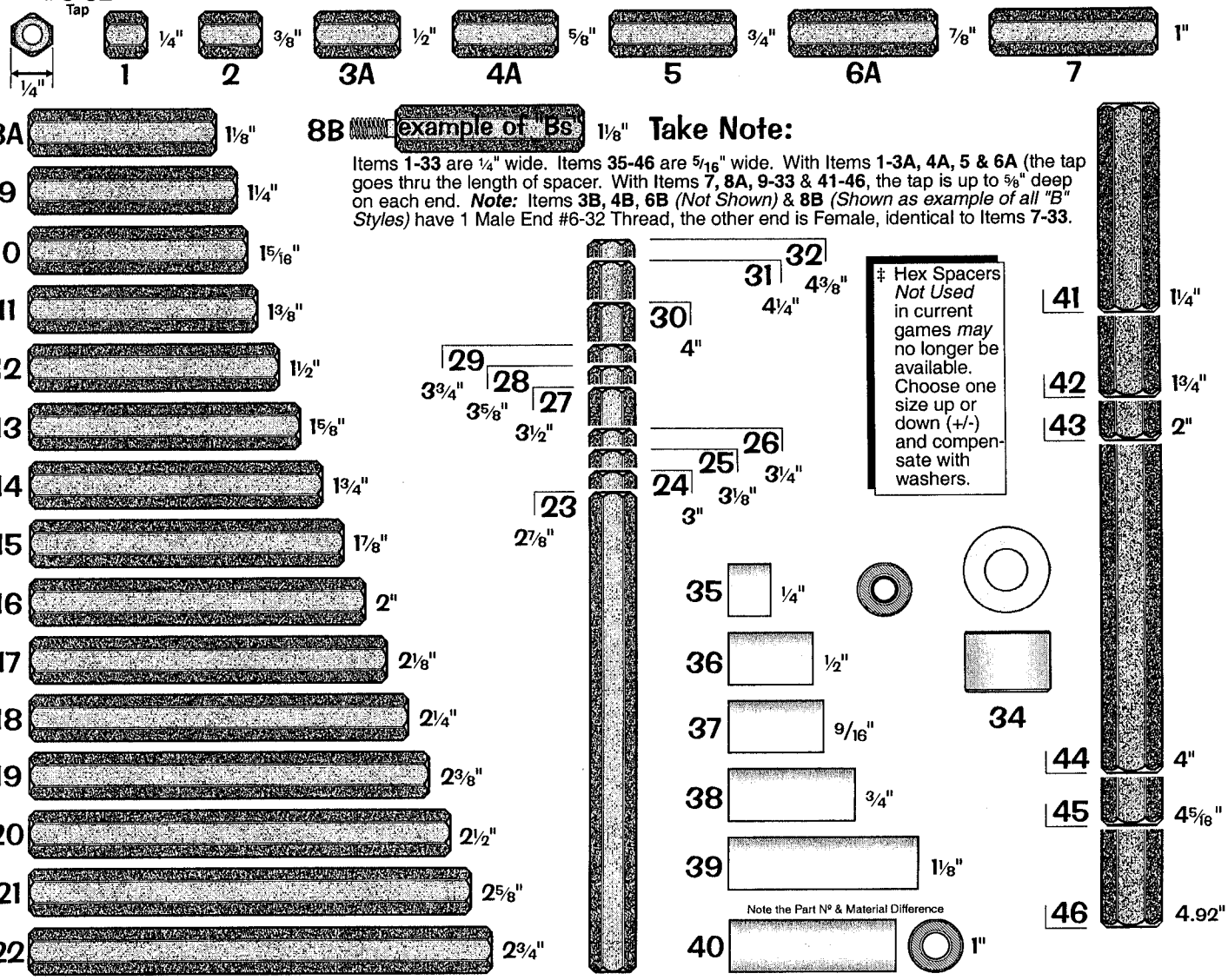
- Plastic Pal Nut (on Flipper Buttons): 240-5003-00
- Metal Pal Nut (on Flipper Buttons): 240-5003-01 ✔
- #6-32 Wing Nut: 240-5001-00
- #8-32 Wing Nut: 240-5100-00
- 1/4"-20 Wing Nut: 240-5302-00
- 1/4"-20 Toggle Wing: 240-5324-00

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

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

Playfield - Metal Spacers (Actual Size) †

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



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.

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

THIS GAME ONLY:

Like Item 1 above, but with #8-32 Tap (Qty. 1) (254-5031-01) used on Bank Assy. (Item 10, Page 79).

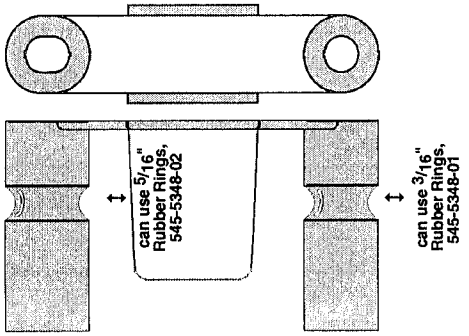
Similiar to Item 16 above, but 1.9" & Male End #8-32 (Qty. 1) (254-5031-03) see Left Ramp (Page 83).

Like Item 16 above, but with Male End #8-32 (Qty. 1) (254-5031-04) see Rt. Ramp (Page 85).

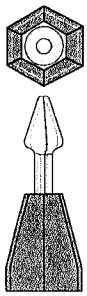
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

Playfield - Plastic Posts and Spacers (Actual Size) †

1** Various Colors



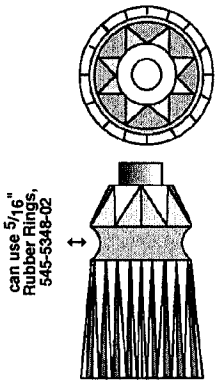
2** Various Colors



3** Limited Colors



4** Various Colors



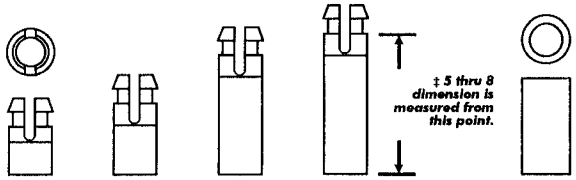
Items 3-4 Posts used in pairs can use 3/4" through 3" Rubber Rings, (See Rubber Parts for Part Nºs).

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



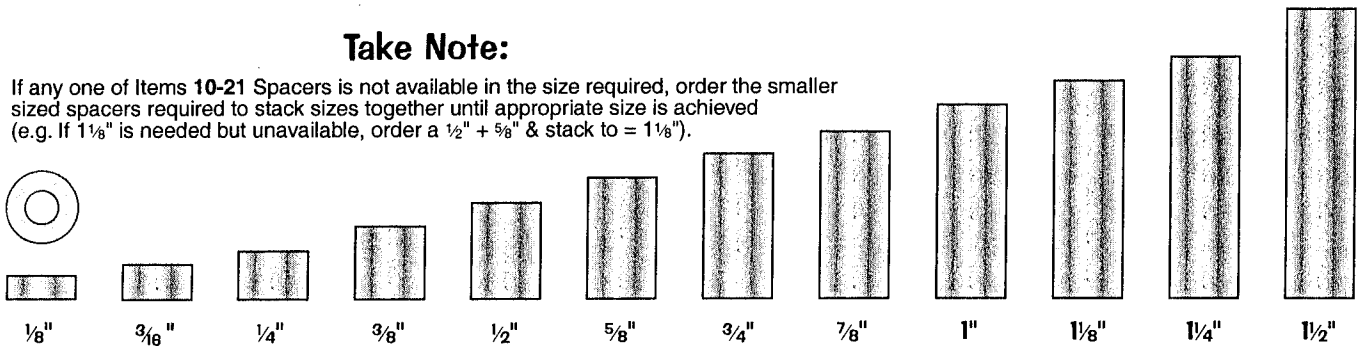
1/4" 3/8" 5/8" 3/4" 1/2"

‡ 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 20 21

Take Note:

If any one of Items **10-21** 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").



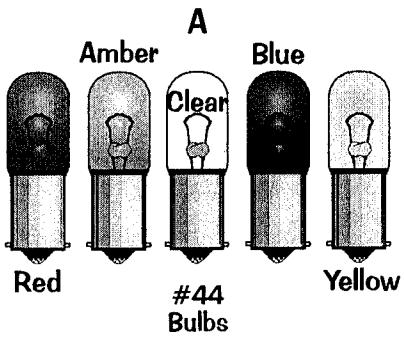
⅛" 3/16" ¼" ⅜" ½" ⅝" ¾" ⅞" 1" 1⅛" 1¼" 1½"

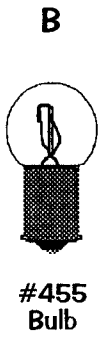
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

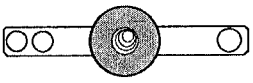
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
1**	Top Lane Mini-Light Hood (Red)	4	550-5061-02
	Item 1 typically secured by: #6-32 X 1-3/4" PPH MS (Zinc) (Qty. 2/per) (237-5511-00) and Washer 9/64" X 5/16" OD X 1/32" (Qty. 2/per) (242-5017-00)		
2**	Mini-Jewel Post Clear	0	550-5052-01
	Item 2 typically secured by: #6 X 3/8" HWH AB (Zinc) (Qty. 1/per) (234-5000-00)		
3**	1 1/16" Single Groove Post (Clear)	19	550-5059-01
4**	*Single* Groove Jewel Post (Clear)	12	550-5034-01
	Items 3 & 4 typically secured by: Post Fastening Screw #6-32 Top / #6-32 Bottom (Qty. 1/per) (530-5012-02, Item 7 Page 59)		
5 ‡	¼" Slf. Rtn. Spacer White	0	254-5007-02
6 ‡	⅜" Slf. Rtn. Spacer White	10	254-5007-01
7 ‡	⅝" Slf. Rtn. Spacer White	0	254-5007-00
8 ‡	¾" Slf. Rtn. Spacer White	0	254-5007-03
9	½" X ¼" Spacer White (Narrow)	0	254-5000-03
	THIS GAME ONLY: *Like Item 8 above, but 1/2" & fits a #8 screw (Qty. 4) (254-5032-04). Used on 4-Position OPTO (Trans.) Board (Item AP-8, Page 79).*		

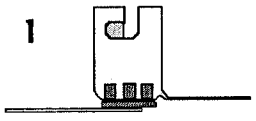
Nº	PLASTIC POST/SPACER NAME	QTY.	SPI PART Nº
10	⅛" X ⅜" Spacer Gray	0	254-5000-19
11	3/16" X ⅜" Spacer Gray (4 for Dot Display)	4	254-5000-18
12	¼" X ⅜" Spacer Gray	0	254-5000-02
13	⅜" X ⅜" Spacer Gray	3	254-5000-12
14	½" X ⅜" Spacer Gray	0	254-5000-01
15	⅝" X ⅜" Spacer Gray	12	254-5000-14
16	¾" X ⅜" Spacer Gray	0	254-5000-07
17	⅞" X ⅜" Spacer Gray	0	254-5000-11
18	1" X ⅜" Spacer Gray/Black	0	254-5000-04
19	1⅛" X ⅜" Spacer Gray	0	254-5000-06
20	1¼" X ⅜" Spacer Gray	0	254-5000-05
21	1½" X ⅜" Spacer Gray	1	254-5000-08

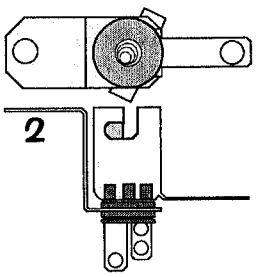
Playfield - Small Bayonet Type Bulbs and Sockets (Actual Size) †

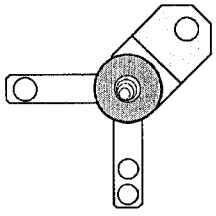


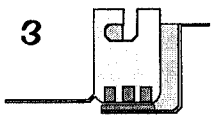


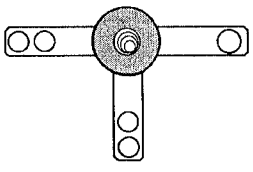


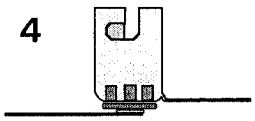


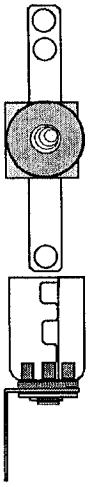


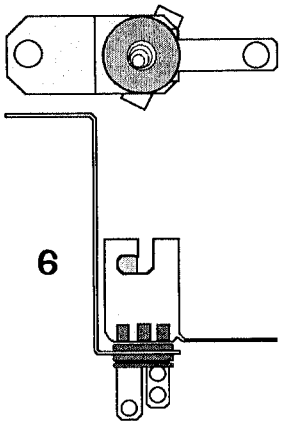


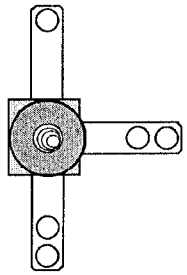


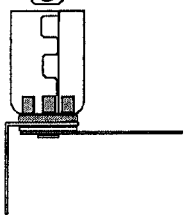


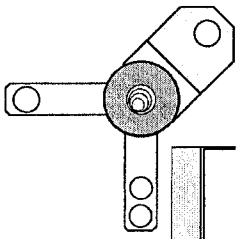


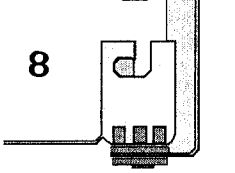


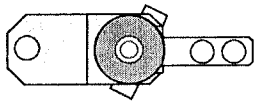


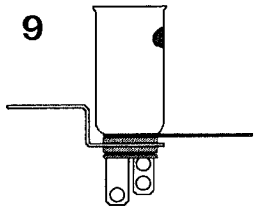


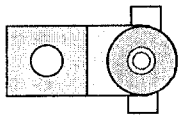


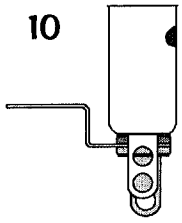


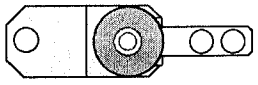


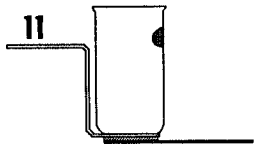


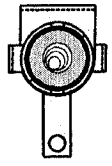


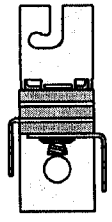








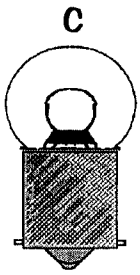




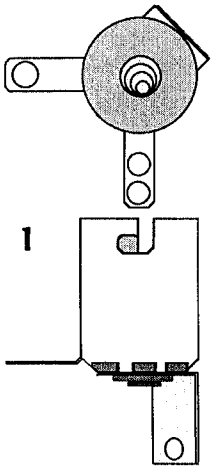
Nº	SMALL BULB & SOCKET NAME	QTY.	SPI PART Nº
A	#44 Bulb (Clear)	22	165-5000-44
A	#44 Bulb (Red)	0	165-5053-02
A	#44 Bulb (Amber)	0	165-5053-03
A	#44 Bulb (Blue)	0	165-5053-05
A	#44 Bulb (Yellow)	10	165-5053-06
B	#455 Twinkle Bulb	0	165-5003-00
1	2-Lug Staple Down Socket	4	077-5000-00
2	3-Lug Stand-Up Short Socket	0	077-5008-00
3	2-Lug Stand-Up Short Socket	0	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	10	077-5013-00
10	2-Lug Stand-Up Lg. Shell Socket (GIs)	17	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

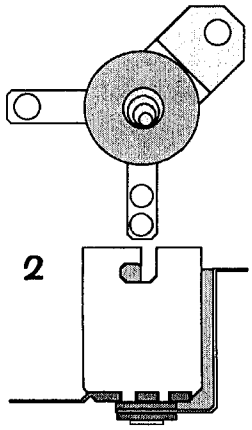
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

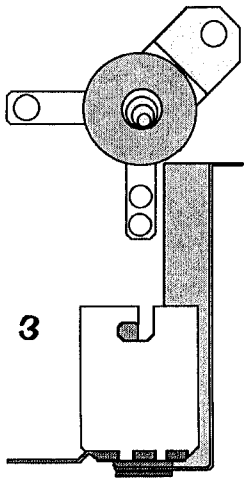
Playfield - Large Bayonet Type Bulb and Sockets (Actual Size) †

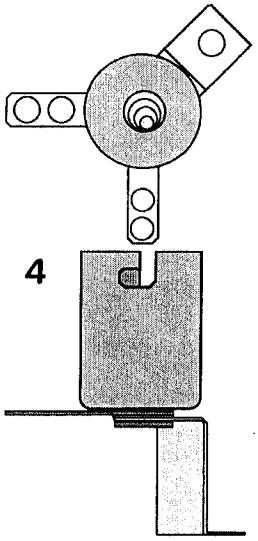


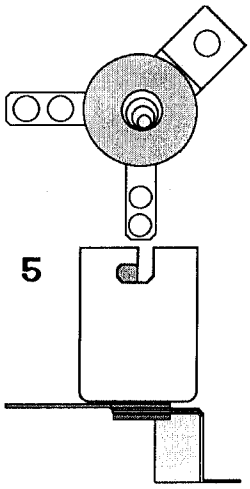
#89
Bulb

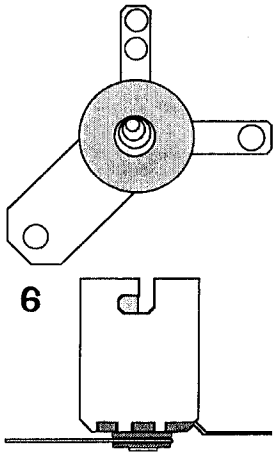








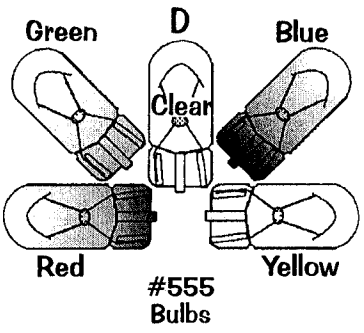


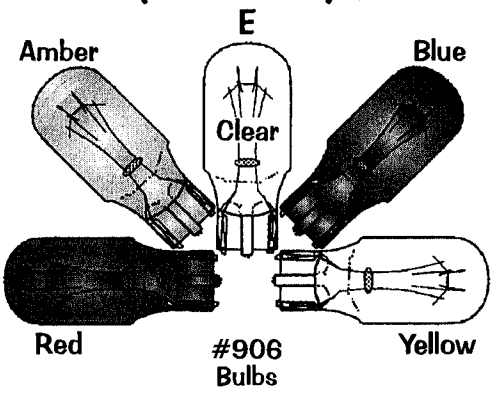


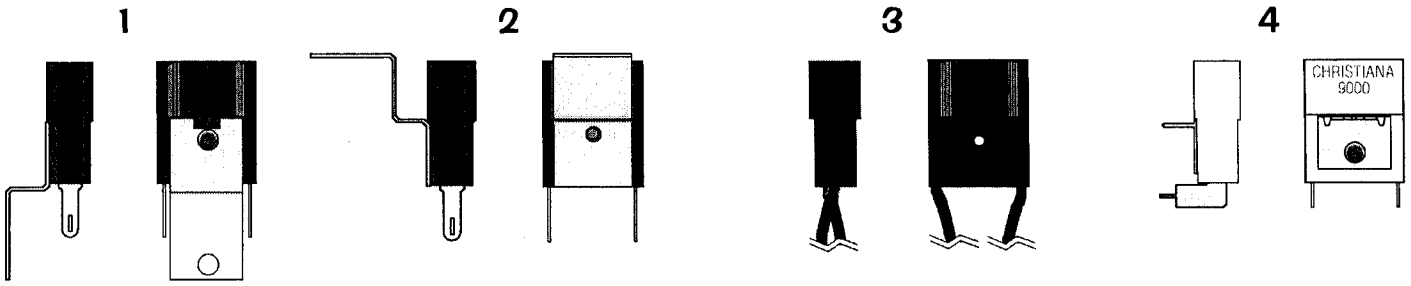
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

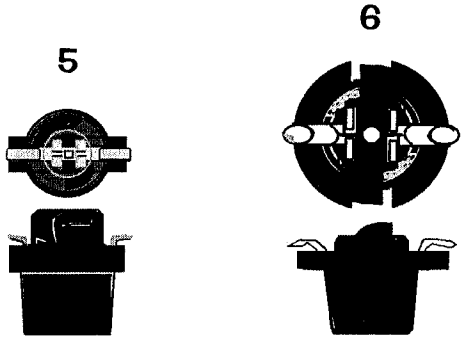
№	LARGE BULB & SOCKET NAME	QTY.	SPI PART №
C	#89 Bulb	3	165-5000-89
1	Laydown Standard Socket	3	077-5100-00
2	2-Lug Stand-Up Short Socket	0	077-5101-00
3	2-Lug Stand-Up Long Socket	0	077-5102-00
4	Stand-Up Socket Rev. Short	0	077-5103-00
5	2-Lug Stand-Up Small Socket	0	077-5106-00
6	Straight Leg Socket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

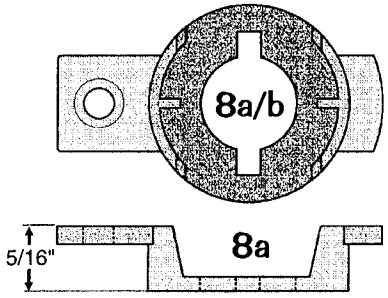
Playfield - Wedge Base Bulbs and Sockets (Actual Size) †











Take Special Note

Item 7a is an **IDC** (Insulation Displacement Connection) Style Socket (this style is solderless). This socket is secured to the playfield or component by Items **8a** or **8b** Snap-On Socket Brackets, or *may* also be snapped into **Item 9** Socket Mounting Plastic Board (used only when sockets are positioned closely together).

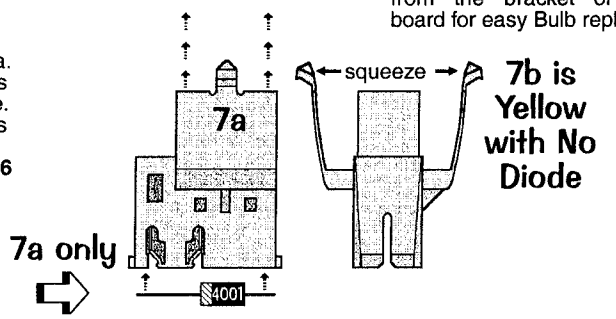
Just squeeze the "side arms" of the socket together and pull away from the bracket or mounting board for easy Bulb replacement.

Take Note:

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

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 **7a/b.**
5. Item **7a** Socket is equipped with a *built-in* Diode, 1N4003 (112-5003-00), however, replacement can be made with a 1N4001 Diode (112-5001-00).
   Item **7b** Socket is ***NOT*** equipped with a diode (not required).

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



№	WEDGE BULB & SOCKET NAME	QTY.	SPI PART №
D	#555 Wedge Base Bulb (Clear)	74	165-5002-00
D	#555 Wedge Base Bulb (Red)	2	165-5054-02
D	#555 Wedge Base Bulb (Green)	0	165-5054-04
D	#555 Wedge Base Bulb (Blue)	1	165-5054-05
D	#555 Wedge Base Bulb (Yellow)	4	165-5054-06
E	#906 Wedge Base Bulb (Clear)	6	165-5004-00
E	#906 Wedge Base Bulb (Red)	0	165-5004-02
E	#906 Wedge Base Bulb (Amber)	0	165-5004-03
E	#906 Wedge Base Bulb (Blue)	0	165-5004-05
E	#906 Wedge Base Bulb (Yellow)	0	165-5004-06

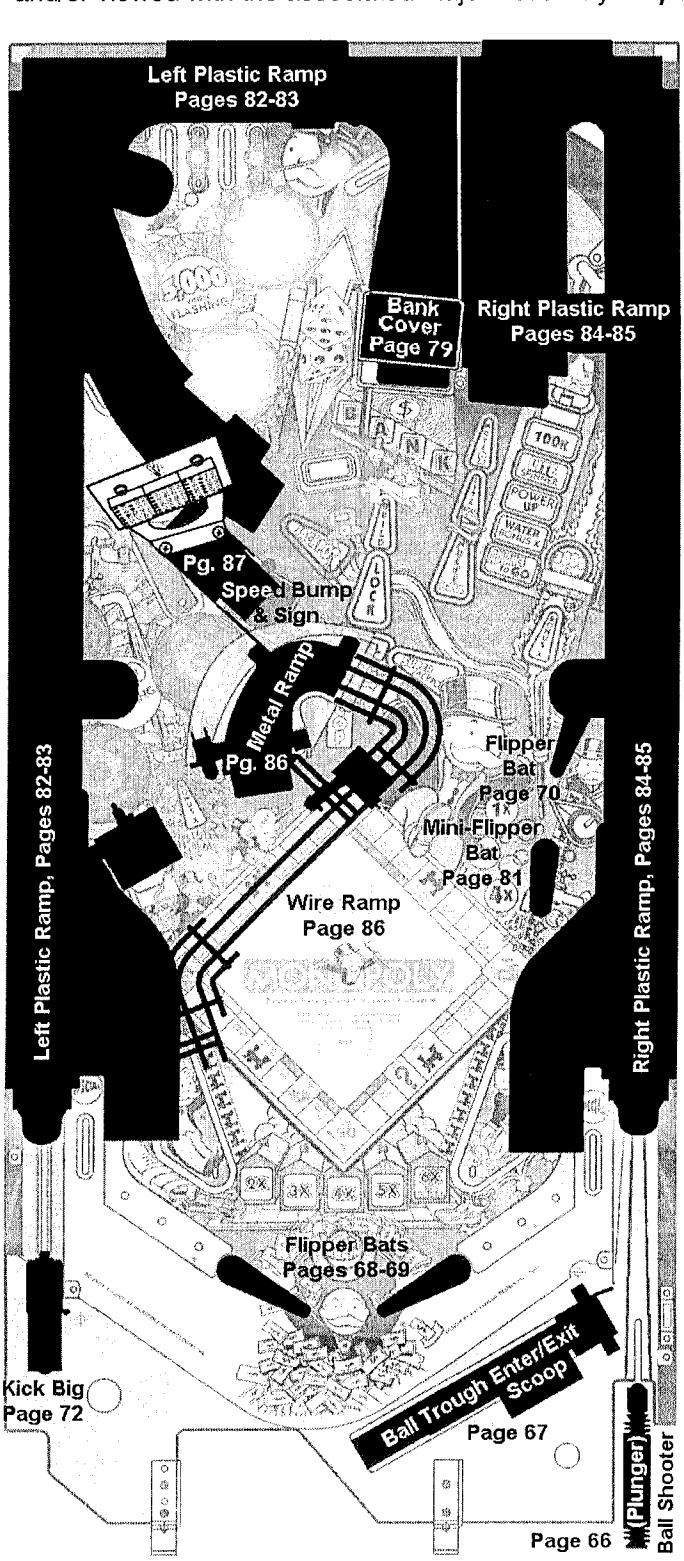
№	WEDGE BULB & SOCKET NAME	QTY.	SPI PART №
1	#555 Wedge Base Socket (Laydown)	0	077-5026-01
2	#555 Wedge Base Socket (Offset)	7	077-5029-00
3	#555 W.B. Socket (for Pop Bumper)	6	077-5206-00
4	#555 W.B. Socket (Solder Type)	0	077-5207-00
5	#555 Wedge Base Socket (Twist)	0	077-5007-00
6	#906 Wedge Base Socket (Twist)	0	077-5016-00
7a	#555 IDC Snap-On Socket	68	077-5216-00
7b	#555 IDC Snap-On Socket ***No Diode***	6	077-5216-**01**
8a	5/16" Ht. Snap-On Socket Bracket	36	545-5760-18
8b*	19/32" Ht. Snap-On Socket Bracket	0	545-5760-19
9a*	Clear Plastic Socket Mtg. Bd. (32/per)	1	830-5987-01
9b*	Clear Plastic Socket Mtg. Bd. (1/per)	6	830-5987-04

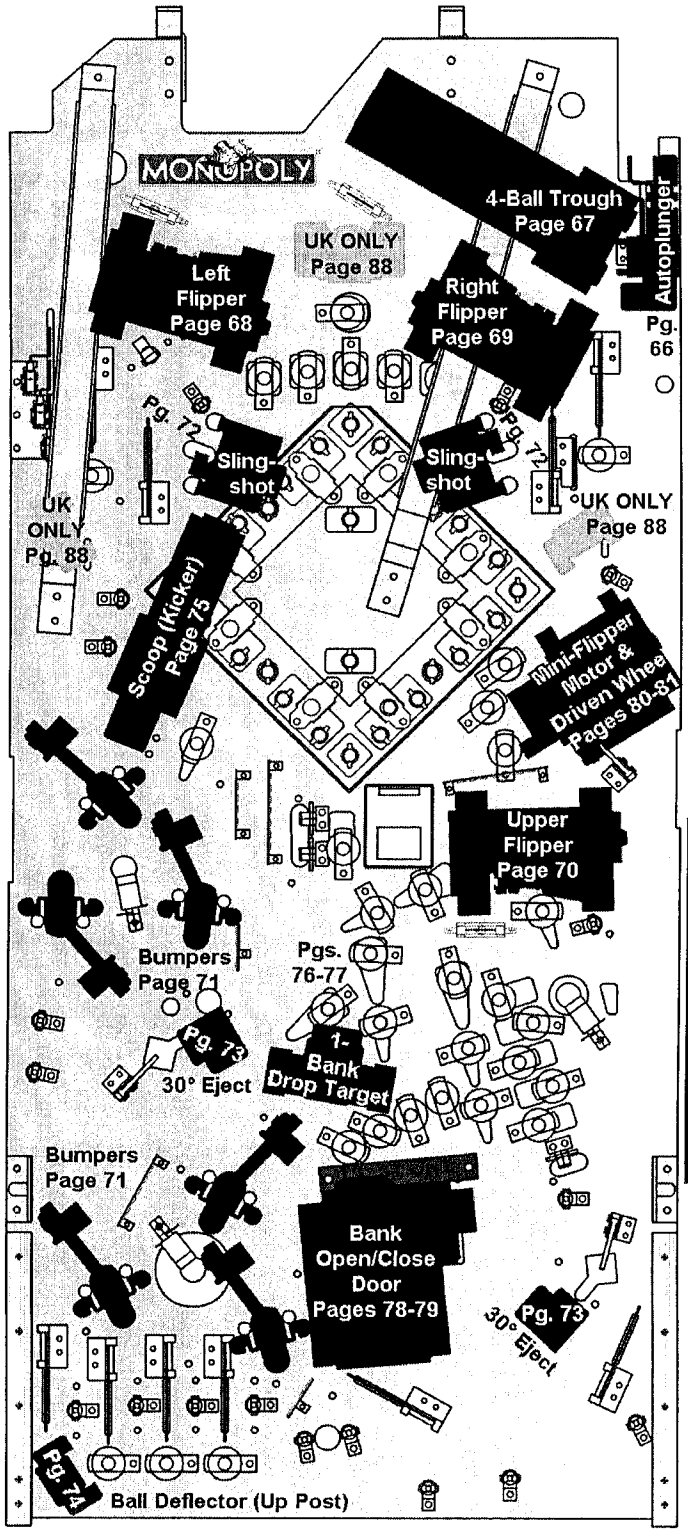
† Items with a Zero Qty. are not used in this game. Size and/or quantities may change during production.

Drawings for Major Assemblies & Ramps (The Blue Pages)

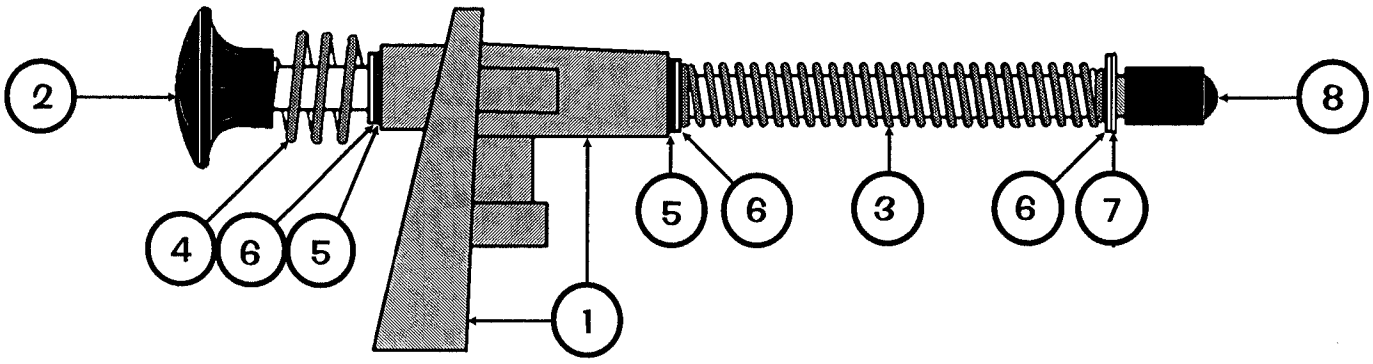
Overview

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 №. ASSOCIATED PARTS (AP-)** are noted and/or viewed with the associated Major Assembly. ***Important:*** Read all "**Take Note:**" items.





Ball Shooter (Plunger) Assembly, 500-6146-00-04 (Items 1-8)

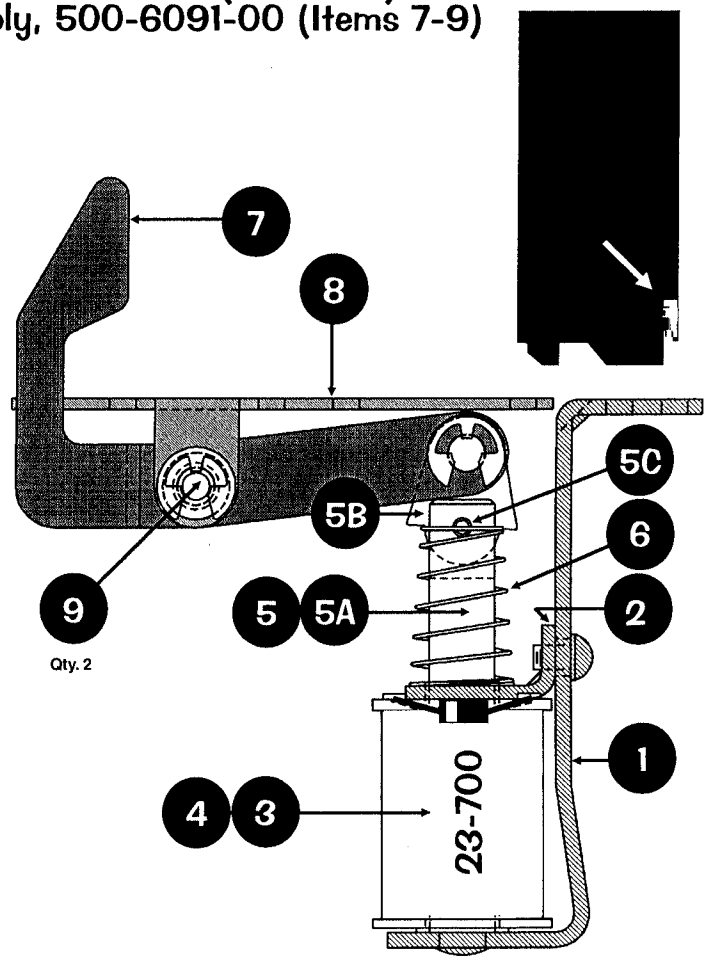


Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Housing (Shooter Assembly)	1	535-5067-02
	Item 1 is secured to the Cabinet by: Support Plate (Qty. 1) (535-5027-00), #10-32 X 1/2" PPH (Sems) Zinc TF (Qty. 3) (237-6033-00), #10 Split Lock Washer (Qty. 3) (234-5003-00) **and** #6 X 5/8" HWH AB (Zinc) (Qty. 2) (234-5002-00)		
2	Rod Assembly (w/Black Knob)	1	515-6557-00
3	Comp. (Return) Spring (GRN, .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

Autoplunger Coil Assembly, 500-6092-05 (Items 1-6) with Autoplunger Arm Weld Assembly, 500-6091-00 (Items 7-9)

Nº	'PLUNGER COIL PART NAME	QTY.	SPI PART Nº
1	Autoplunger Coil Bracket Assembly	1	515-6527-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 9) (234-5101-00)		
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, 23-700	1	090-5022-00T
	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)		
	Ordering Note: If **515-5338-00** *is unavailable*, order the individual part(s) actually required.		
6	Compression (Return) Spring	1	266-5020-00

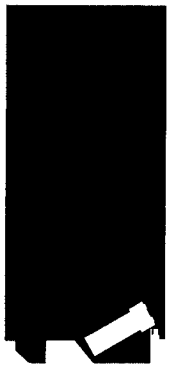
Nº	... ARM WELD PART NAME	QTY.	SPI PART Nº
7	Arm Weld Assembly	1	515-6526-00
	Item 7 is secured to Item 8 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
8	Autoplunger Fulcrum	1	535-7697-00
9	Nyliner, 1/4" (Thomson #4l1-FF)	2	545-5423-00



4-Ball Trough Assembly, 500-6318-14 (Items 1-13)

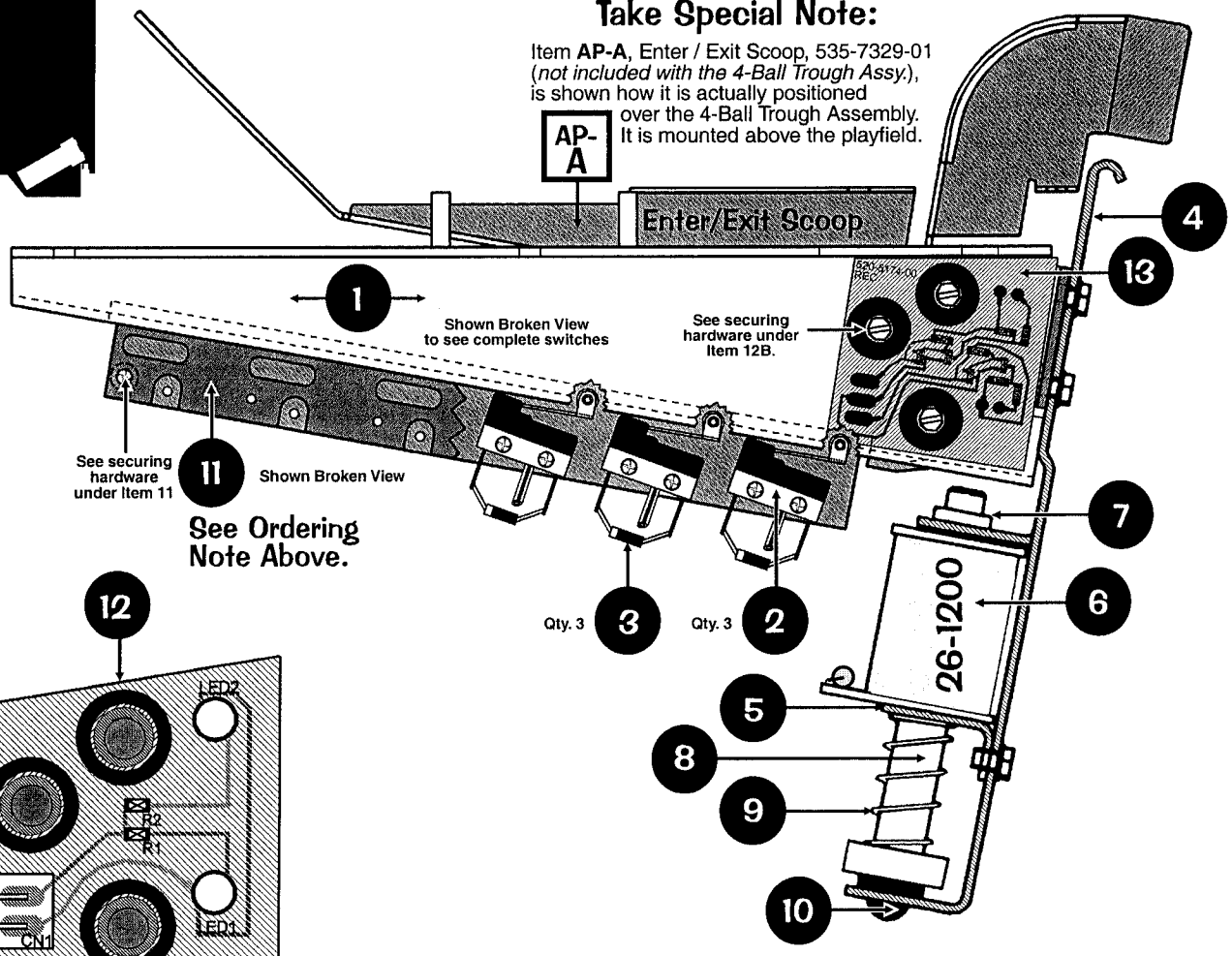
and Associated Parts: See Parts Table below.

Ordering Note: Identical to 500-6318-24 except does not require Item 11, Trough Ball Guide Plate (used only when magnets are present in the game).



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 12, Dual OPTO TRANS (Transmitter) Board, 520-5173-00, is mounted on the other side of the Trough Assembly, in line with Item 13, Dual OPTO REC (Receiver) Board, 520-5174-00, using same hardware.

Take Note:

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

For a break-down of parts of Items 12 & 13 OPTO Boards (520-5173-00 & 520-5174-00), see Section 5, Chapter 4, Trough Up-Kicker Dual OPTO Boards Theory of Operation & Schematic, Component Layout & Parts, Page 99.

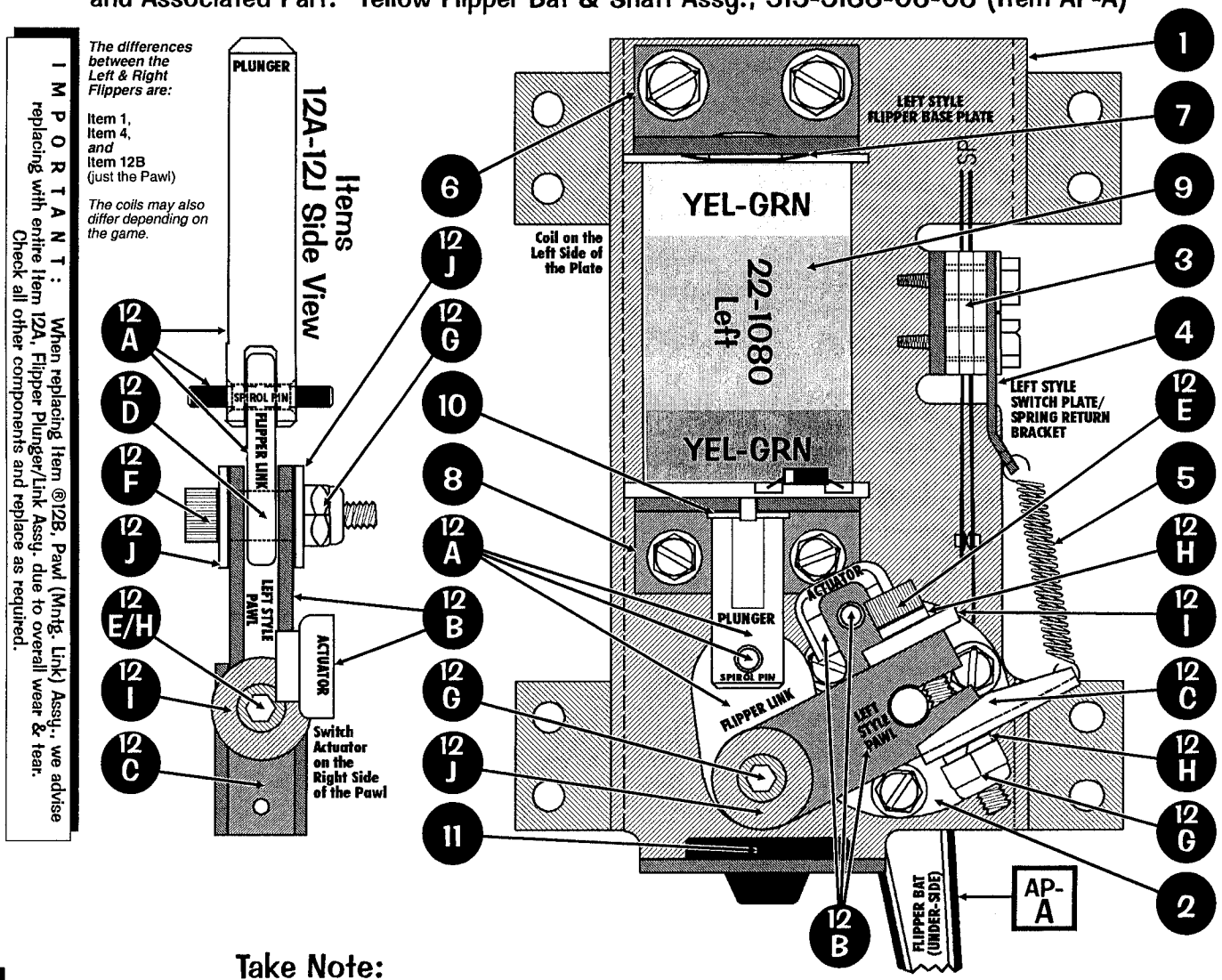
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Ball Trough Outhole Mounting Bracket	1	515-6580-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
2	Micro Switch (Roller Actuator, Lite-Force)	3	180-5119-02
	Item 2 is secured to Item 1 by: #2-56 X 1/2" HWH (Sr) UNS #4HD TR3 BO (Qty. 6) (237-5937-02)		
	Item 2 requires: Heat Shrink Tubing 1/8" ø PUI-24 (Qty. 1"/per) (605-5006-00)		
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 (Sr.) 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 Nº 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 (Return) Spring	1	266-5020-00

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
10	Rubber Bumper (Grommet)	1	545-5105-00
11	Trough Ball Guide Plate	0	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)		
12	Dual OPTO TRANS Board Assembly	1	515-5173-00
13	Dual OPTO REC Board Assembly	1	515-5174-00
	Items 12 & 13 are by: #6-32 X 5/8" HWH Swage (Serr) Zinc (Qty. 3/per) (237-5976-04)		
	For Individual Items use : Dual OPTO TRANS Bd. (Qty. 1) **(520-5173-00)**, Dual OPTO REC Bd. (Qty. 1) **(520-5174-00)**, OPTO PCB Tube Spacer (Brass) (Qty. 3/per) **(530-5308-02)** or OPTO PCB Rubber Grommet (Qty. 3/per) **(545-5518-00)**		

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

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

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

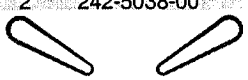


Take Note:

® "R" indicates Item noted is secured with rivet(s) as listed.

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**).		
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)		
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 (17/32" ID X 3/4" X 1")	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, 22-1080 (YEL-GRN) (Left)	1	090-5032-00T
	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

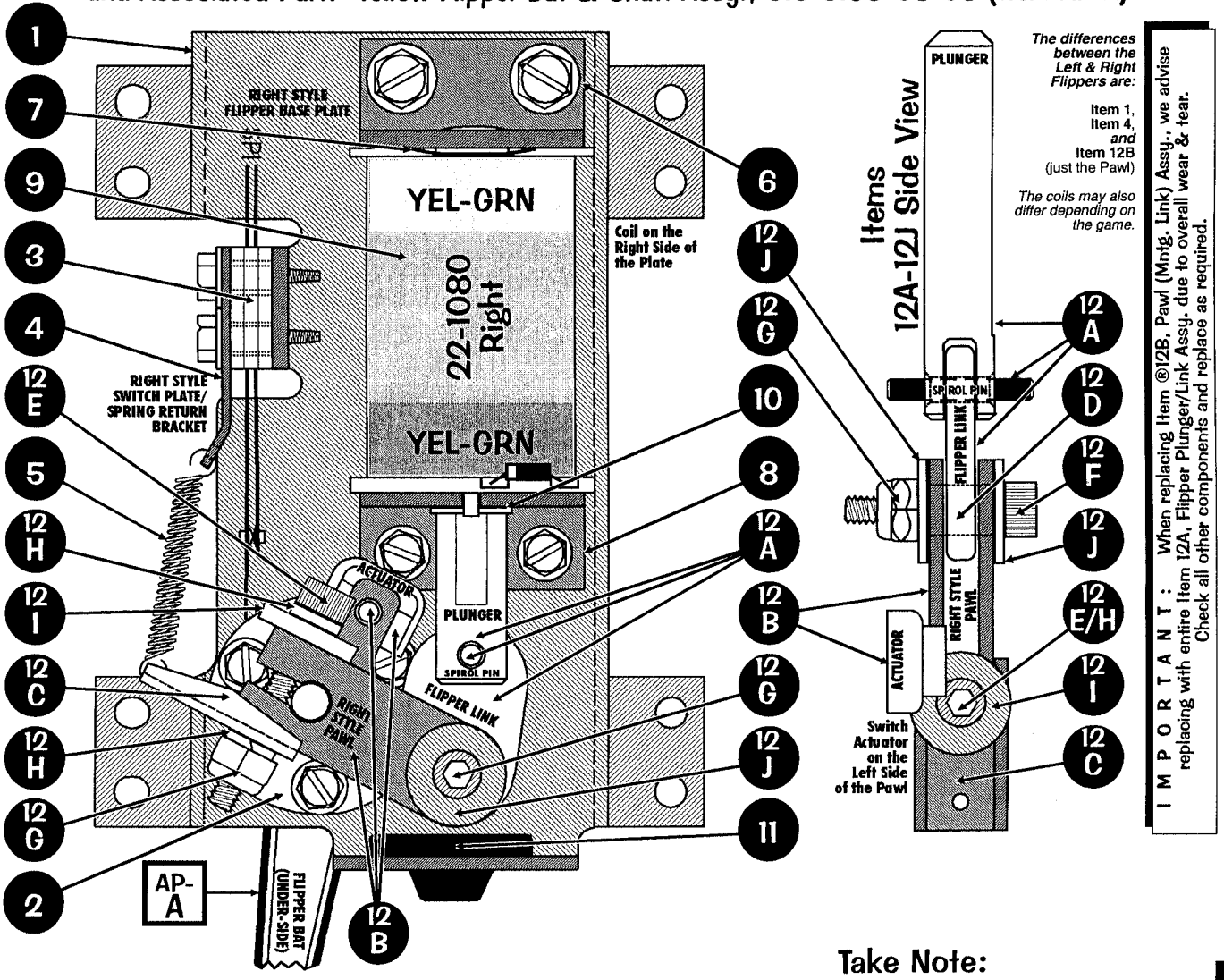
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Plunger, Link & Pawl (Left) Sub-Assy.	1	515-6518-01
	ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:		
12A	**Flipper Plunger/Link Sub-Assy.**	**1**	**515-6304-01**
includes :	*Plunger "Flipper" Link*	*1*	*545-5611-00*
includes :	*Spirol Pin ø 5/32" 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



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

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	**YELLOW** Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
	Large Flipper **RED** Rubber Ring	1	545-5277-22

Flipper (Right) Assembly, 500-5944-02 (Items 1-12)
and Associated Part: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A)

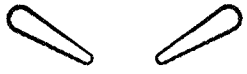


Take Note:

® "R" indicates Item noted is secured with rivet(s) as listed.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Flipper Base Plate Kit (Right)	1	515-6617-00
	ORDERING ABOVE (ITEM 1) KIT (RIGHT) PART № 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**).		
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)		
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 (17/32" ID X 3/4" X 1")	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, 22-1080 (YEL-GRN) (Right)	1	090-5032-00T
	ORDERING ABOVE (ITEM 9) COIL PART № 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

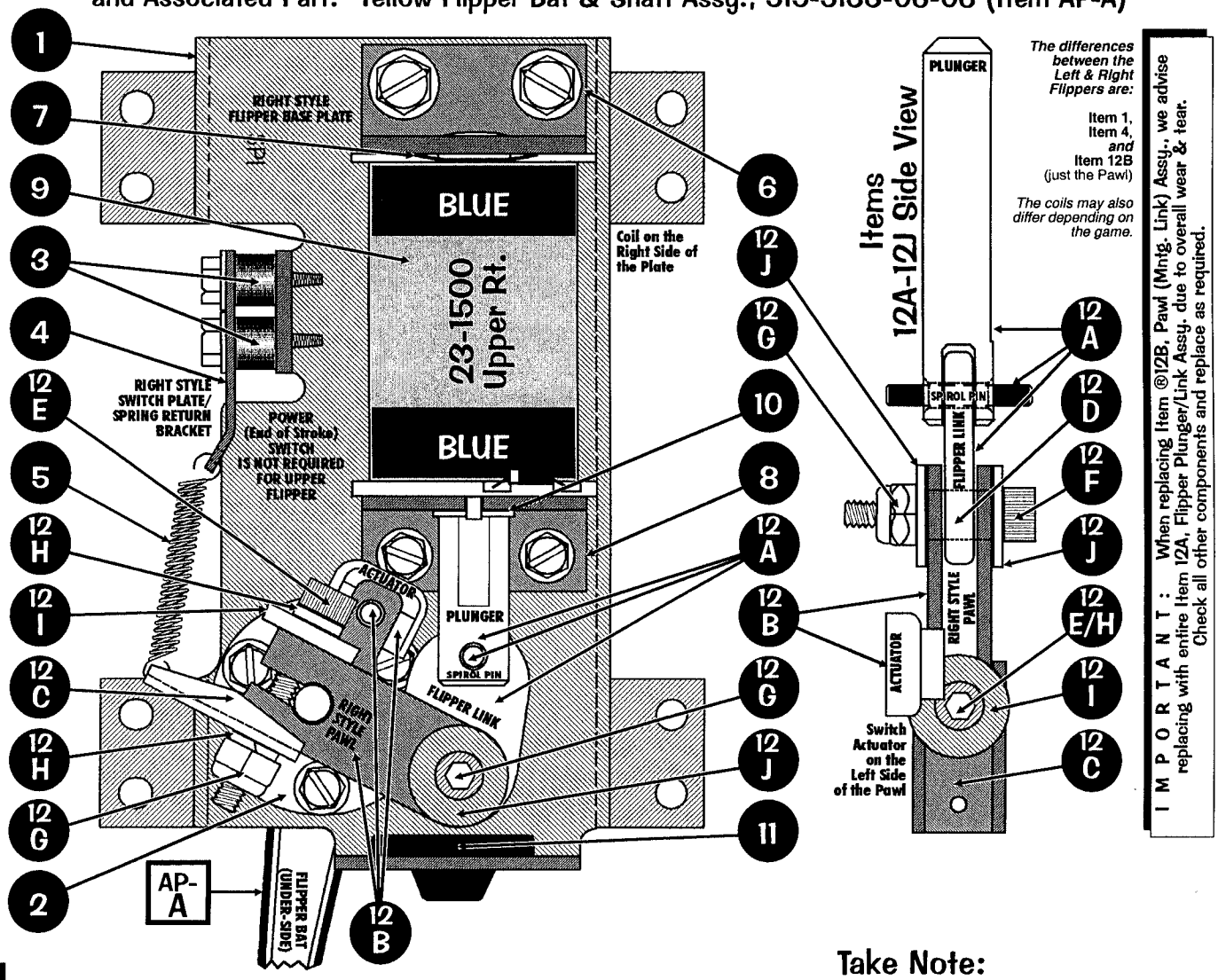
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
12	Plunger, Link & Pawl (Rt.) Sub-Assy.	1	515-6518-00
	ORDERING ABOVE (ITEM 12) SUB-ASSY. PART № WILL INCLUDE:		
12A	**Flipper Plunger/Link Sub-Assy.**	**1**	**515-6304-01**
includes :	*Plunger "Flipper" Link*	*1*	*545-5611-00*
includes :	*Spirol Pin ø 5/32" X 3/4" 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



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

№	ASSOCIATED PART NAME	QTY.	SPI PART №
AP-A	**YELLOW** Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
	Large Flipper **RED** Rubber Ring	1	545-5277-22

Flipper (Upper) Assembly, 500-5944-35 (Items 1-12)
and Associated Part: Yellow Flipper Bat & Shaft Assy., 515-5133-06-06 (Item AP-A)



Take Note:

® "R" indicates Item noted is secured with rivet(s) as listed.

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**).		
	Item 1 is secured below the playfield by: #10 X 1/2" HWH MS (Serr) Zinc ST (Qty. 8) (237-5949-00)		
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 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 (17/32" ID X 3/4" X 1")	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, 23-1500 (BLUE) (Upper Rt.)	1	090-5062-00T
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

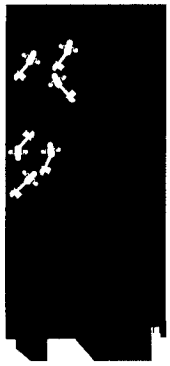
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
12	Plunger, Link & Pawl (Rt.) Sub-Assy.	1	515-6518-00
ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:			
12A	**Flipper Plunger/Link Sub-Assy.**	1	**515-6304-01**
includes :	*Plunger "Flipper" Link*	*1*	*545-5611-00*
includes :	*Spirol Pin ø 5/32" X 3/4" 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

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

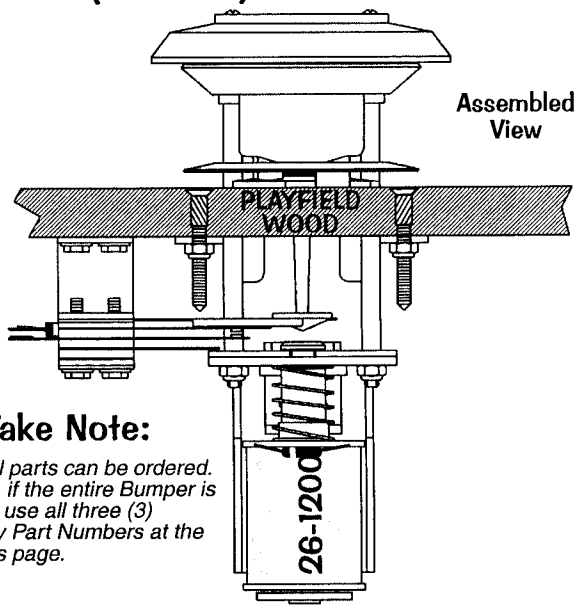
Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	**YELLOW** Flipper Bat & Shaft (Plain) (Non-Knurled End) Assembly	1	515-5133-06-06
	Large Flipper **RED** Rubber Ring	1	545-5277-22

Bumper Top Assemblies, 515-6459-01 (Qty. 6) (Items 1-7), Bumper Bottom Assemblies, 515-6459-04 (Qty. 6) (Items 8-15), Bumper Switch Assemblies, 515-6459-03 (Qty. 6) (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 Bumper is required, use all three (3) Assembly Part Numbers at the top of this page.

Nº	BUMPER TOP PART NAME	QTY.	SPI PART Nº
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

Nº	BUMPER BOTTOM PART NAME	QTY.	SPI PART Nº
8	Plunger	1	530-5348-00
9	Compression (Return) 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)		

Nº	BUMPER SWITCH PART NAME	QTY.	SPI PART Nº
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	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	Bumper Cap (Red)	2	550-5057-02
	Bumper Cap (Clear)	2	550-5057-01
	Bumper Cap, Altered (Cut) (Red)	1	550-5076-02
	Bumper Cap, Altered (Cut) (Clear)	1	550-5074-01

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

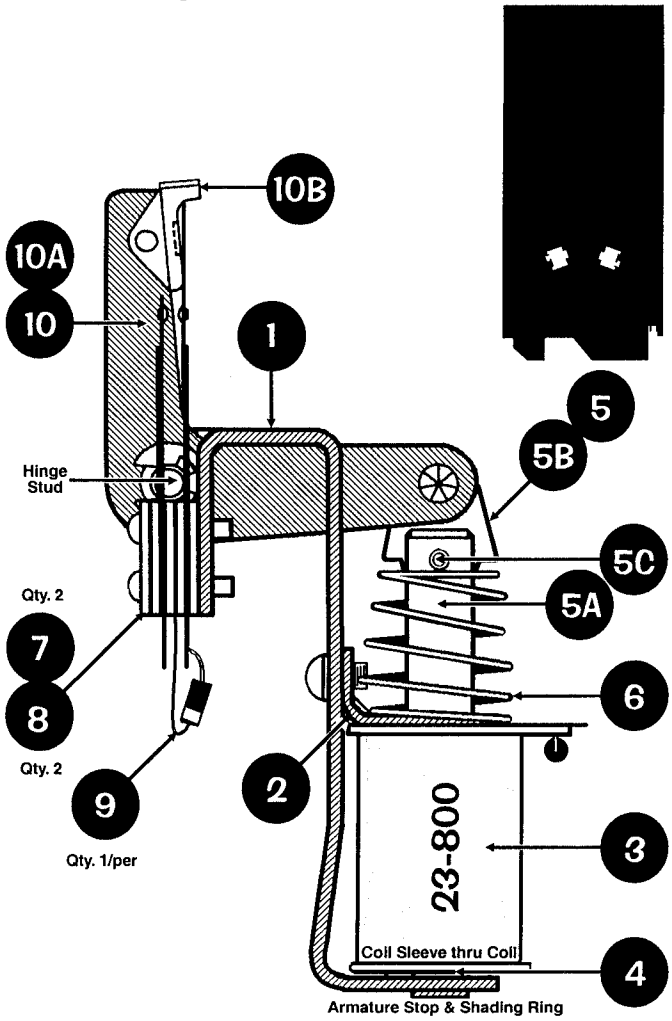
Slingshot Assemblies, 500-5849-00 (Qty. 2) (Items 1-10)

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Slingshot Bracket Assembly	1	515-5339-01
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 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)		
	Ordering Note: If **515-5338-00** *is unavailable*, order the individual part(s) actually required.		
6	Compression (Return) 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 1 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 *(secured to 1A by 1C)*	1	545-5216-01
10C*	Rivet, 1/8" ø x 1/4" Lg.	1	249-5003-00
	Item 10A is secured to Item 1 by: Retaining Ring, 1/4" ø Shaft (Qty. 1) (270-5002-00)		
	Ordering Note: If **515-5340-01** *is unavailable*, order the individual part(s) actually required.		

Take Note:

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

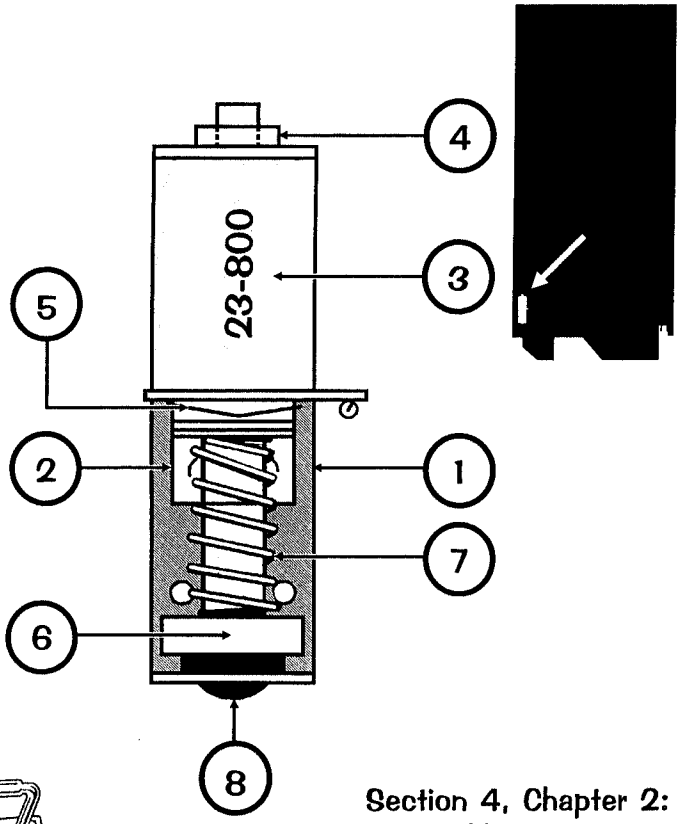
® "R" indicates Item noted is secured with rivet(s) as listed.



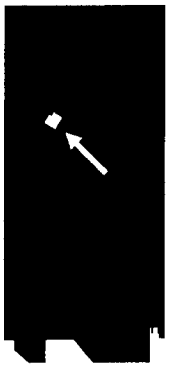
Kick Big (Laser Kick) Assembly, 500-5862-02 (Items 1-8)

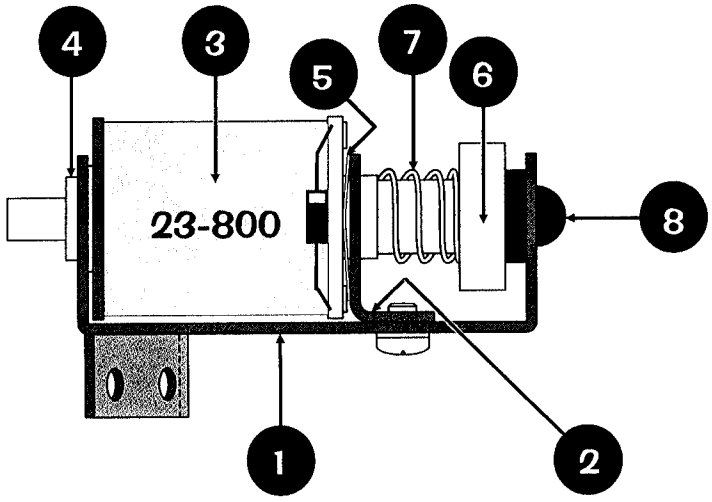
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mounting Bracket (Frame)	1	535-6730-00
	Item 1 is secured above the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
3	Coil, 23-800	1	090-5001-00B
	ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	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	Plunger Assembly	1	515-5000-02
7	Compression (Return) Spring	1	266-5020-00
8	Rubber Bumper (Grommet)	1	545-5105-00

Ordering Note: If **500-5862-02** *is unavailable*, order the individual part(s) actually required or try **-00** or **-01** and change the coil position to match **-02** (-00 Coil Lugs Face Up; -01 Coil Lugs Face Left; -02 Coil Lugs Face Right).



30° Eject Assembly, 500-6511-00 (Items 1-8)



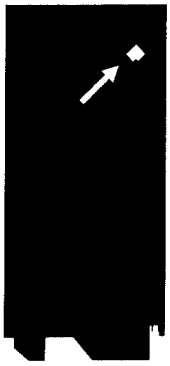


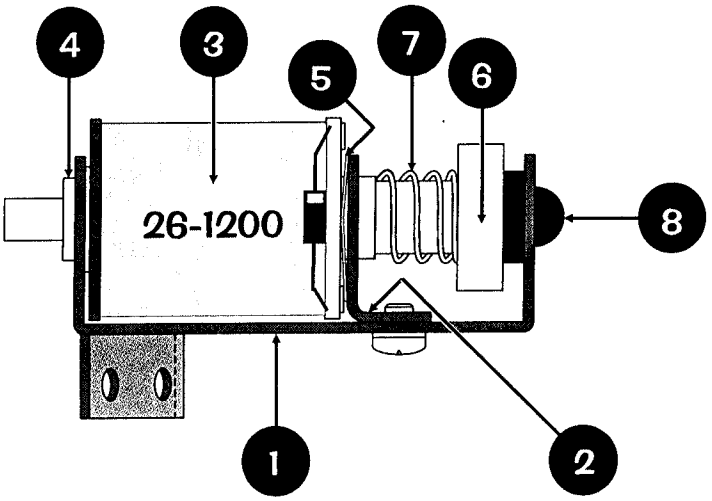
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mounting Bracket 30° Bend (Frame)	1	535-8932-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
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	Plunger Assembly	1	515-7197-00
7	Compression (Return) Spring	1	266-5020-00
8	Rubber Bumper (Grommet)	1	545-5105-00

Ordering Note: If **500-6511-00** *is unavailable*, order the individual part(s) actually required or try **-01** and change the coil to **23-800** (090-5001-00T).

30° Eject Assembly, 500-6511-01 (Items 1-8)



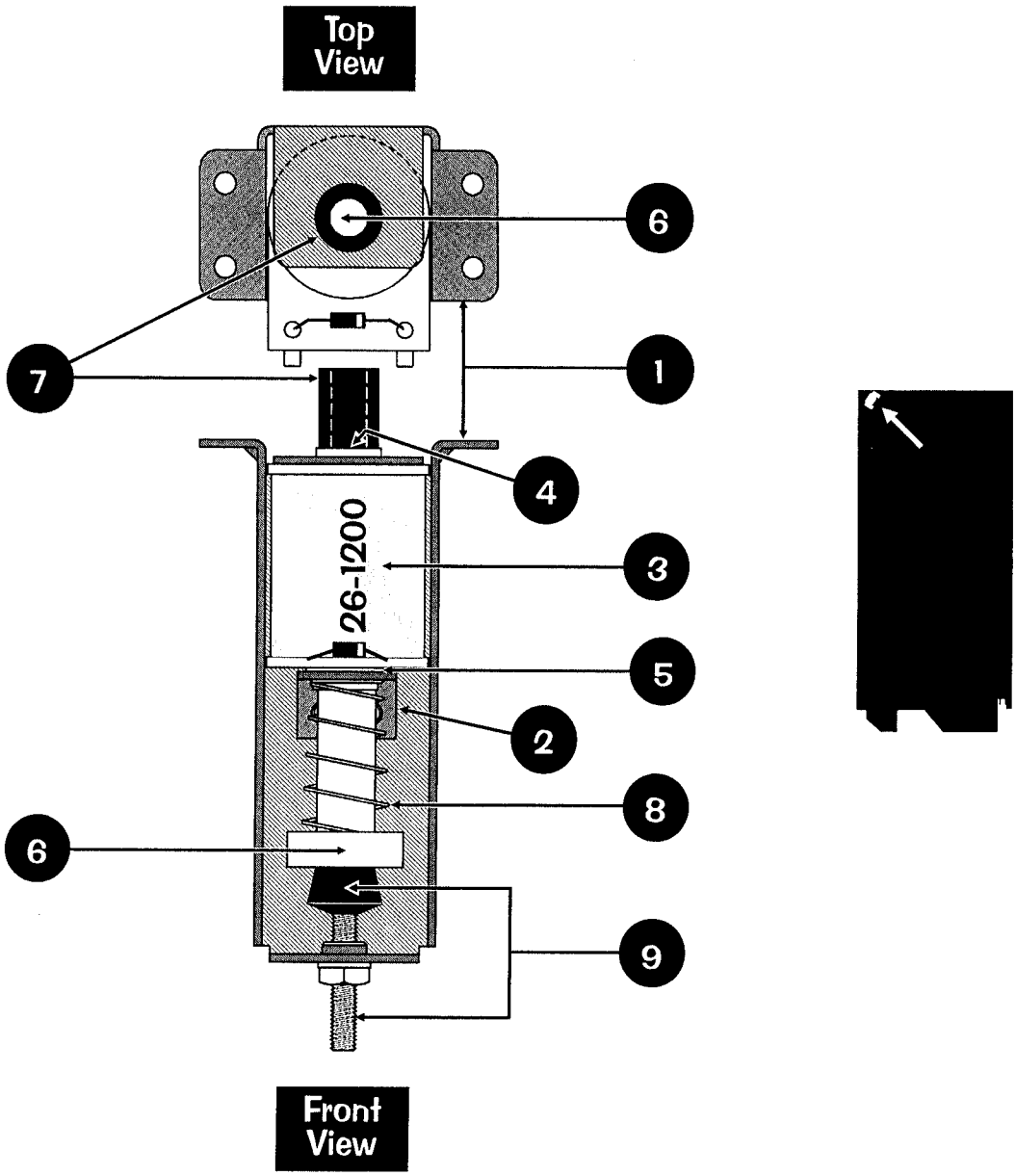


Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mounting Bracket 30° Bend (Frame)	1	535-8932-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 2) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
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

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
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	Plunger Assembly	1	515-7197-00
7	Compression (Return) Spring	1	266-5020-00
8	Rubber Bumper (Grommet)	1	545-5105-00

Ordering Note: If **500-6511-01** *is unavailable*, order the individual part(s) actually required or try **-00** and change the coil to **26-1200** (090-5044-00T).

Ball Deflector Assembly, 500-6433-00 (Items 1-9)



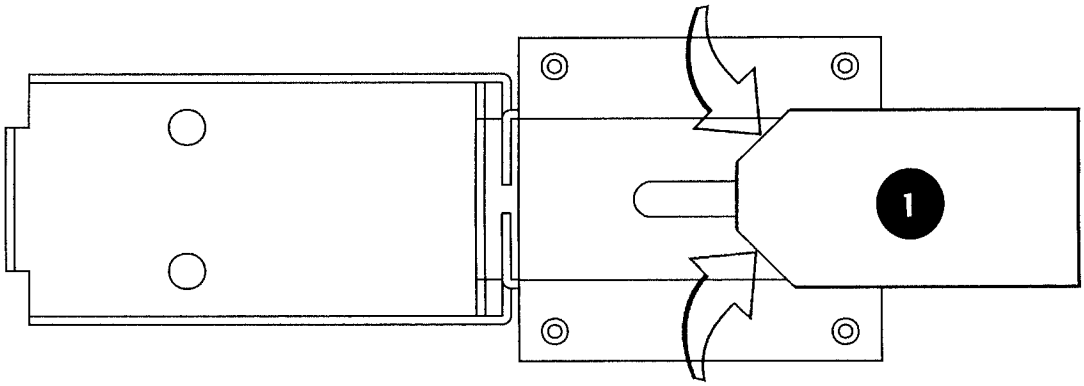
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
	Item 1 is secured below the playfield by: #6 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5001-02)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured to Item 1 by: #8-32 X 1/4" PPH MS (Sems) (Qty. 2) (232-5300-00)		
3	Coil, 26-1200	1	090-5044-00T
	ORDERING ABOVE (ITEM 3) COIL PART № 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 (Tapered Top)	1	515-7089-00
7	Post Black Rubber (Sleeve Tall)	1	545-5308-00
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)		

Ordering Note: If **500-6433-00** *is unavailable,* order the individual part(s) actually required or try **500-5788-02** and change it's Solid Plunger (515-6858-00) with above Solid Plunger (515-7089-00) and add the Post Rubber Sleeve (545-5308-00).

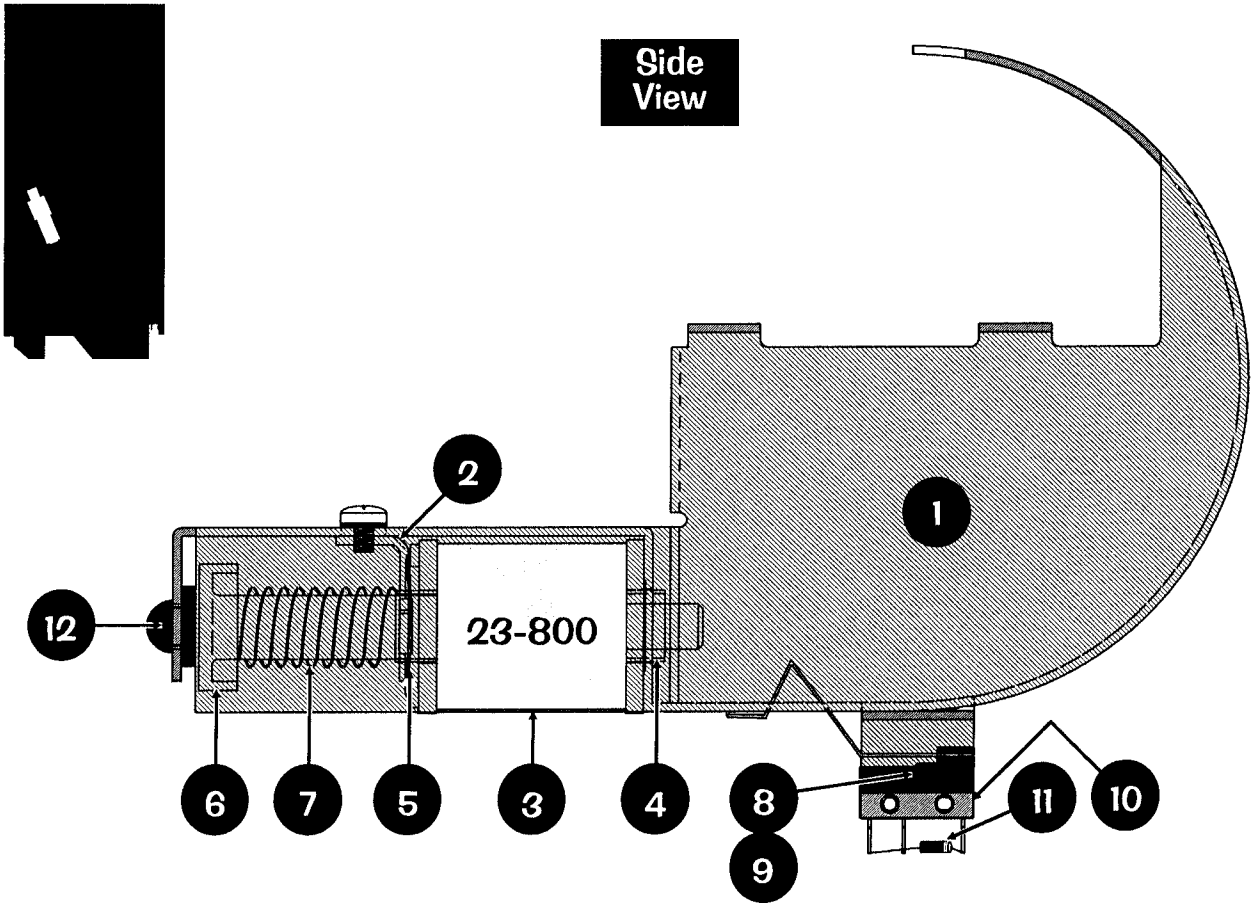
Scoop [Kicker] Assembly, 500-6491-00 (Items 1-12)

Top View

NOTE: The Scoop Exit Top has the corners cut with 45° angles. Ensure SPI Part N° used is 515-7165-01.



Side View



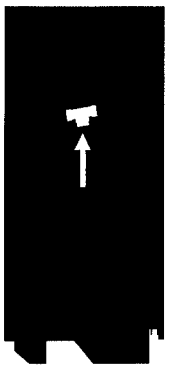
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Scoop Weldment w/cut corners @ top	1	515-7165-**01**
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Coil Retaining Bracket	1	535-5203-03
	Item 2 is secured by: #8-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5300-00)		
3	Coil, 23-800	1	090-5001-00B
	ORDERING ABOVE (ITEM 3) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	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	Plunger Assembly	1	515-5000-02

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
7	Compression (Return) Spring	1	266-5020-00
8	Insulation Fiche Paper *between Items 9 & 1*	1	545-6029-00
9	Micro Switch	1	180-5183-00
10	Switch Body Protect Plate	1	535-6539-00
	Items 8 - 10 are secured to Item 1 by: #2-56 X 1/2" HWH Ser UNS #4HD TRS BO (Qty. 2) (237-5937-02) **and** #2-56 Hex Nut (Qty. 2) (240-5301-00)		
11	Switch Diode, 1N4001	1	112-5001-00
12	Rubber Bumper (Grommet)	1	545-5105-00

Ordering Note: If **500-6491-00** *is unavailable*, order the individual part(s) actually required. Ensure your assembly has the Scoop Weldment with ***cut corners at exit top*** (515-7165-**01**).

1-Bank Drop Target Assembly, 500-6440-21 (Items 1-20)

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



1-Bank Drop Target Assembly, 500-6440-21 (Items 1-20) Continued

The Drawings for this assembly are on the previous page.

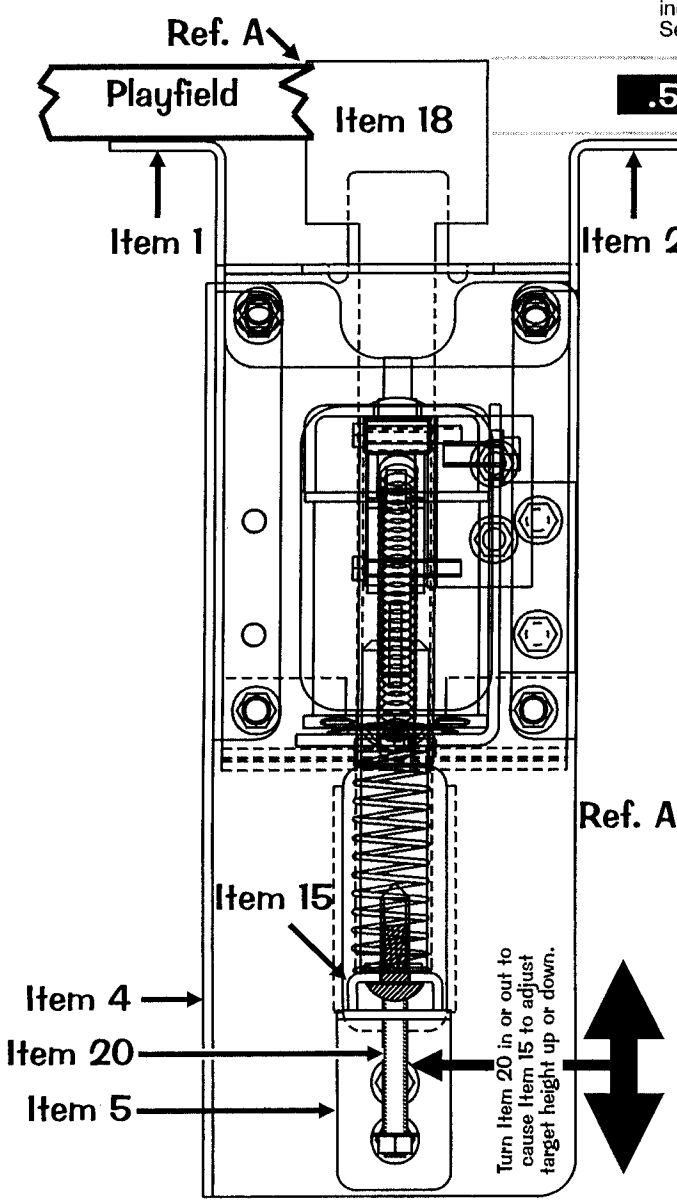
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Bracket Drop Target (Left Side)	1	535-8746-00
2	Bracket Drop Target (Right Side)	1	535-8746-01
	Items 1 & 2 are secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 3/per) (234-5101-00)		
3	Back Plate (1-Bank Drop Target)	1	535-7713-00
4	Bracket, Support (1-Bank D/T)	1	535-7712-00
5	Bracket, Height Adjustment	1	535-7709-01
6	Bracket, Target Retainer (1-Bank D/T)	1	535-7728-00
7	Bracket, Coil Housing	1	535-7707-00
8	Bracket Cap, Coil Housing	1	515-6533-00
	Items 1-3, 5, 7-8 are secured to Item 4 by: #8-32 X 3/8" HWH Swg. (Qty. 16) (237-5975-00)		
9	Coil, 24-940	1	090-5036-00B
	ORDERING ABOVE (ITEM 9) COIL PART № WILL INCLUDE:		
—	Diode, 1N4004 (positioned at bottom)	1	112-5003-00
10	Coil Sleeve	1	545-5709-00
11	Spring Washer (17/32" ID X 3/4" X 1")	1	269-5002-00
	To order Items 7-11 assembled with securing hardware, use SPI №: 515-6535-01.		

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
12	Bracket, Switch (1-Bank D/T)	1	535-7710-00
13	Switch (D/T)	1	180-5158-00
	Item 13 is secured to Item 12 by: #4-40 X 5/8" HWH TF (Qty. 2) (237-5945-00)		
14	Switch Diode, 1N4001	0	112-5001-00
	See "Take Note" below.		
15	Bracket, Target Lift (1-Bank D/T)	1	535-7706-01
16	Plunger (Drive Coil)	1	530-5410-00
	Item 16 is secured to Item 15 by: #10-32 X 3/8" PPH (Sems) (Qty. 1) (232-5401-00)		
	To order Items 15-16 assembled with securing hardware, use SPI №: 515-6537-00.		
17	Compression (Return) Spring	1	266-5020-00
18	Drop Target White (Rollover Target)	1	545-5533-01
	***Note:** Individual Decal Not Available. The entire decal sheet must be ordered for replacement. See Page 57 for part number.*		
19	Spring, Target Reset	1	265-5003-00
20	Height Adj. Screw (#8-32 X 1" HWH)	1	237-6003-00

Ordering Note: If **500-6440-21** *is unavailable,* order the individual part(s) actually required or try **500-6440-01** and remove the Trip Coil & Bracket from Item 4 *(Note: Item 5, Height Adj. Bracket may differ slightly).* ***Also, ensure the diode on the switch is soldered correctly.***

Take 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 95.



Target Height Adjustment Procedure:

1. Adjust the height of the top of ***Item 18*** (Rollover Target) at .52" (+/- .01"), relative to ***Items 1 & 2*** (Left & Right Side Brackets), as shown left. *Adjustment should be made with* ***Item 18*** *(Drop Target) in the* ***DOWN POSITION.***

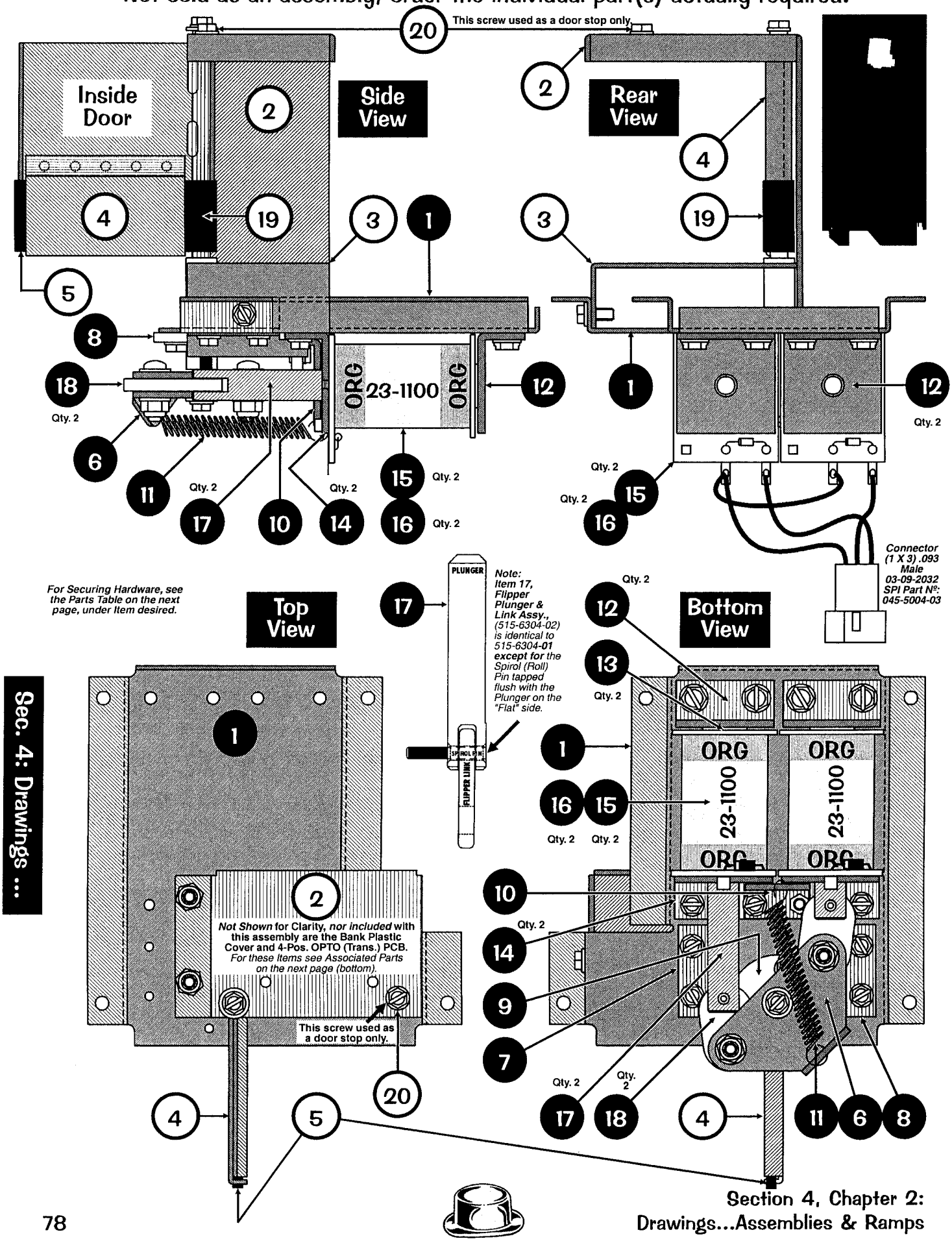
Keep in Mind: This adjustment procedure should have the **TOP SIDE** of ***Item 18*** (Drop Target) *"flush to slightly above"* the *playfield surface* after reinstalling to the underside of the Playfield. This will ensure a **BALL TRAP** is not created where the ball can rest in the target hole above the playfield.

2. Using a Flat Head Screwdriver or a 1/4" Nut Driver, loosen or tighten (turn in or out) ***Item 20*** (Height Adjustment Screw) through ***Item 5*** (Height Adjustment Bracket) to raise or lower ***Item 15*** (Target Lift Bracket) causing ***Item 18*** (Drop Target) to reach desired height as stated above.

MONOPOLY® Bank Assembly, 500-6512-00 (Items 1-20)

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

Not sold as an assembly, order the individual part(s) actually required.



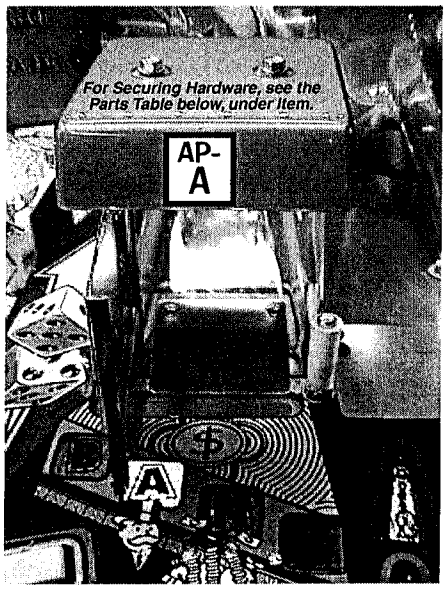
Sec. 4: Drawings ...

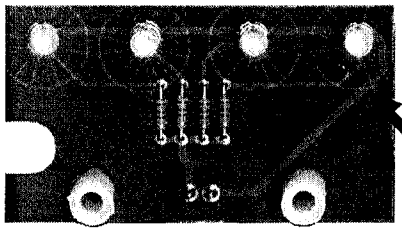
MONOPOLY® Bank Assembly, 500-6512-00 (Items 1-20) Continued

The Drawings for this assembly are on the previous page, also reference pictures below.
Not sold as an assembly, order the individual part(s) actually required.

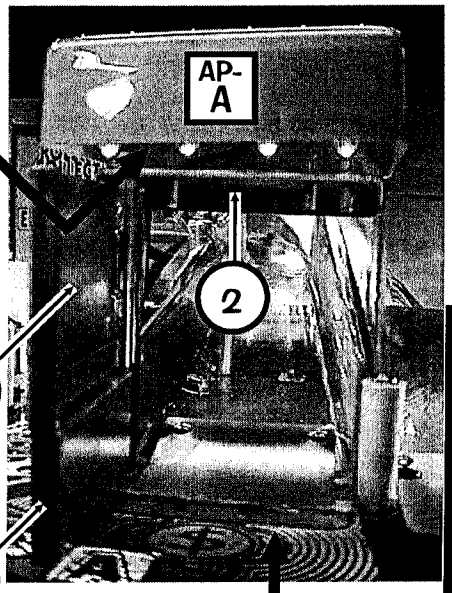
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Bottom Mounting Bracket	1	535-8924-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
2	Housing (Left Wall & Ceiling) Bracket	1	535-8926-00
	Item 2 is secured to Item 1 at Pem Studs by: #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)		
3	Floor (Bracket)	1	535-8925-00
	Item 3 is secured to Item 1 at side by: #8-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 2) (237-5975-00) **and is secured into Item 2's slot holes.**		
4	Door	1	515-7222-00
	Item 4 is secured at the top by: #6-32 X 3/8" HWH Swg (Sr.) Zinc (Qty. 1) (237-5976-02) **and** #6 Washer (Qty. 1) (242-5001-00) *Note: Door with no pad use 535-8927-00*		
	ORDERING DOOR (ITEM 4) WILL INCLUDE RUBBER PAD (ITEM 5) ATTACHED.		
5	Impact Blue Rubber Pad **(Self-Adhesive)**	1	545-5994-00
6	Toggle Bracket	1	535-8929-00
	Item 6 is secured at the center by: #6-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 1) (237-5976-02) **and** #6 Washer (Qty. 1) (242-5001-00)		
7	Roll-Pin Guide Bracket, Left	1	535-9015-00
8	Roll-Pin Guide Bracket, Right	1	535-9015-01
9	Flipper Bat Bushing	1	545-5594-00
	Items 7-9 are secured to Item 1 by: #6-32 X 3/8" HWH Sw. (Sr.) Zc. (Qty. 7) (237-5976-02)		
10	Spring Bracket	1	535-8928-00
	Item 10 is secured to both Item 14's by: #8-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 1) (237-5975-00) **and** 1/4" X 1/4" Hex Spacer,#8-32 Tap (Qty. 1) (254-5031-01)		
11	Flipper Return Spring	1	265-5035-00
12	Coil Stop Bracket Sub-Assembly	2	515-6308-01
	Item 12 is secured to Item 1 by: #10-32 X 3/8" SHWH Swg. (Sr.) Zc. (Qty. 2) (237-5985-00)		
13	Spring Washer (17/32" ID X 3/4" X 1")	2	269-5002-00
14	Coil Support Bracket	2	535-7356-00
	Item 14 is secured to Item 1 by: #8-32 X 3/8" HWH Swage (Serr) Zinc (Qty. 1/per) (237-5975-00) **and secured by Item 10**		
15	Coil, 23-1100 (ORG)	2	090-5030-00T
	ORDERING ABOVE (ITEM 15) COIL PART Nº WILL INCLUDE:		
—	Diode, 1N4004 (positioned at top)	1/per	112-5003-00
16	Coil Sleeve	2	545-5388-00
17	Flipper Plunger & Link Sub-Assy.	2	515-6304-**02**
	includes : Plunger "Flipper" Link	*1*	*545-5611-00*
	includes : Spirol Pin ø 5/32" X 3/4" Lg. ***See Note***	*1*	*251-5015-02*
	include : Flipper Plunger with "Flat"	*1*	*530-5349-01*
	Ordering Note: If **515-6304-02** *is unavailable*, order the individual part(s) actually required, or try **515-6304-01** and **tap the Spirol Pin flush with the Plunger on the "Flat" side** *(all parts otherwise are identical).*		
18	Flipper Link Bushing (Metal, Ext.)	2	530-5139-01
	Specifications: .385" Lg. X .192" ID X .312" OD		
	Item 18 is secured to Item 6 by: #8-32 X 3/4" PPH MS (Zinc) (Qty. 2/per) (237-5604-00), #8 Washer (Qty. 2/per) (242-5005-00) **and** #8-32 Nylon Stop Nut (Qty. 2/per) (240-5102-00)		
19	Post Black Rubber (Sleeve Tall)	1	545-5308-00
20	"Door Stop" #8-32 X 3/8" HWH Sw.	1	237-5975-00
	Ordering Note: If **500-6512-00** *is unavailable*, order the individual part(s) actually required.		

Associated Parts: Bank Plastic Cover, 4-Pos. OPTO (Trans. & Rec.) PCBs (Items AP-A - AP-C)





AP-B **Top View**



Take Note:

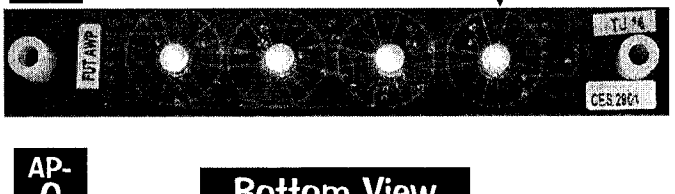
The Individual Decal (BANK) is Not Available. The entire decal sheet must be ordered for replacement. See Page 57 for part number.

Take Note:

For a break-down of parts of Items AP-B & AP-C (below), see Sec. 5, Chp. 4, 4-Position OPTO (Receiver) PC Board Component Layout & Parts, Page 130, or 4-Position OPTO (Transmitter) PC Board Component Layout & Parts, Page 131.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
AP-A	Bank Plastic Cover	1	545-6008-00
	1/2" Slf. Rtn. #8 Spacer White	2	254-5032-01
	Item A is secured to Item 2 (Housing Bracket above) by: #8-32 X 1-1/2" HWH Swage (Zinc) (Qty. 2) (237-6065-00)		
AP-B	4-Pos. OPTO (Trans.) PCB & Cable	1	520-5218-00
	1/2" Slf. Rtn. #8 Spacer White	2	254-5032-01
	Item B is secured inside Item A (Bank Plastic Cover), see Item A for securing hardware.		
AP-C	4-Position OPTO (Receiver) PCB	1	520-5210-00
	3/8" Slf. Rtn. Spacer White	2	254-5007-01
	Item is secured below the playfield by: #6 X 7/8" HWH AB Zinc (Qty. 2) (234-5003-01)		

AP-C **Top View** — **Under Playfield**



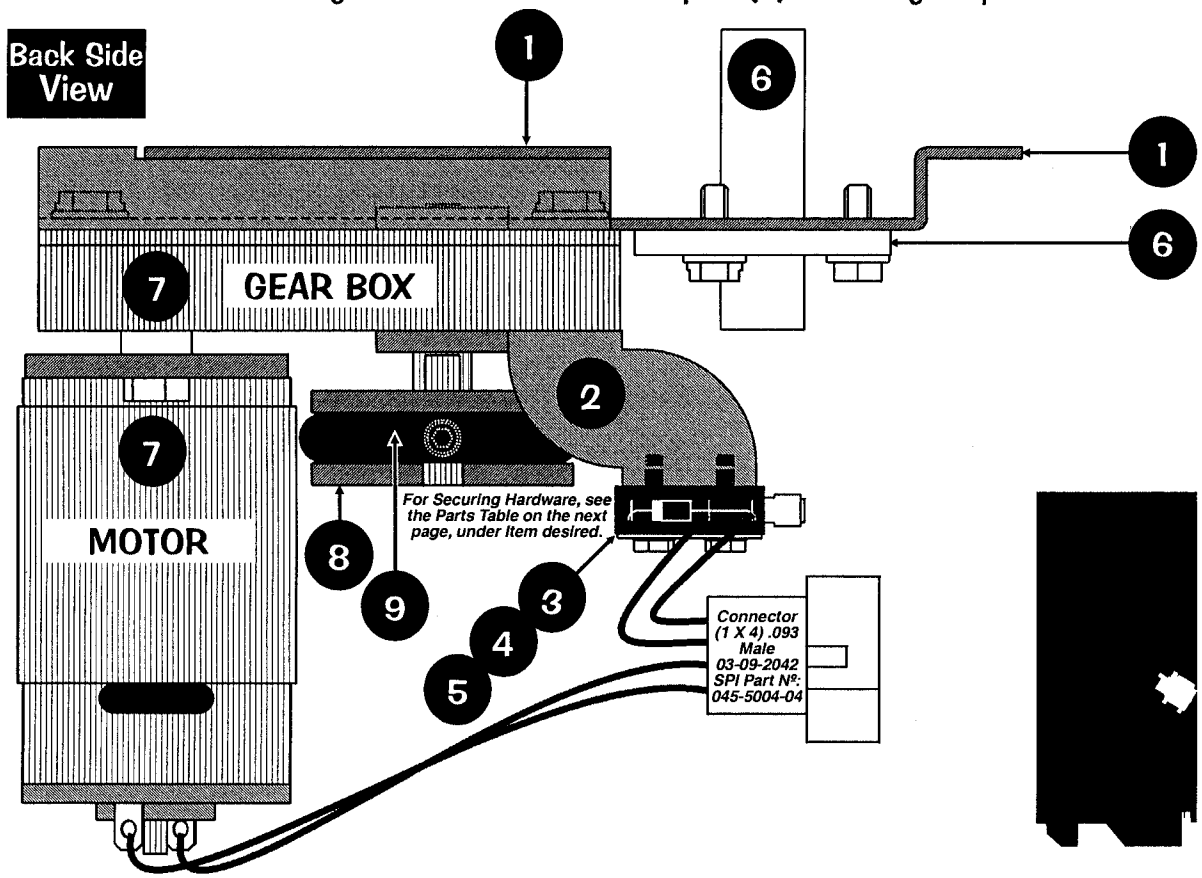
AP-C **Bottom View**

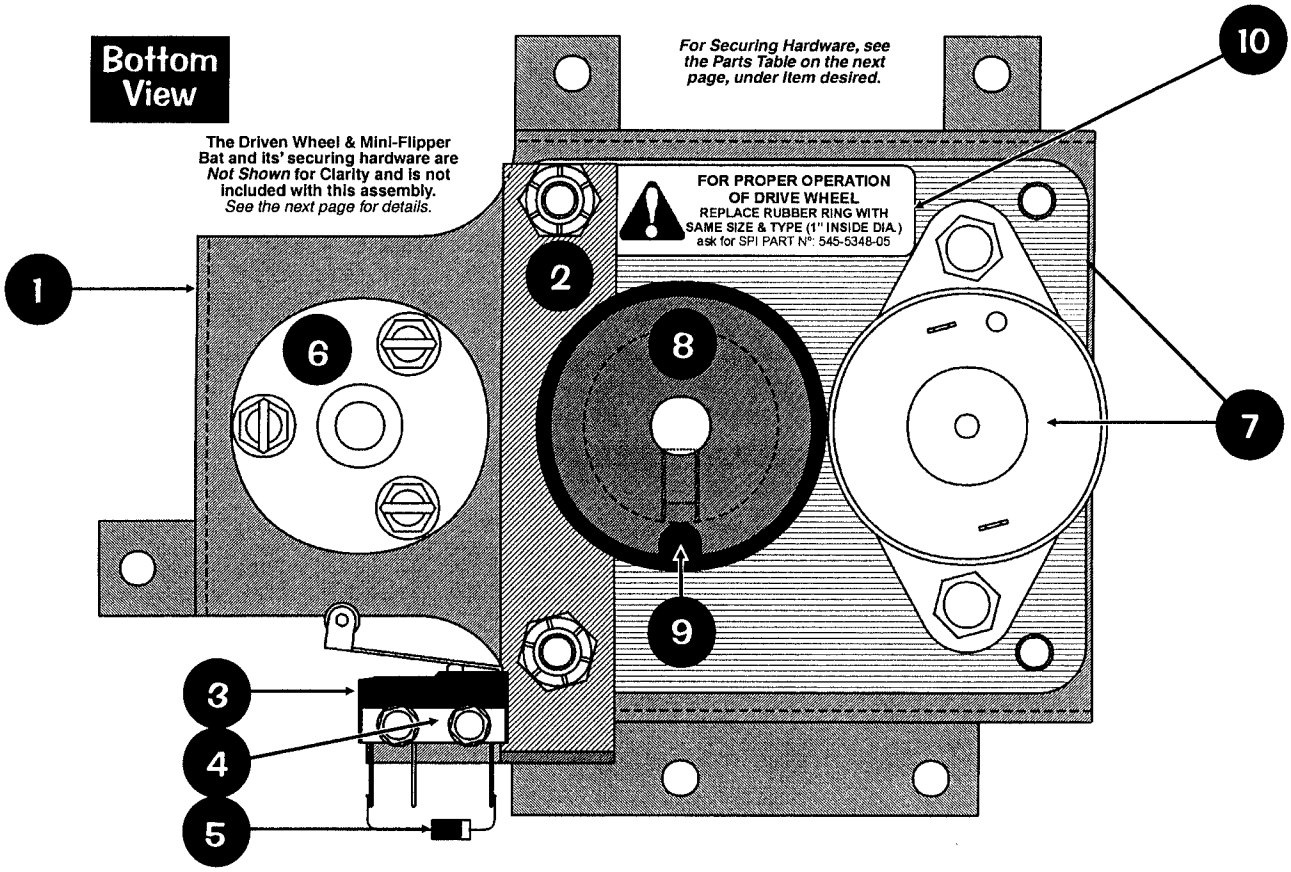


Mini-Flipper & Motor Assembly, 500-6486-00 (Items 1-10)

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

Not sold as an assembly, order the individual part(s) actually required.





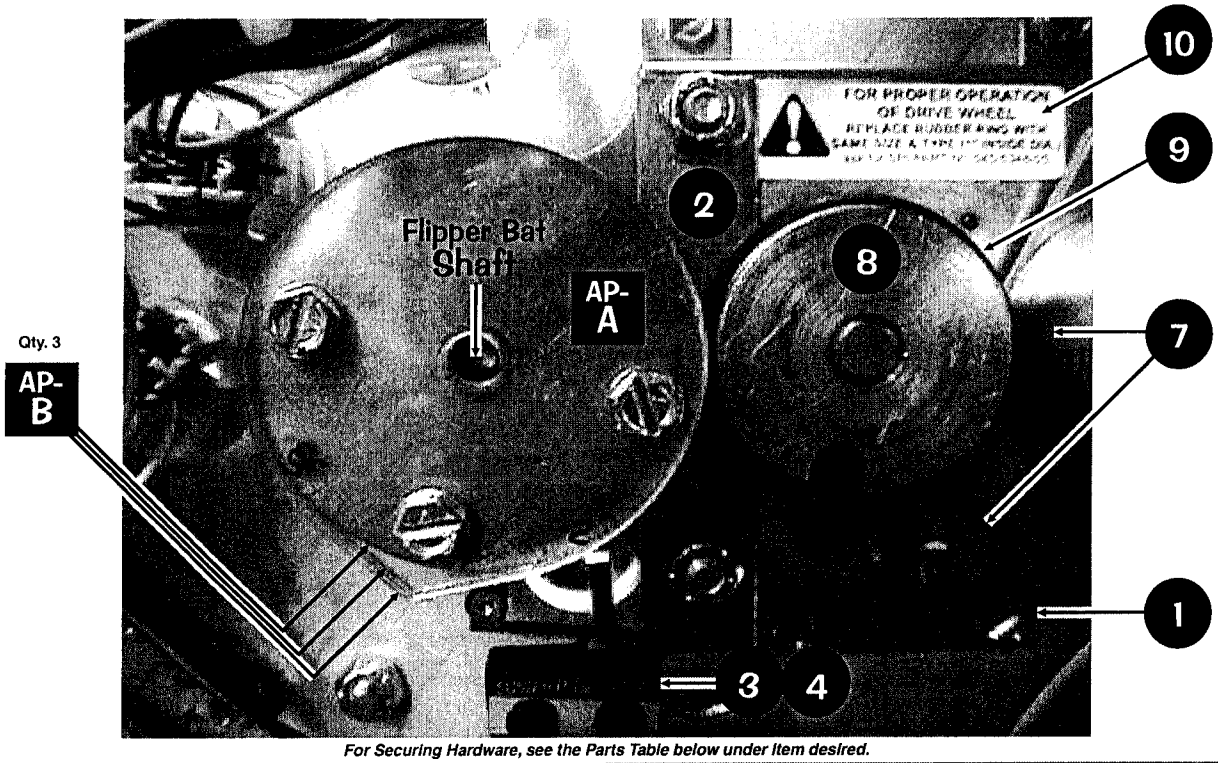
Mini-Flipper & Motor Assembly, 500-6486-00 (Items 1-10) Continued

The Drawings for this assembly are on the previous page, also reference picture below.
Not sold as an assembly, order the individual part(s) actually required.

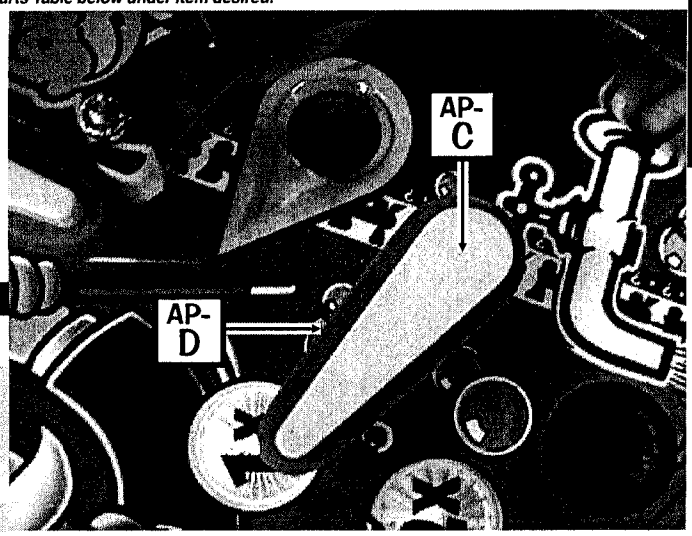
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1	Mounting Bracket (for rotating flipper)	1	535-8930-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 5) (234-5101-00)		
2	Switch Bracket (for rotating flipper)	1	535-8931-00
	Item 2 is secured to Item 6 (Gear Box Part) through Item 1 by: #10-32 X 1" HWH MS (Zinc) (Qty. 2) (237-5811-00) **and** #10-32 Nylon Stop Nut (Qty. 2) (240-5203-00)		
3	Micro Switch (Roller Actuator)	1	180-5119-00
4	Switch Body Protect Plate	1	535-6539-00
	Items 3 & 4 are secured to Item 2 by: #2-56 X 1/2" HWH (Serr) UNS #4HD TR3 BO (Qty. 2) (237-5937-02)		
5	Switch Diode, 1N4001	1	112-5001-00
6	Flipper Bat Bushing	1	545-5594-00
	Item 6 is secured to Item 1 by: #6-32 X 3/8" HWH Swg. (Ser.) Zc. (Qty. 3) (237-5976-02)		
7	Motor & Gear Box	1	041-5083-00
	Motor Specifications: *Multi-Products #7000 EX00159A 20v DC 85 RPM CW/CCW*		
	Item 7 is secured to Item 1 by: #10-32 X 1/2" HWH (Serr) Zinc (Qty. 2) (237-5995-00)		
8	Drive Wheel (with single-groove edge)	1	530-5598-00
	Item 8 is secured to Item 1 by: #10-32 X 5/16" Set Screw Cup Point (Qty. 1) (237-6092-00)		
9	1" I.D. Black Rubber Ring	1	545-5348-05
10	Caution Decal: ***For Proper Operation of...***	1	820-6303-00



Assoc. Parts: Driven Wheel, Plastics, Mini-Flip. Bat & Shaft & Rubber Ring (Items AP-A - AP-D)

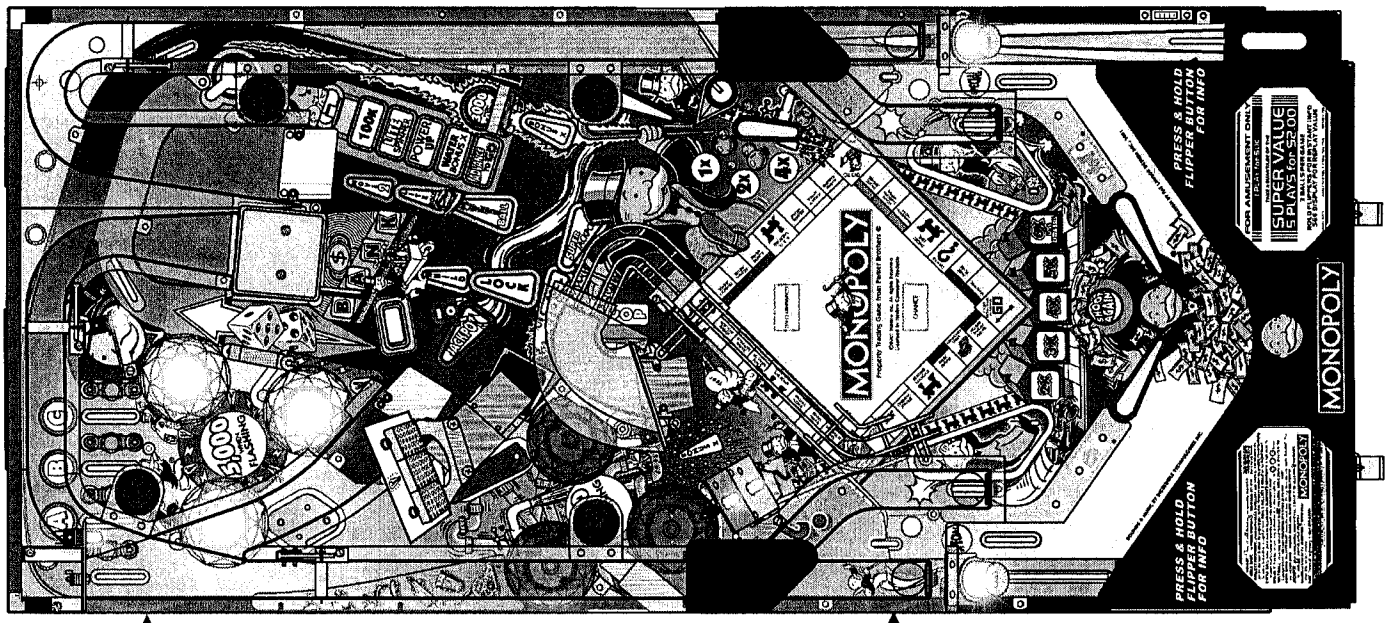


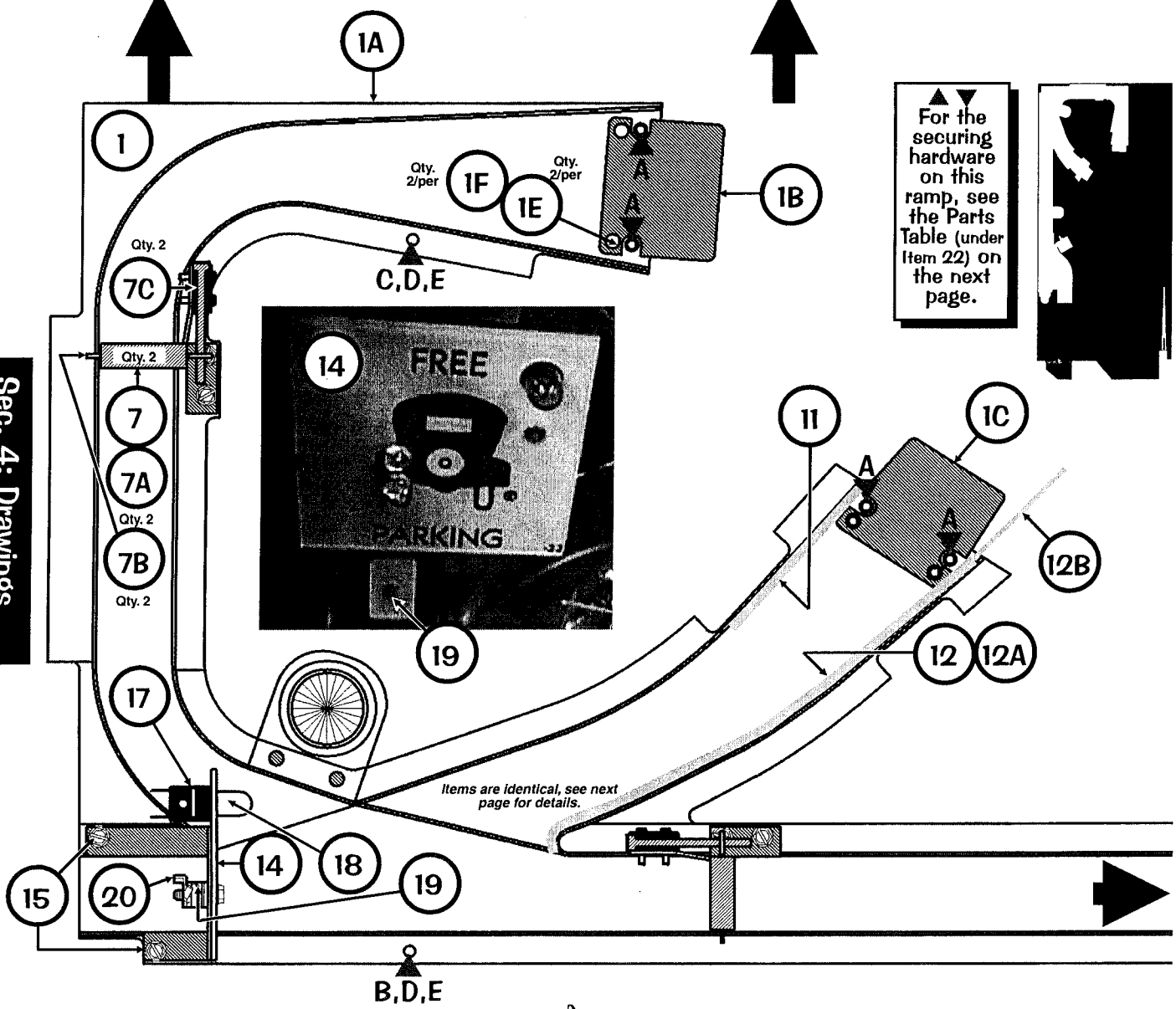
For Securing Hardware, see the Parts Table below under Item desired.



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

Nº	ASSOCIATED PART NAME	QTY.	SPI PART Nº
AP-A	Driven Wheel (smooth edge)	1	530-5599-00
	Item A is secured to Item 3 by: #10-32 X 5/16" Set Screw Cup Point (Qty. 1) (237-6092-00)		
AP-B	Clear Plastic (Butyrate) -2	3	830-5987-02
	Item B (3 stacked) are secured to the bottom of Item 1 by: #8-32 X 1/2" HWH Swage (Serr) Zinc (Qty. 3) (237-5975-01)		
	Special Ordering note on Item B: *The individual pieces may not be available in which case the entire sheet must be ordered. See Sec. 4, Chp. 1, Parts Id. & Location, Page 57.*		
AP-C	**YEL** Mini-Flip. Bat & Shaft (Plain) Assy.	1	515-7191-06
AP-D	Small Flipper **RED** Rubber Ring	1	545-5207-22





For the securing hardware on this ramp, see the Parts Table (under Item 22) on the next page.

Sec. 4: Drawings ...

Left Plastic Ramp, 515-7221-00 (Item 1) & Individual Parts (Items 2-22) Continued

Drawing & Parts Table continues on the previous page.

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1®	Left Plastic Ramp Riveted Assembly	1	515-7221-00
ORDERING ABOVE® RIVETED ASSY. PART № WILL INCLUDE:			
1A®	Ramp (Plain No Parts)	1	545-5992-00
1B®	Left Ramp Flap *(secured to 1A by 1E/F)*	1	535-8966-00
1C®	Center Ramp Flap *(secured to 1A by 1E/F)*	1	535-8967-00
1D®	Clr. Plastic (Buty.) *(secured to 1A by 1G/H)*	3	830-5987-04
1E	Rivet, 1/8" ø X 3/16" Lg.	8	249-5001-00
1F	#6 Lock Washer (Riveting)	8	246-5000-00
1G	Pop Rivet, 1/8" ø X .39" Lg.	2	249-5018-00
1H	Washer 9/64 I.D. X 5/16" O.D. X 1/32"	2	242-5017-00
For how Item 1 is secured to the playfield, see the end of this parts table.			
Ordering Note: If **515-7221-00** *is unavailable*, order the individual part(s) actually required.			
2	Mounting Bracket (for Diverter)	1	535-8987-00
Item 2 is secured to Item 1 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)			
3	Ball Diverter (Coil & Lt. Bracket) Assy.	1	515-6595-00
ORDERING ABOVE (ITEM 3) SUB-ASSY. PART № WILL INCLUDE:			
3A	Frame	1	535-6198-00
3B	Coil Arm & Armature (Left Style)	1	515-6594-00
3C	Return Spring (Jaidninger #SPR29-18)	1	265-5024-00
3D	Coil, 32-1800	1	090-5031-00
Item 3 is secured to Item 2 by: #8-32 X 3/8" PFH 82 Undercut Zinc (Qty. 1) (237-6030-00)			
Ordering Note: If **515-6595-00** *is unavailable*, order the individual part(s) actually required.			
4	Diverter Cover (Black Plastic, Left Style)	1	545-5999-00
Item 4 is secured to Item 2 by: #8-32 X 1/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5975-04)			
5	#906 IDC Snap-On Socket *(no diode)*	3	077-5216-01
6	#906 Wedge Base Bulb (Clear)	3	165-5004-00
7	Gate (Roll-Under 1-1/2" Gold) Assy.	2	515-6490-06
ORDERING ABOVE (ITEM 7) SUB-ASSY. PART № WILL INCLUDE:			
7A	Gate Bracket (Gold)	1	535-8529-00
7B	Wire Form (Gold) (on above item)	1	535-8530-00
7C	Micro Switch (for Roll-Under Gate)	1	180-5087-00
7D*	Switch Body Protect Plate	1	535-6539-00
7E*	Diode, 1N4001	1	112-5001-00
7F*	#2-56 X 1/2" HWH Ser UNS #4HD TR3 BO	2	237-5937-02
Item 7 is secured to Item 1 by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
Ordering Note: If **515-6490-06** *is unavailable*, order the individual part(s) actually required.			
8	Mini-Mars Light Cover (Snap-In) Clear	1	550-5030-01
9	Mini-Mars Light Cover (Snap-In) Red	2	550-5030-02
10	Deflector Pad (Rubber Bumper)	2	545-5428-00
11	Ramp Guard	1	535-9055-00
Item 11 is secured to Item 1 by: #6-32 X 3/8 PPH MS (Sems) Zinc (Qty. 2) (232-5201-00)			

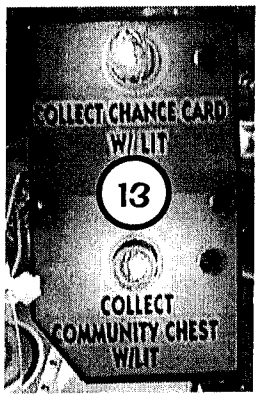
№	INDIVIDUAL PART NAME	QTY.	SPI PART №
12®	Ramp Guard & Flap Assembly	1	515-7209-00
ORDERING ABOVE® RIVETED ASSY. PART № WILL INCLUDE:			
12A®	Ramp Guard (Long) (Plain No Parts)	1	535-9044-00
12B®	Ramp Guard Flap *(secured to 12A by 12C)*	1	533-9045-00
12C*	Rivet, 1/8" ø X 1/8" Lg. (Nickel)	1	249-5008-00
Item 12 is secured to Item 1 by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
Ordering Note: If **515-7209-00** *is unavailable*, order the individual part(s) actually required.			
13®	Screened Plastic (Butyrate) -18	1	830-5985-18
Item 13 is secured to Item 16 by: *See securing hardware under Item 17.*			
14®	Screened Plastic (Butyrate) -22	1	830-5985-22
Item 14 is secured to Item 15 by: #6-32 X 3/4" HWH Swage (Sr) Zc (Qty. 2) (237-5976-05)			
Special Ordering note on Items 13 & 14: *The individual piece may not be available in which case the entire sheet must be ordered. See Sec. 4, Chp. 1, Parts Id. & Loc., Page 57.*			
15®	Bracket (Free Parking), Sign Mounting	1	535-8974-00
16®	Bracket (Collect...), Sign Mounting	1	535-8975-00
Items 15 & 16 are secured to Item 1 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 2/per) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2/per) (240-5102-00)			
17®	#555 Wedge Base Socket (Offset)	3	077-5029-00
Item 17 is secured to Items 13 & 14 by: Rivet, 1/8" ø X 3/16" Lg. (Nickel) (Qty. 1/per) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 1/per) (246-5000-00)			
18	#555 Wedge Base Bulb (Yel)	3	165-5054-06
19	Switch & Target Assy. Narrow (Yel)	1	515-5967-06
20	Bracket, Switch Back Plate	1	535-6452-00
Items 20 & 21 are secured with the same hardware used to secure Item 14 into Item 15.			
21*	Foam Pad (Switch Back) Self-Adh.	1	626-5029-00
22*	Insulator (Fische Paper)	1	545-6024-01
Item 22 is positioned between Items 15 & 19 at mounting point.			

Left Plastic Ramp is secured above the playfield by:

A▲▼	#4 X 5/8" PFH (Black)	Qty. 4	237-5833-00
B▲	2⅛" X 1/4" Hex Spacer #6-32 Tap	Qty. 2	254-5008-32
C▲	2⅝" X 1/4" Hex Spacer #6-32 Tap	Qty. 1	254-5008-08
D▲	#6-32 X 3/8" PPH MS (Sems) Zinc	Qty. 3	232-5201-00
E▲	#6 Washer	Qty. 2	242-5001-00
F▼	1.9" X 1/4" Hex Spacer #8-32 Tap	Qty. 1	254-5031-03
G▼	#8-32 X 3/8" PPH MS (Sems) Zinc	Qty. 1	232-5301-00
H▼	#8 Washer	Qty. 3	242-5005-00

This Ramp is secured into the Back Panel by: *Back Edge Lip into Back Panel Slot.*

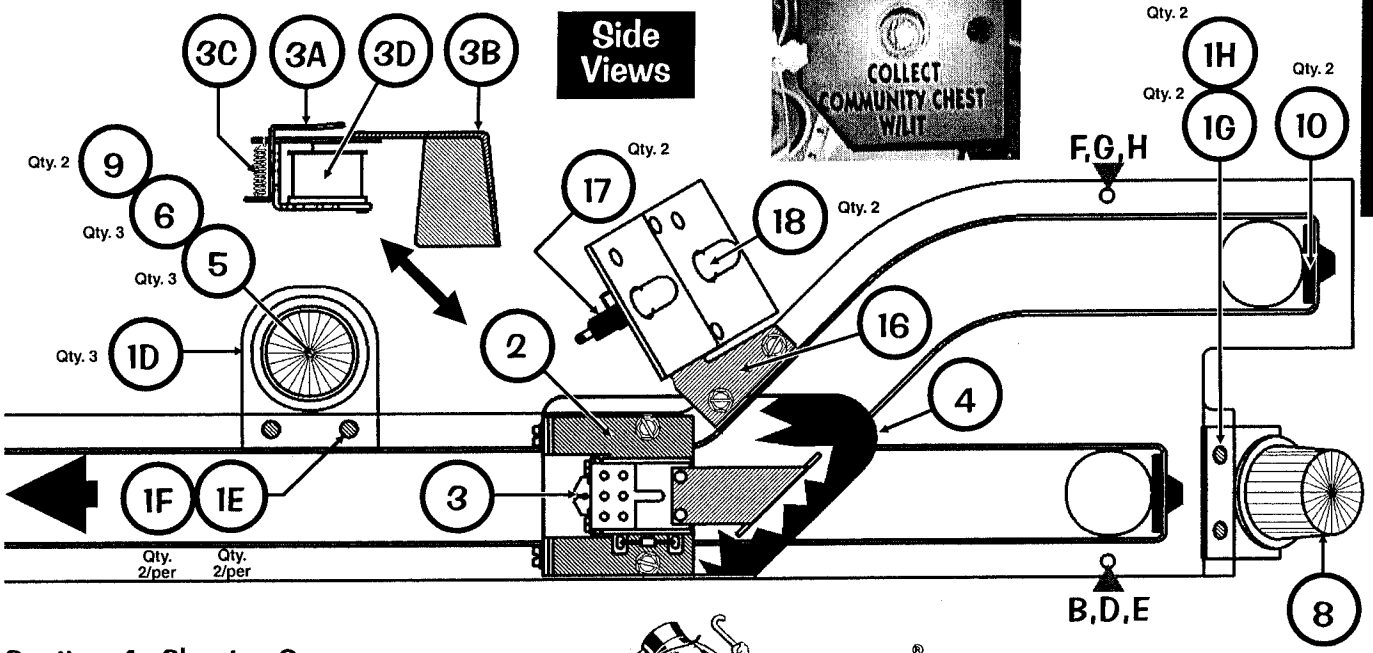
***Note: Item B ▲ is mounted on a Ramp Mounting Bracket** (515-6508-00) on the wood rail.*



Take Note:

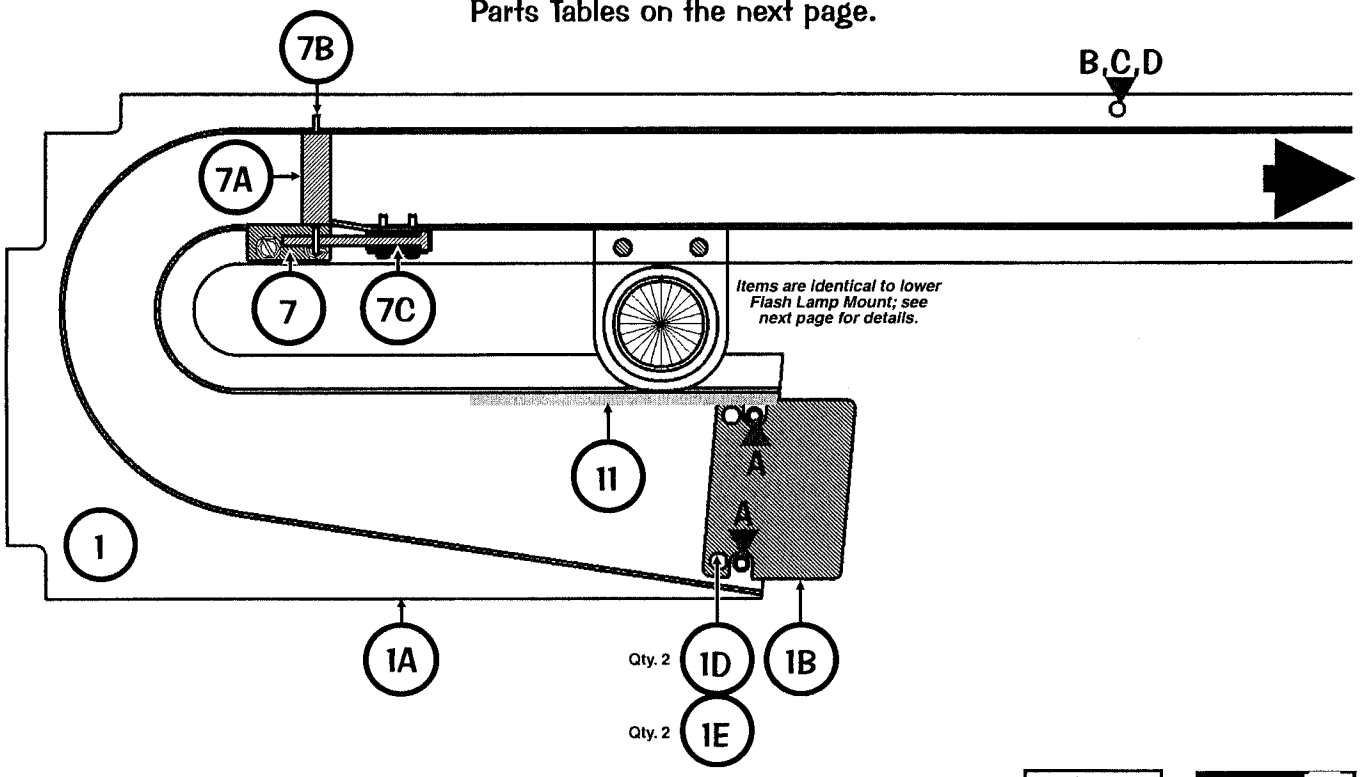
* An asterisk (*) indicates item(s) are not noted in the pictorials.

® "R" indicates Item noted is secured with rivet(s) as listed.



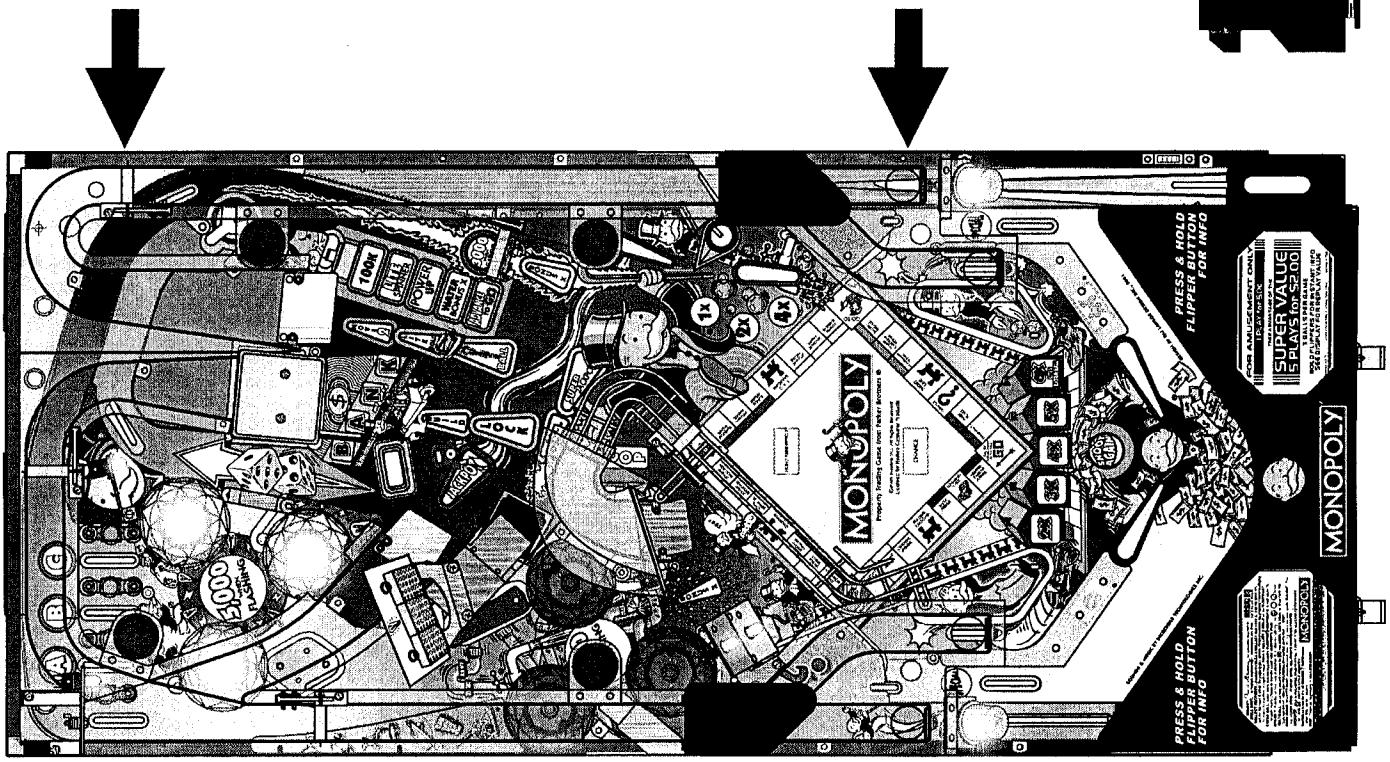
Right Plastic Ramp, 515-7220-00 (Item 1) & Individual Parts (Items 2-11)

Parts Tables on the next page.



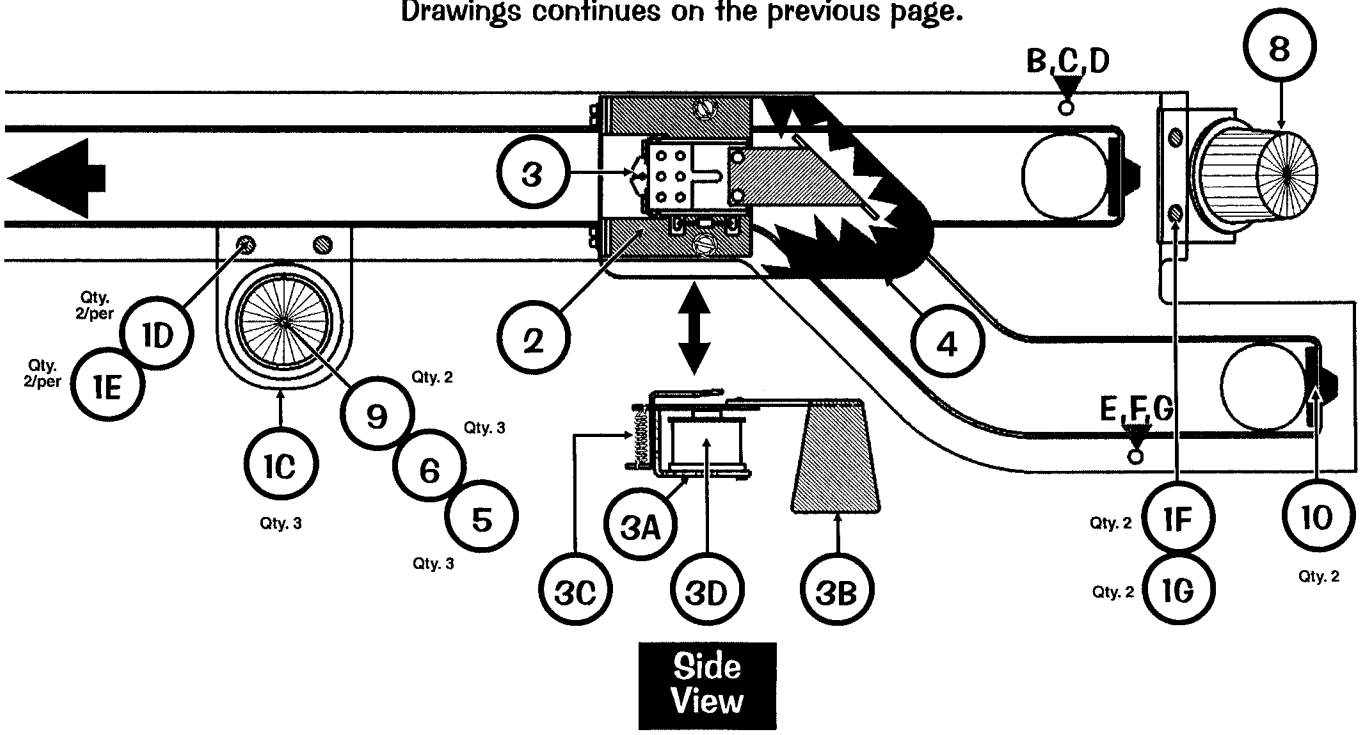
For the securing hardware on this ramp, see the Parts Table (under Item 11) on the next page.





Right Plastic Ramp, 515-7220-00 (Item 1) & Individual Parts (Items 2-11) Continued

Drawings continues on the previous page.



Take Note:

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

® "R" indicates Item noted is secured with rivet(s) as listed.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Right Plastic Ramp Riveted Assembly	1	515-7220-00
ORDERING ABOVE® RIVETED ASSY. PART Nº WILL INCLUDE:			
1A®	Ramp (Plain No Parts)	1	545-5993-00
1B®	Ramp Flap *(secured to 1A by 1D/F)*	1	535-8968-00
1C®	Clr. Plastic (Buty.) *(secured to 1A by 1E/G)*	3	830-5987-04
1D	Rivet, 1/8" ø X 3/16" Lg.	6	249-5001-00
1E	#6 Lock Washer (Riveting)	6	246-5000-00
1F	Pop Rivet, 1/8" ø X .39" Lg.	2	249-5018-00
1G	Washer 9/64 I.D. X 5/16" O.D. X 1/32"	2	242-5017-00
For how Item 1 is secured to the playfield, see the end of this parts table.			
Ordering Note: If **515-7220-00** *is unavailable*, order the individual part(s) actually required.			
2	Mounting Bracket (for Diverter)	1	535-8987-00
Item 2 is secured to Item 1 by: #8-32 X 3/8" HWH MS (Zinc) (Qty. 2) (237-5868-00) **and** #8-32 Nylon Stop Nut (Qty. 2) (240-5102-00)			
3	Ball Diverter (Coil & Rt. Bracket) Assy.	1	515-6595-01
ORDERING ABOVE (ITEM 3) SUB-ASSY. PART Nº WILL INCLUDE:			
3A	Frame	1	535-6198-00
3B	Coil Arm & Armature (Right Style)	1	515-6594-01
3C	Return Spring (Jaidninger #SPR29-18)	1	265-5024-00
3D	Coil, 32-1800	1	090-5031-00
Item 3 is secured to Item 2 by: #8-32 X 3/8" PFH 82 Undercut Zinc (Qty. 1) (237-6030-00)			
Ordering Note: If **515-6595-01** *is unavailable*, order the individual part(s) actually required.			
4	Diverter Cover (Black Plastic, Rt. Style)	1	545-6000-00
Item 4 is secured to Item 2 by: #8-32 X 1/4" HWH Swage (Serr) Zc. (Qty. 2) (237-5975-04)			
5	#906 IDC Snap-On Socket *(no diode)*	3	077-5216-01
6	#906 Wedge Base Bulb (Clear)	3	165-5004-00
7	Gate (Roll-Under 1-1/2" Gold) Assy.	1	515-6490-06
ORDERING ABOVE (ITEM 7) SUB-ASSY. PART Nº WILL INCLUDE:			
7A	Gate Bracket (Gold)	1	535-8529-00
7B	Wire Form (Gold) (on above item)	1	535-8530-00
7C	Micro Switch (for Roll-Under Gate)	1	180-5087-00
7D*	Switch Body Protect Plate	1	535-6539-00
7E*	Diode, 1N4001	1	112-5001-00
7F*	#2-56 X 1/2" HWH Ser UNS #4HD TR3 BO	2	237-5937-02
Item 7 is secured to Item 1 by: #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 2) (232-5201-00) **and** #6-32 Nylon Stop Nut (Qty. 2) (240-5005-00)			
Ordering Note: If **515-6490-06** *is unavailable*, order the individual part(s) actually required.			
8	Mini-Mars Light Cover (Snap-In) Clear	1	550-5030-01
9	Mini-Mars Light Cover (Snap-In) Red	2	550-5030-02
10	Deflector Pad (Rubber Bumper)	2	545-5428-00
11	Ramp Guard	1	535-9054-00
Item 11 is secured to Item 1 by: #6-32 X 3/8 PPH MS (Sems) Zinc (Qty. 2) (232-5201-00)			

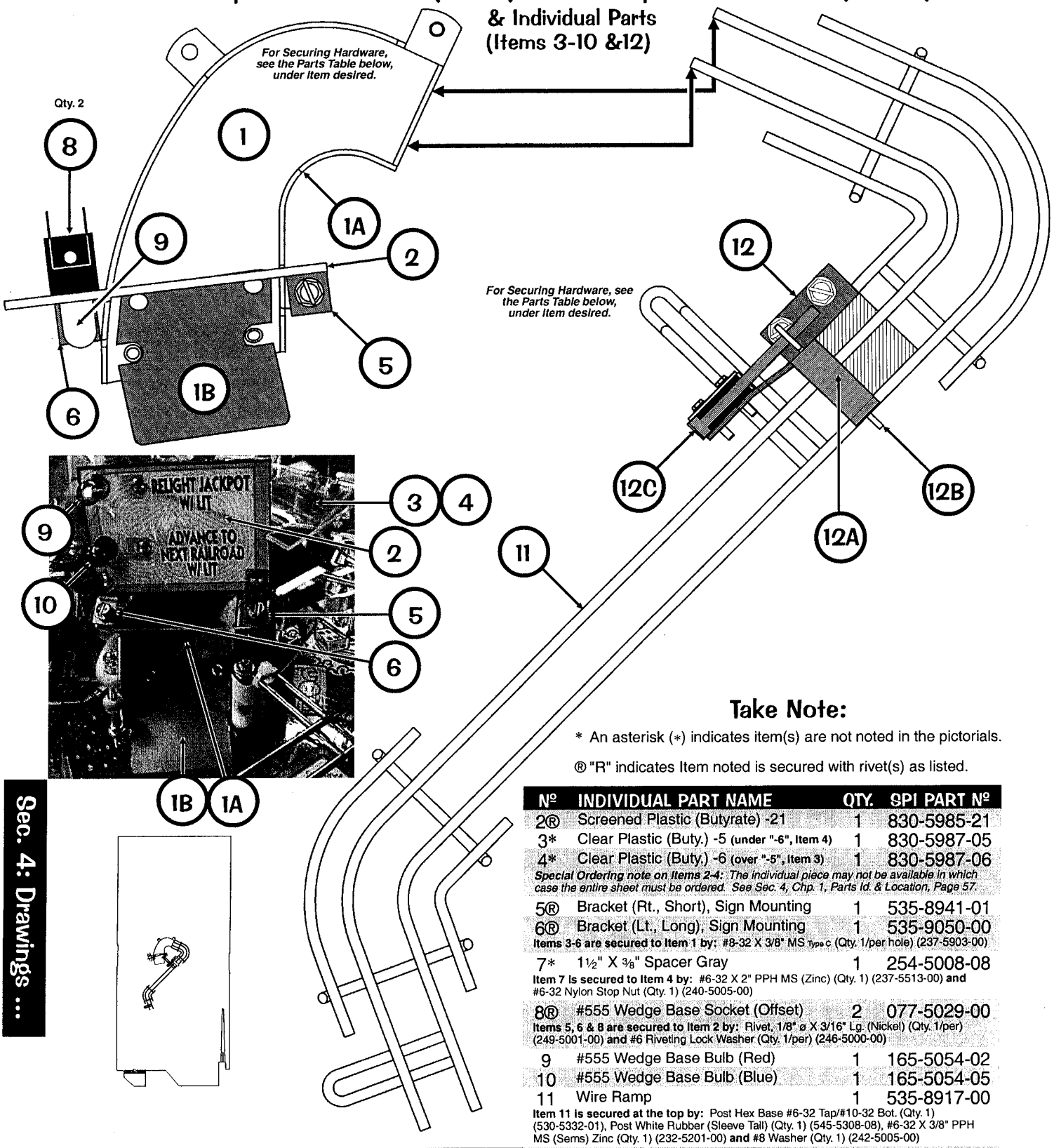
Right Plastic Ramp is secured above the playfield by:

A▲▼	#4 X 5/8" PFH (Black)	Qty. 2	237-5833-00
B▼	2¼" X 1/4" Hex Spacer #6-32 Tap	Qty. 2	254-5008-18
C▼	#6-32 X 3/8" PPH MS (Sems) Zinc	Qty. 2	232-5201-00
D▼	#6 Washer	Qty. 2	242-5001-00
E▼	2" X 1/4" Hex Spacer #8-32 Tap	Qty. 1	254-5031-04
F▼	#8-32 X 3/8" PPH MS (Sems) Zinc	Qty. 1	232-5301-00
G▼	#8 Washer	Qty. 2	242-5005-00

This Ramp is secured into the Back Panel by: *Back Edge Lip into Back Panel Slot.*

Note: Item B ▼ *is mounted on a* ***Ramp Mounting Bracket*** *(515-6508-00) on the wood rail.*

Metal Ramp, 500-6510-00 (Item 1), Wire Ramp, 535-8917-00 (Item 11) & Individual Parts (Items 3-10 &12)



Take Note:

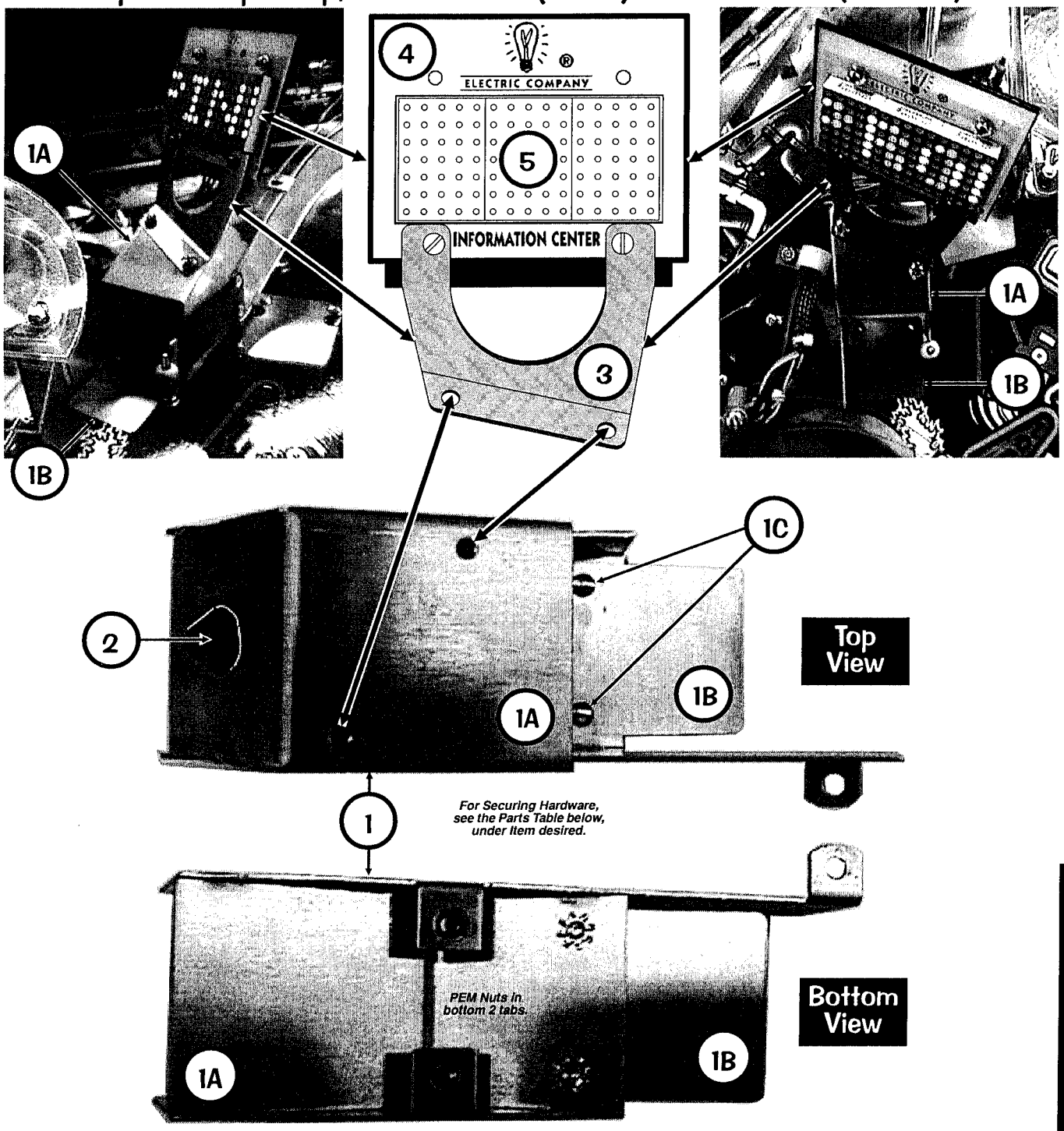
* An asterisk (*) indicates item(s) are not noted in the pictorials.

® "R" indicates Item noted is secured with rivet(s) as listed.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
2®	Screened Plastic (Butyrate) -21	1	830-5985-21
3*	Clear Plastic (Buty.) -5 **(under "-6", Item 4)**	1	830-5987-05
4*	Clear Plastic (Buty.) -6 **(over "-5", Item 3)**	1	830-5987-06
	***Special Ordering note on Items 2-4:** The individual piece may not be available in which case the entire sheet must be ordered. See Sec. 4, Chp. 1, Parts Id. & Location, Page 57.*		
5®	Bracket (Rt., Short), Sign Mounting	1	535-8941-01
6®	Bracket (Lt., Long), Sign Mounting	1	535-9050-00
	Items 3-6 are secured to Item 1 by: #8-32 X 3/8" MS Type c (Qty. 1/per hole) (237-5903-00)		
7*	1½" X ⅜" Spacer Gray	1	254-5008-08
	Item 7 is secured to Item 4 by: #6-32 X 2" PPH MS (Zinc) (Qty. 1) (237-5513-00) **and** #6-32 Nylon Stop Nut (Qty. 1) (240-5005-00)		
8®	#555 Wedge Base Socket (Offset)	2	077-5029-00
	Items 5, 6 & 8 are secured to Item 2 by: Rivet, 1/8" ø X 3/16" Lg. (Nickel) (Qty. 1/per) (249-5001-00) **and** #6 Riveting Lock Washer (Qty. 1/per) (246-5000-00)		
9	#555 Wedge Base Bulb (Red)	1	165-5054-02
10	#555 Wedge Base Bulb (Blue)	1	165-5054-05
11	Wire Ramp	1	535-8917-00
	Item 11 is secured at the top by: Post Hex Base #6-32 Tap/#10-32 Bot. (Qty. 1) (530-5332-01), Post White Rubber (Sleeve Tall) (Qty. 1) (545-5308-08), #6-32 X 3/8" PPH MS (Sems) Zinc (Qty. 1) (232-5201-00) **and** #8 Washer (Qty. 1) (242-5005-00)		
12	Gate (Roll-Under 1-1/2" Gold) Assy.	1	515-6490-06
	ORDERING ABOVE (ITEM 12) SUB-ASSY. PART Nº WILL INCLUDE:		
12A	Gate Bracket (Gold)	1	535-8529-00
12B	Wire Form (Gold) (on above item)	1	535-8530-00
12C	Micro Switch (for Roll-Under Gate)	1	180-5087-00
12D*	Switch Body Protect Plate	1	535-6539-00
12E*	Diode, 1N4001	1	112-5001-00
12F*	#2-56 X 1/2" HWH Ser UNS #4HD TR3 BO	2	237-5937-02
	Item 12 is secured to Item 11 by: #6-32 X 1/4" PPH MS (Sems) Zinc (Qty. 2) (232-5200-00)		
	***Ordering Note:** If **515-6490-06** is unavailable, order the individual part(s) actually required.*		

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Metal Ramp Riveted Assembly	1	500-6510-00
	ORDERING ABOVE® RIVETED ASSY. PART Nº WILL INCLUDE:		
1A®	Ramp (Plain No Parts)	1	535-8922-00
1B®	Ramp Flap *(secured to 1A by 1C)*	1	535-8969-00
1C*	Rivet, 1/8" ø X 1/8" Lg. (Nickel)	2	249-5008-00
	Item 1 is secured above the playfield at Ramp Tab by: #8 X 1/2" HWH AB Zinc (Qty. 1) (234-5101-00) **and at Ramp Flap by:** #4 X 5/8" PPH (Black) (Qty. 2) (237-5833-00)		
	***Ordering Note:** If **500-6510-00** is unavailable, order the individual part(s) actually required.*		

Speed Bump Ramp, 515-7202-00 (Item 1) & Individual Parts (Items 2-5)



Take Note:

® "R" indicates Item noted is secured with rivet(s) as listed.

For a break-down of parts of Item 5, Dot Display Board (520-5197-00), see Sec. 5, Chp. 4, Dot Display (5X7) x3 PC Board (Electric Company Sign) Component Layout & Parts, Page 133.

Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
1®	Speed Bump Metal Ramp Riv. Assy.	1	515-7202-00
ORDERING ABOVE® RIVETED ASSY. PART Nº WILL INCLUDE:			
1A®	Speed Bump Ramp (Plain No Parts)	1	535-9034-00
1B®	Ramp Flap *(secured to 1A by 1C)*	1	535-9037-00
1C	Rivet, 1/8" ø X 1/8" Lg. (Nicke)	2	249-5008-00
Item 1 is secured above the playfield at Ramp Tab by: #8 X 1/2" HWH AB Zinc (Qty. 1) (234-5101-00) **and below the playfield by:** #8-32 X 7/8" HWH MS (Zinc) (Qty. 2) (237-5890-00) **and** #8 Washer .17" I.D. X 1/2" O.D. X .042" (Qty. 2) (242-5015-00)			
Ordering Note: If **515-7202-00** *is unavailable*, order the individual part(s) actually required.			
2	Deflector Pad (Bumper)	1	545-5428-00

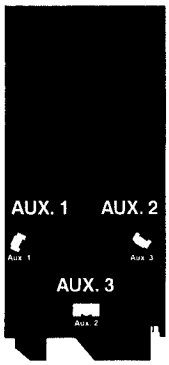
Nº	INDIVIDUAL PART NAME	QTY.	SPI PART Nº
3	Mounting Bracket (Dot Matrix Sign)	1	535-8946-00
Item 3 is secured to Item 1 by: #8-32 X 1/4" MS (Sems) Zinc (Qty. 2) (232-5300-00)			
4	Screened Plastic (Butyrate) -19	1	830-5985-19
Special Ordering note on Item 4: *The individual piece may not be available in which case the entire sheet must be ordered. See Sec. 4, Chp. 1, Parts Id. & Location, Page 57.*			
5	Dot Display (5X7) x3 PC Board	1	520-5197-00
Items 4 & 5 are secured to Item 3 by: #4-40 X 1/2" PPH MS (Sems) Zinc (Qty. 4) (237-5813-00), #4-40 Nylon Stop Nut (Qty. 4) (240-5303-00), #4 Washer Nylon (Qty. 4 @ rear) (242-5068-00) **and** #4 Washer (Qty. 2 @ Item 3 Top) (242-5002-00)			

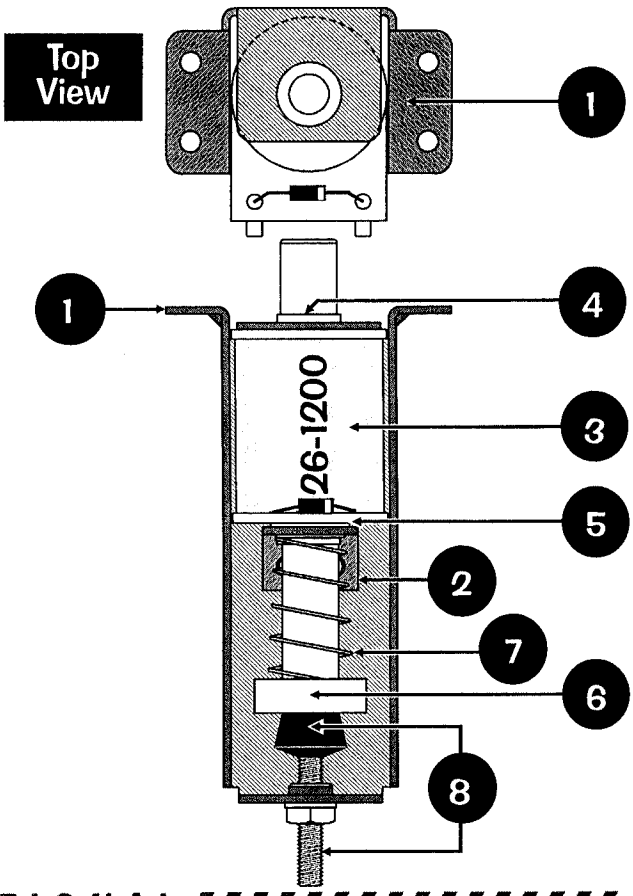
UK ONLY OPTIONAL

Ball Deflector Assemblies, 500-5788-02 (Qty. 2) (Items 1-8)

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Ball Deflector Coil Mounting Bracket	1	535-6857-02
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 4) (234-5101-00)		
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 № 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)		

Ordering Note: If **500-5788-02** *is unavailable,* order the individual part(s) actually required.



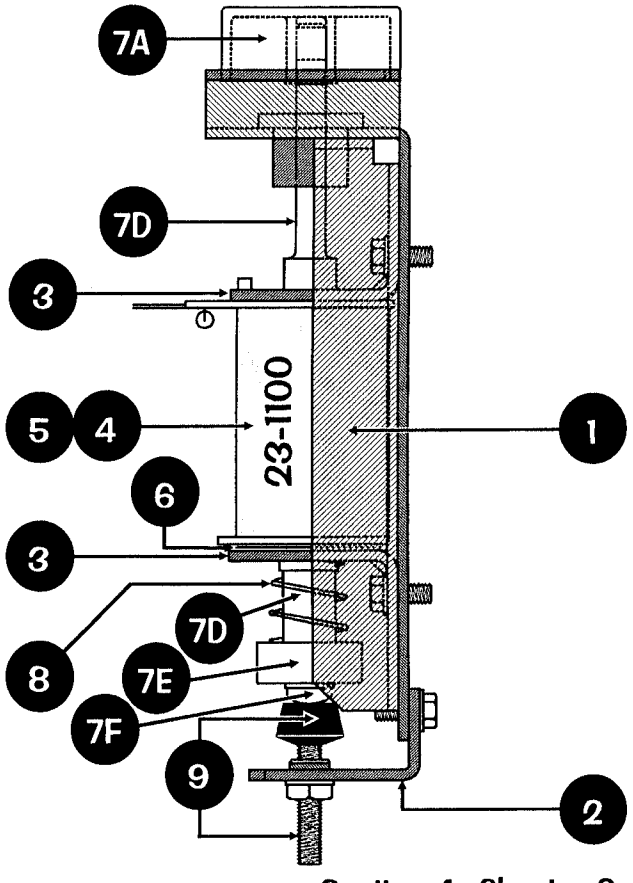


UK ONLY OPTIONAL

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

№	INDIVIDUAL PART NAME	QTY.	SPI PART №
1	Up/Down Post Coil Mounting Bracket	1	515-6840-00
	Item 1 is secured below the playfield by: #8 X 1/2" HWH AB (Zinc) (Qty. 6) (234-5101-00)		
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 № 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 № 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
	Ordering Note: If **515-6844-00** *is unavailable,* order the individual part(s) actually required. Item **7D**, part of Item **7**, Plunger & Shaft Sub-Assembly, is 1 piece and cannot be ordered separated.		
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)		

Ordering Note: If **500-6293-00** *is unavailable,* order the individual part(s) actually required.



Take Note:

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

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 harddrive.

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 Part #
#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	23-700 090-5022-00T
#3	LOWER LEFT POP	Q3	I/O Pwr. Drvr.	BRN-ORG	J8-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#4	LOWER RIGHT POP	Q4	I/O Pwr. Drvr.	BRN-YEL	J8-P5	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#5	LOWER BOTTOM POP	Q5	I/O Pwr. Drvr.	BRN-GRN	J8-P6	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#6	BANK CLOSE	Q6	I/O Pwr. Drvr.	BRN-BLU	J8-P7	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#7	DROP TARGET RESET	Q7	I/O Pwr. Drvr.	BRN-VIO	J8-P8	YEL-VIO	J10-P4/5	50v DC	24-940 090-5036-00B
#8	LOCK KICKER	Q8	I/O Pwr. Drvr.	BRN-GRY	J8-P9	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00B

	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) Part #
#9	UPPER LEFT POP	Q9	I/O Pwr. Drvr.	BLU-BRN	J9-P1	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#10	UPPER RIGHT POP	Q10	I/O Pwr. Drvr.	BLU-RED	J9-P2	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#11	UPPER BOTTOM POP	Q11	I/O Pwr. Drvr.	BLU-ORG	J9-P4	YEL-VIO	J10-P4/5	50v DC	26-1200 090-5044-00T
#12	CHANCE SCOOP	Q12	I/O Pwr. Drvr.	BLU-YEL	J9-P5	YEL-VIO	J10-P4/5	50v DC	23-800 090-5001-00B
#13	BANK OPEN	Q13	I/O Pwr. Drvr.	BLU-GRN	J9-P6	YEL-VIO	J10-P4/5	50v DC	23-1100 090-5030-00T
#14	UPPER FLIPPER (50v RED/YEL)	Q14	I/O Pwr. Drvr.	BLU-BLK	J9-P7	RED-YEL GRY-YEL	J10-P1/2	50v DC	23-1500 090-5062-00
#15	LEFT FLIPPER (50v RED/YEL)	Q15	I/O Pwr. Drvr.	ORG-GRY	J9-P8	RED-YEL GRY-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T
#16	RIGHT FLIPPER (50v RED/YEL)	Q16	I/O Pwr. Drvr.	ORG-VIO	J9-P9	RED-YEL BLU-YEL	J10-P1/2	50v DC	22-1080 090-5032-00T

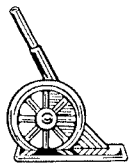
	Low Current Coils Group 1	Drive Transistor (D.T.)	Driver Ouput Board	D.T. Control Line Color	D.T. Control Line Connect	Power Line Color	Power Line Connnection	Power Voltage	Coil, Bulb or Meter Part #
#17	LEFT SLINGSHOT	Q17	I/O Pwr. Drvr.	VIO-BRN	J7-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#18	RIGHT SLINGSHOT	Q18	I/O Pwr. Drvr.	VIO-RED	J7-P3	BRN	J7-P1	20v DC	23-800 090-5001-00T
#19	FLASH RGT RAMP TOP	Q19	I/O Pwr. Drvr.	VIO-ORG	J7-P4	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#20	FLASH RGT RAMP MID (X2)	Q20	I/O Pwr. Drvr.	VIO-YEL	J7-P6	ORG	J6-P10	20v DC	#906 Bulb are ABOVE
#21	FLASH LEFT RAMP TOP (X2)	Q21	I/O Pwr. Drvr.	VIO-GRN	J7-P7	ORG	J6-P10	20v DC	#89 Bulb 165-5000-89
#22	FLASH LEFT RAMP MID (X2)	Q22	I/O Pwr. Drvr.	VIO-BLU	J7-P8	ORG	J6-P10	20v DC	#89 Bulb are BELOW
#23	FLASH LEFT RAMP BOT	Q23	I/O Pwr. Drvr.	VIO-BLK	J7-P9	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#24	OPTIONAL COIN METER	Q24	I/O Pwr. Drvr.	VIO-GRY	J7-P10	RED	J16-P7	5v DC	Meter 5v 091-5000-00

Diode On Terminal Strip (if noted)

	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) or Bulb Part #
#25	WATERWORKS MOTOR	Q25	I/O Pwr. Drvr.	BLK-BRN	J6-P1	BRN	J7-P1	20v DC	EX00159A 041-5083-00
#26	ELECTRIC COMPANY	Q26	I/O Pwr. Drvr.	BLK-RED	J6-P2	BRN	J7-P1	20v DC	23-800 090-5001-00T
#27	MOTOR RELAY	Q27	I/O Pwr. Drvr.	BLK-ORG	J6-P3	BRN	J7-P1	20v DC	DC Relay 520-5066-00
#28	DICE EJECT	Q28	I/O Pwr. Drvr.	BLK-YEL	J6-P4	BRN	J7-P1	20v DC	26-1200 090-5044-00T
#29	FLASH RGT RAMP BOT	Q29	I/O Pwr. Drvr.	BLK-GRN	J6-P5	ORG	J6-P10	20v DC	#906 Bulb 165-5004-00
#30	LEFT RAMP DIVERTER	Q30	I/O Pwr. Drvr.	BLK-BLU	J6-P6	BRN	J7-P1	20v DC	32-1800 090-5031-00
#31	RIGHT RAMP DIVERTER	Q31	I/O Pwr. Drvr.	BLK-VIO	J6-P7	BRN	J7-P1	20v DC	32-1800 090-5031-00
#32	TOP LANE UP/DN POST	Q32	I/O Pwr. Drvr.	BLK-GRY	J6-P8	BRN	J7-P1	20v DC	26-1200 090-5044-00T

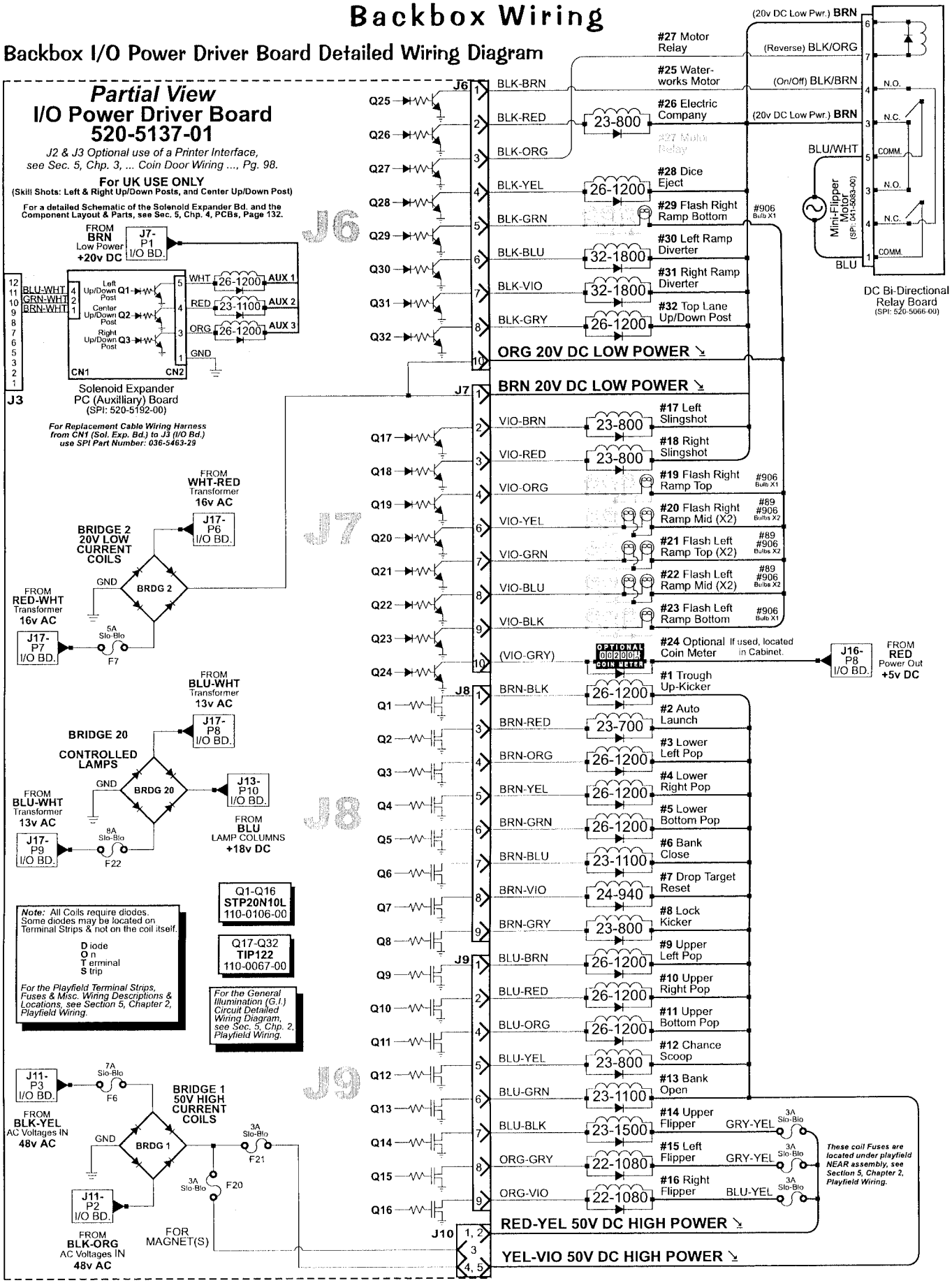
Note: In Test Flash Lamps Menu ("Flash" Icon), Flashers tested are all Flash Lamps located between Q1-Q32 (This Game:)

	Auxilliary (UK ONLY)	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) Part #
AUX 1:	LEFT UP/DOWN POST	Q1	Sol. Expander (Aux. Board)	WHT	J3-P11	BRN	J7-P1	20v DC	26-1200 090-5044-00T
AUX 2:	CENTER UP/DOWN POST	Q2	Sol. Expander (Aux. Board)	RED	J3-P10	BRN	J7-P1	20v DC	23-1100 090-5030-00T
AUX 3:	RIGHT UP/DOWN POST	Q3	Sol. Expander (Aux. Board)	ORG	J3-P9	BRN	J7-P1	20v DC	26-1200 090-5044-00T



Backbox Wiring

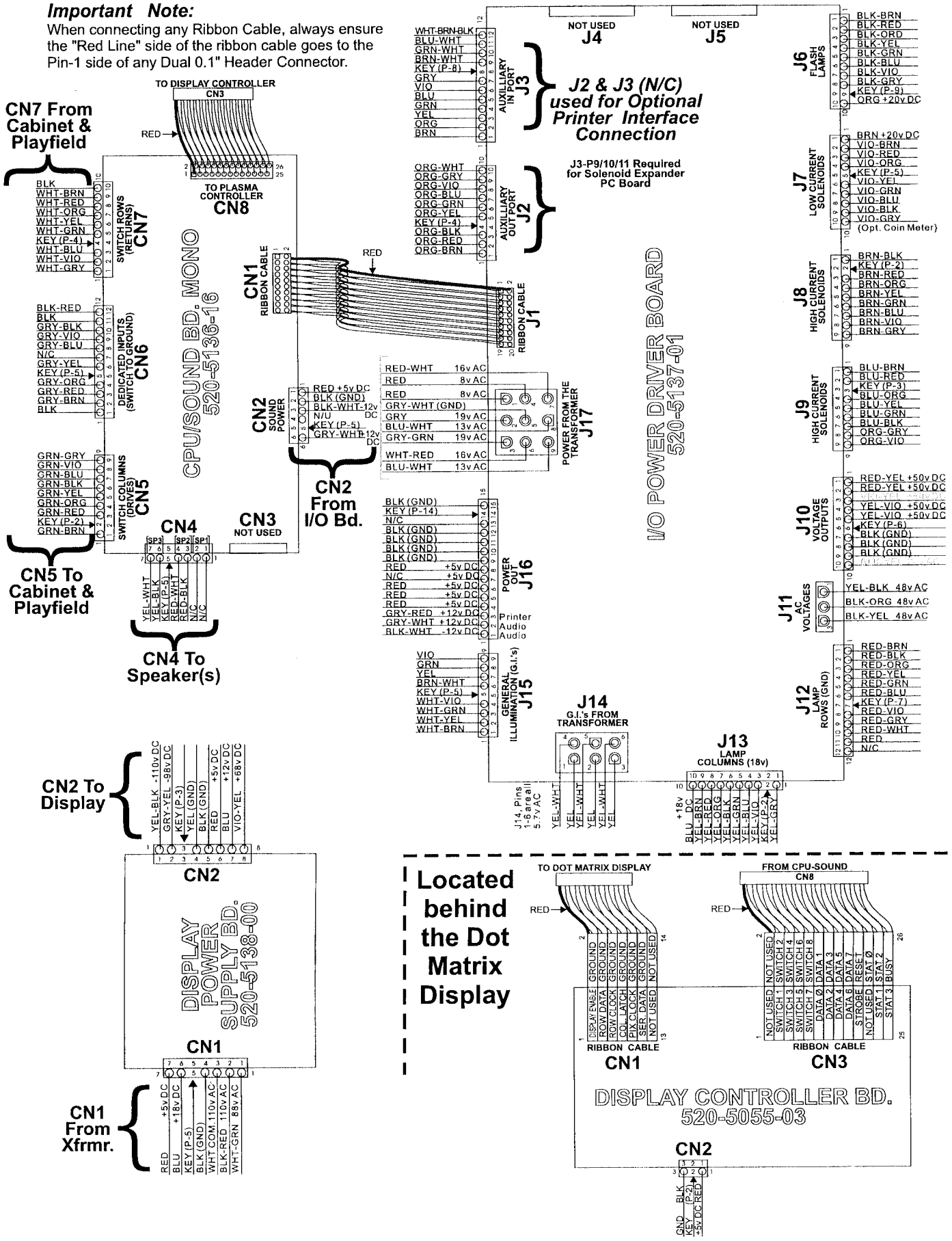
Backbox I/O Power Driver Board Detailed Wiring Diagram



Backbox Board Layout Wiring Diagram

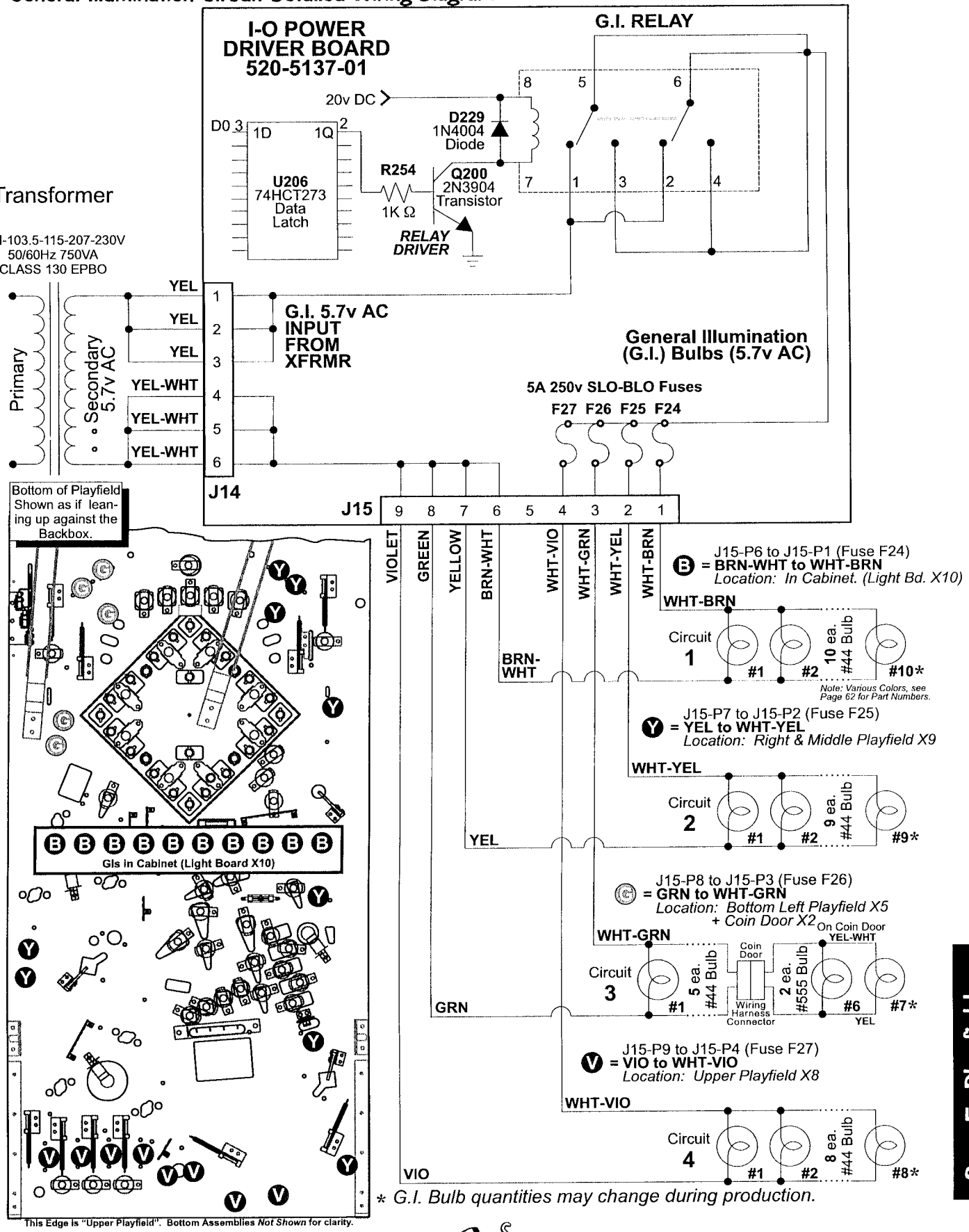
Important Note:

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.



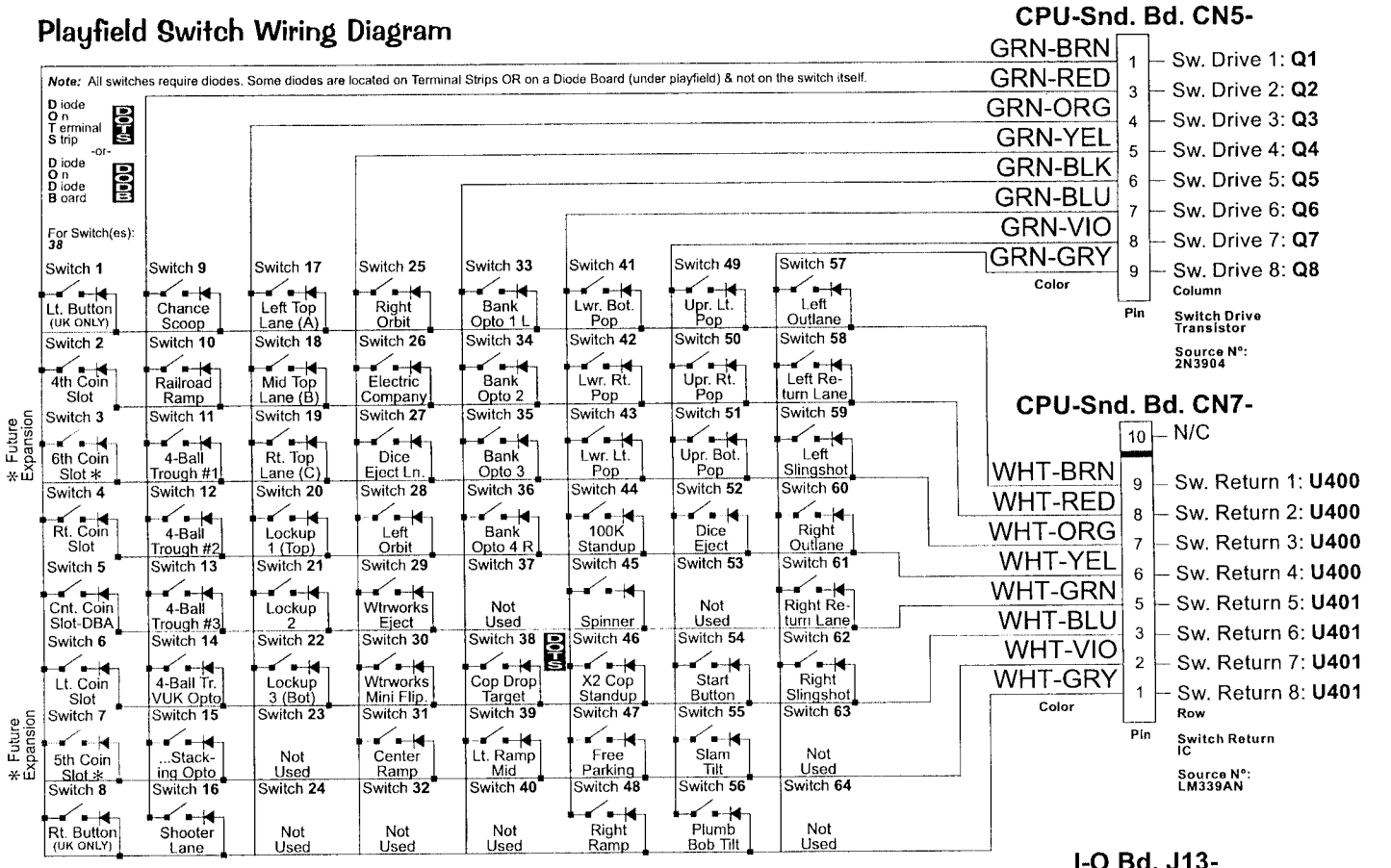
Playfield Wiring

General Illumination Circuit Detailed Wiring Diagram



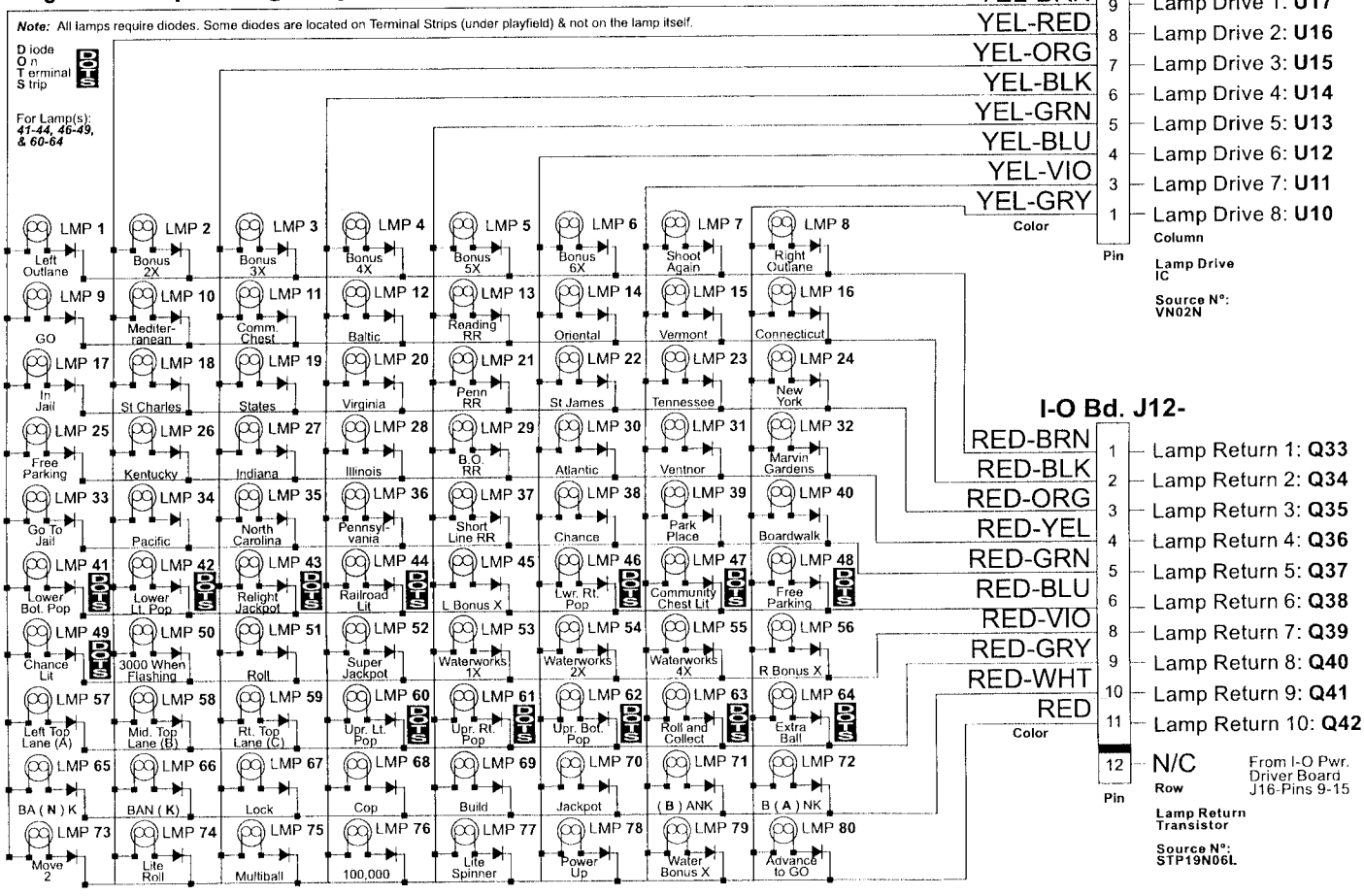
* G.I. Bulb quantities may change during production.

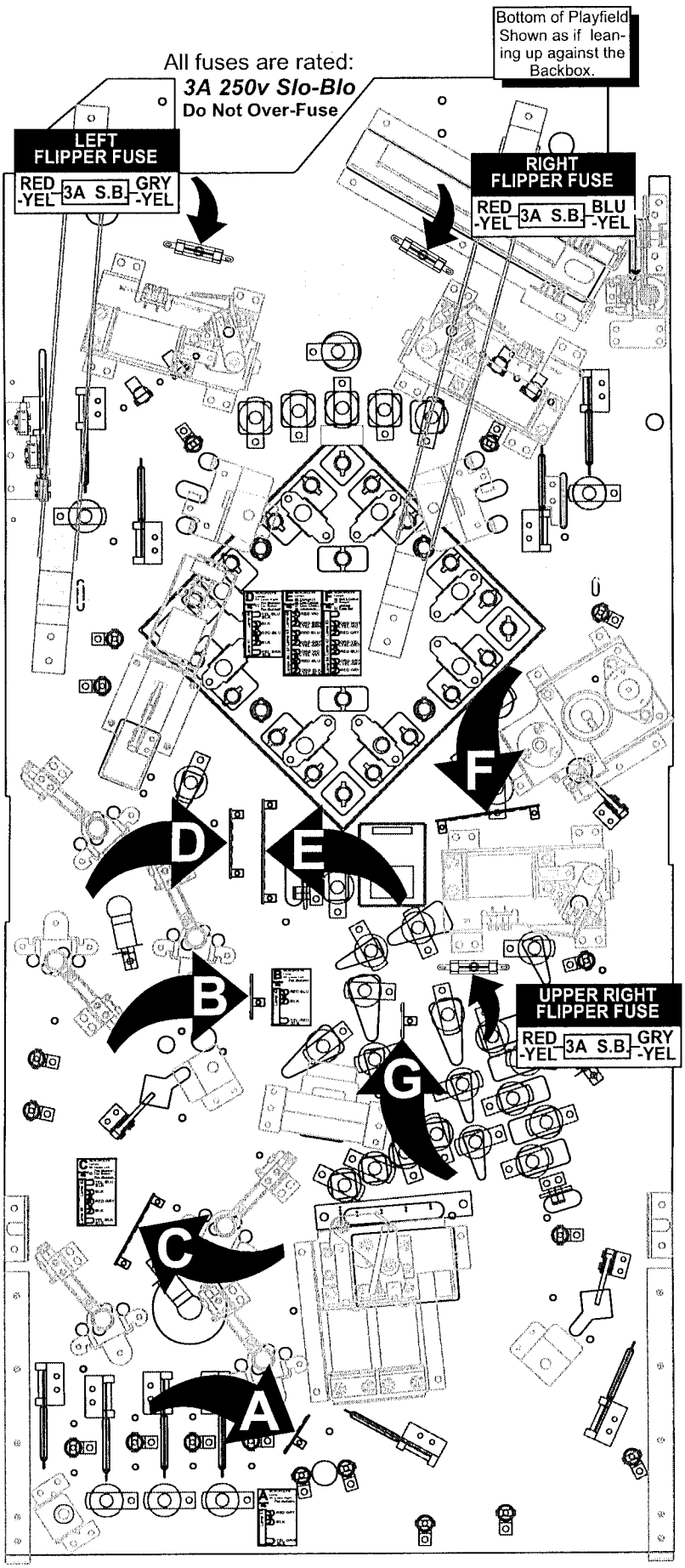
Playfield Switch Wiring Diagram



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").

Please Note: *Terminal Strip(s), Diode Board(s) and/or Fuse Holder(s) locations shown, represent the general location (your game may differ slightly).*

A MONOPOLY® Lamp: 61 Upper Right Pop (Bumper)

Terminal Strip	
Lamp 61	RED-GRY
	BLK
	YEL-GRN BLK

B MONOPOLY® Lamp: 42 Lower Left Pop (Bumper)

Terminal Strip	
Lamp 42	RED-BLU
	BLK
	YEL-RED BLK

C MONOPOLY® Lamps: 60 Upper Left Pop (Bumper), 62 Upr. Bottom Pop (Bumper)

Terminal Strip	
Lamp 62	YEL-BLU BLK
	BLK
	RED-GRY
Lamp 60	BLK
	YEL-BLK BLK

D MONOPOLY® Lamps: 41 Lwr. Bottom Pop (Bumper), 46 Lower Right Pop (Bumper)

Terminal Strip	
Lamp 41	YEL-BRN BLK
	BLK
	RED-BLU
Lamp 46	BLK
	YEL-BLU BLK

E MONOPOLY® Lamps: 49 Chance Lit, 48 Free Parking, 47 Com. Chest Lit, 44 Advance to ...

Terminal Strip	
Lamp 49	RED-VIO
	ORG-BRN to YEL-BRN
Lamp 48	RED-BLU
	ORG-GRY to YEL-GRY
Lamps 44 / 47	ORG-VIO to YEL-VIO
	RED-BLU
	ORG-BLK to YEL-BLK

F MONOPOLY® Lamps: 63 Roll & Collect, 43 Relight Jackpot, 64 Extra Ball

Terminal Strip	
Lamp 63	ORG-WHT to YEL-VIO
	RED-GRY
Lamp 43	ORG-YEL to YEL-ORG
	RED-BLU
Lamp 64	ORG-GRY to YEL-GRY
	RED-GRY

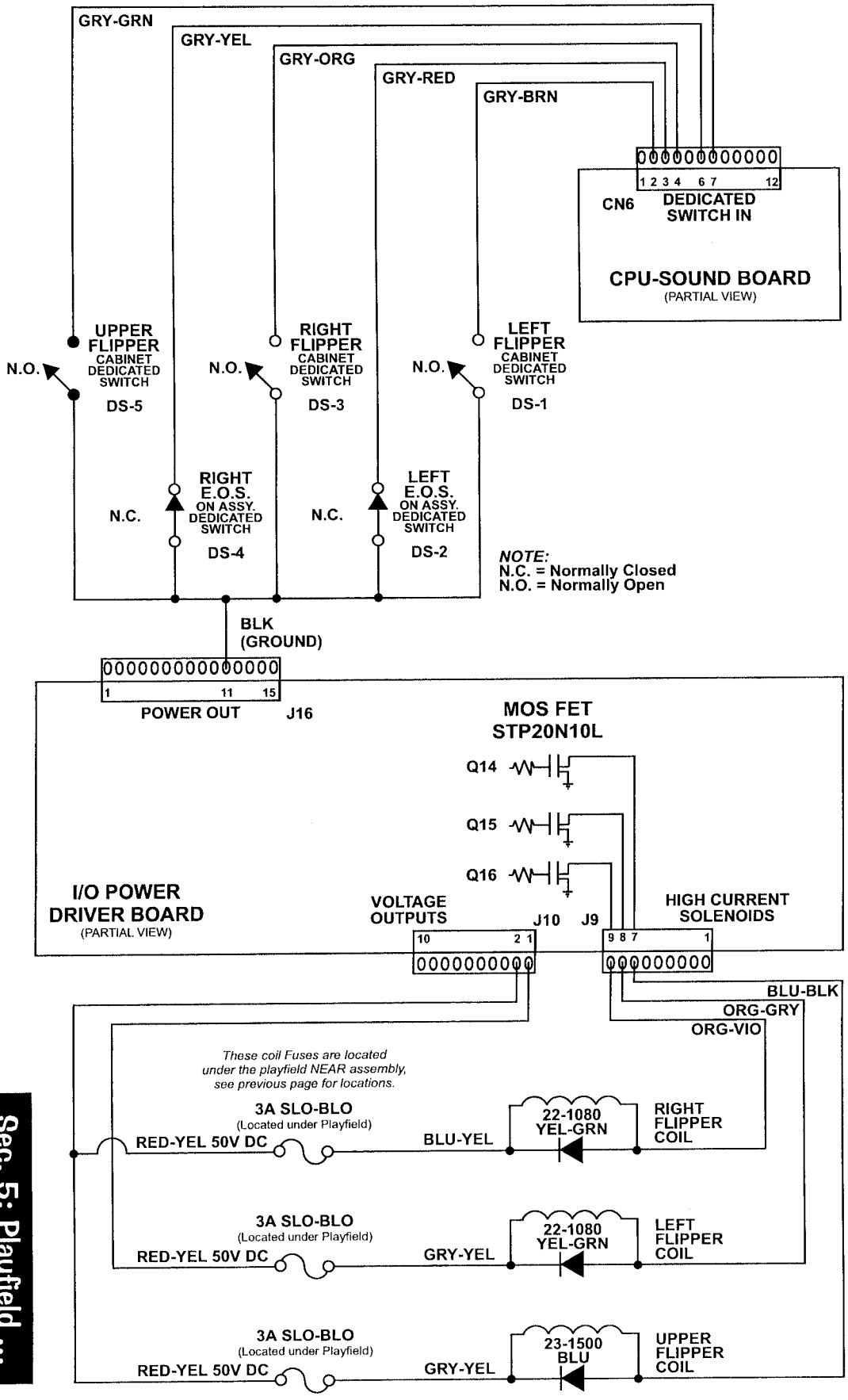
G MONOPOLY® Switch: 38 Cop Drop Target

Switch 38	WHT-BLU
	ORG-BLU to GRN-BLK

See the Pink Pages, Playfield - General Parts (Below) (Pg. 54) for Terminal Strips, Diodes, Fuses and Fuse Holders Part Nºs.

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

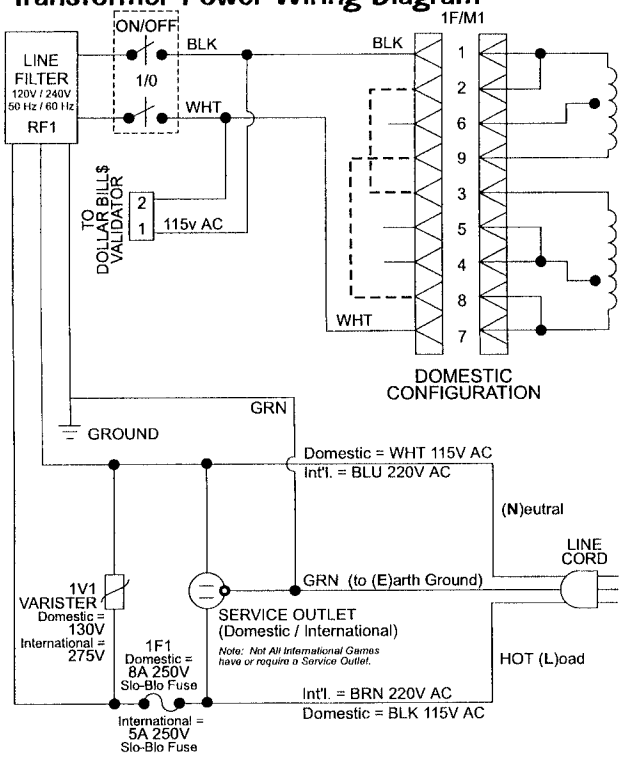
Our ***Flipper System*** uses one supply voltage (50v DC) for both ***kick*** & ***hold***. Once the **Game CPU** detects a Flipper Cabinet Switch closure (during game play) it applies a 40*msec* pulse to the gate of the Flipper Drive Transistor (STP-20N10L). If it continues to detect a Flipper Cabinet 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.

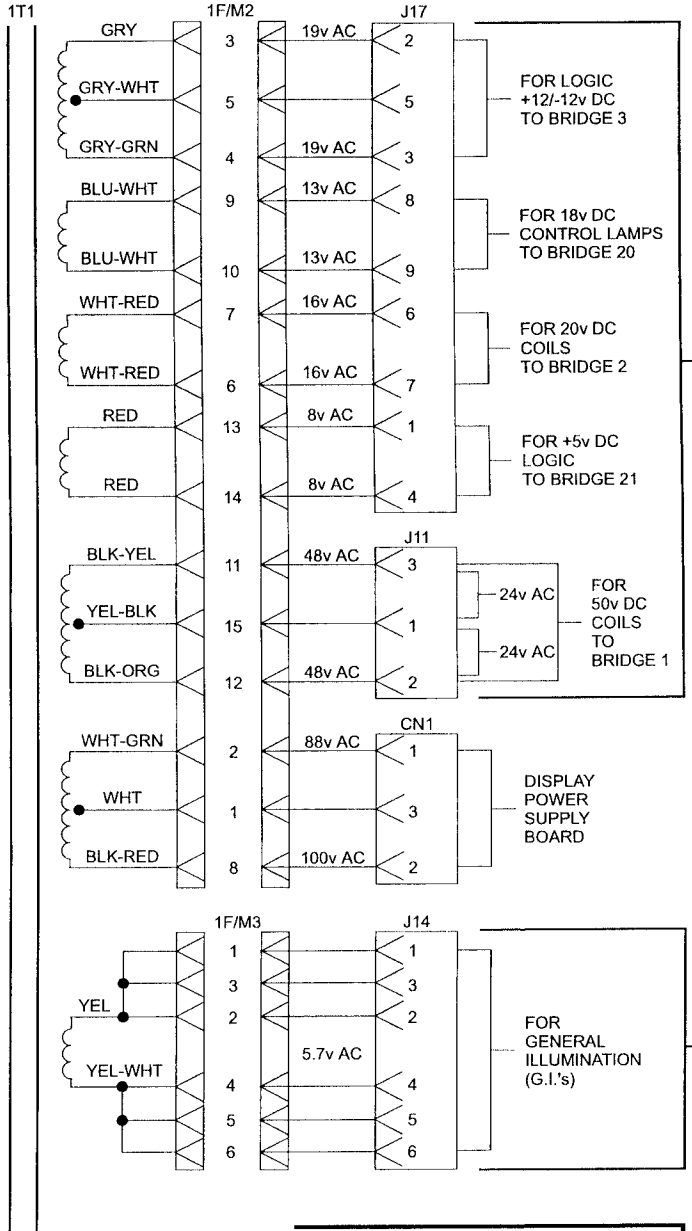
The **E.O.S.** (End-Of-Stroke) **Switch** serves the same function as before as it prevents foldback when the player has the flipper energized to capture balls. The **E.O.S. Switch** is a normally closed switch which opens approximately 1/16" when the flipper is energized. The **Game CPU** will detect 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 same side of the cabinet as the Upper Flipper) will have a* ***"Double-Stacked" E.O.S. Switch****. This allows the player to push the Flipper Button either half-way down to energize only the Lower Flipper or pushing the Flipper Button all the way down to energize both the Lower & Upper Flippers.*

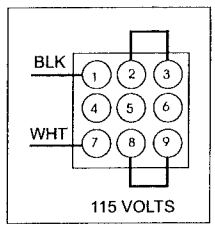
Cabinet Wiring

Transformer Power Wiring Diagram





JUMPERS FOR VOLTAGE VARIATION

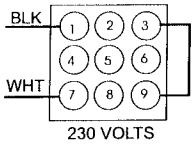


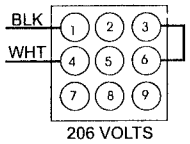
<<< CONFIGURATON FOR DOMESTIC 115V <<<

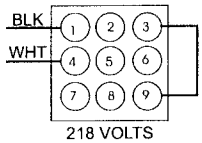
V V V CONFIGURATION OF 220V OR LOWER LINE VOLTAGES FOR INTERNATIONAL USE V V V

EXPORT/ HIGH LINE VOLTAGE
230/218/206 VOLTS

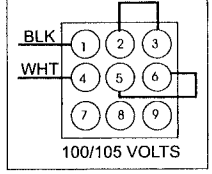
1F1= 5A 250V SLO BLO
1V1= 275V VARISTOR





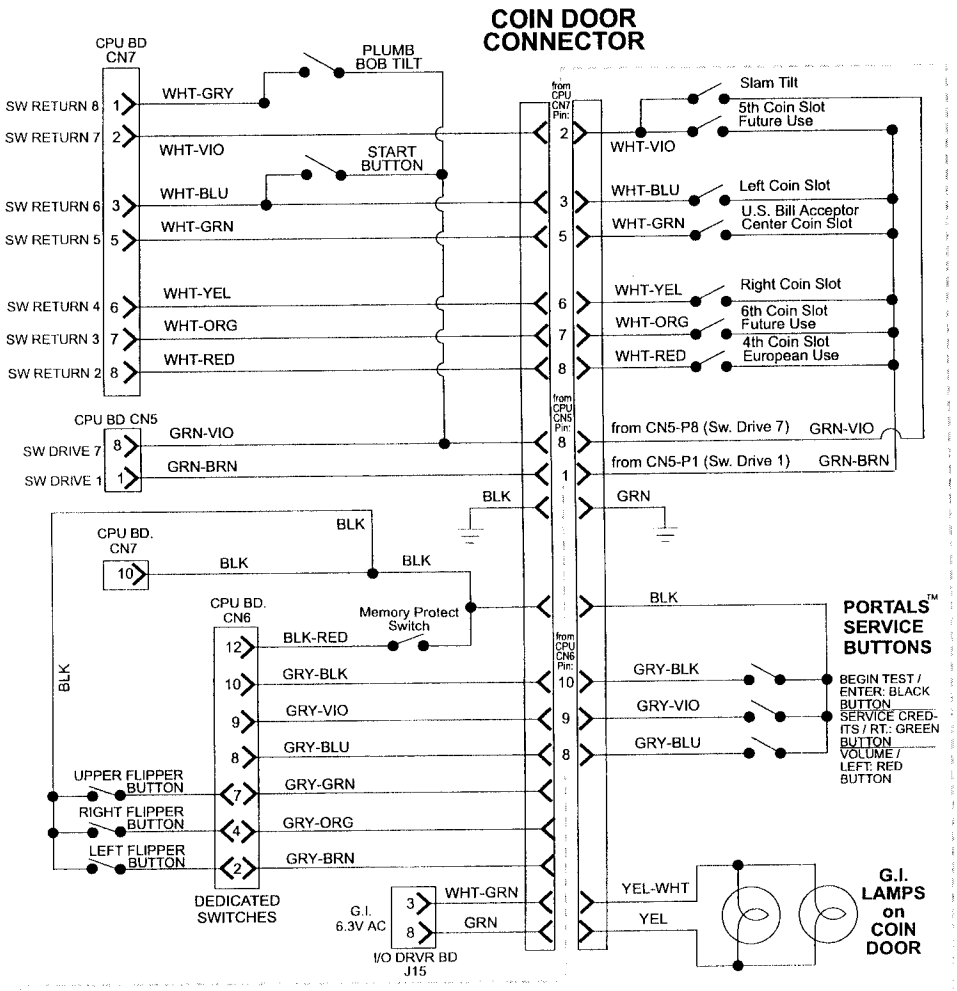


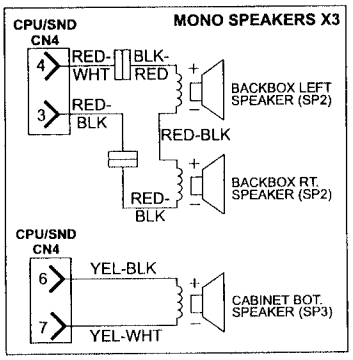
1F1= 8A SLO BLO
1V1= 130V VARISTOR

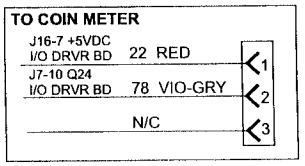


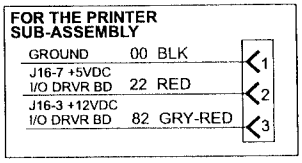
<<< CONFIGURATON FOR JAPAN or LOW LINE VOLTAGE <<<

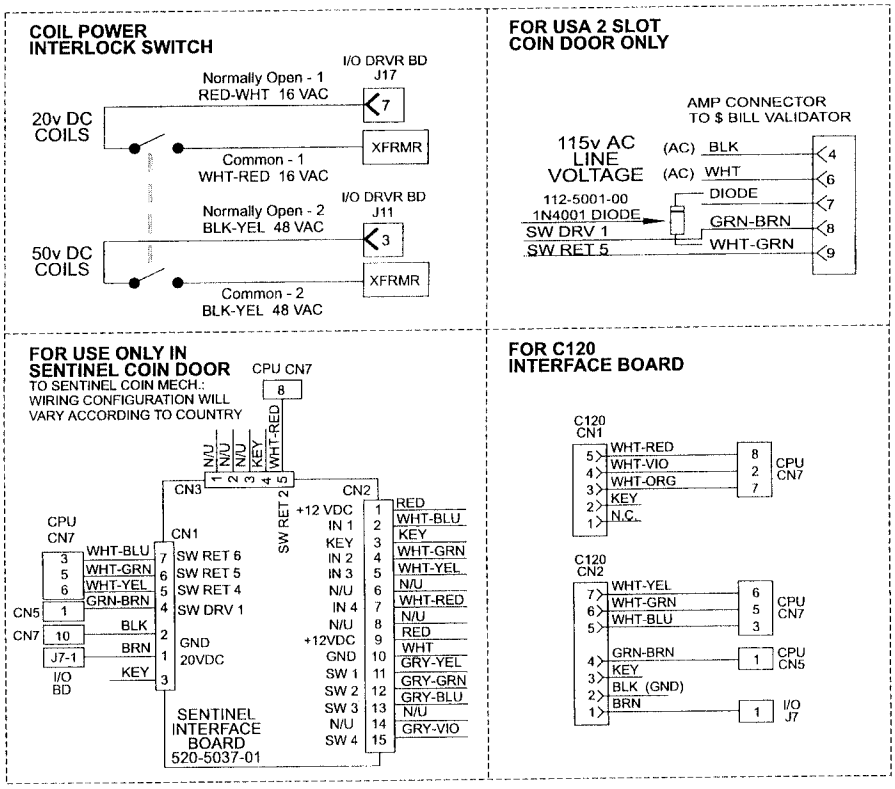
Cabinet / Coin Door Wiring Diagram



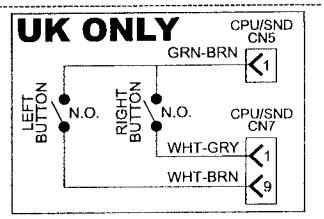






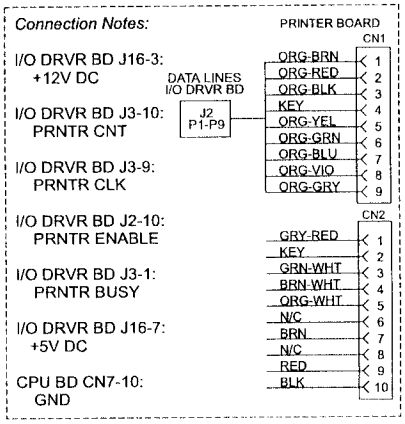


UK ONLY: 2 Extra Cabinet Buttons for the Post Save™Feature are used. The Left Button operates the Left Outlane Ball Deflector. The Right Button operates the Right Outlane Ball Deflector. Both buttons pushed together, operate the Center Up/Down Post. Both buttons are located under the Flipper Buttons.



PRINTER INTERFACE OPTIONAL

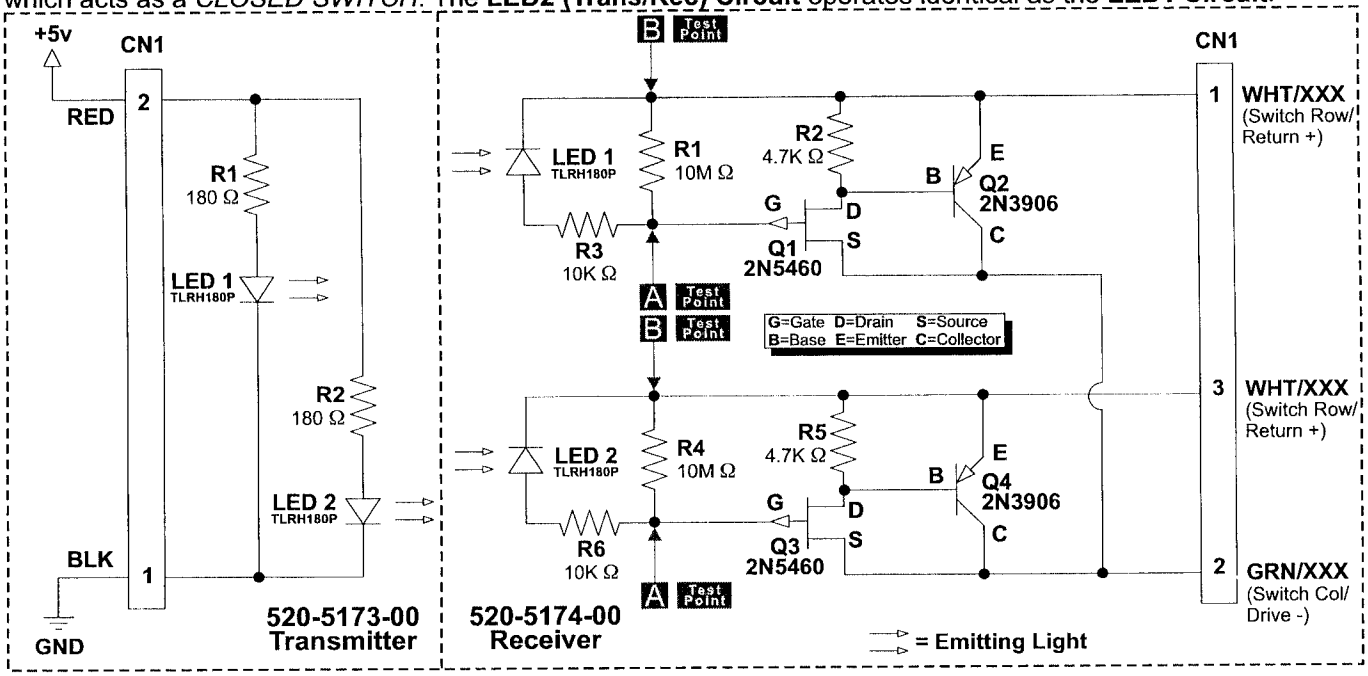
Cable Wiring Harness SPI Part Nº:
036-5408-00
RS-232 Printer Interface Board SPI Part Nº:
520-5069-00



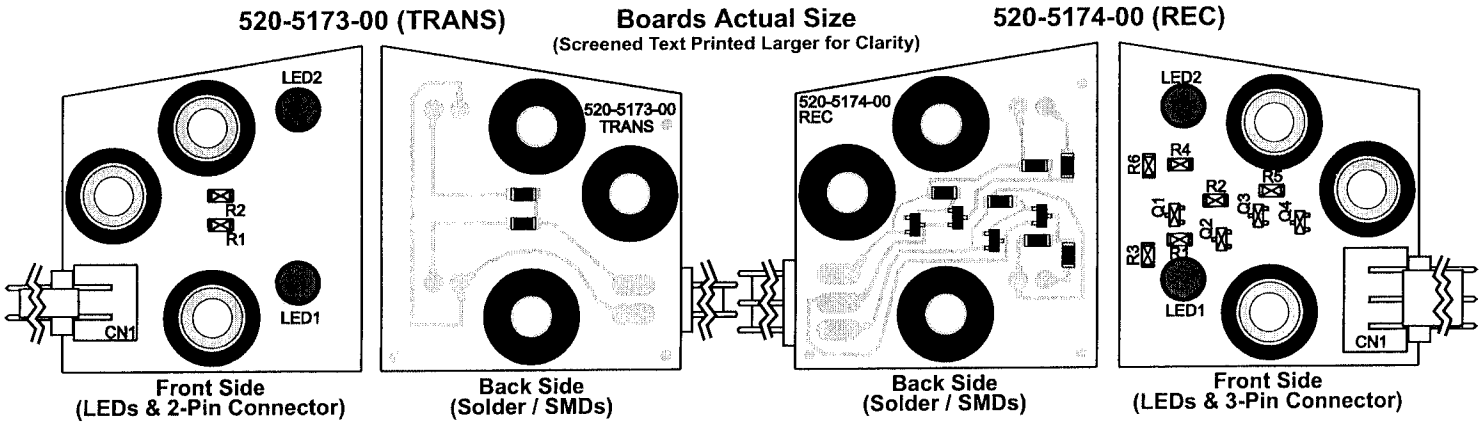
Printed Circuit Boards (PCBs)

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



ITEM	QTY	PART NUMBER	REF-DESIGNATOR
A	**1**	**515-0173-00**	**Dual-OPTO Trans. Bd. Assy.**
—	**1**	**520-5173-00**	**Dual-OPTO Trans. Bd.**
01	1	045-5111-02	CN1
01	**2**	**165-5052-00**	LED1, LED2
04	3	530-5308-02	n/a
03	3	545-5518-00	n/a
05	2	121-5067-00	R1, R2
B	**1**	**515-0174-00**	**Dual-OPTO Rec. Bd. Assy.**
—	**1**	**520-5174-00**	**Dual-OPTO Rec. Bd.**
01	1	045-5111-03	CN1
02	**2**	**165-5052-00**	LED 1, LED 2
04	3	530-5308-02	n/a
03	3	545-5518-00	n/a
05	2	110-5006-00	Q1, Q3
06	2	110-0086-00	Q2, Q4
07	2	121-5082-00	R1, R4
08	2	121-5083-00	R2, R5
09	2	121-5011-00	R3, R6



Replacement Part:
LED TLRH180P
(T1-3/4 GaAlAs)
SPI Part Nº:
165-5052-00

DESCRIPTION

PCB Assy. (with all **Items 1-5**)
PCB Assy. (with Items **1-3** only)
2X, .156" Rt. Angle (26-60-5020) Conn.
LED TLRH180P (Ultra Bright Red)
OPTO PCB Brass Tube Spacer
OPTO PCB Rubber Gromment
180 Ω 1/8W Chip Res. (CRCW)
PCB Assy. (with all **Items 1-9**)
PCB Assy. (with **Items 1-7** only)
3X, .156" Rt. Angle (26-60-5030) Conn.
LED TLRH180P (Ultra Bright Red)
OPTO PCB Brass Tube Spacer
OPTO PCB Rubber Gromment
2N5460, Transistor (P-FET SOT-23)
2N3906, Transistor
10M Ω 1/8W Chip Res. (CRCW)
4.7K Ω 1/8W Chip Res. (CRCW)
10K Ω 1/8W Chip Res. (CRCW)

OPTO Troubleshooting

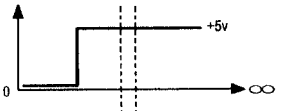
1. Volt Meter Test (indicates normal operating condition):

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.

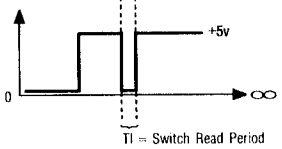
2. Oscilloscope Test (indicates normal operating condition):

Fig. A



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.

Fig. B



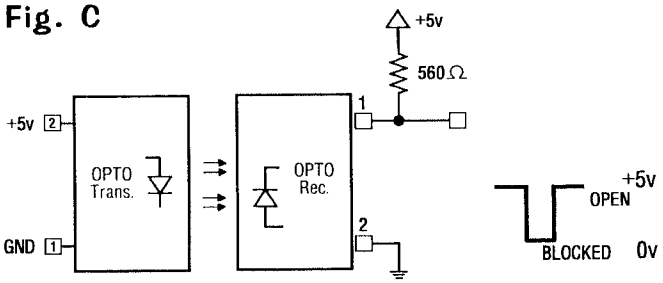
B. **CLOSED OPTO** (Light Blocked) = *SWITCH CLOSED.* Place Scope lead at **Pin-1** of OPTO Rec. Board with Scope Grounded (see Schematic). The Scope should display a **PULSE STREAM** indicating **Q2** has switched "On" as shown in **Fig. B**, Wave Form Diagram. This is your Switch Drive Pulse.

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.***

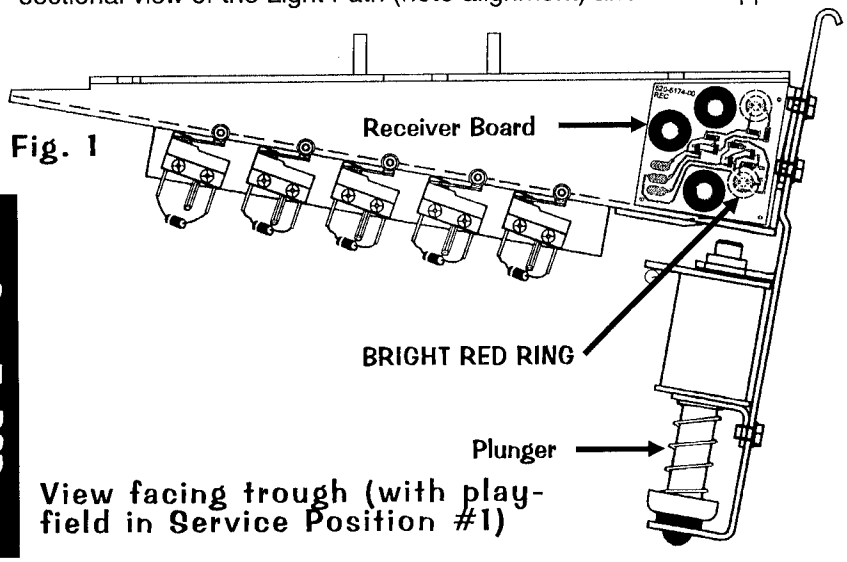
Fig. C



Trough Dual OPTO Boards Alignment / Test for LED1

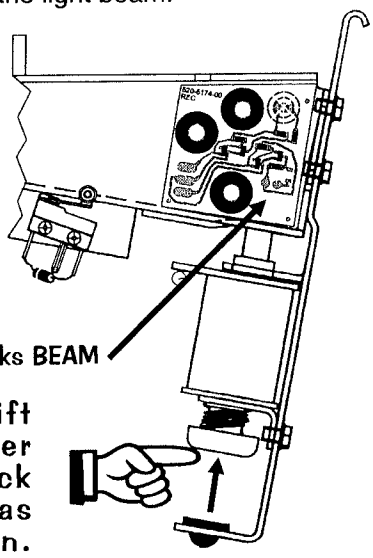
When a working **OPTO** is installed and connected in a game, the transmitter should light (LED1 lower & LED2 upper) when the power is switched on. With the playfield in Service Position #1 (playfield lifted up in the half-way position resting on the Prop Rod or edge slide support brackets) and the game 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



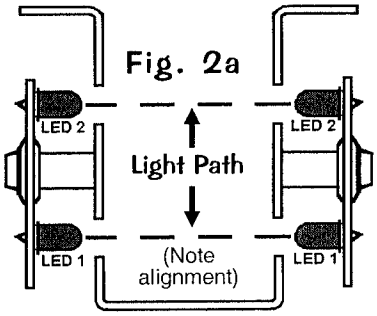
View facing trough (with playfield in Service Position #1)

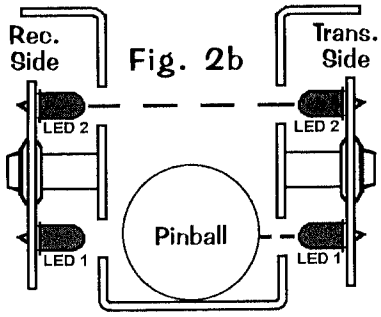
Fig. 2



Lift plunger to check switch as shown.

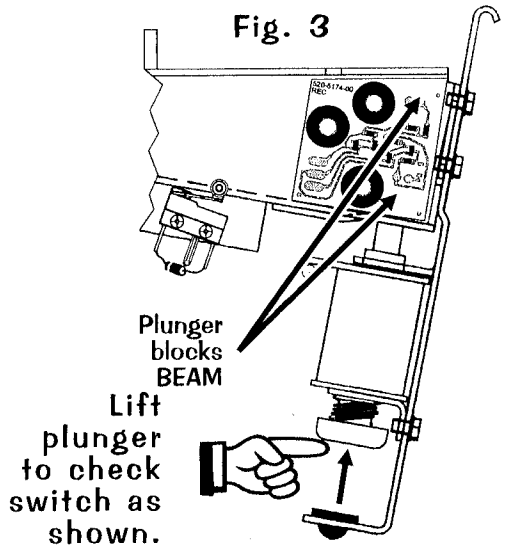
Sectional view from right (Fig. 2a & 2b)

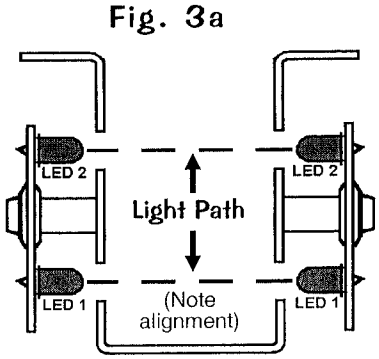


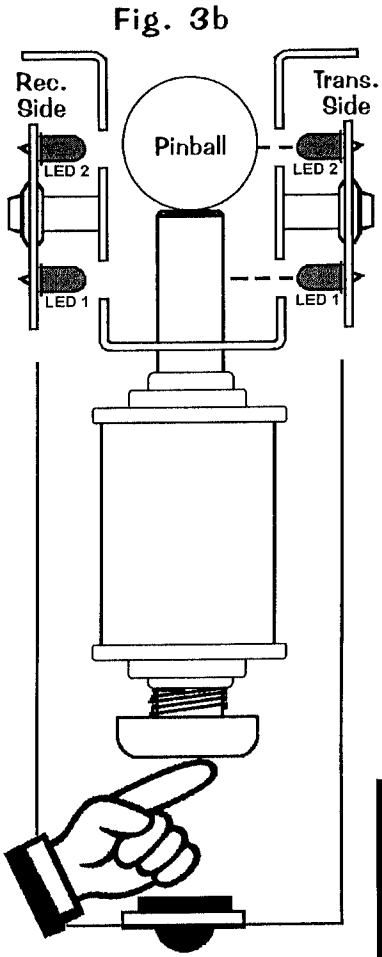


Trough Dual OPTO Boards Alignment / Test for LED2

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****).*

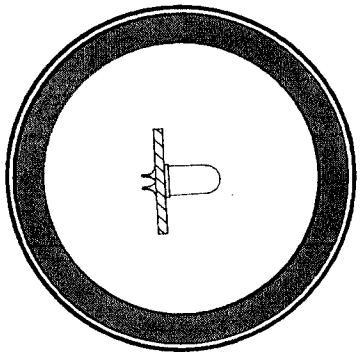


Fig. 4a
Correct Position

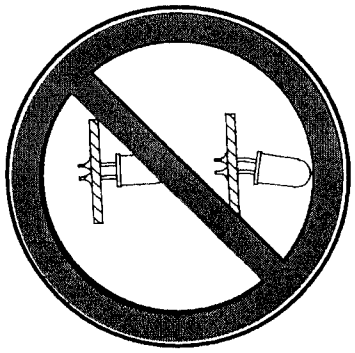
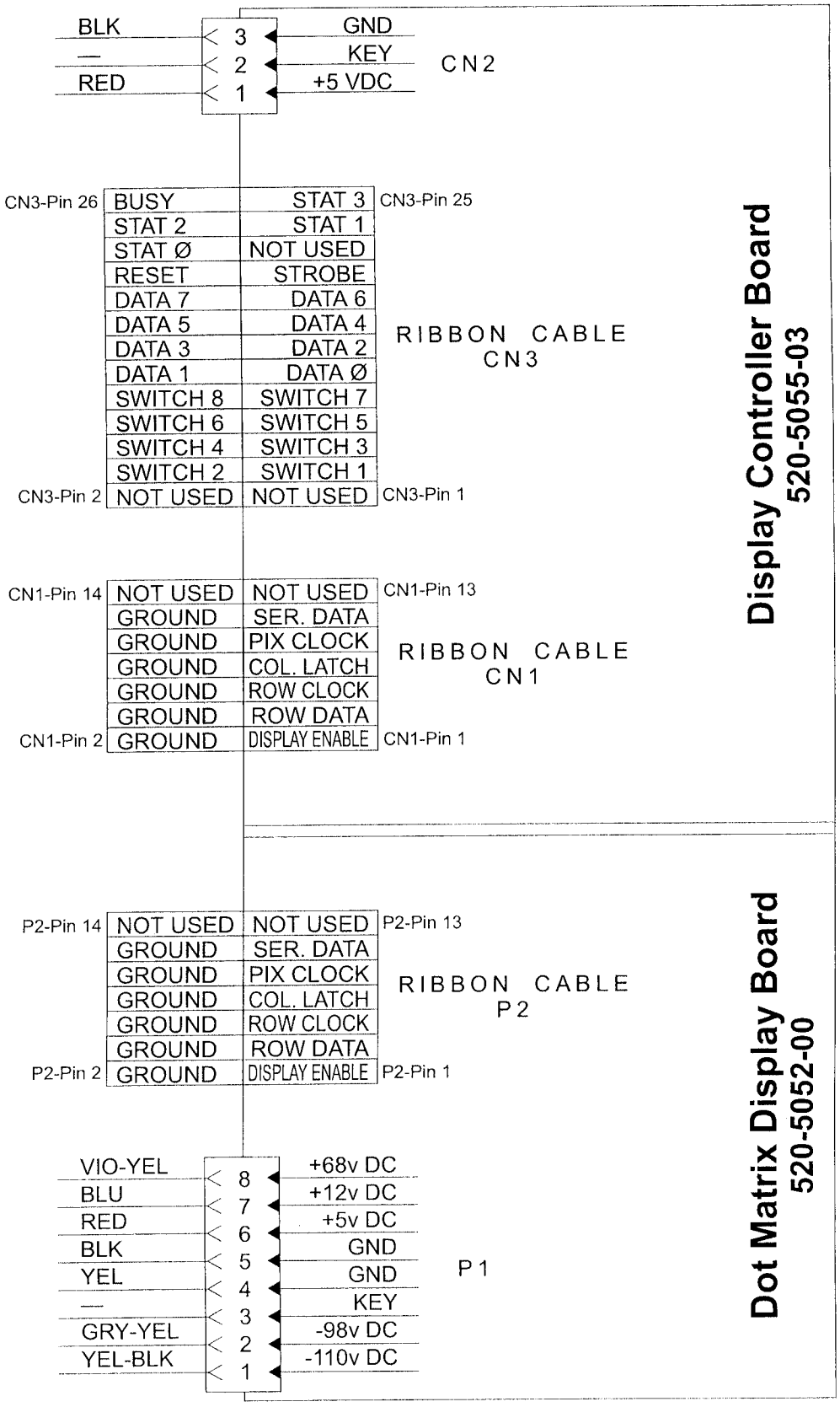
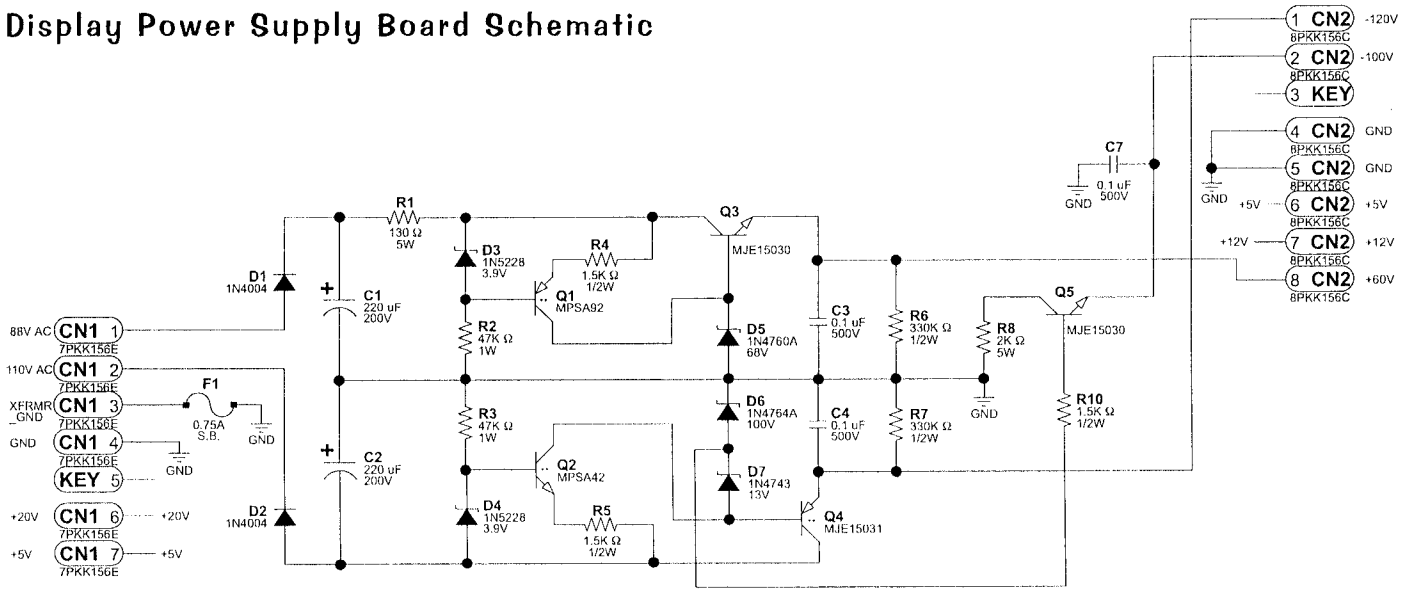


Fig. 4b
Incorrect Position

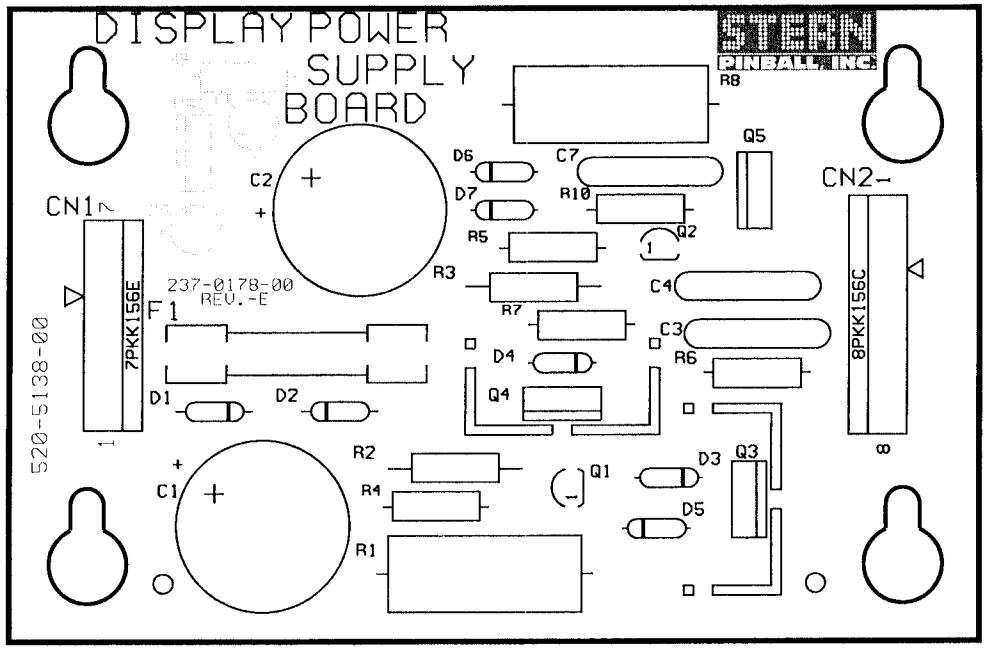

BLK
—
RED
3
2
1
GND
KEY
+5 VDC
CN2
CN3-Pin 26
BUSY
STAT 3
CN3-Pin 25
STAT 2
STAT 1
STAT Ø
NOT USED
RESET
STROBE
DATA 7
DATA 6
DATA 5
DATA 4
DATA 3
DATA 2
DATA 1
DATA Ø
SWITCH 8
SWITCH 7
SWITCH 6
SWITCH 5
SWITCH 4
SWITCH 3
SWITCH 2
SWITCH 1
CN3-Pin 2
NOT USED
NOT USED
CN3-Pin 1
RIBBON CABLE
CN3
CN1-Pin 14
NOT USED
NOT USED
CN1-Pin 13
GROUND
SER. DATA
GROUND
PIX CLOCK
GROUND
COL. LATCH
GROUND
ROW CLOCK
GROUND
ROW DATA
CN1-Pin 2
GROUND
DISPLAY ENABLE
CN1-Pin 1
RIBBON CABLE
CN1
Display Controller Board
520-5055-03
P2-Pin 14
NOT USED
NOT USED
P2-Pin 13
GROUND
SER. DATA
GROUND
PIX CLOCK
GROUND
COL. LATCH
GROUND
ROW CLOCK
GROUND
ROW DATA
P2-Pin 2
GROUND
DISPLAY ENABLE
P2-Pin 1
RIBBON CABLE
P2
VIO-YEL
BLU
RED
BLK
YEL
—
GRY-YEL
YEL-BLK
8
7
6
5
4
3
2
1
+68v DC
+12v DC
+5v DC
GND
GND
KEY
-98v DC
-110v DC
P1
Dot Matrix Display Board
520-5052-00



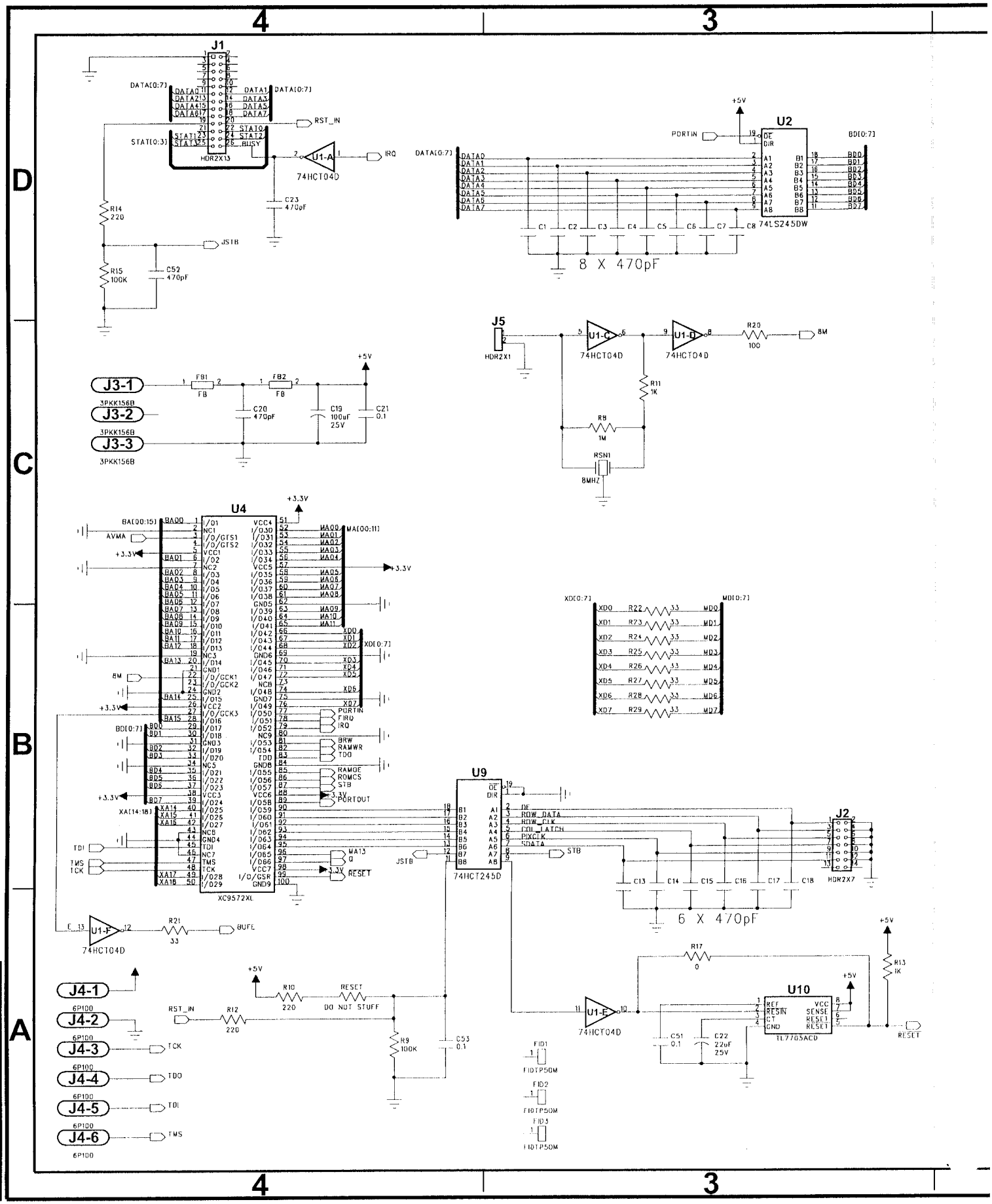
Display Power Supply Board Schematic

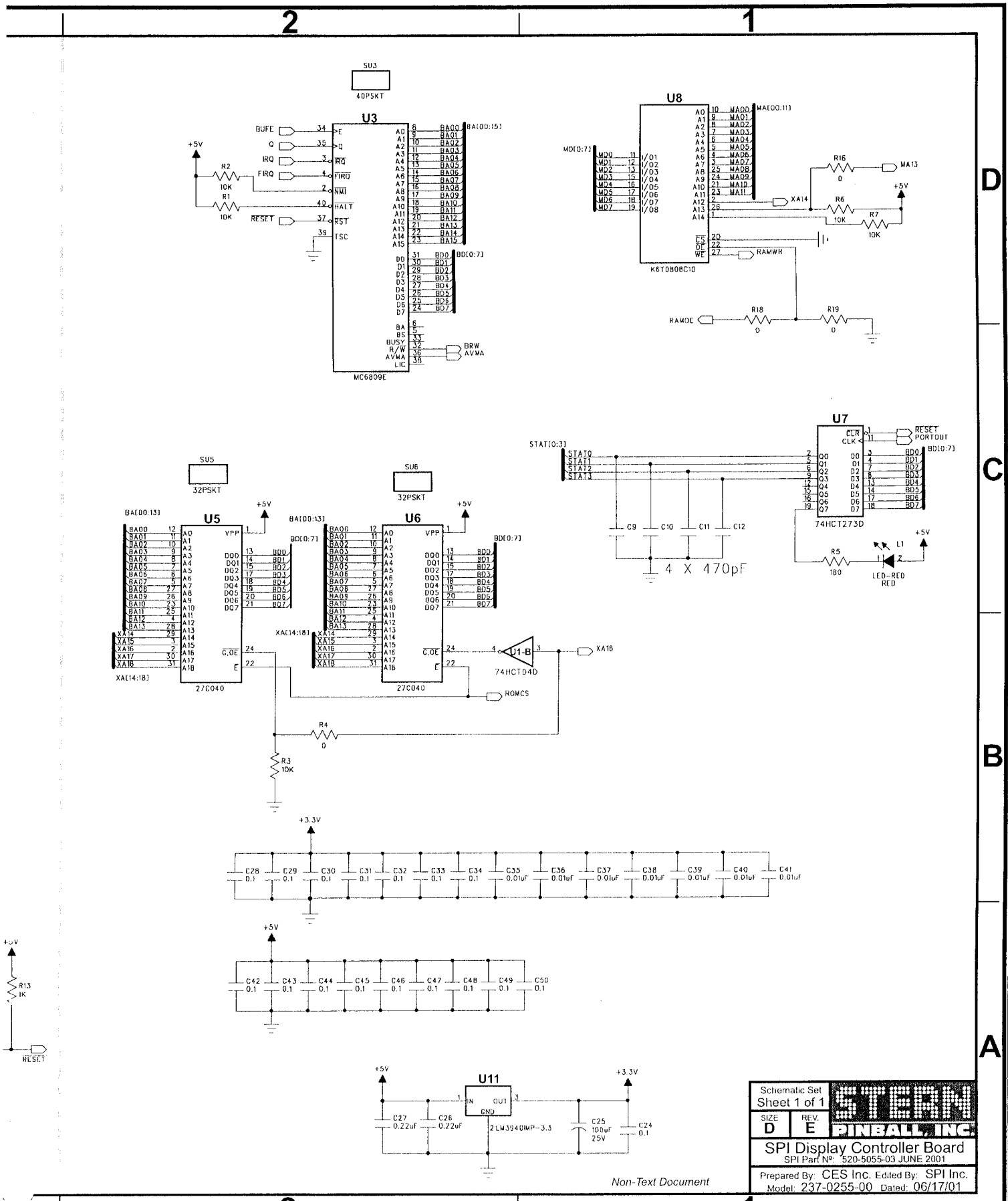


Display Power Supply Board Component Layout & Parts

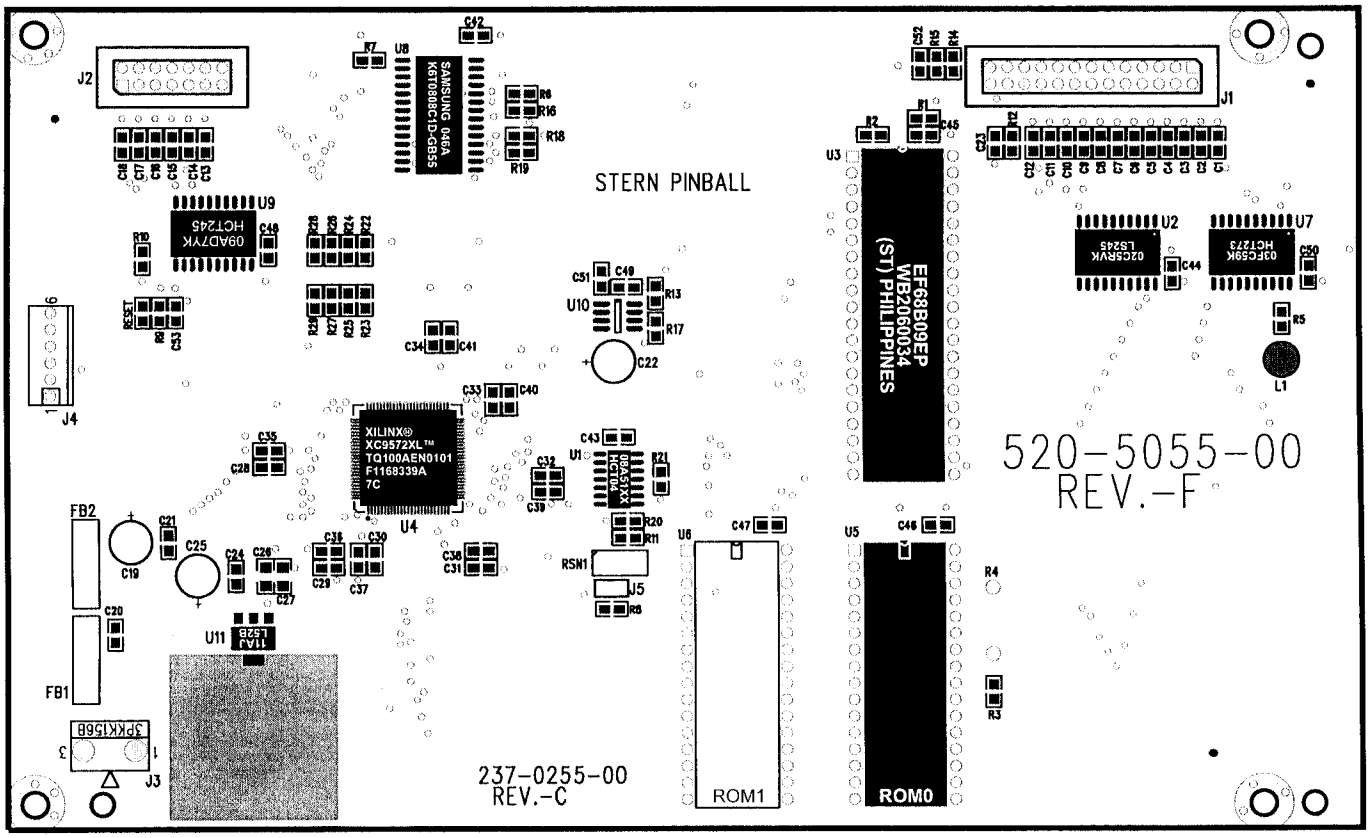


ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	**1**	**520-5138-00**	**Display Power Supply Board**	**Complete PCB Assembly**
01	2	125-5044-00	C1, C2	220uF, 200v, Radial Lytic Cap.
02	3	125-5035-00	C3, C4, C7	0.1uF, 500v, Ceramic Disk Cap.
04	1	045-5015-07	CN1	7PKK156E (PIN5=KEY)
05	1	045-5015-08	CN2	8PKK156 (PIN3=KEY)
06	2	112-5003-00	D1, D2	1N4004, Diode
07	2	112-0053-00	D3, D4	1N5228, 3.9v, Diode
08	1	112-0062-00	D5	1N4760A, 68v, Diode
09	1	112-0049-00A	D6	1N4764A, 100v, Diode
10	1	112-0061-00	D7	1N4743, 13v, Diode
11	1	200-5000-17	F1	3/4A (0.75A) S.B. Fuse
12	2	205-0004-00	F1	Fuse Clip
13	1	110-0100-00	Q1	MPSA92, Transistor
14	1	110-0082-00	Q2	MPSA42, Transistor
15	2	110-0101-00	Q3, Q5	MJE15030, Transistor
16	2	535-5000-11	Q3, Q4	Heatsinks - AAVID #563002
17	2	240-5008-00	Q3, Q4	#6-32 KEPS Nut
18	2	237-5501-00	Q3, Q4	#6-32 X 3/8" PPH Screw
19	1	110-0103-00	Q4	MJE15031, Transistor
20	1	121-5061-00	R1	130 Ω 5W Res.
21	2	121-5060-00	R2, R3	47K Ω 1W Res.
22	3	121-5038-00	R4, R5, R10	1.5K Ω 1/2W Res. (R9: NS)
23	2	121-5059-00	R6, R7	330K Ω 1/2W Res.
24	1	121-5062-00	R8	2K Ω 5W Res.


4
3
D
C
B
A
J1
DATA[0:7]
DATA0
DATA1
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
STAT[0:3]
STAT0
STAT1
STAT2
STAT3
BUSY
HDR2X13
RST_IN
U1-A
74HCT04D
IRQ
R14
220
C23
470pF
JSTB
R15
100K
C52
470pF
U2
PORTIN
BD[0:7]
74LS245DW
C1
C2
C3
C4
C5
C6
C7
C8
8 X 470pF
+5V
J5
HDR2X1
U1-C
U1-D
R20
100
8M
R11
1K
R8
1M
RSN1
8MHZ
J3-1
J3-2
J3-3
3PKK156B
FB1
FB2
FB
C20
470pF
C19
100uF
25V
C21
0.1
U4
BA[00:15]
AVMA
MA[00:11]
XD[0:7]
8M
PORTIN
FIRQ
IRQ
BRW
RAMWR
TDO
RAMOE
ROMCS
STB
PORTOUT
RESET
XC9572XL
XA[14:18]
TDI
TMS
TCK
U9
74HCT245D
JSTB
STB
RDW_DATA
RDW_CLK
COL_LATCH
PIXCLK
SDATA
J2
HDR2X7
C13
C14
C15
C16
C17
C18
6 X 470pF
MD[0:7]
XD0
XD1
XD2
XD3
XD4
XD5
XD6
XD7
R22
R23
R24
R25
R26
R27
R28
R29
33
U1-F
R21
33
BUFE
R17
0
R13
1K
U10
TL7705ACD
REF
RESIN
CT
GND
VCC
SENSE
RESET
C51
0.1
C22
22uF
25V
J4-1
J4-2
J4-3
J4-4
J4-5
J4-6
6P100
R10
220
DO NOT STUFF
R12
220
R9
100K
C53
0.1
FID1
FID2
FID3
FIDTP50M


SU3
40PSKT
U3
MC6809E
BUFE
Q
IRQ
FIRQ
RESET
+5V
R2
10K
R1
10K
BA[00:15]
BD[0:7]
BRW
AVMA
U8
K6T0808C1
MD[0:7]
MA[00:11]
R16
0
MA13
XA14
R6
10K
R7
10K
RAMWR
RAMOE
R18
0
R19
0
U7
74HCT273D
RESET
PORTOUT
STAT[0:3]
C9
C10
C11
C12
4 X 470pF
R5
180
L1
LED-RED
RED
SU5
32PSKT
SU6
32PSKT
U5
27C040
U6
27C040
BA[00:13]
XA[14:18]
U1-B
74HCT04D
XA18
ROMCS
R4
0
R3
10K
+3.3V
C28 0.1
C29 0.1
C30 0.1
C31 0.1
C32 0.1
C33 0.1
C34 0.1
C35 0.01uF
C36 0.01uF
C37 0.01uF
C38 0.01uF
C39 0.01uF
C40 0.01uF
C41 0.01uF
C42 0.1
C43 0.1
C44 0.1
C45 0.1
C46 0.1
C47 0.1
C48 0.1
C49 0.1
C50 0.1
R13
1K
RESET
U11
2LM3940IMP-3.3
C27 0.22uF
C26 0.22uF
C25 100uF 25V
C24 0.1
Schematic Set
Sheet 1 of 1
SIZE D
REV. E
STERN PINBALL, INC.
SPI Display Controller Board
SPI Part Nº: 520-5055-03 JUNE 2001
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0255-00 Dated: 06/17/01
Non-Text Document

Display Controller Board Component Layout & Parts



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5055-03**	**Display Controller Bd. (FCC FEB98) Rev. E June 2001**	**Complete PCB Assembly**
1	2 (See Pg. DR. ③ Table)		U5 (ROM0)	4mB ROM 27C040 (M27C401-100)
2	2	077-5217-00	U5	32-Pin, IC Dip Socket
3	1	045-5015-03	J3	3-Pin, PKK156B Connector
4A	1	100-0189-01	U3	MC6809E
4B	1	045-	U3	40-Pin, Socket
5	1	077-	J4	6-Pin (6P100)
6	1	100-	U1	74HCT04D (74LS04)
7	1	100-	U9	74HCT245D
8	1	100-	U7	74HCT273D
9	1	100-	U2	74LS245DW
10	1	140-	RSN1	8MHZRSN (8Mhz) Cyrstal
11	7	125-	C35-C39, C40, C41	CAP103-0805-X7R, 0.01uF, 50v
12	20	125-	C21, C24, C28-C32, C33, C34, C42, C43, C44, C45, C46 C47, C48, C49, C50, C53	CAP104-0805, 0.1, 50v
13	2	125-	C26, C27	CAP224-1206-Z5U, 0.22uF, 50v
14	21	125-	C1-C12, C13-C18, C20, C23, C52	CAP471-0805, 470pF, 50v
15	2	n/a	FB1, FB2	Ferrite Bead, FB0370
16	3		FID1-3	FIDTP50M
18	1	045-5015-02	J2	7-Pin, Dual Row .1" Hdr. Conn HDR2X7
19	1	045-5015-26	J1	13-Pin, Dual row .1" Hdr. Conn HDR2X13
20	1	100-	U8	K6T0808C1D
21	1	**165-5099-00**	**L1**	**LED T1-3/4 DIFFUSER RED**
22	1	100-	U11	LM3940IMP-3.3
23	4	121-	R16-R18	RES0E1/10W0805, 0
24	1	n/a	RESET	DO NOT STUFF
26	1	121-	R20	RES100E1/10W0805, 100
27	2	121-	R9, R15	RES100K1/10W0805, 100K
28	5	121-	R1, R2, R3, R7	RES10K1/10W0805, 10K
29	1	121-	R5	RES180E1/10W0805, 180
30	2	121-	R11, R13	RES1K1/10W0805, 1K
31	1	121-	R8	RES1M1/10W0805, 1M
32	3	121-	R10, R12, R14	RES220E1/10W0805, 220
33	9	121-	R21, R22-R29	RES33E1/10W0805, 33
34	2	125-5015-00	C19, C25	TCAP100M25VER, 100uF, 25v
37	1	100-	U4	XC9572XL

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's (U204 & U205)** (3 of 8 decoder). Both of these must be in operation for the I/O Board to function properly.

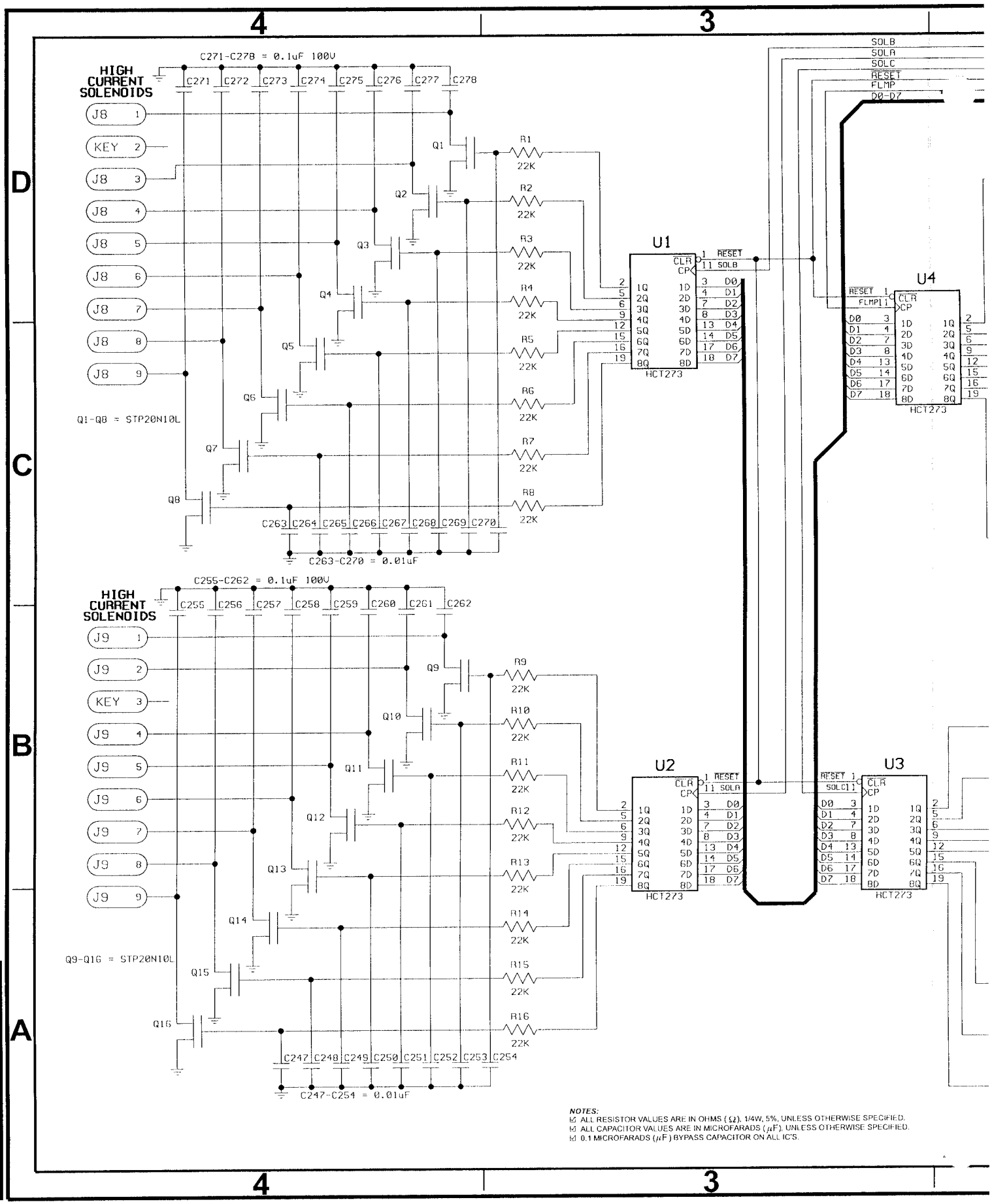
Solenoid (Coil) Drivers & Flash Lamps:
J8 & **J9** are high side drivers for driving solenoids and other heavy loads. Each connector has its own buffer driving 8 drivers. **J8** & **J9** consist of **MOSFET Drivers 20N10L** which can easily & safely be tested by clipping one end of a clip-lead to test 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, R2 controls Q2, et cetera...*

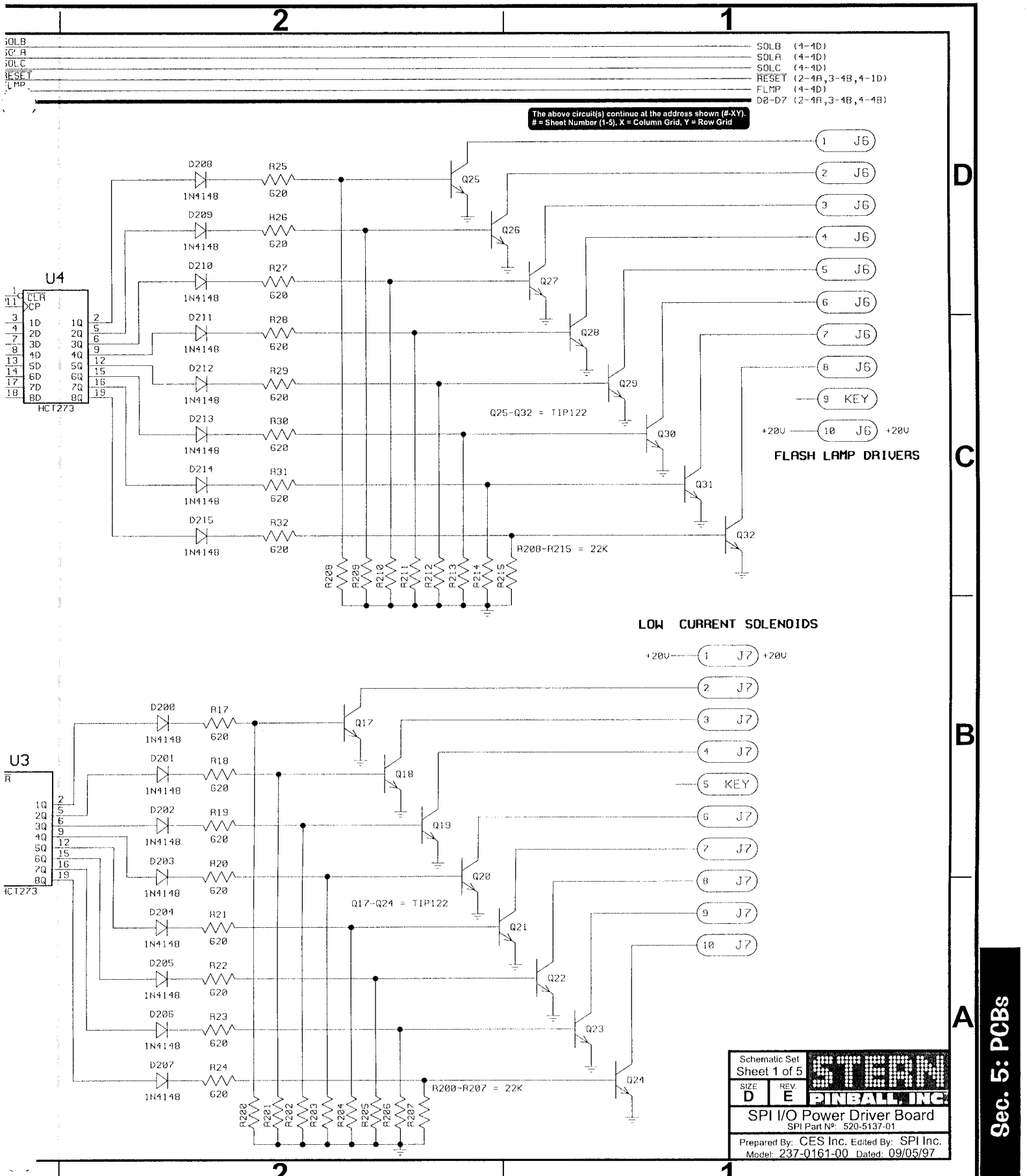
Auxiliary In & Out:
J2-8 CMOS Outputs sometimes used for a printer interface.
J3-8 CMOS Inputs general purpose inputs.

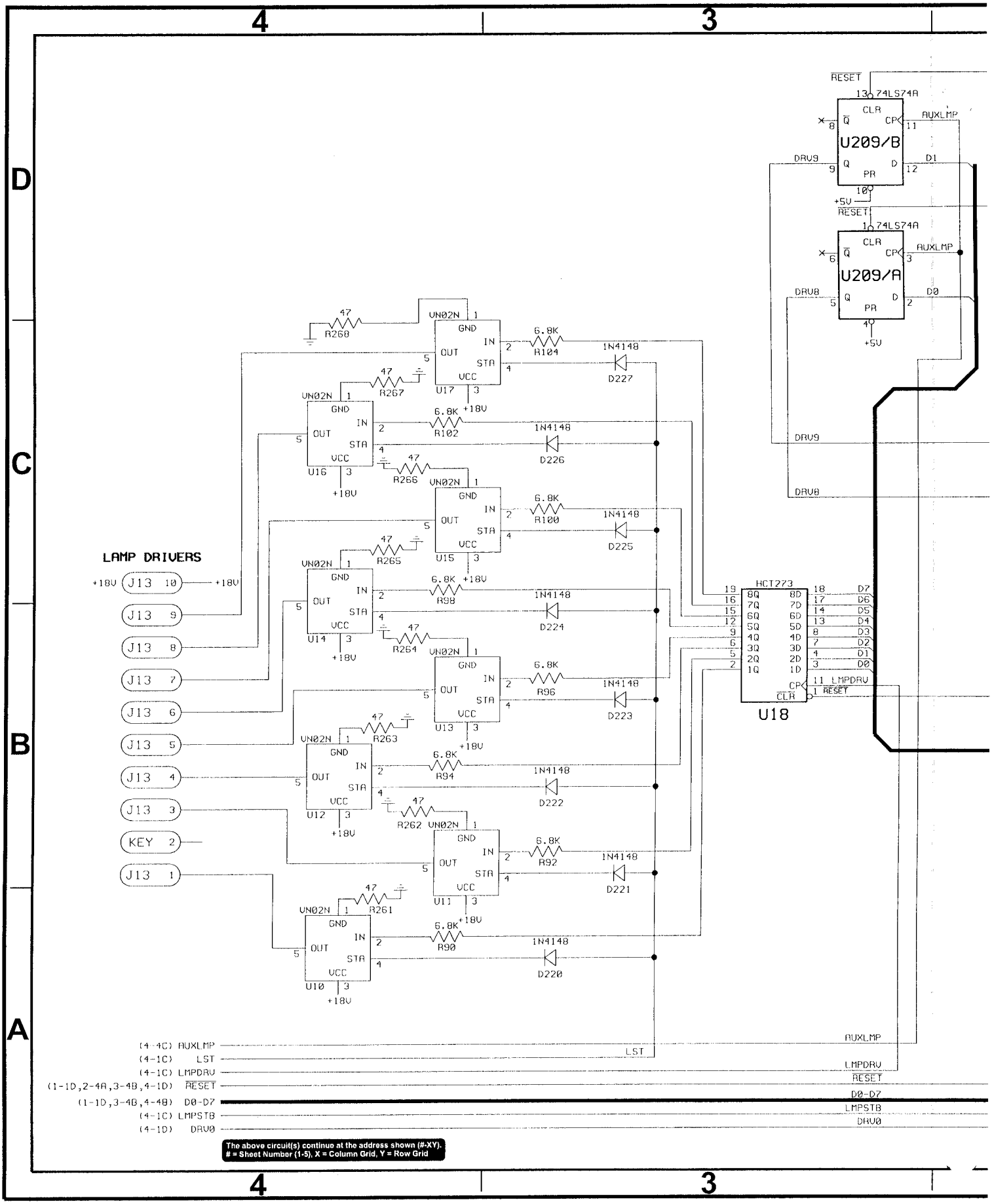
Lamp Matrix:
J12 has 10 low side drivers for the lamp strobes which consist of **19N06L MOSFETS**. Only one lamp strobe should be low at any time. Again the scanning of the lamp strobes keeps the I/O from resetting. **J13** has 8 high side drivers with each having a status indicator. All the status indicators 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.

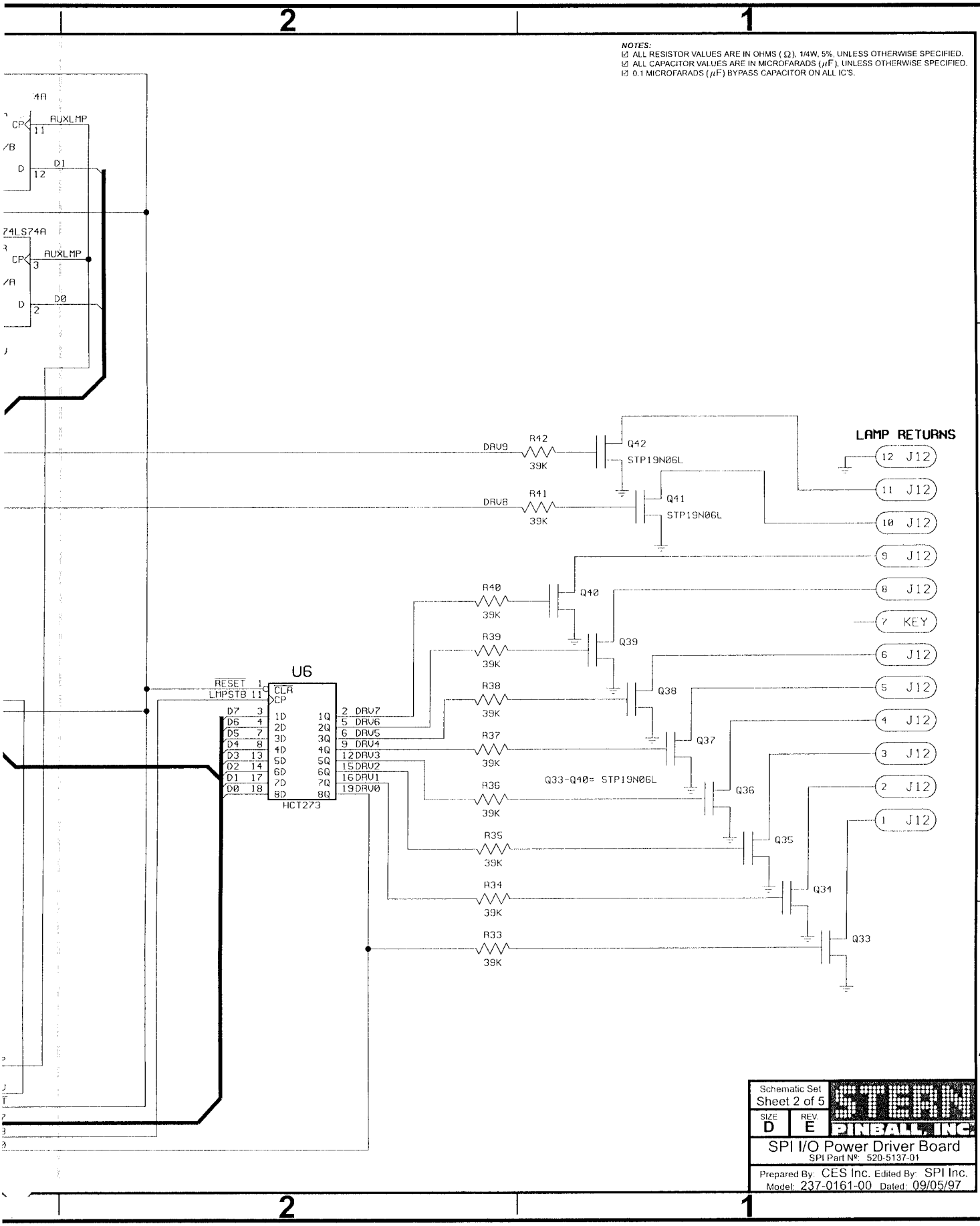

4
3
D
C
B
A
HIGH CURRENT SOLENOIDS
C271-C278 = 0.1uF 100V
C271 C272 C273 C274 C275 C276 C277 C278
J8 1
KEY 2
J8 3
J8 4
J8 5
J8 6
J8 7
J8 8
J8 9
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8
R1 R2 R3 R4 R5 R6 R7 R8
22K
Q1-Q8 = STP20N10L
C263 C264 C265 C266 C267 C268 C269 C270
C263-C270 = 0.01uF
U1
HCT273
CLR
CP
1D 2D 3D 4D 5D 6D 7D 8D
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
RESET
SOLB
SOLB
SOLA
SOLC
RESET
FLMP
D0-D7
U4
RESET
FLMP
U2
SOLA
U3
SOLC
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
R9 R10 R11 R12 R13 R14 R15 R16
22K
Q9-Q16 = STP20N10L
C247 C248 C249 C250 C251 C252 C253 C254
C247-C254 = 0.01uF
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.

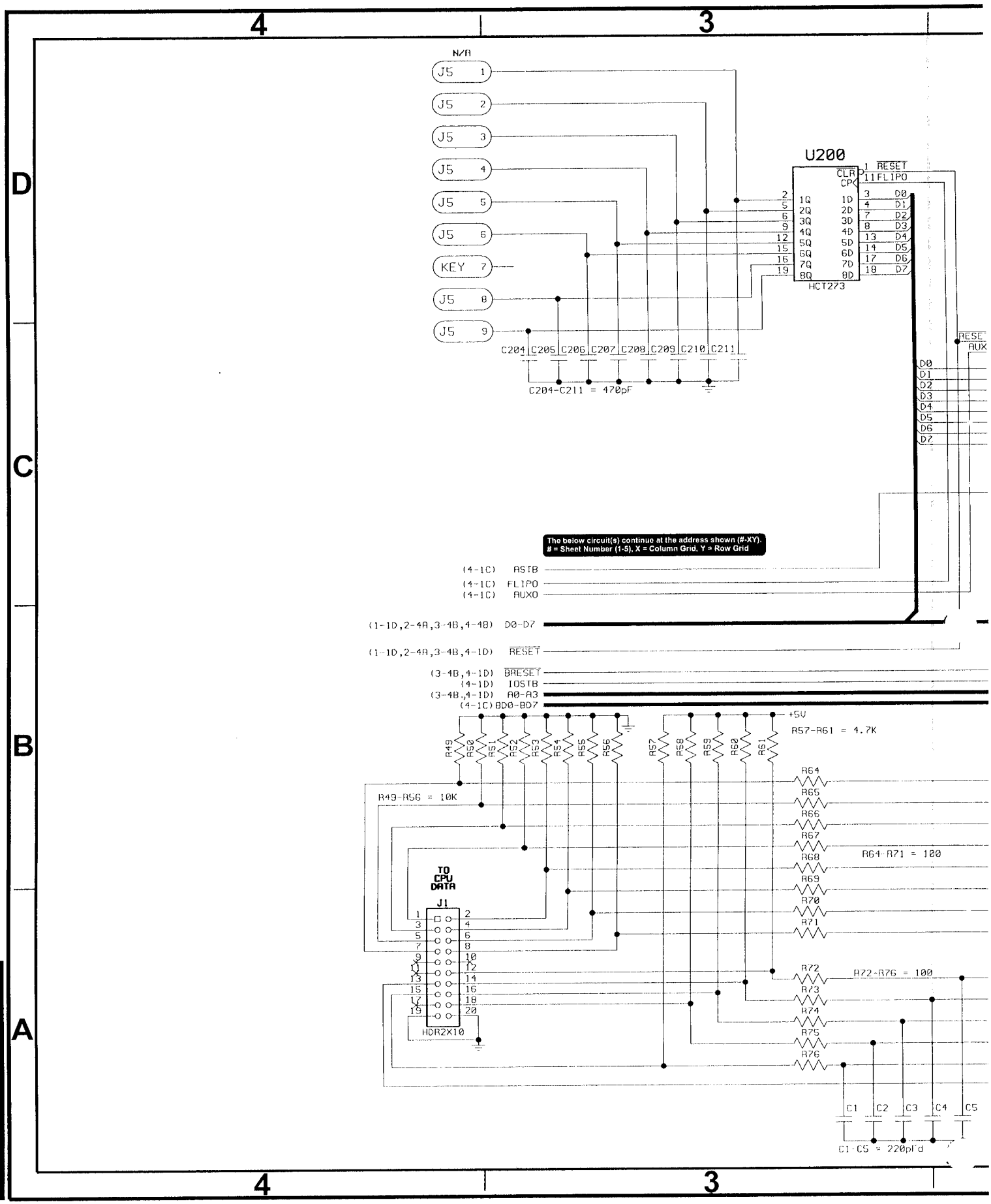



2
1
SOLB (4-4D)
SOLA (4-4D)
SOLC (4-4D)
RESET (2-4A,3-4B,4-1D)
FLMP (4-4D)
D0-D7 (2-4A,3-4B,4-4B)
The above circuit(s) continue at the address shown (#-XY). # = Sheet Number (1-5), X = Column Grid, Y = Row Grid
D
C
B
A
U4
HCT273
D208 D209 D210 D211 D212 D213 D214 D215
1N4148
R25 R26 R27 R28 R29 R30 R31 R32
620
Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32
Q25-Q32 = TIP122
R200-R215 = 22K
R208 R209 R210 R211 R212 R213 R214 R215
1 J6
2 J6
3 J6
4 J6
5 J6
6 J6
7 J6
8 J6
9 KEY
10 J6
+20V
FLASH LAMP DRIVERS
LOW CURRENT SOLENOIDS
U3
HCT273
D200 D201 D202 D203 D204 D205 D206 D207
1N4148
R17 R18 R19 R20 R21 R22 R23 R24
620
Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24
Q17-Q24 = TIP122
R200-R207 = 22K
R200 R201 R202 R203 R204 R205 R206 R207
1 J7
2 J7
3 J7
4 J7
5 KEY
6 J7
7 J7
8 J7
9 J7
10 J7
+20V
Schematic Set
Sheet 1 of 5
SIZE D
REV. E
STERN 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
U209/B
U209/A
74LS74A
RESET
AUXLMP
DRV9
DRV8
D1
D0
+5V
U18
HCT273
U17
U16
U15
U14
U13
U12
U11
U10
UN02N
R268
R267
R266
R265
R264
R263
R262
R261
R104
R102
R100
R98
R96
R94
R92
R90
6.8K
47
+18V
1N4148
D227
D226
D225
D224
D223
D222
D221
D220
J13 10
J13 9
J13 8
J13 7
J13 6
J13 5
J13 4
J13 3
KEY 2
J13 1
(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



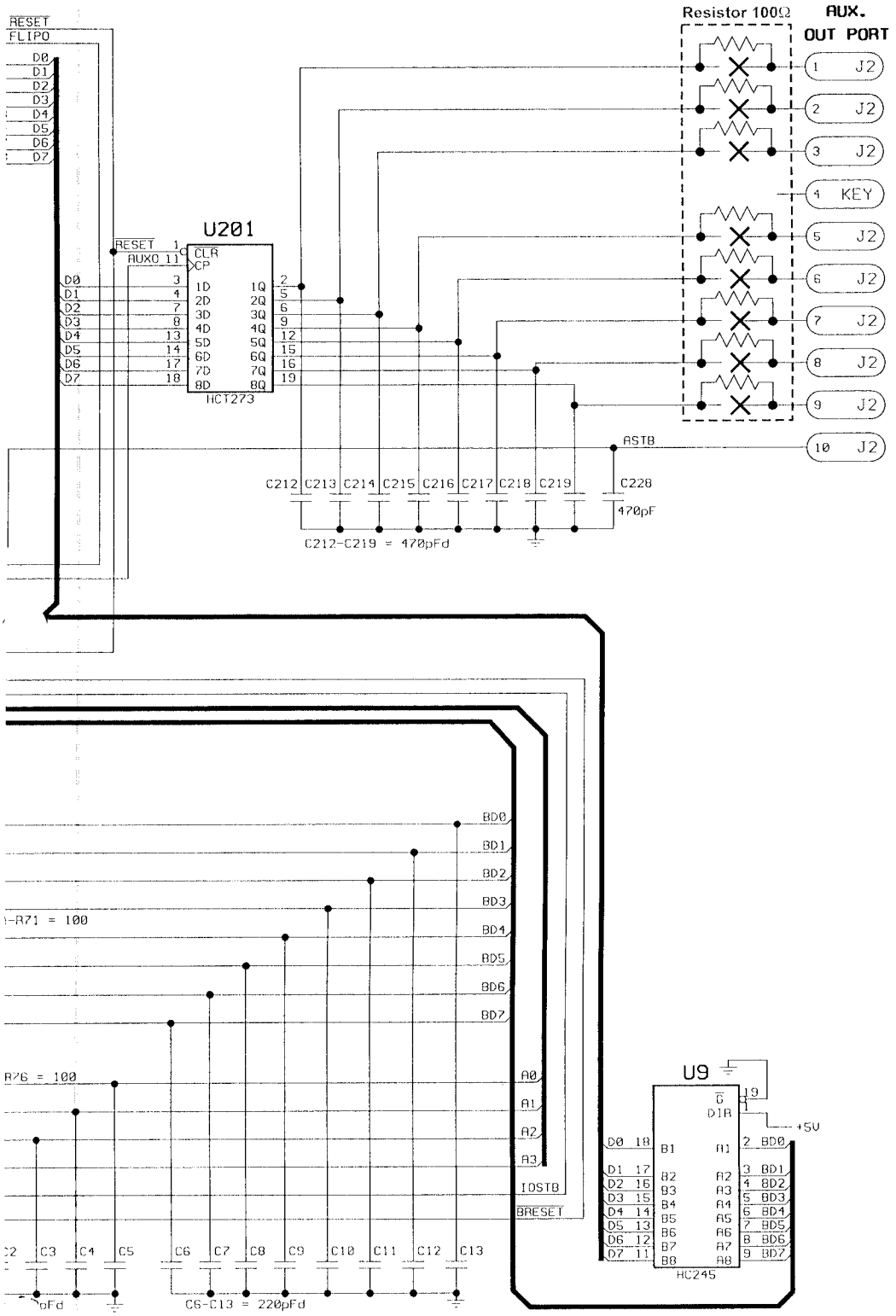

NOTES:
ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.
74LS74A
AUXLMP
D1
D0
U6
RESET
LMPSTB
HCT273
DRV9
DRV8
R42
R41
R40
R39
R38
R37
R36
R35
R34
R33
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
STERN 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
CLR
CP
1 RESET
11 FLIPO
1Q 2Q 3Q 4Q 5Q 6Q 7Q 8Q
1D 2D 3D 4D 5D 6D 7D 8D
D0 D1 D2 D3 D4 D5 D6 D7
HCT273
C204 C205 C206 C207 C208 C209 C210 C211
C204-C211 = 470pF
RESE
AUX
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 R50 R51 R52 R53 R54 R55 R56
R57 R58 R59 R60 R61
R49-R56 = 10K
R64 R65 R66 R67 R68 R69 R70 R71
R64-R71 = 100
R72 R73 R74 R75 R76
R72-R76 = 100
TO CPU DATA
J1
HDR2X10
C1 C2 C3 C4 C5
C1-C5 = 220pFd



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.

DATE	DESCIRIPTION OF CHANGES / REVISIONS	REQ.	BY.
JAN 2001	Cut trace on solder side at Aux. Out Port J2-PIN1 thru J2-PIN3 & J2-PIN5 thru J2-PIN9; Soldered **Resistor 100Ω** 1/4W 5% (SPI N°: 121-5007-00). This Modification (highlighted below at J2 with a dotted-line box) was accomplished on boards produced after Jan. 1, 2001. This board is backwards compatible for the White Star™ Board System.	TS	JET

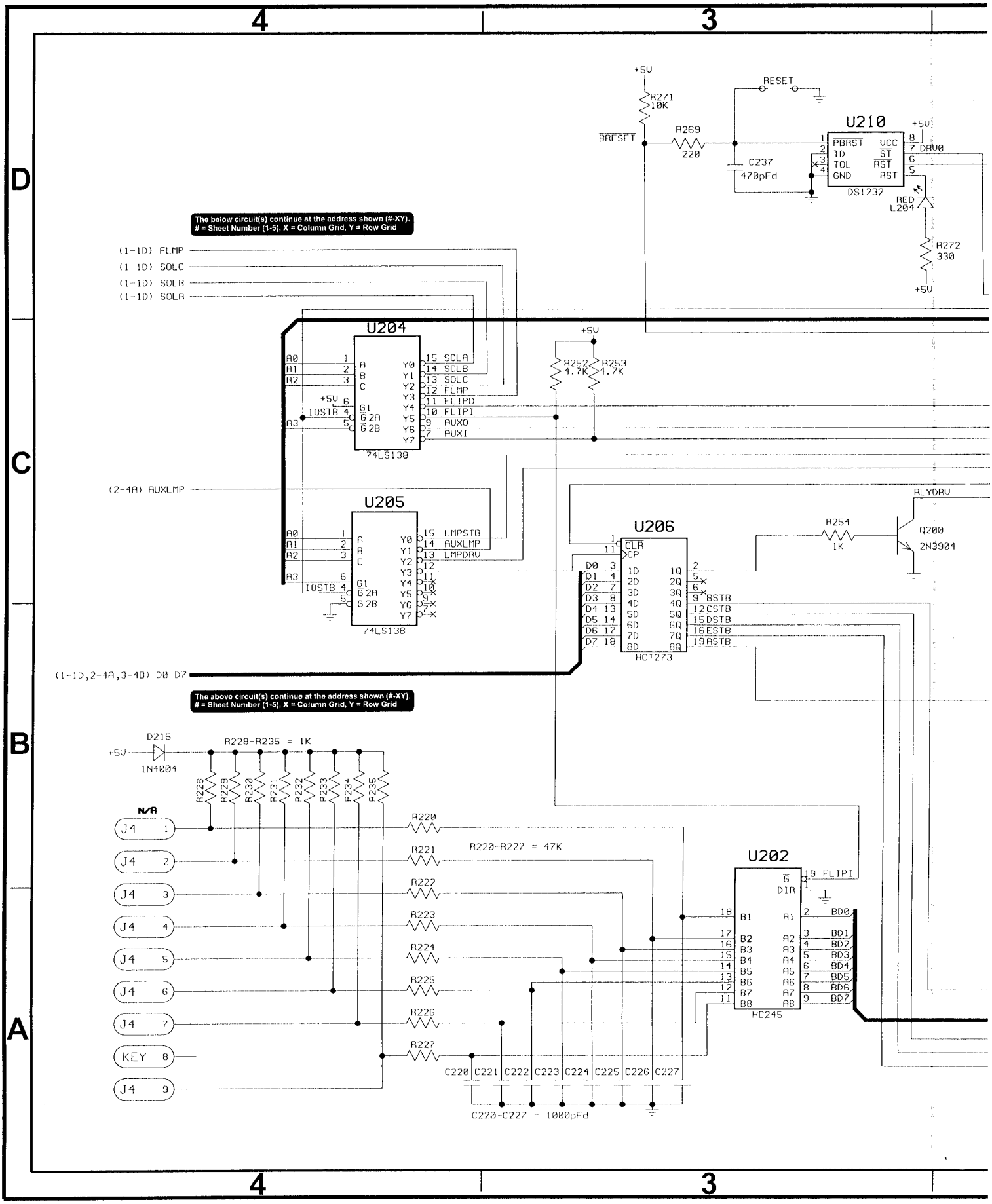


Schematic Set	
Sheet 3 of 5	
SIZE D	REV. E

STERN 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
C237
470pFd
U210
PBRST
TD
TOL
GND
VCC
ST
RST
RST
DS1232
DRV0
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 FLIPD
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
HCT273
BSTB
CSTB
DSTB
ESTB
ASTB
RLYDRV
R254
1K
Q200
2N3904
(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
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
FLIPI
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:
1. ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
3. 0.1 MICROFARADS (μF) BYPASS CAPACITOR ON ALL IC'S.

+5V
R270 4.7K
RESET
BLANKING
RED L204
R272 330
+5V
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

FLIPO (3-4C)
AUXO (3-4C)
LMPSTB (2-4A)
LMPDRV (2-4A)
RLYDRV (5-4C)
ASTB (3-4C)
BD0-BD7 (3-4B)
LST (2-4A)

RLYDRV
Q200 2N3904

+5V
R256 4.7K
LST
D228 1N4148
R255 10K
C236 470pF
R245-R251 = 1K
D217 1N4004
+5V
R245 R246 R247 R248 R249 R250 R251

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

U203
HC245
AUX1 19
G
DIR 1
BD0 2 A1 B1 18
BD1 3 A2 B2 17
BD2 4 A3 B3 16
BD3 5 A4 B4 15
BD4 6 A5 B5 14
BD5 7 A6 B6 13
BD6 8 A7 B7 12
BD7 9 A8 B8 11

R236
R237
R238
R239
R240
R241
R242
R236-R243 = 39K

C229 C230 C231 C232 C233 C234 C235
C228-C235 = 470pFd

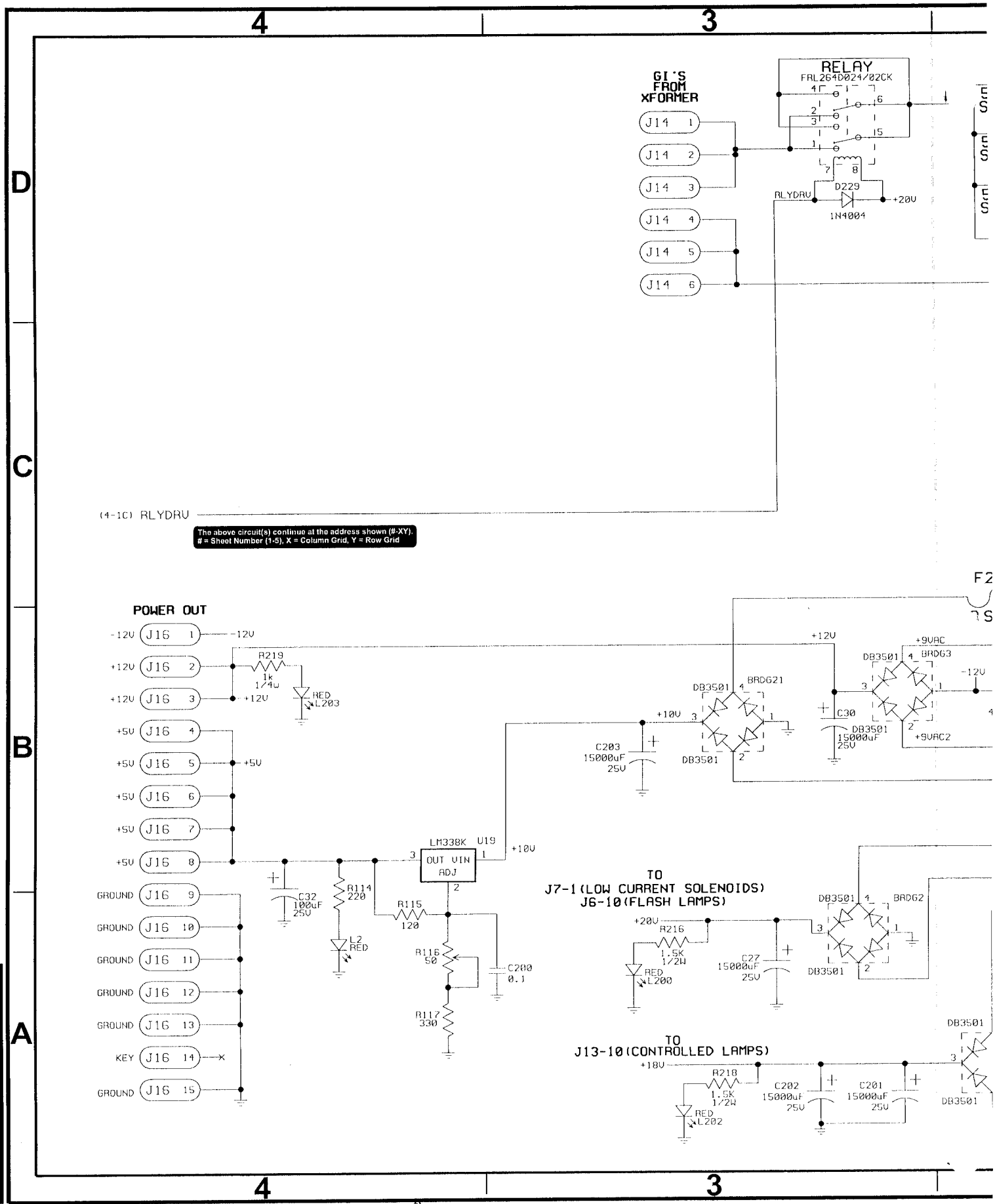
C243 C244 C245 C246
C243-C246 = 470pFd

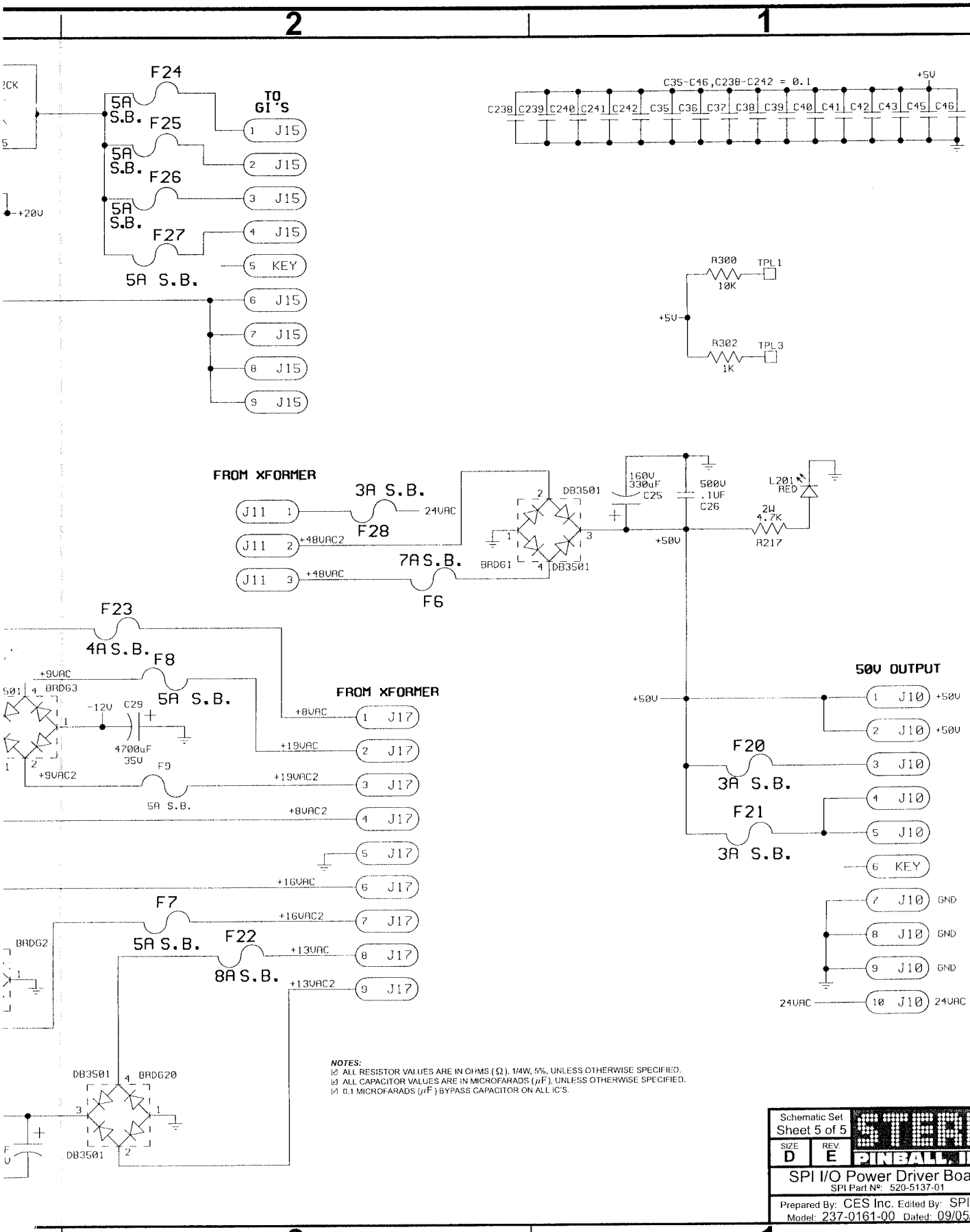
Schematic Set	Sheet 4 of 5
SIZE	D
REV.	E

STERN PINBALL, INC.

SPI I/O Power Driver Board
SPI Part №: 520-5137-01

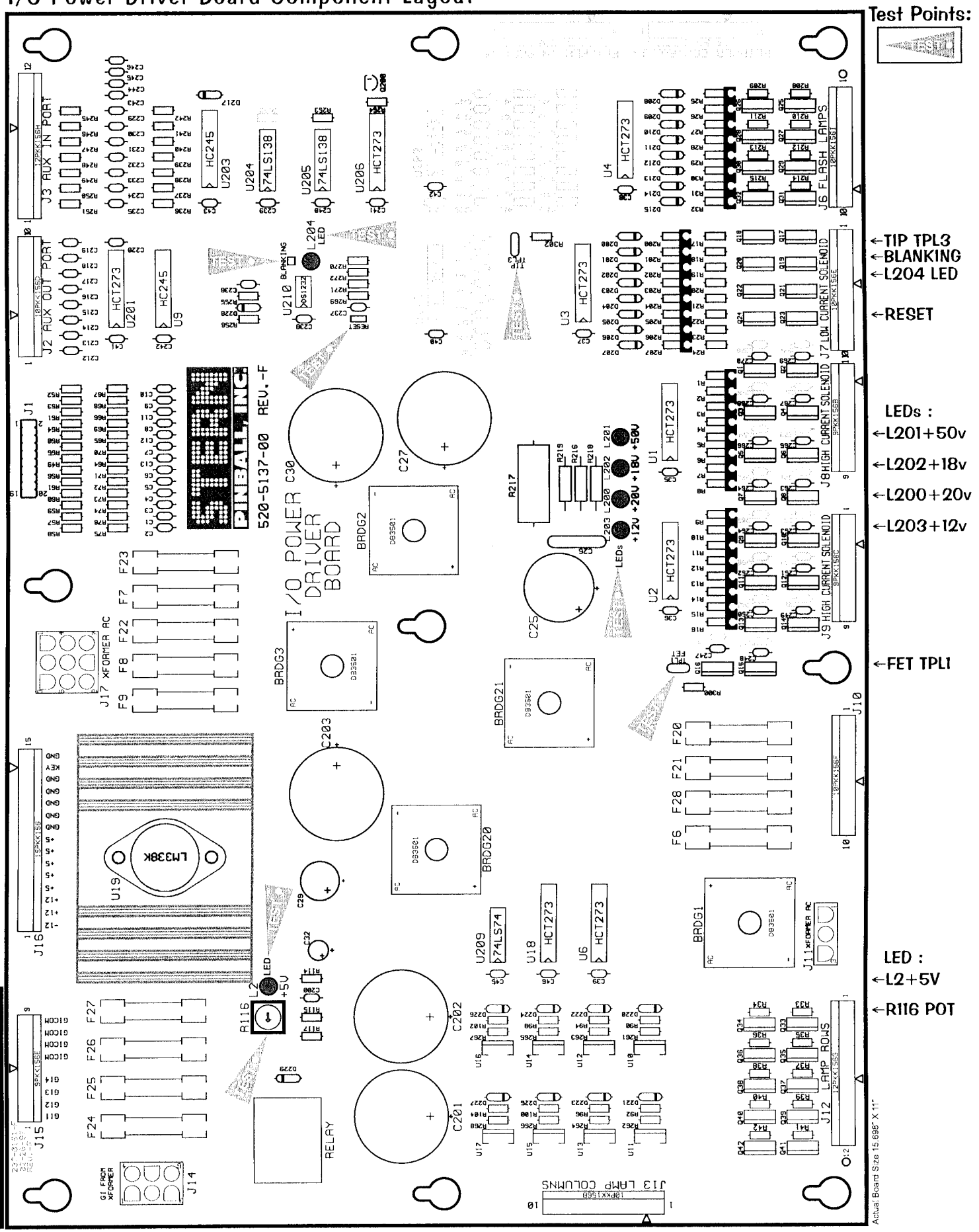
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0161-00 Dated: 09/05/97


4
3
D
C
B
A
GI'S FROM XFORMER
J14 1
J14 2
J14 3
J14 4
J14 5
J14 6
RELAY
FRL264D024/02CK
RLYDRV
D229
1N4004
+20V
(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
C32
100uF
25V
R114
220
L2
RED
R115
120
R116
50
R117
330
C200
0.1
LM338K U19
OUT VIN
ADJ
+10V
C203
15000uF
25V
DB3501 BRDG21
DB3501
+12V
+9VAC
DB3501 BRDG3
C30
DB3501
15000uF
25V
+9VAC2
-12V
TO
J7-1(LOW CURRENT SOLENOIDS)
J6-10(FLASH LAMPS)
+20V
R216
1.5K
1/2W
RED
L200
C27
15000uF
25V
DB3501 BRDG2
DB3501
TO
J13-10(CONTROLLED LAMPS)
+18V
R218
1.5K
1/2W
RED
L202
C202
15000uF
25V
C201
15000uF
25V
DB3501



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.

Schematic Set Sheet 5 of 5	STERN PINBALL, INC.
SIZE D / REV. E	
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	


Test Points:
←TIP TPL3
←BLANKING
←L204 LED
←RESET
LEDs :
←L201+50v
←L202+18v
←L200+20v
←L203+12v
←FET TPL1
LED :
←L2+5V
←R116 POT
J3 AUX IN PORT
J2 AUX OUT PORT
J6 FLASH LAMPS
J7 LOW CURRENT SOLENOID
J8 HIGH CURRENT SOLENOID
J9 HIGH CURRENT SOLENOID
J10
J11 XFORMER AC
J12 LAMP ROWS
J13 LAMP COLUMNS
J14
J15
J16
J17 XFORMER AC
J1
520-5137-00 REV.-F
I/O POWER DRIVER BOARD
PINBALL INC
BRDG1
BRDG2
BRDG3
BRDG20
BRDG21
RELAY
LM338K
U1 HCT273
U2 HCT273
U3 HCT273
U4 HCT273
U6 HCT273
U9 HC245
U18 HCT273
U19
U201 HCT273
U203 HC245
U204 74LS138
U205 74LS138
U206 HCT273
U209 74LS74
U210 DS1232
L200 L201 L202 L203 +12V +20V +18V +50V
L204 LED
L2 LED +5V
R116
R217
R219 R216 R218
C25
C27
C30
C202
C203
C201
Actual Board Size 15.698" X 11"

I/O Power Driver Board Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)
—	1	**520-5137-01**	**I/O Power Driver Board**	**Complete PCB Assembly**
01	5	112-5000-00	BRDG1, BRDG2, BRDG3, BRDG20, BRDG21	DB3501
02	13	125-5030-00	C1, C2, C3>C6, C7, C8, C9>C10, C11, C12	220pF, (221), Cap.
03	1	125-5033-00	C25	100uF, 150v, Radial Lytic Cap.
04	1	125-5035-00	C26	.1UF, 500v, Ceramic Disk Cap.
05	5	125-5036-00	C27, C30, C201, C202, C203	15000uF, 25v, Radial Lytic Cap.
06	1	125-5034-00	C29	4700uF, 35v, Radial Lytic Cap.
07	1	125-5032-00	C32	100uF, 25v, Radial Lytic Cap.
08	17	125-5031-00	C35, C36, C37, C38, C39, C40, C41, C42, C43, C45, C46, C200, C238, C239, C240, C241, C242	0.1uF, (104), Cap.
09	22	125-5028-00	C212>C219, C228>C237, C243>C246	470pF, (471), Axial Cap.
11	16	125-5029-00	C247>C254, C263>C270	0.01uF, (103), 100v Cap.
13	25	112-0054-00	D200>D207, D208>D215, D220, D221, D222, D223, D224, D225, D226, D227	1N4148, Diode
14	2	112-5003-00	D217, D229	1N4004, Diode
15	26	205-0004-00	F6, F7, F8, F9, F20, F21, F22, F23, F24> F27, F28	Fuse Clips
16	1	200-5000-03	F6	7A 250v S.B. Fuse
17	7	200-5000-01	F7, F8, F9, F24>F27	5A 250v S.B. Fuse
18	3	200-5000-08	F21, F20, F28	3A 250v S.B. Fuse
19	1	200-5000-05	F22	8A 250v S.B. Fuse
20	1	200-5000-06	F23	4A 250v S.B. Fuse
21	1	045-5015-01	J1	20-Pin, 0.1 Dual Row Header
22	1	045-5014-01	J2 (Key Pin-4), J6 (Key Pin-9), J7 (Key Pin-5) J10 (Key Pin-6), J13 (Key Pin-2)	10PKK156
23	1	045-5015-00	J3 (Key Pin-8)	12PKK156
24	1	045-5013-00	J8 (Key Pin-2), J9 (Key Pin-3), J15 (Key Pin-5)	9PKK156
25	1	045-0014-03	J11	10-84-4030 (3-Pin MOLEX)
26	1	045-5015-00	J12 (Key Pin-7)	12PKK156
27	1	045-0014-06	J14	10-84-4060 (6-Pin MOLEX)
28	1	045-5016-00	J16 (Key Pin-14)	15PKK156
29	1	045-0014-09	J17	10-84-4090 (9-Pin MOLEX)
30	**6**	**165-5099-00**	**L2, L200, L201, L202, L203, L204**	**LED T1-3/4 DIFFUSER LED**
31	16	110-0106-00	Q1>Q16	22NE10L STP, Transistor
32	16	110-0067-00	Q17>Q24, Q25>Q32	TIP122
33	10	110-0088-00	Q33>Q42	19N06L STP, Transistor
34	1	110-0069-00	Q200	2N3904, Transistor.
35	32	121-5042-00	R1>R8, R9>R16, R200>R207, R208>R215	22K Ω 1/4W Res.
36	16	121-5003-00	R17>R24, R25>R32	620 Ω 1/4W Res.
37	17	121-5045-00	R33>R42, R236>R242	39K Ω 1/4W Res.
38	8	121-5021-00	R49, R57>R61, R253, R256, R270	4.7K Ω 1/4W Res.
39	11	121-5011-00	R50>R56, R255, R271, R300	10K Ω 1/4W Res.
40	13	121-5007-00	R64>R76 Resistors on Solder Side @ J2-Pins: 1-3 & 5-9	100 Ω 1/4W Res.
41	8	121-5029-00	R90, R92, R94, R96, R98, R100, R102, R104	6.8K Ω 1/4W Res.
42	2	121-5033-00	R114, R269	220 Ω 1/4W Res.
43	1	121-5030-00	R115	120 Ω 1/4W Res.
44	1	121-5039-00	R116	50 Ω Pot
45	2	121-5036-00	R117, R272	330 Ω 1/4W Res.
46	2	121-5038-00	R216, R218	1.5K Ω 1/2W Res.
47	1	121-5050-00	R217	4.7K Ω 2W Res. (SANDBAR)
48	1	121-5009-00	R219	1K Ω 1/4W Res.
50	9	121-5009-00	R245>R251, R254, R302	1K Ω 1/4W Res.
51	8	121-5032-00	R261, R262, R263, R264, R265, R266, R267, R268	47K Ω 1/4W Res.
52	1	190-5002-00	RELAY	FRL264D024/02CK Relay
53	2	n/a	TPL1, TPL3	*Test Point Wire (24ga.) Loops*
54	8	100-5012-00	U1, U2, U3, U4, U6, U18, U201, U206	74HCT273
55	1	110-0058-00	U9	74LS245
56	1	100-5023-00	U210	DS1232
57	8	110-0089-00	U10, U11, U12, U13, U14, U15, U16, U17	VN02N
58	1	100-0356-00	U19	LM338K
59	1	n/a	U19	Heatsink (5v Reg.)
60	1	100-0338-00	U203	74HC245
61	2	100-0148-00	U204, U205	74LS138
62	1	100-0037-00	U209	74LS74
63	1	n/a	BLANKING, RESET	*Test Points*



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. 8 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** (**BAT1**) which have a **TEST POINT VBATT** 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 (**U207 & U208**). The CPU's reset line is buffered by **Q10** and fed over to the I/O through **CN1**. An *I/O Strobe Signal* is fed 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(**Q1-Q8**) 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.

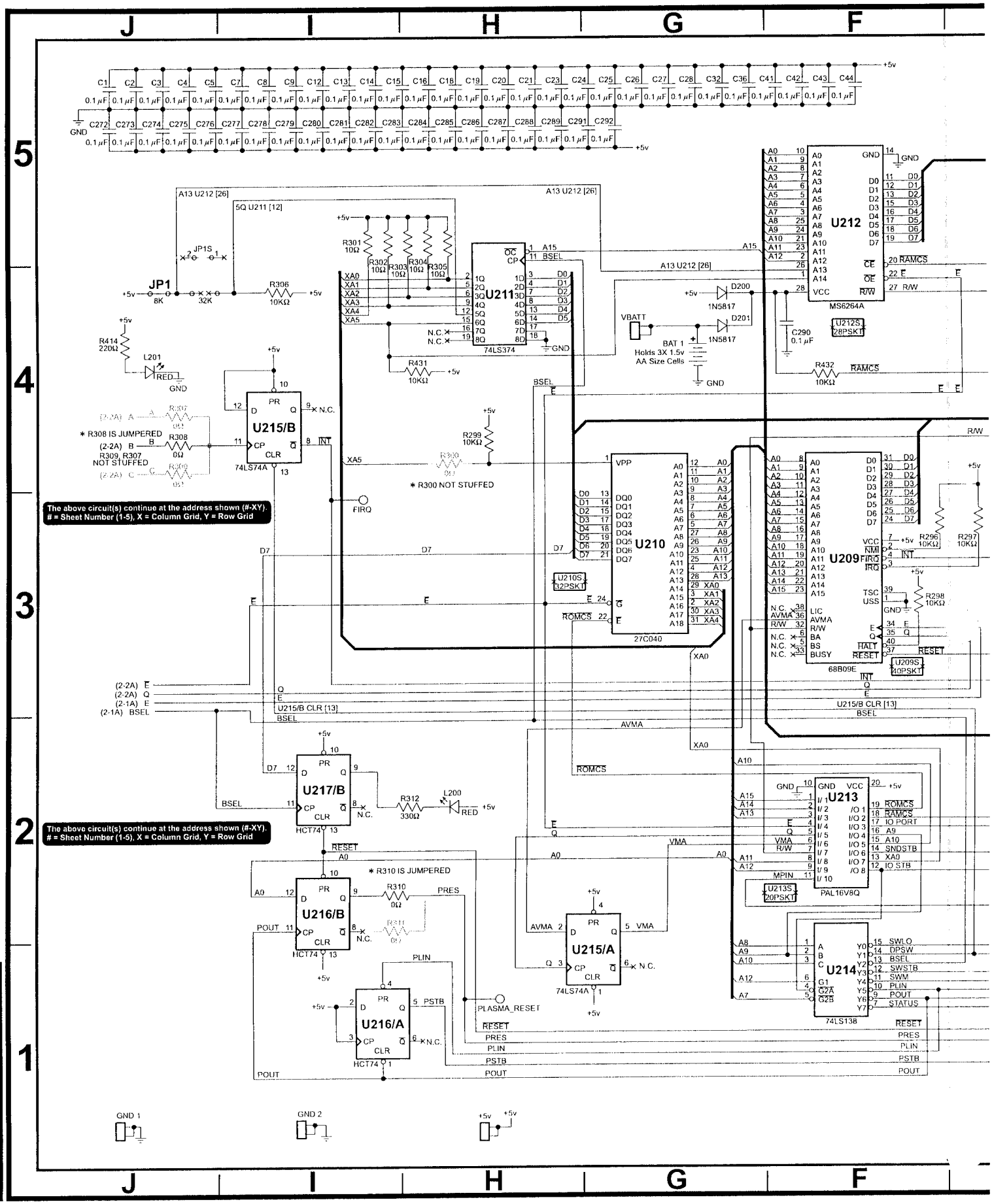
Plasma Interface:
The data path for communication to and from the Plasma Controller Board is 8 bits wide. There are separate *Input* and *Output Busses*. The *Input Bus* from the Plasma Controller to the CPU/Sound Board comes in on **CN8** [PLASMA CONTROL]-**Pins 3-10** and is fed into **U200** for input 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.

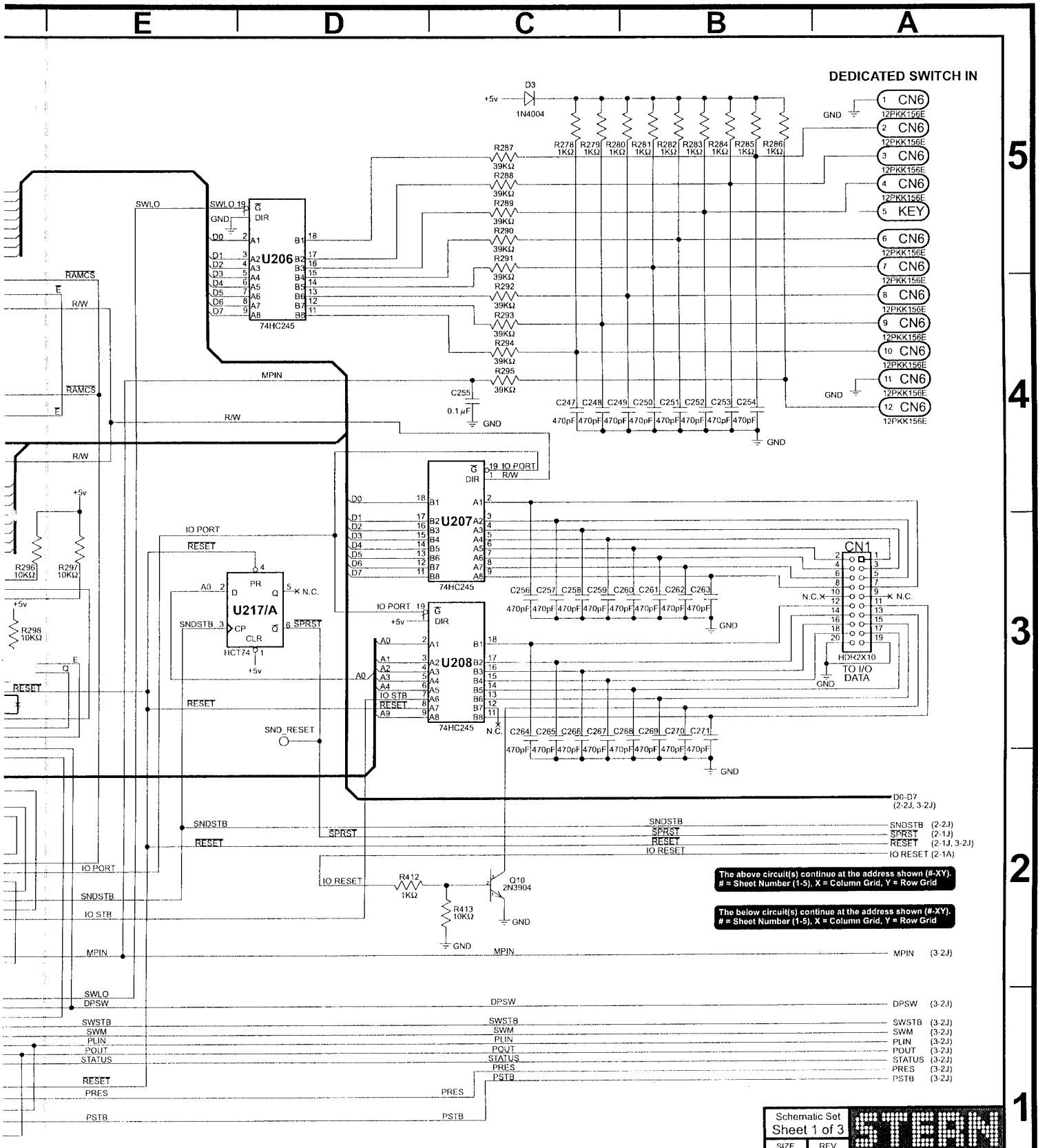
Sound Section:
The audio section consists of a **BSMT SOUND CHIP U9** Sound (Voice) EPROMs (**U17 U21 U36 U37**) **68B09E U6** and Sound Code **EPROM U7**. The **BSMT** latches sound EPROM addresses in **U13** & **U12** for output to the Sound EPROMs. Sound Data from the EPROMs is read through **U19** 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, U26**). 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 the 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 U209** 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
MS6264A
U211
74LS374
U215/B
74LS74A
U210
27C040
U209
68B09E
U213
PAL16V8Q
U217/B
HCT74
U216/B
U216/A
U215/A
U214
74LS138
JP1
JP1S
R306
10KΩ
8K
32K
R414
220Ω
L201
RED
R308 IS JUMPERED
R309, R307
NOT STUFFED
R300 NOT STUFFED
R310 IS JUMPERED
R312
330Ω
L200
D200
D201
1N5817
VBATT
BAT 1
Holds 3X 1.5v
AA Size Cells
C290
0.1 µF
R431
10KΩ
R432
10KΩ
R296
10KΩ
R297
10KΩ
R298
10KΩ
U212S
28PSKT
U210S
32PSKT
U209S
40PSKT
U213S
20PSKT
The above circuit(s) continue at the address shown (#-XY).
= Sheet Number (1-5), X = Column Grid, Y = Row Grid
A13 U212 [26]
5Q U211 [12]
U215/B CLR [13]
BSEL
AVMA
ROMCS
RESET
PRES
PLIN
PSTB
POUT
PLASMA_RESET
GND 1
GND 2
+5v
GND



Schematic Set Sheet 1 of 3		STERN PINBALL, INC.
SIZE D	REV. E	

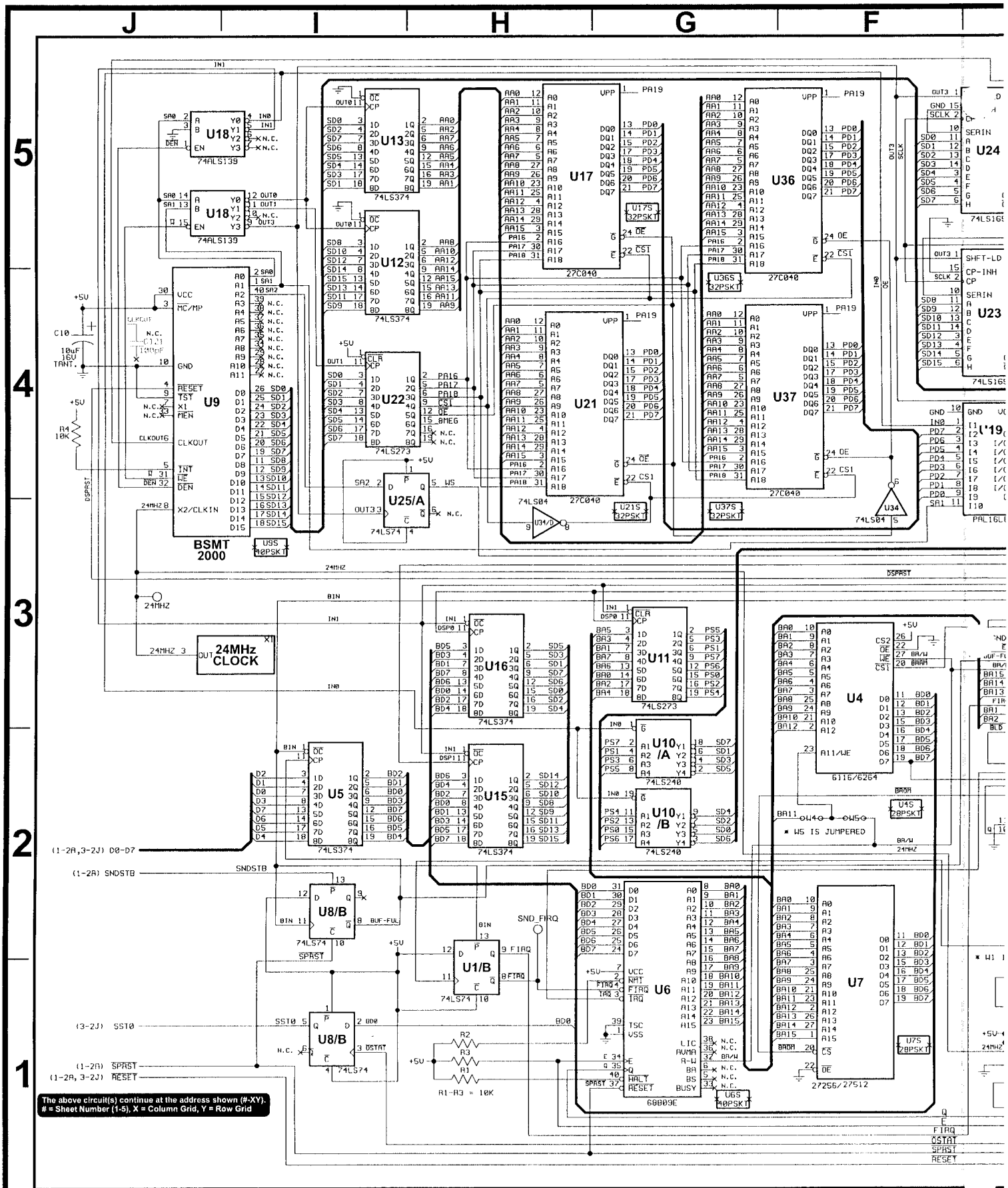
SPI CPU/Sound Board
SPI Part №: 520-5136-16

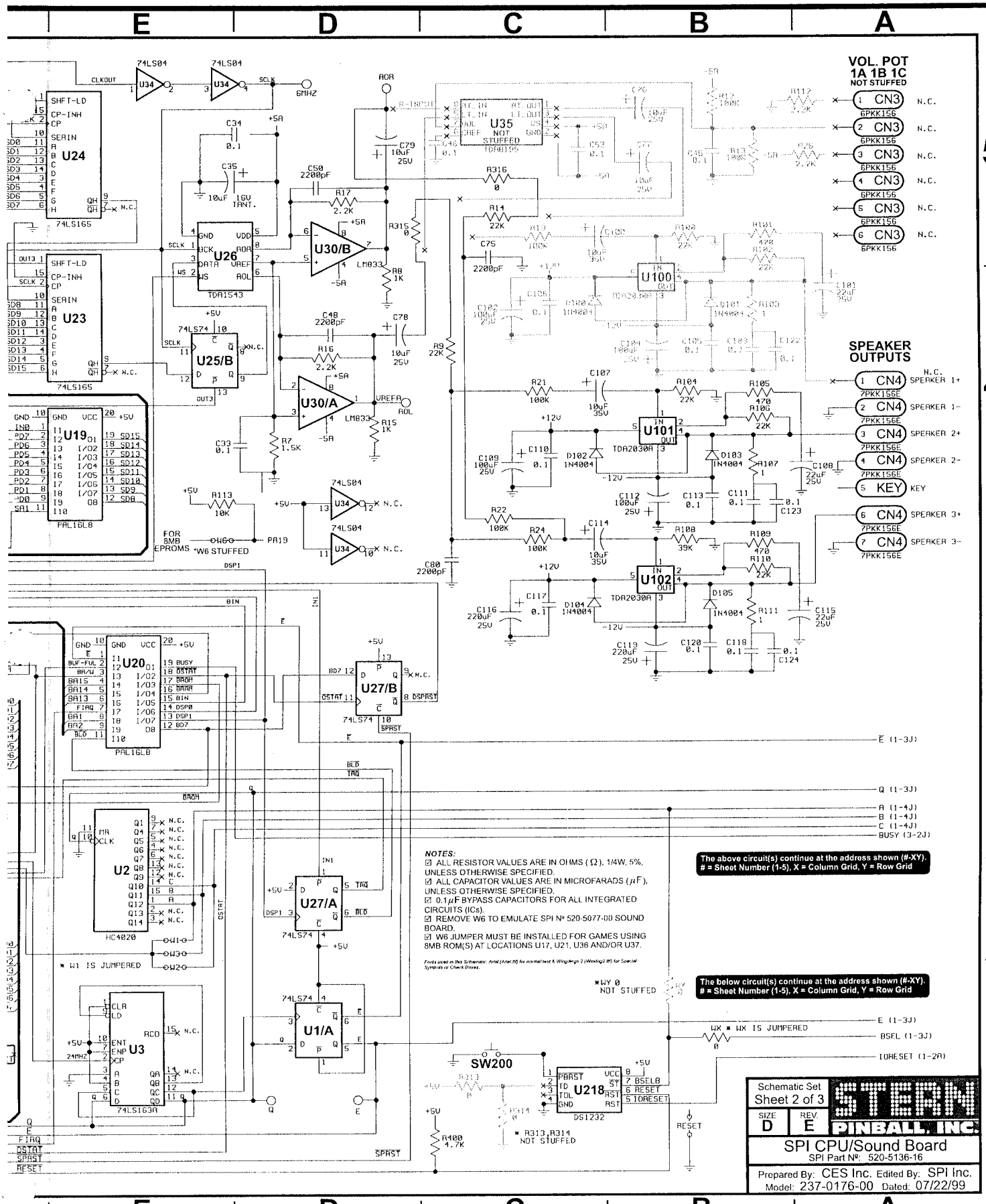
Prepared By: CES Inc. Edited By: SPI Inc.
Model: 237-0176-00 Dated: 07/22/99

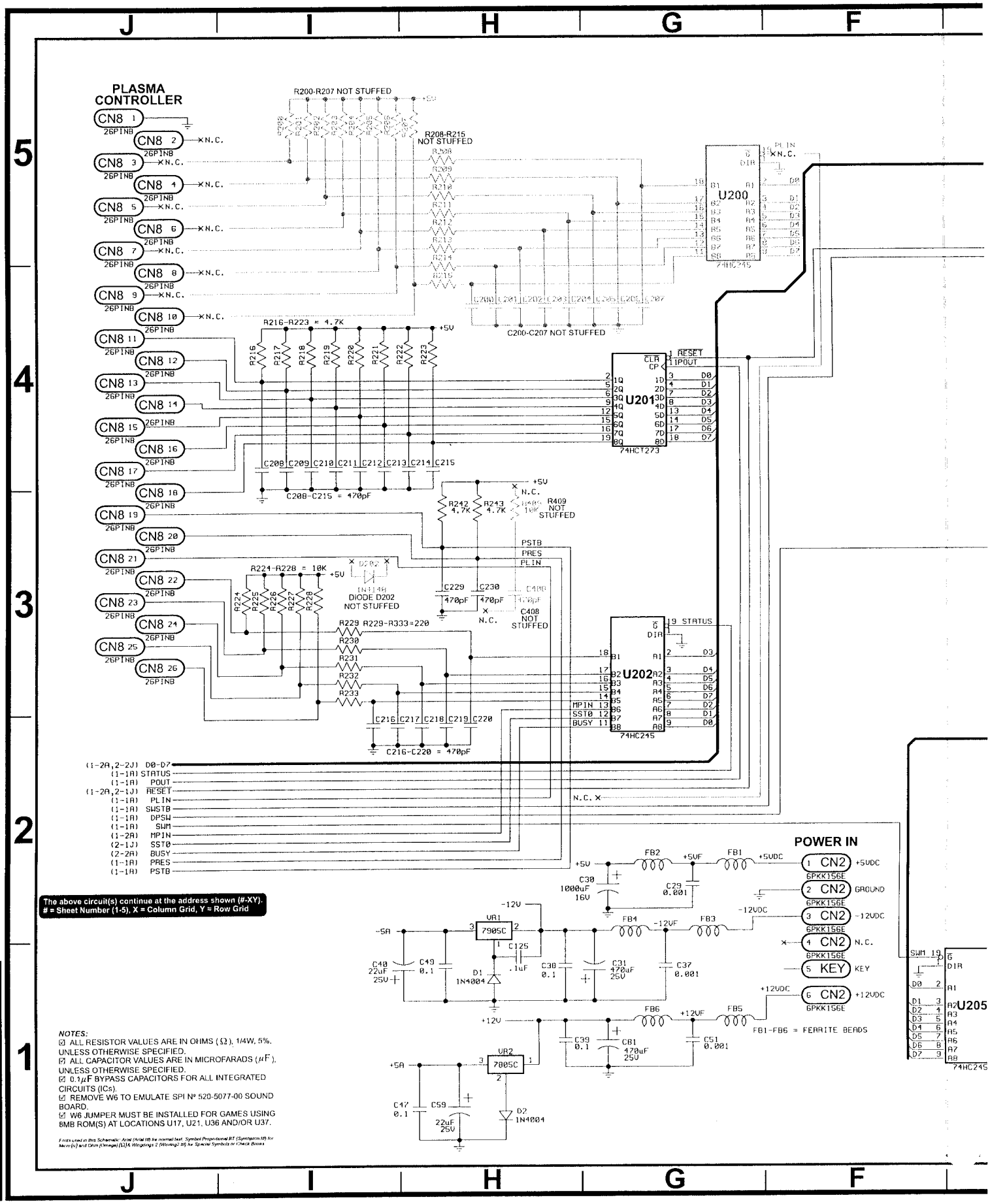
NOTES:

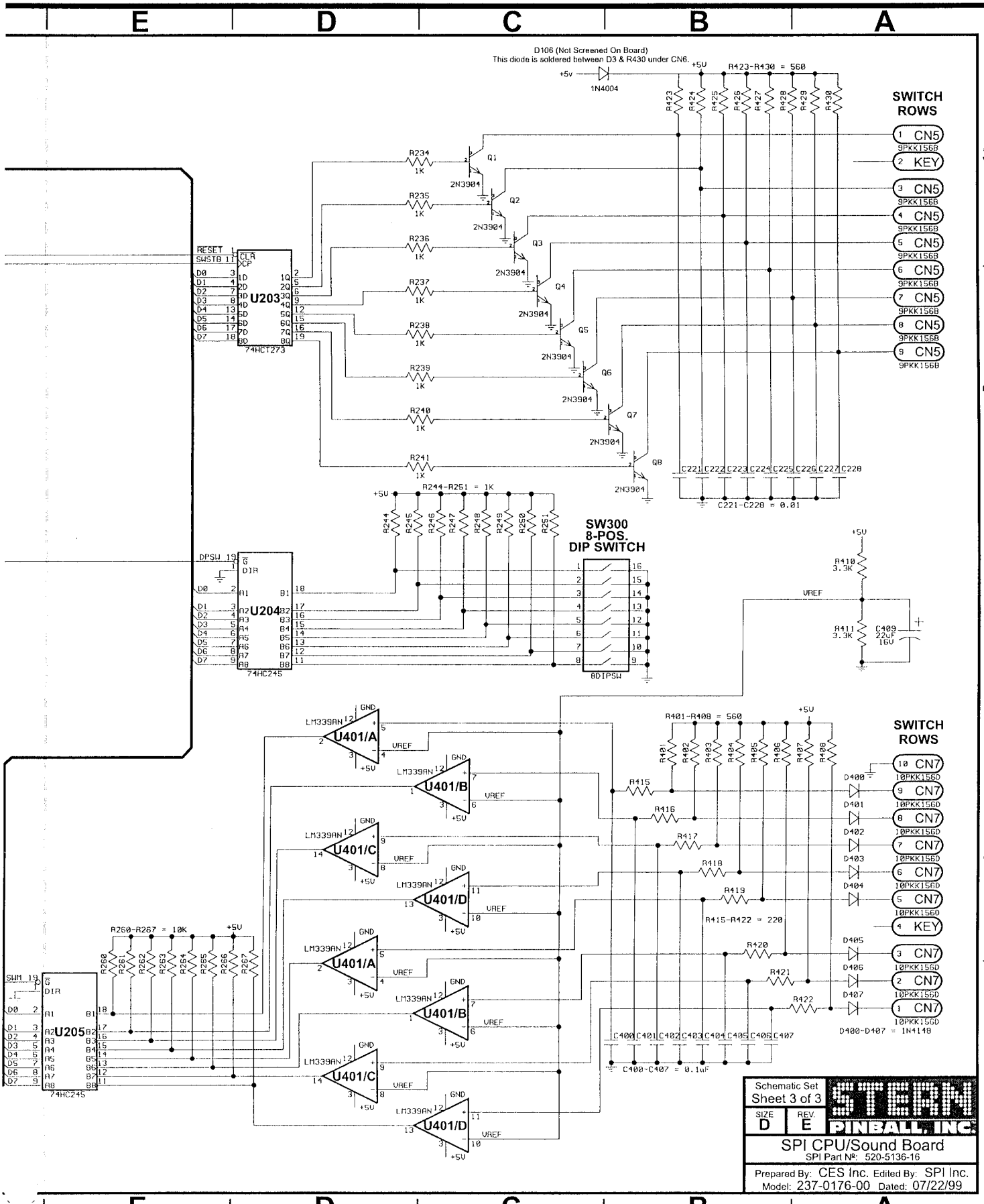
- ☑ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
- ☑ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED.
- ☑ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).
- ☑ REMOVE W6 TO EMULATE SPI № 520-5077-00 SOUND BOARD.
- ☑ W6 JUMPER MUST BE INSTALLED FOR GAMES USING 8MB ROM(S) AT LOCATIONS U17, U21, U36 AND/OR U37.

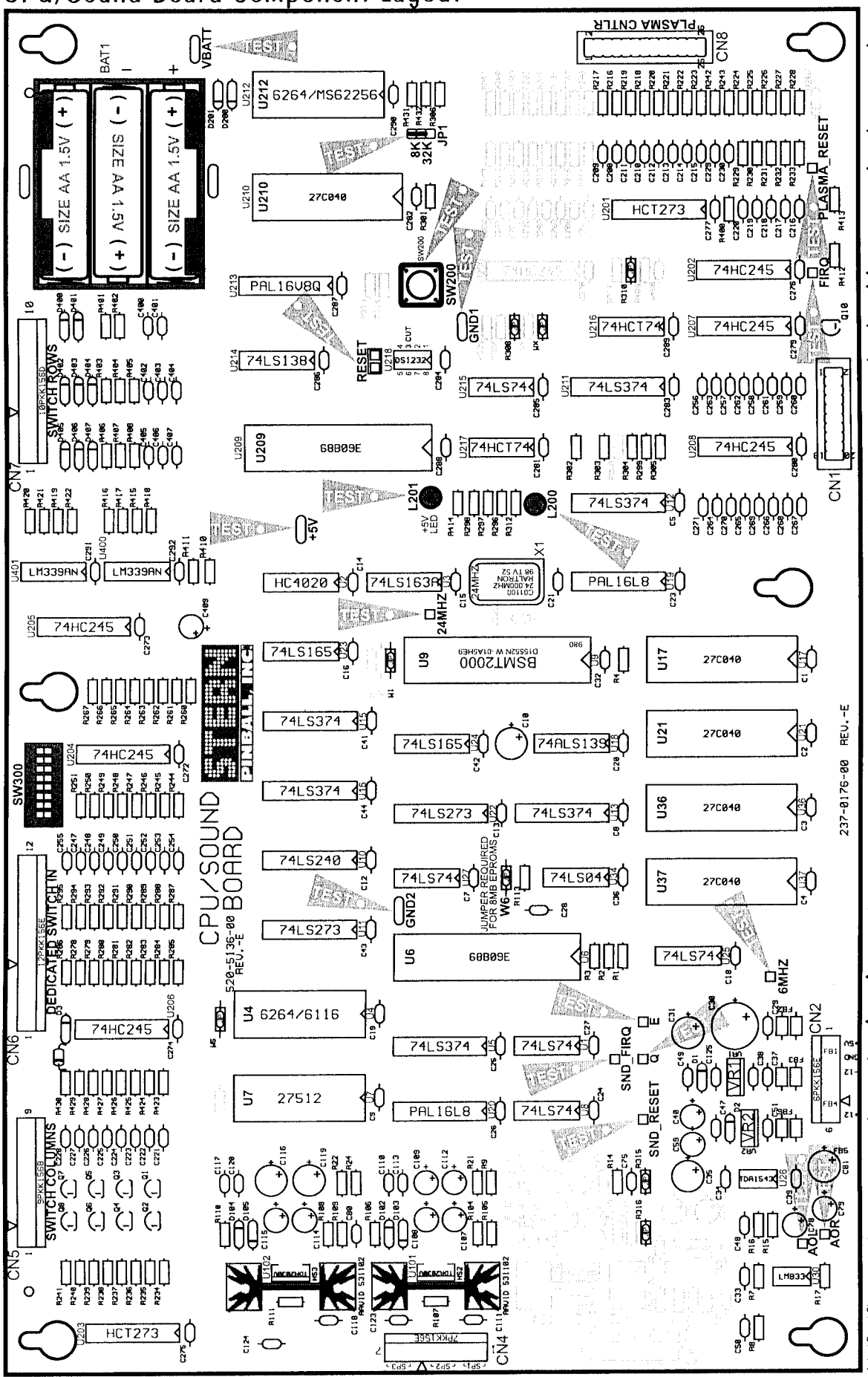
Fonts used in this Schematic: Arial (Arial MT) for normal text. Symbol (Proportional BT (Symbol)) for Micro(μ) and Ohm (Omega)(Ω) & Wingdings 2 (Wingdings 2 MT) for Special Symbols or Check Boxes.


J
I
H
G
F
5
4
3
2
1
U18
74ALS139
U13
74LS374
U12
74LS374
U22
74LS273
U17
27C040
U21
27C040
U36
27C040
U37
27C040
U9
BSMT 2000
U25/A
74LS74
U34
74LS04
U16
74LS374
U15
74LS374
U5
74LS374
U11
74LS273
U10 /A
74LS240
U10 /B
74LS240
U4
6116/6264
U7
27256/27512
U6
68B09E
U8/B
74LS74
U1/B
74LS74
U24
74LS165
U23
74LS165
24MHz CLOCK
(1-2A,3-2J) D0-D7
(1-2A) SNDSTB
(1-2A) SPRST
(1-2A,3-2J) RESET
(3-2J) SST0
SND_FIRQ
* WS 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
SPEAKER 1+
SPEAKER 1-
SPEAKER 2+
SPEAKER 2-
KEY
SPEAKER 3+
SPEAKER 3-
U24
U23
U19
U20
U2
U3
U26
U25/B
U30/B
U30/A
U35
U100
U101
U102
U27/B
U27/A
U1/A
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.
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
STERN 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
74HC245
R216-R223 = 4.7K
U201
74HCT273
C208-C215 = 470pF
R242 4.7K
R243 4.7K
R409 NOT STUFFED
PSTB
PRES
PLIN
R224-R228 = 10K
DIODE D202 NOT STUFFED
C229 470pF
C230 470pF
C408 NOT STUFFED
R229 R229-R333=220
U202
74HC245
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) SWM
(1-2A) MPIN
(2-1J) SST0
(2-2A) BUSY
(1-1A) PRES
(1-1A) PSTB
N.C.
POWER IN
+5VDC
GROUND
-12VDC
N.C.
KEY
+12VDC
FB1-FB6 = FERRITE BEADS
VR1 7905C
VR2 7905C
D1 1N4004
D2 1N4004
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 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.


D106 (Not Screened On Board)
This diode is soldered between D3 & R430 under CN6.
1N4004
R423-R430 = 560
SWITCH ROWS
CN5
KEY
9PKK156B
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
2N3904
R234
R235
R236
R237
R238
R239
R240
R241
1K
U203
74HCT273
RESET
SWSTB
C221 C222 C223 C224 C225 C226 C227 C228
C221-C228 = 0.01
R244-R251 = 1K
SW300
8-POS.
DIP SWITCH
8DIPSW
U204
74HC245
DPSW
DIR
R410
3.3K
R411
3.3K
VREF
C409
22uF
16V
R401-R408 = 560
SWITCH ROWS
CN7
10PKK156D
KEY
D400
D401
D402
D403
D404
D405
D406
D407
D400-D407 = 1N4148
R415
R416
R417
R418
R419
R420
R421
R422
R415-R422 = 220
C400 C401 C402 C403 C404 C405 C406 C407
C400-C407 = 0.1uF
U401/A
U401/B
U401/C
U401/D
LM339AN
GND
+5V
R260-R267 = 10K
U205
SWM
Schematic Set
Sheet 3 of 3
SIZE
D
REV.
E
STERN
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



Test Points:

- ←VBATT
- ←8K/32K JUMPER JP1
- ←PLASMA_RESET
- ←FIRQ
- ←SW200
- ←GND1
- ←RESET

LEDs :

- ←L201+5v & L200
- ←+5V
- ←24MHZ

REQUIRED FOR 8MB EPROM USE

- ←W6 JUMPER
- ←GND2
- ←6MHZ
- ←E
- ←SND_FIRQ & Q
- ←SND_RESET
- ←AOL & AOR

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**
01	1	545-5685-00	BAT1 HOLDER *(Always replace all 3, Size AA 1.5v Cells, with new ones, when required)*	
02	79	125-5031-00	C1, C2, C3, C4, C5, C7, C8, C9, C12, C13, C14, C15, C16, C18, C19, C20, C21, C23, C24, C25, C26, C28, C32, C33, C34, C36, C38, C39, C41, C42, C43, C44, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272, C273, C274, C275, C276, C277, C279, C280, C281, C282, C283, C284, C285, C286, C287, C288, C289, C290, C291, C292, C400>C401, C402>C404, C405>C407	0.1uF, (104), Axial Cer. Cap.
03	2	125-5017-00	C10, C35	10uF, 16v, Radial Tant. Cap.
04	3	125-5043-00	C29, C37, C51	0.001uF, (102), Cap.
05	1	125-5037-00	C30	1000uF, 16v, Radial Lytic Cap.
06	2	125-5019-00	C31, C81	470uF, 25v, Radial Lytic Cap.
07	4	125-5020-00	C40, C59, C108, C115	22uF, 25v, Radial Lytic Cap.
08	4	125-5039-00	C48, C50, C75, C80	0.0022uF, (222), Cap.
09	6	125-5017-00	C78, C79, C107, C114	10uF, 25v-35v, Radial Lytic Cap.
10	2	125-5015-00	C109, C112	100uF, 25v, Rad. Ltc. Cap.
11	2	125-5012-00	C116, C119	220uF, 25v, Radial Lytic Cap.
13	44	125-5028-00	C208>C215, C216>C220, C229, C230, C247>C254, C256>C263, C264>C271	470pF, (471), Cer. Cap.
14	8	125-5029-00	C221>C228	0.01uF, (103), 100v Cap.
15	1	125-5014-00	C409	22uF, 16v, Radial Lytic Cap.
16	1	045-5015-01	CN1	20-Pin, 0.1 HEADER
17	1	045-5015-06	CN2 (Key Pin-5)	6PKK156
18	1	045-5015-07	CN4 (Key Pin-5)	7PKK156
19	1	045-5013-00	CN5 (Key Pin-2)	9PKK156
20	1	045-5015-00	CN6 (Key Pin-5)	12PKK156
21	1	045-5014-01	CN7 (Key Pin-4)	10PKK156
22	1	045-5015-26	CN8 x2	26-Pin, 0.1 HEADER
23	7	112-5003-00	D1, D2, D3, D102, D103, D104, D105	1N4004, Diode
24	2	112-5008-00	D200, D201	1N5817, Diode
25	8	112-0054-00	D400, D401, D402>D404, D405>D407	1N4148, Diode
26	6	n/a	(FB1)-FB2, FB3-(FB4), (FB5)-FB6	Ferrite Bead *(if required, call Tech Support)*
27	**1**	**165-5099-00**	**L200, L201**	**LED T1-3/4 DIFFUSER LED**
28	10	110-0069-00	Q1>Q8, Q10	2N3904, Transistor
29	36	121-5011-00	R1>R3, R4, R113, R224>R228, R244>R251, R260>R267, R296>R298, R299, R301, R302>R305, R306, R413, R431>R432	10K Ω 1/4W Res.
30	1	121-5018-00	R7	1.5K Ω 1/4W Res.
31	5	121-5023-00	R9, R14, R104, R106, R110	22K Ω 1/4W Res.
32	20	121-5009-00	R15, R8, R234>R241, R278>R286, R412	1K Ω 1/4W Res.
33	2	121-5043-00	R16, R17	2.2K Ω 1/4W Res.
34	3	121-5051-00	R21, R22, R24	100K Ω 1/4W Res.
35	2	121-5046-00	R105, R109	470K Ω 1/4W Res.
36	2	121-5009-00	R107, R111	1K Ω 1/4W Res.
37	9	121-5045-00	R108, R287>R294	39K Ω Res.
38	11	121-5021-00	R216>R223, R242, R243, R400	4.7K Ω 1/4W Res.
39	15	121-5033-00	R229>R233, R295, R414, R415>R422	220 Ω 1/4W Res.
40	5	n/a	R308, R310, R315>R316, WX	0Ω *Jumper Wire (24ga.)*
41	1	121-5036-00	R312	330 Ω 1/4W Res.
42	16	121-5047-00	R401>R402, R403>R405, R406>R408, R423>R430	560 Ω 1/4W Res.
43	2	121-5048-00	R410, R411	3.3K Ω 1/4W Res.
44	1	n/a	SW200	B3F4000
45	1	181-5002-00	SW300	8-Pin, Dip Switch
46	5	100-0037-00	U1, U8, U25, U27, U215	74LS74
47	1	100-0249-00	U2	74HC4020
48	1	100-0049-00	U3	74LS163
49	1	105-0052-05	U4	6116 RAM
50	3	077-5208-00	U4, U7, U212	28-Pin, IC Dip Socket
51	6	100-0064-00	U5, U12, U13, U15, U16, U211	74LS374
52	1	100-0189-01	U6, U209	68B09E
53	3	077-5209-00	U6, U9, U209	40-Pin, IC Socket
54	1 (See Pg. DR. ❸ Table)		U7	27512 EPROM
55	**1**	**105-0116-00**	**U9**	**BSMT2000**
56	1	100-0149-00	U10	74LS240
57	5 (See Pg. DR. ❸ Table)		U17, U21, U36, U37, U210	27C040 EPROM
58	5	077-5217-00	U17, U21, U36, U37, U210	32-Pin, IC Socket
59	1	100-0043-00	U18	74ALS139
60	**1**	**965-0136-00**	**U19 - YELLOW DOT**	**PAL16L8 (Programmed) YELLOW DOT**
61	**1**	**965-0137-00**	**U20 - WHITE DOT**	**PAL16L8 (Programmed) WHITE DOT**
62	2	100-0022-00	U22, U11	74LS273
63	2	100-5008-00	U23, U24	74LS165
64	1	100-5018-00	U26	TDA1543
65	1	100-0375-00	U30	LM833
66	1	100-0027-00	U34	74LS04
68	2	100-5016-20	U101, U102	TDA2030A
69	3	535-5000-10	U101 (HS2), U102 (HS3)	AAVID 531102 (Heat Sink)
70	2	100-5012-00	U201, U203	74HCT273
71	6	100-0338-00	U202, U204, U205, U206, U207, U208	74HC245
72	**1**	**105-5046-00**	**U212**	**MS6264A**
73	**1**	**965-6504-00**	**U213- BLUE DOT**	**PAL16L8 (Programmed) BLUE DOT**
74	1	100-0148-00	U214	74LS138
75	2	100-5015-00	U216, U217	HCT74
76	1	100-5023-00	U218	DS1232
77	2	100-0377-00	U400, U401	LM339AN
78	4	n/a	VBATT, +5v, GND1, GND2	*Test Point Wire (24ga.) Loops*
79	1	124-5002-00	VR1	LM7905CT **-5v** Regulator
80	1	124-5001-00	VR2	LM7805CT **+5v** Regulator
81	6	n/a	W1, W5, **W6* (*for 8MB EPROMs)**	0Ω *Jumper Wire (24ga.)*
82	1	140-0011-00	X1	24Mhz
83	12	n/a	AOR, AOL, SND_RESET, SND_FIRQ, Q, E, 6Mhz, 24Mhz, FIRQ, PLASMA_RESET, RESET (X2)	*Test Points*

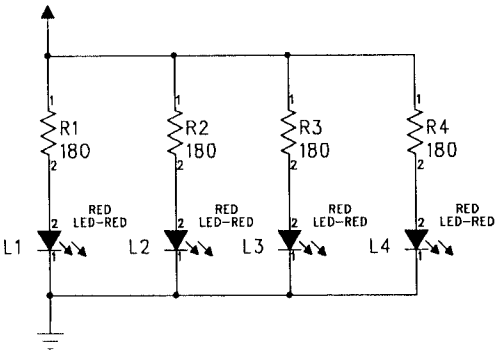
4-Position OPTO (Trans. & Rec.) PC Boards Theory of Operation & Schematic

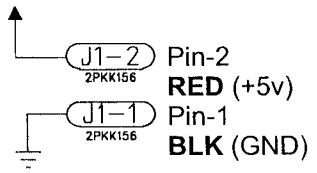
The following theory applies to circuit one (1) of four (4); apply the same logic to the other circuits, respectively.

The light falling on **LED** (**L1**) generates a voltage which is applied to the input (Pin-4) of the **LM339 Comparator** (**U1**). **R1** bleeds off excess charge. Upon receiving .1 volt input from **LED** (**L1**), the **Comparator** (**U1**) then *drives both* the **Switch Transistor** (**Q1**) *(during switch line strobes)* and the indicator **LED** (**L5**). If a switch line is being strobed, the emitter of **Q1** drops to the saturation voltage of the *Switch Line Driver,* about **.3 volts**. This, plus the **.7 volt** drop on the base, gives a **1v** forward bias voltage to **Q1**, so the current flows through the transistor during strobes. This drives **Q1** on and *makes the switch.* The normal state of the **Switch Transistor Q1** is **ON** (N.C.) and the indicator **LED (L5)** is also **ON**. When the beam is blocked, then **Q1** and **LED (L5)** are turned **OFF**.

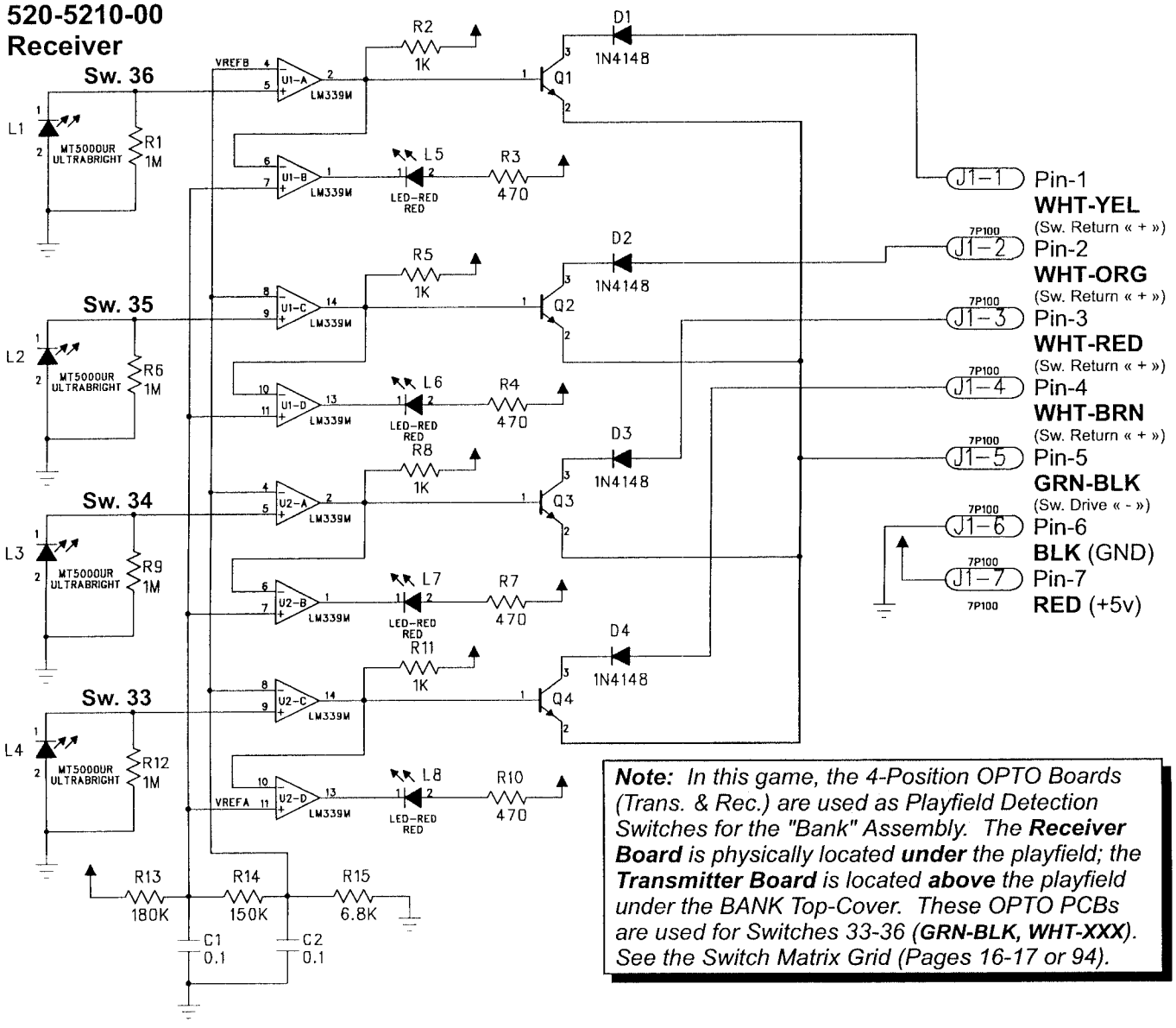
520-5218-00 Transmitter

L1 Trans. ↔ *L4, L8 Rec.*
L2 Trans. ↔ *L3, L7 Rec.*
L3 Trans. ↔ *L2, L6 Rec.*
L4 Trans. ↔ *L1, L5 Rec.*





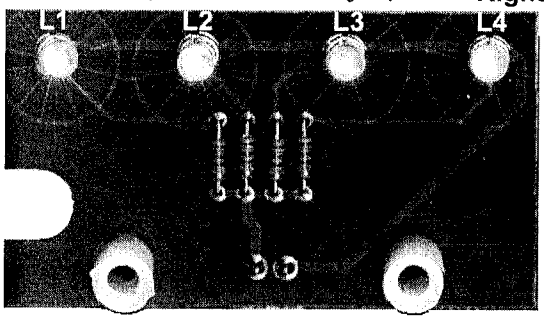
520-5210-00 Receiver



Note: *In this game, the 4-Position OPTO Boards (Trans. & Rec.) are used as Playfield Detection Switches for the "Bank" Assembly. The* ***Receiver Board*** *is physically located* ***under*** *the playfield; the* ***Transmitter Board*** *is located* ***above*** *the playfield under the BANK Top-Cover. These OPTO PCBs are used for Switches 33-36 (****GRN-BLK, WHT-XXX****). See the Switch Matrix Grid (Pages 16-17 or 94).*

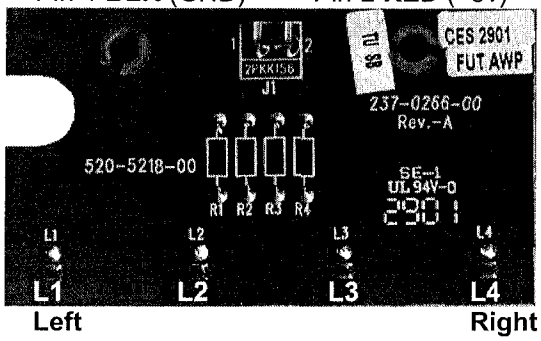
4-Position OPTO (Trans. & Rec.) PC Boards Component Layout & Parts

Front Side
Left (Faces down towards Playfield) Right



L1 = Sw. 33
L2 = Sw. 34
L3 = Sw. 35
L4 = Sw. 36

Back Side
Pin-1 **BLK** (GND) Pin-2 **RED** (+5v)

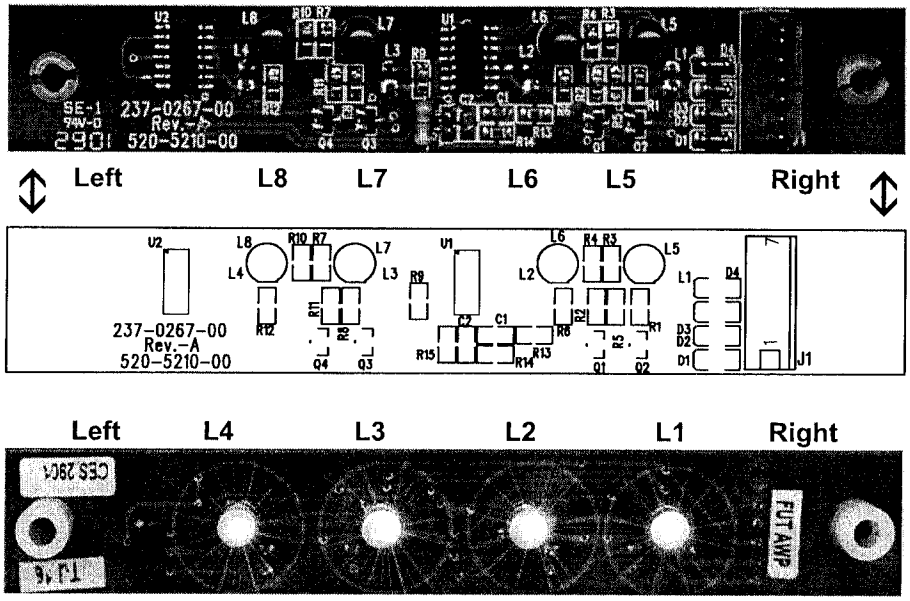


Left Right

Transmitter ↑ (520-5218-00) *Located above the Playfield, under the Bank Cover.*

Receiver ↓ (520-5210-00) *Located under the Playfield*

Back Side
(Faces down into cabinet)



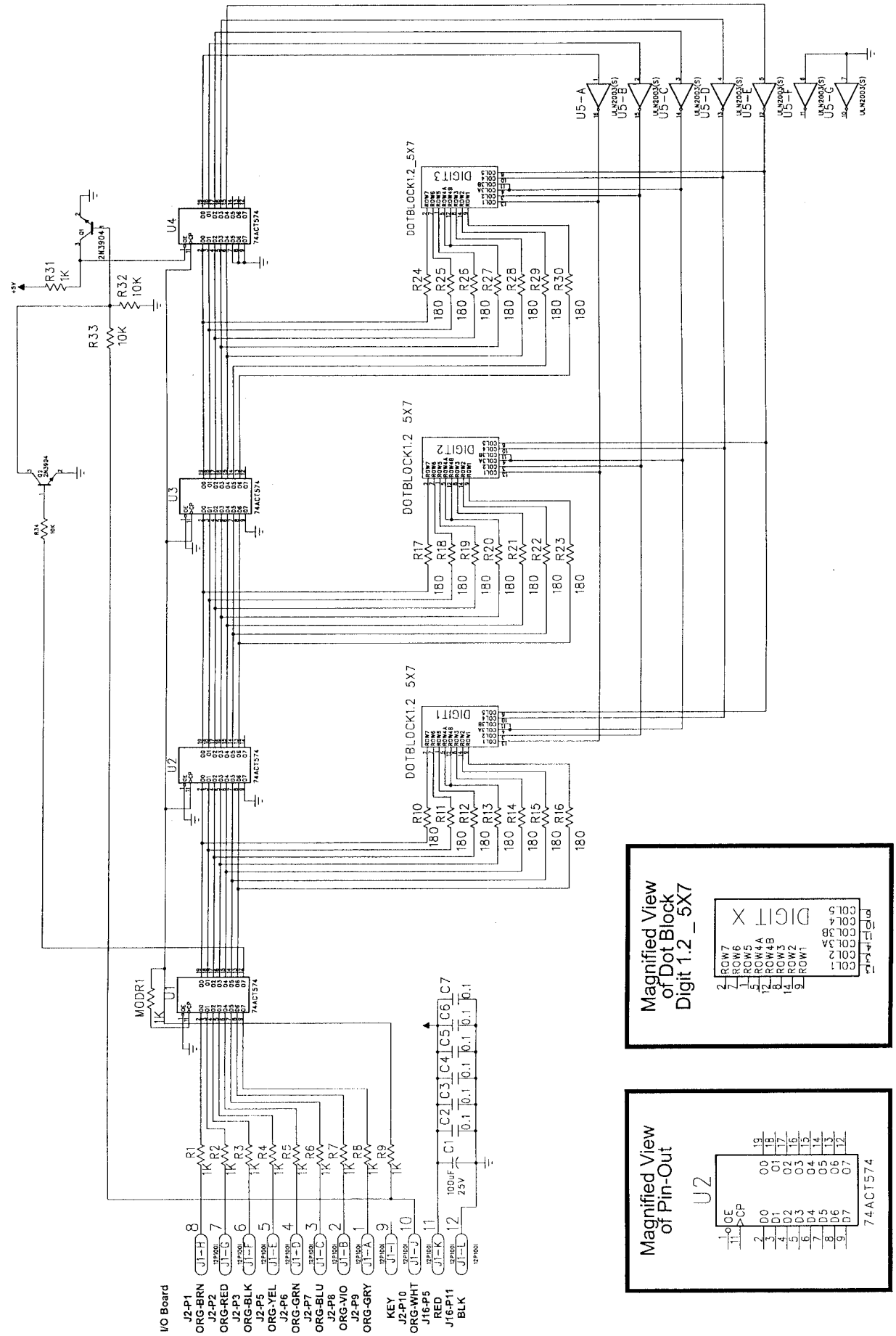
Front Side
(Faces up through playfield)

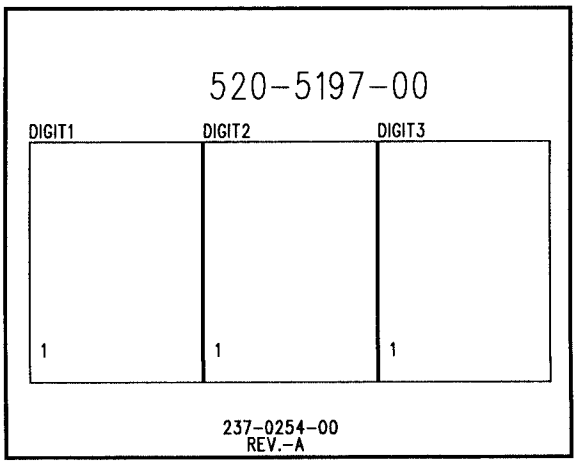
Pin-1
WHT-YEL
(Sw. Return « + »)
Pin-2
WHT-ORG
(Sw. Return « + »)
Pin-3
WHT-RED
(Sw. Return « + »)
Pin-4
WHT-BRN
(Sw. Return « + »)
Pin-5
GRN-BLK
(Sw. Drive « - »)
Pin-6
BLK (GND)
Pin-7
RED (+5v)

L4, L8 = Sw. 33
L3, L7 = Sw. 34
L2, L6 = Sw. 35
L1, L5 = Sw. 36

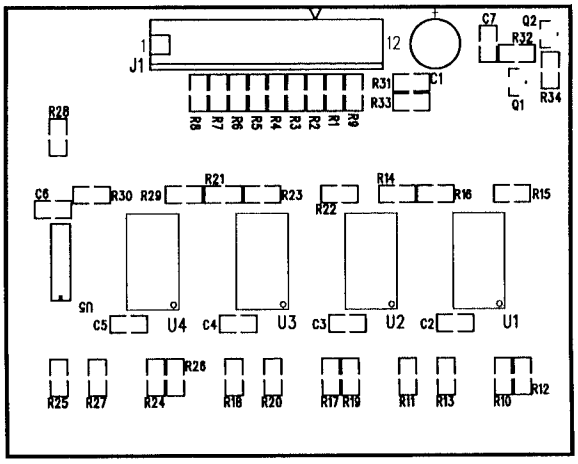
Note: *In this game, the 4-Position OPTO Boards (Transmitter & Receiver) are used as Playfield Detection Switches for the "Bank" Assembly. The* ***Receiver Board*** *is physically located* ***under*** *the playfield; the* ***Transmitter Board*** *is located* ***above*** *the playfield under the BANK Top-Cover. These OPTO PCBs are used for Switches 33-36 (****GRN-BLK, WHT-XXX****). See the Switch Matrix Grid (Pages 16-17 or 94).*

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
--	**1**	**520-5218-00**	**4-Position OPTO (Transmitter) PC Board**	**PCB Assy. with Cable & Connector**
1	2	254-5032-01	n/a	1/2" Slft. Rtn. #8 Spacer White
2	4	**165-5052-00**	**L1, L2, L3, L4**	**LED TLRH180P (Ultra Bright Red)**
3	4		R1, R2, R3, R4	180Ω 1/4 Res.
--	**1**	**520-5210-00**	**4-Position OPTO (Receiver) PC Board**	**PCB Assy.**
1	2	254-5007-01	n/a	3/8" Slf. Rtn. Spacer White
2	**4**	**165-5052-00**	**L1, L2, L3, L4**	**LED TLRH180P (Ultra Bright Red)**
3	**4**	**165-5099-00**	**L5, L6, L7, L8**	**LED T1-3/4 DIFFUSER LED**
4	2		U1, U2	LM339M, Semi-Conductor
5	4		D1, D2, D3, D4	1N4148, Diode
6	4		Q1, Q2, Q3, Q4	Transistor SMT
7	2		C1, C2	0.1, Capacitor SMT
8	4		R1, R6, R9, R12	1MΩ Resistor SMT
9	4		R2, R5, R8, R11	1KΩ Resistor SMT
10	4		R3, R4, R7, R10	470KΩ Resistor SMT
11	1		R13	180KΩ Resistor SMT
12	1		R14	150KΩ Resistor SMT
13	1		R15	6.8KΩ Resistor SMT

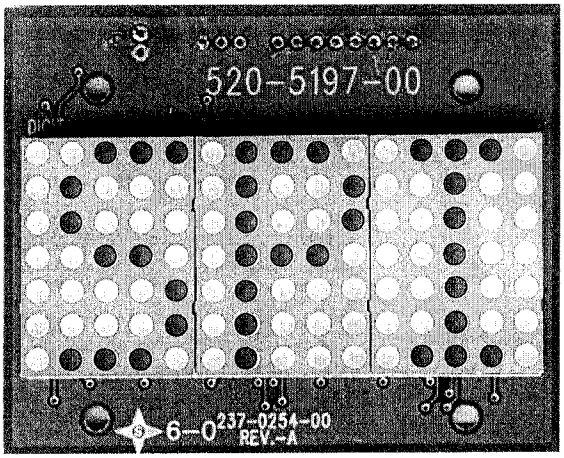

U5-A
U5-B
U5-C
U5-D
U5-E
U5-F
U5-G
ULN2003(S)
DIGIT 3
DIGIT 2
DIGIT 1
DOTBLOCK1.2_5X7
DOTBLOCK1.2 5X7
R24 R25 R26 R27 R28 R29 R30
R17 R18 R19 R20 R21 R22 R23
R10 R11 R12 R13 R14 R15 R16
180
U4
U3
U2
U1
74ACT574
Q1
2N3904
R31 1K
R32 10K
R33 10K
MODR1 1K
R1 R2 R3 R4 R5 R6 R7 R8 R9 1K
C1 100uF 25V
C2 C3 C4 C5 C6 C7 0.1
I/O Board
J2-P1 ORG-BRN
J2-P2 ORG-RED
J2-P3 ORG-BLK
J2-P5 ORG-YEL
J2-P6 ORG-GRN
J2-P7 ORG-BLU
J2-P6 ORG-VIO
J2-P9 ORG-GRY
KEY J2-P10 ORG-WHT
J16-P5 RED
J16-P11 BLK
J1-H
J1-G
J1-F
J1-E
J1-D
J1-C
J1-B
J1-A
J1-J
J1-K
J1-L
Magnified View of Dot Block Digit 1.2_5X7
DIGIT X
ROW7
ROW6
ROW5
ROW4A
ROW4B
ROW3
ROW2
ROW1
COL1
COL2
COL3A
COL3B
COL4
COL5
Magnified View of Pin-Out
U2
74ACT574
OE
CP
D0
D1
D2
D3
D4
D5
D6
D7
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7



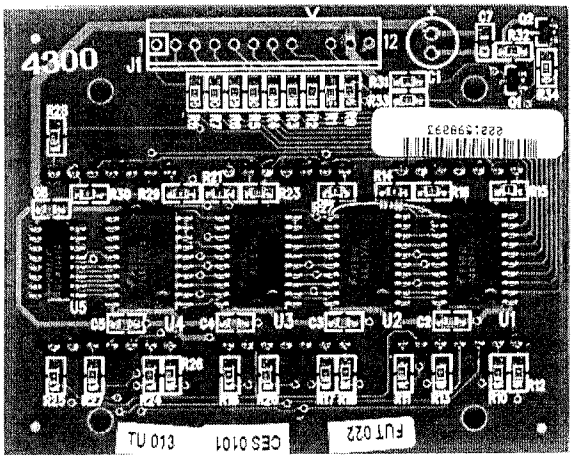
Component Side



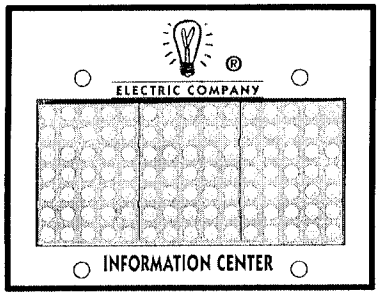
Solder Side



Component Side

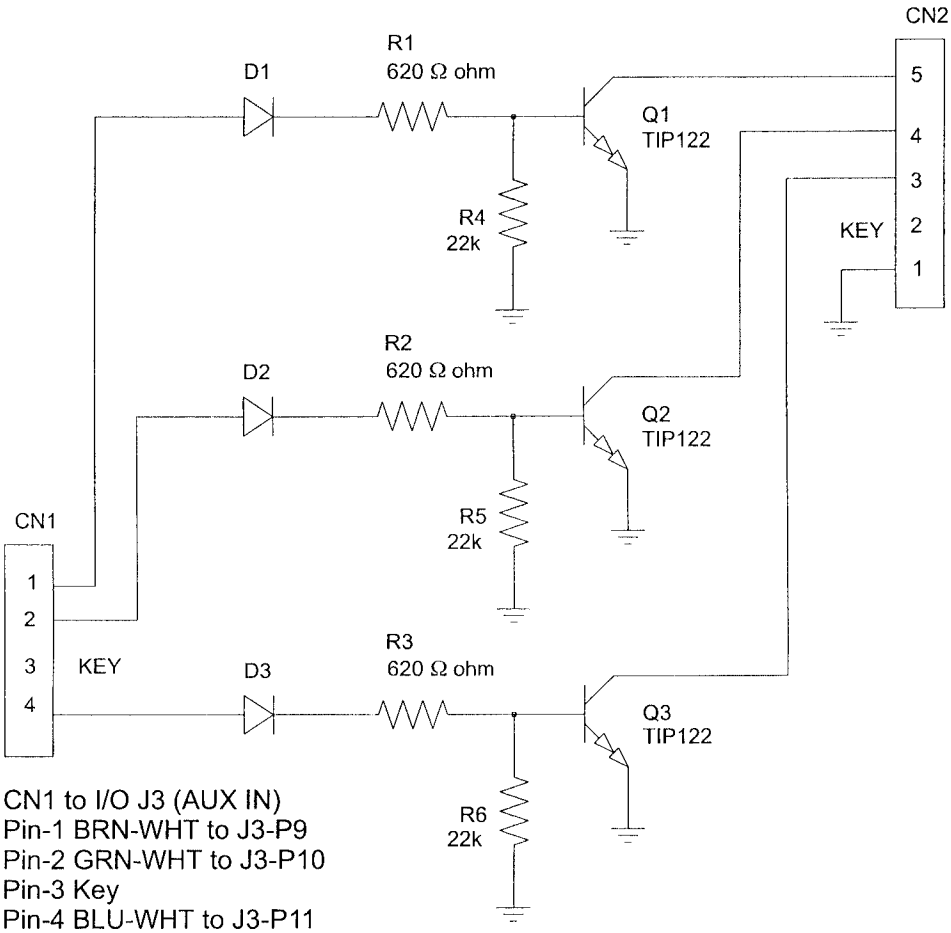


Solder Side



ITEM	QTY	PART NUMBER	REF-DESIGNATOR		DESCRIPTION
A	1	520-5197-00	Dot Display (5X7) x3 PC Board		PCB Assembly
1	1	100-5035-00	J1	(Manex Nº: 315-0004125)	9T Conn. 12P.1VM
2	2	112-5017-00	Q1, Q2	(Manex Nº: 211-0003589)	2N3904S 40V 0.2A
3	4	100-5036-00	U1, U2, U3, U4	(Manex Nº: 221-0006048)	74ACT574
4	6	100-5039-00	C2-C7	(Manex Nº: 121-0004238)	Cap. 104-0805 0.1 50V
5	3	100-5040-00	DIGIT1, DIGIT2, DIGIT3	(Manex Nº: 430-0006059)	Dot Block 1.2: 5X7 GMA8875C
6	3	121-5084-00	R32-R34	(Manex Nº: 101-0001827)	10KΩ 1/10W 0805 Res.
7	10	121-5088-00	R1-R9, R31	(Manex Nº: 101-0001905)	1KΩ 1/10W 0805 Res.
8	21	121-5086-00	R10-R30	(Manex Nº: 101-0001897)	180Ω 1/10W 0805 Res.
9	1	100-5037-00	C1	(Manex Nº: 131-0003773)	100uF 25V T. Cap.
10	1	100-5038-00	U5	(Manex Nº: 225-0005340)	ULN2003(S)
11	1	121-5089-00	MOD1	(Manex Nº: 105-0002703)	1KΩ 1/8W 5CF Res.

(UK Only) Solenoid Expander PC Board Schematic

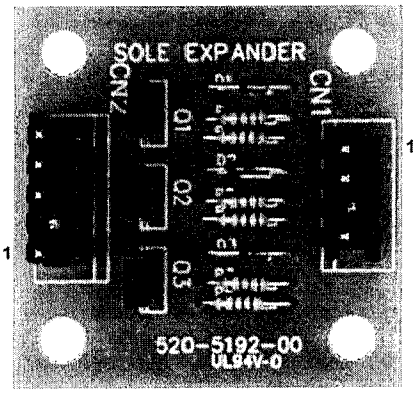


CN2 to Coils to I/O J7-P1 20v BRN

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)

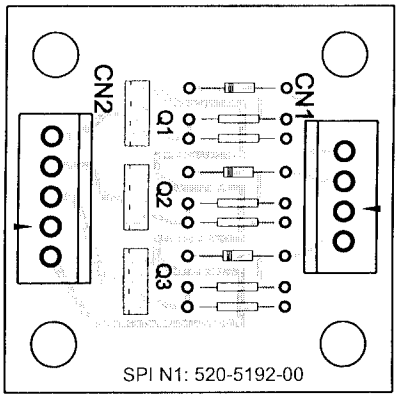
CN1 to I/O J3 (AUX IN)
Pin-1 BRN-WHT to J3-P9
Pin-2 GRN-WHT to J3-P10
Pin-3 Key
Pin-4 BLU-WHT to J3-P11

Component Side

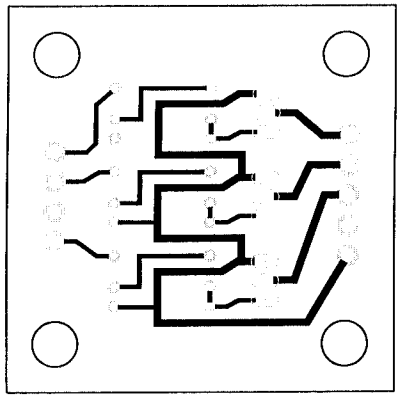


(UK Only) Solenoid Exp. PCB Component Layout & Parts

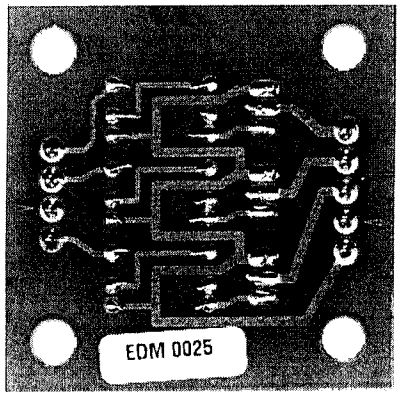
Component Side



Solder Side



Solder Side



ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION
—	1	**520-5192-00**	**Solenoid Expander PC Board**	**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

Appendix
Table of Contents

- Appendix A, Pinball Game Firmware Table A2-A3
  ...describes the EPROM with its chip size, the Stern™ Pinball, Inc. (SPI) Part Nº, version (if applicable), and CPU Board & CPU/Sound Board Pin location(s).

- Appendix B, Semi-Conductors / I.C.'s / Relays Cross-Reference Table A4
  ...describes diodes and transistors with Source Nº, SPI Part Nº, NTE Nº, ECG Nº, Radio Shack Nº & RCA Part Nº (If applicable).

- Appendix C, Game Mfg. Date, Manual Part Nº & CPU Jumper Table A5
  ...provides the Game Manufactured Date & Manual Part Nº, the CPU version, the EPROM Position, Jumpers Installed and Jumpers Removed (games specified).

- Appendix D, Board Type Table A6-A7
  ...provides Board Part Nºs for Games Laser War through Batman Forever (Flipper, Sound, Power Supply, Dot Matrix Display, Display Controller & OPTOs) and the White Star Board System, Games Apollo 13 through current (Flipper*, I/O Power Driver, CPU/Sound, Display Power Supply, Dot Matrix Display, Display Controller & OPTOs; *Flipper Board with the White Star Bd. System for A13 & Golden Eye only.)

- Appendix E, Generic Coil Cross-Reference Guide & Flipper Coil Table A8-A9
  ...provides the Coils used with Part Nº and Gauge-Turns (of the coil).

- Appendix F, Motor Specification Table A10-A11
  ...provides all the Motor Function, Specifications and Part Nº for Games Laser War through current.

- Appendix G, Part Number Prefix Classification Codes A12
  ...explains how our Part Numbers are developed to help sort parts easier.

- Appendix H, Playfield Inserts (Plastic Light Covers) A13
  ...gives a pictoral view with the name and Part Nº of all the inserts used (also gives the Color Code Chart).

- Appendix I, Stand-Up Targets (Happ Modular & Regular) A14
  ...gives a pictoral view with the name and Part Nº of all the Single Stand-Up Targets used (also gives the Color Code Chart).

- Glossary of Terms A15
  ...gives definitions or explanations of some pinball terms and acronyms.

- Parts Order Checklist Notes A16
  ...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	960-5007-00
			- 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	960-7001-02
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	960-5006-00
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	(128K)	965-0031-00	A02-7	B5	960-5006-00
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	(128K)	965-0026-00	A03-2	B5	960-5006-00
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	(128K)	965-0051-00	A02-7	B5	960-5006-00
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	(128K)	965-0056-00	A1-7	B5	960-5006-00
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	(128K)	965-0061-00	A1.04	B5	960-5006-00
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
Lethal Weapon 3					
CPU	(512K)	965-0082-00	A2.08	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 Frankenstein *					
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 (Note 1)					
Game ROM	(1M)	965-0208-00	A5.01 | $09FF	U210	960-5009-00
Sound	(512K)	965-0212-00		U7	960-7001-02
Display	(4M)	965-0213-00	A5.00 | $B92B	ROM 0	960-5015-01
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)
Golden Eye (Note 1)					
Game ROM	(1M)	965-0214-42	A4.04 | $3FFF	U210	960-5009-00
Sound	(512K)	965-0217-42		U7	960-7001-02
Display	(4M)	965-0218-42	A4.00 | $E6ED	ROM 0	960-5015-01
Voice 1	(4M)	965-0215-42		U17	n/a (masked)
Voice 2	(4M)	965-0216-42		U21	n/a (masked)
Twister (Note 2)					
Game ROM	(1M)	965-0219-41	A4.05 | $E9FF	U210	960-5009-00
Sound	(512K)	965-0221-41		U7	960-7001-02
Display	(4M)	965-0222-41	A4.01 | $FD01	ROM 0	960-5015-01
Voice 1	(4M)	965-0220-41		U17	960-5015-01
Voice 2	(4M)	965-0223-41		U21	960-5015-01
ID4: Independence Day (Note 2)					
Game ROM	(1M)	965-0224-45	A2.02 | $9CFF	U210	960-5009-00
Sound	(512K)	965-0227-45		U7	960-7001-02
Display	(4M)	965-0228-45	A2.00 | $ABF7	ROM 0	960-5015-01
Voice 1	(4M)	965-0225-45		U17	960-5015-01
Voice 2	(4M)	965-0226-45		U21	960-5015-01
Space Jam (Note 2)					
Game ROM	(1M)	965-0229-43	A3.00 | $E6FF	U210	960-5009-00
Sound	(512K)	965-0233-43		U7	960-7001-02
Display	(4M)	965-0234-43	A3.00 | $0057	ROM 0	960-5015-01
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
The Star Wars Trilogy - Special Edition (S.E.) (Note 2)					
Game ROM	(1M)	965-0235-56	A4.03 | $5EFF	U210	960-5009-00
Sound	(512K)	965-0238-56		U7	960-7001-02
Display	(4M)	965-0239-56	A4.00 | $8817	ROM 0	960-5015-01
Voice 1	(4M)	965-0236-56		U17	960-5015-01
Voice 2	(4M)	965-0237-56		U21	960-5015-01
The Lost World: Jurassic Park (Note 2)					
Game ROM	(1M)	965-0240-53	A2.01 | $C2FF	U210	960-5009-00
Sound	(512K)	965-0243-53		U7	960-7001-02
Display	(4M)	965-0244-53	A2.01 | $7F46	ROM 0	960-5015-01
Voice 1	(4M)	965-0241-53		U17	960-5015-01
Voice 2	(4M)	965-0242-53		U21	960-5015-01
The X-Files (Note 2)					
Game ROM	(1M)	965-0245-46	A3.03 | $A2FF	U210	960-5009-00
Sound	(512K)	965-0248-46		U7	960-7001-02
Display	(4M)	965-0249-46	A3.00 | $66D0	ROM 0	960-5015-01
Voice 1	(4M)	965-0246-46		U17	960-5015-01
Voice 2	(4M)	965-0247-46		U21	960-5015-01
Starship Troopers (Note 3)					
Game ROM	(1M)	965-0250-59	A2.00 | $85FF	U210	960-5009-00
Sound	(512K)	965-0253-59		U7	960-7001-02
Display	(4M)	965-0254-59	A2.00 | $E77B	ROM 0	960-5015-01
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
Viper Night Drivin' (Note 4)					
Game ROM	(1M)	965-0266-35	A2.01 | $C5FF	U210	960-5009-00
Sound	(512K)	965-0271-35		U7	960-7001-02
Display	(4M)	965-0272-35	A2.01 | $C17D	ROM 0	960-5015-01
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
Lost In Space (Note 4)					
Game ROM	(1M)	965-0282-60	A1.01 | $B2FF	U210	960-5009-00
Sound	(512K)	965-0287-60		U7	960-7001-02
Display	(4M)	965-0288-60	A1.02 | $32AB	ROM 0	960-5015-01
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
Godzilla (Note 4)					
Game ROM	(1M)	965-0289-40	A2.05| $B1FF	U210	960-5009-00
Sound	(512K)	965-0294-40		U7	960-7001-02
Display	(4M)	965-0295-40	A2.00 | $C929	ROM 0	960-5015-01
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
South Park (Notes 4, 5)					
Game ROM	(1M)	965-0301-71	A1.03 | $58FF	U210	960-5009-00
Sound	(512K)	965-0306-71		U7	960-7001-02
Display	(4M)	965-0307-71	A1.01 | $166F	ROM 0	960-5015-01
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
Harley-Davidson® (Notes 4, 5)					
Game ROM	(1M)	965-0319-67	A1.03 | $3EFF	U210	960-5009-00
Sound	(512K)	965-0320-67		U7	960-7001-02
Display	(4M)	965-0321-67	A1.04 | $FC7C	ROM 0	960-5015-01
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
Striker Xtreme (Notes 4, 5)					
Game ROM	(1M)	965-0326-68	A1.02 | $E4FF	U210	960-5009-00
Sound	(512K)	965-0327-68		U7	960-7001-02
Display	(4M)	965-0328-68	A1.03 | $1957	ROM 0	960-5015-01
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
NFL (Notes 4, 5)					
Game ROM	(1M)	965-0339-73	A1.00 | $D2FF	U210	960-5009-00
Sound	(512K)	965-0340-73		U7	960-7001-02
Display	(4M)	965-0341-73	A1.01 | $845A	ROM 0	960-5015-01
Voice 1	(8M)	965-0342-73		U17	960-5016-00
Voice 2	(8M)	965-0343-73		U21	960-5016-00
Voice 3	(8M)	965-0344-73		U36	960-5016-00
Voice 4	(8M)	965-0345-73		U37	960-5016-00
Sharkey's Shootout (Notes 4, 5)					
Game ROM	(1M)	965-0333-72	A2.04 | $5CFF	U210	960-5009-00
Sound	(512K)	965-0334-72		U7	960-7001-02
Display	(4M)	965-0335-72	A2.01 | $6C33	ROM 0	960-5015-01
Voice 1	(8M)	965-0336-72		U17	960-5016-00
Voice 2	(8M)	965-0337-72		U21	960-5016-00
Voice 3	(8M)	965-0338-72		U36	960-5016-00
High Roller Casino (Notes 4, 5)					
Game ROM	(1M)	965-0346-65	A2.10 | $19FF	U210	960-5009-00
Sound	(512K)	965-0347-65		U7	960-7001-02
Display	(4M)	965-0348-65	A2.00 | $13EE	ROM 0	960-5015-01
Voice 1	(8M)	965-0349-65		U17	960-5016-00
Voice 2	(8M)	965-0350-65		U21	960-5016-00
Voice 3	(8M)	965-0351-65		U36	960-5016-00
Voice 4	(8M)	965-0352-65		U37	960-5016-00
Austin Powers™ (Notes 4, 5)					
Game ROM	(1M)	965-0353-74	A3.00 | $ACFF	U210	960-5009-00
Sound	(512K)	965-0354-74		U7	960-7001-02
Display	(4M)	965-00355-74	A3.00 | $6A34	ROM 0	960-5015-01
Voice 1	(8M)	965-0356-74		U17	960-5016-00
Voice 2	(8M)	965-0357-74		U21	960-5016-00
Voice 3	(8M)	965-0358-74		U36	960-5016-00
Voice 4	(8M)	965-0359-74		U37	960-5016-00
Monopoly® (Notes 4, 5)					
Game ROM	(1M)	965-0360-75	A | $	U210	960-5009-00
Sound	(512K)	965-0361-75		U7	960-7001-02
Display	(4M)	965-0062-75	A | $	ROM 0	960-5015-01
Voice 1	(8M)	965-0363-75		U17	960-5016-00
Voice 2	(8M)	965-0364-75	GAME CODE	U21	960-5016-00
Voice 3	(8M)	965-0365-75	IN	U36	960-5016-00
Voice 4	(8M)	965-0366-76	PRODUCTION	U37	960-5016-00

footnotes:

1 ROMs on CPU/Sound Bd.: 520-5136-**00** (Stereo) & Display Cont. Bd.: 520-5055-01
2 ROMs on CPU/Sound Bd.: 520-5136-**10** (Mono) & Display Cont. Bd.: 520-5055-01
3 ROMs on CPU/Sound Board: 520-5136-**15*** (Mono) (*FCC 11-97) & Display Controller Board: 520-5055-**02*** (*FCC 11-97)
4 ROMs on CPU/Sound Bd.: 520-5136-**16**† (Mono) (†FCC 02-98) & Display Controller Board: 520-5055-**03**‡ (‡FCC 02-98)
5 This game uses **8MB** VOICE ROMS at U17, U21, U36 & U37 *(if 3 ROMs use U37 will be unused)* requiring a **Jumper at Loc. W6**. Refer to CPU/Snd. Bd. Schematic (2 of 3).

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 1-708-345-7700 (Select Option 1). Visit our website www.SternPinball.com where code can be downloaded (an EPROM Burner is required).

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 **TLRH180P** (T1-3/4 GaAlAs)	165-5052-00 *(old SPI Part №: 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 Nº & CPU Jumper Table†

Game Name	Game Mfg. Date and Manual PNº	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

Game Name	Game Mfg. Date and Manual PNº	CPU Ver.	EPROM Position	Jumpers Installed	Jumpers Removed
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
43a. Striker Xtreme	MAR 00 780-5068-01	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
43b. NFL	OCT 00 780-5073-00	—	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
43. High Roller Casino	JAN 01 780-5065-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
44. Austin Powers™	MAY 01 780-5074-00	—	U17 U21 U36 U37	W6 CPU/Snd.	n/a
45. MONOPOLY®	SEP 01 780-5075-00	—	U17 U21 U36 U37	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.

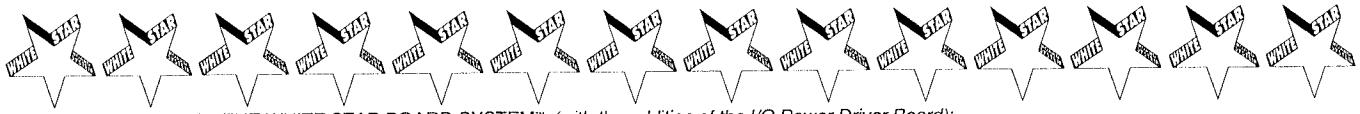
APPENDIX D

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 Apllication
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

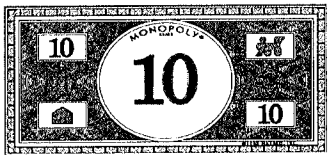
Miscellaneous Boards (Lamp Boards & Relay Boards) not listed above can be found in each individual game manual.



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 Apllication
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 (NFL)	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						
High Roller Casino	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	520-5194-00 4-Pos. Motor Sensor on Roulette Wheel Motor
						520-5082-00 Long Hop OPTO	520-5083-01 Long Hop OPTO	Ball Lock Under Roulette	
	Miscellaneous PC Boards:	Dot Display (5X7) in Slot Mach. 520-5197-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5196-00 3-Pos. OPTO	520-5195-00 3-Pos. OPTO	Up/Dn Ramp in Slot Mach.	
Austin Powers™	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	520-5212-00 Pulse-Stretcher OPTO on Spini-Me
	Miscellaneous PC Boards:	Relay Bd. (X3) 520-5010-00			for UK ONLY> Solenoid Expander Bd. 520-5192-00				
Monopoly®	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:	DC Relay Bd. 520-5066-00	Dot Display (5X7) in Elec. Sign 520-5197-00		for UK ONLY> Solenoid Expander Bd. 520-5192-00	520-5218-00 4-Pos. OPTO	520-5210-00 4-Pos. OPTO	Bank Door	

† ***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	23-1500	4.4 Ω	BLU	090-5062-00T
						24-1570	9.5 Ω	N/A	090-5025-00
						25-1800	13.8 Ω	BLU/GRN	090-5041-00

NOTE: Ohm values may vary +/- .03 Ω depending on meter calibration.

† 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 Ω	090-5054-00	32-1250	35 Ω	515-6916-01	23-800	3.6 Ω
20½-480	2.9 Ω	090-5064-02	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	Nº of Flippers	LOWER FLIPPERS		UPPER FLIPPERS	
		SPI Nº / GAUGE-TURNS / Color		SPI Nº / 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 (NFL) †	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 **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	090-5030-00T **23-1100 -ORG-**	Not Used
High Roller Casino †	2	090-5020-20T **22-900 -YEL-**	090-5032-00T **23-1080 -YEL-GRN-**	Not Used	Not Used
Austin Powers™ †	2	090-5020-30 **23-900 -GRN-**	090-5030-00T **23-1100 -ORG-**	Not Used	Not Used
Monopoly® †	3	090-5032-00T **22-1080 -YEL-GRN-**	090-5032-00T **22-1080 -YEL-GRN-**	Not Used	090-5062-00T **23-1500 -BLU-**

† Coil Part Nºs ending with a "T" signifies the Diode is on the top of the lug (on the coil-winding side);
Coil Part Nºs 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. *Part Numbers starting with "515-" will include the Wiring Harness & Connector.*

Game Name	Function	Specifications	Part №
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. *Part Numbers starting with "515-" will include the Wiring Harness & Connector.*

Game Name	Function	Specifications	Part №
Twister	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5026-00) 50/60Hz 3W 325 RPM CCW	515-6347-00
	Backbox Fan (Tornado Wind)	Multi Products Motor 24v A.C. (041-5052-00) 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. (041-5058-00) 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. (041-5059-03) 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 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires 7" Shaft:** 530-5503-00
Lost In Space	Spinning Disc with Magnet	Multi Products Motor 24v A.C. (041-5046-00) 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. (041-5072-01) 20 RPM CCW	515-7025-00
Striker Xtreme (NFL)	Goalie (Linebacker) Left to Right Movement	Multi #3590 12v D.C. (041-5075-00) 60 RPM	515-7071-00
Sharkey's Shootout	Mystery Ball Rotating Movement	Hankscraft Motor Model-E 24v A.C. (041-5076-00) 50/60Hz 3W 20 RPM CW	515-7095-00
High Roller Casino	Roulette Wheel Rotating Movement	Multi Products Motor 20V D.C. (041-5078-00) 17 RPM CCW	515-7153-00
	Up/Dn. Ramp in Slot Mach. Lift Up/Down Movement	Haydon Switch & Instrument, Inc. Stepper Motor 12v D.C. 4.6W (041-5062-00), Series 36000: 1.4"ø (Non-Captive Shaft not incl.) HSI #36864-12 (Unipolar) Travel per Step: .004 Step Angle: 15°	515-6794-00 **Requires Shaft 4¼":** 530-5503-01
Austin Powers™	Time Machine Rotating Movement	Multi Products Motor 24v A.C. (041-5079-00) 50/60Hz 20RPM CCW	515-7141-00
	Laser Beam Left to Right Directional	Autotrol Motor 24V A.C. (041-5081-00) 50/60Hz 4W 10RPM Bi-Directional	515-7171-00
	Dr. Evil Target Lift Up/Down Movement	Hankscraft Motor Model-E 24v A.C. (041-5030-00) 50/60Hz 6RPM CCW	515-5900-00
Monopoly®	Mini-Flipper (Waterworks) Rotating Movement	Multi Prod. Motor & Gear Box #7000 EX00159A 20v D.C. 50/60Hz 85RPM CC/CCW	041-5083-00

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)

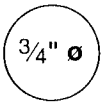
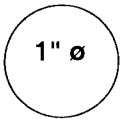
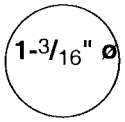
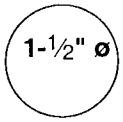
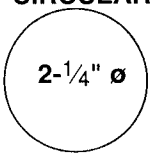
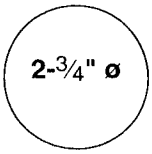
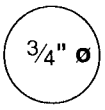
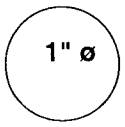
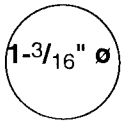
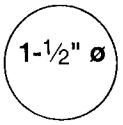
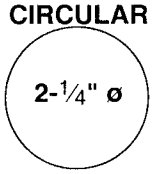
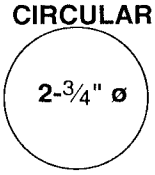
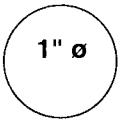
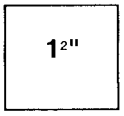
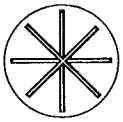
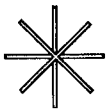
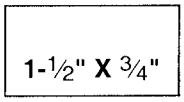
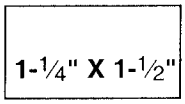
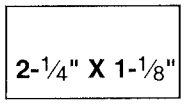
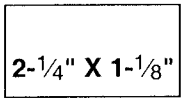
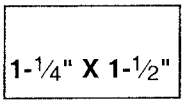
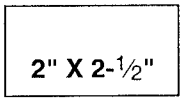
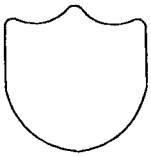
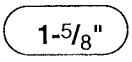
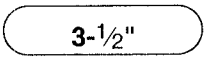
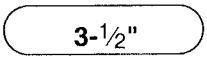
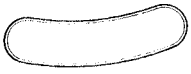
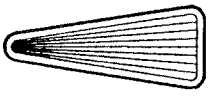
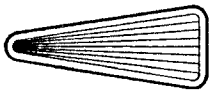
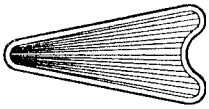
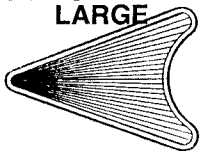
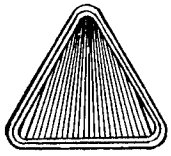
VIII. Bulk Materials
- 600- Braided Ground Wire
- 601- Stranded Wire
- 602- Ribbon Cable
- 605- Sleeving (Shrink Tubing)
- 626- Foam Rubber

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  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

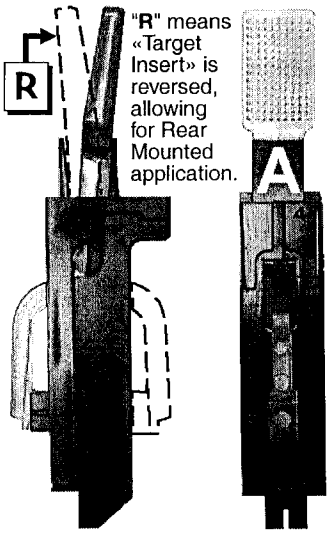
Note: The shapes and sizes shown above are not to scale. Some shapes may no longer be available in every color.

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.*

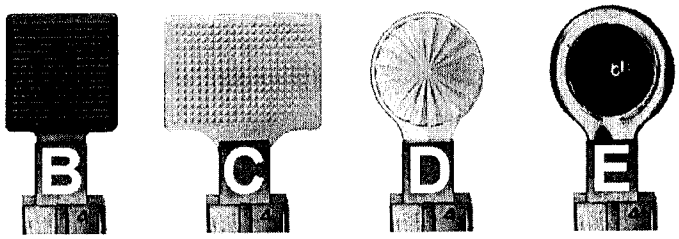
PLASTIC PART COLOR CHART											
Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color	Nº	Color
-00	Black or Solid Clear	-03	Amber	-06	Yellow	-09	Purple	-12	Fluor. Blue	-15	Luminescent
-01	Clear	-04	Green	-07	Orange	-10	Fluor. Orange	-13	Teal Green	-16	Gold
-02	Red	-05	Blue	-08	White	-11	Fluor. Green	-14	Gray	-17	Trans. Brown

APPENDIX I

Stand-Up Targets



"**R**" means «Target Insert» is reversed, allowing for Rear Mounted application.



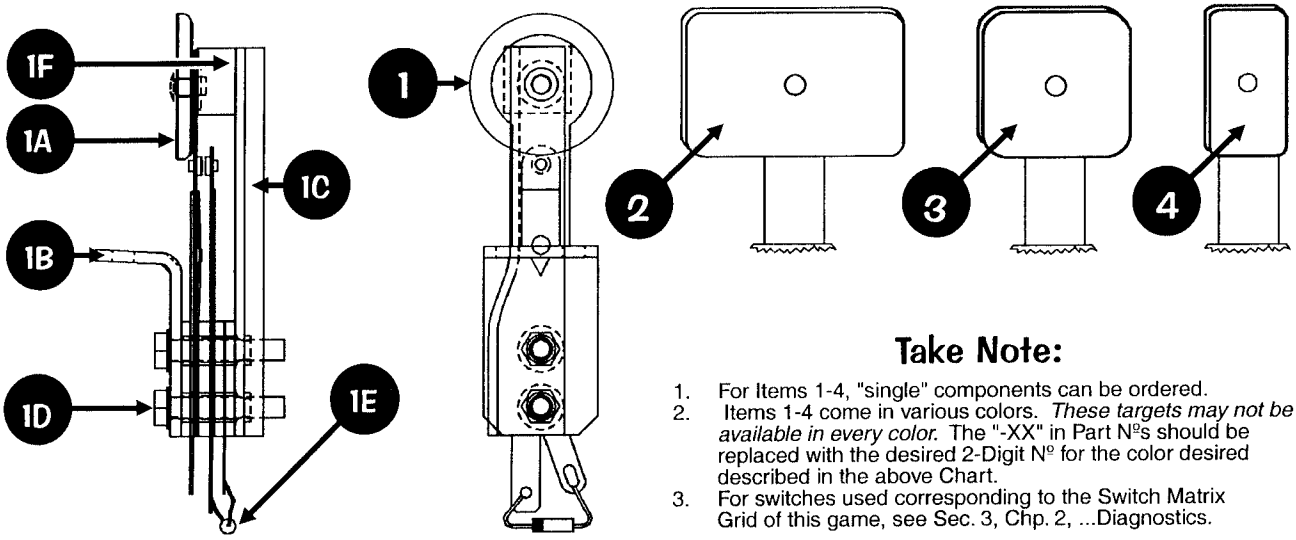
PLASTIC PART COLOR CHART	
Nº	Color
-00	Black
-01	Clear
-02	Red
-03	Amber
-04	Green
-05	Blue
-06	Yellow
-07	Orange
-08	White
-09	Purple
-10	Fluor. Orange
-11	Fluor. Green
-12	Fluor. Blue
-13	Teal Green
-14	Gray
-15	Luminescent
-16	Gold

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 » « Reversed » 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.

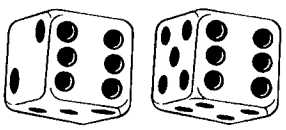
Zener Diode A semi-conductor diode used for voltage regulation. Application depends on reverse break-down voltage.

"-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 Nº	Qty.	Description	Date Received



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PRINTED CIRCUIT BOARDS (GAME LOGIC):	2 MONTHS
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.

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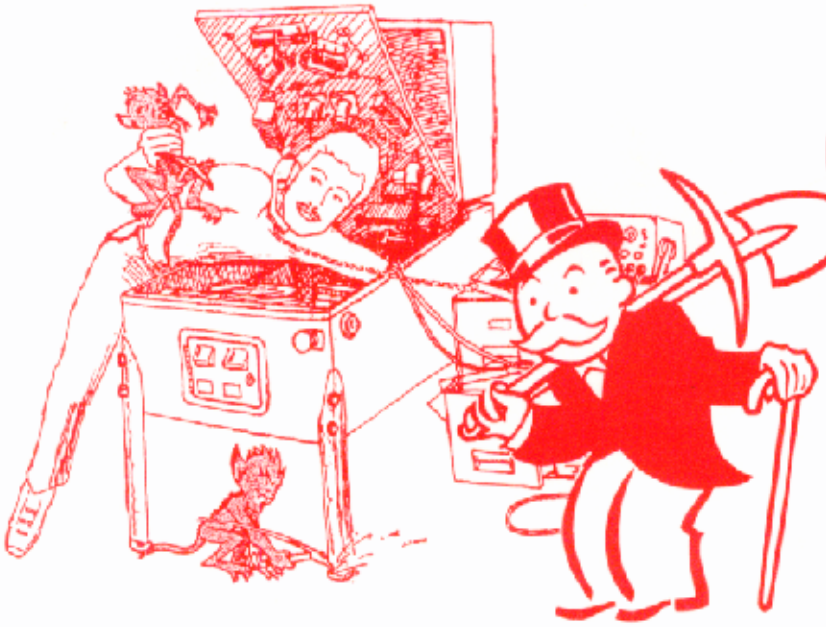
▼ U.S. ▼
Customary
Inch Ruler

Metric Conversion

1/16" .0625" 1/8" .125" 1/4" .25" 1/2" .5" 3/4" .75" 1/32" (.03125")

1" = 2.54cm /25.4mm
1cm = .3937"
1mm = .03937"

- For metric, multiply inch value by metric value. e.g. 5" X 2.54cm = 12.7cm or 127mm.
- For US, multiply metric value by inch value. e.g. 13cm X .3937" = 5.118"





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